TRACE Project Deliverable 1.1. Road users and accident causation. Part 1: Overview and general statistics

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Deliverable 1.1

Road users and accident causation. Part 1: Overview and general statistics

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Abstract:

This report aims to present the general results of the descriptive analyses performed within the first TRACE Work Package, 'WP1-Road Users', in order to identify the main problems and the magnitude of these problems related to accident causation for the following five different road user groups: passenger car drivers; powered two wheelers riders; van, bus and truck drivers; pedestrian and cyclists and, finally, elderly people and gender classification.

The descriptive analysis of each of these five tasks has been performed using the available European national accident databases within TRACE via WP8. Those relevant safety problems for the different road users are the main output of this report and will be analysed in detail during the next steps of the project through the use of in-depth accident databases and exposure data in order to assess the risk of being involved in an accident from the point of view of road user.

Keyword list:

National databases, macro accidentology, descriptive analysis, causation, general statistics, road user groups, passenger cars, powered two wheelers, buses, trucks, vans, pedestrians, cyclists, elderly people, gender .

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1 Executive Summary

Two thirds of the road casualties occur in developing countries according to the World Health Organization and other sources. In 2006, there were 1,277,126 accidents involving injured casualties at EU27 [1] level where 42,953 people were killed and 1,678,474 people were injured. Therefore, enhancement of safety at pan European level still constitutes a main social concern despite the several efforts developed during the last decades to improve the level of safety in vehicles. Many experts agree that the prevention of accidents and recovery in case of emergency situation approaches are to be brought forward in order to continue with this positive safety trend. Although existing data sources cannot provide the analysis that Europe may need at this moment, they can contribute to give a better understanding of accident causation and to evaluate the effectiveness of some on-board safety functions with the final purpose of improving road safety.

One of the purposes defined at the European level is the decreasing of 50% number of deaths from 2001 to 2010. As it can be shown in the following figure, although the trend is decreasing, too many aspects should be applied into the road word (politician decisions, safety measures, driving training,…) to gather this important objective.

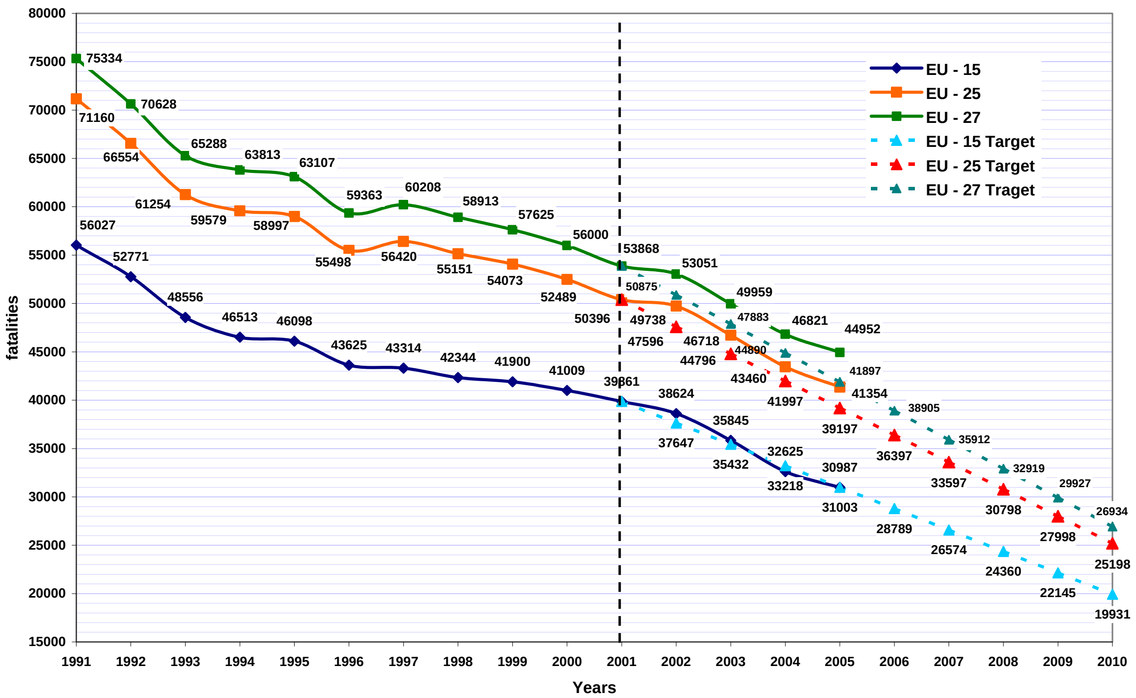

Figure 1.1.- Road Safety evolution in EU-27[2].

Because the reduction of road traffic injuries is a challenge, the European Community has been trying for many years to promote initiatives through the different Framework Programs in order to contribute to the safety effort. The Commission has expressed two kinds of interest as regards accident analysis:

[1] CARE reports: Road safety evolution in EU (December 2007).

[2] CARE, IRTAD, IRF and National Databank Statistics.

- Research in consistent accident causation analysis to gain a detailed knowledge about the real backgrounds of European traffic accidents using existing data sources.
- Research to assess the potential impact and socio-economic cost/benefit, up to 2020, of stand-alone and co-operative intelligent vehicle safety systems in Europe.

Within this context, TRACE project (**TR**affic **A**ccident **C**ausation in **E**urope) is aimed at developing a scientific accident analysis encompassing two main issues:

- The **determination and the continuous up-dating of the aetiology**, i.e. causes, **of road accidents** under three different but complementary research angles: road users, types of situations and types of factors.
- The **identification and the assessment** (in terms of saved lives and avoided accidents), among possible technology-based safety functions, **of the most promising solutions that can assist the driver or any other road users** in a normal road situation or in a emergency situation or, as a last resort, mitigate the violence of crashes and protect the vehicle occupants, the pedestrians, and the two-wheelers in case of a crash or a rollover.

TRACE analyses on the accident causes are developed through reliable exposure, accident and injury data systems. Therefore, the safety diagnosis provided by TRACE is based on available, reliable and accessible existing and on-going databases.

Accident causation is a topic that deserves more than only statistical tables. Current knowledge needs to be structured and linked to specific research angles and analysed according to specific methodologies to avoid misleading and to allow a clear view of what accident causation is. Therefore, TRACE proposes **three different research angles** to cover accident causation issues:

- The **Road user approach**: it allows specific causation factors for specific road users (it will be dealt in Work Package 1 'Road User').
- The **Types of situation approach**: as the road user can be confronted with different driving situations that can develop into different emergency situations that deserve specific analysis regardless the road user type (it will be dealt in Work Package 2 'Type of situations').
- The **Types of factors approach**: factors can be identified and observed according to an innovative split: the social and cultural factors, the factors related to the trip itself and the factors related to the driving task (it will be dealt in Work Package 3 'Human factors').

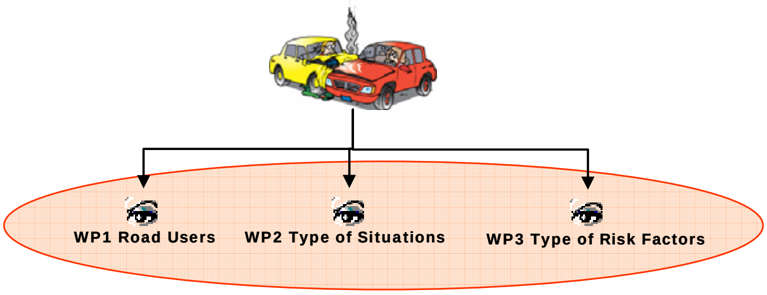

Figure 1.2.- Three different research angles to cover accident causation in TRACE.

Within this context, WP1 (Road Users) is addressing the **analysis of the different accident causation mechanisms of each of the road user groups**. The work package is divided in five different tasks:

- Task 1.1: Passenger Car Drivers.
- Task 1.2: Powered Two Wheeler Riders.
- Task 1.3: Van, Bus and Truck Drivers.
- Task 1.4: Pedestrian and Cyclists.
- Task 1.5: Elderly People and Gender related accidents.

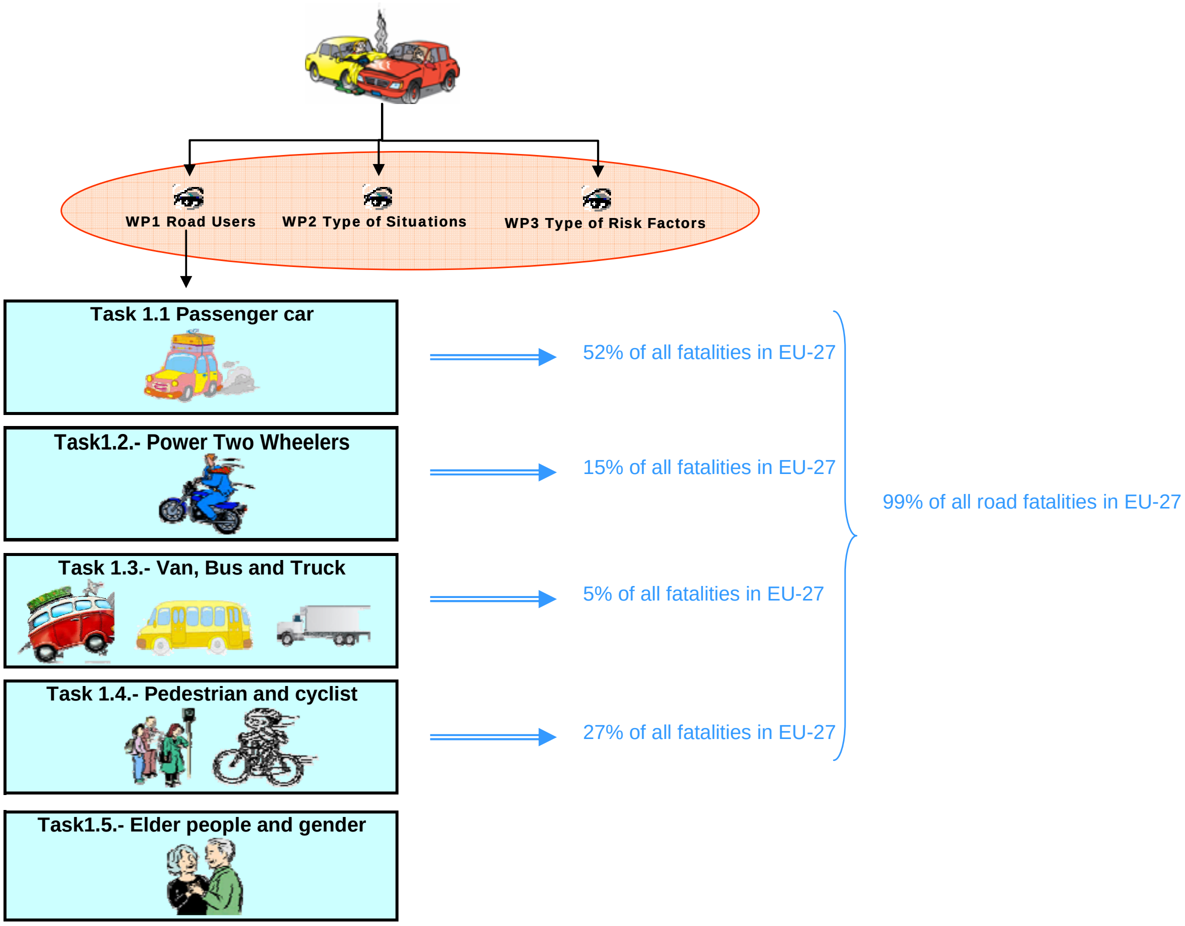

Figure 1.3.- Different road user groups (tasks) planned in TRACE (2004)[3].

The above tasks main objective is to identify the accident causation aspects through three different kinds of analyses:

1. A **macroscopic** statistical analysis aimed at describing the main problems of each road user group (Descriptive Analysis).
2. A **microscopic** analysis aimed at describing the accident mechanisms with the use of in – depth data (In – Depth Analysis).
3. A **risk analysis** aimed at quantifying the risk factors in terms of risk, relative risk and, where possible, attributable risks.

The present deliverable **D1.1** will cover the first type of analysis within WP1 (**Macroscopic descriptive analysis**) for each one of the different road users groups, corresponding to the activities of each task. The objective is to obtain, for each road user, the **main relevant issues**, **their relevance at macroscopic level and the description of their associated accident configurations.** Therefore, this report does not contain an analysis of the different causation mechanisms for the above main accident configurations as that is to be tackled through the in – depth and risk analysis. Nevertheless, the step represented through this report (Descriptive Analysis) is essential to focus the next analysis only on the relevant problems for each road user, **giving a general overview of the problematic**.

[3] Statistics of Road Traffic Accidents in Europe and North America. United Nations (2007).

All tasks have followed a similar approach for the Descriptive Analysis. At first, those participants in each task with in – house available national data performed a first analysis upon those data sources offering a first view of the main problems. With these results, each task developed a detailed data request (set of empty tables to be filled in by TRACE data providers through **Work Package 8 'Data supply'**) so as to develop an analysis with as many European countries as available within TRACE. It required specific analysis upon each database crossing several different variables in order to describe at the maximum possible and reliable detail the issues. This step has allowed not only identifying the main accident problems for each road user but also to describe them at macroscopic level. The output of this stage determines what in – depth analysis should focus on in the following steps with more detail looking at information that is not available within macroscopic databases.

Apart from that, the analysis of detailed data should provide more precise answers to the questions posed by the study of European data as should an examination of the literature. Finally, the descriptive analysis will enable to shed light on the differences in "behaviour" among the different road users involved in accidents, how these differences still need to be seen fit into the details of accident data studied in-depth.

Therefore, in the incoming 'in – depth analysis' step in the WP1, the main accident causation mechanism will be provided for each of the identified problems at macroscopic level. Microscopic accident databases will provide information able to tackle the three basic pillars of safety: the driver, the environment and the vehicle. Only looking at the whole picture of each accident with deep detail it can be stated what set of factors can be considered as causes of the accident. Therefore, what 'in-depth analysis' will provide to TRACE project is the possibility of detecting which the main 'contributing factors' are in accidents, this would mean the way to know all the accident causations, from different point of view. The big difference between analyzing information from 'National databases' or from 'In-depth databases' is the possibility to obtain more precious information from the last one. This is the main reason 'In-depth' analyses will be done over the most frequently accident scenarios detected in 'National database' analysis.

At last, and once the main contributing factors have been detailed for each accident scenario, 'risk analysis' will be done to estimate what is the risk of being involved in an accident for each of the different road users groups taking into consideration the exposure to the different causation mechanisms identified in the in – depth analysis. A deeper explanation of this activity would help to understand that, through respective statistical analysis (odds-ratio values, logistics regressions,…) over specific variables coming from exposure data, risk factors will be detected. In fact, these risk factors will be variables (coming from exposure data) that can be considered as influential in the occurrence of an accident. Of course, these risk factors are supposed to be statistically related to contributing factors in each scenario, so that, when a risk factor exists during the previous phase to an accident, this can mean that a contributing factor can appear (due the relation between risk factors and contributing factors) and therefore the accident is more likely to happen. The study of these risk factors will also help to answer questions related to aspects as over-representation of specific variables in accidents (a phenomenon of excess risk for those variables or simply depending on exposure).

The following figure shows which information will be obtained from each step, although during this report only information from literature review and descriptive (National databases) analyses will be shown.

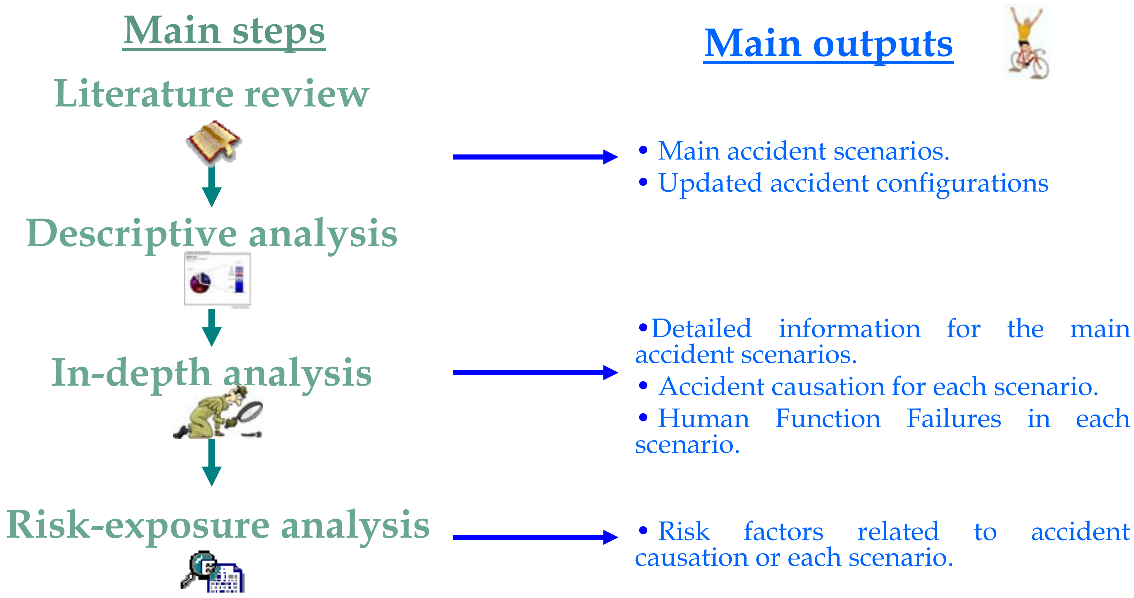

Figure 1.4.- Steps planned in WP1 for the detection of the accident causation and risk factors.

1.1 Main results from the literature review and descriptive analysis

The main results from the descriptive analysis have been focused on general statistics through detailed queries over extensive databases. These queries have allowed obtaining the main scenarios and characteristics of the accidents where different road users have been involved (Passenger Car Drivers; Powered Two Wheeler Riders; Van, Bus and Truck Drivers; Pedestrian and Cyclists; and finally, Elderly People and Gender related accidents).

In the five following subchapters, it could be shown which main findings to keep in mind TRACE has gathered, what main issues TRACE analyses have obtained and what new knowledge and innovations WP1 brings to scientific community.

1.1.1 *Task 1.1: Passenger Car Drivers.*

The first aim of this descriptive analysis was to identify the main general accident configurations for passenger cars and to describe its magnitude at EU 27 level. The following two configurations cover more than 50% of all fatal accidents:

✓ **Single passenger car accidents**.

✓ **Passenger car / passenger car** (no pedestrian and no other vehicles).

Other types of collisions between passenger cars and other vehicles have been relevant but not so important in terms of fatal accidents. Moreover, they are studied in the other tasks of WP1.

The main achievements of Task 1.1 in this report are as follows:

✓ **This task has estimated general accident figures of some European countries in order to get an overview of EU27 accident situation and evolution, being this a basic step in order to combine it with some exposure data. Two main conclusions arise:**

- The decrease of fatalities is higher in EU15 then in new countries (EU25 – EU27).
- Fatalities in passenger cars decrease faster than the global decrease of fatalities in Europe.

✓ **General risk analysis has been performed at EU27 level comparing the performance between different European countries. Main exposure data used has been:**

- Population.
- Passenger car vehicle fleet.
- Distance travelled by passenger car occupants.
- Road networks length.

✓ **There is a lack of exposure data necessary to complete the above general risk figures mainly related to:**

- Weather conditions frequency per year (rain precipitation, fog, …).
- Traffic road volume according to the different types of vehicles.
- Road traffic volume according to luminosity.
- Traffic flow divided by intersection / not at intersection.

✓ **The majority of passenger car accidents occur with the following conditions: good weather condition, outside of urban area (fatal accidents), during daylight and out of intersection. Nevertheless, this does not mean that these conditions are more risky. Indeed, combining accident data with the appropriate exposure data (when available) usually demonstrate the opposite.**

✓ **The macroscopic analyses performed cannot provide insight identifying accident causation factors because the complex process of a crash is not analyzed and recorded in macroscopic databases.**

1.1.2 Task 1.2: Powered Two Wheeler Riders.

Analysis over motorcycle and moped accidents have allowed obtaining the following main scenarios where this type of vehicles (PTW) is involved in an accident.

Motorcycle group: The most common configurations related to fatal and serious motorcycle accidents are:

✓ Configuration A: **Single accidents**.
This type of collisions involves 27% of the total fatal and serious motorcycle accidents. The main findings related with their characteristics are:

- In 40% of the accidents there were visibility problem due to terrain profile, specially.
- The type of driver who suffered a run-off accident was a 31-40 years old driver with more than 10 years of experience. The drivers were travelling during leisure time in most of configurations. Analysis shows that drivers were travelling with an inadequate speed when the accident happened. In most of configurations, while tyres were in normal conditions.
- Related to road conditions, road surface was mostly dry and clean. The carriageway where the accidents happened had paved shoulder in most of the crashes. Apart from these aspects, surface has not been considered as accident causation.

✓ Accidents between **passenger car and motorcycles**:
The total percentage of fatal and serious accident is 42%. Furthermore, the most frequent configurations are:

- o Configuration B: **Front-side accidents in rural and urban junctions between motorcycles and passenger cars**.

This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the motorcycle) or the target (damage in the side part of the motorcycle). This type of collisions involves near 13% of the total fatal and serious motorcycle accidents. The main findings related with their characteristics are:

- Most of the fatal and serious accidents happened during daylight. Black and red were the colours of a big part of the crashed motorcycles. In majority of the accidents there was good visibility.
- In these accidents, almost always the rider was parking or getting into a carriageway from another road or street (more than a half). In spite of these manoeuvres, in a few configurations the rider was considered in most of the cases not being in fault of any infraction. In most of the accidents, speed was considered as accident causation (according to police opinion) (not from the rider).
- For rural areas, the most common type was 'T' or 'X' junctions, which were regulated by stops sign or none.

o Configuration C: **Side-side accidents in rural and urban non junctions between motorcycles and passenger cars**.
This type of collisions involves 5% of the total fatal and serious motorcycle accidents. The main findings related with their characteristics are:

- Concerning the visibility of motorcycle from the car driver point of view, about 70% of the fatal and serious accidents happened with daylight conditions. The most common motorcycle colours were black and red, and in most of cases the motorcycle lightings were not turned on.
- Before the accident, the rider was either in a normal way of driving, or overtaking the passenger car. In these accidents, police has considered that rider inexperience and speed were the main accidents causes.
- The rider was in a normal driving or overtaking by the left/right side. Although most of riders involved in accidents have the license for more than 10 years, rider inexperience has been considered as accident causation in majority (95% of total accidents). Other aspects related to accident causes show that speed (93% in fatal & serious accidents) was also the main cause.
- Near a half, the rider did a traffic violation during its driving. For example, in fatal and serious accident, the most common rider infraction were absent-minded (10%), overtook illegally (10%), not obeyed STOP sign (1.8%), not obeyed general priority (1.8%) or not obeyed GIVE WAY sign (1.5%).

o Configuration D: **Rear-end accidents in rural and urban non junctions between motorcycles and passenger cars**.
This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the motorcycle) or the target (damage in the rear part of the motorcycle). This type of collisions involves 5% of the total fatal and serious motorcycle accidents.

Three out of four accidents were in daylight conditions (8% during the night period without luminosity). Although there were good weather conditions in most of the accidents, the weather restricted visibility in 5% of the fatal and serious accidents and the surface was wet near 3%.

During the accidents, the different driver (passenger car or motorcycle) infractions were:

Type of collision	Percentage of fatal and serious accidents (Motorcycle rider)	Percentage of fatal and serious accidents (Passenger car driver)
Absent-minded	33.1%	10.9%
Turn incorrectly	0%	3.4%
Overtake illegally	7.8%	5.3%
Not keeping safe distance	16.6%	3.1%
Others	12.8%	13.9%
None infractions	29.7%	63.4%

Moped group: The most common configurations related to fatal and serious motorcycle accidents are:

✓ Configuration E: **Single accidents**.

This type of collisions involves 21% of the total fatal and serious moped accidents. The main findings related with their characteristics are:

- If the analysis is focused on conspicuity ('how good is the visibility from the driver point of view'), it can be said that most of run-offs happened during good weather conditions. Nevertheless, in more than 20% of total accidents happened there was a problem visibility, most of them related with terrain profile (15%).
- In these accidents, where there is only one moped involved, inexperience has been considered (police opinion) as a direct causation in more than 95% of the fatal and serious accidents, meanwhile wrong speed was in almost 80%. Concerning the surface, in 90%, the surface was dry and clean and in 50% there was not hard shoulder. In less than 1% of total the run-offs, surface condition has been detected as accident causation.
- Together with these causes, the most common rider infraction was the absent-minded.

✓ Accidents between **passenger car and motorcycles**.

The total percentage of fatal and serious accident is 46%. For these accidents, it has been detected that the most common configurations are:

- o Configuration F: **Front-side accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars**.

  This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the moped) or the target (damage in the side part of the moped). This type of collisions involves near 30% of the total fatal and serious moped accidents. The main findings related with their characteristics are:

  - Most of fatal and serious moped accidents were in urban junctions. The most common types of junction (urban or rural) were 'X or +' layout (60%) or 'T or Y' layout (30%).
  - Near 70% of the accidents happened during daylight. No restricted visibility problems were identified for most of the accidents, included in junction ones.
  - In these accidents, drivers were driving in a normal way (50% for riders or 40% for car drivers) or crossing an intersection (30% for riders or car drivers). In the case of junctions, the priority was regulated by traffic light (28%), STOP sign (24%), GIVE THE WAY sign (19%) or no sign at all (22%).
  - Near a half of accidents, the rider committed an infraction. The most common were 'not obeying traffic signs indications' (7.8%), 'absent-minded driving' (5.7%) or 'overtaking illegally' (5.3%). On the other hand, passenger car driver carried out an infraction in 60%. 'Not obeying STOP signals' (9.8%), 'not obeying GIVE THE WAY signals' (7.5%) or 'not

obeying traffic signals indications' (7.1%) were the main infractions committed by passenger car drivers.

- Configuration G: **Head-on accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars**.

  This type of collisions involves 8% of the total fatal and serious moped accidents. The main findings related with their characteristics are:

  - These accidents happened, most of times, in urban area (67%). In 60% of the urban collisions, they happened at junctions (especially in 'T or Y'). In accidents in non junction areas, more than 50% were in a straight section.
  - Related to light conditions, near 60% were during the daylight, although one out of four were at night (with enough visibility). Another important aspect is the fact that accidents occurred with some visibility problems (40%).
  - In more than a half, the rider carried out an infraction during the accident (55%), specially straying onto the opposite lane (18%), absent-minded driving (8.6%), driving in a forbidden direction (6.4%) or overtaking illegally (4%). During all the accidents, the rider was under abnormal conditions (alcohol, drugs or tiredness) in less than 2%.

1.1.3 Task 1.3: Van, Bus and Truck Drivers.

Accidents in road transport count for a high part of human and material loss, for the individual, for the common, and for the business and welfare. Transport accidents on the road are lower in absolute figure as compared to other modes of traffic participation (such as car, two-wheel-vehicles, etc.), but they result in much higher average damage losses, including the responsibility for a good part of traffic congestions, because of temporal total closings, on Europe's roads. Truck and van accidents are more destructive against the unprotected, namely pedestrians, cyclists, and small passenger cars, the reasons for that become obvious thinking in terms of the biomechanics effects of different mass volumes, standing against each other. Since the goods transport on EU's roads do, and will increase rapidly, as shown by all economical figures (yearly average ton kilometres), and since the same prognoses see the road with most increase, it is a major challenge for research, business, and politics to improve safety of the road transport industry.

This chapter compares the accidents figures within the EU with respect to the state of the art parameters. It could be shown that, on the one hand, a plausible distribution of truck/van/coach accidents beneath the countries is to be found, according to the dimension of each land, by gross domestic product, ton kilometres, number of vehicles, length of road net, and others. Insofar Spain, the UK, Germany, Italy, France show higher absolute figures, namely in fatalities. Unfortunately, Spain is in the very top with fatalities, and also Portugal, as a smaller country, has high figures. This waits to get analyzed in future surveys. On the other hand, all data must be read beyond certain exposures, kilometres or ton kilometre per year in the first place. Secondly, and lamented by all experts and politicians, the great differences in law, enforcement procedures, statistical measurements, and others, hinder to get comparable data. However, the result of this descriptive level is positive, as it is for other road vehicles – accident figures for fatalities decrease, the common efforts for safety in transport vehicles do work, right now. What are still the problem fields? The descriptives in detail show the urban road the as the worst place for transport fatalities. The highway is, indeed the first place as compared to other modes of vehicles (severe car accidents, compared to trucks, do happen less often on highway, but more often on rural roads. But severe truck/van accidents, compared to cars, do happen more on the highway). Nonetheless: Within the truck/van/coach distribution the urban road is the list leader for severe accidents – because unprotected persons (pedestrians, cyclists) and relative weaker cars are involved. This happens in the overwhelming part in daylight. This outcome is not to misunderstand for the night not being a problem. But it shows, the urgent priority for countermeasures, e.g. by vehicle improvement and ADAS. This EU figures show, it is not the spectacular night time autobahn crash, it's the daytime in urban crash, which waits get deeper addressed, e.g. by turning support, crossing support, or round vision aids. All these figures are at least, with respect to statistical non-comparability, similar in the EU 27.

In details, by type of accident, by causation factors, some characteristic differences are to observe between nations. But they are simply structural, effected a lot by different modes of data collecting, they do not contradict the major factors of the certain incident in principal. So, we find a broad range of the factor "unadapted speed" or "distance" throughout Europe. But any in-depth analysis of any single case will lead to the same interaction of factors. So, the "big five" causes are prominent in our figures as well: Speed, distance, turning errors, overtaking errors, and alcohol, all of them to get addressed by improvements in vehicle safety, ADAS, and enforcement. Alcohol and fatigue play separate roles. The data forbid simple compartments. As it seems, Germany is with high figures here, but other countries do not compute alcohol as Germany does. We must not conclude alcohol would be unimportant for truck/van/coach safety in the EU. Furthermore, intersections and single-vehicle-accidents remain an extra field to look on. Most important accident scenarios were van or coach or truck colliding with car moving along in same way, and while turning or crossing (each covering at least around 16-45% of the cases), documenting the need for break assist, turning/crossing aids, and ACC. In the causation figures, the unadapted speed was found still in the top to further focus, when fighting transportation accidents in Europe.

1.1.4 Task 1.4: Pedestrian and Cyclists.

Throughout the countries of the European Union nearly 40,000 human fatalities and 1.7 million related injures occur in vehicle accidents annually, resulting in a cost of approximately 160 billion euros. Nevertheless, injuries are not only caused to vehicles' occupants; in many cases **pedestrians as well as cyclists are accident victims (generally when they are knocked down by a vehicle)**. As European statistics show, roughly 6,000 of these deaths are a result of collisions between pedestrians and motor vehicles, primarily occurring in urban areas. These staggering figures have led car manufacturers, European governments and consumer organisations to further develop means for the prevention or mitigation of such accidents and injuries to vulnerable road users.

Romania, Latvia, Estonia, Lithuania and Poland presented the higher relative rates for pedestrian accident fatalities in relation to total traffic accident fatalities in 2004, with percentages moving from 44% to 35%. In EU-27, over the 45,916 fatalities in traffic accidents, 9,164 were pedestrians, which represent 20%. In absolute terms, Romania, Poland, Germany, Italy and the United Kingdom present the higher number of pedestrian fatalities, with figures moving from 1986 (Poland) and 694 (UK).

Cyclist accidents also represent an important problem. Cyclist fatalities made up 4.5% of the total number of road accident fatalities in 2004. That year, 1,209 people riding bicycles were killed in traffic accidents in 14 European Union countries.

It is important to remark that there are few projects focused on the analysis of the accidents where at least one pedestrian or one cyclist (vulnerable user) is involved. TRACE is giving a new step in the definition of the accident causation in Europe. The results presented suppose an innovative work due to, with the data from 6 countries and the statistical methodology defined in the project, the definition of the most relevant accident scenario which has been done for EU-27.

There are few technical papers on accident causation. The industry is working to develop active and passive safety systems which may avoid these accidents or reduce the injuries produced. However, the accident scenarios are not well-known. Then, there is still a margin to improve development methodologies which might lead to real benefits.

Pedestrian and cyclist accidents have been categorized regarding area, light conditions, age, gender and scenario configuration.

At this first and basic level, it seems that the most significant parameters for the avoidance of the accident are related with the visibility of all participants and the conspicuity of the environment. The vulnerable road users need to be aware of the dangerous scenarios, and make themselves visible to others. The opposing participants should have tools to enhance visibility, especially in urban areas, for the pedestrians and in the countryside for the cyclists.

1.1.5 Task 1.5: Elderly People and Gender related accidents.

Analysis over elderly people and gender related accidents are summarized in the following results.

Elderly people:

Over the next 30 years, a 40% increase in people over 65 is expected among the European population member and associate countries and the proportion of those over 80 will double. This trend is associated with a cohort effect: as the level of health increases, the elderly continue to drive actively longer than before. It has to be stressed that driving a car is a guarantee of physical, social and psychological autonomy for the elderly. And more than for other users, autonomy for elderly people depends on consequential safety. It is therefore of utmost importance to look into the safety of the elderly at the wheel in the perspective of adapting the driving system appropriately.

The question of excess risks among elderly drivers is a subject of debate. This population is often presented as having less accident par inhabitant but more per km than other. But this excess risk is only in the case with the occasional elderly driver with low mileage. However, most elderly people become physically fragile and vulnerable, making this population more susceptible to being injured or killed when involved in accidents.

Some pathologies linked with age can impair driving behaviours and accident occurring. They shouldn't be mixed with driving difficulties linked with normal ageing. The latter leads to a progressive alteration of human functions at different levels: motor, cognitive and sensorial. But elderly people use compensatory strategies to prevent the effects of age on their driving behaviour, by limiting their exposure to external difficult driving conditions, and by adopting a specific behaviour in a reduction in the chosen travel speed, and the fewer tendencies to overtake other vehicles, to swerve and to break traffic laws.

Some general conclusions can be drawn from statistical data:

- ✓ The situation that appears to pose the greatest problem to elderly drivers (and more specifically to elderly women) is **driving at intersections, especially without right-of-way, and left-turn situations.**
- ✓ Concerning the environmental context, **the risk of elderly road users' accidents is higher in rural areas** (2.6 times higher than for other drivers) **than in urban** areas (1.3 times higher).
- ✓ **Elderly users are more injured of killed at daytime, during the week and on dry roads, this being probably the result of their avoidance strategy** (i.e.: limiting their exposure to external difficult driving conditions, as driving at night).
- ✓ **The presence of passengers is considered to increase the risk of accidents among elderly drivers, except during night-time driving.**
- ✓ Depending on the degree of severity of the casualty, **the elderly road users are more or less prone to be involved in accident.** Indeed, we observe that the relative rate of injury is less important (between 0.33 and 0.62 times less) for users over 65 than for the younger. Inversely, we find that elderly users are more concerned by fatal accidents than the young ones.
- ✓ **Those accidents occur mainly for elderly car drivers.** But over 65 years old users are also identified more often than younger in crashes involving bicycles and pedestrians. This last result

is true for injury as well as fatal accidents. A special mention can be brought on female pedestrians who seem to be the most represented category.

✓ **When looking at accidents configurations,** several parameters seem to go toward the same direction: the seniors' accidents usually involve 'Two vehicles' or 'One vehicle and a pedestrian'; they are occurring mainly at intersection and more precisely when not having the right-of-way; at last, lateral - and rear - collisions are over represented in the data when compared to the younger users' crashes. All those trends are even more important when the results come to fatalities.

Such data need to be further investigated through and in-depth accident analysis in order to find out the specific difficulties elderly people meet on the road, the driving situations in which they meet these difficulties and the human errors they produce consequently.

Gender related accidents:

Driving an automobile is an activity mainly performed by men even if driving behaviour among women in Europe has changed in the last few decades. There still are important differences in terms of miles driven and accident rates depending on gender: women less frequently have driving licences, drive less and have fewer accidents than men. These elements appear to be at the origin of a least study of driving activities among women compared to men.

The following statements can be drawn from descriptive statistical analysis on the involvement of men vs. women in traffic accidents:

✓ **Men are more prone to traffic accidents than women.**

In the seven European countries studied, where the proportion of men is 48.7%, there is a variance in traffic accident victims between men and women: men account for 67.9% of those injured and 80.7% of those killed on the road. Men and women are most frequently involved in accidents in cars. When motorcycles are looked, it can bee seen that men are involved 5.7 times more often and killed 7.9 times more often than women.

✓ **The most common pre-accident situations:**

- Loss of vehicle control is a phenomenon that happens more often to men than to women: the number of fatalities varies between 1.1 times more and 3.4 times more for men than for women according to the country considered.
- Women are more often involved than men in accidents at intersections and when performing manoeuvres.

✓ **The most common conditions encountered**

- 64.8% of men are injured in accidents in urban areas and 65.1% are killed in rural areas. Women are more often injured in urban areas (69.9%) and less often killed in rural areas (56.9%) than men.
- Moreover, men are more often injured than women in accidents occurring at night, on dry roads and at week-ends.
- More than 6 accidents out of 10 involve 2 vehicles and women are involved in these accidents more often (47.4% vs. 45.1%).
- In the average of 7 European countries, men have 1.4 times more accidents and 1.5 times more fatalities than women in accidents involving a single vehicle.
- As for the types of collisions, men are involved on average 1.1 times more in frontal collisions than women. Women on average have 1.4 times more rear-end collision accidents than men.
- Concerning the type of transport, women are injured more as drivers of cars, and secondly as pedestrians (16.1% of women's accidents are as pedestrians vs. 9.1% for men). This figure rises

to 35.0% when speaking of women killed as pedestrians vs. 14.1% for men. Consequently, more than one-third of women killed on the road are pedestrians.

- Women appear to have excess risk on wet carriageways. On the other hand, the literature indicates that they have a tendency to avoid difficult driving situations. What might the causes of the excess risk be: is it a stress situation that causes them to react poorly, a lack of experience in these situations, excessive speed, a lack of appreciation of stopping distances in such conditions, etc. All these questions need to be further investigated taking into account not only their mileage, but also their travel patterns, social roles, and so on.

Gender issues in accidents through literature and statistical facts show all the complexity which can be hidden behind an apparently simple dichotomist factor. Analysing the role of gender from a too simple point of view would be neglecting this complexity, and thus leads to a misleading understanding of the differences between men and women as roads users and accidents victims. That is why, in the frame of this Task 1.5 contributing to TRACE project, the analysis will be completed by the In-depth study of accident data allowing going deeper in the comprehension of the role of gender.

2 Introduction

Road safety at European level constitutes ones of the major social problems nowadays. Although only 1%[4] of European deaths come from road traffic accidents it accounts for 42,953 people killed in Europe in 2006[5]. In spite of a decreasing trend of traffic accidents casualties can be observed during the last decade across the European level nevertheless, almost 1,700,000 casualties every year in Europe constitute an unacceptable social and economic cost for society. Because the reduction in road traffic injuries is a challenge, the European Community has been trying for many years to promote initiatives through the different Framework Programs in order to contribute to the safety effort. However, without a real safety target, a common commitment is not possible and the progress (in term of road safety) is difficult to evaluate.

This is why, in 2001, the European Commission published its 'White Paper' on transport policy (European Commission 2001), in which the main research axes to be improved and quantified targets are determined for road traffic safety. The short-term strategic objective is to halve the number of fatalities by 2010 compared to 2001. The medium term objective is to cut the number of people killed or severely injured in road accidents by around 75% by 2025, while the long-term vision is to render road transport as safe as all other modes. It is hoped that supporting research addressing human, vehicle and infrastructure environment could achieve this last strategic target. Research should also combine measures and technologies for prevention, mitigation and investigation of road accidents paying special attention to high risk and vulnerable user groups, such as children, handicapped people and the elderly. As it can be shown in the following figure, although the trend is decreasing, too many aspects should be applied into the road word (politician decisions, safety measures, driving training,…) to gather this important objective.

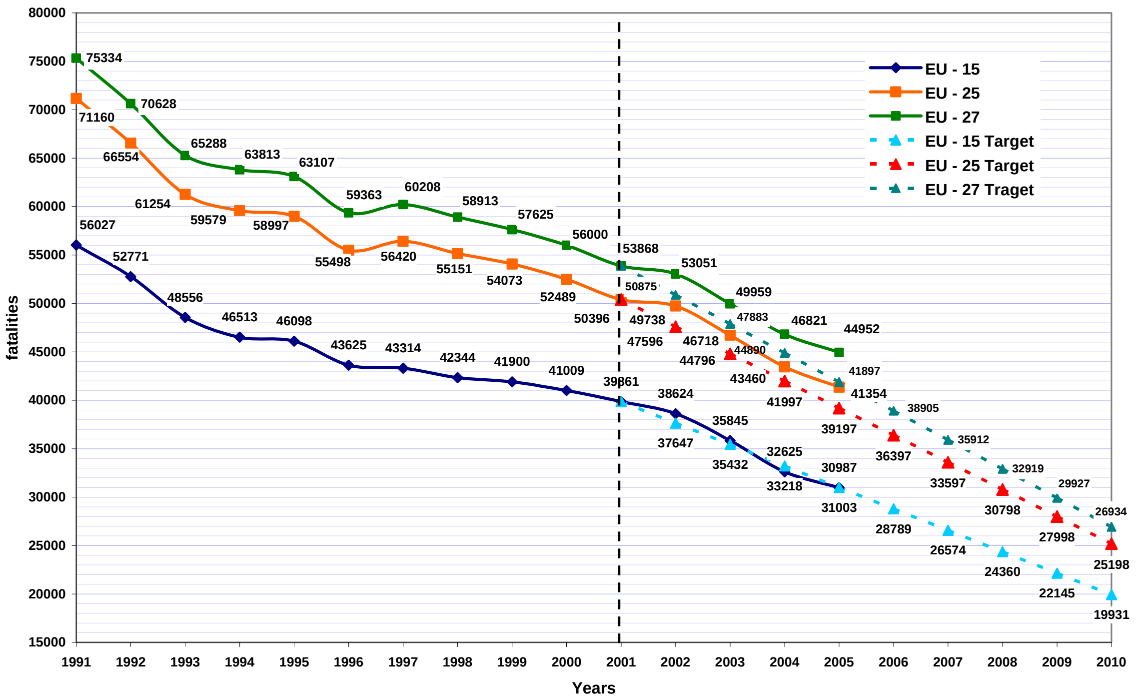

Figure 2.1.- Road Safety evolution in EU-27[6].

[4] European Detailed Mortality Database, .2007. World Health Organisation.

[5] CARE reports: Road safety evolution in EU (December 2007).

[6] CARE, IRTAD, IRF and National Databank Statistics.

Because the reduction of road traffic injuries is a challenge, the European Community has been trying for many years to promote initiatives through the different Framework Programs in order to contribute to the safety effort. The Commission has expressed two kinds of interest as regards accident analysis:

- ✓ Research in consistent accident causation analysis to gain a detailed knowledge about the real backgrounds of European traffic accidents using existing data sources.
- ✓ Research to assess the potential impact and socio-economic cost/benefit, up to 2020, of stand-alone and co-operative intelligent vehicle safety systems in Europe.

Within this context, TRACE project (**TR**affic **A**ccident **C**ausation in **E**urope) is aimed at developing a scientific accident analysis encompassing two main issues:

- ✓ The **determination and the continuous up-dating of the aetiology**, i.e. causes, **of road accidents** under three different but complementary research angles: road users, types of situations and types of factors.
- ✓ The **identification and the assessment** (in terms of saved lives and avoided accidents), among possible technology-based safety functions, **of the most promising solutions that can assist the driver or any other road users** in a normal road situation or in a emergency situation or, as a last resort, mitigate the violence of crashes and protect the vehicle occupants, the pedestrians, and the two-wheelers in case of a crash or a rollover.

2.1 Objectives of TRACE Project

The general objective of TRACE project (**TR**affic **A**ccident **C**ausation in **E**urope) is to provide the scientific community, the stakeholders, the suppliers, the vehicle industry and the other Integrated Safety program participants with **an overview of the road accident causation issues in Europe**, and possibly overseas, based on the analysis of any current available databases which include accident, injury, insurance, medical and exposure data (including driver behavior in normal driving conditions). The idea is to identify, characterise and quantify the nature of risk factors, groups at risk, specific conflict driving situations and accident situations; and to estimate the safety benefits of a selection of technology-based safety functions.

In accordance with these objectives, TRACE has been divided into the following three series of Workpackages (WP):

- ✓ The **Operational Workpackages** ('WP1: Road Users'; 'WP2: Types of driving situations and types of accident situations'; 'WP3: Types of risk factors' and 'WP4: Evaluation of the effectiveness of safety functions in terms of expected (or observed) accidents avoided and lives saved') propose three different research angles for the definition and the characterisation of accident causation factors, and the evaluation of the safety benefits of safety functions. Accident causation analysis is to be analysed from three different research angles that will allow offering an integral understanding of the different accident configurations. Those are:
    - The Road Users approach (WP1: Road Users).
    - The Situations approach (WP2: Types of Situations).
    - The Factors approach (WP3: Types of Factors).

- ✓ The **Methodologies Workpackages** ('WP5: Analysis of Human factors'; 'WP6: Determination of Safety Functions' and 'WP7: Statistical Methods') propose to improve the methods actually used in accident analysis, and to transfer these improvements to the operational Workpackages.
- ✓ And finally, the **Data Supply Workpackage** ('WP8: Data Supply') prepares and delivers to the operational Workpackages, for analysis, the data tables constituted from various European data sources.

In the following figure, TRACE objectives and structure are shown:

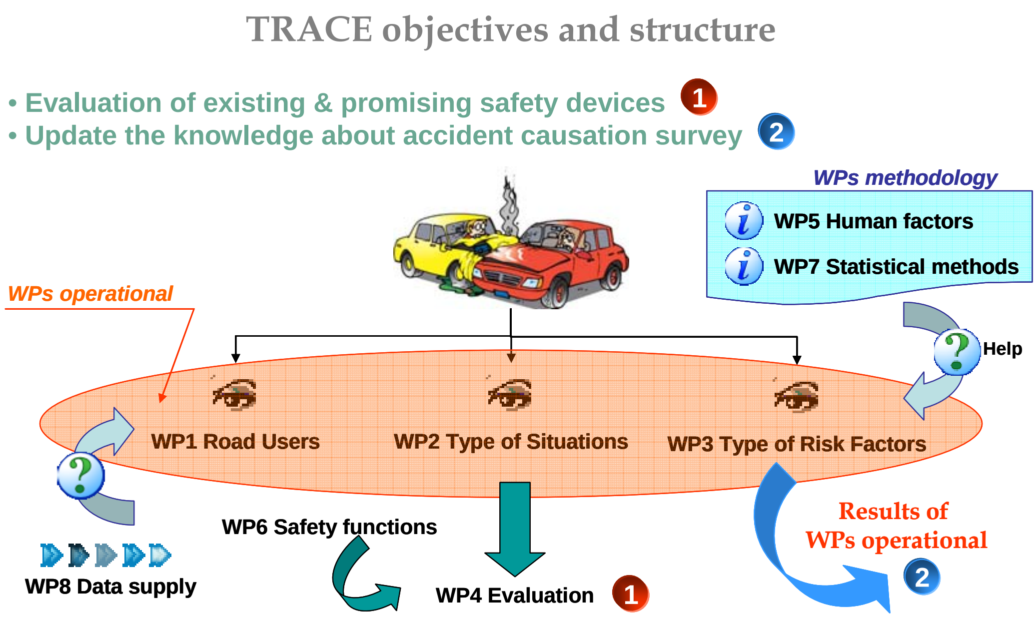

Figure 2.2.- Main TRACE objectives and structure of the different Work Packages.

2.2 'Work Package 1: Road Users'

2.2.1 *WP1 description*

Obtaining a better understanding of the causes of the accidents is a difficult task that needs to study many different aspects. Any detailed look at real accidents shows that very often it is not possible to establish the only cause of an accident, but it is necessary to use a holistic approach taking into account a mixture of several parameters (human factor, vehicle characteristics, environment, type of accident, situation, etc.).

In this Work Package, **the analysis of the different issues and specifications of each of the user groups (Tasks) related to accident causation is addressed**. Each one of the tasks of this WP is focused on the following specific group of road users:

- **Task 1.1: Passenger Car Drivers.**

  This task will try to organise the acquired knowledge according to the macro – micro – risk split and to perform additional analyses specially on accident involving newer cars in order to get a prospective view of the remaining factors of accidents that we will observe 5 to 10 years ahead when all cars will be equipped with devices that already proved effectiveness.

- **Task 1.2: Powered Two Wheeler (PTW) Riders.**

  Motorcycles and mopeds plays one of the most important roles in the traffic system. There are some specific characteristics of this user group that need to be addressed in this Task: relationship between motorcycles and other vehicles, conspicuity, rider psychological characteristics, training and education of PTW riders, road alignment and infrastructure …

- **Task 1.3: Van, Bus and Truck Drivers.**

  At macro level, it is intended to use intensive databases from the police records and insurance files, analysing the data with the main focus on available causation data broken down by different variables. At micro level, other parameters related to accident causation will be analysed in-depth: fatigue, alcohol, speed, visibility, distance to other vehicles, … At last, the analysis of exposure data will allow obtaining the risk of the accident.

- **Task 1.4 Pedestrian and Cyclists.**

  The approach to perform the work in this Task is based on the principle of improving road safety for vulnerable road users looking into the effect of safety functions on pedestrians and cyclist safety. Risk factors and situations that apply to them will also be evaluated, taking into account statistical information on accidents and in-depth studies.

- **Task 1.5 Elderly people and Gender related accidents.**

  The objective of this task is to analyse the specificity of the difficulties encountered by these groups inside the traffic system. These two populations are commonly poorly studied, and tend too often to be analysed according to stereotypes. Their accidental problems will be examined in logic of comparison with other road users.

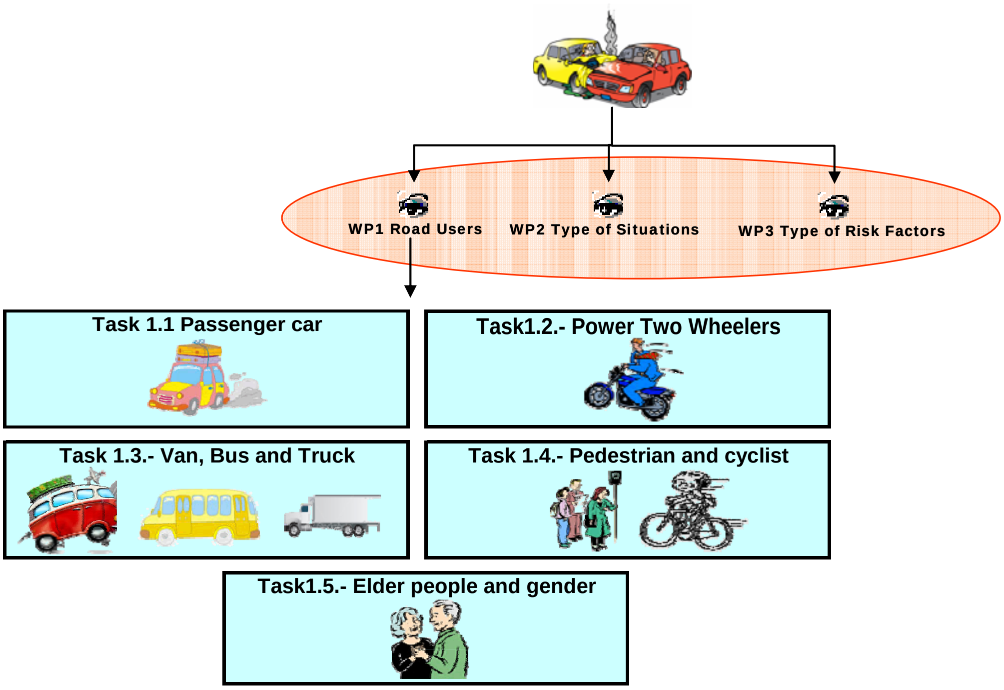

Figure 2.3.- Different road user groups (tasks) planned in WP1.

Within the framework of the first four tasks, it is intended to address the specifications of the different means of road transport and their potential influence in the causation of the accidents. However, the last task deals with the identification of the common accident causation issues for elderly people and also taking into account the differences, if any, between male and female users, without dealing with a specific mean of transport.

2.2.2 Overview of the problem

It seems reasonable that every type of road users may have a different perception of the driving task and also may tackle different difficulties when driving. The identification of the causation mechanisms for each type of road user is to allow the development of specific safety solutions addressing their particular needs. Although passenger cars represented in 2004, 87% of the total vehicles in use[7], it can be observed in the following figures that passenger cars do not present the same percentage of road fatalities. According to that, it is worth analyzing what are the safety problems encountered by the different road users while performing the driving task.

Europe 27	
Injury accidents	1 323 036
Fatalities	46 821
Injured	1 763 747
Casualties	1 810 568

Figure 2.4.- General overview in EU-27[8] (2004).

In the following figures, it can be shown that passenger cars represent a 52% of road fatalities, while vulnerable road users (PTWs, pedestrians and cyclists) account for 42%, while only 5% of fatalities do occur within big vehicles like trucks, vans and buses. It has to be taken into account that due to the typical dimensions and mass of big vehicles, that allow them to transmit a huge energy in the event of crash they can provoke severe injuries to other road users and, therefore, their accident causation issues are also worth being studied. Moreover, drivers do not have the same capacities across their driving life and therefore the mechanisms that induce them to commit failures might also be different according to the driver age. The following figures can provide the most current situation in EU-27[9]:

[7] ANFAC, 2004 European Motor Vehicle Park (2006). Provided by TRACE Work Package 8.4 (Preparation and Comparison of Risk Exposure Data).
[8] Statistics of Road Traffic Accidents in Europe and North America. United Nations, 2007. Although, until 1st January 2007 Europe there were not 27 countries in Europe, through this source it has been possible to obtain data for EU-27 in 2004 from road user point of view.
[9] Statistics of Road Traffic Accidents in Europe and North America. United Nations, 2007.

Passenger car

Fatalities in the passenger car	24 136	52%
Injured in the passenger car	1 021 273	58%
Casualties in the passenger car	1 045 409	58%

Power Two Wheelers

Fatalities in the PTW	7 084	15%
Injured in the PTW	288 277	16%
Casualties in the PTW	295 361	16%

Van, Bus and Truck

Fatalities in the van, bus and truck	2 229	5%
Injured in the van, bus and truck	39 174	2%
Casualties (in the van, bus and truck)	41 403	2%

Pedestrian and cyclist

Fatalities (pedestrian and cyclist)	12 450	27%
Injured (pedestrian and cyclist)	326 142	18%
Casualties (pedestrian and cyclist)	338 592	19%

Elder people and gender

Fatalities elder than 65 years	19%
Female fatalities	23%
Male fatalities	77%

Figure 2.5.- Overview of the problem from each road user point of view in EU-27[10].

[10] Statistics of Road Traffic Accidents in Europe and North America. United Nations, (year 2004).

2.2.3 WP1 Partners

In the following figure, the partners involved in this work package are detailed. Seven institutes were working to gather the objectives planned in this deliverable.

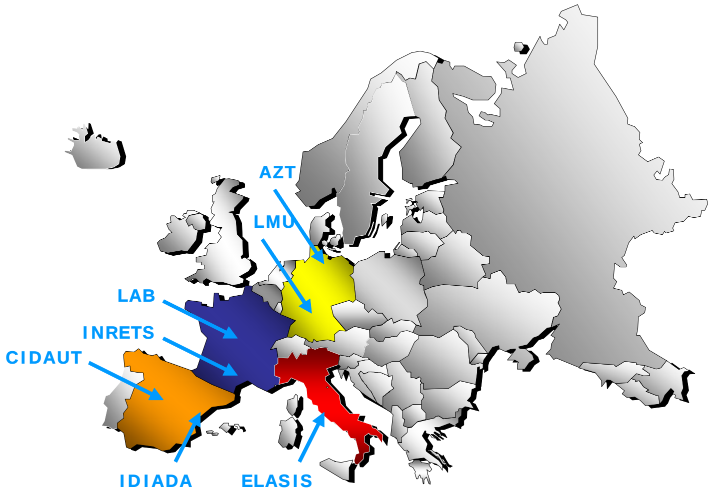

Figure 2.6.- Partners involved in WP1.

2.2.4 WP1 objectives and methodology

The methodology of Work Package 1 is much related with its technical objectives that could be summarized as follows:

- ✓ To obtain the relevant **macroscopic characteristics for each group of road users** of road traffic accidents through the use of the available extensive databases.
- ✓ To identify the specific **accident causes for each group of road users** at microscopic level analysing available intensive databases.
- ✓ To estimate the **risk of being involved in an accident for the different road user** categories.

Each of the above objectives needs of different data and different analyses in order to be successfully achieved and none of them can be performed without the execution of the previous one as accident causation analysis is not a simple research issue that can be inferred from general accident statistics.

In the first place, a literature review has been made to know which are the most important aspects related to accident configurations and accidents causes from the five task points of view. Secondly, it has been intended to look at national or European data to understand the potential problems and the size of those problems (macro level analysis). In third place, in this WP an analysis of in-depth accident databases will be performed to understand the nature of the problem (micro level analysis), with a strong focus on human behaviour before and during the pre-impact phase. At last, the relative risk of being involved in an accident will be identified for the different road user groups. So, the work will be developed in four steps for each of the five tasks mentioned above:

1. Literature review.
2. Descriptive statistical analysis.
3. In – depth analysis.
4. Risk analysis.

Specifically, these four levels of steps will consist on:

2.2.4.a Literature review

The first step for Work Package 1 tasks is to perform a detailed ***literature review*** covering for each of the road users the following issues:

- ✓ The existing knowledge on the main accident configurations (groups of accidents that offer a number of similarities that may answer to the questions like Who?, When?, Where?, How?, gathering a relevant number of fatal and serious casualties). This previous knowledge is aimed at improving the focus of the macroscopic analysis.
- ✓ The methodologies applied for the investigation of accident causation and risk analysis and the type of data necessary to use them.
- ✓ Main causation factors already linked by research activities to the different configurations for each group of road users.

2.2.4.b Descriptive statistical analysis

The next step for Work Package 1 analysts is to perform a ***macroscopic descriptive analysis*** upon national accident databases (extensive databases). The main objective is to obtain the most relevant accident configurations for each road user group in terms of fatal and serious casualties together with a general description. This macroscopic analysis is to group accidents according to relevant similarities and their associated number of fatal and serious casualties. This may seem rather fast to obtain but that is not the actual case. Detailed and specific analyses have to be done upon the extensive database in order to group the accidents properly. The main variables to be researched address the following topics:

- ✓ Where did the accident occur? (Type of road, road layout, …) What were the conditions of the environment? (weather conditions, luminosity, possible visibility obstructions, …)
- ✓ Who was the opponent, if any, of the road user under analysis?
- ✓ How did the accident occur? (Type of collision, driver actions, …)
- ✓ Who was the user involved? (Age, experience, physical conditions, …)

Cross tabulation data of the above issues are addressed within this step. The main data used for this analysis was provided by Work Package 8 ('Data Supply'), where all partners with access to extensive databases are able to provide the necessary information. Work Package 1 analysts defined the tables they needed to identify the accident configurations through the use of the correspondent templates created by Work Package 8.

The results of the above two first steps of this Work Package are the main issue of this report and, therefore, it does not provide any final conclusion on the accident causation mechanisms of road user groups. Nevertheless, it is able to provide the **main general accident configurations for each one of the road users**. This is why this report provides what the important safety problems are according to the different road user groups. All the following methodological steps will be applied only analysing these configurations.

Definition of extensive databases

The available extensive or national databases used in TRACE project (via WP8 'Data supply') have been the following ones (depending on each task, some of them are not able to be used).

Country	Database	Data provider	Covered area
Germany	OGPAS	BASt	The data relate to the entire territory of the Federal Republic of Germany since 3 October 1990

France	BAAC	LAB	Whole France
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 2.1.-National database used in TRACE project.

Moreover, Australian data (VicRoads – Victoria Accident Database) have been available for TRACE project to compare differences in all the trends observed for each task between European and non European data (Australian data in this case).

Definition of injury severity

For each extensive database used, the definition of injured has been as follows:

Germany: **Fatality:** all persons who died within 30 days as a result of the accident
Seriously injured: all persons who were immediately taken to hospital for inpatient treatment (of at least 24 hours).

France: **Killed:** all persons who died within 6 days as a result of the accident.
Seriously injured: all injuries.

Great Britain: **Fatality**: an accident in which at least one person sustained injuries causing death within 30 days of the accident. Confirmed suicides are excluded from this.
Seriously injured: an accident in which at least one person is seriously injured, but no person (other than a confirmed suicide) is killed. A serious injury is defined as 'an injury for which a person is detained in hospital as an "in-patient", or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts and lacerations, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident'.
Slightly injured: an accident in which one person is slightly injured, but no person is killed or seriously injured.

Greece: **Fatality**: Victim that died within 30 days as a result of the accident.
Seriously injured: Hospitalised for more than 24h
Slightly injured: Hospitalised less than 24h.

Italy: **Fatality**: all persons who died within 30 days as a result of the accident.
Seriously injured: all persons who were immediately taken to hospital for inpatient treatment (of at least 24 hours).
Slightly injured: all other injured persons.

Spain: **Fatality:** Victim that died within 24 hours as a result of the accident.
Seriously injured: Hospitalised for more than 24h.
Slightly injured: All other injured persons.

Czech Republic: **Fatality:** all persons who died within 30 days as a result of the accident.
Seriously injured: Opinion of the doctor.
Slightly injured: Opinion of the doctor.

Australia: **Fatality:** Injury resulting in death within a period of up to 30 days from the casualty crash.
Seriously injured: Includes Hospital admissions as well as transport to Hospital, but not necessarily requiring hospitalisation.
Slightly injured: A treat injury that did not require hospitalisation or transport to Hospital.

EU-27 expansion

TRACE project is to try giving an overview for the 27 current European countries related to different aspects, in this case, from the different road user points of view. Although in some occasions it is possible to show some general data from EU-27 level (Germany, Belgium, France, Italy, Luxembourg, The Netherlands, Denmark, Ireland, the United Kingdom, Greece, Spain, Portugal, Austria, Finland, Sweden, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Czech Republic, Slovakia, Slovenia, Bulgaria and Romania) or EU-25 level (for the last two incoming countries, Bulgaria and Romania, it is somehow difficult to find road accident data), specific queries over extensive databases are not available for the whole European level. This is the situation for TRACE related this report and the first steps ('Descriptive analysis database') for operational Workpackages (WP1, WP2 and WP3).

To solve this situation and give some of the most specific overviews related road accident aspects at an EU-27 level, TRACE project (via **Work Package 7 'Statistical Methods'**) has developed a statistical method to extrapolate conclusions from queries over the 7 available extensive databases (see Annex 1 'Expansion of national data to EU-27 level') to the European level. Although the methodology is valid for each road user query, due to European margin inability, it has been very difficult to make the extrapolation for some task of this Work Package.

2.2.4.c In-depth analysis

The third step is the ***microscopic or in-depth analysis*** through a detailed analysis of microscopic databases. As the descriptive analysis is able to provide the representative accident configurations, this step is aimed at obtaining more detail on information that cannot be gathered in national police accident databases tackling those configurations. This type of information is essential to the addressing of accident causation and can only be obtained through the analysis of in-depth databases.

A similar procedure to descriptive one is to be followed so as to obtain the appropriate data from Work Package 8 of this type of databases (intensive databases). Once the main analyst has performed a first analysis on their in-home in-depth accident database, a link is to be developed with WP8 in order to obtain similar information from other databases.

Finally, a relationship was established with methodological **Work Package 5 'Human Factors'** with the aim of applying a method to determine the possible Human Function Failures (HFF) in road accidents.

2.2.4.d Risk analysis

Last, a ***risk analysis*** will be performed in Work Package 1 in order to assess the risk for a road user of being involved in an accident. In this issue, exposure data (data about the level of exposition to the different risk factors identified in the previous analyses) is a key issue as it will determine the type of statistical risk that each task is able to estimate (absolute risk, relative risk, …). On this stage, Work Package 7 will play also a key role contributing to determine the appropriate statistical methods to be applied upon each kind of data.

The results of the last two steps (In-depth and Risk analysis) of this Work Package 1 will be covered by the following deliverable of this work package (D1.2 '*Road users and accident causation. Part 2: In-depth accident causation analysis').*

In the following figure, these four steps are shown as well as the expected outputs from each step in the Work Package 1.

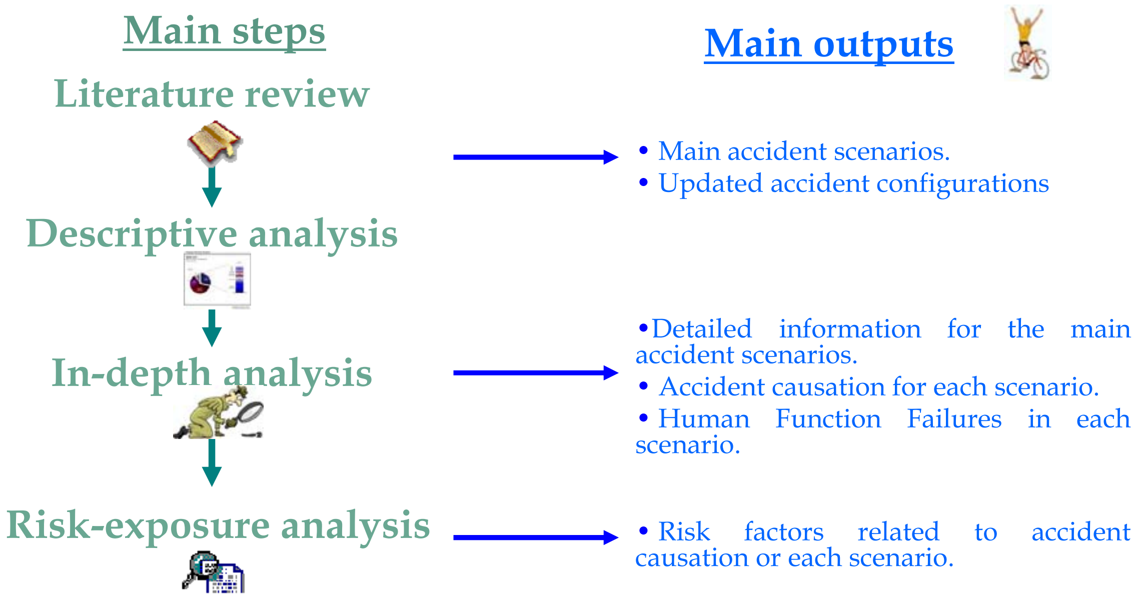

Figure 2.7.- Main steps and expected outputs planned in WP1.

2.2.5 Deliverable D1.1

2.2.5.a Main challenges

At the beginning of this deliverable (therefore, at the beginning of the first two steps of the Work Package 1: 'Literature review' and 'Descriptive analyses'), specific challenges were detected to be overcome:

- A Diagnosis of traffic safety problems at the European Level from the research angle: Road Users.
- Two aspects to study: Literature review - Descriptive statistics.
- Rely on a set of various national accident databases.

2.2.5.b Expected outputs

The achievement of these challenges has implied the obtaining of the expected output in this deliverable:

- Update diagnosis of road traffic safety in Europe.
- Update knowledge of main accident scenarios.
- Define the main scenarios from each road user point of view for the following steps in 'Work Package 1' (In-depth and risk analyses) which will help for:
  - The evaluation of the effectiveness of existing safety devices.
  - The determination of the most promising safety systems.
  - The identification of the configurations not addressed by present technologies.

2.2.5.c Structure of the deliverable

The present report is structured on the following way. After a brief summary and this introduction section, specific chapters are going to be dedicated to the results from the literature review and descriptive analysis for each one of the Work Package 1 tasks.

The different sections for each chapter (task) will be:

- ✓ General introduction: The magnitude of the problem will be detailed.
- ✓ Literature review: Main outcomes from the literature review done over each task will be given to establish existing knowledge and the missing subjects. The most interesting results from this analysis is used to create a data request which is forwarded to WP8 to request similar tables of aggregated data from other TRACE partners who have access to their national data
- ✓ Descriptive analysis: The goal of this chapter is to explain the methodology used during the analysis of data coming from the extensive database available for TRACE and the results obtained from this analysis (focused on giving general statistics from the point of view of the road users).
- ✓ Conclusions: A brief summary is to be showed related to the results from the analysis done. The same way, next steps in the Work Package after these results will be detailed.
- ✓ References: References used during the analysis of each task are going to be listed. Most of them are European references due to the purpose of the project.
- ✓ Annex: Additional information about each task is included in the different annexes of this report.

The report will be concluded with a final chapter presenting some discussions and the global conclusions.

3 Task 1.1: Passenger Car Drivers

3.1 Introduction

Passenger car accidents represent a big issue for road safety. Indeed, the car is the most popular and used transport mode in Europe compared to bus, coach, railway transport….The general trend shows an increase of its use of 16%[11] from 1995 in Europe 25. In relation with this information, passenger car fleet in Europe follows the same trend (+ 14%). In 2004, in Europe there are 458 passenger cars for 1,000 inhabitants[12]. In spite of the missing data from Bulgaria and Romania, it is assumed that the trends in Europe 27 will not differ from Europe 25 (as passenger car fleets in Romania and Bulgaria in 2004 represents 2,5% of the total European passenger car fleet).

Then, in EU27, in 2004, passenger car accidents represented 81% of all injury accidents (1,070,320 of 1,323,036), 70% of all road fatalities (32,726 of 46,821) and 93% of all casualties (1,690,810 of 1,810,568). Casualties and fatalities in these accidents are mainly in the passenger car (respectively 62% and 74%).

In spite of a significant work done to reduce road fatalities, it is necessary to identify the main problems and the magnitude of the problems related to the causation of the accidents involving a passenger car – as road accident is still one of the main causes of fatalities (in France, it is the third one). We defined in the study a passenger car as a motor vehicle with four wheels used to transport only or mainly people (seating for no more than 8 passengers).

The intention of the descriptive statistical analysis is to obtain the situations/factors/parameters (targets) where likelihood of having an accident is high from the **point of view of passenger car road user**. The purpose is to analyze the personal, technical and environmental conditions in which the accident has happened to find an appropriate understanding of the circumstances the accident occurs under. Some of these conditions are: age, driving experience / training, professional occupation, cohabitation with other road users, gender, light, time / day / month, specific type of vehicle, speed…

Moreover, this descriptive statistical analysis will be followed by a risk analysis in order to quantify the "chance" or "relative incidence" of traffic accident involvement according to different accident characteristics.

All these information which will contribute to the statistical knowledge of passenger car road safety are defined with several indicators:

- **Stake indicator**: for instance, there are 46,821 road fatalities per year, in EU27. It means 128 fatalities every day.
- **Relative stake indicator**: for instance, 24,136 fatalities in 2004 was passenger car occupants, that is to say 52% of all fatalities. It means that one fatality out of two is a passenger car occupant.
- **Risk indicator**: in EU27, in 2004, there are 46,821 road fatalities and EU27 gathers 487 millions inhabitants, that is to say 96 fatalities for one million of inhabitants.
- **Relative risk indicator**: for instance, in France, the young represent 10% of the whole population and 25% of all road fatalities. It means that the risk to be killed in a road accident is three times higher ((25/10) / (75/90)) for young comparing to the remainder population.

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[11] Eurostat and European Union Road federation
[12] Eurostat

3.1.1 The stakes and general overview

The accidents involving at least one passenger car stakes are significantly high. Indeed, in Europe 27, these accidents represent:

- ✓ 81% of road injury accidents (1,070,320 road injury accidents involving at least one passenger car),
- ✓ 71% of the fatalities (24,136 fatalities in passenger car accidents),
- ✓ 94% of the casualties (1,700,585 casualties in passenger car accidents).

The KSI[13] indicator is rate of fatalities and seriously injured. In EU27, KSI is around 19%. It means that fatalities and seriously injured in passenger car accidents represent 19% of all road casualties. This indicator is widely different according to the country. Indeed, it varies from 7%, 8% (respectively in Portugal and in Belgium) to 32% (in Denmark and in France). This difference can be explained by the posting of injury accidents and definition of injury severities.

In the following figures, the distribution of the rates of fatalities and severity for accidents involving at least one passenger car are presented for each country in EU27.

The rate is calculated by dividing the number of the sub-set by the total number of the sample. For example, the fatality rate is the number of fatalities in the accidents involving at least one passenger car divided by the total number of fatalities in injury accidents.

Note: The next results are based on available data and for the missing ones by simple linear regression estimation or WP7 methodology. They do not represent the strict reality.

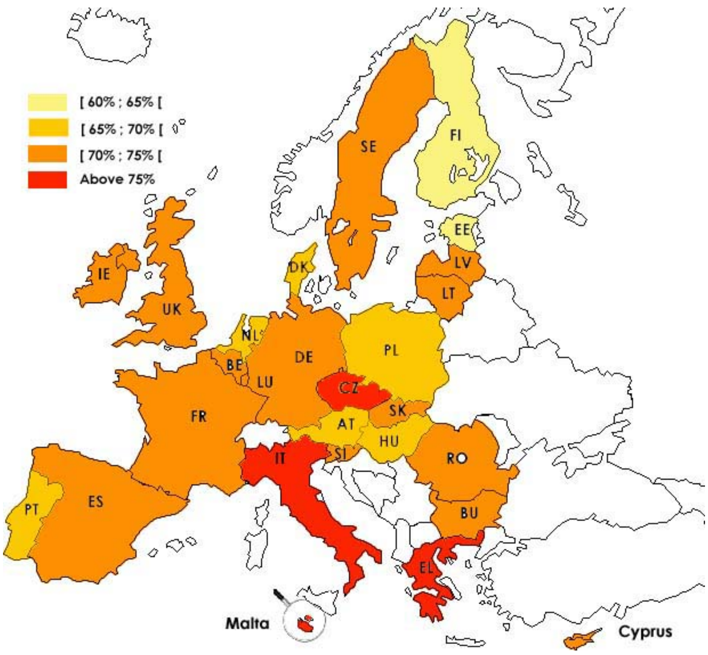

Figure 3.1.-Distribution of the passenger car accident fatality rate by EU27 countries

(Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

[13] KSI = fatalities and seriously injured in passenger car accidents / all road casualties.

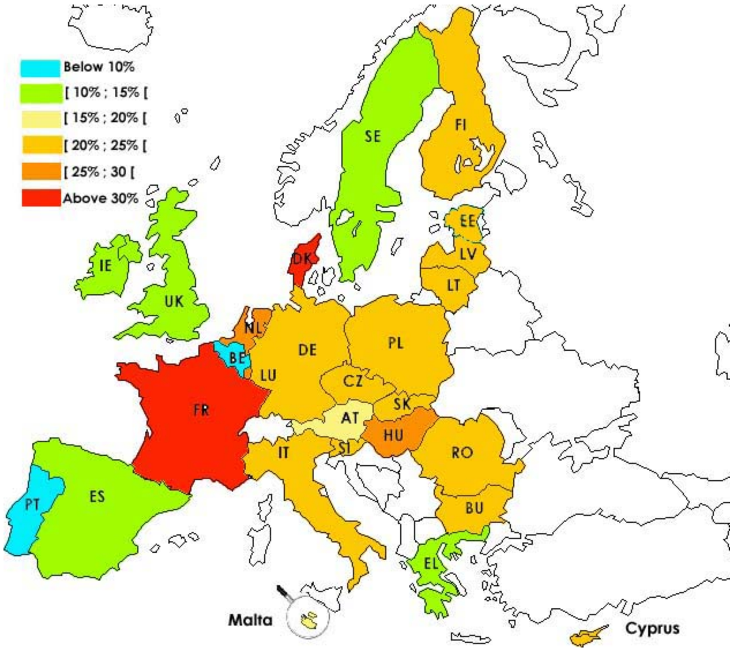

Figure 3.2.-Distribution of the passenger car accident KSI rate by EU27 countries

(Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

3.2 Main outcomes of the literature review

As explained above, the aim of this chapter is to focus on the situations, the factors and the parameters which could have contributed to the causation of passenger car accidents. Even if, it is not possible to determine the only cause of the accident, it is necessary to underline some relevant factors which could have contributed to generate the accident or some significant situations based on their preponderance and/or their risk to be killed.

Some studies have focused on passenger car accidents causations and have highlighted different issues for them. These issues will be further analyzed using national databases in this report and then in-depth databases in the next report.

3.2.1 Accident situations

Loss of control or guidance problems[14]

Accidents are usually not classified in official accident statistics according to whether or not skidding or loss of control has been a contributing factor. The study of Campbell et al. (2003) is based on a total of ca. 73,000 accidents from two US databases. Accidents of all severities are included in their analysis. In about half of all single vehicle offroad accidents, skidding has been a major contributing factor, and in about half of these accidents speeding (driving above the speed limit) has been an additional contributing factor. The study of the Insurance Institute for Highway Safety (2005) has estimated the proportions of different types of accidents that may be prevented by ESC. Langwieder et al. (2003) have analyzed reports of ca. 1500 injury accidents in Germany in order to estimate the proportions of accidents which involved skidding. Sferco et al. (2001) have investigated ca. 2,700 accidents in the European accident causation survey (EACS, based on data from five European countries). They have estimated quite large amounts of accidents which involve loss of control and which may be affected

[14] Alena Erke, effects of electronic stability control on accidents: a review of empirical evidence

by ESC. The proportion of accidents which actually may be avoided by ESC is assumed to be much smaller. Unselt et al. (2004) have analysed data from a representative sample of over two million accidents in Germany in 2002 and estimated how many accidents involved loss of control. Zobel et al. (2000) have analyzed 10,000 accidents in the database of the Hannover Medical School (MHH).They have estimated the proportions of accidents with at least one very severely injured (MAIS 5+) that involved skidding. According to Zobel et al. (2000), the probability of at least one very severely injured (MAIS 5+) in accidents, which without ESC would be side collisions, would be reduced by 50% if all vehicles were equipped with ESC. The proportion is larger in curves (53%) that in straight sections (40%). The results show quite consistently large proportions of single vehicle accidents which involve contributing factors that may be affected by ESC, and smaller proportions for multi-vehicle accidents. The proportions are consistently larger for fatal accidents than for injury accidents. These results do not take into account potential effects on driver behaviour.

		Proportion of accidents involving contributing factor (%)		
Study	Accident contributing factor	Single vehicle	Multi-vehicle	All
Campbell et al. (2003)	Skidding	50 (single vehicle off-road)	1 (rear-end) 8 (lane change)	
Insurance Institute for Highway Safety (2005)	ESC-relevant	56	17	34
Langwieder et al. (2003)	Skidding	39	12	
Sferco et al. (2001)	Loss of control, ESC-relevant			42 (injury accident) 67 (fatal accident)
Unselt et al. (2004)	Loss of control			21 (injury accident) 43 (fatal accident)
Zobel et al. (2000)	Skidding			44 (very severe injury accident)
Summary	ESC-relevant	40–50	10	20–40

Figure 3.3.-Proportion of accidents in which contributing factors may be affected by ESC (Source: Alena Erke, effects of electronic stability control on accidents: a review of empirical evidence)

Accident at intersection

Numerous surveys have shown that intersection crash avoidance represents a great challenge. Actually, in Europe-14, in 2004, 23,406 fatal accidents occurred, including 22% at junction (5,078 fatal accidents, Safetynet and Care references).

39% of intersection accidents occurred at crossroad (at-grade intersection) and 25% at T or Y intersection. Round-about accounts for 5% of the fatal accidents at junction.

In US, crashes at junctions represent about 60% of all crashes with 44% at intersections (intersection and intersection-related) (Wang 1994; Ragland 2003), and fatalities in crashes occurring at intersections account for slightly more than 20% of all motor vehicle traffic fatalities in US every year.

In France, 84318 injury accidents occurred in 2004. 27 % of injury accidents happened at intersections and resulted in 15 % of the fatalities and 27 % of the severely and slightly injured. Intersection accidents happened mainly in urban areas (80%) but the severity is lower (42 % of the fatalities in intersections occurred in urban areas). Of the injury accidents at intersection, 23 % involved at least one passenger car and resulted in 10 % of all fatalities[15].

Elsewhere, UK statistics (Department of the environment, transport and the region) indicate that 59% of personal injury accidents happen within 20 meters of a junction. Note that this definition leads to take into account accidents with no relation with intersection.

The German Federal Statistical Office identifies that overall 34% of accidents happen at intersections. In Spain, 34% of injury accidents occurred at intersection. Austrian statistics show 32% of all accidents occurring at intersection while Switzerland counts 24%.

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[15] INTERSAFE, Statistic Accident Analysis and Definition of Relevant Scenarios

3.2.2 Risk Factors

Although risk factor is a topic which will be studied in other Work Package of this project (Work Package 3 'Type of Risk Factors'), nevertheless, passenger cars accidents literature review makes some relevant risk factors stand out.

Driving speed and the risk of crashes

A decrease of 10% of the mean speed reduces the number of fatal accidents of 37,8%[16]

Speed = first problem in fatal accidents[17]

Most studies suggest that there is an exponential relationship between speed and crash rates at the individual vehicle and that a power function can be defined for the relationships at the road section level. Both types of studies found evidence that the increase in crash rates with speed much steeper on minor roads than on major roads. Further, lane width, junction density and traffic flows were found to have an effect on the relationships. Speed dispersion studies found that, generally, larger differences in vehicle speeds - a vehicle moving much faster than the surrounding traffic - result in higher crash rates. No relationship, however, was observed with a vehicle much slower than the surrounding traffic.

The effects of age and sex on accident risk

8500 young passenger (15-24 years old) cars drivers killed on the road, in the OECD countries in 2004. That is to say 27% of all the killed drivers whereas young people represent 10% of the total population[18].

Male young driver = fatal accident risk multiplied by 7 compared to 30-59 years old male drivers[18].

18,5% of killed on the road have more than 65 years old in Europe: most of them are pedestrian or passenger car drivers[19].

In France, accidents involving elderly often occur during the week, the day, at intersection and involve two vehicles[20].

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[16] Elvik, R., Christensen, P.,Amundsen, A. (2004). Speed and road accidents. An evaluation of the Power Model, in 740/2004. Institute of Transport Economics TOI, Oslo.
Nilsson, G. (1981). The effects of speed limits on traffic crashes in Sweden. in Proceedings of the international symposium on the effects of speed limits on traffic crashes and fuel consumption. Dublin: Organisation for Economy, Co-operation, and Development (OECD), Paris.

Nilsson, G. (2004). Traffic safety dimensions and the power model to describe the effect of speed on safety, in Bulletin 221., Lund Institute of Technology, Lund.

[17] Organisation for Economic Co-operation and Development / European Conference of Ministers of transport (2005). Preliminary data on road safety in Europe in 2005

[18] OECD/CEMT (2007). Young Drivers: The Road to Safety

[19] European Commission

[20] ONISR 2005

An investigation into the effects of age and sex on the risk of causing a collision was carried out on accidents recorded in the Spanish Dirección General de Tráfico (DGT) traffic crash database between 1990 and 1999. Crude and adjusted ORs were calculated for each age and sex category[21].

Findings: Among male drivers, the lowest risk was associated with the 25-49 age group but increased significantly and exponentially for the over 50 categories. Similarly, the lowest risk was associated with the 23-44 age group among female drivers and the highest with those above 74 years old. The adjusted odds ratios were lower than the crude odds ratios for drivers of both sexes younger than 40 but higher for all drivers over 40 years old. This study reported lower risks for younger drivers than other similar studies. This has been attributed to the methodological differences, such as the exclusion of single vehicle accidents and collisions involving motorcycles. Nevertheless, the study suggests that the risk of causing an accident is directly related to age and that a number of confounding factors such as inexperience, speeding and driving while intoxicated increase the risk.

Alcohol[22]

Apart from a few countries where alcohol is prohibited, impairment by alcohol is an important factor influencing both the risk of a road traffic crash as well as the severity and outcome of the injuries that result from it. The frequency of drinking and driving varies between countries, but decades of research have shown that drink drivers have a significantly higher risk of being involved in a road crash than drivers who have not consumed alcohol.

In most high-income countries about 20% of fatally injured drivers have excess alcohol in their blood, i.e. blood alcohol concentration (BAC) in excess of the legal limit. In contrast, studies in low- and middle-income countries have shown that between 33% and 69% of fatally injured drivers and between 8% and 29% of non fatally injured drivers had consumed alcohol before their crash.

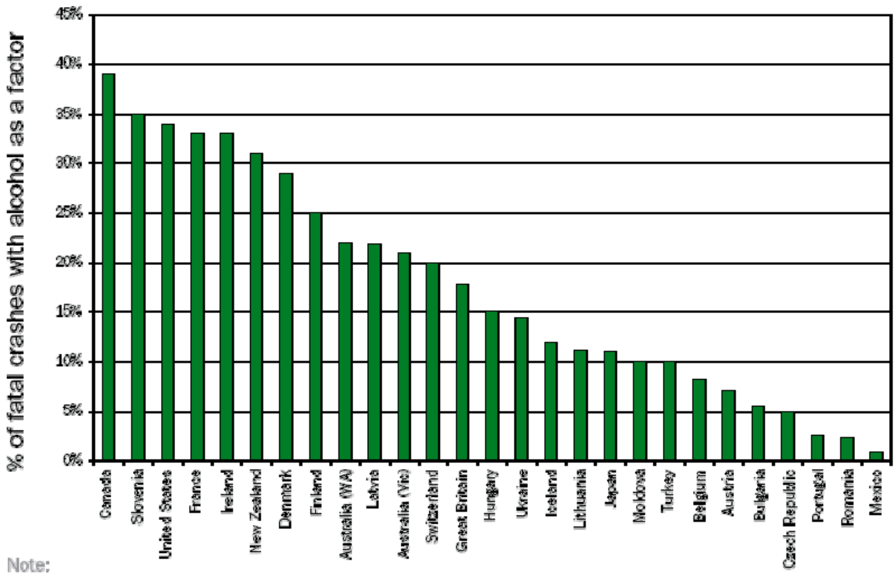

Figure 3.4.-Drink - driving as factor in fatal crashes in 2002, 2003 and 2004 (source WHO: Drinking and driving: a road safety manual for decision-makers and practitioners (2007))

Austria: the figure (7%) is largely underestimated. This is due to the fact that in Austria it is not allowed to check alcohol on a dead person.
Portugal: data are largely underestimated, since not all drivers are checked.

[21] Claret PL, Castillo JdDLd, Moleón JJJ, Cavanillas AB, Martín MG, Vargas RG. Age and sex differences in the risk of causing vehicle collisions in Spain, 1990 to 1999. Accident Analysis and Prevention 2005; 35: p. 261-272

[22] Drinking and driving: a road safety manual for decision-makers and practitioners (2007)

Fatigue

Fatigue or sleepiness is associated with a range of factors, including long-distance driving, sleep deprivation and the disruption of circadian rhythms. Three high-risk groups have been identified[23] :

- young people, particularly males, aged 16–29 years;
- shift workers whose sleep is disrupted by working at night or working long, irregular hours;
- people with untreated sleep apnoea syndrome or narcolepsy.

Estimates of the proportion of car crashes attributable to driver sleepiness vary, depending on the type of study and the quality of data. A population based case–control study in New Zealand found that factors that substantially increased the risk of a fatal crash or a crash with serious injuries were:

- driving while feeling sleepy;
- driving after less than five hours of sleep in the preceding 24 hours;
- driving between 02:00 and 05:00.

The study concluded that a reduction in all three of these behaviours could reduce the incidence of crashes involving injury by up to 19%[24].

3.3 Descriptive analysis

The descriptive analysis will use two sources of information. The first one is available data from TRACE project and the second one is estimated data (for data not available). Both data will be described in the next parts.

3.3.1 Available data

3.3.1.a Period of data

The data used in this work is restricted to a 4 year period, from 2001 to 2004 as an average. Only the Greek data are from the year 2004. When analyzing the data of the different countries, it was not always possible to get full information for the entire period of 4 years. In some cases, certain countries could not be taken into consideration as the lack of information could not be solved properly. Therefore missing countries in some tables throughout the report are just attributed to missing data.

3.3.1.b Accidents considered in the study

The study contains data about accidents with personal damage, which is distinguished after fatalities, seriously and slightly injured persons.

3.3.1.c Vehicles considered in the study

Accidents under study involve at least one passenger car or one taxi.

[23] National Center on Sleep Disorders Research/National Highway Traffic Safety Administration Expert Panel on Driver Fatigue and Sleepiness. Drowsy driving and automobile crashes. Washington, DC, National Highway Traffic Safety Administration, 1996. (http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html, accessed 17 November 2003).

[24] Connor J et al. Driver sleepiness and risk of serious injury to car occupants: population based control study. British Medical Journal, 2002, 324:1125.

3.3.1.d Involved countries and covered geographical area

The databases used are the following ones:

Country	Database	Data provider	Covered area
France	BAAC	LAB	Whole France
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 3.1.- National database description for passenger car accidents.

3.3.2 Estimated data

The following results are based both on TRACE and CARE data, and completed with other sources such as IRTAD, IRF and National Statistics Databanks. The missing values have been estimated with two methodologies: a linear regression or a n iterative proportional fitting procedure. The choice depended on the availability of annex data to estimate missing data and the complexity of the estimation. For instance, in EU19, by countries, fatalities in accidents involving at least one passenger car is strongly correlated to the total number of fatalities. So a simple linear regression is sufficient for the estimation.

Linear regression - The simple linear regression uses the relevant parameters (such as number of accidents, fatalities, victims, etc.) and the requested information available on the other countries. This is the case for the number of fatalities in accidents involving at least one passenger car for Germany, Cyprus, Latvia, Lithuania, Slovakia, Slovenia, Bulgaria and Romania that have been estimated from this variable available in the other 19 countries and from the total number of fatalities in each country.

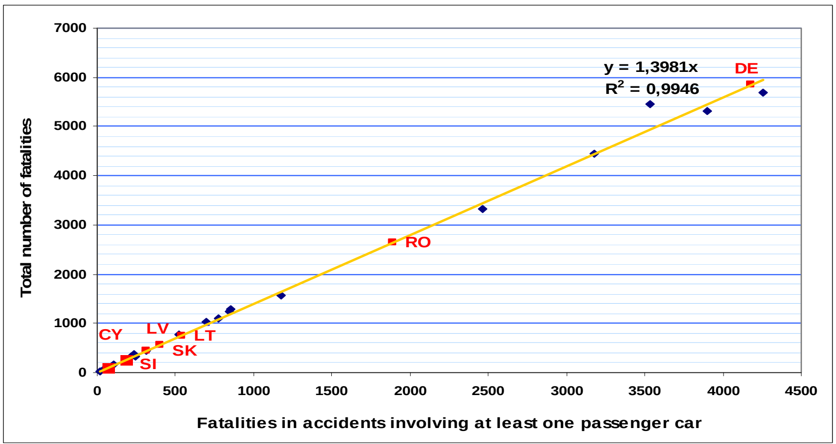

Figure 3.5.-Estimation of the number of fatalities in accidents involving at least one passenger car in EU-27 (year 2004, Sources CARE, IRF, IRTAD, National Statistics Databank)

Iterative proportional fitting procedure (IPFP – Report D7.1 - Statistical methods for improving the usability of existing accident databases) - A multi-dimensional contingency table of observed count data serves as initial or starting table. Then, the *iterative proportional fitting procedure (IPFP)* is applied to adjust the starting table to certain one- or higher-dimensional marginal distributions which represent the external information. The adjusted table is an easily calculated solution to a table which satisfies the marginal constraints and preserves those main and interaction effects for which no external margins are available. Applied to our expansion problem, the adjusted table produced by the IPFP combines different data sources in a way that all information available at the European level is used and only the missing information is taken from the regional or national data bases.

The important hypothesis behind this estimation is that the information available in some countries being representative of the EU-27. Most of the available data comes from Western European countries with a culture on road traffic safety anchored well for several years. If the estimations have been based only with these countries, certainly that results could be discussed. However we can say hat these estimations are good for the following reasons:

- The number of missing data has to remain lower than the available ones;
- Some data are available in Eastern European countries such as Estonia, Czech Republic, Poland, Malta or Hungary which represent 80% of the overall fatalities among the Eastern Europe;
- Most of the Eastern European countries where data are missing are small ones and their contribution in term of fatality remains small (Cyprus, Malta, Latvia, Lithuania).

3.3.3 Exposure data

Exposition is defined as the condition of being subjected to a source of risk. For example, if the number of road fatalities is the same in two countries but the number of inhabitants is different, the risk to be killed, for an inhabitant, in a road accident is not the same. Another example, if a driver has an accident in one year and he drives 10,000 kilometres per year whereas another driver has an accident in one year and drives 50,000 kilometres per year then the risk for both vehicles is not the same.

So the accidents are characterized by their occurrences and their risks. That is what we will use to determine the relevance of a factor or a situation.

Population

Europe 27 (Germany, Belgium, France, Italy, Luxembourg, The Netherlands, Denmark, Ireland, the United Kingdom, Greece, Spain, Portugal, Austria, Finland, Sweden, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Czech Republic, Slovakia, Slovenia, Bulgaria and Romania) gathers in 2007, ***489 millions of inhabitants***, that is to say 113 inhabitants per kilometre square[25].

This exposure data gives information on the risk to be killed in a road accident. For example, Poland and France have a similar number of fatalities (in 2004, 5,712 and 5,530 fatalities respectively) but the population is clearly different with 38 millions and 60 millions inhabitants, respectively. So the risk to be killed in a road accident is definitively higher in Poland than in France. This information is related to all kind of road accidents and the report is focusing on passenger car accidents. That is why this risk is analyzed in another part of the report using national passenger car accidents databases.

Population, motorization and GDP[26]

In Europe, in 2004, there are around ***458 passenger cars for 1,000 inhabitants***[27] on the road (in 1995, this figure was about 394 passenger car for 1,000 inhabitants), that is to say more than 223 millions of cars for the whole European population.

Nevertheless, the number of passenger cars per inhabitant is widely different according to the country (from 15, in Romania, to 65, in Luxembourg, passenger cars per 1,000 inhabitants) but seems to be linked to the GDP of the country. Indeed, the higher is the GDP, the larger is the number of passenger cars per inhabitant (Figure 3.6). That is why it can be easily distinguished on the figure Europe 15 and the 12 other countries that joined Europe in 2004 and 2007.

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25 INSEE
26 Gross domestic Product
27 Eurostat - http://epp.eurostat.ec.europa.eu

It can be thought that in few years, after an increase of GDP/inhabitant of the other 12 countries, these ones will take the place of current Europe 15. And these 15 countries will probably tend to an asymptote[28].

To conclude, a greater GDP generate a bigger passenger car fleet. Then, it means that passenger cars are more exposed to hypothetic collisions. And so, considering a country developing itself from an economic point of view (increase of the GDP), having in the same time a bigger passenger car fleet and doing nothing to improve road safety, it should result in a higher number of road accidents and obviously a higher number of road fatalities.

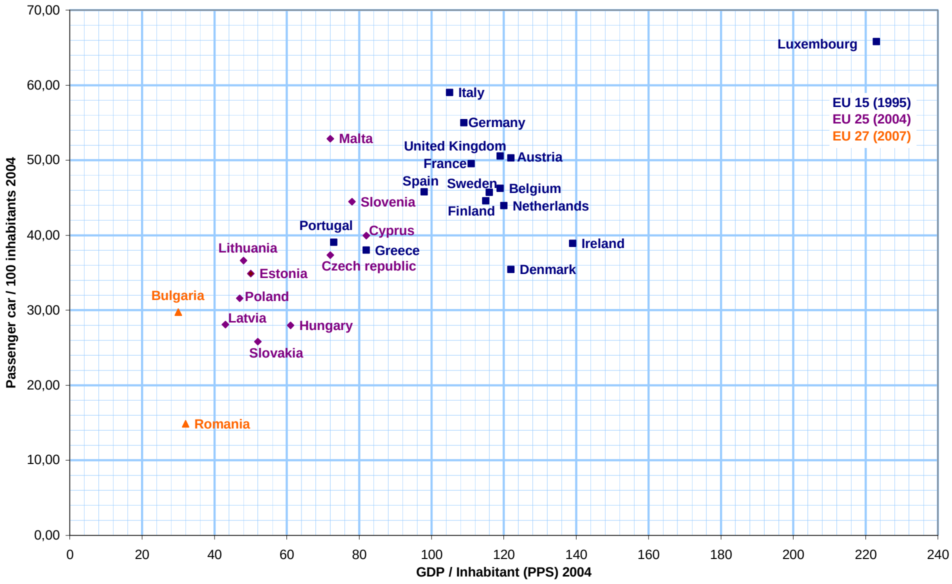

Figure 3.6.-Relationship between passenger cars per 1,000 inhabitants and GDP per inhabitants in 2004 (Source: Eurostat)

It can be distinguished two groups. The first one, on the bottom right corner, which mainly gathers countries that joined Europe from 2004. The second group has a lowest rate of road fatalities in passenger cars per 100,000 inhabitants.

It has been supposed above that if the passenger car fleet grows up, vehicles are more exposed to hypothetic collisions. And the next chart shows that for similar passenger car fleets (two examples with red lines: United Kingdom, France, Belgium, Austria and Spain on one hand and Portugal, Ireland, Greece, Cyprus on another hand), road fatalities per 100,000 inhabitants are widely different.
So, the next part of the report characterizes these differences between countries thanks to the analysis of national databases.

[28] *SCENES program financed by the EU*

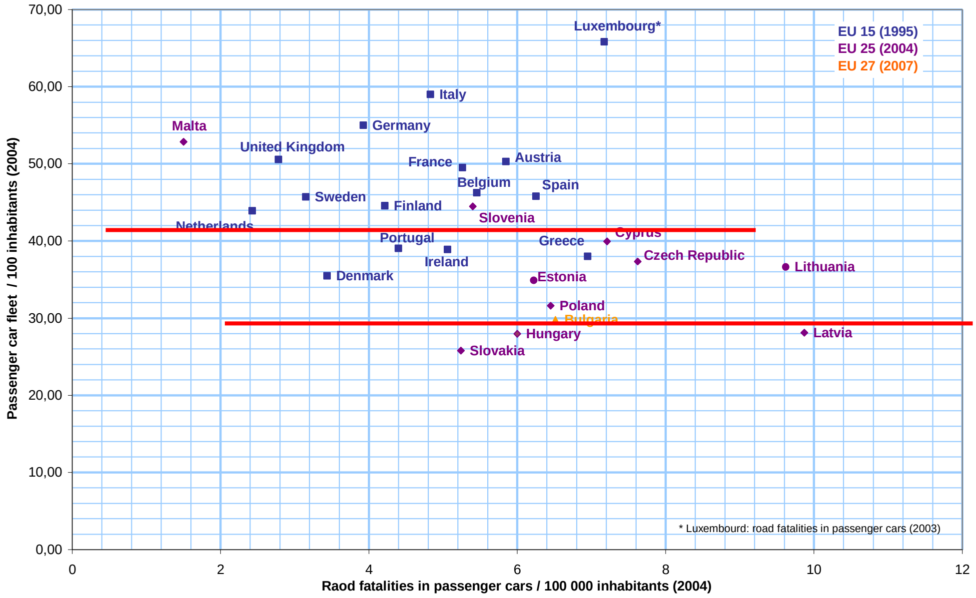

Figure 3.7.-Relationship between passenger car fleet per 100 inhabitants and Road fatalities in passenger cars per 100 000 inhabitants (2004) (Source: Economic Commission for Europe, Road Traffic Accidents 2007)

Road network and passengers

In Europe, ***5 million kilometres of road network***[29] are identified, in 2003, including 60,000 kilometres of motorways, 355,000 kilometres of national roads, 1,267,000 kilometres of secondary or regional roads and more than 3 million kilometres of other roads.

This information is another exposure data. Indeed, it could be estimated the number of accidents per kilometre of road for example. United Kingdom and Spain have the same length of total road (350,000 kilometres) and the total number of fatal accidents are respectively in these countries 3,106 and 3,643. It means that in the United Kingdom, every 1,000 kilometres there are 8 accidents and in Spain it is 10 accidents every 1,000 kilometres.
In the same way, the knowledge of length of total road network by category and country gives the possibility to estimate the risk to be involved in an accident on motorways or on national roads…

More than ***4,444 billion passenger-kilometre***[30], in 2003, for car passengers are estimated in Europe. It means that 1 person in Europe, per year, travels between 7,000 and 13,000 kilometres[31]. It represents an increase of 16% from 1995. Moreover, cars gather 84% of the total inland transport in Europe 25 (% of passenger kilometres), it can be considered that people use more and more and principally this kind of transport.

It is also a good indicator for road safety when occupancy in the vehicle and the length of the trip until the accident are known.

5 occupants in a car having an accident after driven 100 kilometres have a bigger risk (considering the exposure data passenger-kilometre) to be involved in an accident than 1 occupant in a car having an accident after driven 100 kilometres.

[29] European Union Road Federation
[30] Without Bulgaria and Romania
[31] Eurostat and European Union Road Federation

3.3.4 Analysis and methodologies

At first the general accident situation of each country is shown with the help of an overview. Some relevant factors linked to accident causations will be determined and then these ones will be examined during the in-depth accidents analyze.

The level of these describing data will go gradually deeper and deeper and indicate to the most important configurations.

3.3.5 Results for passenger cars

3.3.5.a General overview

From 74% to 86% of road injury accidents involve at least one passenger car, in Europe, an average of 83% estimated in EU27, in 2004. If the results for the EU19 (EU15 – Germany + Czech Republic + Estonia + Latvia + Malt + Poland) can be considered as close to the reality, on the other hand those related both EU25 and EU27 are only estimations and are strongly correlated to the EU19 ones.

Although this rate is quite homogeneous between countries in EU27, the contribution of each of them is different. Indeed, Germany, Italy and UK pull up injury accidents (involving at least one passenger car) numbers as they contribute to 59% of all accidents. It can be noticed that in central and east Europe, Poland has the highest contribution (4%).

These data show a dispersion between countries that could be explained with the differences of network, urbanization, vehicle fleet and also with the differences of definition used in the national databases such as the definition of the seriousness of injuries (especially for slight injury accidents). Therefore, it is necessary to identify where the risk is for each of them.

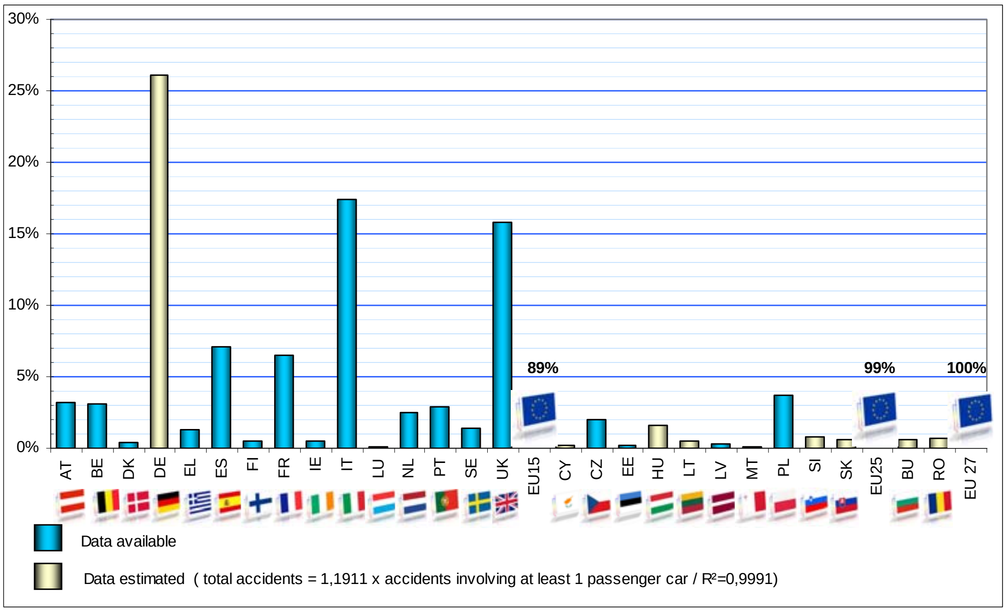

Figure 3.8.-Accidents involving at least one passenger car contribution by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Figure 3.9 shows the distribution of the rate of fatalities in accidents involving at least on passenger car by EU27 countries. As for previous charts and figures, this proportion is quite homogeneous as it varies from 64% to 75% (excluding Malt and Estonia where the fatality contribution is very low and distort the results). In EU27, an average of 71% is estimated.

It is interesting to see in which vehicle the fatalities are. The rate of fatalities in passenger car is heterogeneous according to countries. Indeed, it varies from 35% to 65% and the average is 52% in EU27.

This dispersion can be explained by transport mode, culture, road network and accident configuration. In Portugal, Netherlands and Romania where the rate is very low, most of the fatalities are riders, pedestrians and cyclists. The report will identify what characterizes these differences and the in-depth and risk analysis will give more details on this relevant information. Germany, Spain, France, Italy, United Kingdom and Poland are the countries where the number of fatalities in passenger cars are the most important as they gather 68% of them.

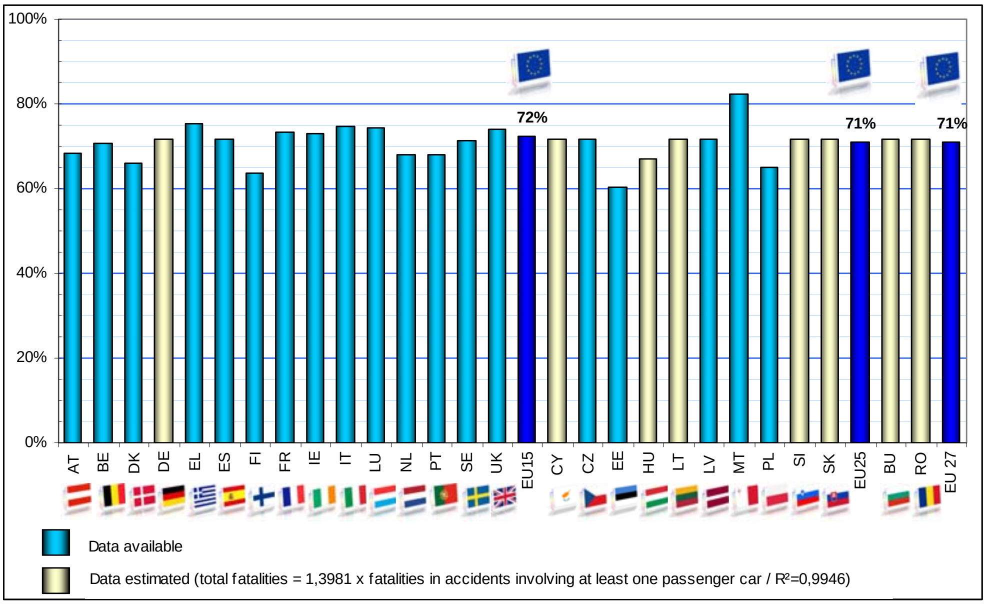

Figure 3.9.-Distribution of the rate of fatalities in accidents involving at least one passenger car by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

The KSI[32] indicator states on the rate of fatalities and seriously injured among the casualties. The results are very heterogeneous as they vary from 7% to 32% and the estimated average is 19%. This information is clearly linked to the injury seriousness definition. For instance, in UK there are 3 times more casualties than in France whereas the KSI is 3 times more important in France than in UK.

[32] KSI= (Killed and seriously injured) / casualties

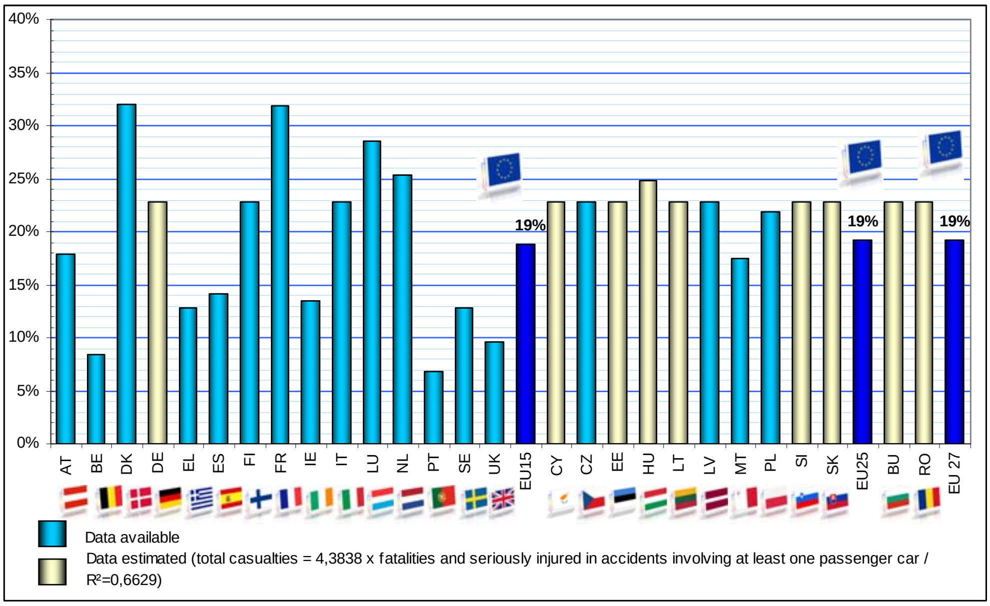

Figure 3.10.-Distribution of the accidents involving at least one passenger car severity KSI by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

Next figures present three measures of road accident fatality risk. These are labeled "health risk", "traffic risk1" and "traffic risk2".

Health risk is the number of fatalities in passenger cars per year per 100,000 inhabitants. Health risk attributable to road accidents can be compared to the health risk represented by other causes of death.

Traffic risk1 is the number of fatalities in passenger cars per year per 100,000 passenger cars (In the fleet). The level of traffic risk indicates how safe passenger car travel is in a country. For car manufacturers, it is interesting to know the probability of fatalities in a passenger car.

Traffic risk2 is the number of fatalities in passenger cars per year per 1 billion passenger car occupants kilometres. As exposure, this indicator takes into consideration passenger car fleet, occupants and the kilometer of travel of each occupant.

The three next figures show that there are fairly large variations in health risk and traffic risks between EU27 countries. All these countries are highly motorized, having at least 0,14 passenger cars per inhabitant. The average rate for the EU27 countries is 0,46 passenger cars per inhabitant. From a general point of view, these three risks are lower in EU15 than in other countries in EU27. For comparison, in the world, for road accident fatalities, the health risk is 8,6 and the traffic risk is 44,8[33].

[33] The handbook of road safety measures – Rune Elvik and Truls Vaa

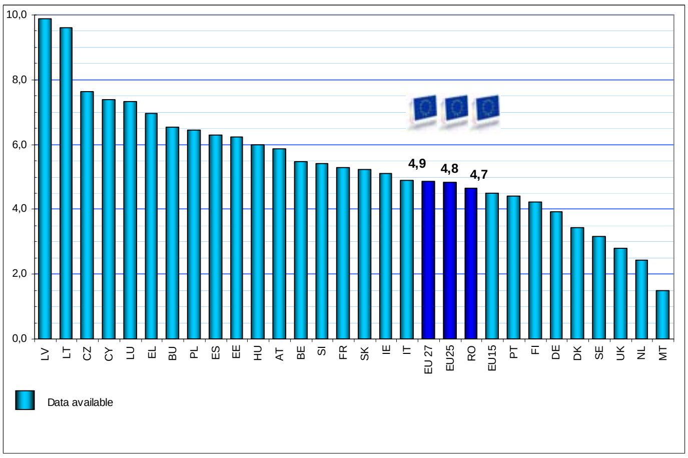

Figure 3.11.-Health risk (killed in the passenger cars per 100,000 inhabitants) - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

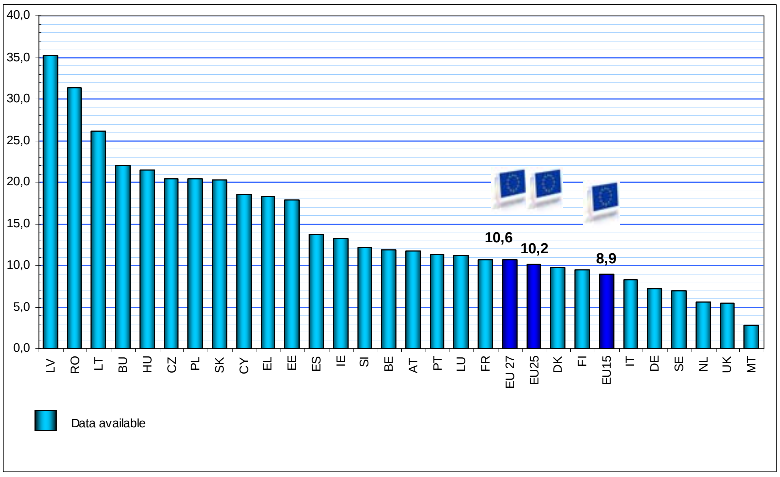

Figure 3.12.-Traffic risk1 (killed in the passenger car per 100,000 passenger cars) - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

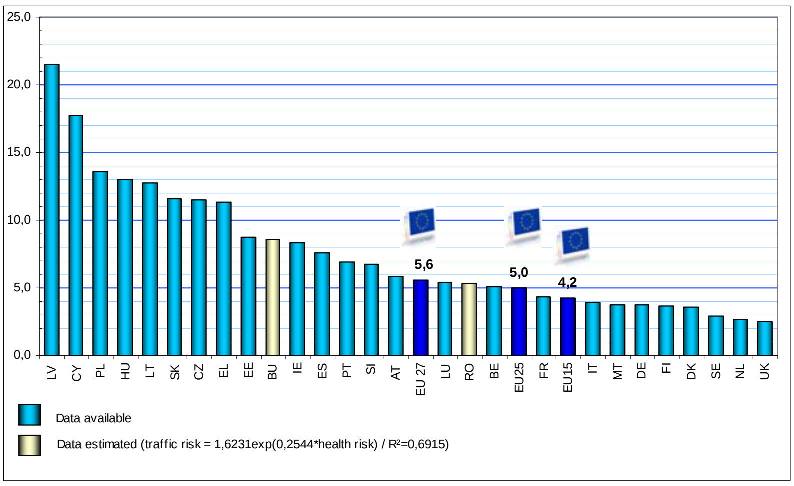

Figure 3.13.-Traffic risk2 (killed in the passenger car per 1 billion passenger car occupants kilometre) - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

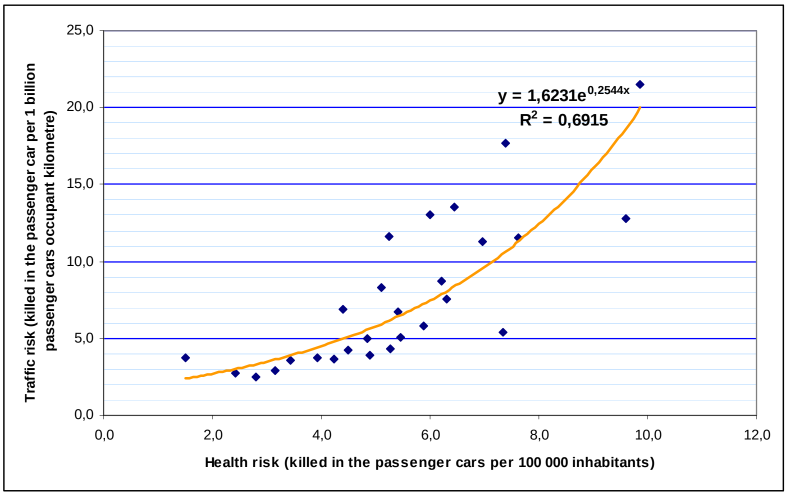

Figure 3.14.-Relationship between health risk (killed in the passenger cars per 100,000 inhabitants) and traffic risk (killed in the passenger car per 1 billion passenger cars occupant kilometre) in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

3.3.5.b Accident evolution

Fatalities in EU 27 from 2001 to 2004		
Reduction of fatalities in EU15	-7 337	-18%
Reduction of fatalities in EU25	-7 037	-14%
Reduction of fatalities in EU27	-7 148	-13%

Fatalities in passenger cars from 2001 to 2004		
Reduction of fatalities in passenger cars in EU15	-4 888	-22%
Reduction of fatalities in passenger cars in EU25	-4 734	-18%
Reduction of fatalities in passenger cars in EU27	-4 700	-17%

Figure 3.15.-Fatalities reduction in passenger cars from 2001 to 2004, in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Figure 3.15 presents the reduction of road accident fatalities from 2001 to 2004 in EU27 and the reduction of fatalities in passenger cars from 2001 to 2004 in EU27. The general information is:

- **The decrease of fatalities is higher in EU15 than in new countries in EU25 or EU27**. Road safety policies from an European/national point of view mainly contribute to drive safer. Indeed, policy can impose to car manufacturers to have safety systems as a standard on their vehicles (ABS since July 2004) or to national governments to decrease fatalities by half in 2010.
- **Fatalities in passenger cars decrease faster than the global decrease of fatalities in Europe**. As noticed earlier in the report, passenger car is the most popular and use road transport mode. It means that when a general safety measure (such as speed checks in France or better road maintenance) is taken and applied, the effects are visible where issue is important – so, on passenger cars users. In addition to this trivial remark, it is also necessary to underline the work of car manufacturers to improve their vehicles. Occupants are better and better protected (because of better vehicle structure, more passive safety systems…).

Nervetheless, 9 new countries (on 12) in EU27 have an increase of fatalities in passenger cars. Later in the report, we will focus on the age of passenger car fleet and whose involve in accidents in order to try to understand this difference.

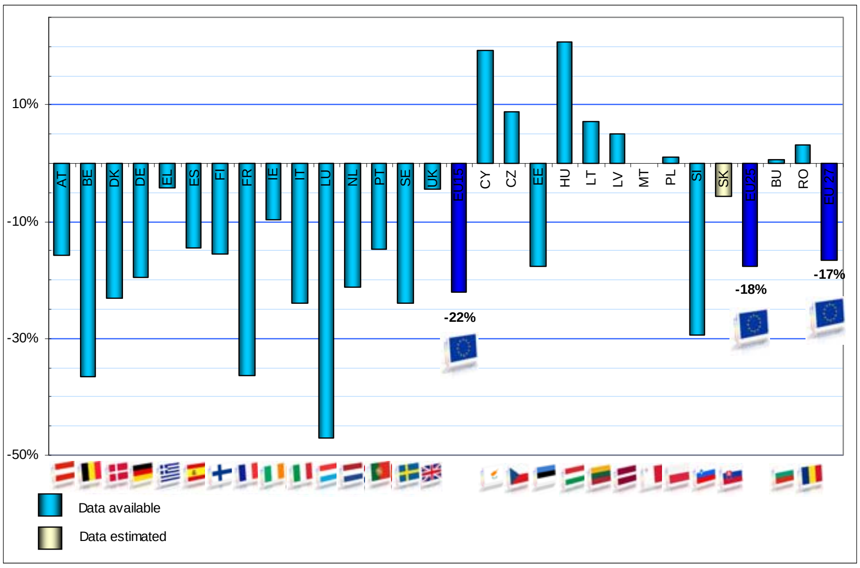

Figure 3.16.-Fatalities in passenger car reductions from 2001 to 2004 by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

Data focusing on the rate of passenger car per 1,000 inhabitants are available on Eurostat. For EU15, it is obvious that risk to be killed in a passenger car has decreased as the exposure data is greater (passenger car fleet) and the fatalities is lower.

For new countries in EU27 and particularly countries having a number of fatalities rising, it is not anymore so obvious. We see that these last 10 years, the use and the access to passenger cars have increased considerably and faster than in EU15. The availability of more detailed exposure data (passenger car fleet per year) is necessary to determine the evolution of the risk for these countries.

Comparing Figure 3.13 and Figure 3.17, it is interesting to see that in 2004, the traffic risk is higher for countries which knew a high evolution of their passenger car fleet from 1995 to 2004, especially for new countries from EU27 (whereas for other EU15 countries this development was earlier). For instance, in EU15, the traffic risk was higher in Greece, Ireland and Portugal and these ones among countries known the biggest evolution in their passenger fleet since 1995.

Predictions of future safety developments have been proposed by SWOV, the Dutch Road Safety Research Foundation based on time-series analyses and other methodologies. It is worthwhile to quote from the OECD Summary report *"Road Infrastructure Rehabilitation and Safety Strategies in Central and East Europe"* which is specifically related to CEEC's where traffic accident risks are dramatically high and motorisation has been increasing at an unprecedented pace:

"The growth of motorisation is accompanied by an exponentially decreasing curve for fatality rates. Just by combining both developments as a product [fatalities = fatalities/kilometrage × kilometrage] the development of fatalities could be described. This leads to the conclusion that a reduction in the number of fatalities ought to be the result of a higher decrease in fatality rate than an increase in mobility growth. *A reduction rate of 8-10 per cent in fatality rates must be considered realistic targets for Central and Eastern European countries.* If traffic growth is not accompanied by appropriate risk reducing countermeasures and activities, an increase of road fatalities might be the outcome. The lesson to be learned from highly motorised countries is, when accelerated traffic growth is anticipated, **no time can be lost to invest in safety**."

Naturally, only linked the fleet evolution to the risk would be too much simplistic. It also depends on which measures were taken in the country to reduce road accidents and on, once again, characteristics of the country – what will be lighten in the next parts of the report.

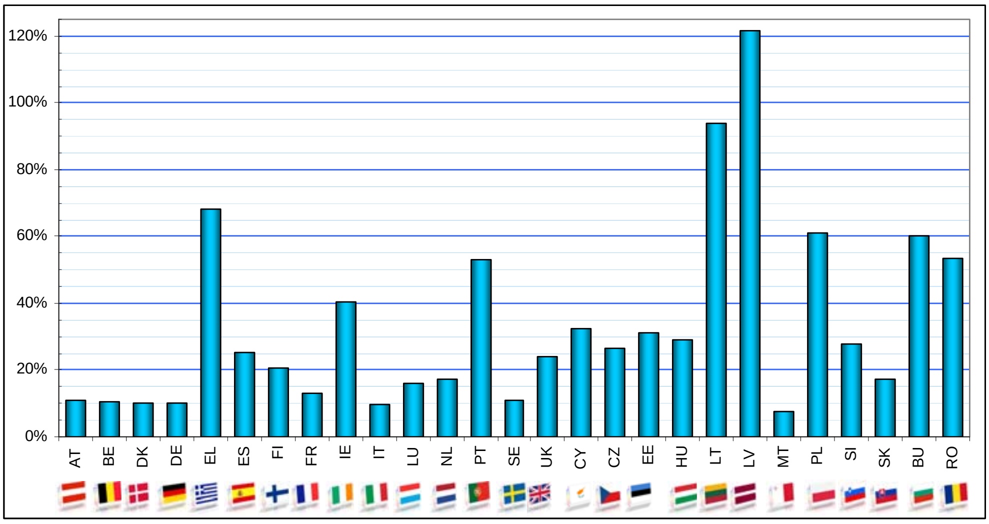

Figure 3.17.-Evolution, from 1995 to 2004, of passenger car per 1,000 inhabitants by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

3.3.5.c What is the weather condition?

Passenger cars accidents in EU 27	
Injury accidents	1 070 320
Fatalities in the accident	32 726
Casualties in the accident	1 690 810

Normal weather		
Injury accidents	876 511	82%
Fatalities in the accident	26 818	82%
Casualties in the accident	1 412 525	84%

Bad weather		
Injury accidents	145 602	14%
Fatalities in the accident	4 358	13%
Casualties in the accident	238 073	14%

Other or unknown weather condition		
Injury accidents	48 207	5%
Fatalities in the accident	1 370	4%
Casualties in the accident	40 212	2%

Figure 3.18.-Contribution of weather conditions in passenger car accidents in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

In EU27, around 80% of injuries accidents and fatalities in accidents involving at least one passenger car occur in good weather conditions. There is no difference between countries except for Luxembourg where the number of road injury accidents is very low.

On the other hand, several behavioral experiments (Edwards, J., "Speed adjustment of motorway commuter traffic to inclement weather", 1999…) underline the fact that driver behaviour is different according to the weather condition. Road users drive slower, their behaviours are different, the traffic is more congested and the state of the roads is also an important information. Indeed, the roadholding, the visibility, the lisibility of the road and the contrast with other road users are different according to weather conditions.

So, if national statistics cannot give us relevant information on weather contribution on road accidents causations, in-depth data and risk analysis should bring out accident contributing factors related to weather conditions.

Remark: WP2 – type of situations – study a special topic on degradation scenario (gathering accidents concerned with the presence of factors which degrade the road way, the environment and trigger accidents).

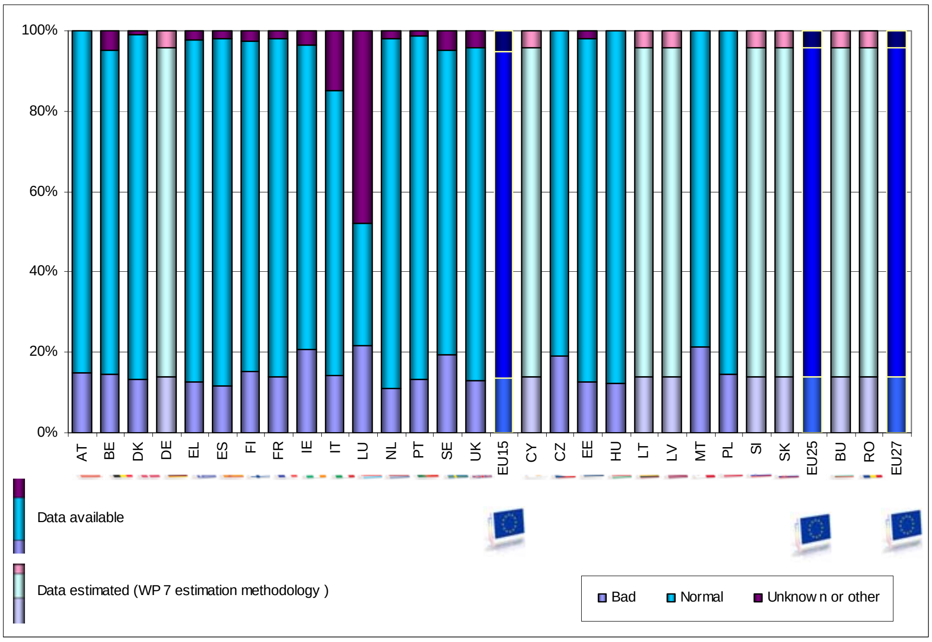

Figure 3.19.-Distribution of the rate of fatalities in accidents involving at least one passenger car according to weather conditions by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

For this factor, the exposure data which could denote the amount of activity in which accidents may occur could be the number of precipitation and/or fog days per year, the traffic volume according to weather condition. Unfortunately, no observatory in Europe gathers this kind of information. It would be very interesting to compare risk of accidents between and inside countries in Europe according to weather conditions.

Indeed, national statistics show that accident rates according to weather conditions are very similar between EU27 countries. What is relevant is the fact that countries are not exposed in the same way. For instance, in winter, road conditions are not the same in Sweden and in Greece and we can assume that the number of bad weather day is different between them. So, it means that their risks (of accidents or fatalities) are also different.

Although this lack of European information, several national studies focused on the contribution of weather conditions in the risk of accidents. For instance, in Norway, on the basis of several studies Vaa, , Sakshaug and Vaa 1995…), the relative accident rate is at least 1,3 higher when the road surface is wet or icy than when it is dry.

3.3.5.d Where the accidents occur?

Passenger cars accidents in EU 27	
Injury accidents	1 070 320
Fatalities in the accident	32 726
Casualties in the accident	1 690 810

Inside urban area - No motorway		
Injury accidents	717 766	67%
Fatalities in the accident	10 675	33%
Casualties in the accident	1 004 594	59%

Motorway - urban or rural area		
Injury accidents	50 073	5%
Fatalities in the accident	1 957	6%
Casualties in the accident	83 681	5%

Unknown		
Injury accidents	18 403	2%
Fatalities in the accident	1 189	4%
Casualties in the accident	38 929	2%

Outside urban area - No motorway		
Injury accidents	284 078	27%
Fatalities in the accident	18 905	58%
Casualties in the accident	563 606	33%

Figure 3.20.-Road type contribution in passenger car accidents in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

In EU27, in 2004, Figure 3.20 shows that two thirds of passenger car injury accidents occur inside urban area (no motorway) while more than half of fatalities are outside urban area (no motorway). We can suggest the possibility that traffic speed are higher outside urban area comparing to inside urban area and so the risk to be killed in an accident is higher (Solomon, Nilsson…). The in-depth analysis should light this difference and determine the speed of the vehicles before the crash. Nevertheless, this analysis should underline other characteristics which could contribute to explain why there are more injury accidents inside urban area and paradoxically more fatalities outside urban area (such as the age of the drivers, the traffic flow on each road category or the quality of them, the us of the road by different road users).

On the other hand, fatalities on motorway, where the speed traffic is the highest, are not over-represented. Then, risk analysis will take into consideration exposure data which could give a first answer to these differences and the in-depth analysis will define the characteristics of accidents causations according to road type.

The next figure presents the contribution of road type by EU27 countries. For all of them, there is no big dispersion except for Greece where the information is not available. But these results are clearly linked to the infrastructure equipment in each country and this is what the next part (risk analysis) will try to integrate in the analysis.

And once again, even if the next figure shows homogeneous results, the in-depth analysis should give us different characteristics of accident causation regarding to road type.

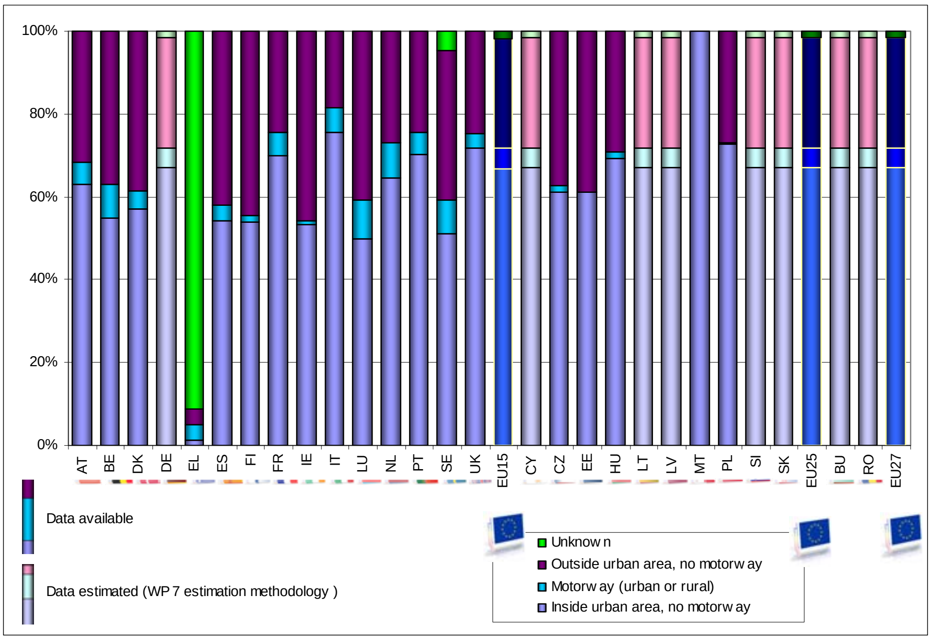

Figure 3.21.-Distribution of the rate of accidents involving at least one passenger car according to road type by EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

EU27 gathers around 5,3 millions kilometres of road exceed 130 times the earth's circumference, or 14 times the distance between the earth and the moon.

The difficulty to estimate a risk linked to the road type is that this one is not defined in the same way in each country and at different level. That is why for risk analysis we considered two kinds of roads: motorways (which are identified in most data available) and other roads.

Remark: SafetyNet project is working on this topic. The aim is to harmonize and collect exposure data for road such as the length of roads and the volume of road traffic.

This paragraph will present two risks:

- Traffic risk 1: the exposure data used in the length of roads. Ideally speaking, this is not the best measure of traffic risk but it is a common data available for EU27 countries.
- Traffic risk 2: the exposure data used is the traffic road volume (defined in vehicle kilometres) which take into consideration volume of traffic and kilometres covered by vehicles. This is a better measure of traffic volume comparing to traffic risk 1. Nevertheless, this data considers all kind of vehicle and not only traffic road volume for passenger cars and is available for only 9 countries in Europe. In spite of this lack of information at EU27 level, the main tendencies observed would be likely to apply to most highly motorised countries and to passenger car accidents too.

In EU27, in 2004, fatality risk per 1,000 kilometres is higher on motorway than on other roads (ratio~5). As average, every 1,000 kilometres on motorway there are 32 fatalities in passenger car accidents whereas on other roads; for the same length, there are 6 fatalities. It is a sample indicator which could be compared easily with other countries. Nevertheless for a traffic risk determination, more than the length is necessary. Indeed, exposure mainly depends on the volume of traffic on different roads (number of vehicles and kilometres of travel covered). That is why we present another traffic risk more interesting but with less data available.

All countries included in Table 3.2 of them conclude that motorways have the lowest rate of fatality in passenger cars accidents. Then, the risk is at least 2,43 more high on other roads than on motorway.

Even if traffic speed is higher on motorways than on other roads, they are safer roads. It means that speed is not the only factor which contributes to fatality in passenger car accidents on motorways and the in-depth analysis will determine the parameters of this accidents regarding to road types.

	Relative risk of fatality in passenger car accidents in different countries								
Type of road	AT	BE	DK	DE	FI	FR	UK	CZ	SI
Motorway	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*
Other roads (no motorway)	2,42	3,45	3,05	7,08	4,30	5,20	5,30	3,90	3,62

Table 3.2.-Relative risk to be killed in passenger car accidents (from traffic risk2) on different types of roads in different countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

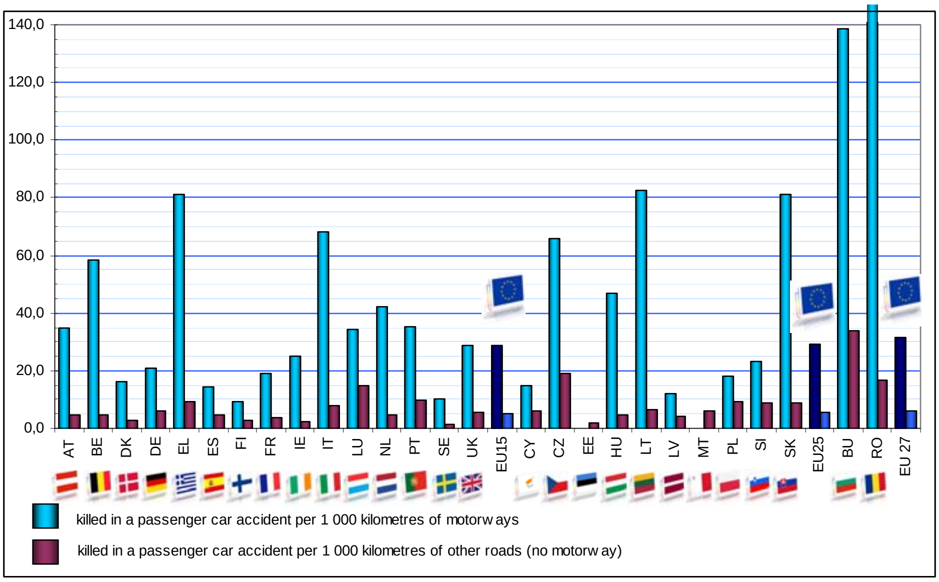

Figure 3.22.-Traffic risk1 (killed in passenger car accidents per 1,000 kilometres of roads) - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

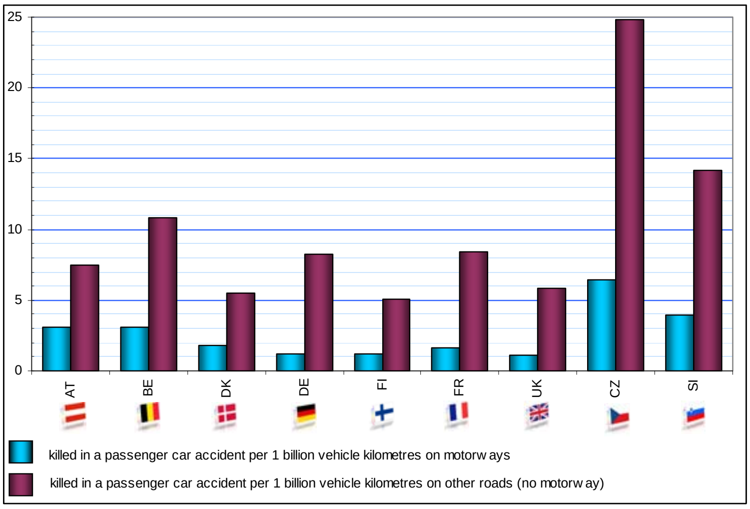

Figure 3.23.-Traffic risk2 (killed in passenger car accidents per 1 billion vehicle kilometres on road) - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

3.3.5.e What is the luminosity during the accidents?

Passenger cars accidents in EU 27	
Injury accidents	1 070 320
Fatalities in the accident	32 726
Casualties in the accident	1 690 810

Darkness		
Injury accidents	296 373	28%
Fatalities in the accident	11 674	36%
Casualties in the accident	489 691	29%

Daylight or twilight or unknown		
Injury accidents	773 947	72%
Fatalities in the accident	21 052	64%
Casualties in the accident	1 201 118	71%

Figure 3.24.-Luminosity contribution in passenger car accidents in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

In EU27, three fourth of passenger car injury accidents occur at daytime. This statistic shows a higher risk of fatalities in passenger car accidents during the night. The next figure presents the rate of accidents and fatalities in passenger car accidents according to the luminosity, in EU27 countries. All these results are homogeneous between countries. For all of them, the risk at night is higher than the risk at day time. Many studies deal with road accidents at night, as the risk is higher. Indeed, the driving conditions are very different and the road users are not the same. Problems of fatigue, alcohol, visibility of road users (contrast, dazzle) and lisibility of the road are often quoted. In-depth analysis will identify the parameters which differentiate these accident conditions

Remark: CARE has defined the luminosity in two categories: darkness and daylight or twilight or unknown. We assume the fact that they are not so much unknown answers as luminosity is an easy information to collect by authorities.

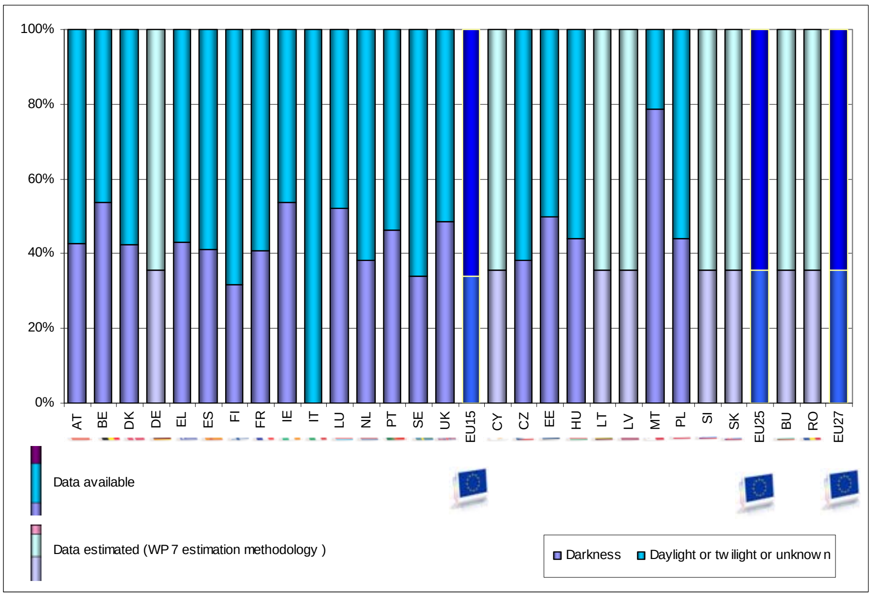

Figure 3.25.-Distribution of the rate of fatalities in accidents involving at least one passenger car according to the luminosity by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

Most of the information drivers use in traffic is visual. Visual conditions can therefore be significant for safe travel. In the dark, the eye picks up contrast, detail and movement to a far lesser than in daylight. This one is one of the reasons why the risk of an accident is higher during darkness than during daylight for all road users.

To estimate the traffic risks and to compare countries, an interesting indicator would be the road traffic volume according to the luminosity. Unfortunately, it is an exposure data which is difficult to collect, in EU27 countries. The only information which could be found focuses on well identified roads in each country.

So the indicator used to the risk analysis is the rate of fatalities per 100 road injury accidents occurring the night or the day. Then, for all EU27 countries, the fatality rate per 100 accidents by night is higher than the fatality rate per 100 accidents during the day. The average in EU27 is 4 fatalities per 100 road injury accidents at night (involving at least one passenger car) whereas during the day there are 2,7 fatalities. On the basis that you are involved in an injury accident, the risk to be killed the night is at least 1,3 higher than during the day (Figure 3.26).

The in-depth analysis should light these differences. Indeed, some hypothesis can be suggested and the in-depth analysis should turn particularly one's attention to these topics:

- There is less road traffic during the night
- Road users exposed to an accident during the night are probably not the same than during the day: more trucks at night, young people are often considered as a risky population at night….
- Fatigue, alcohol, problems of visibility and lisibility

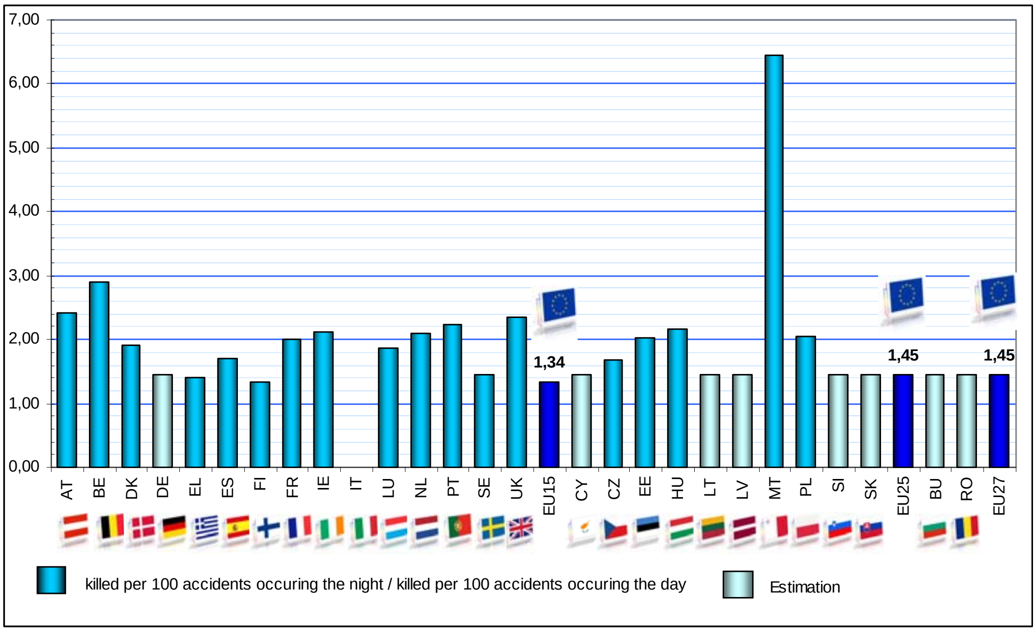

Figure 3.26.-Killed per 100 accidents occurring the night / killed per 100 accidents occurring the day by EU27 countries - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

3.3.5.f What the contribution of accidents at intersection?

Passenger cars accidents in EU 27	
Injury accidents	1 070 320
Fatalities in the accident	32 726
Casualties in the accident	1 690 810

No junction		
Injury accidents	553 311	52%
Fatalities in the accident	24 920	76%
Casualties in the accident	898 420	53%

At junction		
Injury accidents	482 144	45%
Fatalities in the accident	6 757	21%
Casualties in the accident	716 750	42%

Unknown		
Injury accidents	34 865	3%
Fatalities in the accident	1 049	3%
Casualties in the accident	75 640	4%

Figure 3.27.-Junction contribution to passenger car accidents in EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

In EU27, the passenger car accidents at intersection represent:

- 45% of passenger car injury accidents
- 42% of the total casualties (fatalities and injured) in passenger car accidents
- 21% of the fatalities in passenger car accidents

In EU27, it is interesting to see that around once out of two passenger car injury accidents occurs at junction, these ones contribute only to one fifth of the total fatalities.

Remark: WP2 focuses on accident scenarios corresponding to the main situations to which road users are confronted. And a special view on intersection accidents is detailed.

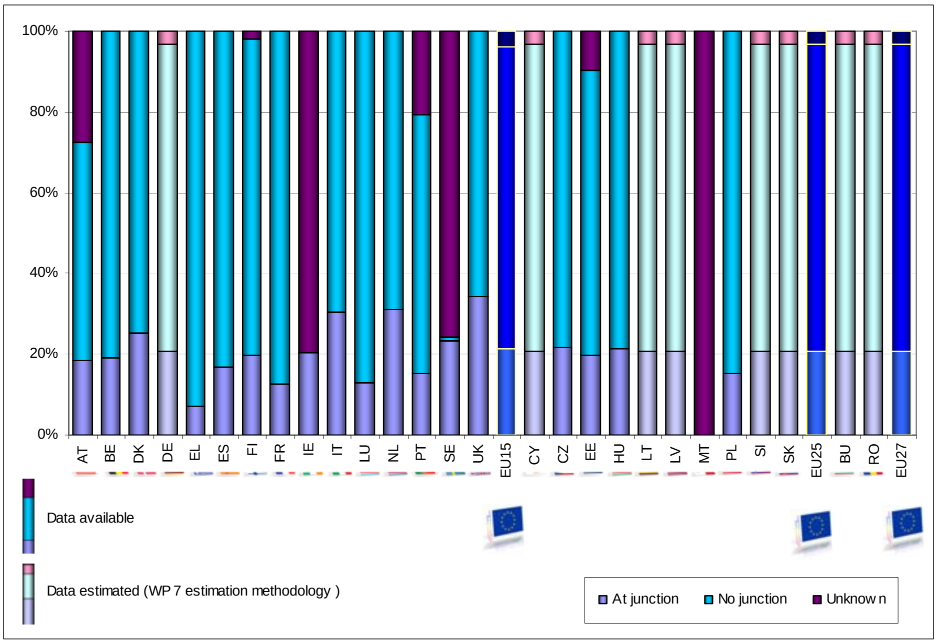

Figure 3.28.-Distribution of rate of fatalities in accidents involving at least one passenger car according to location - EU27 - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

Risk analysis

The number of intersections in a country or a traffic flow at intersection and not at intersection should be considered as a relevant exposure. It seems obvious that it is not so simple to get these parameters.

The indicator used to the risk analysis is the rate of fatalities per 1,000 road injury accidents occurring at intersection or not. Then, for EU27 countries, the fatality rate per 1,000 accidents out of intersection is higher than the fatality rate per 1,000 accidents at intersection. EU 27 average is 45 fatalities per 1,000 road injury accidents out of intersection (involving at least one passenger car) whereas at intersection there are 14 fatalities. On the basis that you are involved in an injury accident, the risk to be killed out of intersection is at least 3,2 higher than at intersection (Figure 3.29 and Table 3.3).

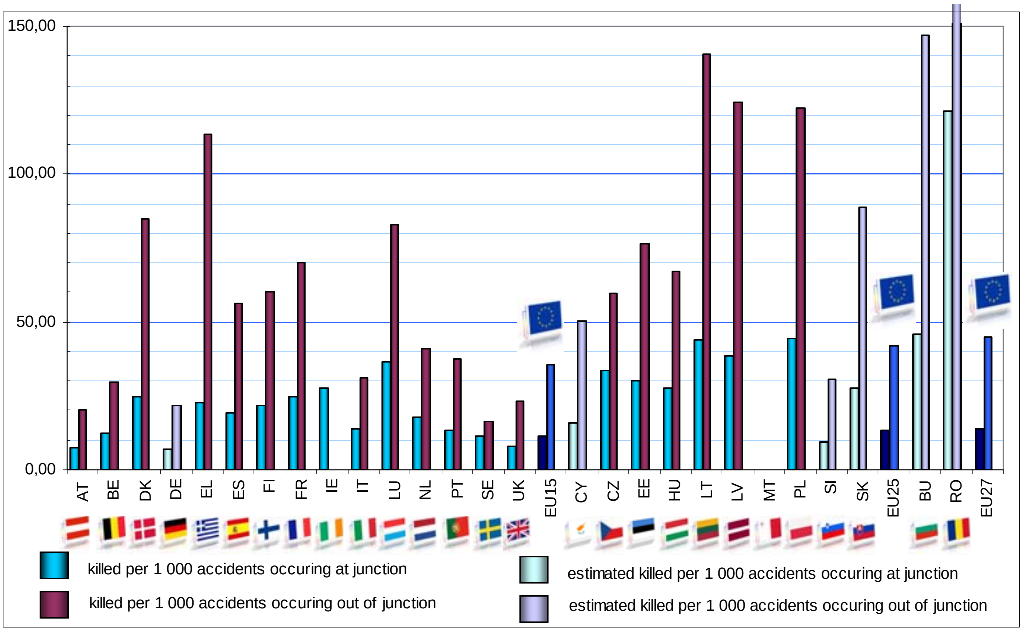

Figure 3.29.-Killed per 1 000 accidents according to junction - (Year 2004, Sources CARE, IRF, IRTAD, TRACE, National Statistics Databanks)

	Relative rate of killed in passenger car accidents									
Junction or not	AT	BE	DK	DE	EL	ES	FI	FR	IE	IT
At junction	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*
No junction	*2,69*	*2,45*	*3,45*	*3,21*	*4,96*	*2,91*	*2,79*	*2,83*		*2,27*
Unknwon	*3,48*	*0*		*2,15*					*2,14*	
	LU	NL	PT	SE	UK	**EU15**	CY	CZ	EE	HU
At junction	*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	***1,00***	*1,00*	*1,00*	*1,00*	*1,00*
No junction	*2,26*	*2,34*	*2,85*	*1,45*	*2,89*	***3,16***	*3,21*	*1,78*	*2,55*	*2,45*
Unknwon			*2,17*	*2,59*		***2,42***	*2,15*		*2,64*	
	LT	LV	MT	PL	SI	SK	**EU25**	BU	RO	**EU27**
At junction	*1,00*	*1,00*	*n.a.*	*1,00*	*1,00*	*1,00*	***1,00***	*1,00*	*1,00*	***1,00***
No junction	*3,21*	*3,21*	*n.a.*	*2,74*	*3,21*	*3,21*	***3,21***	*3,21*	*3,21*	***3,21***
Unknwon	*2,15*		*n.a.*		*2,15*	*2,15*	***2,15***	*2,15*	*2,15*	***2,15***

In red, data are estimation / n.a.: not available

Table 3.3.-Relative risk of fatality in passenger car accidents according to junction

3.3.5.g What is the configuration of the accidents?

From now, results showed in the next chapters mainly take into consideration the 6 national databases presented in part 3.3.1. Indeed, information presented is not available at European level because of differences in coding definition and information collect in national databases.

- Single passenger car accidents. This accident configuration contributes at least in the 6 national databases to 25% of fatalities in passenger car accidents (Figure 3.30). These accidents are mainly loss of control or problem of guidance accidents. Collisions with fixed obstacles are recurrent and violent.
- Passenger car / passenger car (no pedestrian and no other vehicles). Passenger car fleet is the most important one. So the probability for a passenger car to crash another one is very high.

Accidents with a pedestrian and a passenger car are significant in Great Britain, Czech Republic, France and Greece as they contribute to around 15% of injury accidents in each country.

Accidents with a powered two wheeler and a passenger car vary from 22% to 40% in France, Greece and Spain. And in general in Europe, powered two wheelers fleet increases regularly since 1994[34].

It can be also noticed that accidents involving a passenger car and a truck are not so important (except in Spain where registrations in 2004 of commercial vehicles over 3,5 tonnes where the third most important in Europe 15, behind France and Germany) than in the other configurations but the risk of being killed in this configuration and in single vehicle accidents is similar. Moreover, it is obvious that most of fatalities are in the passenger car considering the compatibility between a truck and a passenger car.

To conclude accidents with vulnerable road users (pedestrians, bicycles, power two-wheels) are significant in each country studied. These road users compared to passenger cars have not the same flow speed, the same size and the same way of driving. Problems of visibility are often underlined in the literature. The causes of this accident configuration will be more detailed when in-depth accident databases will be analyzed.

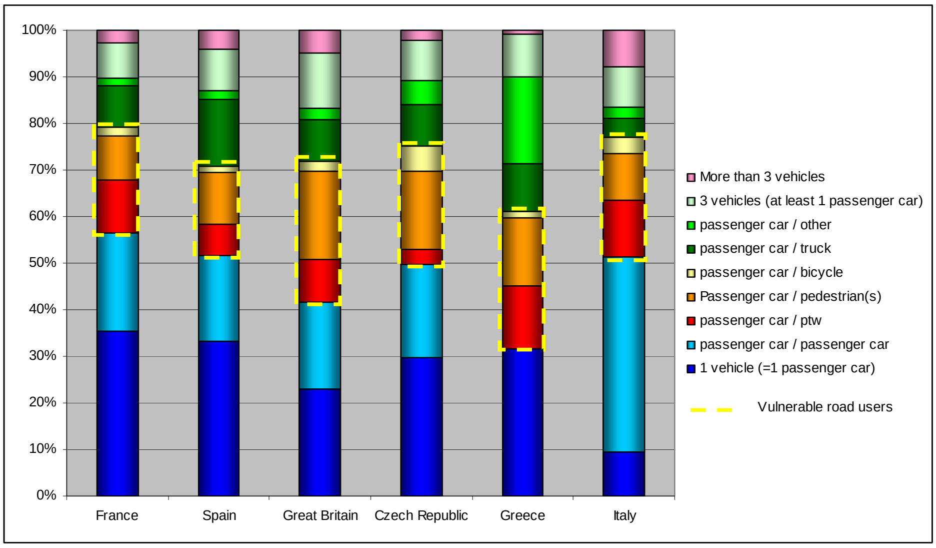

Figure 3.30.-Fatalities contribution according to the accident configuration - (Year 2004, Sources National Statistics Databanks)

[34] Association des Constructeurs Européens de Motocycles

Risk analysis

Table 3.4 presents the number of fatality for 100 passenger car injury accidents (passenger car vs passenger car, passenger vs power two wheelers…) according to the accident configurations.

Table 3.5 shows the relative risk of fatality in passenger car accidents considering that passenger car vs passenger car accidents have a risk of 1. For instance, to determine the relative risk of fatality in passenger car vs Powered two wheelers accidents comparing to passenger car vs passenger car accidents, we used the following calculation:

$$\text{Relative risk} = \frac{fatality\_for\_100\_passenger\_car\_vs\_PTW\_accidents}{fatality\_for\_100\_passenger\_car\_vs\_passenger\_car\_accidents}$$

There is no homogeneous result from the 6 national databases. The configurations which emerge from this risk analysis are single passenger car accidents, passenger car vs truck accidents and multiple vehicle accidents. Indeed, they are the most fatal accidents comparing to the other configurations. Accidents with a vulnerable road user have a lower risk of fatality comparing to other configurations. It means that these accidents are mostly injury accidents.

This chapter stressed the importance of compatibility of road users in an accident. Indeed passenger car vs truck accidents are very fatal due to their compatibility. Moreover, passenger car vs passenger car accidents are the most preponderant injury accidents and involve recent vehicles as older vehicles. And what about the compatibility between them? The in-depth analysis could give use some answers to this standard accident configuration.

	Fatality for 100 injury passenger car accidents according to its configuration					
Type of road	FR	ES	GB	CZ	EL	IT
Passenger car vs passenger car	*5,45*	*3,15*	*0,73*	*3,76*		*0,64*
Passenger car vs PTW	*2,51*	*1,23*	*1,50*	*2,92*	*3,84*	*0,61*
Passenger car vs bicycle	*2,68*	*2,71*	*0,43*	*3,06*	*14,68*	*0,93*
Passenger car vs pedestrian	*3,91*	*4,67*	*1,78*	*5,85*	*11,31*	*2,17*
Single passenger car accident	*13,25*	*6,59*	*2,76*	*5,52*	*34,92*	*2,04*
Passenger car vs truck	*12,70*	*7,72*	*1,91*	*10,05*	*20,00*	*1,10*
Passenger car vs other vehicle	*4,24*	*4,34*	*1,11*	*6,41*		*1,23*
3 vehicles (at least 1 passenger car)	*7,44*	*4,73*	*1,89*	*7,31*	*13,00*	*1,08*
more than 3 vehicles	*10,56*	*5,67*	*2,73*	*8,00*	*28,57*	*2,64*

Table 3.4.-Fatality for 100 injury passenger car accidents according to its configuration - (Year 2004, Sources National Statistics Databanks)

	Relative risk of fatality in passenger car accidents					
Type of road	FR	ES	GB	CZ	EL	IT
Passenger car vs passenger car	*1,00*	*1,00*	*1,00*	*1,00*		*1,00*
Passenger car vs PTW	*0,46*	*0,39*	*2,05*	*0,77*	*1,00*	*0,96*
Passenger car vs bicycle	*0,49*	*0,86*	*0,59*	*0,81*	*3,82*	*1,46*
Passenger car vs pedestrian	*0,72*	*1,48*	*2,43*	*1,55*	*2,95*	*3,40*
Single passenger car accident	*2,43*	*2,09*	*3,77*	*1,47*	*9,10*	*3,21*
Passenger car vs truck	*2,33*	*2,45*	*2,62*	*2,67*	*5,21*	*1,74*
Passenger car vs other vehicle	*0,78*	*1,38*	*1,51*	*1,70*		*1,94*
3 vehicles (at least 1 passenger car)	*1,94*	*1,80*	*3,73*	*2,13*	*3,39*	*4,16*
more than 3 vehicles	*1,94*	*1,80*	*3,73*	*2,13*	*7,44*	*4,16*

Table 3.5.-Relative risk of fatality in passenger car accidents according to the accident configuration - (Year 2004, Sources National Statistics Databanks)

3.3.5.h What is the age of the passenger cars involved in the accident?

The following results focus on the issue of passenger cars age when they are involved in a fatal accident. Figure 3.31 shows that in Spain, Greece and Italy the newest is the passenger car involved in the accident, the more fatalities there are in the accident. In France and in Great Britain, from 9-10 years old, the number of fatalities begins to decrease. Before this limit, the number of fatalities is high but stable. These results are very linked to the vehicle fleet and the configuration of the accident (age, vehicle type…). So the next part will determine which category of vehicles is the most risky.

Remark: Czech Republic has no data available.

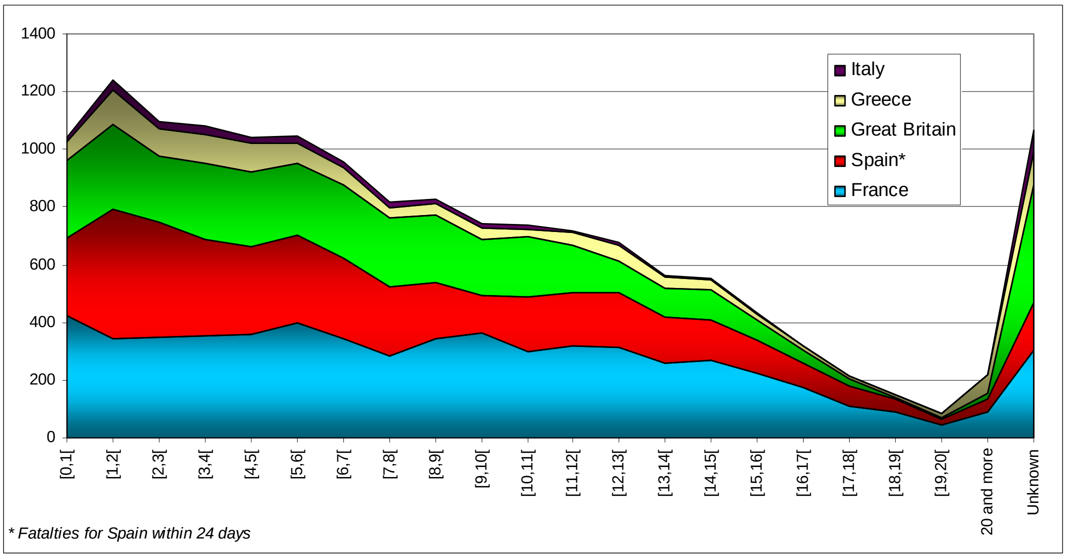

Figure 3.31.-Distribution of fatalities in the accidents according to the age of the passenger car involved - (Year 2004, Sources National Statistics Databanks)

Risk analysis

The indicator used in this section is the risk to be killed in 100,000 passenger cars according to its age. We use the age distribution of the passenger car fleet to determine this risk. That is why only 4 national information are available.

In France, this risk is high for very new vehicles (0 to 1 year) and older ones. For the first group, the in-depth analysis could focus on the "social" characteristics of the driver and its experience. Many studies underline the fact that drivers with few experience (and especially young drivers) are the more risky drivers. For the second group, we assume the fact that older vehicles are not as protecting as the new ones. Indeed, these ones have better passive safety systems and structure. The average age of French passenger car fleet is 7,1 years old.

The average age of Spanish passenger car fleet is 7,5 years old. This figure is quite similar to French fleet. In spite of this similarity, the risk is not the same between the two countries. The risk to be killed in higher in Spain whatever is the age of the passenger car except for 10 years old and more vehicles. Moreover, in Spain, the risk is homogeneous for all levels of vehicle age.

In Great Britain, average age of passenger car fleet is 6,2 years old. It is the lowest one of the 4 countries and the less risky for occupants whatever the vehicle age is. As in France and probably for the same reason, we notice that the oldest is the passenger car the more risk there is to be killed inside.

In Czech Republic, the passenger car fleet in older than the three first analyzed countries as the average is 9,3. It is quite difficult to determine conclusions for this country as results are very heterogeneous.

To conclude new vehicles largely contribute to road fatalities, due to passenger car fleet, but considering the risk to be killed in the vehicle, this one is higher in older vehicle than in younger ones.

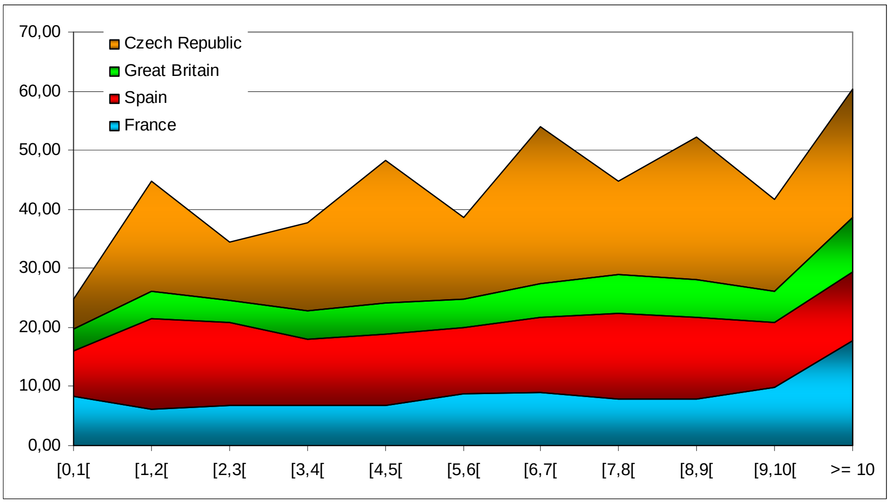

Figure 3.32.-Number of fatalities in a passenger car for 100 000 passenger cars according to its age - (Year 2004, Sources National Statistics Databanks)

	Relative risk of fatality in passenger car according to the its age			
Passenger car age	FR	ES	GB	CZ
[0,1[	*1,00*	*1,00*	*1,00*	*1,00*
[1,2[	*0,74*	*1,85*	*0,55*	*2,24*
[2,3[	*0,81*	*1,69*	*0,44*	*1,19*
[3,4[	*0,82*	*1,35*	*0,56*	*1,81*
[4,5[	*0,83*	*1,45*	*0,64*	*2,88*
[5,6[	*1,06*	*1,34*	*0,58*	*1,65*
[6,7[	*1,09*	*1,51*	*0,70*	*3,19*
[7,8[	*0,94*	*1,75*	*0,78*	*1,92*
[8,9[	*0,95*	*1,67*	*0,75*	*2,90*
[9,10[	*1,19*	*1,32*	*0,63*	*1,89*
>= 10	*2,14*	*1,38*	*1,11*	*2,63*

Table 3.6.-Relative risk of fatality in passenger car according to its age - (Year 2004, Sources National Statistics Databanks)

3.3.5.i What is the age of the passenger car drivers involved in the accident?

Figure 3.33 presents the contribution of road fatality according to the age of the passenger car driver involved in an injury accident, with a special focus on young drivers .For instance in France, accidents involving a passenger car driver aged from 18 to 19 years totalize 198 fatalities.

The result is that young drivers mainly contribute to road fatality and especially drivers aged from 18 to 25. These ones are at the heart of research studies as for most of them, driving experience is very low and behaviour (speed, alcohol, drugs…) and way of life are quite different from other drivers.

From 25 to 64 years old, the fatality contribution of passenger car drivers decreases and it can be suggested than drivers are more experienced and drive safer. And finally from 65 years old, the fatality contribution increases. As for young drivers, research focuses its attention to this driver category. Indeed, in many countries, population is ageing and so they are more exposed to road accident. Moreover, they are more delicate and so they are physically less robust in a crash and the way of analyzing driving situation is different (especially at intersection).

Nevertheless, even if these figures are good indicators to determine stakes according to driver age, they are not sufficient to evaluate the risk of each population.

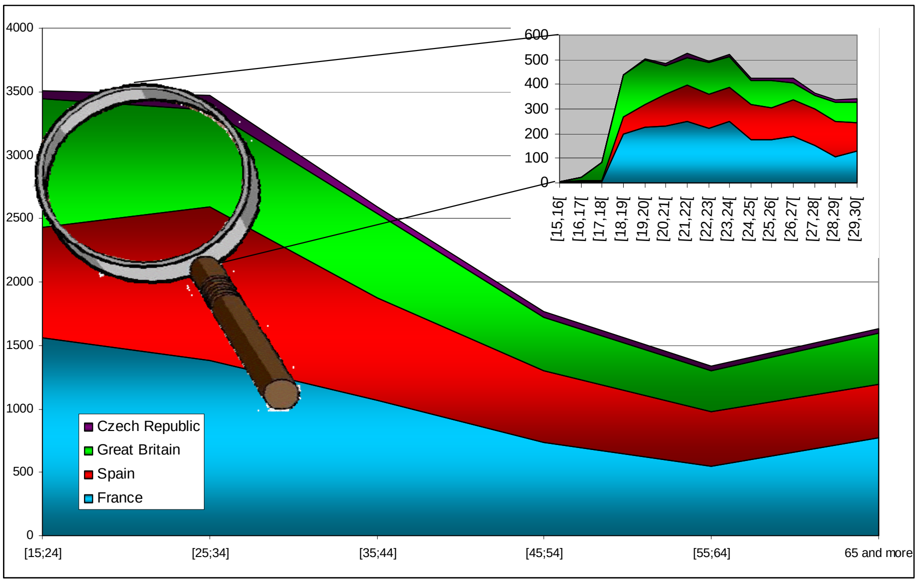

Figure 3.33.-Number of fatality according to the passenger car driver age involved in he accident - (Year 2004, Sources National Statistics Databanks)

Risk analysis

A pertinent exposure data to estimate the risk of fatality in the passenger car according to the age of its driver should be the number of kilometers travelled by the driver for each age level. Nevertheless, this data is very difficult to obtain at national and European level. So for the risk analysis, we used the driving population by age and estimated the number of fatality in passenger cars for 100,000 drivers according to the driver ages. Even if this exposure data does not consider only passenger car drivers, it gives a good overview of the driving license distribution.

This risk analysis produces a U-shaped curve where the highest fatality rates are for the youngest and oldest drivers. Moreover, in the previous paragraph, we determine that these drivers mainly contribute to road fatalities.

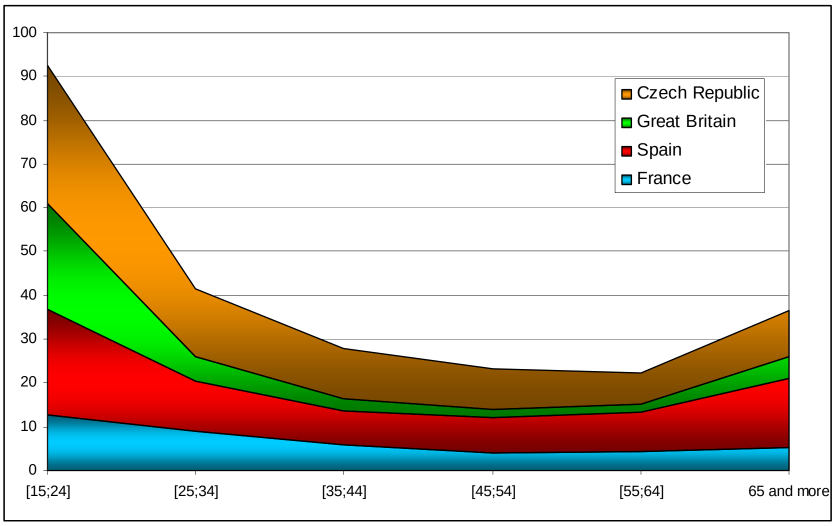

Figure 3.34.-Number of fatalities in passenger cars for 100 000 drivers according to the driver age - (Year 2004, Sources National Statistics Databanks)

	Relative risk of fatality in passenger car accidents according to the age of the passenger car driver			
Passenger car driver age	FR	ES	GB	CZ
[15;24]	*3,05*	*3,01*	*13,46*	*3,35*
[25;34]	*2,15*	*1,26*	*3,15*	*2,15*
[35;44]	*1,38*	*0,50*	*0,57*	*1,10*
[45;54]	*1,00*	*1,00*	*1,00*	*1,00*
[55;64]	*1,02*	*1,15*	*0,98*	*0,76*
65 and more	*1,24*	*1,97*	*2,78*	*1,12*

Figure 3.35.-Relative risk of fatality in passenger car according to the age of the passenger car driver - (Year 2004, Sources National Statistics Databanks)

3.4 Conclusions

The aim of TRACE is to analyze road accidents according to several points of view (road users, road user situation and accident factors). So the point of view examined in this report is the road user one and especially the passenger car. This report has focused on a macro accidentology level. Indeed, it relied on intensive accident databases such as census of accident data registered by the police forces and put into national files or CARE database. This macro accidentology study is rather poor in identifying accident causation factors because the complex process of a crash is not analyzed and recorded in such databases and because many of the recorded variables are mostly descriptive and not analytic. Nevertheless, they can often provide reliable information that can be used to identify the magnitude of the problems (e.g. 25 % of fatalities are young road users between 18 and 24 years old, 70 % of the fatalities occur in rural roads, 20 % of injury accidents occur on wet pavements, etc.) and to start risk analysis if they can be connected to exposure data (e.g. the risk to be involved in an accident whilst the pavement is wet is doubled compared to dry pavement if the 20 % accidents on wet pavement is compared to the 10 % kilometres driven whilst the pavement is wet).

These **'Stake' and 'risk analysis' approaches** are fundamental in accident causation and are frequently the ignition of any kind of accident analysis as they consider the accident in its quantitative aspect (how many of what kinds of accidents ?). And it is what we examined in this report focussing on passenger car accidents. The outcomes are descriptive data and risk indicators. They are highly useful to determine the prevalence of factors (e.g. in France, a driver under the influence of alcohol is recorded in 27 % of the road accidents), or, even more interesting, the relative risk and the attributable risk to be involved in an accident due to a risk factor or a combination of factors. Then, the results of this report are a first approach of accident and will give guidances to the next part of the study which is the micro accidentology level study (using in-depth databases): in which accident conditions, we need to focus to determine accident causations? That is to say where the issues are important and where the risks are the highest.

Passenger car accidents represent a big issue for road safety as this transport is the most popular and used one. It means that any counter-measure applied on this transport would deeply decrease fatalities and injuries on the road. Nevertheless, in order to prioritize these measures, it is necessary to point out where we have to focus on. The data used in this report came from CARE, IRF, IRTAD, TRACE and National Statistics Databanks. When data were missing to establish EU27 issues, these ones has been estimated with a simple linear regression or an iterative proportional fitting procedure stern from WP7 focussing on statistical methods for improving the usability of existing accident databases. In EU27, in 2004, passenger car accidents represented 81% of all injury accidents (1,070,320 of 1,323,036), 70% of all road fatalities (32,726 of 46,821) and 93% of all casualties (1,690,810 of 1,810,568). Casualties and fatalities in these accidents are mainly in the passenger car (respectively 62% and 74%).

On the whole, we found differences between EU15 and new countries in EU27. Indeed, we noticed that Germany, France and Italy largely contribute to fatalities in passenger cars but where the risk to be killed in a passenger car is high is in Greece and new countries from EU25 and EU27. One country emerges from the analysis: Poland mainly contributes to road fatalities in passenger cars (similar to countries in EU15 such as Spain, Italy) and the risk to be killed in a passenger car is very high.

On the other hand, these differences between EU15 and new countries from EU27 are relevant when studying road accident evolutions. Indeed, the risk to be kill in a passenger car accident is higher for countries which knew a high evolution of their passenger car fleet from 1995 to 2004, especially for new countries from EU27 (whereas for other EU15 countries this development was earlier).

So the in-depth analysis could work on the difference of road accidents between EU15 and new countries from EU27 to establish relevant counter-measures. Moreover, these countries could model their road safety policy on what EU15 did before when they knew an important increase of their vehicle fleet.

In EU27, around 80% of injuries accidents and fatalities in accidents involving at least one passenger car occur in good weather conditions. Even if it is quite difficult to obtain relevant exposure data to determine the risk of accident or of fatality in passenger car accident, several national studies focused on the contribution of weather conditions in the risk of accidents. The results are that the relative accident rate is higher when the road surface is wet or icy than when it is dry.

So, the in-depth analysis could examin what are the factors and the causes of theses accidents according to weather conditions. Indeed, accidents occurring in good weather conditions are a big issue but accidents occurring in bad weather conditions are more risky. In addition to a bad roadholding due to bad weather conditions, problems of visibility or lisibility of the road could appear from the in-depth analysis.

Remark: WP2 - task 2.4 focuses on degraded situations.

In EU27, in 2004, two thirds of passenger car injury accidents occur inside urban area (no motorway) while more than half of fatalities are outside urban area (no motorway). We can suggest the possibility that traffic speed are higher outside urban area comparing to inside urban area and so the risk to be

killed in an accident is higher (Solomon, Nilsson…). On the other hand, on motorway where the speed is higher than in both previous quoted roads, the risk to be killed is less important. It means those motorways are safe roads.
The in-depth analysis should focus on accidents outside urban area (no motorway) and inside urban area (no motorway) in order to characterize them. We can assume that the speeds of the vehicles, the road development, the users…are different and the counter-measures should be different too.

In EU27, three fourth of passenger car injury accidents occur at daytime whereas one third of fatalities are during the night. The risk analysis shows that on the basis that you are involved in an injury accident, the risk to be killed is at least 1,3 higher than during the day. The night there is less traffic comparing to the day, the road user driving the day and the night are probably not the same and do not have the same aim of travel and the causes of accidents are probably different (fatigue, alcohol, visibility and lisibility…). The in-depth analysis could explain what characterize these differences and what the main issues for both situations are.

In EU27, the passenger car accidents at intersection represent 45% of passenger car injury accidents, 42% of the total casualties (fatalities and injured) in passenger car accidents and 21% of the fatalities in passenger car accidents. The risk analysis demonstrated that on the basis that you are involved in an injury accident, the risk to be killed out of intersection is at least 3,2 higher than at intersection. Even if the risk is higher out of intersection, it will be interesting to study causations in both situations as the stakes are quiet similar. And on the other hand, the way of driving at intersection is certainly different from the way of driving out of intersection. The in-depth analysis could determine what the causes of these accidents are and what are the relevant counter-measures associated to the causes according to the situation.

Remark: WP2- task 2.2 focuses on the accidents at intersection.

In TRACE databases, accidents with vulnerable road users (pedestrians, bicycles, power two-wheels) are significant in each country studied as they represent from 23% to 53% of accidents involving at least one passenger car. These road users compared to passenger cars have not the same flow speed, the same size and the same way of driving. Problems of visibility are often underlined in the literature. The causes of this accident configuration will be more detailed when in-depth accident databases will be analyzed.

The analysis of the age of the passenger car drivers involved in the accident produces a U-shaped curve where the highest fatality rates are for the youngest and oldest drivers. Moreover these drivers mainly contribute to road fatalities. These two road driver categories have different characteristics (from a physical level to the way of driving). So the in-depth analysis should focus on these drivers and should bring up characteristics and differences between these drivers.

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4 Task 1.2: Powered Two Wheelers Riders

4.1 Introduction

Motorcycle and moped vehicles owners can differ in an important way of driving from other more common vehicles like passenger cars, for instance. Despite their dimensions, much smaller than other types of vehicles, those who choose to ride a PTW (Powered Two Wheeler) do not always buy it just 'because they need it'. Due to their size they may become not easy to be detected by other users (PTW conspicuity), they give a freedom feeling to the rider who is much more exposed to hypothetic collision energy than a passenger car driver. Moreover, because they only have two wheels their dynamics is completely different, most of all in braking maneuvers and curves approaching. Therefore, relevant questions like When?, How? and Why? a motorcyclist rides different than other road users are essential to address their specific accident causes.

PTW use has been increasing in past years. In one hand, the number of mopeds in use in 2005 (also known as the "parc") was 13.2 million across the EU-27[35]. In 1998 the ratio of new moped deliveries to mopeds in use was 1:9; by 2005 it had fallen to 1:19. This is largely down to the fact that modern machines are of a higher quality and have an extended lifetime, so changes in the annual number of new moped deliveries are not directly mirrored by a reduction in total mopeds in use. By contrast, the number of motorcycles in use has continued to raise in each of the EU 27 countries and reached over 17 million in 2005, an increase of nearly 50% on 1998. Combined with a more stable level of new motorcycle registrations, the overall ratio of new motorcycles against total motorcycles in use being 1:10 in 1998 and 1:13 in 2005. Again the longevity of modern motorcycles will tend to reduce the replacement rate, but the significant growth of motorcycles in use (which was already well established since before 1998) is a clear indication of their growing popularity.

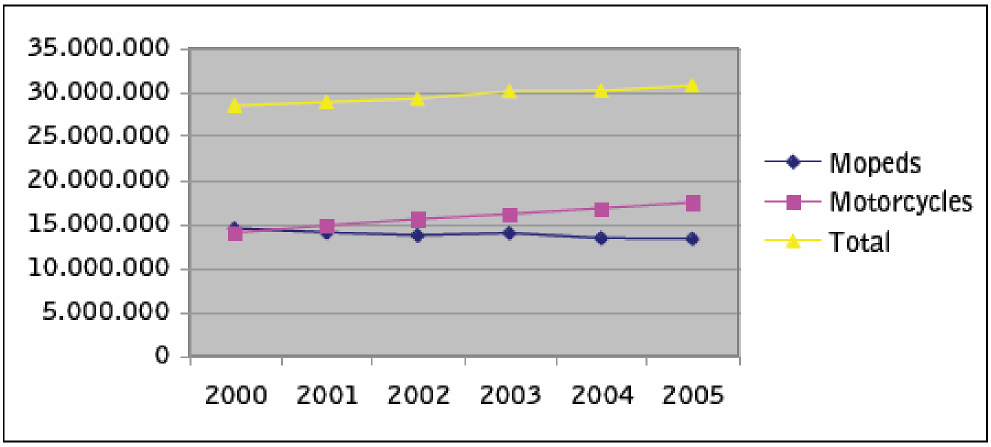

Figure 4.1.- PTWs in use in EU-27.

On the other hand, and opposite to what happens with other users, PTWs accidents do not show such a clear decreasing trend during last years as it can be observed in the following figure.

[35] Year book (2007). ACEM.

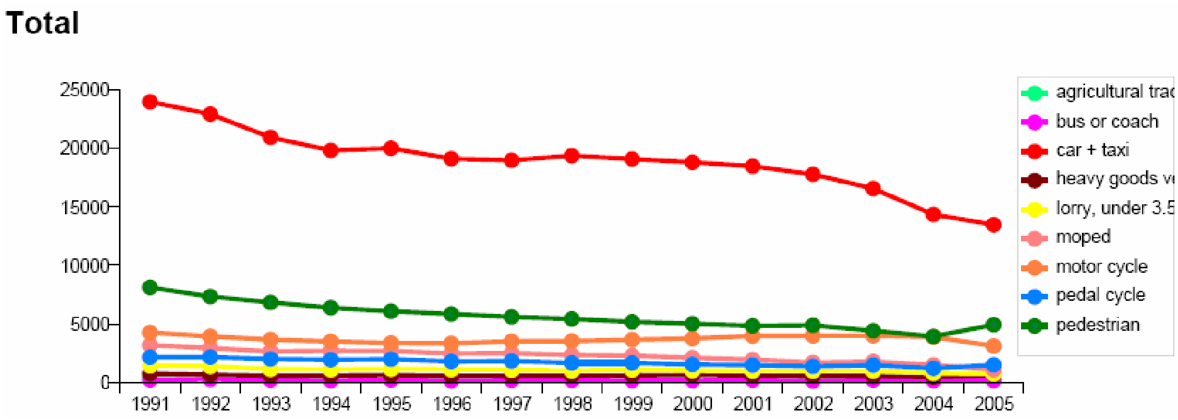

Figure 4.2.-Comparions between PTW fatalities evolution and other transport modes (EU countries included in CARE)[36].

In total number of percentage, the most current data available offers the following situation related to PTWs fatalities: **18% of the total road fatalities come from PTWs (in EU countries included in CARE, 2006)**, although this percentage increase in the case of inside urban fatalities (22%)[37].

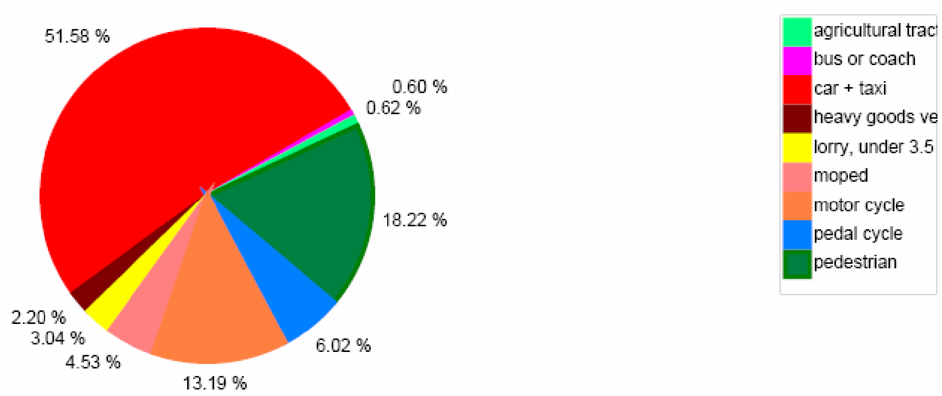

Figure 4.3.-Comparions between PTW fatalities and other transport modes (EU countries included in CARE, 2006).

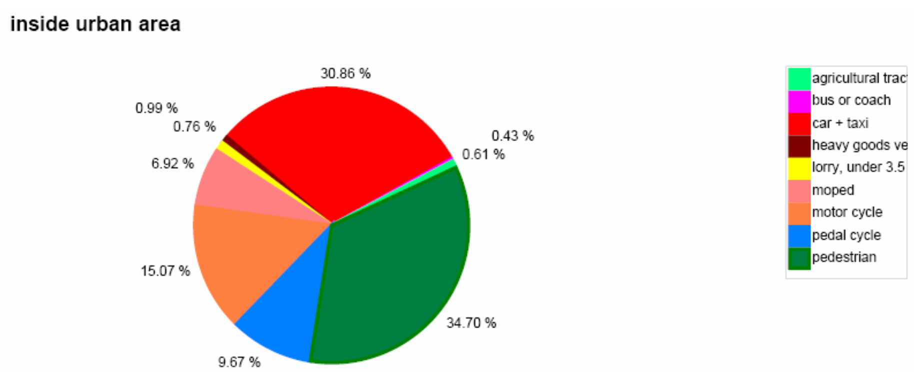

Figure 4.4.-Comparions between PTW fatalities and other transport modes (EU countries included in CARE, 2006).

[36] CARE (March 2008)

[37] The most current percentage available for the whole EU-27 shows that 15% of fatalities come from PTWs (2004), as it was shown in Figure 1.3.

This situation does not necessarily mean that riding a PTW is a hazard itself but not enough comprehensive knowledge about why they have accidents and what influence the road infrastructure and other vehicles have in that event. That is why this chapter is aimed at analyzing the accident causes of the main PTWs accident configurations. **The objective of the results covered in this report, from the point of view of the PTW road users, is to detect the most common configurations (Descriptive Analysis) where these users suffer an accident.** Thank to these analysis, a further investigation will be carried out in further phases of the project (In-depth and Risk PTW Analysis phases) in order to obtain their accident causes.

4.2 Main outcomes of the literature review

This chapter is focused on 'Powered Two Wheeler Drivers' and identifying the main characteristics of the PTW accidents, especially from the contributing factors point of view. It seems obvious that it is not possible to state the 'only cause' of the accident, but it is needed to point to several different factors that have contributed to generate the accident.

Different studies have been carried out in the past where the specific problems of motorcyclists have been addressed. In this report, some of these studies have been reviewed in order to identify which factors have been identified as important regarding the causation of accidents. These factors will be further analyzed using national, in-depth databases and exposure data.

The consulted sources in this literature review has been assorted, varying from Public Studies performed by Governments to published Scientific Papers from different research teams. Between these two groups, there are also reports from European associations related to the motorcycle world or results from other European research projects.

4.2.1 Main findings

After finding methodologies about how to treat the information from any kind of databases, the next step has been focused on the main findings from any kind of studies related directly to PTW accidents carried out in Europe.

4.2.1.a MAIDS project

Thanks to the MAIDS project ('Motorcycle Accidents In Depth Study') the most comprehensive in-depth data currently available for Powered Two Wheelers (PTWs) accidents in Europe was developed . The investigation was conducted during 3 years (period 1999-2000) on 921 accidents from 5 countries using a common research methodology (France, Germany, Italy, Netherlands and Spain). On one hand, the information from in-depth investigations is more detailed than in intensive databases, but on the other it will be only extensible to European level if the sample is representative. Following, general conclusions from this study are shown.

General accident characteristics

- ✓ There were 103 cases (11.1%) involving a fatality of either the rider or the passenger.
- ✓ 54.3% of the PTW accidents took place at an intersection.
- ✓ Passenger cars were the most frequent collision partner (60%).
- ✓ 72% of the accidents took place in urban areas.
- ✓ A PTW was more likely to collide with a passenger car in an urban area than in a rural area. (64.1% versus 46.7%).

Accident causation

- ✓ The main primary contributing factors were the PTW rider (37.1%) and the other vehicle driver (50.4%).
- ✓ In 10.6% of all cases, PTW rider inattention was present and contributed to accident causation.
- ✓ In 36.6% of all cases, the primary contributing factor was a perception failure on the part of the other vehicle driver.
- ✓ 27.7% of PTW riders and 62.9% of other vehicle drivers made a traffic-scan error which contributed to the accident.
- ✓ 32.2% of PTW riders and 40.6% of other vehicle drivers engaged in faulty traffic strategies which contributed to the accident.
- ✓ A difference in speed compared to the surrounding traffic was identified as a contributing factor for PTWs in 18.0% of all cases and a contributing factor for the other vehicle in 4.8% of all cases.
- ✓ The weather was a contributing factor or precipitating event for the PTW in 7.4% of cases.
- ✓ 3.7% of cases involved a PTW tyre problem and 1.2% a brake problem.

Vehicle Characteristics

- ✓ Engine displacement did not represent a risk factor in accident involvement.
- ✓ Only white PTWs were found to be over-represented in the accident data.
- ✓ Due to low frequencies in the accident and exposure samples and some questions regarding the validity of the ABS counts in the exposure sampling, no meaningful conclusions related to advanced braking systems could be made.
- ✓ Visual inspection showed some sort of tampering with the engine or driveline in 17.8% of L1[38] vehicles involved in accidents.
- ✓ 99% of all cases indicated no mechanical problems with the PTW or the other vehicles, prior to the accident.

Collision Dynamics

- ✓ More than 60% of the PTWs and 55% of the other vehicles were travelling in a straight line prior to the precipitating event and 64% continued in a straight line up to impact.
- ✓ PTW accidents occurred in a wide variety of different impact configurations (i.e., many different relative heading angles).
- ✓ At the time of the precipitating event, 50% of all PTWs, 37% of PTWs in single vehicle collisions and 19.4% of PTWs in fatal accidents were travelling at 50 km/h or less.
- ✓ When the collision involved a PTW and other vehicle, at the time of the precipitating event, 82% of the other vehicles were travelling at 50 km/h or less.

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[38] L1 and L2: mopeds (see ISO 9645 for further details),
L3: two wheeled motor vehicles with an engine cylinder capacity > 50 cm3 or maximum speed > 50 km/h,
L4: three wheeled motor vehicles with an engine cylinder capacity >50 cm3 or maximum speed > 50 km/h, the wheels being attached asymmetrically along the longitudinal vehicle axis,
L5: three wheeled motor vehicles with an engine cylinder capacity >50 cm3 or maximum speed > 50 km/h, having a gross vehicle mass rating < 1000 kg and wheels attached asymmetrically along the longitudinal vehicle axis.
(source: Sandberg U. Harmonoise European Project: Vehicle categories for description of noise sources. Brussels. 2003).

- ✓ 90% of all vehicles different to PTWs were to the front of the PTW rider and 60% of the PTWs were to the front of these other vehicles, at the time of the precipitating event.
- ✓ 75% of all PTW impact speeds were under 50 km/h.
- ✓ 78% of PTW impact speeds were 50 km/h or below in multiple vehicle accidents, and 56% of PTW impact speeds were below 50 km/h in the case of single vehicle accidents.
- ✓ The impact speeds of the other vehicles were under 50 km/h in 88.7% of the multiple vehicle collisions.
- ✓ L1 vehicle travelling speeds were under 37 km/h 50% of the time, the mean L1 impact speed was 30.7 km/h.
- ✓ In multiple vehicle crashes, 71.2% of the PTW operators attempted some sort of collision avoidance manoeuvre (49.3% by braking, 16.2% by swerving). 69% of the other vehicles drivers attempted no collision avoidance manoeuvre.
- ✓ In 32.2% of the multiple vehicle collisions, there was no time available for the PTW rider to complete a collision avoidance manoeuvre.

Environmental factors

- ✓ 89.9% of the accidents took place on dry days.
- ✓ 84.7% of the time the roads were dry at the time of the accident.
- ✓ Road surfaces had defects in 30% of cases.
- ✓ Road surfaces were considered optimal in 61.4% of cases.
- ✓ Roadside barriers accounted for 60 PTW rider injuries.
- ✓ Where there was a traffic control, it was violated in 29.8% of cases by the PTW riders and in 45.6% of cases by the other vehicle driver.

Human factors

- ✓ Riders under 17 were neither under- nor over-represented in the accident data. Riders between 18-21 and 22-25 were over-represented, while riders between 41 and 55 were under-represented in the accident population. This suggested that riders between the ages of 41 and 55 have less risk of being in an accident when compared to the general riding population.
- ✓ 58.7 % of the L1 operators were under 21, while 88.1% of the L3 operators were over 21.
- ✓ Riders under 21 were the primary accident contributing factor 42% of the time, while riders over 21 were the primary contributing factor less then 37% of the time.
- ✓ Riders of all ages were most often involved in impact speeds of 50 km/h or less (70%).
- ✓ 77% of the other vehicles drivers different to PTWs ones were over the age of 26, almost all were licenced and 21% also had a PTW licence.
- ✓ Other vehicle operators who also held a PTW licence were less likely to commit perception failures than these other vehicles operators who did not have a PTW licence (26.4% versus 50.9%).
- ✓ Improperly licenced or unlicenced riders were over-represented in the accidents, suggesting that these riders have greater risk of being involved in an accident when compared to qualified riders.
- ✓ 7.8% of accidents involved riders with less than six months experience on any kind of PTW.
- ✓ In general riders with more experience are less likely to be the primary contributory factor of an accident.

- ✓ 29% of riders with less than 6 months experience had a skills deficiency and this percentage went down to 6.4% for riders with over 98 months of experience.
- ✓ Low rates of alcohol or other drug impairment were found among all riders and other vehicles drivers. However, when the PTW rider was under influence of alcohol, he was 2.7 times more likely to be involved in an accident.

Traffic environment

- ✓ Visibility was limited by an environmental condition for both the PTW operator and the other vehicle operators in 3% of the cases.
- ✓ Stationary view obstructions, including vegetation and parked vehicles, were recorded for 18.0% of the PTW riders and 20.5% of the other vehicle operators. At the time of the accident, there were mobile view obstructions, cars, trucks and buses, for 9.5% of the PTW riders and 11.6% of the other vehicle drivers.
- ✓ Almost 90% all PTW accidents occur in light to moderate traffic conditions.
- ✓ The headlamp was in use for 69.4% of the accident PTWs.
- ✓ The effect of the background on PTW conspicuity was positive in 7.5% and negative in 14.4% of multi-vehicle cases.
- ✓ The use of dark PTW rider clothing decreased conspicuity in 13.0% of all accidents.

Rider protection

- ✓ The most frequently reported first collision contact point for the PTW was the centre front (28.9% of all cases).
- ✓ The most frequently reported first collision contact point for the OV was the left side (21.9% of all cases).
- ✓ A total of 3644 injuries were reported. Most injuries were reported to be minor lacerations, abrasions or contusions.
- ✓ Lower extremity injuries made up 31.8% of all injuries, followed by upper extremity injuries which made up 23.9% of all injuries. Head injuries accounted for 18.7% of all reported injuries.
- ✓ Most upper and lower extremity injuries occurred as a result of impacts with the OV or the roadway.
- ✓ There were cases of helmets coming off the riders head due to improper fastening of the retention system or helmet damage during the crash sequence.
- ✓ In 69% of cases, helmets were found to be effective at preventing or reducing the severity of head injury.

4.2.1.b SafetyNet project

SafetyNet is an Integrated Project funded by the European Commission, whose objective is to build the framework of a European Road Safety Observatory, which will support all aspects of road and vehicle safety policy development at European and national levels, making new proposals for common European approaches in several areas including exposure data and Safety Performance Indicators.

Besides these purposes, some statistical reports are made using European extensive databases. Regarding with PTWs and accident situations, some statistics show the following general aspects.

Age and gender

Table 1 in Annex2.2 shows the percentages of motorcycle and moped rider fatalities by age group and gender. During 2005, almost 30% of the total motorcycle and moped rider fatalities (1.750 people) were people younger than 25 years old. The age at which driving a moped or motorcycle is allowed varies across the European community,. As is shown in Table 1, a large majority of the PTW fatalities are male in all countries. Among moped fatalities 12% is female, among motorcycle riders less than 7% is female.

The number of moped rider fatalities by single year age bands are presented in figures 1 and 2 in the Annex2.2. The number fell between 1996 and 2005 for almost all ages, as can be seen in the inset.

During 2005, 29% of the total motorcycle and moped fatalities were aged between 15 and 24 years old. The number of motorcycle rider fatalities fell between 1996 and 2005 only for those under the age of 25, while it rose for most ages over 30.

Figure 3 in the Annex2.2 shows the fatality rate by age group in the EU-14 countries. The rates for moped riders aged 15-19 and motorcycle riders aged 20-50 are notably high.

Drivers and Passengers

Almost all fatalities among PTW riders are drivers, only 8% are passengers.

The proportion of fatalities who were passengers was relatively high in Sweden, Italy and Portugal. This may be due to differences in helmet use rates or to more PTW carrying passengers.

Road network: area and road type

Table 3 in the Annex2.2 shows that the majority of motorcycle and moped rider fatalities in all countries do not occur on motorways but on the nonmotorway network. This may be explained by the fact that mopeds are not allowed on motorways in most European countries. Furthermore, motorways have controlled access and their connection to the other road network is via grade-separated junctions. The existence of medians, separating opposite traffic flows on motorways, also results in a reduction in the number of fatal PTW accidents. Fatal accidents with mopeds occur more often in urban areas, whereas the number of motorcycle rider fatalities is higher in rural areas.

The data for Figure 4 in Annex2.2 show that in 2005, 1.800 motorcycle riders and 826 moped riders were killed inside urban areas. This is 42% and 53% respectively of the total motorcycle/moped rider fatalities, a large proportion compared to car occupants (20%).

Relatively few motorcycle rider fatalities died on motorways (4,6%), compared to 8,5% for car occupants. Junction type Table 4 in the Annex2.2 indicates that 28% of all motorcycle rider fatalities and 34% of the moped rider fatalities (1.740 persons) occur at a junction. For comparison, for car occupants only 16% occur at junctions. Table 5 shows that nearly 40% of the total number of motorcycle/moped rider fatalities recorded at a junction occurred at crossroads.

Month of the year

There are relatively few fatalities in the winter, and relatively many in the summer. This reflects the seasonal pattern of use of mopeds and motorcycles.

In figure 5 and 6 in the Annex2.2 the distribution of fatalities over the months is displayed for mopeds and motorcycles respectively. The five countries with the largest numbers are displayed, as well as the sum of the other 13 countries from the EU-18. The number of moped fatalities do not vary over the months as much as the numbers of motorcycle fatalities, however in all countries there are more fatalities each month in the period April-October.

For motorcycles the better weather conditions, inducing more use of motorcycles, are more pronounced from May to September, where a large number of fatalities is observed.

4.2.1.c Other studies

As it has been found through the diverse papers reviewed within this report, there are some common points highlighted in almost all the general studies concerning motorcycles and mopeds. However, there are some issues pointed out as significant ones in some studies whilst are not even mentioned in others. This difficulty rises especially when the document comes from governments or public institutions on one hand or from riders associations or motorcycle industry on the other. The factors that have been accepted as contributing to the accident causation are the following:

– The low conspicuity of motorcycle and mopeds.

– The fault of car driver of not giving the right of way to the PTW.

– Alcohol and rider impairment.

– Importance of accidents at intersections within urban area and run off the road accidents in bends outside urban areas.

– Extreme risk takers.

– Road infrastructure hazards, mainly related to the loss of traction of the single track vehicle.

– Braking problems.

– Riding experience and training.

And among the unclear factors that are found in some reports as contributing to the accident causation:

– Speeding.

– Engine size.

– Gender and age of the rider.

All these factors will be investigated at European level using different sources of data. The first stage within TRACE is to analyse the accident data compiled within the different National Accident Databases (usually developed by the Police Forces) to describe the magnitude of the problem. Then, analysis of different in-depth databases in which some sort of evaluation can be carried out will help in the identification of the actual factors contributing to the causation of accidents.

4.2.2 Summary

Available literature concerning accidents involving PTW has been reviewed. These reports vary from scientific publication to different associations agendas for the coming years, apart from governmental strategic plans.

It has been found that motorcyclist accidents are a huge problem all over the world, including European countries. In most of them, the accidents of this user group are one of the main safety concerns of the Governments due to its high frequency and severity.

Different studies have been carried out by several institutions, but most of them were partial studies using a low number of cases or, on the other hand, studies using National statistics without having enough detailed information to give proper estimations on risk factors. These inconveniences could be solved within TRACE as it is foreseen to collect information not only from Police data but also taking into account a great deal of in-depth accident databases.

Several factors having potential influence in accident causation involving motorcycles/mopeds have been identified within this document. Some of them are agreed by almost all the studies. Nevertheless, there are others that some studies consider contributing to accident causation whilst others state that they do not influence the accident occurrence at all.

All these factors will be addressed within the next stages of TRACE. The potential benefit of this project is high as there are a lot of data sources both at National and in-depth level to confirm whether the hypothesis stated in the different reviewed papers are true or not.

4.3 Descriptive analysis

4.3.1 Available data

4.3.1.a Period of data

Data analysed in this task has been focused on a 4 year period, from 2001 to 2004 as an average, although Greek data are only from the year 2004. Due to the queries and the analysis done are too much specific for extensive databases, in some cases, certain countries could not be taken into consideration as the lack of information could not be solved properly.

4.3.1.b Accidents considered in the study

The study contains data about accidents with personal damage (fatal, seriously or slightly injured people) in which, at least, one PTW has been involved, although some results will be focused specially on fatal and serious accidents.

4.3.1.c Vehicles considered in the study

Accidents under study involve at least one PTW.

4.3.1.d Involved countries and covered geographical area

The databases used are the following ones:

Country	Database	Data provider	Covered area
Germany	OGPAS	BASt	The data relate to the entire territory of the Federal Republic of Germany since 3 October 1990
France	BAAC	LAB	Whole France
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 4.1.-National database description for passenger car accidents.

As the following figure shows, four out of the six National databases available to TRACE concerns the four countries with higher 'parc' of PTWs. This is an important fact from the point of view of the results from this Task. The extrapolation of the results obtained in this task from the six National databases to the whole EU-27 level could not be considered as inappropriate.

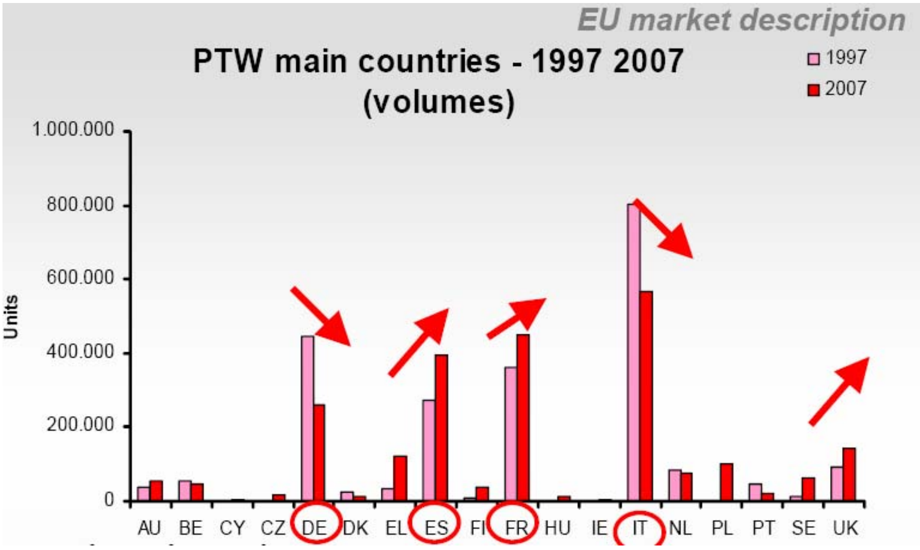


Figure 4.5.- European countries with higher PTW parc[39]

Besides, data from Australian extensive database are available for this analysis with the purpose of compare trends from European and non European data.

4.3.2 Analysis and methodologies

An overview of the general accident situation is to be the first step to be studied in this task, using data from each country. Queries and analysis over more specific variables are going to be the following activities to obtain general statistics from each country and to draw a general situation from the point of view of PTW users.

4.3.3 Results

Results obtained from analysis over TRACE extensive database are going to be showed. The analysis done will show general data observed over the seven extensive databases available for the project and subsequently comparisons with Australian data are to be made for some issues for obtaining differences. As it can be thought, queries done from Work Package 8 have been too much detailed, with the goal of selecting scenarios where accidents are likely to happen. Although a statistical method to extend data to all European level has been described, it has not been able to do this extension due the inability of margin data needed. Nevertheless, as it has been said, four out countries of the six national databases used in TRACE are the four countries with the highest PTWs parc in EU-27, therefore he extrapolation of the results obtained in this task from the six National databases to the whole EU-27 level could not be considered as inappropriate.

In the first steps, analysis is going to be done in a common way for motorcyclists and mopedists. Different considerations for these two users will be taken into account when differences are found. It is important to remark that main scenarios will be detected after analysing all kind of data, especially from fatal and serious accidents.

[39] 1997-2007 European PTW Market Trends (ACEM, 2008)..

4.3.3.a Location

One important aspect that can be studied previously is the area (urban or non urban) where accidents happen. It is said that moped accidents are found mainly in urban areas. Analysis over TRACE databases (Figure 5 and Figure 6 in Annex2.2) shows that motorcycle accidents (fatal and serious) happen in urban areas in a similar proportion than in non urban ones (although for some countries this contribution is higher either non urban or urban, being this percentage is like Australian data. Related moped accidents (fatal and serious) happen in urban accidents (near 75%).

Following to this location, special interest is to know if the accident has happen in a junction or not. As it has been shown in the literature review (table 4.2), 30 % of all motorcycle and moped fatalities occurs in a junction layout. If the analysis is done crossing area information and junction, it can be observed the following table.

Vehicle	Junction	Location
Motorcycle accidents	Non junction (72% of motorcycle accidents)	Urban (45% of the accidents in non junctions)
		Rural (55% of the accidents in non junctions)
	Junction (28% of motorcycle accidents)	Urban (74% of the accidents in junctions)
		Rural (26% of the accidents in junctions)
Moped accidents	Non junction (73% of moped accidents)	Urban (68% of the accidents in non junctions)
		Rural (32% of the accidents in non junctions)
	Junction (27% of moped accidents)	Urban (82% of the accidents in junctions)
		Rural (18% of the accidents in junctions)

Table 4.2.-Junction and area location of fatal and serious PTW accidents.

Although, it is clear that most accidents happen out of junctions, accidents in junctions should be taken into account.

4.3.3.b Type of accident and opponent

In this subchapter, analysis over type of accident is done. Considering area and junction location, the type of accident where PTWs are involved are detailed in the following table.

Vehicle	Type of accident	Junction and area
Motorcycle accidents	Head-on (20.63% of motorcycle accidents)	Urban junction (37.88% of head-on accidents)
		Rural junction (13.12% of head-on accidents)
		Urban non junction (23.04% of head-on accidents)
		Rural non junction (25.96% of head-on accidents)
	Front vs Side (22.52% of motorcycle accidents)	Urban junction (50.97% of front-side accidents)
		Rural junction (20.60% of front-side accidents)

		Urban non junction (15.94% of front-side accidents)
		Rural non junction (12.49% of front-side accidents)
	Side vs Side (6.15% of motorcycle accidents)	Urban junction (36.54% of side-side accidents)
		Rural junction (15.42% of side-side accidents)
		Urban non junction (19.9% of h side-side accidents)
		Rural non junction (28.13% of side-side accidents)
	Rear-end (10.42% of motorcycle accidents)	Urban junction (26.97% of rear-end accidents)
		Rural junction (17.62% of rear-end accidents)
		Urban non junction (26.85% of rear-end accidents)
		Rural non junction (28.55% of rear-end accidents)
	Run-off (20.99% of motorcycle accidents)	Urban junction (11.18% of run-off accidents)
		Rural junction (9.28% of run-off accidents)
		Urban non junction (27.88% of run-off accidents)
		Rural non junction (51.66% of run-off accidents)
	Other (19.29% of motorcycle accidents)	
Moped accidents	Head-on (34.65% of moped accidents)	Urban junction (40.81% of head-on accidents)
		Rural junction (8.77% of head-on accidents)
		Urban non junction (31.58% of head-on accidents)
		Rural non junction (18.84% of front-side accidents)
	Front vs Side (17.96% of moped accidents)	Urban junction (52.58% of front-side accidents)
		Rural junction (16.62% of front-side accidents)
		Urban non junction (19.63% of front-side accidents)
		Rural non junction (11.18% of front-side accidents)
	Side vs Side (2.48% of moped accidents)	Urban junction (37.64% of side-side accidents)
		Rural junction (11.36% of side-side accidents)
		Urban non junction (28.06% of h side-side accidents)
		Rural non junction (22.94% of side-side accidents)
	Rear-end (11.80% of moped accidents)	Urban junction (27.64% of rear-end accidents)
		Rural junction (8.14% of rear-end accidents)
		Urban non junction (41.58% of rear-end accidents)
		Rural non junction (22.64% of rear-end accidents)
	Run-off	Urban junction (10.91% of run-off accidents)

	(15.98% of moped accidents)	Rural junction (2.83% of run-off accidents)
		Urban non junction (54.21% of run-off accidents)
		Rural non junction (32.04% of run-off accidents)
	Other (17.14% of moped accidents)	

Table 4.3.-Type of fatal and serious PTW accident.

Through this table, the situation shows that **head-on, front-side and run-off** accidents are the most frequent **for motorcycles**. **These same situations are the most frequent also for mopeds**.

If the analysis over TRACE extensive databases focus over which kind of opponent has been involved against the PTW, it can be observed that, in fatal and serious accidents, crashes against **passenger cars** (42% for motorcycle accidents and 46% for mopeds) and **single collisions** (27% for motorcycle accidents and 21% for mopeds) are the most frequent (see Figure 4.6).

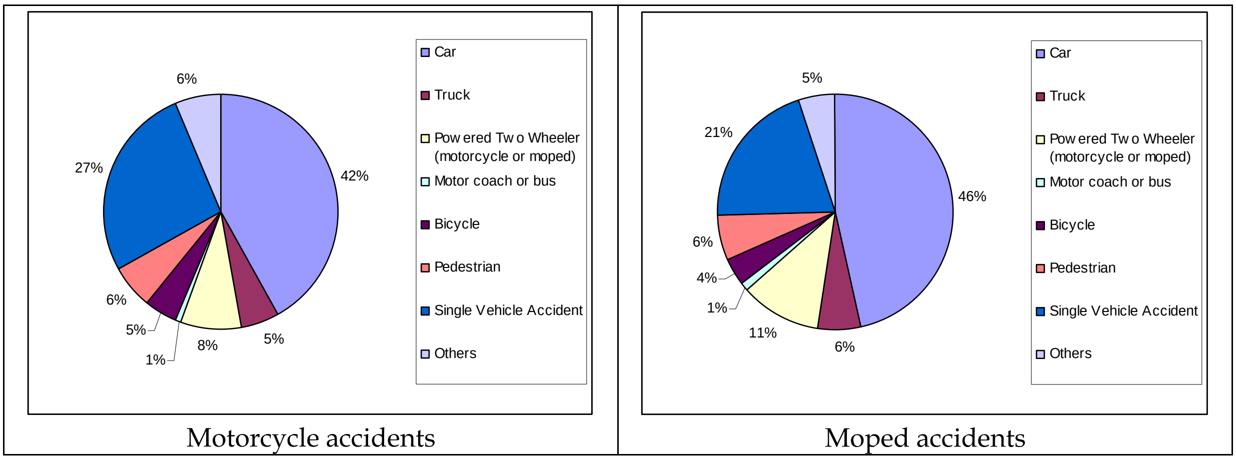


Figure 4.6.-Motorcycle and Moped fatal and serious accidents (2001–2004) for France, GB, Greece, Italy, Germany, Spain and Czech Republic.

Looking at national percentage, it can be observed (see Figure7_Annex2.2 and Figure8_Annex2.2) that in each TRACE extensive databases, these percentages are similar except for Italy due to 'single vehicle accidents' can not be detected.

After this overview, the descriptive study should be deeper for the most frequent configurations. Therefore, a detailed description of single accidents and accidents between PTW and passenger cars will be the focus of the next sections (involving around 70% of the total fatal and serious accidents).

4.3.3.c Main accident configurations

Until this chapter, general statistics have been given, either for all European level or only for TRACE database suppliers (seven countries in this task). Furthermore, some comparisons with Australian situation have been made. Nevertheless, on of the main goals of these report is to give the most important and frequent scenarios where PTW accidents happen, specially related to the most severe ones (fatal and serious accidents).

After this overview and taking into account the different statistics, the main configurations are detailed below. Apart from these data, experience and knowledge from analysts have been considered to detect the following main scenarios.

Motorcycle group: The next four configurations cover more than 50% of the total fatal and serious motorcycle accidents.

✓ Configuration A: **Single accidents**.
For these accidents, the study is to be focused on the following type of single rural accidents: run-offs, rollover on the carriageway and collisions with road restraint systems. This type of collisions involves 27% of the total fatal and serious motorcycle accidents.

✓ Accidents between **passenger car and motorcycles**:
The total percentage of fatal and serious accident is 42%. For these accidents, the study will be focused on the following types:

- Configuration B: **Front-side accidents in rural and urban junctions between motorcycles and passenger cars**.
This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the motorcycle) or the target (damage in the side part of the motorcycle). This type of collisions involves near 13% of the total fatal and serious motorcycle accidents.

- Configuration C: **Side-side accidents in rural and urban non junctions between motorcycles and passenger cars**.
This type of collisions involves 5% of the total fatal and serious motorcycle accidents.

- Configuration D: **Rear-end accidents in rural and urban non junctions between motorcycles and passenger cars**.
This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the motorcycle) or the target (damage in the rear part of the motorcycle). This type of collisions involves 5% of the total fatal and serious motorcycle accidents.

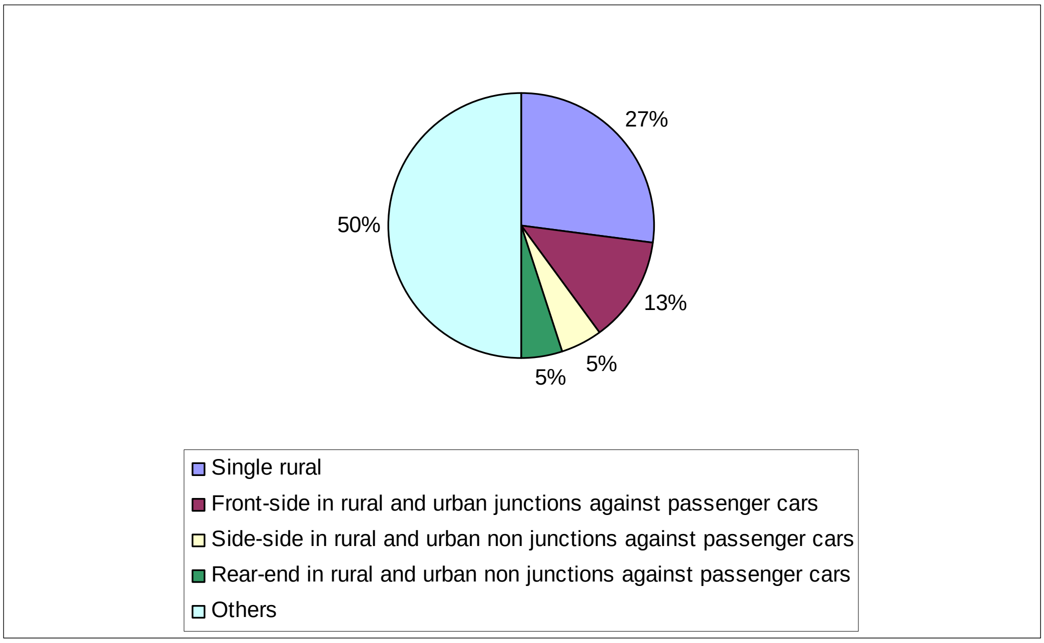


Figure 4.7.-Distribution of fatal and serious motorcycles accidents (2001-2004).

Moped group: The next three configurations cover near 60% of the total fatal and serious moped accidents.

✓ Configuration E: **Single accidents**.
For these accidents, the study will be focused on the following type of single (rural or urban) accidents: run-offs, rollover on the carriageway and collisions with road restraint systems. This type of collisions involves 21% of the total fatal and serious moped accidents.

✓ Accidents between **passenger car and mopeds**.
The total percentage of fatal and serious accident is 46%. For these accidents, the study will be focused on the following types:

- Configuration F: **Front-side accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars**.
This configuration includes accidents in which the motorcycle is the bullet (damage in the front part of the moped) or the target (damage in the side part of the moped). This type of collisions involves near 30% of the total fatal and serious moped accidents.

- Configuration G: **Head-on accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars**.
This type of collisions involves 8% of the total fatal and serious moped accidents.

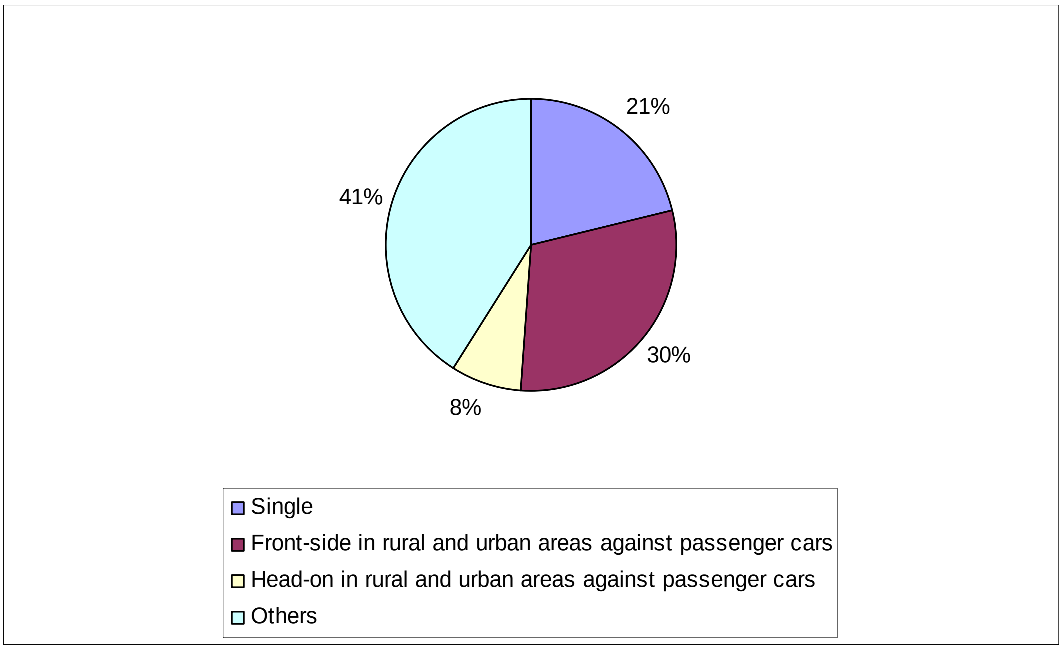


Figure 4.8.-Distribution of fatal and serious moped accidents (2001-2004).

4.3.3.d Characteristics for the main scenarios

An extensive descriptive study of the seven final scenarios for PTW is going to be shown with the purpose of characterising them from several for several points of view. Although the main seven scenarios has been selected based on European data (all countries) and TRACE extensive database (seven countries), the following characteristics have been obtained only from one of the extensive database available for TRACE (Spanish national database called 'DGT database'). The reason of this inability data from other extensive databases is that many specifics queries have been tried to do over the seven specific scenarios with the purpose of answering questions like How?, Why?, What?, Where?…nevertheless, these specific queries have been only possible to obtain it from the Spanish database. The aspects studied to describe the different configurations are the following ones:

- Conspicuity.
- Motorcycle driver experience.
- Risk taking.
- Surface.
- Leisure/professional travel.
- Technique.
- Motorcycle driver infractions.
- Rider psychophysics conditions.

These issues will be dealt for motorcycle accidents and for moped accidents.

Motorcycle:

✓ **Configuration A: Motorcycle - single rural accidents.**

Although the majority of fatal and serious accidents happened during good weather conditions in a normal driving way, in 40% of the accidents there were visibility problem due to terrain profile, specially.

The type of driver who suffered a run-off accident was a 31-40 years old driver with more than 10 years of experience (in police reports, it was indicated that inexperience was not the accident cause). The drivers were travelling during leisure time in most of configurations (80%), although also they were travelling during labour time (6%), commuting (4%) or during a long weekend trip (4%).

Analysis shows that drivers were travelling with an inadequate speed when the accident happened. In most of configurations (97%), tyres were in normal conditions.

Related to road conditions, road surface was mostly dry and clean (91%). The carriageway where the accidents happened had paved shoulder in 70% of the crashes. Apart from these aspects, surface has not been considered as accident causation.

The main driver, during the fatal and serious run-offs, was absent-minded in a 28% percentage.

The psychic driver status was apparently normal (75%) meanwhile 3% of the drivers were in under alcohol or drug influence or tiredness conditions.

✓ **Configuration B: Motorcycle - front-side accidents against passenger cars in rural and urban junctions**.

If the analysis is focused on how the motorcycle is detected, it has been found that most of the fatal and serious accidents happened during daylight, although for example in rural junctions, where near the 18% of the accidents were at night. Black and red were the colours of a big part of the crashed motorcycles. In majority of the accidents there was good visibility.

In these accidents, almost always the rider was parking or getting into a carriageway from another road or street (more than a half). In spite of these manoeuvres, in a few configurations the rider was considered in most of the cases not being in fault of any infraction. In most of the accidents, speed was considered as accident causation (according to police opinion) (not from the rider).

For rural areas, the most common type was 'T' or 'X' junctions, which were regulated by stops sign or none (82% of fatal and serious accidents).

The psychic driver status was apparently normal (80%), and only in two cases, the driver was under alcohol influence or tiredness conditions.

✓ **Configuration C: Motorcycle - side-side accidents against passenger cars in rural and urban non junctions.**

Concerning the visibility of motorcycle from the car driver point of view, about 70% of the fatal and serious accidents happened with daylight conditions. The most common motorcycle colours were black and red, and in most of cases the motorcycle lightings were not turned on.

Before the accident, the rider was either in a normal way of driving, or overtaking the passenger car. In these accidents, police has considered that rider inexperience and speed were the main accidents causes.

The rider was in a normal driving or overtaking by the left/right side. Although most of riders involved in accidents have the license for more than 10 years, rider inexperience has been considered as accident causation in majority (95% of total accidents). Other aspects related to accident causes show that speed (93% in fatal & serious accidents) was also the main cause.

Near a half, the rider did a traffic violation during its driving. For example, in fatal and serious accident, the most common rider infraction were absent-minded (10%), overtook illegally (10%), not obeyed STOP sign (1.8%), not obeyed general priority (1.8%) or not obeyed GIVE WAY sign (1.5%).

The type of driver who suffered this accident was a particular one who was travelling during the labour time, commuting or in leisure time.

✓ **Configuration D: Motorcycle - rear-end accidents against passenger cars in rural and urban non junctions.**

Three out of four accidents were in daylight conditions (8% during the night period without luminosity). Although there were good weather conditions in most of the accidents, the weather restricted visibility in 5% of the fatal and serious accidents and the surface was wet near 3%.

During the accidents, the different driver (passenger car or motorcycle) infractions were:

Type of collision	Percentage of fatal and serious accidents (Motorcycle rider)	Percentage of fatal and serious accidents (Passenger car driver)
Absent-minded	33.1%	10.9%
Turn incorrectly	0%	3.4%
Overtake illegally	7.8%	5.3%
Not keeping safe distance	16.6%	3.1%
Others	12.8%	13.9%
None infractions	29.7%	63.4%

Table 4.4.-Type of infractions in fatal & serious rear-end accidents between motorcycle and cars.

Moped:

✓ **Configuration E: Moped - single rural accidents.**

If the analysis is focused on conspicuity ('how good is the visibility from the driver point of view'), it can be said that most of run-offs happened during good weather conditions. Nevertheless, in more than 20% of total accidents happened there was a problem visibility, most of them related with terrain profile (15%).

In these accidents, where there is only one moped involved, inexperience has been considered (police opinion) as a direct causation in more than 95% of the fatal and serious accidents, meanwhile wrong speed was in almost 80%. Concerning the surface, in 90%, the surface was dry and clean and in 50% there was not hard shoulder. In less than 1% of total the run-offs, surface condition has been detected as accident causation.

Together with these causes, riders have carried out the following driving infractions:

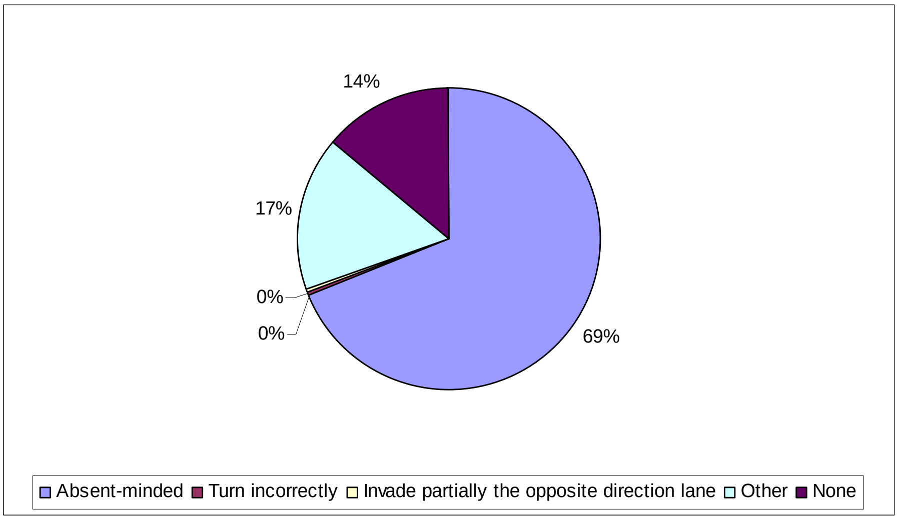


Figure 4.9.-Distribution of moped riders' infractions in run-offs accidents.

Drivers were travelling during leisure time (73.7%) when the accident happened; and they were driving in a normal way (90%).

The psychic driver status was apparently normal (65%), meanwhile some of the drivers were in under alcohol or drug influence (4.1%) or tiredness conditions (1.5%). The number of hours the rider was driving was less than 1 hour (as it is shown in the next figure).

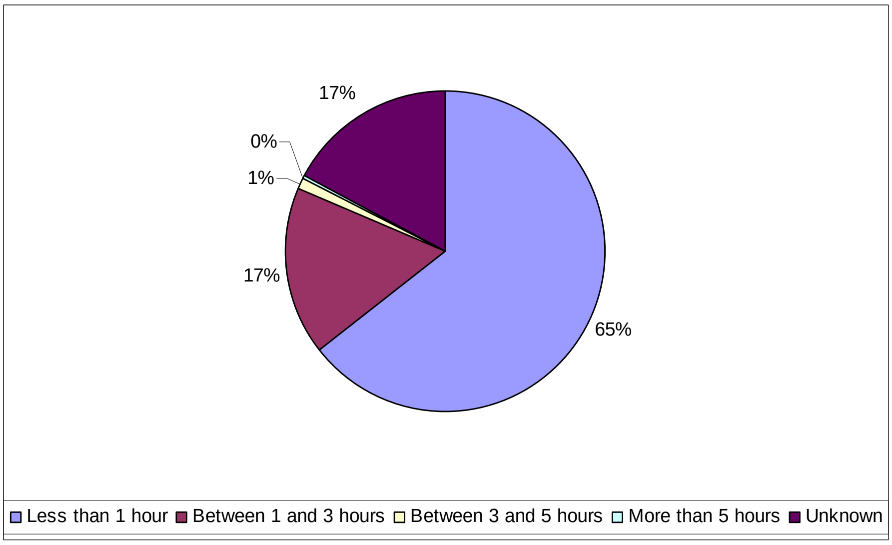


Figure 4.10.-Number of hours driving in moped run-offs.

- ✓ **Configuration F: Moped - front-side accidents against passenger cars in rural and urban areas (junction and non junction).**

Most of fatal and serious moped accidents were in urban junctions. The most common types of junction (urban or rural) were 'X or +' layout (60%) or 'T or Y' layout (30%).

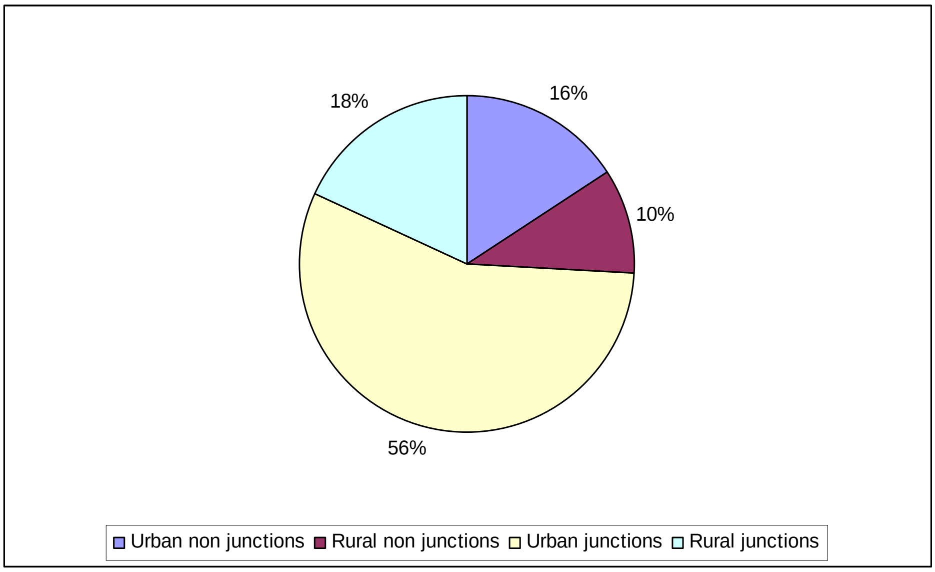


Figure 4.11.-Number of hours driving in moped run-offs.

Near 70% of the accidents happened during daylight, meanwhile one out of four was at night with enough luminosity. No restricted visibility problems were identified for most of the accidents (82%) included in junction ones.

In these accidents, drivers were driving in a normal way (50% for riders or 40% for car drivers) or crossing an intersection (30% for riders or car drivers). In the case of junctions, the priority was regulated by traffic light (28%), STOP sign (24%), GIVE THE WAY sign (19%) or no sign at all (22%).

Near a half of accidents, the rider committed an infraction. The most common were 'not obeying traffic signs indications' (7.8%), 'absent-minded driving' (5.7%) or 'overtaking illegally' (5.3%). On the other hand, passenger car driver carried out an infraction in 60%. 'Not obeying STOP signals' (9.8%), 'not obeying GIVE THE WAY signals' (7.5%) or 'not obeying traffic signals indications' (7.1%) were the main infractions committed by passenger car drivers.

Only in 1% of the riders, alcohol or drugs were found. None of the accidents were due to tiredness.

- ✓ **Configuration G: Moped - head-on accidents against passenger cars in rural and urban areas (junction and non junction).**

These accidents happened, most of times, in urban area (67%). In 60% of the urban collisions, they happened at junctions (especially in 'T or Y'). In accidents in non junction areas, more than 50% were in a straight section.

Related to light conditions, near 60% were during the daylight, although one out of four were at night (with enough visibility). Another important aspect is the fact that accidents occurred with some visibility problems (40%).

In more than a half, the rider carried out an infraction during the accident (55%), specially straying onto the opposite lane (18%), absent-minded driving (8.6%), driving in a forbidden direction (6.4%) or overtaking illegally (4%). During all the accidents, the rider was under abnormal conditions (alcohol, drugs or tiredness) in less than 2%.

4.4 Conclusions

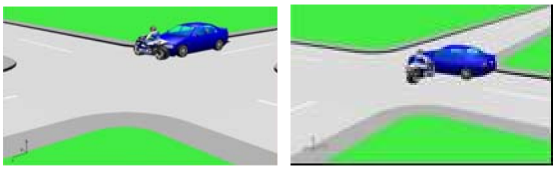
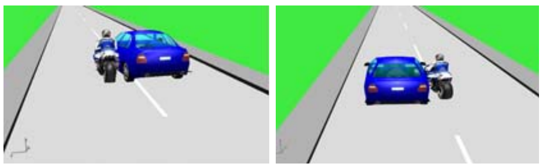
This chapter was intended to identify the main problems and magnitude of the accidents where, at least, one 'Powered Two Wheeler' had been involved.

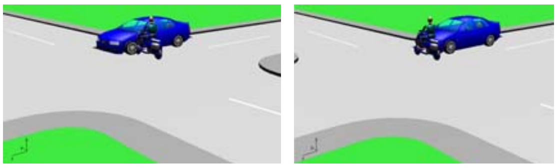
The main results of the literature review performed on PTWs traffic accidents have been presented in this section. Different papers and public reports have been reviewed with the aim of identifying which factors have already been analysed as possible PTWs accident risk factors and which methodologies have been used to conclude that.

Different studies have been carried out by several institutions, but most of them were partial studies using a low number of cases or, on the other hand, studies using National statistics without having enough detailed information to give proper estimations on possible risk factors. These inconveniences are to be solved within TRACE as information not only from Police data but also taking into account a great deal of in-depth accident databases are being used.

Once the available knowledge on PTWs accident situation was reviewed, the next step has been to detect which the main accident configurations were for this road user. It has been obtained analysing the available national accident databases within the TRACE consortium. The accident configurations have been mainly selected according to the type of collision, other vehicles involved in the accident, location of the accident and road layout configuration. For each of the configurations a general description of other relevant parameters has also been provided.

The final most common scenarios detected are the following ones:

Accident Configuration	Fatal & Serious accident percentage	Illustration
1. **Motorcycle single accidents:** Accidents which involved just one motorcycle on a rural road (run-offs, rollover on the carriageway and collisions with road restraint systems).	27%	
2. **Front-side accidents in rural and urban junctions between motorcycles and passenger cars.**	13%	
3. **Side-side accidents in rural and urban non junctions between motorcycles and passenger cars.**	5%	
4. **Rear-end accidents in rural and urban non junctions between motorcycles and passenger cars.**	5%	

5. **Moped single accidents:** Accidents which involved just one moped on a rural or urban road (run-offs, rollover on the carriageway and collisions with road restraint systems).	21%	
6. **Front-side accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars.**	30%	
7. **Head-on accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars.**	8%	

Finally, some relevant issues deserved to be mentioned regarding the above configurations:

- Those will be the ones upon the In–depth and Risk Analyses will be performed in the next steps of this project as they constitute the most relevant accident problematic for PTWs accidents. Accident causes for each one of the configurations will be obtained as well as the main risk factors for each configuration.
- They have been constructed so as to be easily recognisable when analysing in – depth accident databases.
- Due to the nature of the databases analysed for this analysis (macroscopic accident databases), that are mainly filled in by police questionnaires, no reliable information can be provided regarding accident causation as it is well recognised within the accident research community that those databases do not contain the necessary level of detail to offer such conclusions.

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5 Task 1.3: Vans, Bus and Truck Drivers

This task is to study the road transport accidents in Europe. Vans, busses, and trucks a urgent to study, since they contribute for a high part to the average loss in terms of personal and material damages. Though not the highest in absolute figures, road transport vehicles count for the most severe accidents as to the effects of the impacts. High masses lead to higher severe impacts, namely for the unprotected (pedestrians, cyclists, two-wheel-drivers), and the lower mass vehicles (small cars). The importance of the road as mode for transportation will increase in terms of ton kilometres in the whole EU. Insofar, transportation accidents by van, bus, and truck must be kept in mind, when targeting road safety in Europe and the aim to halfen the EU road fatlity figure.

The main outcomes to report in this chapter are the identified most frequent and important accident scenarios for vans, buses and trucks for the time period from 2001 to 2004. As the rest of road user shown in this report, period of more than one year was taken to get the average and for more meaningful data. Single factors of influence (e.g., extreme weather conditions, big events, etc.) are weighted less strongly. The under limit of the year 2001 was chosen to get the current accident scene. The availability of the data was the reason for the upper limit of 2004. Younger accidents are not yet gathered to the statistics in most of the countries.

At the beginning of this chapter a summary of the literature review is going to be given, followed by a general overview about the accident situation. The tables show the number of accident of the respective vehicles broken down by location, light condition accident opponent, type of accident and accident causation. In the next step the most frequent accident scenarios were found out. These scenarios correlate with the results of the literature review.

The three most important or rather most frequent scenarios were selected and examined more exactly. Bases of this investigation are the data from Germany, France, Great Britain, Greece, Italy, Spain and Czech Republic. National differences can be shown with the help of these investigations.

5.1 Main outcomes of the literature review

As a result of the literature review, Germany (20,524 accidents) is the land with the highest absolute number of heavy truck accidents followed by United Kingdom (13,274), France (6,510), Spain (5,388), Netherlands (2,099) and Sweden (1,135). On account of Germany's central transit position of Europe and the good road network it is clear that in Germany most of the accidents have occurred. There is not a great difference between rural and urban in Germany. In opposite to Spain there is a great difference (4,463 rural and 924 urban accidents). In France and the United Kingdom the casualties on the country were also as high as in the city. These accidents were all with personal damage and on the country road, where the speed limit is higher. Therefore, it is clear that on the rural the likelihood of injury is higher as in the city (Gwehenberger & Bende, 2003; Gwehenberger, 2003; Meewes, 2004).

The result of this literature review regarding to the opponent is that passenger cars are the most frequent accident opponents of trucks. The kind of collisions are different, but the rear-end collision accounts for a high amount of these accidents. The passenger car was the opponent of the truck in over 50 % of all truck accidents (Knight, 2000). Crashes with unprotected road users have serious consequences for the weak party. In these kinds of casualties the crossroads and the inlets were the places with the highest accident potential. Especially, right turning accidents have severe consequences for pedestrians and cyclists. These crashes are the result of the dead angle on the right side in the case of trucks (left side for the United Kingdom). Although the pedestrians made in the most accidents the fault, perhaps the accident could have been avoided with an electronic system installed in the truck. The problem is that the most cyclists or pedestrians could not estimate the behaviour of the truck. They do not know how trucks react in a turning or a crossroad (Niewöhner, 2004; Gwehenberger & Bende, 2004).

Another finding is the heavy injury risk in single truck accidents. Often the truck is tilting to the side or rollover, because the speed in the bend was too high. The final consequence of the accident is that the cap is seriously deformed. Drivers not wearing safety belt constitute one of the most important problems in terms of injury consequences of the accident. On account of the impact they would be thrown out the windscreen or the side screen and would be seriously injured. The result of a single accident could be a crash, because the driver falls asleep, was distracted or drives with unadapted speed. In this case there is also a high injury risk for the occupant. For falling asleep at the wheel there are several causes. These would be a shift-work, too long working hours and sleeping lack (Assing, 2004; Gwehenberger, 2002; Horne & Reyner, 1999; Gander et al., 2006).

The truck/truck accidents are like the single truck accidents with a high potential of serious injury for the occupant. There are two vehicles, which are big and heavy and the impact could be enormous. The missing crumble zone does not receive the driver and the end would be serious injured people. Clear statements regarding accident causation could not be taken from the literature. Because most reports refer on police data, the real causes are often not mentioned for not accusing themselves. From presumptions of different literature sources reveals the most frequent causations distraction or inattentiveness and fatigue.

Finally, there is no information about accident causation which is providing us with the necessary information for any kind of vehicle relating the target of TRACE project. In comparison with our issue the majority of reports only treat sections. There are only subsets treated in the specific articles, e. g. trucks over 7.5t GVW.

5.2 Descriptive analysis

5.2.1 Available data

5.2.1.a Period of data

The data used in this work is restricted to a 4 year period, from 2001 to 2004 as an average. Only the Greek data are from the year 2004. When analyzing the data of the different countries, it was not always possible to get full information for the entire period of four years. In some cases, certain countries could not be taken into consideration as the lack of information could not be solved properly. Therefore missing countries in some tables throughout the report are just attributed to missing data.

5.2.1.b Accidents considered in the study

The study contains data about accidents with personal damage, which is distinguished after fatalities, seriously and slightly injured persons.

5.2.1.c Vehicles considered in the study

The following vehicles have been considered in the queries and analysis done:

- Coach or Bus (with more than 8 seats without driver).
- Vans are goods road vehicles/lorries with a G.V.W. (Gross Vehicle Weight) $\leq$ 3.5 t.
- Trucks are goods road vehicle/lorries with a G.V.W. > 3.5 t.

However, the German trucks do not include trucks with foreign registration and trucks with German registration for which no information on the G.V.W was available.

5.2.1.d Involved countries and covered geographical areas

The databases used are the following ones:

Country	Database	Data provider	Covered area
France	BAAC	LAB	Whole France
Germany	OGPAS	BASt	The data relate to the entire territory of the Federal Republic of Germany since 3 October 1990
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 5.1.- Databases used from different countries, and area covered by these.

Therefore, the total number of accidents might differ from table to table. The national statistics cover all accidents reported to the police authorities. These were registered by the police officers, who attended the accident.

5.2.2 *Analysis and methodologies*

At first the general accident situation of each country is shown with the help of an overview. The level of these describing data will go gradually deeper and deeper and indicate to the most important configurations. Afterwards, the most important accident scenarios of the three road user are investigated more exactly. The choice of these scenarios occurred on account of the investigation of the German material, mainly. The reasons why German data have been used is the availability from the other countries and the disproportionate amount of work which would have been necessary to evaluate the raw data for all lands plays a role. These three most frequent scenarios for each road user arose very unambiguously from the German data material. The advantage of this German focus is that here we find the most extensive exposure as to yearly transportation kilometers. Also traffic density and road length is highest. So, these figures illustrate best, what the leading problems are with transport accidents, in dependence with growing traffic.

5.2.3 *Results*

The following chapter contains results from the analysis of accidents with injuries to persons involving Goods road vehicles and Bus/Coach in the different countries. Considering the four year period of observation, the seven countries account for more than 3.8 million accidents of all road users. Although a first look on the development of the accident numbers reveals no uniform trend for the countries.

5.2.3.a Number of fatalities

The following figures represent the absolute number of fatalities for occupants or drivers of vans, trucks and busses for the time period of 2001 to 2004. These figures are based on information of the European Road Accident Database CARE.

By comparison of the figures of all countries of the years 2001 and 2004, a pleasantly clear decreasing trend appears mostly. Also it is clear evident that in all countries more occupants of vans are killed than of trucks or coaches. Unfortunately, no separate figures for vans and trucks are available from Germany; therefore, the total number of van plus truck accidents is recorded in figure 5.2b, including Germany. The high number of the killed van and truck occupants in Spain and in France also for trucks is remarkable.

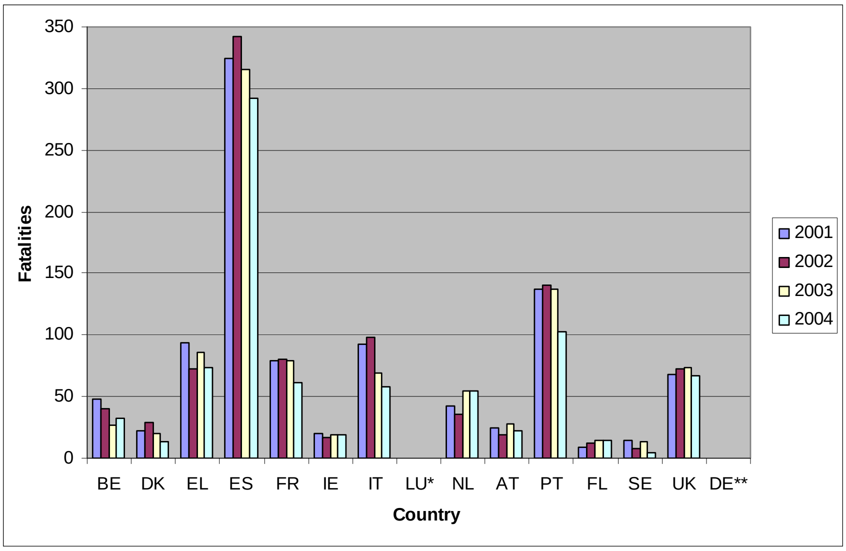

Figure 5.1.-Fatality development for drivers and passengers of vans (Time period: 2001 to 2004, Source: CARE - * No data available; **No isolated data for vans available).

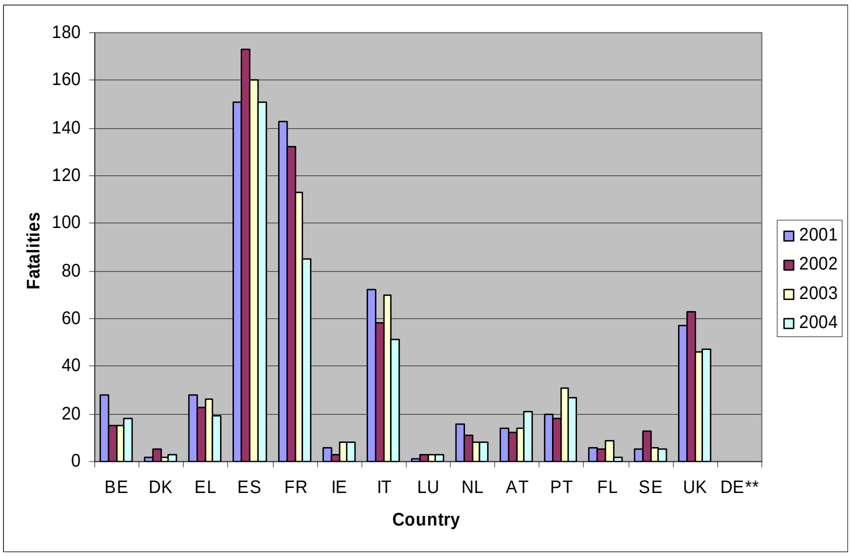

Figure 5.2.-Fatality development for drivers and passengers of trucks (Time period: 2001 to 2004, Source: CARE - **No isolated data for trucks available).

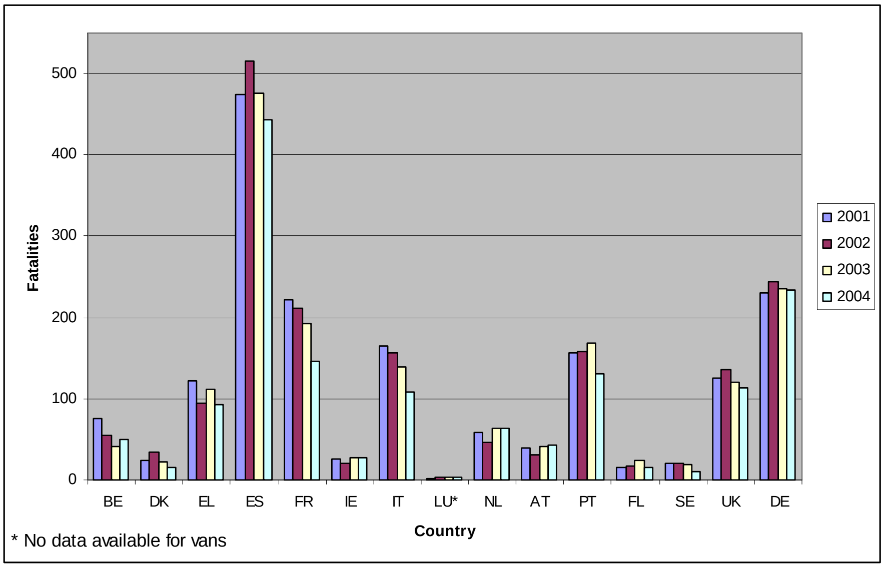

Figure 5.2b.-Fatality development for drivers and passengers of vans plus trucks (Time period: 2001 to 2004, Source: CARE).

Regarding the killed occupants of coaches the figures diversify in all countries in a relatively wide range. The reason for this might be that one heavy coach accident could cause a high number of deaths. Depending on whether such kind of accident happens or not figures go up and down. All together, nevertheless, the allotment of the occupants who are killed in a coach accident is relatively low.

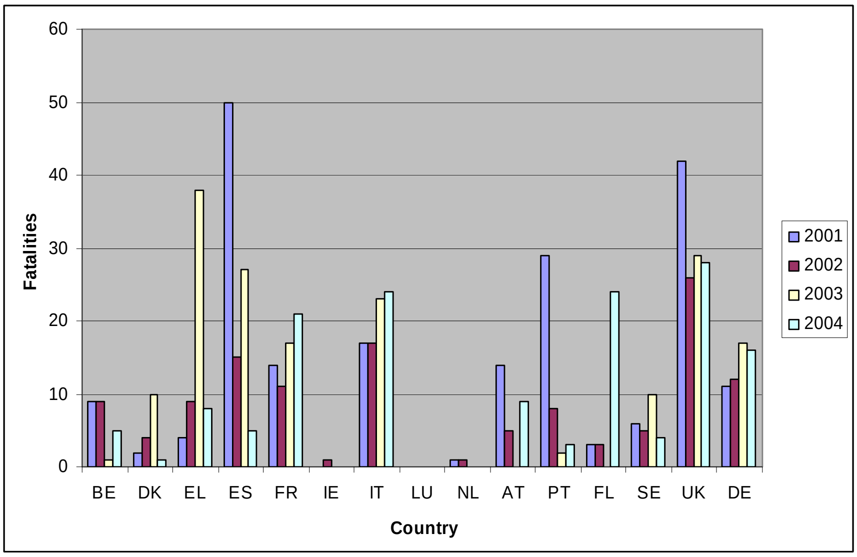

Figure 5.3.-Fatality development for drivers and passengers of coaches/busses (Time period: 2001 to 2004, Source: CARE)

5.2.3.b Location and road type

The purpose of this chapter is to find out the most frequent location of the accidents for each country. This is basic information for example referable driver assistance system effectiveness prediction. Concerning accidents of goods road vehicles, all counties (except Greece) have a clear higher rate of motorway accidents than all road users together. This fact might be attributed to the fact that truck are used more frequently on motorways compared to passenger cars, motorcycles etc. The higher rate of goods road vehicle accidents on motorways can be explained with the high "through-traffic" which mostly uses the motorways and the fact that trucks are used more frequently on motorways compared to passenger cars, motorcycles etc. Nonetheless, the majority of personel damage accidents of goods road vehicles occur in-urban, compared inbetween the distribution of all types of roads, where severe goods vehicle accidents do happen. In the comparison of all countries arose a uniform trend (except in Spain). Most frequent accidents of trucks with personal damage happened on urban roads and least on motorways (figure 5.4).

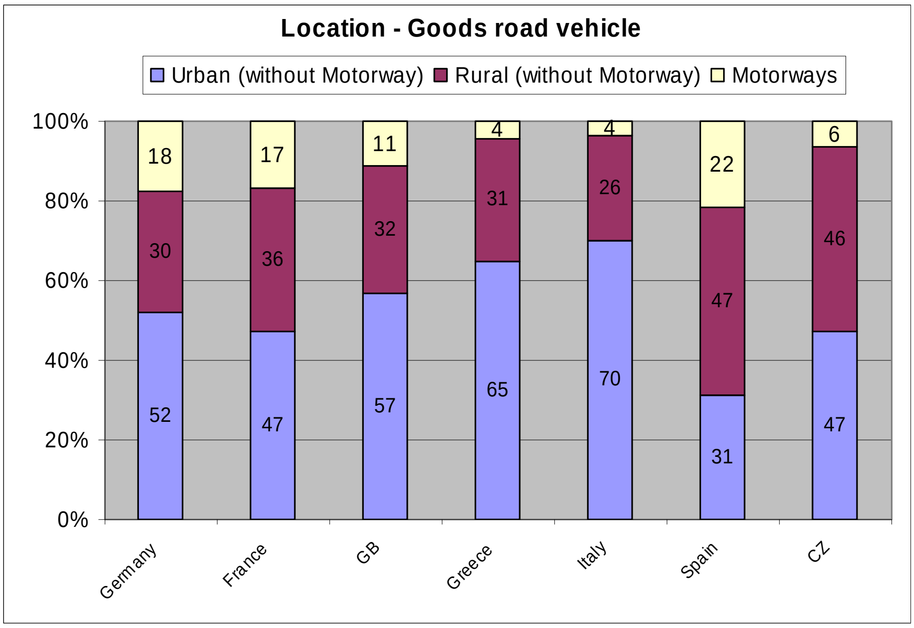

Figure 5.4.-Distribution of the location for goods road vehicle for all countries (Accidents with personal damage; Time period: 2001 to 2004).

In the case of coach accidents it appears a good correlation of the majority of all countries. The clearly higher urban rate in comparison to all road users together attracts attention. The high allotment of coach accidents with personal damage in urban area can be explained by the application in the passenger transport (frequent boarding and alighting of passengers, starting and removing from the bus stop, speed accelerations are prominent in bus passenger accidents). To sum up, it can be said that the main focus for further investigations regarding buses should be accidents on urban area (figure 5.5).

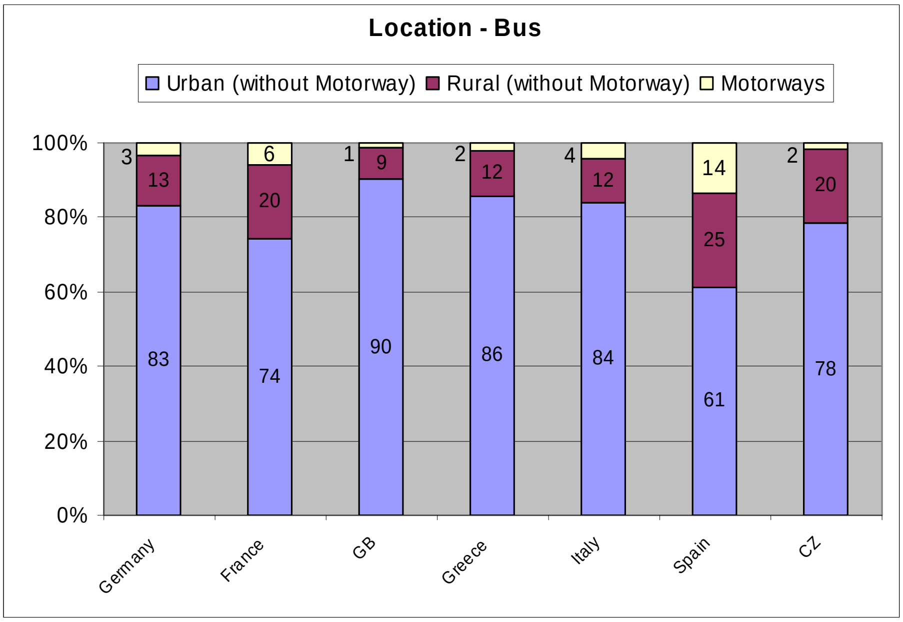

Figure 5.5.-Distribution of the location for busses for all countries (Accidents with personal damage; Time period: 2001 to 2004).

Unfortunately, an extension of the tables for the whole EU-25 is not possible because of a lack of information regarding injury accidents for trucks, vans and busses. The only available information is the number of fatalities for 15 countries which is not suitable for an extension.

5.2.3.c Light condition

Related to the light conditions, it appears that the absolute majority of the accidents happened in connection with daylight. Up to slight differences this is similar in all investigated seven countries. Nevertheless, one remarkable effect appears for all countries, accidents of trucks and coaches occur less often at night than all road users.

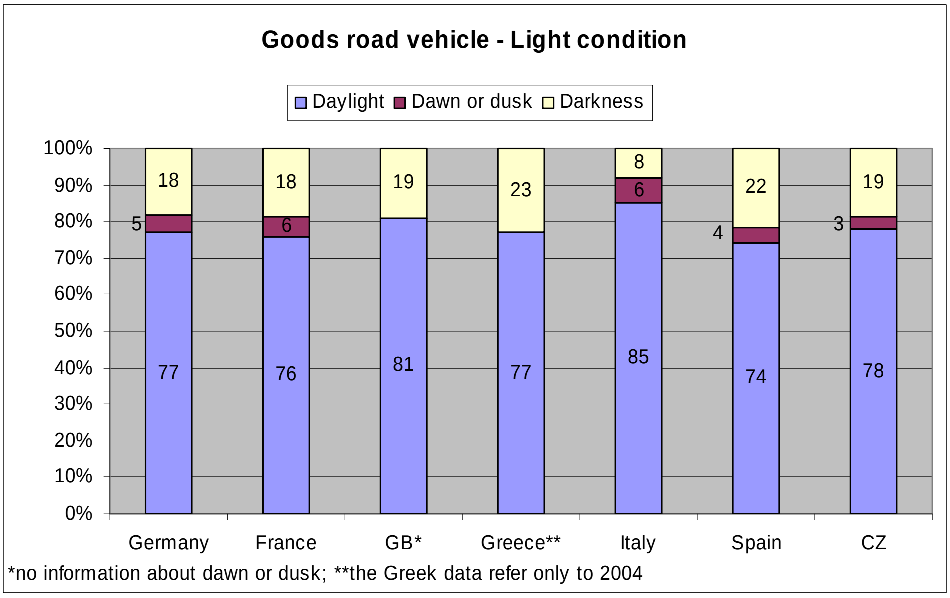

Figure 5.6.-Distribution of the light condition goods road vehicle (Accidents with personal damage; Time period: 2001 to 2004).

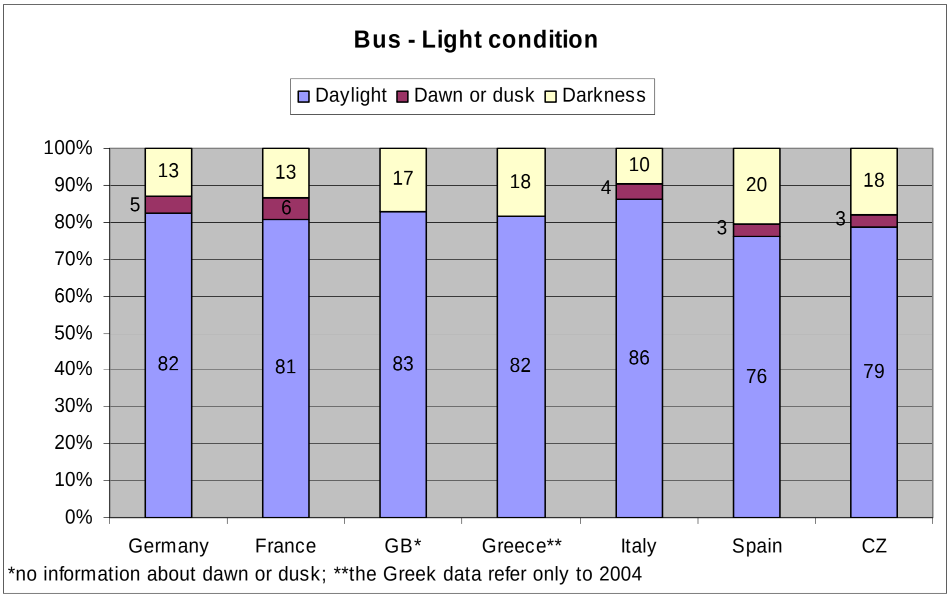

Figure 5.7.-Distribution of the light condition for accident of Coach/Bus (Accidents with personal damage; Time period: 2001 to 2004).

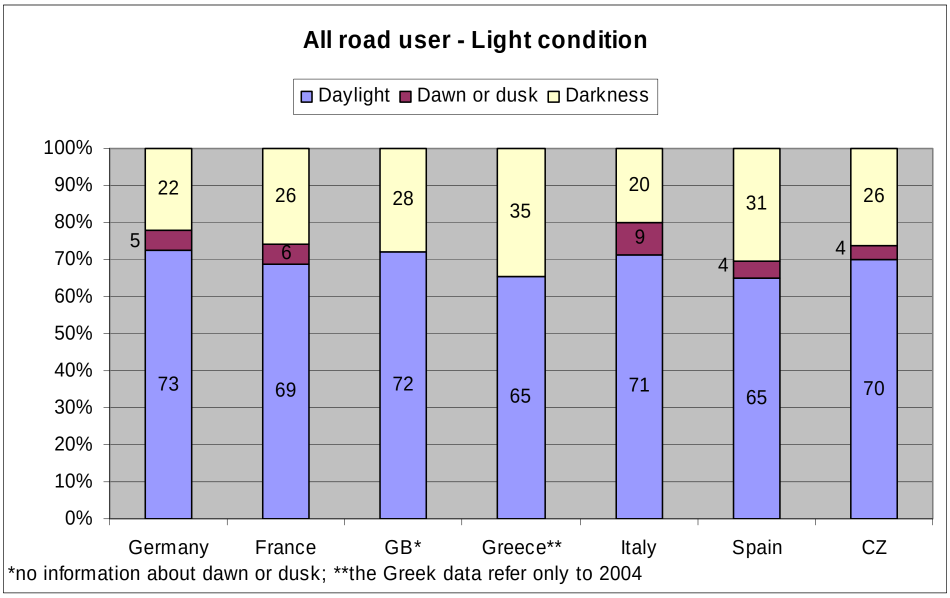

Figure 5.8.-Distribution of the light condition for accident of all roads user (Accidents with personal damage; Time period: 2001 to 2004).

5.2.3.d Type of accident opponent

The purpose of this paragraph is to recognise the most frequent accident opponent of each of the road user considered in this task. Unfortunately, from Italy and Czech Republic the data were not available. The data from the other counties could be distinguished between vans (goods road vehicle <3.5t), trucks (goods road vehicle> 3.5t) and coaches. This differentiation could not be done for France.

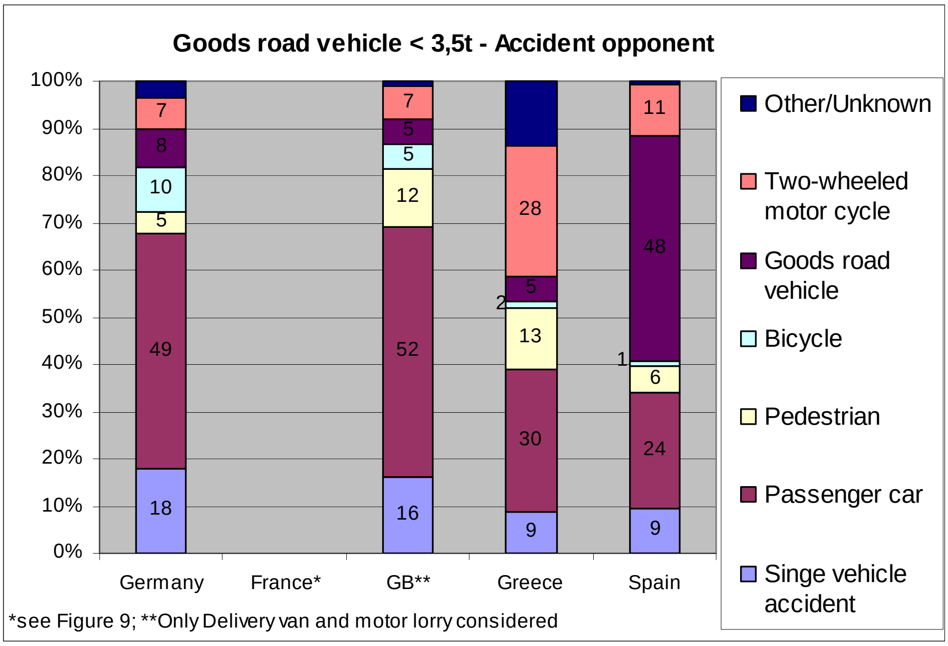

Figure 5.9.-Van accidents categorised by accident opponent (Accidents with personal damage; Time period: 2001 to 2004).

As expected, the passenger car turned out as the most frequent rival of vans. The passenger car is followed by the single vehicle accident in Germany and GB. In Greece the second frequent opponent is the two-wheeled motor cycle what can be traced back on the high two-wheel vehicle population in Greece.

The only common characteristic for nearly all countries is the passenger car as the most frequent opponent of trucks (see figure 5.10). More than one road user and the two-wheeled motor cycles are the most important rivals in France. The second frequent accident opponent of trucks is in Germany the bicycle, in Great Britain the single vehicle accident and in Greece the two-wheeled motor cycles.

Also in the case of coach accidents, the passenger car is dominating accident opponent (see figure 5.11). Only in the Great Britain the single vehicle accident appears more often than a collision with a passenger car. The second frequent involved partner in Germany and France is the pedestrian, in Greece and Spain it is the single vehicle accident. The common use of the coach in the mass passenger transport is connected with frequent boarding and alighting of passengers, starting and removing from bus stops which explain the high rate of involved pedestrians. The use of coaches in holiday traffic is connected with long inter-urban routes, often on motorways which explain the high rate of single vehicle accidents in Greece and Spain.

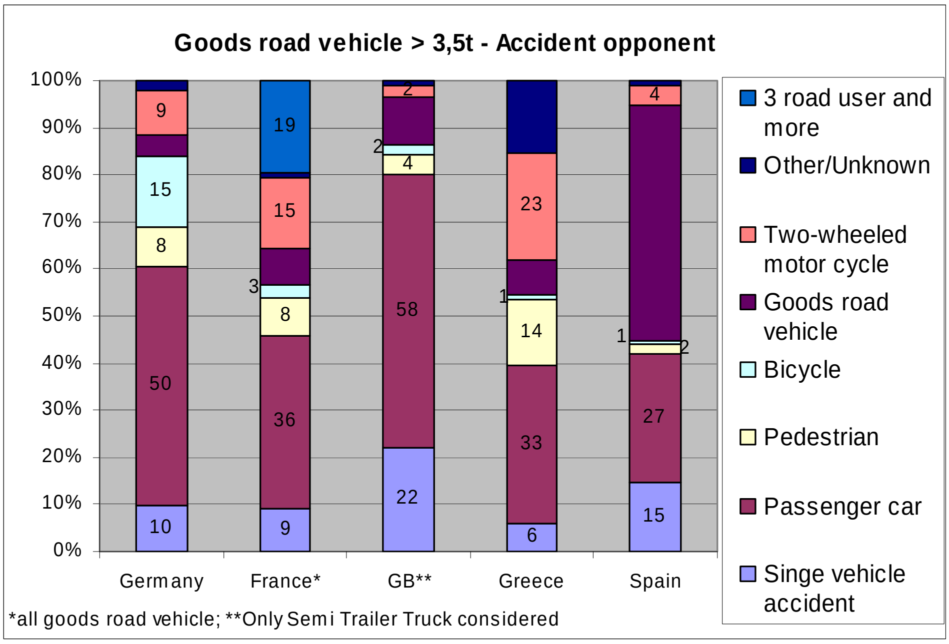

Figure 5.10.-Truck accidents categorised by accident opponent (Accidents with personal damage; Time period: 2001 to 2004).

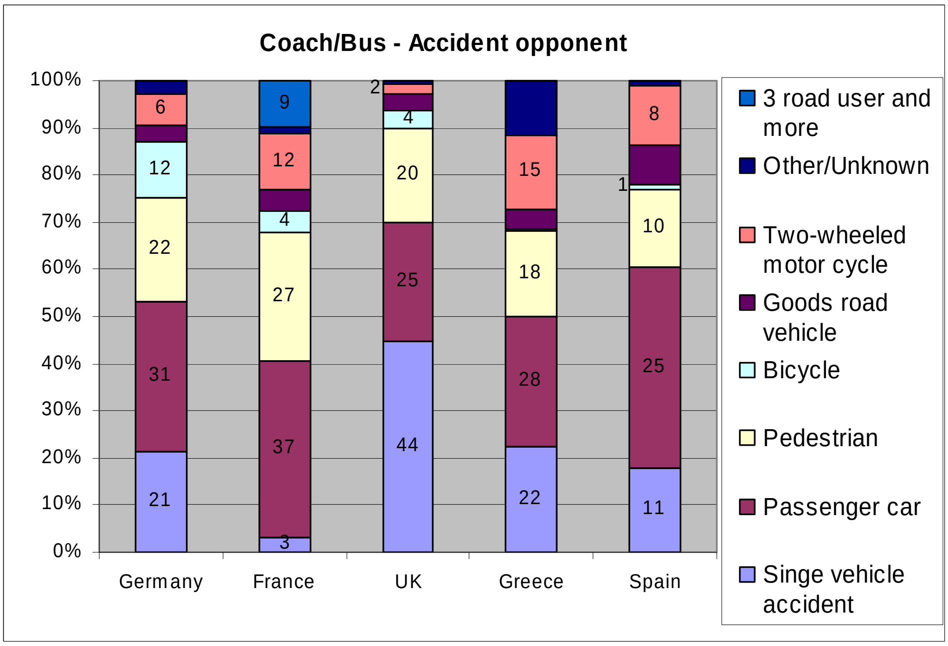

Figure 5.11.-Coach/bus accidents categorised by accident opponent (Accidents with personal damage; Time period: 2001 to 2004).

5.2.3.e Type of accident

The data regarding the accident type should give more precise information about the most frequent accident configurations with participation of vans, trucks and coaches. The type of accident describes the conflict situation which resulted in the accident, i.e. a phase in the traffic situation where the further course of events could no longer be controlled because of improper action or some other cause.

Unlike the kind of accident, the type of accident does not describe the actual collision but indicates how the conflict was touched off before this possible collision.

The three most frequent accident types (see figure 5.12) with vans are the accident moving along in carriageway, the driving accident and the accident at sections or inlets. In Germany, Greece and Italy the accident on intersections is the most frequent type of accident, followed by the accident moving along in carriageway. In the Czech Republic the most important ones are the accident moving along in carriageway and the driving accident. The high rate of the driving accident in Spain is possibly to be led back on the fact that no information was given for the accident moving along in carriageway. This will be contained assumedly in one of the other categories; however, this cannot be comprehended with the help of the available data. Taking into consideration the division of "manoeuvre of vehicle" (GB) to the accident type provided by all other countries displacements are possible. This can also be the reason for the high rate of the driving accident in the GB.

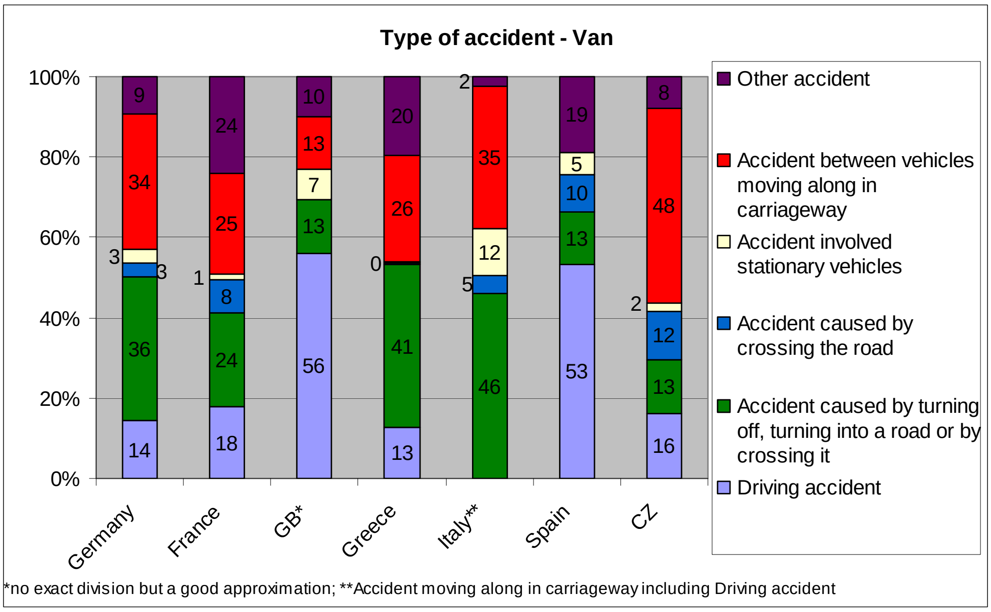

Figure 5.12.-Van accidents categorised by type of accident (Accidents with personal damage; Time period: 2001 to 2004).

By consideration of the truck accidents (see figure 5.13) the most important types of accident are in Italy and Germany the accident moving along in carriageway and junctions. In Greece the situation is exactly backwards. Also in the Czech Republic the most frequent type of accident is accident moving along in carriageway followed by the driving accident. Contrary to the Czech Republic it is in France, the driving accident is more frequent than the accident moving along in carriageway. This fact is already explained on top in context with the van accidents. But also in the Great Britain the accident moving along in carriageway is with the most important accident type. Recapitulating, it can be said that the accident moving along in carriageway and on crossroads followed by the driving accident are the most frequent types of accident in case of truck accidents.

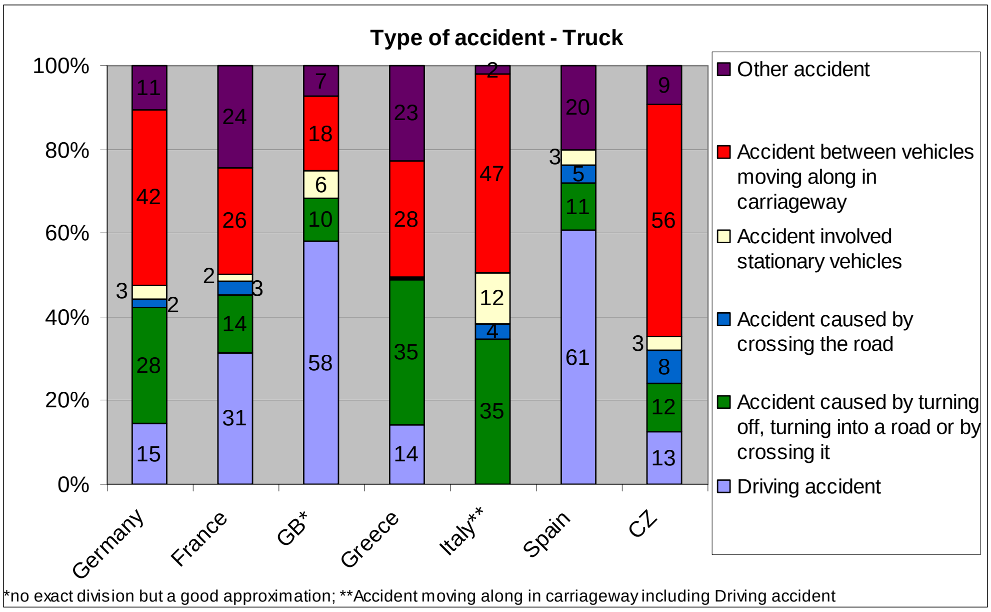

Figure 5.13.-Truck accidents categorised by type of accident (Accidents with personal damage; Time period: 2001 to 2004).

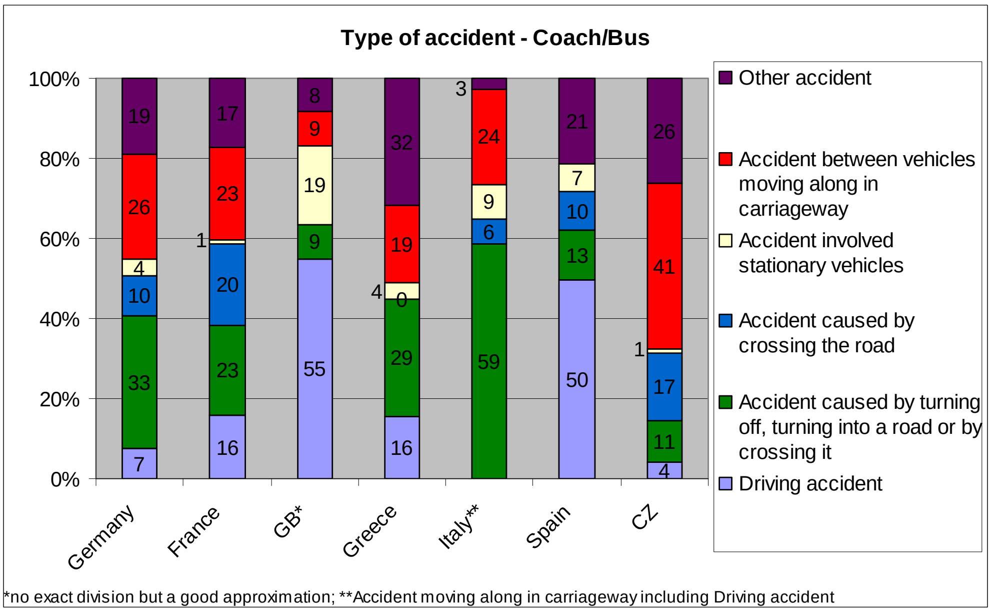

Figure 5.14.-Coach/bus accidents categorised by type of accident (Accidents with personal damage; Time period: 2001 to 2004).

During the investigation of coach accidents regarding the type of accident a similar picture are given for Italy, Greece, France and Germany. In these countries the most important type is the accident caused by turning off, turning into a road or by crossing it, followed by the accident moving along in carriageway. Nevertheless, in the Czech Republic accidents moving along in carriageway are the most frequent type and the accident caused by crossing the road is the second frequent type of accident. This type of accident means that the accident was caused by a conflict between a vehicle and a pedestrian on the carriageway, unless the pedestrian walked along the carriage-way and unless the vehicle turned off the road. The same like with the vans and trucks counts to Spain and GB again, nevertheless, the high interest of accidents involved stationary vehicles is remarkable.

5.2.3.f Accident causation

In the present chapter it should be elaborated, why the accidents of each road user happened. Unfortunately, data regarding the accident causation are only available from Italy, France and Germany. To get at least this information, it was renounced a further division of the goods road vehicle.

While in France the accident causations of goods road vehicle non-essential differ from those of all road users, an increased rate of distance accidents in Germany and in Italy the combination of low distance and excessive speed can be observed. The most frequent accident causation all together are mistakes in connection with the priority regulation, unadapted speed, insufficient safety distance and mistakes in connection with turning or bending.

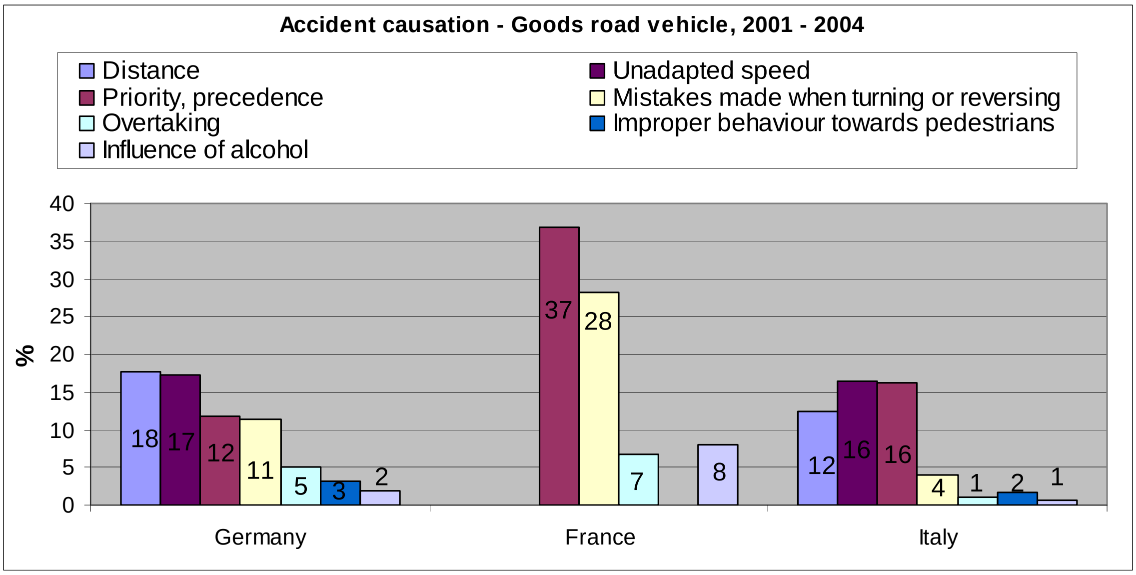

Figure 5.15.-Goods road vehicle accidents categorised by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

The comparison of the coach accidents with those of all road users shows in Italy that the mistakes in connection with the priority regulation are less important and the unadapted speed is the most frequent causation. In France the rate of the mistakes in connection with turning or bending is clearly higher than of all road users. This cause is also the most important in France followed by the mistakes in connection with the priority regulation. In Germany the rate of unadapted speed and mistakes in connection with the priority regulation are represented less often in the case of coach accidents than of accidents of all road users. The high rate of improper behaviour towards pedestrians is striking in Germany. The most important causes in coach accidents are mistakes in connection with the priority regulation, mistakes in connection with turning or bending, improper behaviour towards pedestrians and the short distance.

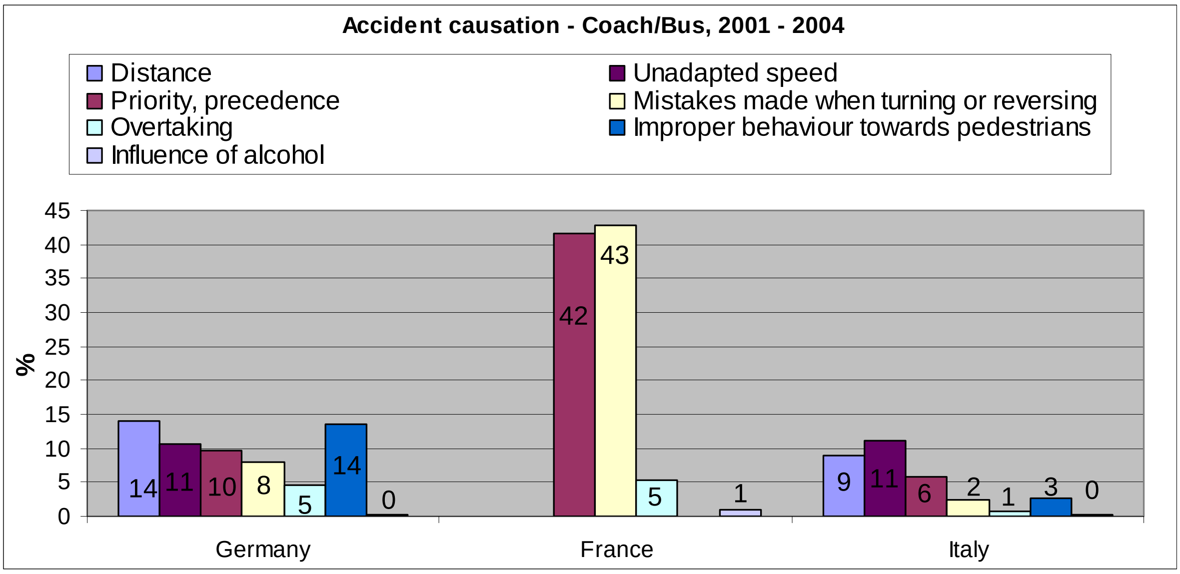

Figure 5.16.-Coach/bus accidents categorised by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

For the sake of completeness the accident causation of Spain is mentioned in figure 5.17. Because of using different causation variables in Spain compared to the other countries, these are not comparable with those of the other countries which are shown in the chart above. Nevertheless, the Spanish causation of goods road vehicle and bus accidents shows no remarkable differences in comparison of all road users. Therefore it seems trucks and buses have no characteristically specific accident causations.

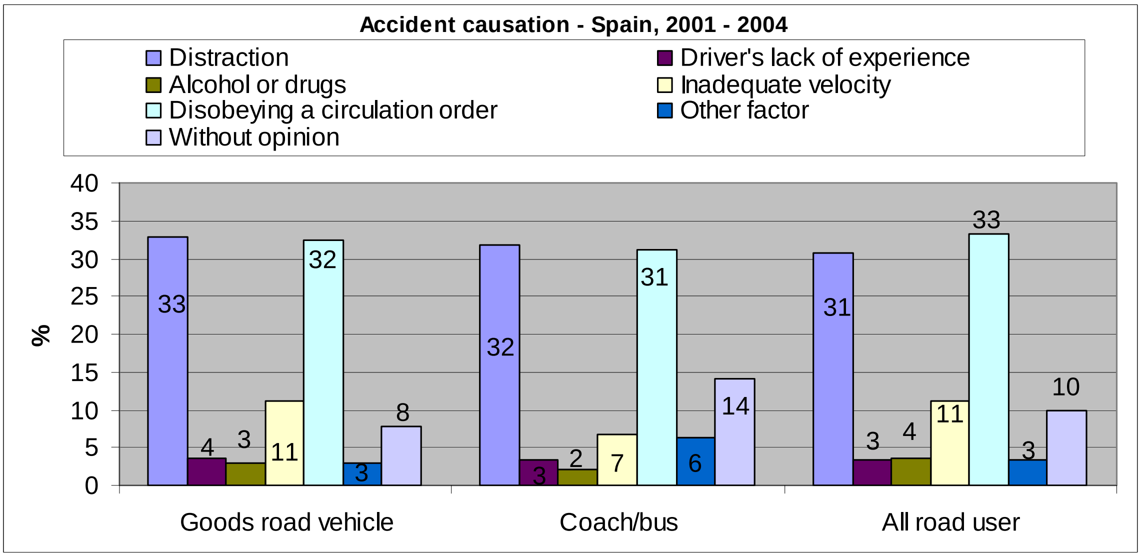

Figure 5.17.-Spanish accidents of each road user categorised by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

5.2.4 Scenarios for Vans

In this paragraph the three most frequent accident scenarios for vans become more exactly examined. The intention is to identify the most important, i. e. the most frequent, accident scenes in order to get the causation of these accidents. How in the previous chapter (figure 5.9) is to be recognised, the opponent of these accidents is mostly a passenger car. The purpose is now to find out the most important type of accident relating these accidents (see figure 5.18) and to examine these accidents more precisely in the next chapters.

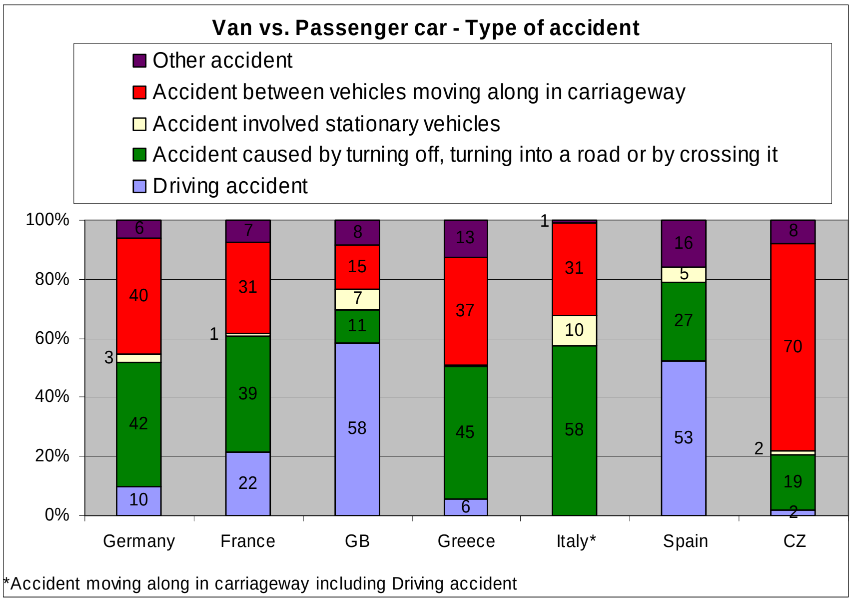

Figure 5.18.-Van versus passenger car accidents categorised by type of accident (Accidents with personal damage; Time period: 2001 to 2004).

Basically, the two most frequent types of accident are clearly the accident moving along in carriageway and at junctions. The high interest of the driving accidents in Spain and Great Britain cannot be explained from our side and must be still checked. Therefore the three most frequent scenarios are the van against the passenger car in the longitudinal traffic and at crossroads as well as the van in single vehicle accident.

In the following, the three accident scenarios for vans are investigated more precisely. These scenarios were detected on the basis of the German data and now compared with all available data from the other countries.

Regarding the 'non - accident information', in Germany a trip recorder is required by law only for vehicles with a GVW with more than 7.5 tons. Therefore, there are no legal regulations for vans relating the regulation of the maximum driving duration (behind the wheel times) or maximum speed. This means that the driver of a van is not bound to maximum "behind the wheel times" and the risk of over fatigue or inattention is thereby basically higher.

5.2.4.a 1st frequent accident scenario

The most important accident scenario for Vans is against a **passenger car and moving along in carriageway**. This means that the accident was caused by a conflict between road users moving in the same or opposite direction. In this connection mostly it is about rear-end collisions, lane changing accidents or head-on collisions. On the next step this configuration was investigated after the location and causation.

This scenario represents 70% and 15% of the accidents involving Vans depending on the country analysed, but most of the countries (except Czech Republic with 70% and Great Britain with 15) are inside the interval 30 and 40%, which represents a consistent frequent scenario.

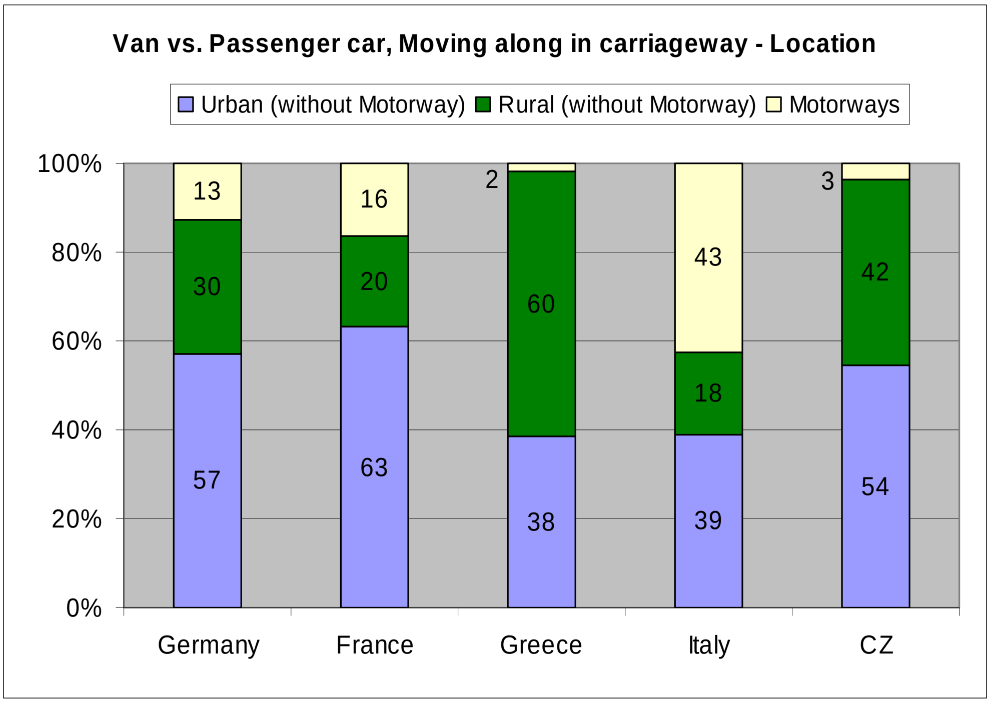

Figure 5.19.-Van versus passenger car in accidents moving along in carriageway broken down by location (Accidents with personal damage; Time period: 2001 to 2004).

In the course of the investigation after the location different results were obtained. While in Germany, France and Czech Republic the biggest part happened on urban streets, in Greece the most accidents occurred rural. The relatively low motorway rate in Greece and Czech Republic also reflects their low interest of motorway network on the whole road network. The reason for the high Italian motorway rate, presumably associate with the geographic area of the SISS database. The main focus for further in depth investigations should be laid on **accidents moving along in carriageway happening urban and rural** (without motorway).

More difficultly than with the location it is regarding the accident causation. Very different information of each country appears. The reason for the differences might also be found in the respective country, perhaps in the method of encoding the accidents used by the scene of an accident. In Italy and Czech Republic it appears relatively often the field "Others". For further considerations the causation "Others" are not included. The most important causations for this scenario are insufficient safety distance and unadapted speed. In Czech Republic it is additional added the failure to observe the rules relating the right of way. The situation in France is absolutely different from all other countries. Mistakes made when entering the flow of traffic (e.g. from premises, from another part of the road or when starting off the edge of the road), mistake made when turning and overtaking are the most frequent causation in France.

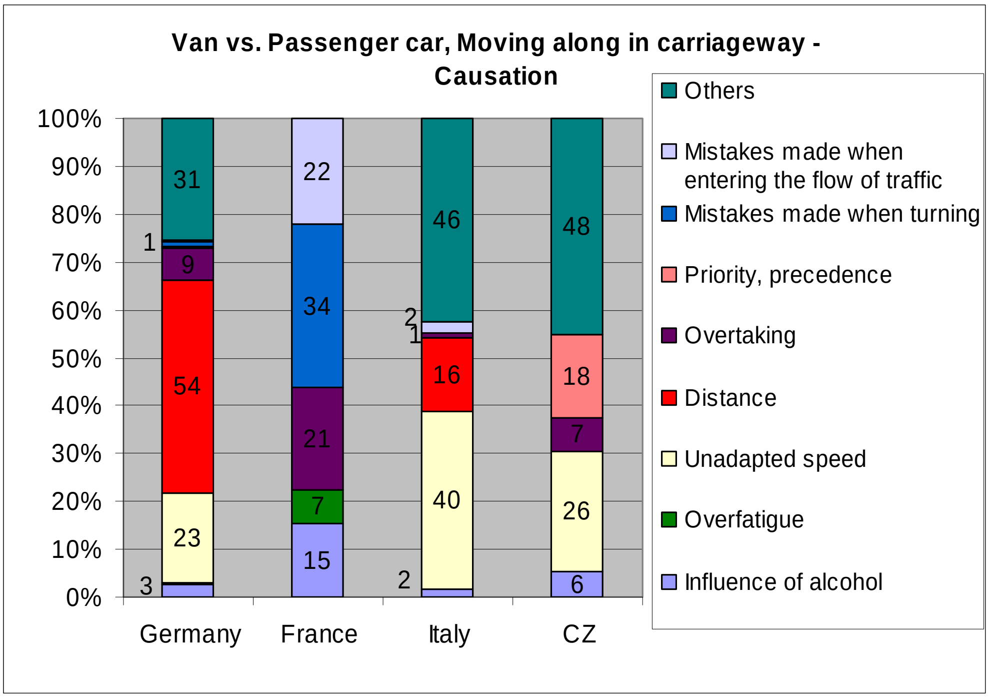

Figure 5.20.-Van versus passenger car in accidents moving along in carriageway broken down by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

It is not possible to evaluate how the division is judged in the scene of the accident: whether the process at which the accident happened was written down by the police officer and not the real reason (e.g. that the following traffic driver against a turning vehicle on account of too low distance). However, the high interest in France on over fatigue and influence of alcohol is remarkable; these are less frequent in the other countries To sum up, the following causes turned out as the most important ones: insufficient safety distance, unadapted speed and overtaking.

5.2.4.b 2nd frequent accident scenario

The next important accident scenario for Vans is also against a **passenger car and while turning into a road or by crossing it**. This means that the accident took place because of a conflict between a road user turning into a road or crossing it and having to give way and a vehicle having the right of way at crossings, junctions, or exits from premises and car parks. On the next step this configuration was investigated regarding the location and causation.

A uniform trend arises by the distribution of location over all countries. The major part of the accidents caused by turning into a road or by crossing it of vans occurred in urban areas. A clearly minor part happened rural and hardly any on motorways. Thus it appears that the accident mostly occur on crossroads, junctions, inlets as well as gateways within urban areas.

This scenario represents 58% and 11% of the accidents involving Vans depending on the country analysed, but most of the countries (except Italy with 58% and Great Britain with 11%) are inside the interval 19 and 45%, which represents a consistent frequent scenario.

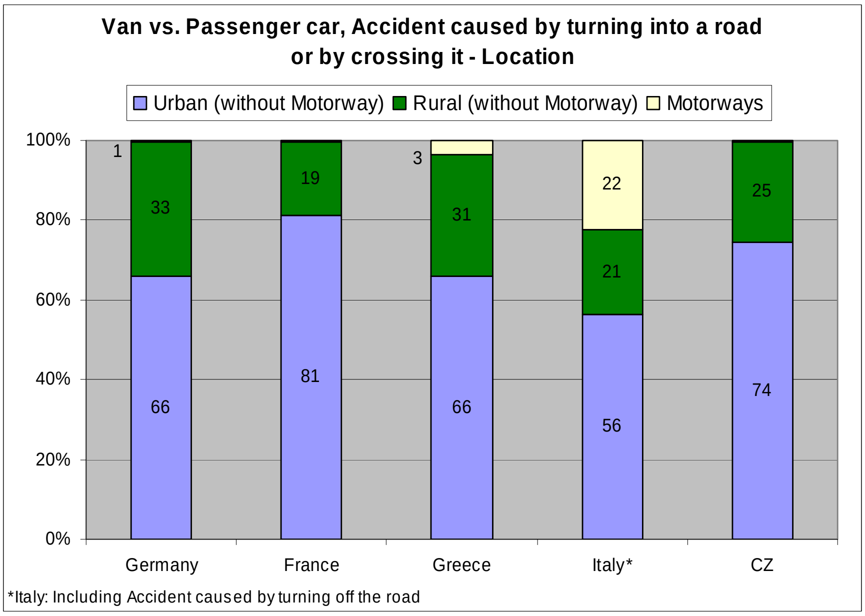

Figure 5.21.-Van versus passenger car in accidents caused by turning into a road or by crossing it broken down by location (Accidents with personal damage; Time period: 2001 to 2004).

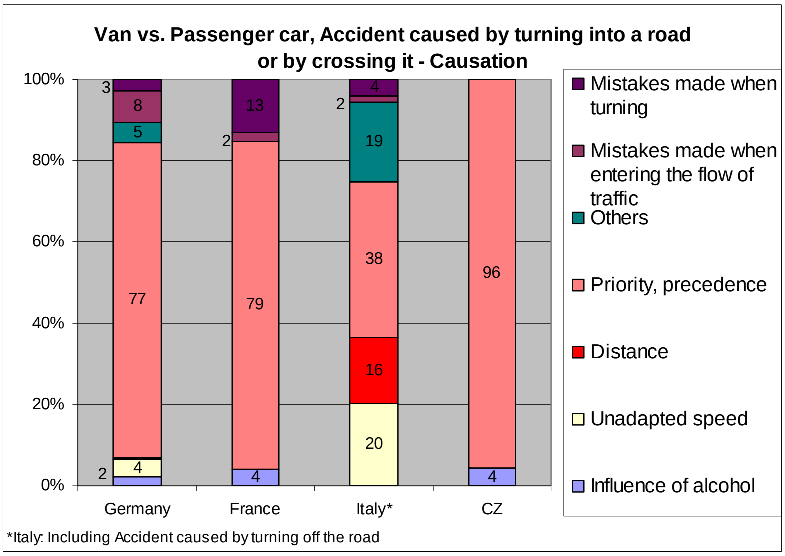

Figure 5.22.-Van versus passenger car in accidents caused by turning into a road or by crossing it broken down by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

As expected mostly "failure to observe the priority rules" is called as the matching accident causation. The influence of alcohol shows only a small rate with maximum of 5%. In Italy two additional reasons for the accident are given, even unadapted speed and too low distance.

5.2.4.c 3rd frequent accident scenario

The last frequent accident scenario for Vans is the **single vehicle accident** caused by driving accident. This means that during the driving task the driver lose vehicle control (due to unadapted speed or misjudgement of the course or condition of the road, etc.), without other road users begin involved in the accident. On the next step this configuration was investigated after the location and causation.

This scenario represents 58% and 0% of the accidents involving Vans depending on the country analysed. This percentage changes considerably depending on the country but, taking absolute numbers, it can be justified as a frequent scenario.

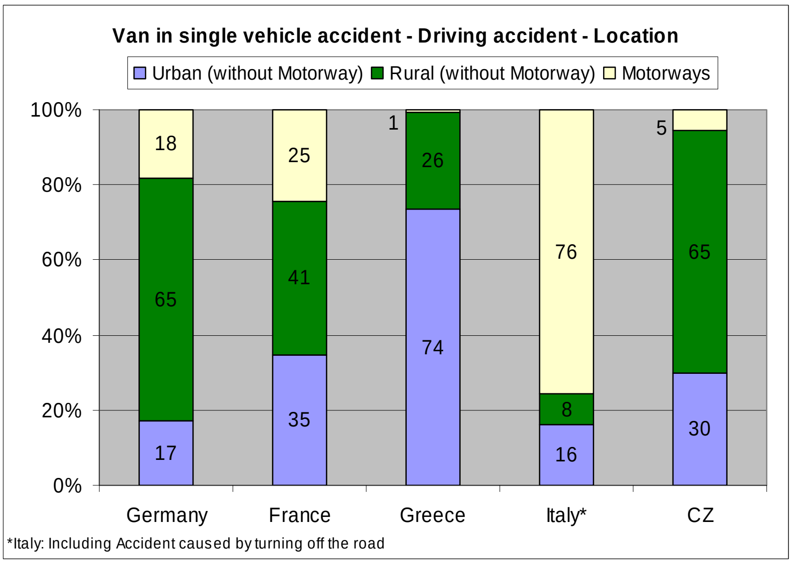

Figure 5.23.-Van in single vehicle accidents broken down by location (Accidents with personal damage; Time period: 2001 to 2004).

In the case of single vehicle accidents a different picture appears relating location. In Germany, France and Czech Republic the accidents happened primarily in rural area (without Motorway). Greece has due of his low highway allotment on the whole road network as already expected hardly any highway rate. To sum up, the most important location for the single vehicle accident of vans is on rural streets without motorways.

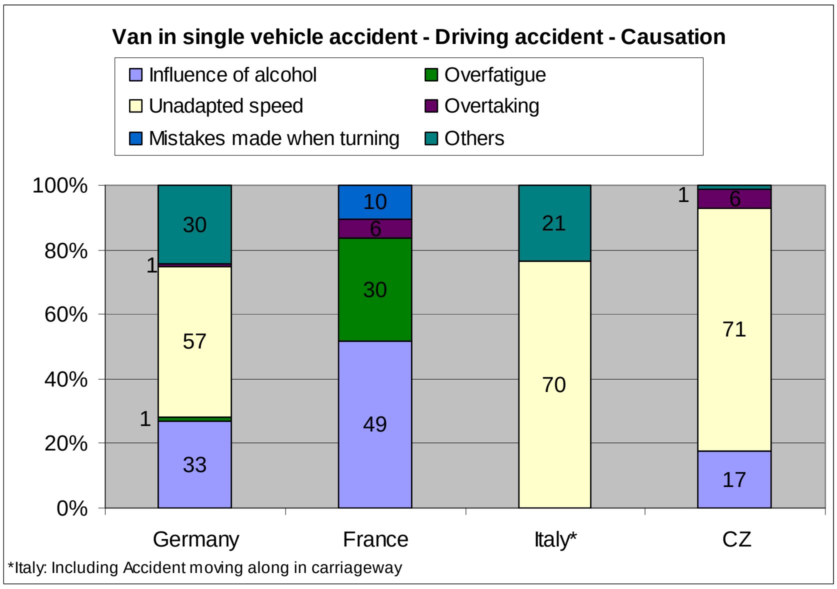

Figure 5.24.-Van in single vehicle accidents broken down by accident causation (Accidents with personal damage; Time period: 2001 to 2004).

The most frequent accident causation for single vehicle accidents of vans is unadapted speed. The second frequent causation is the influence of alcohol, mainly in France, briefly half of all single vehicle accidents happened because of alcohol. In Germany and Czech Republic there is a relatively low rate with maximum 17%. The Italian data makes no statement about the influence of alcohol because this field was not filled. This might mean that there were no accidents with influence alcohol or that they were not covered. Furthermore the big allotment of 30% of accidents because of fatigue is remarkable in France, which is in the other countries of a subordinated role. As already mentioned in scenario 1, the accidents relating over fatigue will be probably underrepresented at least in Germany. Therefore the most important accident causation is the unadapted speed and of the influence of fatigue should not be let out of sight.

5.2.5 Scenarios for Trucks

First of all, a distribution of the most common scenarios is presented for each country. The three more relevant scenarios are:

- Accident between vehicles moving along in carriageway.
- Accident caused by turning into a road or by crossing it.
- Driving accident.

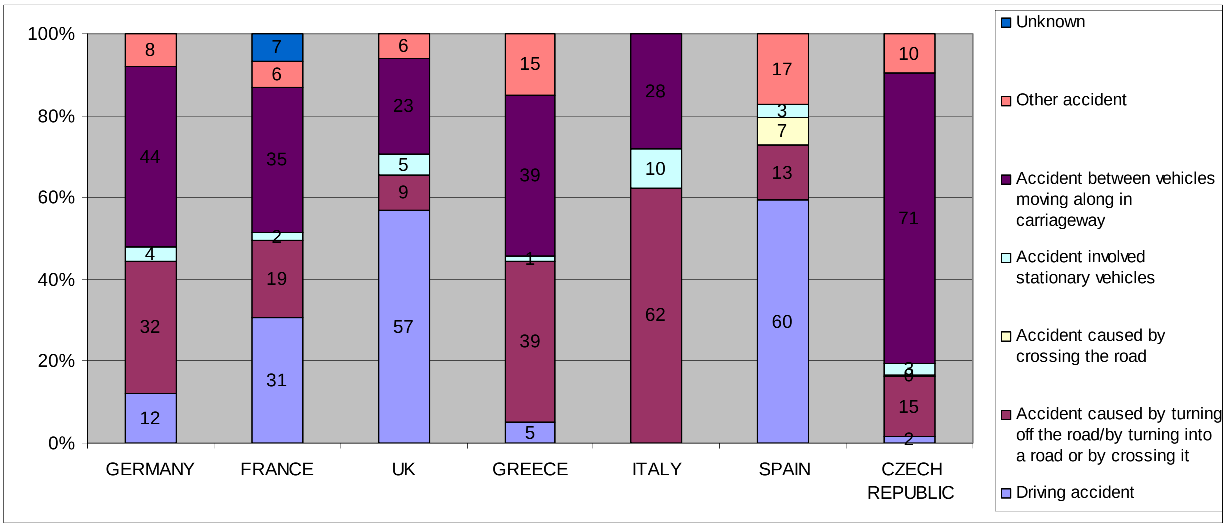

Figure 5.25.-Distribution of Accident types for different European countries.

It can be seen that Germany, France, GB and Spain can be more or less homogeneous. Italy and Czech Republic, and even Greece, do not present many driving accidents. This difference can be due to the classification used in each database for each country.

5.2.5.a 1st frequent accident scenario

The most important accident scenario for Trucks is **against a passenger car and moving along in carriageway.** This means that the accident was caused by a conflict between road users moving in the same or opposite direction. On the next step this configuration was investigated after the location and causation.

This scenario represents 71% and 0% of the accidents involving Trucks depending on the country analysed, but most of the countries (except Czech Republic with 71% and Spain with 0%) are inside the interval 44 and 28%, which represents a consistent frequent scenario.

Distribution by location

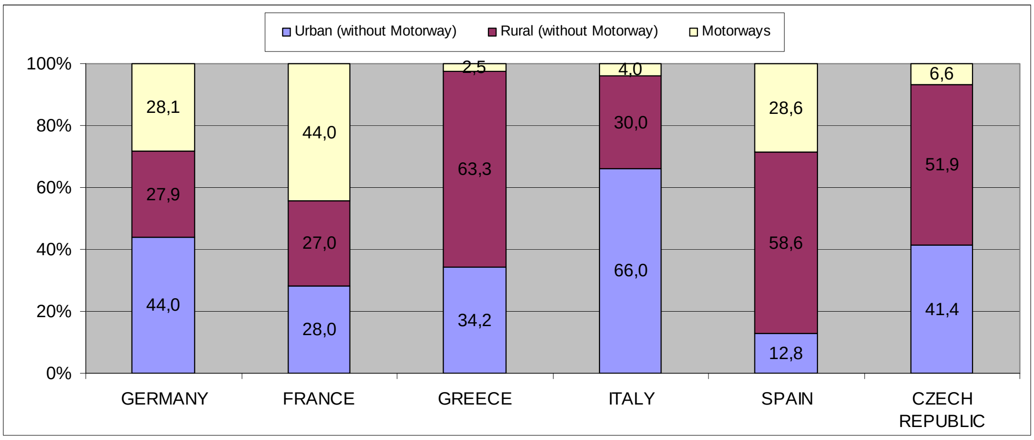

Figure 5.26.-Distribution of truck accidents between road users moving in the same or opposite direction, by location.

Motorways are the smallest issue in Greece, Italy and Czech Republic. Bigger countries, as Germany and France, and Spain, have motorways as first or second issue.

Distribution by accident causation

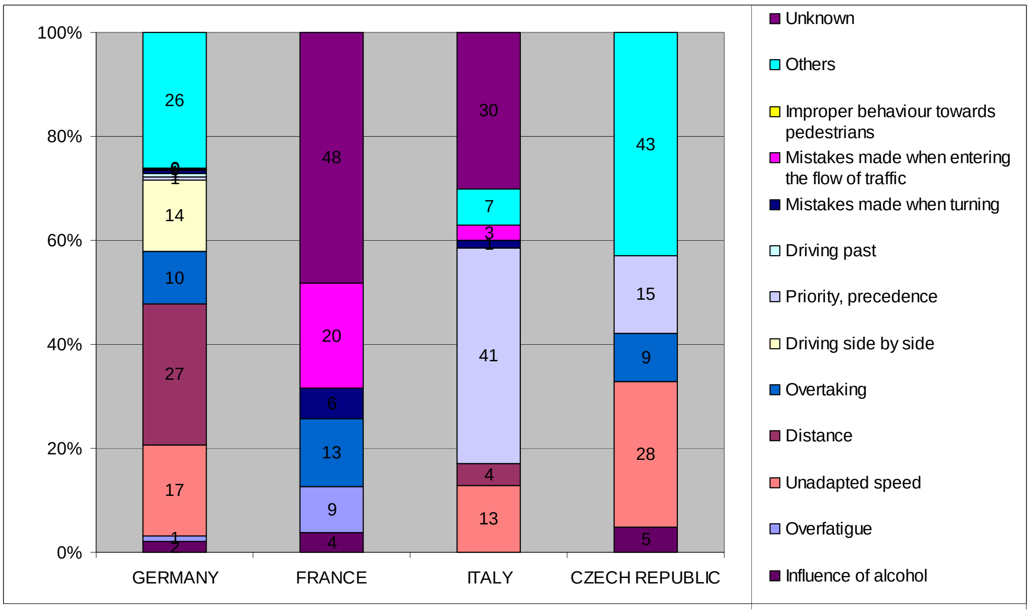

Figure 5.27.-Distribution of trucks accidents between road users moving in the same or opposite direction, by cause.

Some countries had not this classification and the others had a big percentage of unknown or other scenarios. It is important to comment distance and speed in Germany, entering the traffic flow in France, priority in Italy and Speed in Czech Republic.

On the whole it is fair to say that motorway accidents are more of an issue in the larger European countries i.e. German, France and Spain. However no clear conclusion can be drawn as to a trend in the causations, as there is no data for Spain or Greece, and of the data that is discussed for the remaining countries there are a lot of unknown, and ´other´ classifications therefore showing no clear or reliable trend.

5.2.5.b 2nd frequent accident scenario

The next important accident scenario for Trucks is **against a passenger car and caused by turning into a road or by crossing it**. This means that the accident was caused by a conflict between a road user turning into a road or crossing it and having to give way and a vehicle having the right of way at crossings, junctions, or exits from premises and car parks. On the next step this configuration was investigated after the location and causation.

This scenario represents 62% and 9% of the accidents involving Trucks depending on the country analysed, but most of the countries (except Italy with 62% and GB with 9%) are inside the interval 39 and 13%, which represents a consistent frequent scenario.

Distribution by location

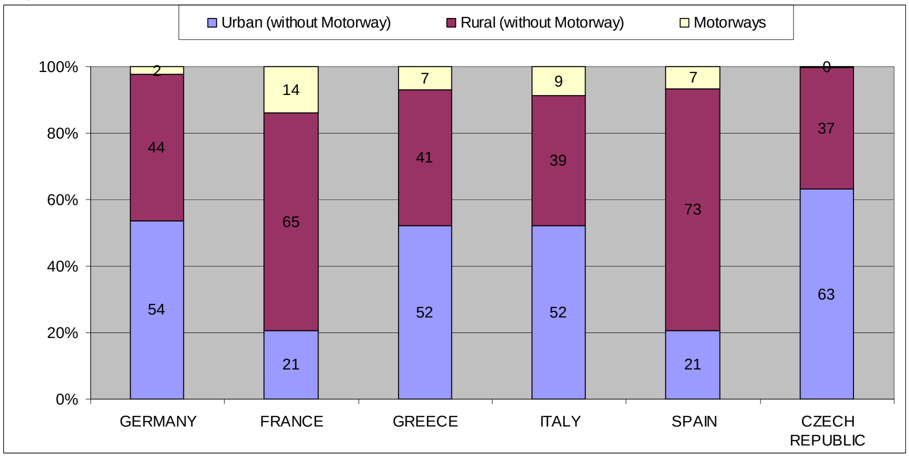

Figure 5.28.-Distribution of Trucks in turning Accident scenario by location.

It is obvious that motorways do not present many problems while crossing or turning into other roads. For the rural-urban distribution, data is not homogeneous. Germany, Greece and Czech Republic have more problems in urban areas, but difference is not very important. France and Spain do have a big difference with main problems in rural zones.

Distribution by accident causation

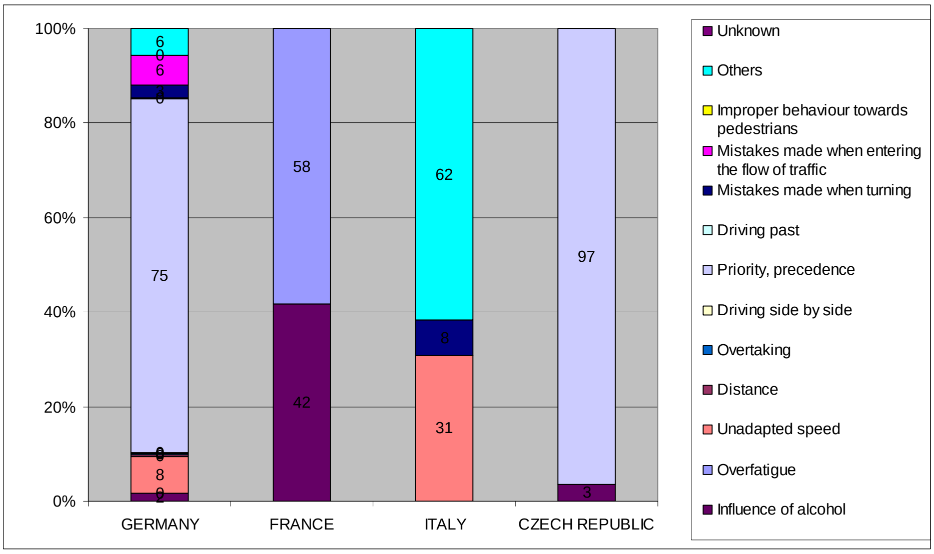

Figure 5.29.-Distribution of Trucks in turning accident scenario by cause.

Priority is main topic for Germany and Czech Republic. In France, main topics are alcohol and fatigue. Italy has a too big 'others' classification, so it is difficult to establish conclusions on it.

From figure 5.29 it can be concluded that indeed, motorways are not a real concern when considering accidents with Trucks against a passenger car, caused by turning into a road or by crossing it. This is to be expected as generally motorways tend to be straight for the most part and the only real manoeuvring to be expected would be that of lane-changing. There is no real differentiation between urban and rural except in the larger two countries of France and Spain, this could be due to less clear sign posting in rural areas, or simply the reduced traffic which may cause drivers to relax their attention to driving more. The causation of accidents does not reveal any clear trends, though the Czech republic and Germany both reveal the main cause to be priority, probably due to people reluctance to give way ad avoid accidents when they feel they have precedence. France reveals the accidents to be linked wholly to the state of mind of the driver rather any external conditions, and Italy's data is too unclassified to draw any reliable trends.

5.2.5.c 3rd frequent accident scenario

The 3rd frequent accident scenario for Trucks is the Driving accident. This scenario represents 60% and 0% of the accidents involving Trucks depending on the country analysed. This percentage changes considerably depending on the country but, taking absolute numbers, it can be justified as a frequent scenario.

Distribution by location

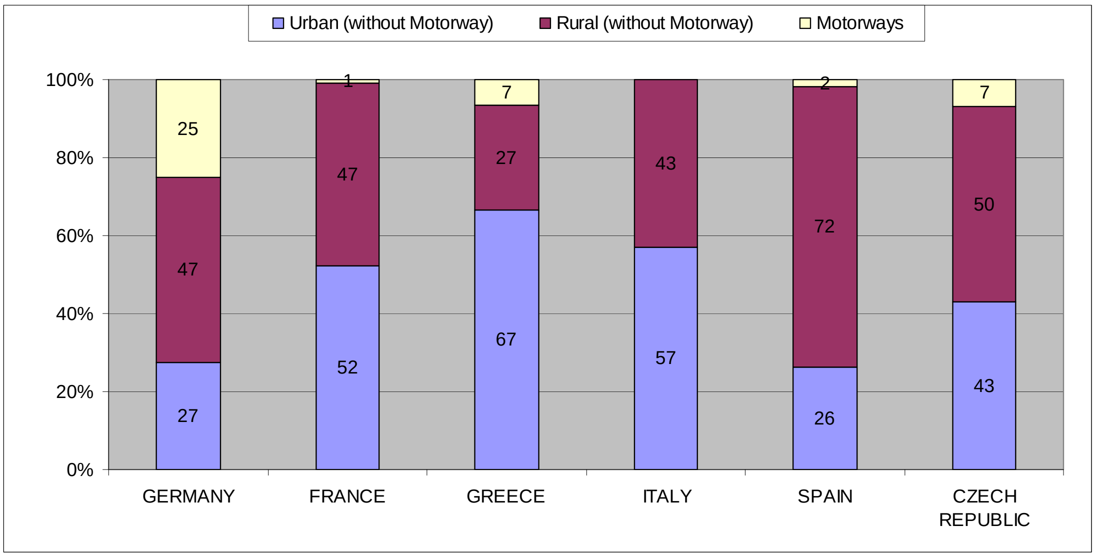

Figure 5.30.-Distribution of Trucks in driving accident scenario by location.

Once again, it seems that motorways provide a higher safety level and it is the less concurrent location. Then, the accidents distribute homogeneously in urban and rural zones. Spain has the highest percentage of rural accidents (72%), while Greece has the lowest one (27%).

Distribution by accident causation

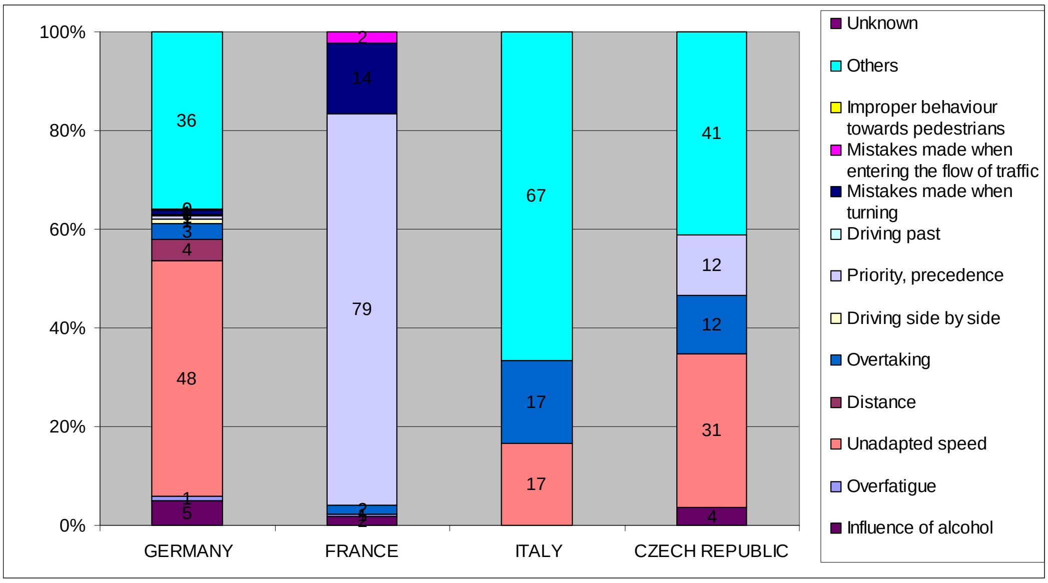

Figure 5.31.-Distribution of Trucks in driving accident scenario by cause.

'Others' classification is a problem once again. It is important to note that while France had no priority causes in turning or crossing accidents, for driving accidents it is the main issue. It would be interesting to check the classification they use in their own databases and the attributes they give to each accident. In general, for the other countries, speed and overtaking are the main issues.

5.2.5.d Truck in Single Vehicle Accidents

In addition to the most common scenarios analysed above, some data about single vehicle accidents is given. The distribution of the scenarios of these accidents, the place where they take place and their causes is discussed.

Distribution of single vehicle accidents

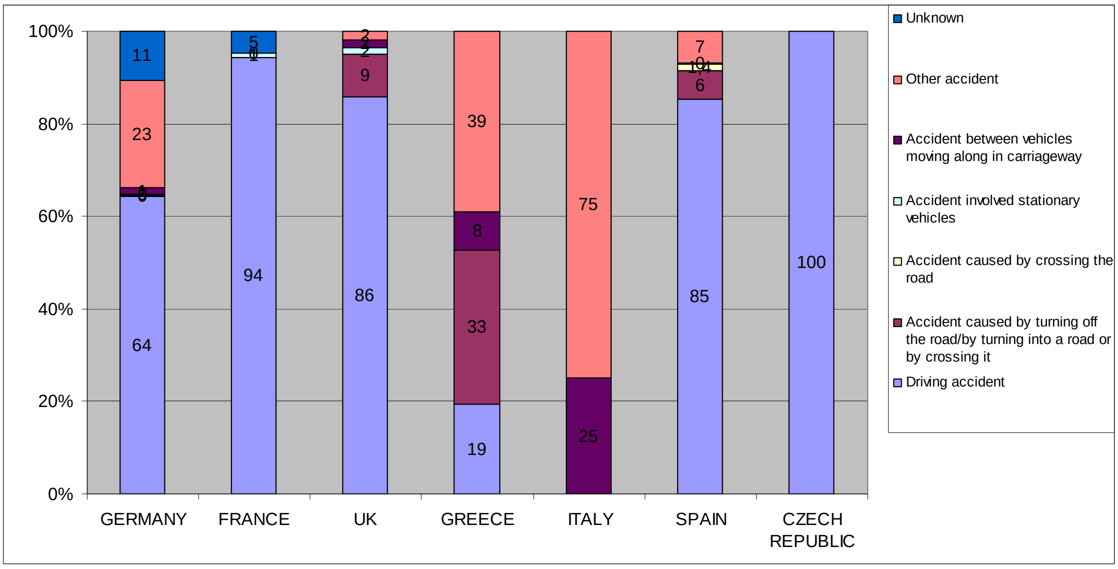

Figure 5.32.-Distribution of type of single vehicle truck accidents.

The main scenario for single vehicle accidents is driving accidents, though no clear conclusions can be drawn from data in Greece and Italy due to ´other´ classifications.

Distribution by location

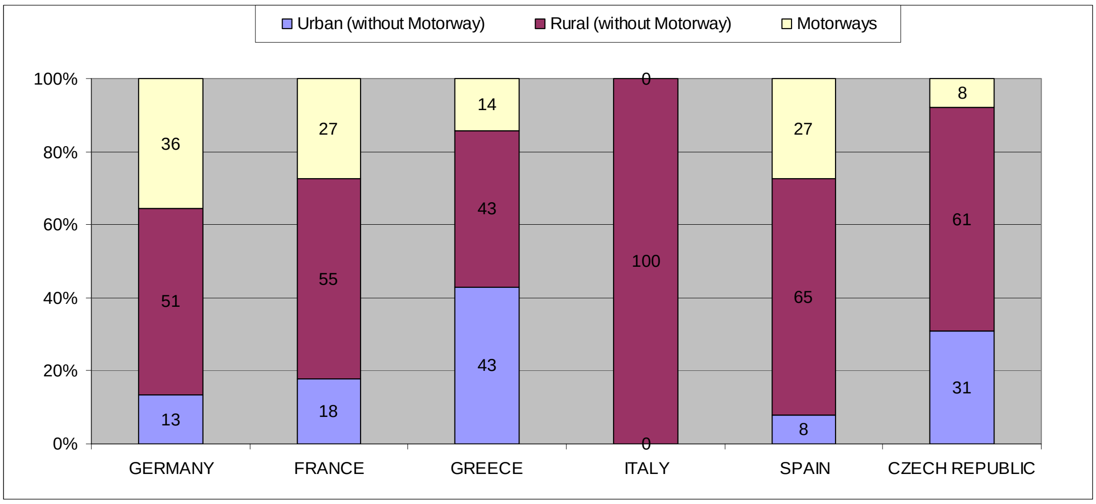

Figure 5.33.-Distribution of single vehicle truck accidents by location.

Most accidents take place in rural zones. Then, the distribution between urban zones and motorways is not homogeneous. Although all countries except Greece show the accidents to be more occurant in rural areas than urban, Greece has an equal divide.

Distribution by accident causation

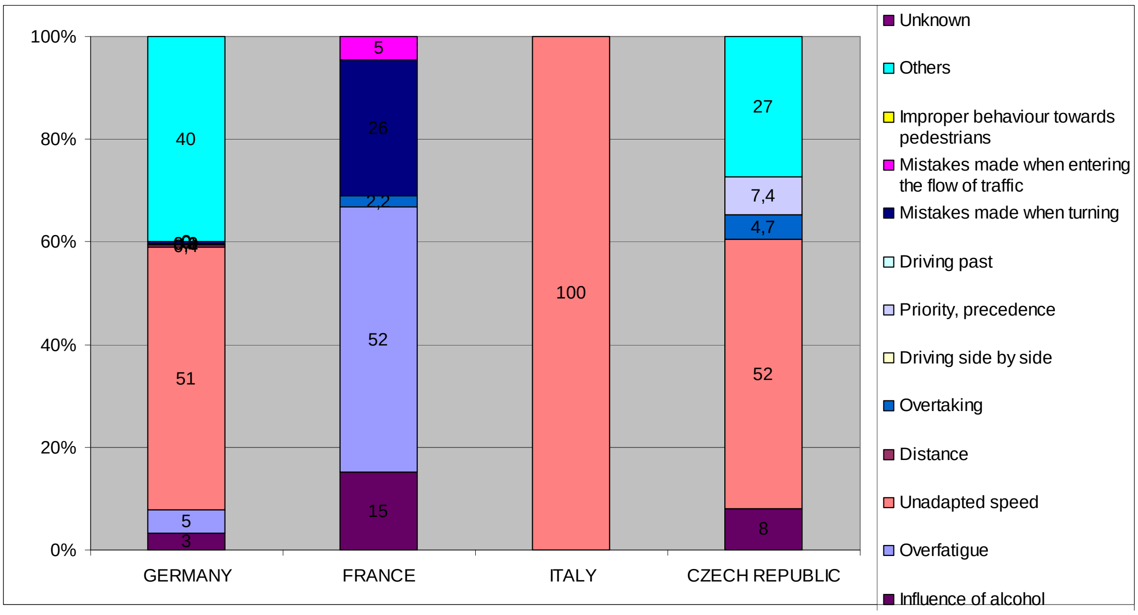

Figure 5.34.-Distribution of single vehicle truck accidents by cause.

Speed and fatigue appear as the most common causes in the studied countries. Although it is observed once more France seems to break the trend of the other countries with respect to accident causation, being due to alcohol, fatigue and mistakes rather than speed.

Single vehicle accidents on the whole are mainly due to driving accidents, resulting from unadapted speed in urban and rural areas. Though there are slight divergences from this when considering individual countries more closely.

5.2.6 Scenarios for Coach/Bus

First of all, a distribution of the most common scenarios is presented for each country. The three more relevant scenarios are:

- Coach/Bus against a passenger car and moving along in carriageway
- Coach/Bus against a passenger car and caused by turning into a road or by crossing it
- Coach/Bus involved in driving accidents

Accident type distribution

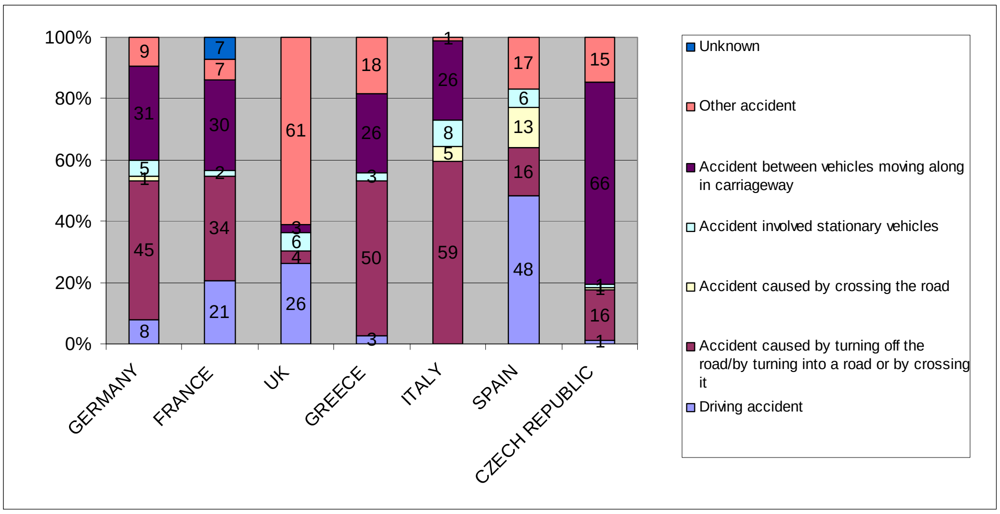

Figure 5.35.-Distribution of coach/ bus accidents by type.

Figure 5.35 shows that similarly to trucks, the two most common accident types for bus/ coaches are accidents caused by turning and accidents between vehicles moving along carriageways. The next most common scenario is that of a driving accident.

5.2.6.a 1st frequent accident scenario

The most important accident scenario for Coach/Bus is **against a passenger car and moving along in carriageway**. This means that the accident was caused by a conflict between road users moving in the same or opposite direction. On the next step this configuration was investigated after the location and causation.

This scenario represents 66% and 3% of the accidents involving Coaches/Buses depending on the country analysed, but most of the countries (except Czech Republic with 66% and GB with 3%) are inside the interval 31 and 26%, which represents a consistent frequent scenario.

Distribution by location

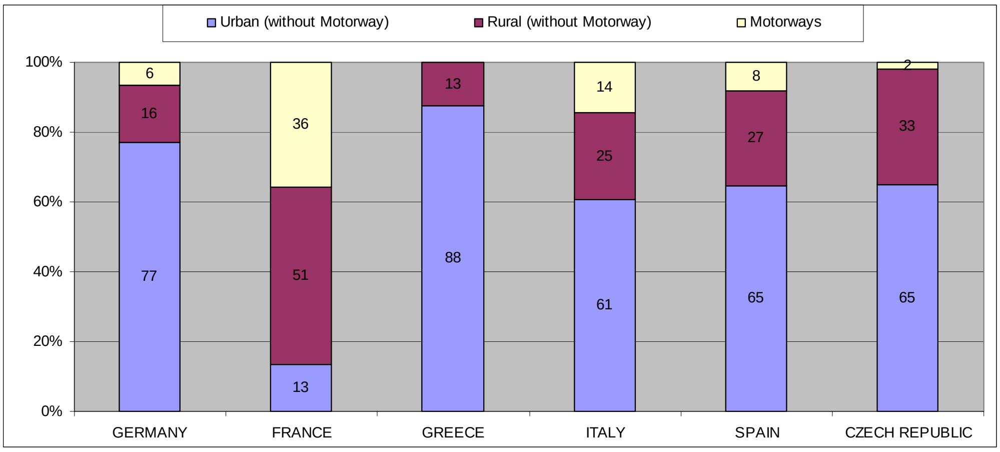

Figure 5.36.-Distribution of coach/ bus accidents between road users moving in the same or opposite direction, by location.

Most accidents are located in urban areas for all countries, excepting France.

Distribution of accident causation

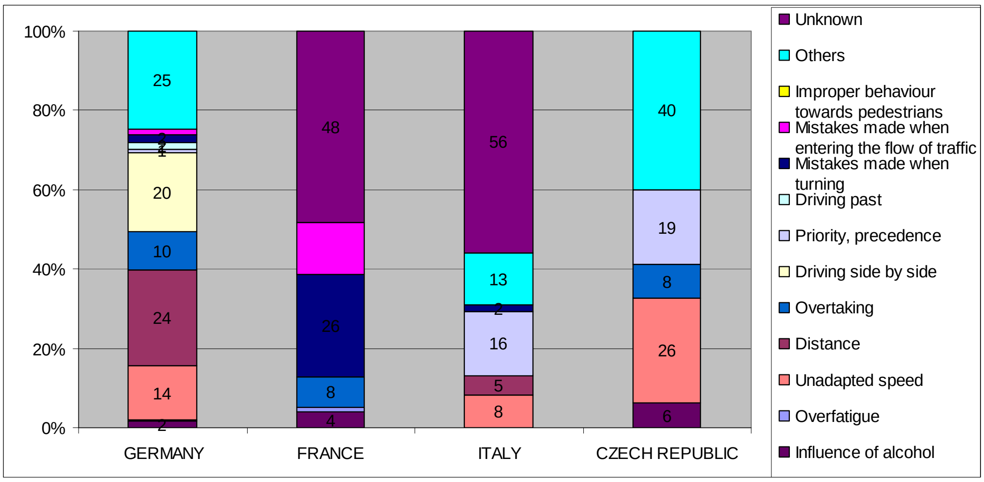

Figure 5.37.-Distribution of coach/ bus accidents between road users moving in the same or opposite direction, by cause.

Not taking into account 'unknown' and 'other' categories, priority, speed, overtaking and distance can be identified as the most common causes of this kind of accidents.

5.2.6.b 2nd frequent accident scenario

The next important accident scenario for buses/ coaches, like with trucks, **is against a passenger car and caused by turning into a road or by crossing it**. This means that the accident was caused by a conflict between a road user turning into a road or crossing it and having to give way and a vehicle having the right of way at crossings, junctions, or exits from premises and car parks.

This scenario represents 59% and 4% of the accidents involving Coaches/Buses depending on the country analysed, but most of the countries (except Italy with 59%, Greece with 50% and GB with 4%) are inside the interval 45 and 16%, which represents a consistent frequent scenario.

Distribution by location

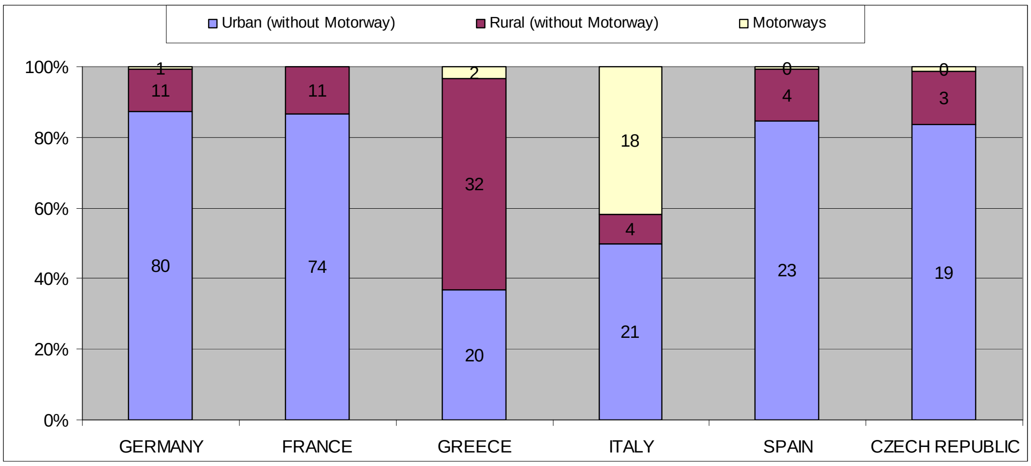

Figure 5.38.-Distribution of bus/ coach in turning accidents by location.

Distribution by accident causation

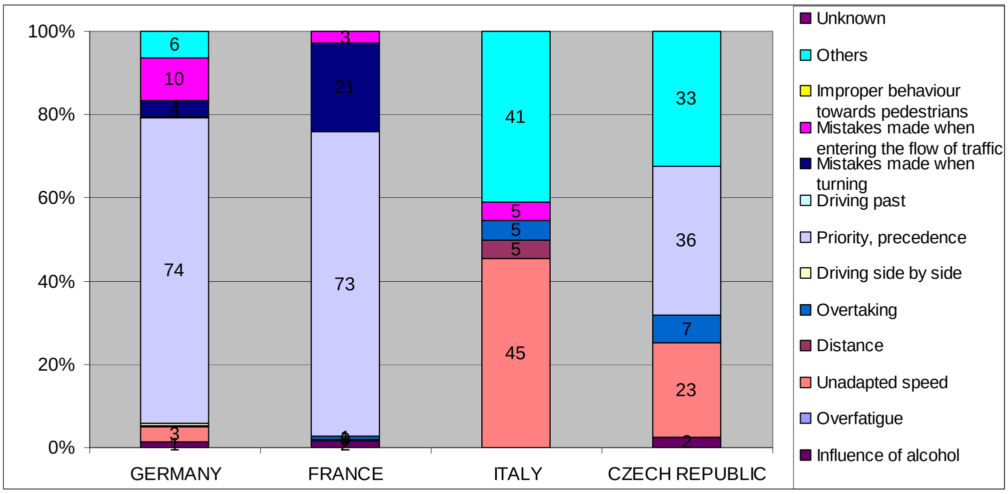

Figure 5.39.-Distribution of bus/ coach in turning accidents by cause.

From figures 5.38 and 5.39 it can be concluded that generally the main location for buses involved in turning accidents is in urban areas. The main causation for shown for the accidents is priority, although Italy reveals a different trend tending towards speed, however this is not as reliable due to the large amount of data classed as ´others´.

5.2.6.c 3rd frequent accident scenario

The 3rd frequent accident scenario for buses/ coaches, like Trucks, is the **Driving accident**. This scenario represents 48% and 0% of the accidents involving Trucks depending on the country analysed. This percentage changes considerably depending on the country but, taking absolute numbers, it can be justified as a frequent scenario.

Distribution by location

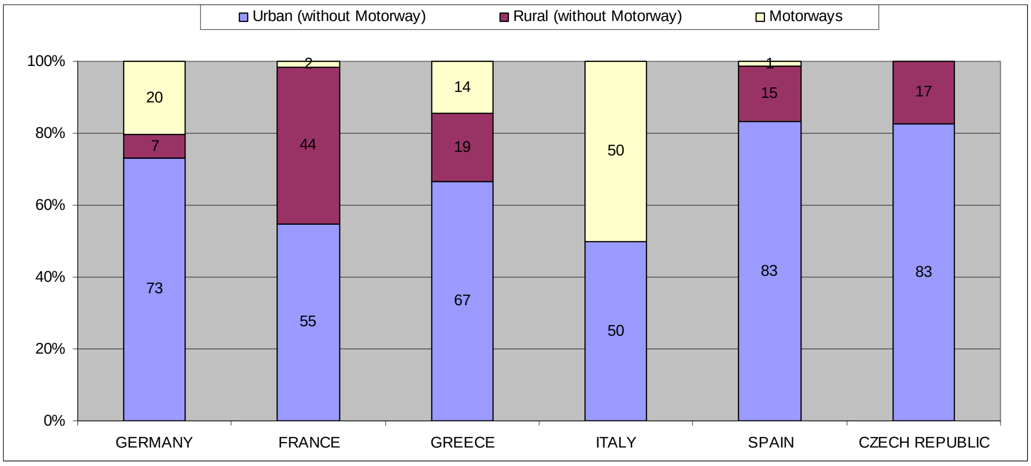

Figure 5.40.-Distribution of bus/ coach in driving accidents by location.

The main location for driving accidents is in urban areas; however there is no clear trend between different countries for the causation of buses in these accidents.

Distribution of accident causation:

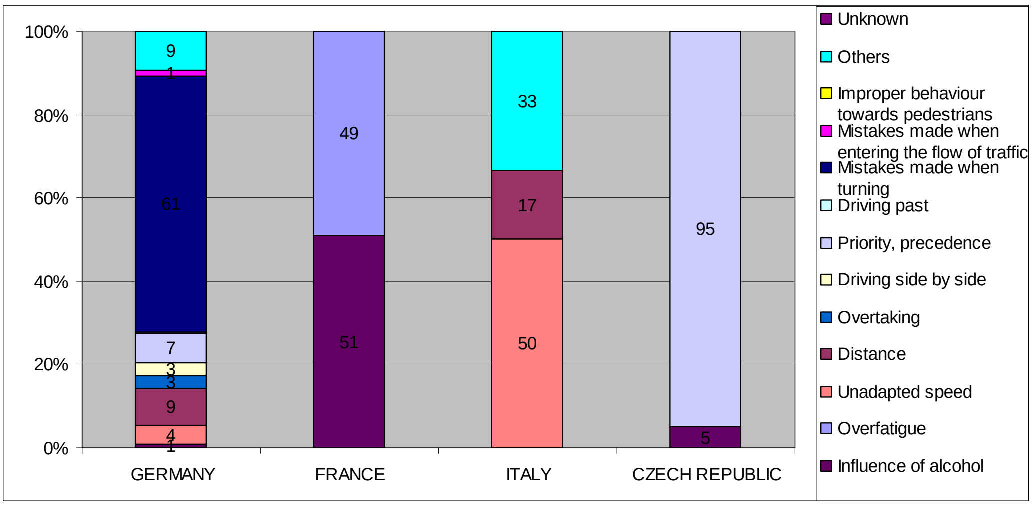

Figure 5.41.-Distribution of bus/ coach in driving accidents by cause.

There are no clearly defined causes of this type of accidents and strongly depend on the country from the source is coming. Turning is clear for Germany, while fatigue and alcohol predominates in France, distance and speed for Italy and priority for Czech Republic. No absolute conclusions can be done here. It would be interesting to check how these causes are coded for each country. It is important to note that all these actions correspond to human errors and some of them include carelessness, as alcohol, speed and distance.

5.2.6.d Coach/Bus in Pedestrian Accidents

In addition to the most common scenarios, a special emphasis is done over Coach/Bus involved in **pedestrian accidents**. The parameters analysed here correspond to their distribution and their causes.

Distribution by location:

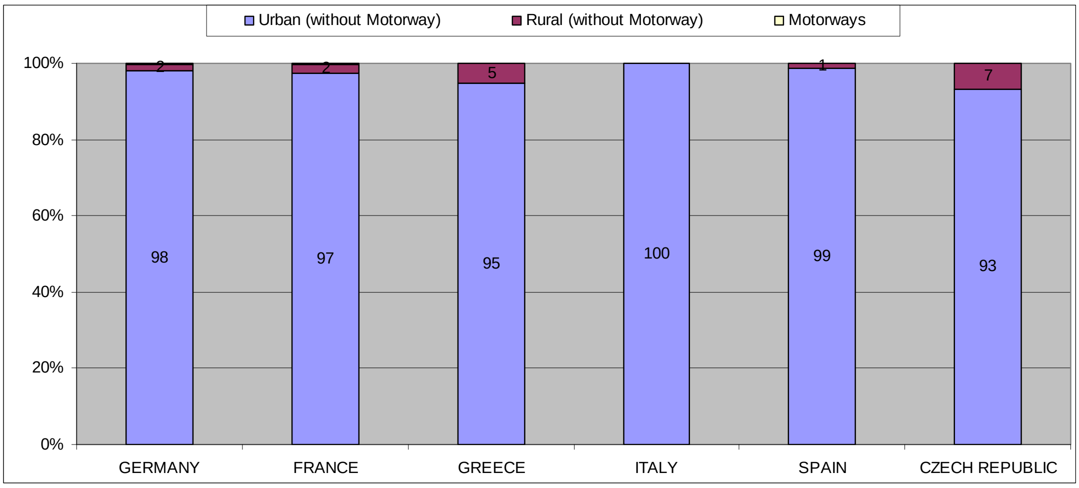

Figure 5.42.-Distribution of bus and pedestrian accidents by location.

As is clearly shown, accidents between buses and pedestrians are almost always occurring in urban areas. This is probably due to the higher population density a higher presence of pedestrians in these areas.

Distribution of accident causation

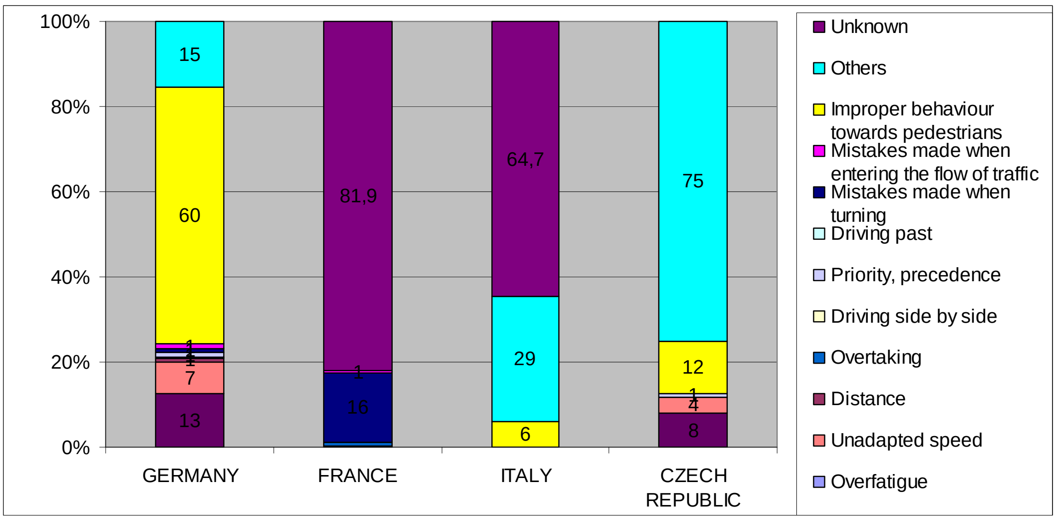

Figure 5.43.-Distribution of bus and pedestrian accidents by cause.

There is little clearly defined data in figure 5.43 due to large amounts of unknown and ´other´ accident categorisations. The only obvious result is that in German the main cause for accidents between buses and pedestrians, is due to improper behaviour towards the pedestrians.

Therefore the main conclusions to be made for this section are that accidents between buses and pedestrians almost always take place in urban areas. These are probably busy areas, and so it is not too surprising that Germany´s trend tended towards the cause of these accidents being improper behaviour, as drivers may become more agitated and feel under more pressure. Although no definitive conclusion can be made generally for all the countries.

5.3 Conclusions

According to investigation of the location, accident opponent and type of accident three most important accident scenarios arose for each road user. These were carried out with the help of the German statistics, because the required data of the other countries arrived late. However, the trends of most countries can be compared with the German ones.

In the following, it is given a short summary of the main outcomes related to the investigation of van, truck and bus accidents.

The three most important accident scenarios for vans:

- **Accidents between a van and a passenger car moving along in carriageway [40% - 30%]**
  In general, these accidents are rear-end collisions and collisions between oncoming vehicles. Mostly, the accidents occurred on urban and rural roads (without motorways) caused by insufficient safety distance, unadapted speed or overtaking.
- **Accidents between a van and a passenger and while turning into a road or by crossing it [45% - 19%]**
  These accidents mostly happened on urban roads caused by a failure to observe the priority rules. These accidents happened on junctions or gateways.
- **The single vehicle accident (Driving accident) of vans [58% - 0%, but not consistent]**
  These accidents happened without an influence of another road user, such as skidding. The accidents mostly happened on rural roads by the cause of unadapted speed or/and influence of alcohol.

The three most important accident scenarios for trucks are:

- **Accidents between a truck and a passenger car moving along in carriageway [44% - 28%]**
  Mostly, the accidents occurred on rural roads including motorways, caused by insufficient safety distance, unadapted speed and mistakes made when entering the flow of traffic.
- **Accidents between a truck and a passenger and while turning into a road or by crossing it [39% - 13%]**
  Remarkable is the relative high rate of rural accident (without motorways) in comparison to vans or all road users. Main causations are failures to observe the priority rules and partly influence of alcohol.
- **The single vehicle accident (Driving accident) of trucks [60% - 0%, but not consistent]**
  The main location of these accidents is rural and motorways in connection with the causations unadapted speed and overfatigue.

Three most important accident scenarios for coach and bus are:

- **Accidents between a bus and a passenger car moving along in carriageway [31% - 26%]**
  The main part of these accidents happened clearly on urban roads (except France). The most important accident causations are unadapted speed, overtaking and insufficient safety distance
- **Coach/Bus against a passenger car and caused by turning into a road or by crossing it [45% - 16%]**

The main location for buses involved in turning accidents is in urban areas. In general terms, the main causation shown for these accidents is priority

- **Coach/Bus involved in driving accidents [48% - 0%, but not consistent]**
  These accidents happened without an influence of another road user, such as skidding. It is difficult to establish strong conclusions, as there is no homogeneous data for the analysed countries. Factors included here are turning in crossings, fatigue, alcohol, speed and distance. They are not concurrent for all the countries but most of them include human errors and even some carelessness.
- **Accidents between a bus and a pedestrian**
  Quit all accidents occurred on urban roads. Related to this scenario the most important causations are improper behaviour towards pedestrian, mistakes made when turning and unadapted speed.

In comparison of this outcomes with older literature documentations of transport accidents it became clear that isolated knowledge from isolated countries, often out of Europe (USA, Australia), is indeed applicable to the EU 27 situation. Beside all statistical trouble, the leding causing and contributing factors that result in transport fatalities or severe injuries, are to verify in our data, if unadapted speed, alcohol, fatigue, turning/crossing errors, or distance. Secondly, the differentiated look of this chapter could add to the existing national studies, which special focus should be done, compared to the other EU countries, since some factors are common, others are more special or unimportant.

In final conclusion, this descriptive study show severe transport accidents on urban roads in daylight, special at intersection against smaller cars, pedestrians, and motorized and unmotorized two-wheelers, are to address most, when planning countermeasures.
Safety improvements can be reached by vehicle safety, such as ADAS in crossing, turning, and lane keeping (since single vehicle and fatigue accidents count for a good part to accident figures). This result became obvious form the comparison of light conditions, type of road, and type of accident. But unadapted speed and alcohol must find further measurements, namely in enforcement.

This result is congruent with other findings, but as mentioned, here the EU wide necessity was verified. All countries, which were compared, show similar structural problems with transport fatalities and assure similar measures to be effective in reducing these fatalities.

Nonetheless, it remains a lot to work on EU level, to reach full comparability in accident figures. Statistical methods, record policy, and categorization of causations are not optimal in all countries. This is contraproductive in computing comparable risk indices.

5.4 References

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6 Task 1.4: Pedestrians and Cyclists

6.1 Introduction

Throughout the countries of the European Union nearly 40,000 human fatalities and 1.7 million related injures occur in vehicle accidents annually, resulting in a cost of approximately 160 billion euros. Nevertheless, injuries are not only caused to vehicles' occupants, in many cases **pedestrians as well as cyclists are accident victims (generally when they are knocked down by a vehicle)**. As European statistics show, roughly 6,000 of these deaths are a result of collisions between pedestrians and motor vehicles, primarily occurring in urban areas.

It is these staggering figures which have led car manufacturers, European governments and consumer organisations to further develop means for the prevention or mitigation of such accidents and injuries to vulnerable road users. The EC Directive and the Euro NCAP testing and assessment protocols both advise the simulating of pedestrian impacts at 40 km/h, based on work carried out by the EEVC (European Enhanced Vehicle-safety Committee) Working Group 17 in this field. Euro NCAP started with the assessment of pedestrian protection in 1996 with a protocol based on the recommendations from the EEVC WG 10, the working group that first developed pedestrian protection test methods. In 2002, Euro NCAP changed to the more stringent test and rating protocol based on the updated procedures proposed by the EEVC WG 17. The EC Directive's first phase was introduced in 2005, with a second, more stringent stage in 2010. These methods are focused on encouraging passive and/or secondary safety measures. Secondary safety systems are design measures which work to protect the pedestrian against injury or fatality in the event of an accident. The secondary safety systems are very much 'state of the art', using new technologies including pedestrian protection airbags, active hood systems and further development of energy absorbing materials and structures being applied to the design of bumpers, bonnets and windscreens.

To date, it has been very common to consider cyclist accidents as particular cases of pedestrian accidents and therefore, there have been some approaches in this way. As this report will show, the configuration of cyclist accidents is different than the configuration for pedestrians and there is a need to specify special protocols and case studies for these types. Neither the configuration of the scene of the accident, the position of the vulnerable road user nor the dynamics during the crash follow the same pattern. Then, special emphasis on these road users has to be taken. However, the solution should be the avoidance of the crash. Primary safety systems are those focussed on avoiding the occurrence of an accident or significantly altering the conditions in which the accident will take place, in such a way that the risk becomes lower. In terms of the pedestrian accidents, there are many primary safety systems which work to avoid the accident. Examples of these systems range from driver visual aids such as night vision, to autonomous emergency braking systems. Some of the more traditional vehicle systems such as brake assist and traction control can also work to reduce braking distances or prevent vehicles from leaving road surfaces, both of which could aid the prevention of an impact with pedestrians. At present, a lot of safety systems are being developed so that driving becomes safer for all users. Indeed, prevention of accidents has become the principle objective of all manufacturers. Many components, most of which electronic, are responsible for avoiding accidents; these are called 'primary safety systems'. However, if a crash occurs it is 'secondary safety systems', such as airbags, that have the objective of diminishing the vehicle occupant's injuries. For the development of these platforms a definition of the accident patterns is needed.

6.1.1 Overview of Pedestrian accidental situation

Statistics imply that road safety measures implemented over the previous decade have considerably improved with respect to pedestrian fatality numbers.

The following figures represent the absolute number of fatalities for pedestrians for 2004.

	2004	Ped. Killed	Total Fat.	% Country	% Europe
Netherlands	**NL**	68	804	8%	0.7%
Belgium	**BE**	101	1163	9%	1.1%
France	**FR**	581	5530	11%	6.3%
Denmark	**DK**	43	369	12%	0.5%
Luxembourg	**LU**	6	49	12%	0.1%
Italy	**IT**	**710**	5625	13%	7.7%
Slovenia	**SI**	35	274	13%	0.4%
Finland	**FI**	49	375	13%	0.5%
Germany	**DE**	**838**	5842	14%	9.1%
Sweden	**SE**	67	480	14%	0.7%
Spain	**ES**	683	4749	14%	7.5%
Austria	**AT**	132	878	15%	1.4%
Cyprus	**CY**	18	117	15%	0.2%
Malta	**MT**	2	13	15%	0.0%
Ireland	**IE**	64	379	17%	0.7%
Portugal	**PT**	233	1294	18%	2.5%
Greece	**EL**	293	1619	18%	3.2%
Czech Republic	**CZ**	281	1382	20%	3.1%
United Kingdom	**UK**	**694**	3368	21%	7.6%
Hungary	**HU**	326	1296	25%	3.6%
Bulgaria		260	943	28%	2.8%
Slovakia	**SK**	188	603	31%	2.1%
Estonia	**EE**	59	170	35%	0.6%
Poland	**PL**	**1986**	5712	35%	21.7%
Lithuania	**LT**	263	752	35%	2.9%
Latvia	**LV**	197	516	38%	2.1%
Romania		**1055**	2418	44%	11.5%
Total 27		9164	45916	20%	

Table 6.1.- Number of Pedestrian fatalities and percentage of pedestrian fatalities to total fatalities by country, 2004.

Grouping the fatalities in the different age categories, the distribution of the pedestrian killed is showed in the following table.

	0-9 years	10-14 years	15-17 years	18-20 years	21-24 years	25-64 years	65+ years	Unknown	Total
Austria	7	4	4	3	5	49	60	0	132
Belgium	6	1	3	2	1	39	49	0	101
Denmark	2	2	0	1	4	18	16	0	43
Finland	1	0	3	0	1	21	23	0	49
France	22	13	15	18	17	180	282	3	550
Germany	26	17	24	33	24	317	394	3	838
Greece	12	3	3	3	8	106	143	15	293
Luxembourg	0	0	0	0	0	3	4	0	7

Ireland	2	0	1	3	3	28	28	5	70
Italy	15	3	7	6	12	259	381	27	710
Netherlands	3	3	0	5	2	29	26	0	68
Portugal	15	4	1	4	4	92	120	6	246
Sweden	1	3	1	6	2	19	35	0	67
Spain	21	13	18	21	20	319	305	70	787
United Kingdom	29	35	33	51	41	303	277	5	774
Czech Republic	6	3	2	7	10	160	94	0	282
Cyprus	0	0	0	0	0	5	13	0	18
Estonia	1	4	2	1	2	37	12	0	59
Hungary	8	6	7	6	8	184	98	9	326
Latvia	2	1	1	2	1	110	61	19	197
Lithuania	5	2	5	7	13	160	71	0	263
Malta	0	0	0	0	0	1	1	0	2
Poland	71	33	40	62	71	1090	538	81	1986
Slovakia	10	5	1	8	8	112	47	5	196
Slovenia	1	1	0	0	0	15	18	0	35
Bulgaria	13	7	1	2	2	107	111	0	243
Romania	36	35	9	16	41	527	304	0	968
Total 27	315	198	181	267	300	4290	3511	248	9310
Total 25	266	156	171	249	257	3656	3096	248	8099

Table 6.2.- Number of pedestrian fatalities by age group by country.

Comparing the numbers with the population for the different age groups, we could find the following relative figures.

	0-9 years	10-14 years	15-17 years	18-20 years	21-24 years	25-64 years	65+ years	Total
Austria	8.4	8.2	13.8	10.1	12.0	10.7	46.6	109.9
Belgium	5.2	1.6	8.1	5.5	1.9	7.0	27.5	56.8
Denmark	2.9	5.9	0.0	5.9	16.5	6.0	19.9	57.1
Finland	1.7	0.0	15.9	0.0	3.8	7.4	28.3	57.1
France	3.0	3.5	6.4	7.8	5.4	5.8	28.8	60.6
Germany	3.4	3.8	8.3	11.8	6.1	6.9	26.5	66.8
Greece	11.6	5.3	8.3	11.8	6.1	6.9	26.5	66.8
Luxembourg	0.0	0.0	0.0	0.0	0.0	12.0	62.5	74.5
Ireland	8.7	0.0	12.5	38.5	31.6	31.8	118.6	241.7
Italy	2.8	1.1	4.1	3.3	4.6	8.0	34.2	58.1
Netherlands	1.5	3.0	0.0	8.8	2.6	3.2	11.6	30.5
Portugal	13.8	7.2	2.9	10.4	6.7	16.0	67.0	123.9
Sweden	1.0	4.8	2.9	19.2	4.8	4.0	22.7	59.5
Spain	5.1	6.2	13.3	14.0	8.2	13.1	42.2	102.2
United Kingdom	4.1	9.0	14.0	21.9	13.5	9.6	28.9	101.1
Czech Republic	6.5	4.8	5.1	17.2	16.6	27.4	66.1	143.6

Cyprus	0.0	0.0	0.0	0.0	0.0	12.6	146.1	158.7
Estonia	7.9	37.4	32.3	16.7	26.3	51.5	58.5	230.6
Hungary	8.0	9.9	18.6	15.3	13.7	32.9	62.5	160.9
Latvia	10.2	6.9	9.1	17.9	7.2	89.9	160.1	301.3
Lithuania	14.2	7.8	29.9	42.7	67.7	88.7	139.2	390.2
Malta	0.0	0.0	0.0	0.0	0.0	4.7	18.9	23.6
Poland	18.5	13.0	23.4	31.8	27.0	53.2	107.2	274.1
Slovakia	18.1	13.6	4.0	31.1	22.2	37.7	75.1	201.8
Slovenia	5.5	9.6	0.0	0.0	0.0	13.2	58.8	87.1
Bulgaria	19.8	16.7	3.2	6.3	4.6	24.9	83.4	159.0
Romania	16.6	26.3	8.7	11.7	31.3	45.2	96.5	236.4
EU 27	6.3	7.0	10.1	14.3	11.7	16.2	44.0	109.5
EU 25	5.6	5.9	10.3	14.7	10.7	14.7	41.1	103.0
EU 15	4.0	4.7	8.4	11.5	7.5	8.6	32.9	77.6

Table 6.3.- Pedestrian fatalities per 1000 inhabitants by country.

On the whole, the number of pedestrian deaths in the EU-14[40] (EU-15 excluding Germany), has steadily decreased by more than a third (38.2%) over the last 10 years. 2004 showed that only 3,753 pedestrians, 13.9% of all fatalities in 2004, were killed in road traffic accidents; this is notably less than the previous 6,068 deaths in 1995. Furthermore, the total number of accidents related fatalities has been reduced by one quarter (-26.5%).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BE	149	154	142	162	154	142	158	127	113	101
DK	118	68	87	73	82	99	49	63	49	43
EL	481	422	409	417	399	375	338	279	257	293
ES	1,000	960	967	996	906	899	846	776	786	683
FR	1,086	1,043	982	1,044	932	838	822	866	626	581
IE	113	115	130	114	92	85	89	86	64	-
IT	945	985	893	844	847	897	932	1,163	781	710
LU	8	9	8	3	2	11	11	6	-	-
NL	142	109	119	110	111	106	106	97	97	-
AT	200	157	156	165	182	140	117	160	132	132
PT	598	624	549	406	393	384	337	339	280	233
FI	72	70	69	62	67	62	62	40	59	49
SE	71	74	72	69	86	73	87	58	55	67
UK	1,085	1,039	1,010	946	909	889	858	808	802	694
EU-14	6,068	5,830	5,592	5,411	5,163	5,000	4,813	4,868	4,108	3,753
Yearly ch.	-	-3.90%	-4.10%	-3.20%	-4.60%	-3.20%	-3.70%	1.10%	-15.60%	-8.60%

Table 6.4.- Pedestrian fatalities by country by year, 1995-2004.

[40] CARE Database / EC (Date of query: October 2006) published in the European Road Safety Observatory (Traffic Safety Basic Facts 2006: Pedestrians & Traffic Safety Basic Facts 2006: Bicycles).

The proportion of pedestrian fatalities to the total number of road traffic fatalities in each country is shown in the next table. Pedestrian fatalities amounted to approximately 10% of all road accidents in Belgium, Luxemburg, The Netherlands and France. This is comparatively much lower than 21% in the United Kingdom, 19% in Ireland, and 18% in Portugal and Greece. However, Spain, the United Kingdom, France and Italy had the highest number of pedestrian deaths overall, this is why it is important to consider percentages of the accidents as differing population sizes could result in misleading statistics.

	Pedestrian fatalities	Total fatalities	Ratio
BE	101	1,162	8.7%
DK	43	369	11.7%
EL	293	1,67	17.5%
ES	683	4,741	14.4%
FR	581	5,53	10.5%
IE*	64	337	19.0%
IT	710	5,625	12.6%
LU**	6	62	9.7%
NL*	97	1,028	9.4%
AT	132	878	15.0%
PT	233	1,294	18.0%
FI	49	375	13.1%
SE	67	480	14.0%
UK	694	3,368	20.6%
EU-14	3,753	26,919	13.9%

Table 6.5.- Pedestrian fatalities as a percentage of total fatalities, 2004.

The figure below, shows a very high reduction, from 2,623 to 1,667 people (-36.4%), in the number of senior citizen (aged>64) pedestrian fatalities over the last 10 years. Although the total number of pedestrian fatalities was reduced by 38.2% in the same time period, senior citizens remain the largest group in pedestrian fatalities. Young people (aged>18) remain the smallest affected group quantitively, even though they too have had a proportionally high decrease in fatalities over the last decade.

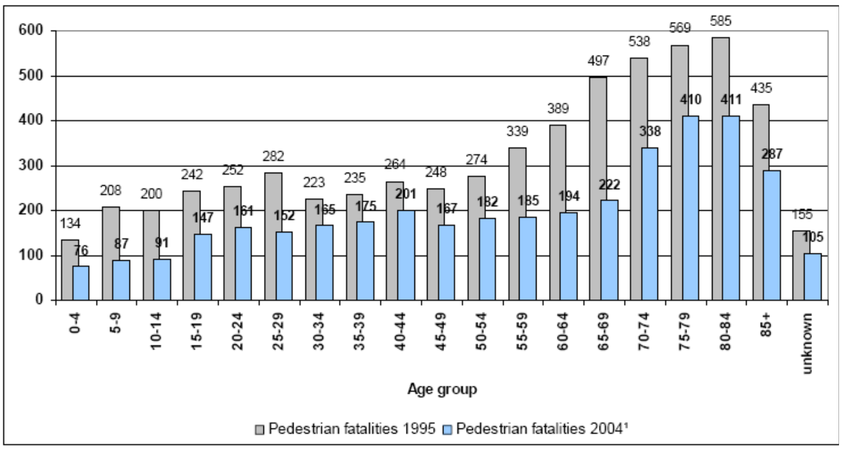

Figure 6.1.- Number of pedestrian fatalities by age group in EU-14, 2004 compared to 1995.

While considering gender, the female proportion pedestrian accidents with regards to the total number of fatalities are significantly high. Suggesting that females are more likely to be involved as a dead pedestrian when in a road traffic accident, even though it is still the male population dominating the quantity of fatal road traffic accidents on the whole.

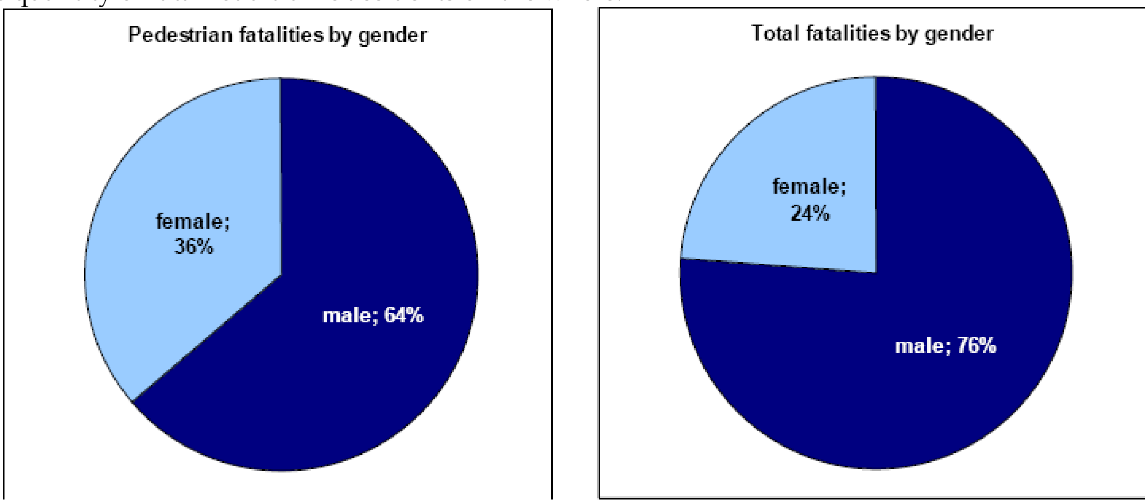

Figure 6.2.- Distribution of pedestrian fatalities and total fatalities by gender.

The distribution of fatalities by light conditions shows that the most dangerous time for pedestrians to be during darkness, representing the average of almost 50% of the total. This is variable between the respective countries, from 58% in Austria to 35% in The Netherlands, as presented in the next figures. Luxemburg and Italy are excluded due to a high share of fatalities with unknown light conditions. It is recognised however, that accidents during daylight time still contribute highly to the total number of fatalities.

	Darkness	Daylight	Daylight or twilight	Twilight	Unknown	Total
BE	44	51	-	6	-	101
DK	23	18	-	1	1	43
EL	131	136	-	26	-	293
ES	296	354	-	34	-	683
FR	245	307	-	30	-	581
IE*	36	-	28	-	-	64
IT	-	-	-	-	710	710
LU**	1	-	-	-	5	6
NL*	34	57	-	6	-	97
AT	76	52	-	4	-	132
PT	111	114	-	8	-	233
FI	20	28	-	1	-	49
SE	32	27	-	5	3	67
UK	365	7	322	-	-	694
EU-14	1,413	1,150	350	121	719	3,753
Share	37.7%	30.6%	9.3%	3.2%	19.2%	100.0%

Table 6.6.- Number of pedestrian fatalities by light condition (EU-14).

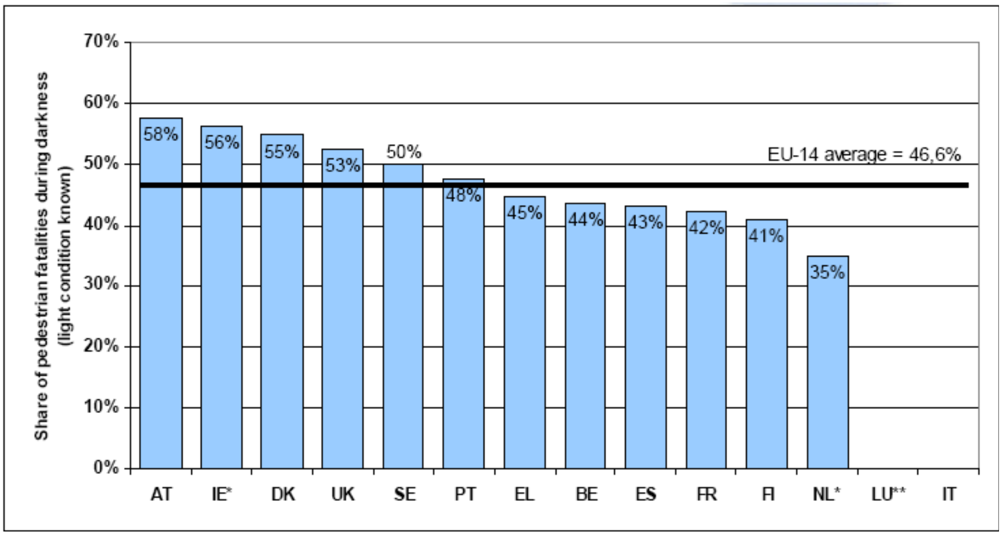

Figure 6.3.- Share of pedestrian fatalities during darkness by country.

6.1.2 Overview of the Cyclist accidental situation: CARE database[41]

Cyclist fatalities made up 4.5% of the total number of road accident fatalities in 2004. In 2004, 1,209 people riding bicycles were killed in traffic accidents in 14 European Union countries, which is 5.1% less than the 1,275 bicycle fatalities reported in 2003 in the same countries. There was a reduction of 37.3% during the decade for the same countries, 731 fatalities less in 2004 than the 1,940 in 1995.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BE	128	121	122	135	122	134	130	105	110	79
DK	77	88	65	58	59	58	56	52	47	53
EL	34	28	32	34	23	22	29	14	21	24
ES	123	101	116	114	119	84	100	96	78	88
FR	368	296	318	296	295	244	235	208	185	177
IE	28	22	24	21	14	10	12	18	10	-
IT	391	413	428	364	402	381	331	314	326	296
LU	3	1	1	1	0	1	1	1	-	-
NL	267	233	242	194	194	198	195	169	188	-
AT	77	73	66	57	68	62	55	80	56	58
PT	96	75	75	74	41	56	50	58	63	47
FI	74	46	61	54	63	53	59	53	39	26
SE	57	49	42	58	45	47	43	42	35	27
UK	217	208	187	165	173	131	140	133	116	136
EU-14	1,940	1,755	1,779	1,626	1,618	1,481	1,436	1,343	1,2752	1,209
Yearly change		-9.6%	1.4%	-8.6%	-0.4%	-8.5%	-3.0%	-6.4%	-5.1%	-5.1%

Table 6.7.- Annual number of cyclist fatalities in EU-14, 1995-2004.

[41] CARE Database / EC (Date of query: October 2006) published in the European Road Safety Observatory (Traffic Safety Basic Facts 2006: Pedestrians & Traffic Safety Basic Facts 2006: Bicycles).

Comparing the cyclist fatalities with the total fatalities in 2004, the countries with the highest percentage of bicycle fatalities are Denmark, the Netherlands and Finland, as is indicated by the following table. In contrast, in Greece, Spain and Luxembourg bicycle constitute only a small part (<2%) of the road accident fatalities. Of these fatalities, the overall average shows the most affected group to be males over the age of 60 who are involved in over a third (36.9%) of these bicycle fatalities.

%	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BE	8.8	8.9	8.9	9.0	8.7	9.1	8.7	8.0	9.1	6.8
DK	13.2	17.1	13.3	11.6	11.5	11.6	13.0	11.2	10.9	14.4
EL	1.4	1.3	1.5	1.6	1.1	1.1	1.5	0.9	1.3	1.4
ES	2.1	1.8	2.1	1.9	2.1	1.5	1.8	1.8	1.4	1.9
FR	4.1	3.5	3.8	3.3	3.5	3.0	2.9	2.7	3.1	3.2
IE	6.4	4.9	5.1	4.6	3.4	2.4	2.9	4.8	3.0	-
IT	5.6	6.2	6.4	5.8	6.0	5.7	4.9	4.7	5.4	5.3
LU	4.3	1.4	1.7	1.8	0.0	1.3	1.4	1.6	-	-
NL	20.0	19.7	20.8	18.2	17.8	18.3	19.6	17.1	18.3	-
AT	6.4	7.1	6.0	5.9	6.3	6.4	5.7	8.4	6.0	6.6
PT	3.5	2.8	3.0	3.5	2.1	3.0	3.0	3.5	4.1	3.6
FI	16.8	11.4	13.9	13.5	14.6	13.4	13.6	12.8	10.3	6.9
SE	10.0	9.1	7.8	10.9	7.8	8.0	7.4	7.5	6.6	5.6
UK	5.8	5.6	5.0	4.6	4.9	3.7	3.9	3.7	3.2	4.0
EU-14	5.3	5.0	5.1	4.7	4.7	4.4	4.4	4.2	4.42[2]	4.51[1]

Table 8.- Percentage of cyclist fatalities to total traffic fatalities in EU-14.

Age group	0-14		15-24		25-39		40-59		60+		Unknown
Gender	female	male	female	male	female	male	female	male	female	male	
BE	1.3	3.8	0.0	8.9	1.3	3.8	8.9	15.2	11.4	45.6	1.3
DK	5.7	5.7	5.7	1.9	5.7	11.3	3.8	18.9	17.0	24.5	5.7
EL	0.0	20.8	4.2	8.3	0.0	8.3	0.0	16.7	0.0	41.7	0.0
ES	2.5	5.9	0.3	8.9	1.5	17.3	1.4	25.3	3.5	31.9	2.5
FR	3.6	9.0	3.0	4.8	4.2	3.6	5.4	29.9	6.6	29.9	3.6
IE*	10.0	20.0	10.0	0.0	0.0	10.0	0.0	10.0	0.0	40.0	10.0
IT	0.0	4.1	1.7	2.0	1.7	10.5	4.4	16.9	9.1	47.6	0.0
LU**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
NL*	5.9	5.3	3.7	6.4	3.7	3.7	4.3	12.8	19.1	34.6	5.9
AT	1.7	1.7	1.7	3.4	0.0	6.9	3.4	17.2	15.5	48.3	1.7
PT	0.0	2.5	0.0	4.9	0.0	19.6	0.0	29.4	4.9	34.4	0.0
FI	0.0	0.0	3.8	0.0	0.0	11.5	0.0	15.4	26.9	42.3	0.0
SE	0.0	3.7	0.0	3.7	0.0	0.0	3.7	18.5	14.8	55.6	0.0
UK	2.2	14.0	5.1	11.8	3.7	13.2	4.4	22.1	4.4	19.1	2.2
EU-14	2.4	6.5	2.6	5.4	2.5	8.7	4.1	19.8	10.3	36.9	2.4

Table 6.9.- Average number of cyclist fatalities by gender by age group (EU-14).

* *Data from 2003*
** *Data from 2002*

The age distribution for all countries by single age bands is displayed in the next figure. The number of fatalities has dropped for all ages, but most for people younger than 40 years old.

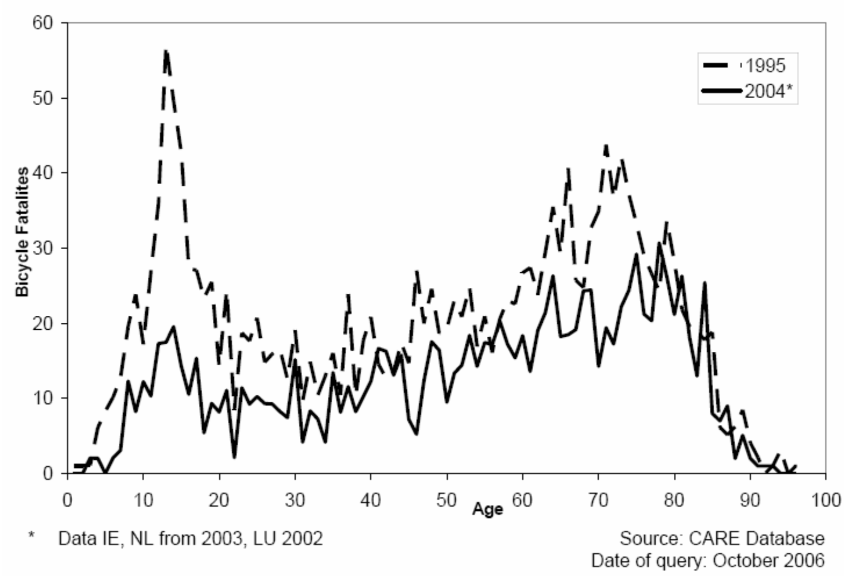

Figure 6.4.- Number of cyclist fatalities by single age bands (EU-14), 2004 compares to 1995.

From the next tables, it follows that the majority of bicycle fatalities in all countries occur within urban areas. The highest percentage of bicycle fatalities inside urban areas is found in the United Kingdom (64%). All bicycle fatalities in Ireland (10) and Luxembourg (1) happened outside urban areas, but these are both very small numbers compared to the other countries. The second figure shows the percentage of road traffic fatalities in 2004 that occurred at junctions and the types of junction involved. Bicycles have an extremely high share of fatalities at junctions: almost half of the fatalities occurred at a junction. Of all the bicycle fatalities that happened on a junction the majority happened on crossroads.

	Inside urban area	Outside urban area	Not known
BE	41.8%	58.2%	0.0%
DK	56.6%	43.4%	0.0%
EL	41.7%	58.3%	0.0%
ES	23.2%	76.8%	0.0%
FR	48.5%	51.5%	0.0%
IE*	0.0%	100.0%	0.0%
IT	62.2%	37.8%	0.0%
LU**	0.0%	100.0%	0.0%
NL*	60.6%	39.4%	0.0%
AT	50.0%	50.0%	0.0%
PT	51.2%	48.8%	0.0%
FI	53.8%	46.2%	0.0%
SE	63.0%	33.3%	3.7%
UK	64.0%	36.0%	0.0%
EU-14	53.6%	46.3%	0.1%

Table 6.10.- Percentage of bicycle fatalities by type of area by country.

	Not at junction	At Junction					Not defined
		cross-road	T or Y junction	level crossing	round-about	other junction type / unknown	
BE	40	0	0	0	2	37	0
DK	23	12	0	1	1	15	1
EL	24	0	0	0	0	0	0
ES	61	9	14	0	1	2	0
FR	127	29	10	0	6	5	0
IE*	0	2	0	0	1	0	7
IT	155	52	0	0	6	83	0
LU**	1	0	0	0	0	0	0
NL*	78	49	48	9	4	0	0
AT	28	14	5	0	2	1	8
PT	31	6	5	0	0	0	6
FI	0	0	0	0	0	13	13
SE	2	15	0	0	0	1	9
UK	57	9	37	0	8	25	0
EU-14	627	539					44
%	51.8%	44.6%					3.6%
% junction type		197 36.5%	118 21.9%	10 1.9%	32 5.9%	183 33.9%	

Table 6.11.- Number of bicycle fatalities by type of junction by country, 2004.

6.2 Main outcomes of the literature review

6.2.1 Related to accident causation

There are few papers found concerning accident causation. In the technical documents reviewed the main relevant parameters discussed are location of accidents (i.e. crossings, signalled intersections), visibility and opponent vehicles. There is no clear definition as to the most concurrent scenarios and conditions relating to pedestrian and cyclist accidents. Data from studies focussed on accidents in UK, Japan and Korea has been collected and it is found that pedestrians differ in sizes and biomechanical response during accidents, even behaving differently while crossing the street (*Cheol et altri 2005, Clarke et altri 2005, Depriester et altri 2005*). In these cases, old people and children are more likely to have an accident and more specifically from this old people are more likely to result severely injured after these accidents. It is also revealed that most of the vehicle opponents during pedestrian accidents reduce to a certain set of vehicle types. Through guaranteeing the effective protection in these vehicles concerned, a high number of injuries would be prevented (*Leffler et altri 2004*).

6.2.2 Related to development methodologies

The industry is developing active and passive safety systems trying to avoid accidents and reduce the severity of their consequences (*Berg et altri*). New testing and simulation tools have been designed in order to get more information about all aspects concerning accident causation (*Wanke et altri 2005, Nagatomi et altri 2005*). From this testing and simulation it can be said that technical measures in the structure and frontal vehicle shape can clearly improve the safety performance *(Lee et altri 2005, Crandall et altri 2005)*. However, the effectiveness of these parameters strongly depends on the individual vehicle's front geometry and differs for between adults and children. Impactor and/or component test procedures have been proposed for further evaluating pedestrian safety; some modifications are applicable when using these methods for the evaluation of cyclists (*Maki et altri 2003)*. More testing is necessary to assess the possible effects that differences introduced in pre-test orientation, surrogate stature, and clothing will have on the surrogate response (*Kuehn et altri 2005, Lawrence 2005)*.

6.2.3 Related to regulations

The National Administrations are developing new regulations in Pedestrian Protection as the Directive of the European Parliament and of the council relating to the protection of pedestrians and other vulnerable road-users in the event of a collision with a motor vehicle (*Directive 2003/102/EC*), so as to try and force to the automotive industry into the application of measures to improve this dramatic situation. These new regulations will take into consideration the presence of active systems such as the Advanced Driver Assist and Pre-Crash Systems (*Hardi et altri 2003*). Options under discussion for resolving these changes are to increase the number of vehicle types and protected areas, as well as providing protection at higher speeds. Possible improvements to the test methods and tools, refining the impact conditions, and testing with a combination of dummy and subsystem tests, are also being considered.

Global harmonization should not be used an as an excuse for delaying efforts to reduce traffic casualties; the overdue EU Directive on Pedestrian Protection for example. Furthermore, due to the differences in vehicle fleets and other legitimate considerations, harmonization might not be appropriate at all and our scarce resources should not be wasted in futile efforts.

6.3 Descriptive analysis

As it is known, **the objective of this analysis is to obtain a general overview of the problem of the vulnerable road users (pedestrians and cyclists) compared with other accidents and to provide scenarios associated to the problem in order to identify possible safety measures or systems which may be relevant for the solution of the identified problems**. To simplify the tables, the aim of the study is to be done with data covering the period 2001-2004, avoiding evolutions along these years. In order to get a good overview on the magnitude of accidents and causes, all graphics have been done with relative percentages. It is important to note that these relative percentages refer for a period of four years. Then, it is easy to get an average value for one year.

6.3.1 Available data

6.3.1.a Period data

The time period for the data used in this report is from 2001 to 2004, and an average has been done. The number of samples refer to accidents happened during these four years. Only Greek data corresponds to the 2004 period.

6.3.1.b Accidents considered in the study

The study contains data about pedestrians and cyclists accidents with personal damage, which is distinguished after fatalities, seriously and slightly injured persons. The option unknown has been decided to take it out, as it is not used by all countries.

6.3.1.c Vehicles considered in the study

All vehicles involved in a Cyclist / Pedestrian road accident.

6.3.1.d Involved countries and covered geographical area

The databases used are the following ones:

Country	Database	Data provider	Covered area
France	BAAC	CEESAR	Whole France
Germany	OGPAS	BASt	The entire territory of the Federal Republic of Germany since 3 October 1990.
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain

Table 6.12.- Vehicle databases envolved counties and covered area.

Therefore, the total number of accidents might differ from table to table. The national statistics cover all accidents reported to the police authorities. These were registered by the police officers who attended the accident.

6.3.1.e Definition of the injury severity

The analysis of the accident data considers fatalities, seriously and slightly injured persons. A general remark should be made regarding the accuracy of the casualty data in the report. The statistical collection revealed differences in quality of the data, e.g. the level of reporting injuries in the countries is not always the same.

Germany: **Fatality:** all persons who died within 30 days as a result of the accident
Seriously injured: all persons who were immediately taken to hospital for inpatient treatment (of at least 24 hours).
Slightly injured: all other injured persons.

France: **Killed:** all persons who died within 6 days as a result of the accident.
Seriously injured: all injuries.

Great Britain: **Fatality**: an accident in which at least one person sustained injuries causing death within 30 days of the accident. Confirmed suicides are excluded from this.
Seriously injured: an accident in which at least one person is seriously injured, but no person (other than a confirmed suicide) is killed. A serious injury is defined as 'an injury for which a person is detained in hospital as an "in-patient", or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts and lacerations, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident'.
Slightly injured: an accident in which one person is slightly injured, but no person is killed or seriously injured.

Greece: No information.

Italy: **Fatality**: all persons who died within 30 days as a result of the accident.
Seriously injured: all persons who were immediately taken to hospital for inpatient treatment (of at least 24 hours).
Slightly injured: all other injured persons.

Spain: **Fatality:** Victim that died within 24 hours as a result of the accident.
Seriously injured: Hospitalised for more than 24h.
Slightly injured: All other injured persons.

6.3.2 Analysis and methodologies

The analysis has been separated into two vertical lines: pedestrian and cyclist. Not much horizontal analysis has been done, but a comparison between the data regarding pedestrians and the data regarding cyclists can be easily done.

According to the information received, it is important to comment that most countries have presented consistent data and this can help in this study and in the future. There is only one problem with Italian data. It seems they used data coming from two databases. The first one, with very low numbers, presented the classification fatal, serious and slight, as other databases. It is believed that these low numbers cannot represent the whole country accidents. Another data is presented, ISTAT (Instituto Nazionale di Statistica), with the classification injured and not injured. The number of samples in this data can represent the whole country accidents. To make it easy, only the first database has been used, as it can be compared relatively with data coming from other countries. The data from the second database has not been used in this document, but could be useful for comparing absolute number among countries in Europe, losing the possibility of classifying in fatal, serious and slight injuries. In some tables, when the information data source had too low accidents recorded, the information has not been showed. On the contrary, when the information of Italy is showed it is due to the fact that the information is more reliable.

The methodology applied is the same for all parameters under study. It is based on the relative percentage analysis, showing the percentage of fatal, serious or slight accidents attributed to each category. Nevertheless, some comments on the absolute numbers of the accidents have been introduced, as they are considered to be also important to give in-depth information.

In certain cases, when it is considered important or when the graph cannot show distributions, the ratios 'number of fatal or serious accidents for this category / number of all accidents for this category' is given in a table.

6.3.3 Results for pedestrians

6.3.3.a General national statistics

A synthesis of all the statistical study carried out over the data obtained from different countries in Europe for the period 2001 – 2004 is presented here. The objective of this synthesis is to provide a description of the representative characteristics, causes and conditions, of pedestrian accidents, in order to enable a future in-depth study of cases fulfilling these characteristics.

Over the parameters identified at the beginning of the statistical analysis, a set of 7 characteristics have been chosen. Their description, distribution over countries and influence on the severity of the accidents are summarized here.

6.3.3.b Location

This chapter tries to locate and make a difference between accidents occurring in urban or rural areas, and relate them to the location or not in an intersection. Taking into account data coming from the 6 countries analysed, urban areas present more than 90% of the accidents and less than 10% corresponds to rural area, as expected (Table 4_Annex2.6.-Location). In general terms, regarding the separation between intersection and non-intersection accidents, it seems that the majority of them do not take place in an intersection. The only exception is Great Britain, the only country in which the number of accidents occurring in intersections is higher (Figure 19/Figure 23_Annex2.6.-).

Accidents taking place in rural areas have a more elevated percentage of fatal injuries (the circulating velocity is higher in these areas). Serious injuries are also more commonly caused in rural areas than in urban areas, which give an idea of the severity of the accident. On the contrary, slight injuries use to be caused on accidents taking place in urban areas.

6.3.3.c Light conditions

This bullet analyses the different light conditions, mainly night and day, but it also take into account dawn and dusk. The differentiation between urban and rural areas is very important in this case. Talking in absolute numbers, and regarding pedestrian accidents in urban roads, the majority of them occur with daylight, as shown in Annex2.6, Table 8. It is also important to note that for all countries, the relative percentage of fatal and serious accidents is bigger in darkness than in daylight, surely due to the severity of the impact when the driver cannot visualize the pedestrian. Regarding rural accidents, it must be noted that there is no difference between the number of accidents occurring with daylight or in the night, but accidents with darkness still being more harmful and fatal for pedestrians. In all the countries the trend is similar (Annex2.6, Figure 35/Figure 40.

6.3.3.d Type of accident opponent

The opponent is considered as the vehicle that impacts against the pedestrian. Taking into account the data collected from the 6 countries analysed, we can conclude that passenger cars are, with great difference, the primary rival for pedestrians. The second rival changes depending on the country; in Spain and Greece, motorcycles and moped are also an important cause of pedestrian and cyclists accidents, whereas in France, Germany and Great Britain it is more divided into trucks, motorcycles and other causes. These figures are collected in the Annex2.6, Table 3 and graphed distinguishing between the different countries in the Annex2.6, Figure 13/ Figure 18. Regarding the aggressiveness of the vehicles, trucks produce the highest rate of fatalities and severe injuries, especially in France and Spain. Slight injuries are caused in a similar rate by cars, trucks, motorcycles, buses, moped and others. In all the cases, the vulnerability of the pedestrian is remarked.

6.3.3.e Road grip and weather conditions

Road grip and weather conditions are considered to be a related cause of accidents. In order to classify accidents according to road conditions (dry, wet, ice, slippery, etc), this chapter focuses on analysing the influence of external factors that can interfere in an accident. Regarding urban roads, most accidents happen on dry road, which proves that accidents cannot only be justified by weather conditions, but its influence is notable. As concluded in the preceding chapter, the rates of fatal and serious injuries are higher in rural roads, but these represent a small percentage. An important data is that the relative percentage of fatal, serious and slight injuries is similar under any road grip circumstance, which might mean that pedestrian accidents in rural zones have a high rate of misperception. These figures are collected in the Annex2.6, Table 5 and graphed distinguishing between the different countries in the Annex2.6, Figure 24/ Figure 29. The classification for weather conditions is very similar to the road grip conditions, as it is directly related, but additional evidences can be concluded from Annex2.6, Table 7 that shows the accident distribution related to weather conditions. First, comparing the percentage of fatal injuries occurring in urban areas, it can be stated that fog is a relevant factor and causes the highest relative rate of fatal injuries to pedestrians in countries with dry weather. When analysing the situation in rural areas, similar tendencies can be appreciated. Once more, fog is the most relevant and harmful factor for pedestrians, as accidents produced under fog conditions cause the higher relative percentage of fatal and serious injuries.

Countries with wet weather have no differentiation among weather conditions, neither in urban nor rural zones.

6.3.3.f Age and gender

Age and gender issues are discussed here. In this chapter, the age of pedestrians involved in the accidents is classified. A first division has been made so that child and teenagers are grouped together, so as to see the relevance of accidents involving the youngest part of the population. Then, the rest of the population has been grouped in divisions of ten years, and finally elderly people, which are considered to be older than 60 years, are also grouped together. It is not totally clear which is the age group with the highest rate of pedestrian accidents; it depends on the country. For example Annex2.6, Figure 42 and Figure 43 show two dramatically different distributions of the accidents concerning the population age in Great Britain and Germany, making an eventual typical age classification difficult. Nevertheless, there is one important thing in common: the most dangerous ages are the groups 0-19 and +60 years, the ones which represent both the youngest and the oldest people. This is a significant detail, as it shows that people is more vulnerable during the two extremes of life.

In relative terms, percentage of fatal and serious accidents is bigger for older people than the rest, both for urban and rural areas. The minor rate of fatal injuries is for child and teenagers, but then it changes to get more equalled when referring to the serious and slight ones. According to gender distribution, the number of accidents regarding pedestrians in urban roads tends to be equal between males and females in general terms. Annex2.6, Figure 52 shows the data from Spain, which is probably most typical of the accident ratio between males and females; data from the other countries follows the same trend (See Annex2.6, Figure 47-Figure 52). When considering relative percentages, there are not great differences about the distribution of fatal, serious and slight injuries. Concerning pedestrians in rural roads, the number of accidents is higher for males than for females in all the cases, which could be explained as a bigger tendency of men to outdoor activities.

6.3.3.g Opponent vehicle age

The purpose of this chapter is to study if there is any relation between the age of the car involved in the accident and the injuries caused to the pedestrian. In general terms, the number of accidents for 0-4 year old vehicles is higher than the number for 5-9 year old and older . Important data given by the statistics is that, despite the new technologies and the recent developments introduced to the majority of cars, the percentages of fatal injuries as well as serious injuries caused to pedestrians in urban roads are still very similar (there has only been a reduction of 1% or 2% in the last 10 years, see Annex2.6, Table 11, which means that security systems for pedestrians should be taken into consideration more in the future. It is confirmed that accidents are more harmful in rural areas than in urban areas, but no clear conclusion can be extracted, as the variables are too great and it is unknown how many and which cars are using different safety systems aboard that may influence these statistics.

6.3.3.h Accident causation

As most of the accidents involving pedestrian take place in urban zones, main causes of these accidents will be defined only for these areas. Two main causes can be identified when analysing pedestrian accidents:

- ✓ **On the one hand, it is a high casuistic for pedestrians who do not obey the crossing zones, maybe because they are not respecting the traffic lights or maybe because they are crossing by a zone which is not enabled for it.**
- ✓ **On the other hand, it is very common to find accidents at intersections, when a vehicle turning is not able to appreciate a pedestrian crossing, even there is a crossing zebra marked or not.**

6.3.3.i Data Extrapolation to EU 27 or EU25 Countries

As it has been explained, the previous characteristics detailed have been obtained after analysis over extensive database available for the TRACE project. A specific extrapolation method is going to be used (see Annex1) for determining some information for 27 or 25 European countries (data from four countries will be used: Spain, Germany, France and Great Britain). In comparison to the national data which are separated into urban and rural, it is here necessary to consider the data as a whole, expressed in number of persons killed or injured when using this extrapolation method.

As aiming to obtain values for the 25 European Countries (not from all the 27 countries), it has been decided to realise this extrapolation for the year 2004 only (and not the 4 years period 2001-2004) to facilitate the data collecting, comparison and storing. It is then necessary to consider the data from

Spain, France, Germany and Great Britain for 2004 only, which by the way represents about 21% of the 4 years period casualties.

In order to extrapolate these data, the following numbers from the 25 countries are to be known, being used as margins for the calculation:

- Total number of pedestrian fatally (resp. seriously, resp. slightly) injured, whatever the conditions
- Total number of victim, distributed to each condition studied

All of the related data of pedestrian and cyclist accidents in EU 25 are cited from Annual Statistical Reports 2006 of CARE Database and Statistics of Road Traffic Accidents in European and North America by Economic Commission for Europe, which makes the extrapolation result more authoritative and close to the real world.

Light conditions
Table 6.13 shows the data collected for the four countries, during the year 2004, concerning pedestrians involved in accidents classified as occurring under Daylight / Dawn / Darkness conditions. The victims are separated into Fatally / Severely / Slightly injured.

Data for Spain, France, Germany and UK					
Light Conditions 2004		Fatal	Severe	Slight	*Sum*
	Daylight	1152	13198	50164	*64513*
	Dawn	88	690	2219	*2997*
	Darkness	1232	6632	16456	*24319*
	Sum	*2472*	*20519*	*68839*	

Table 6.13.- Light Conditions classification of the data from Spain, France, Germany and GB.

The margins of the EU 25 countries are then to be introduced into this table for processing the extrapolation (Table 6.14).

EU 25 Margins for Extrapolation						
Light Conditions EU 25 margins		Fatal	Serious	Slight	*Sum*	**EU 25**
	Daylight	1152	13198	50164	*64513*	**257960**
	Dawn	88	690	2219	*2997*	**18512**
	Darkness	1232	6632	16456	*24319*	**102425**
	Sum	*2472*	*20519*	*68839*		
	EU 25	**7814**	**52468**	**319153**		

Table 6.14.- Light Conditions classification of the data from Spain, France, Germany, GB and EU 25 countries margins.

The European Statistics usually classify the severity of the accidents into two groups: Killed and Injured. In order to separate this total number of injured cases into Serious and Slight, the Expansion method for EU 25 is used. The 371621 injured cases are then divided into 52,468 serious and 319,153 slight according to this expansion. The EU 25 statistics shows the accidents to be distributed as: 68% occurring under Daylight conditions, 27% under Darkness and 4.88% within Dawn conditions. This distribution is used to determine the linear margins of the table.

Data Extrapolated to Europe 25 'Light Conditions'						
Light Conditions extrapolated to EU 25 in 2004		Fatal	Serious	Slight	*Sum*	**EU-25**
	Day light	3395	32046	222885	*258326*	**257960**
	Dawn	408	2633	15497	*18538*	**18512**
	Darkness	4011	17789	80771	*102570*	**102425**
	Sum	*7814*	*52468*	*319153*	*379435*	
	EU-25	**7814**	**52468**	**319153**		**379435**

Table 6.15.- Casualties Extrapolated to EU 25.

It is quite clear when analysing these data that the Light Conditions have a considerable influence on the accidents, especially on their severity. While the casualties occurring under Dark conditions account for 27% of all the pedestrian casualties, they are leading to more than 50% of the total pedestrian fatalities. More generally, considering a sample of 100 accidents occurring in Daylight conditions, 86 pedestrian will only suffer slight injuries and 1 will be killed. Considering the same sample of 100 accidents but occurring this time under Dark conditions, 79 pedestrian will suffer slight injuries and 4 will be killed. This uneven severity distribution demonstrates the aggressiveness of the accidents occurring in dark conditions.

Age of the victims

Starting from the grouped Spanish, French, English and German data for 2004 (Table 6.16), the same process is applied to obtain reliable values for the 25 European Countries, concerning the age of the pedestrian involved in accidents, and their severity.

Data for Spain, France, Germany, UK ('Age')					
Age distribution (2004)	Age	Fatal	Severe	Slight	*Sum*
	0-19	302	7050	26611	*33963*
	20-29	224	2028	9020	*11272*
	30-39	241	1781	7475	*9497*
	40-49	242	1714	6238	*8195*
	50-59	288	1760	5503	*7551*
	60 & +	1114	5742	11996	*18852*
	DK	48	413	2071	*2531*
	Sum	*2460*	*20487*	*68915*	

Table 6.16.- Casualties classified according to age of the pedestrian involved, for Spain, France, Germany and GB.

EU 25 Margins for Extrapolation							
Age distribution and EU 25 Margins in 2004	Age	Fatal	Severe	Slight	*Sum*	EU 14	**EU-25**
	0-19	302	7050	26611	*33963*	40586	**64815**
	20-29	224	2028	9020	*11272*	15894	**25383**
	30-39	241	1781	7475	*9497*	13391	**21386**
	40-49	242	1714	6238	*8195*	12456	**19892**
	50-59	288	1760	5503	*7551*	9590	**15315**
	60 & +	1114	5742	11996	*18852*	33179	**52987**
	DK	48	413	2071	*2531*	0	**5846**
	Sum	*2460*	*20487*	*68915*			
	EU 14	3753	32962	200810			
	EU-25	**7814**	**52468**	**319153**			

Table 6.17.- Casualties classified according to age of the pedestrian involved, for Spain, France, Germany and GB and EU 25 Margins.

The linear European Margins have here been determined from the EU 14 data, already classified according to the age groups by the European Road Safety Observatory. The determination of the EU 25 corresponding margins then relies on extrapolation from 14 to 25, according to the ratio for total pedestrian accidents.

Age distribution extrapolated to EU 25 in 2004						
Age Distribution extrapolated to EU 25 in 2004	Age	Fatal	Severe	Slight	*Sum*	**EU-25**
	0-19	715	14643	104155	*119513*	**64815**
	20-29	621	4922	41261	*46804*	**25383**
	30-39	670	4351	34412	*39433*	**21386**
	40-49	736	4575	31369	36680	**19892**
	50-59	744	3990	23506	28240	**15315**
	60 & +	4189	18942	74572	97702	**52987**
	DK	139	1045	9879	11063	**2314**
	Sum	*7814*	*52468*	*319153*	*379435*	
	EU-25	**7814**	**52468**	**319153**		**379435**

Table 6.18. - Extrapolation to EU 25.

The 0-19 and 60 & + clearly stand out of this table by the total number of accidents in which they are involved. Though the severity distribution is considerably different along these two ranges, the young being killed in 0.5% of the accidents whereas the elder range presents a rate of more than 4%, considering the same conditions.

Weather conditions

Table 6.19 shows the number of pedestrian accident by severity (fatal, serious injured and slight injure) by different weather conditions (dry, rain, snow, fog and other) in France, Spain, Great Britain, and Germany, 2004.

Data for Spain, France, Germany, UK					
Weather Conditions (2004)		Fatal	Serious	Slight	*Sum*
	Dry	1562	11310	48402	*61274*
	Rain	226	1563	6240	*8029*
	Snow	5	40	153	*198*
	Fog	17	59	178	*253*
	Other	73	378	1606	*2057*
	Sum	*1883*	*13350*	*56578*	

Table 6.19.- Number of pedestrian accident by weather condition in 4 counties, 2004.

In order to extrapolate the data from 4 countries to the whole EU 25 countries, the margin value of each weather condition and each accident severity should be given. As the Table 6.20 shown, the last row in the table is the statistic value of fatal, serious injured and slight injured pedestrian accident in EU 25 counties in 2004, while the last column is the total number of pedestrian accidents (including all of severities) in each weather condition in EU 25 countries in 2004.

EU 25 Margins for Extrapolation						
Weather Conditions and EU 25 Margins (2004)		Fatal	Serious	Slight	*Sum*	**EU-25**
	Dry	1562	11310	48402	*61274*	**317050**
	Rain	226	1563	6240	*8029*	**45472**
	Snow	5	40	153	*198*	**2666**
	Fog	17	59	178	*253*	**5566**
	Other	73	378	1606	*2057*	**15680**
	Sum	*1883*	*13350*	*56578*		
	EU-25	**7814**	**52468**	**319153**		

Table 6.20.- Margin value of extrapolation for EU-25, 2004.

Table 6.21 is the extrapolation result for EU-25 countries. From the data in the table, it can be seen that about 80% of the pedestrian accidents occur in the dry weather condition and another 12% of accidents happen in the raining day. But with respect to the percentage of fatalities in the total number, the highest possibility of pedestrian fatalities happens in the fog weather, see figure 5.

Data extrapolated to EU 25 in 2004 (Weather)						
Weather Conditions extrapolated to EU 25 (2004)		Fatal	Serious	Slight	*Sum*	**EU-25**
	Dry	6084	42544	262679	*311308*	**317050**
	Rain	968	6463	37217	*44648*	**45472**
	Snow	49	397	2172	*2618*	**2666**
	Fog	291	964	4210	*5465*	**5566**
	Other	422	2099	12875	*15396*	**15680**
	Sum	*7814*	*52468*	*319153*	*379435*	
	EU-25	**7814**	**52468**	**319153**		

Table 6.21.- Number of pedestrian accident by weather condition in EU-25, 2004.

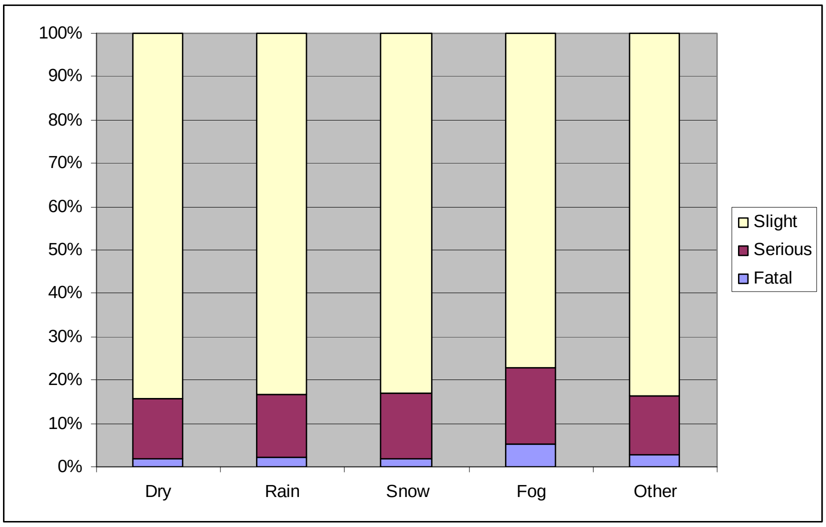

Figure 6.5.- Percentage of each severity in different weather conditions.

Road conditions
Table 6.22 shows the number of pedestrian accident by severity (fatal, serious injured and slight injure) by different road conditions (dry, wet, ice, slippery and other) in France, Spain, Great Britain and Germany, 2004.

Data for Spain, France, Germany, UK					
Road Conditions (2004)		Fatal	Serious	Slight	*Sum*
	Dry	1782	14975	52791	*69548*
	Wet	637	5109	14386	*20133*
	Ice	21	282	789	*1092*
	Slippery	5	70	184	*259*
	Others	9	45	178	*232*
	Sum	*2454*	*20482*	*68328*	

Table 6.22.- Number of pedestrian accident by road condition in 4 counties, 2004.

In order to extrapolate the data from 4 countries to the whole EU 25 countries, the margin value of each road condition and each accident severity should be given. As the Table 6.23 shows, the last row in the table is the statistic value of fatal, serious injured and slight injured pedestrian accident, while the last column is the total number of pedestrian accidents (including all of severities) in each road condition in EU 25 countries in 2004.

EU 25 Margins for Extrapolation						
Road Conditions and EU 25 Margins (2004)		Fatal	Serious	Slight	*Sum*	**EU-25**
	Dry	1562	11310	48402	*61274*	**317050**
	Wet	226	1563	6240	*8029*	**45472**
	Ice	5	40	153	*198*	**2666**
	Slippery	17	59	178	*253*	**5566**
	Others	73	378	1606	*2057*	**15680**
	Sum	*1883*	*13350*	*56578*		
	EU-25	**7814**	**52468**	**319153**		

Table 6.23.- Margin value of extrapolation for EU-25, 2004.

Table 6.31 is the extrapolation result for EU-25 countries. From the data in the table, it can be seen that about 80% of the pedestrian accidents occur in the dry road condition and another 12% of accidents happen on the wet road, which is consistent with the result of weather condition. But differed from the fatalities percentage in weather condition, higher possibility of pedestrian fatalities occurs on the wet and dry road, see figure 6.6.

Data extrapolated to EU 25 in 2004						
Road Conditions extrapolated to EU 25 (2004)		Fatal	Serious	Slight	*Sum*	**EU-25**
	Dry	6144	41975	263189	*311308*	**317050**
	Wet	1112	7246	36290	*44648*	**45472**
	Ice	40	431	2146	*2618*	**2666**
	Slippery	84	945	4436	*5465*	**5566**
	Others	435	1870	13092	*15396*	**15680**
	Sum	*7814*	*52468*	*319153*		
	EU-25	**7814**	**52468**	**319153**		

Table 6.24.- Number of pedestrian accident by weather condition in EU-25, 2004.

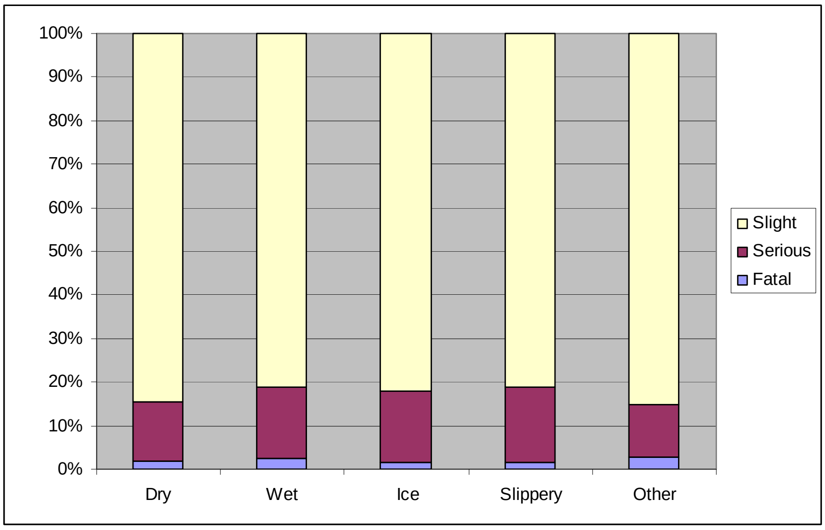

Figure 6.6.- Percentage of each severity in different road conditions.

6.3.4 Results for cyclists

Proceeding in the same way as in pedestrian accidents, the synthesis of all the statistical study carried out is presented here. This will enable a future in-depth study of cases fulfilling these characteristics. Over the parameters identified at the beginning of the statistical analysis, the same set of 7 characteristics has been chosen. Their description, distribution over countries and influence on the severity of the accidents is summarized here.

6.3.4.a Location

This chapter tries to locate and make a difference between accidents occurring in urban or rural areas, and relate them to the location or not in an intersection. Urban areas present more than 90% of the accidents and less than 10% corresponds to rural area, as expected, in most of the countries considered (See Annex2.6, Table 15 and Annex2.6, Figure 77-Figure 82)

Regarding the separation between intersection and non-intersection accidents, it seems that the majority of them do not take place in an intersection. Spain, showing a much smaller contrast between urban and rural areas, is the exception of the sample

In general terms, accidents taking place in rural areas have a more elevated percentage of fatal injuries, especially the ones happening in non-intersections. Serious injuries are also more commonly caused in rural areas than in urban areas, which give an idea of the severity of the accident. On the contrary, slight injuries use to be caused on accidents taking place in urban areas (See Annex2.6, Table 15).

6.3.4.b Light conditions

This bullet analyses the different light conditions, mainly night and day, but it also take into account dawn and dusk. The differentiation between urban and rural areas is very important in this case. Regarding cyclist accidents in urban roads, the majority of them occur with daylight, in accordance to the fact that the majority of the cyclist are circulating during the daytime. In general, the relative percentage of fatal accidents is similar in darkness than in daylight (Annex2.6, Table 19). Regarding rural accidents, it must be noted that there is also a big difference between the absolute number of accidents occurring with daylight or in the night, but accidents with darkness still being more harmful and fatal for cyclists. Darkness seems to be an important relative parameter in rural accidents, as the distribution of fatal and serious accidents is higher at night.

6.3.4.c Type of accident opponent

The opponent is considered as the vehicle which impacts against the cyclists. Passenger cars are, with great difference, the first rival for cyclists. The second rival changes depending on the country; in some of them, motorcycles and mopeds are also an important cause of cyclist accidents, whereas in others it is more divided into trucks, motorcycles and other causes, this contrast between the two different trends can be represented by the Annex2.6, Figure 71-Figure 76. Besides the obviously high number of car-cyclist accidents, France presents a relatively high rate of motorcycle or moped/cyclist accidents, whereas the truck/ cyclist impacts are fewer. The figures Annex2.6, Figure 71-Figure 76 show the relatively different trend that Germany, Great Britain and Italy carry. Great Britain and Germany have close trends; with considerable accidents relative to trucks and quite few accidents related to motorcycle/moped (Italy also presents a considerable rate of bus/cyclist accidents, comparable to the truck/cyclist cases). Finally, Spain and Greece form another group with rates of truck/cyclist and two wheelers/cyclist which are equivalents. It is important to consider that the distribution of the vehicle parks in the different countries have a high influence in the occurrence of the accident. Apart from the prominence of accidents involving cars, the most relevant common characteristic of all countries is the fact that accidents caused between trucks and cyclists have the higher rate of fatal and serious injuries. Slight injuries are caused in a similar rate by cars, trucks, motorcycles, buses, mopeds and other in all the countries.

6.3.4.d Road grip and weather conditions

Road grip and weather conditions are considered to be a related cause of accidents. In order to classify accidents according to road conditions (dry, wet, ice, slippery, etc), this chapter focuses on analysing the influence of external factors that can interfere in an accident. In urban roads, the majority of accidents take place on dry road, which proves that accidents cannot be only justified due to weather conditions. In rural roads, the number of accidents is still little in comparison to urban accidents. As concluded in the preceding chapter, the following table shows that the rates of fatal and serious injuries are higher in rural roads (See Annex2.6, Table 18). When analysing rural areas, the situation changes a lot in many countries, but in general terms, it could be stated that bad weather conditions (rain, snow, fog) tend to produce more risky accidents in rural than in urban zones.

6.3.4.e Age and gender

Age and gender issues are discussed here. A first division has been made so that children and teenagers are grouped together, so as to see the relevance of accidents involving the youngest part of the population. Then, the rest of the population has been grouped in divisions of ten years, and finally elderly people, which are considered to be older than 60 years, are also grouped together. In differentiation between pedestrians, the distribution of the number of accidents and their consequences is not very relevant to age, as data is much more homogeneous (Annex2.6, Table 20 and Annex2.6, Figure 100- Figure 105).

According to gender distribution, the percentage of accidents regarding cyclists in urban roads tends to be considerably higher for males than for females, possibly because males tend to practice this sport a lot more than females. The same observation can be applied for cyclists in rural roads (Annex2.6, Table 21 and Annex2.6, Figure 106- Figure 111).

6.3.4.f Opponent vehicle age

The purpose of this chapter is to study if there is any relation between the age of the car involved in the accident and the injuries caused to the cyclist. In absolute numbers, the number of accidents for 0-4 year old vehicles is higher than the number for 5-9 year old and older. This data is interesting but it would be interesting to compare these results with the vehicle age distribution for each country. An important data given by the statistics is that, despite the new technologies and the recent developments than have been introduced to the majority of cars, the percentage of fatal injuries as well as serious injuries caused to cyclist in urban roads stills very similar (there has only been a reduction of 1% or 2% in the last 10 years), which means that security systems for cyclists should be more taken into consideration in the future. In rural areas, it is confirmed that accidents are more harmful than in urban areas (Annex2.6, Table 22 and Annex2.6, Figure 112- Figure 117) but no other important conclusion can be extracted.

6.3.4.g Accident causation

It is very important to differentiate between urban and outside urban areas accidents when analyzing the causes of cyclist accidents.

- ✓ **On the one hand, accidents in urban areas are caused when a vehicle invades the lane used the cyclist or, even, when a cyclist invades a lane used by other vehicles. Other concurrent scenario is produced in the called 'illicit turning', which takes places at intersections. An example of this type of accident could be: a cyclist riding in the right lane when approaching to the junction and trying to continue straight and a vehicle driving in the centre lane which tries to turn right. At this point, the vehicle stands in the way of the cyclist or, even, runs over the cyclist.**
- ✓ **On the other, accidents in rural areas occur mainly in manoeuvres when a vehicle drives in the same way as the cycle and tries to overtake it or approaches to it in a point with reduced visibility, as bends or hill brows.**

6.3.4.h Data Extrapolation to EU 27 or EU25 Countries

Light conditions

Proceeding as previously, the cyclist casualties are hereby extrapolated to the 25 European countries (impossible to obtain marginal data from all the 27 countries) from the Spanish, French, German and British data which have been grouped and as presented in Table 6.25.

Data for Spain, France, Germany, UK (2004)					
Light Conditions (2004)	Condition	Fatal	Severe	Slight	*Sum*
	Daylight	645	12721	58255	*71621*
	Dawn	35	607	2561	*3203*
	Darkness	164	2584	9705	*12453*
	Sum	*844*	*15911*	*70521*	

Table 6.25.- Cyclist causalities classified according to Light conditions.

Table 6.26 shows the same data paired with the corresponding margins values for the EU 25.

EU 25 Margins for Extrapolation						
Light Conditions and EU 25 Margins (2004)	Condition	Fatal	Severe	Slight	*Sum*	**Eu 25**
	Daylight	645	12721	58255	*71621*	**190634**
	Dawn	35	607	2561	*3203*	**1368079**
	Darkness	164	2584	9705	*12453*	**75693**
	Sum	*844*	*15911*	*70521*		
	EU25	**2725**	**39205**	**238414**		

Table 6.26.- Cyclist causalities classified according to Light conditions.

As mentioned previously severities as described by the European Road Traffic Accidents Statistics are either "Fatal" or "Injured". The separation into "Severe" and "Slight" has then been realised using the expansion method. Concerning the light conditions, statistics show the proportion of accidents occurring under Daylight, Dawn or Dark conditions, which has been used to determine the EU 25 number in each of these cases from the total accidents number.

Table 6.27 shows the result of the extrapolation:

Data extrapolated to EU 25 in 2004						
Light Conditions extrapolated to Eu 25 (2004)	Condition	Fatal	Severe	Slight	*Sum*	**EU-25**
	Daylight	1630	25371	163861	*190863*	**190634**
	Dawn	142	1950	11606	*13697*	**13681**
	Darkness	953	11883	62947	*75784*	**75693**
	Sum	*2725*	*39205*	*238414*	*280344*	
	EU-25	**2725**	**39205**	**238414**		

Table 6.27.- Extrapolation to EU 25 countries.

As for the pedestrian accidents, it can be seen that the number of accidents occurring under dark conditions is 60% smaller than the accidents occurring during daylight conditions; however the death in dark conditions equal 60% of the ones met under daylight scenes. The aggressiveness of the accidents occurring in dark conditions is much higher than the one for daylight accidents.

Weather conditions

Table 6.28 shows the number of cyclist accident by severity (fatal, serious injured and slight injure) by different weather conditions (dry, rain, snow, fog and other) in France, Spain, GB and Germany, 2004.

Data for Spain, France, Germany, UK					
Weather		Fatal	Serious	Slight	*Sum*
	Dry	322	2825	15795	*18942*
	Rain	18	245	1630	*1893*
Conditions	Snow	0	3	26	*29*
	Fog	3	12	61	*76*
	Other	21	102	539	*662*
(2004)	*Sum*	*365*	*3187*	*18051*	

Table 6.28.- Number of cyclist accident by weather condition in 4 counties, 2004.

In order to extrapolate the data from 4 countries to the whole EU 25 countries, the margin value of each weather condition and each accident severity should be given. As the Table 6.29 shows, the last row in the table is the statistic value of fatal, serious injured and slight injured cyclist accident in EU 25 counties in 2004, while the last column is the total number of cyclist accidents (including all of severities) in each weather condition in EU 25 countries in 2004.

EU 25 Margins for Extrapolation						
Weather		Fatal	Serious	Slight	*Sum*	**EU-25**
Conditions	Dry	322	2825	15795	*18942*	**94480**
	Rain	18	245	1630	*1893*	**13545**
and EU 25	Snow	0	3	26	*29*	**795**
	Fog	3	12	61	*76*	**1655**
Margins	Other	21	102	539	*662*	**4665**
	Sum	*365*	*3187*	*18051*		
(2004)	**EU-25**	**2725**	**15588**	**94968**		

Table 6.29.- Margin value of extrapolation for EU-25, 2004.

Table 6.30 is the extrapolation result for EU-25 countries. From the data in the table, it can be seen that more than 80% of the cyclist accidents occur in the dry weather condition and about 12% of these accidents happen in the raining day. In other conditions, due to the bad weather, people seldom use bicycle that is why the percentage of cyclist accident in snow and fog weather condition is so small compared with that in dry and raining day.

Data extrapolated to EU 25						
Weather		Fatal	Serious	Slight	*Sum*	**EU-25**
Conditions	Dry	2230	13002	77722	*92955*	**94480**
	Rain	184	1620	11522	*13326*	**13545**
extrapolate	Snow	17	71	695	*782*	**795**
	Fog	87	237	1304	*1628*	**1655**
d to EU 25	Other	207	657	3725	*4590*	**4665**
	Sum	*2725*	*15588*	*94968*	*113281*	
(2004)	**EU-25**	**2725**	**15588**	**94968**		

Table 6.30.- Number of cyclist accident by weather condition in EU-25, 2004.

Road Conditions
Table 6.31 shows the number of cyclist accident by severity (fatal, serious injured and slight injure) by different road conditions (dry, wet, ice, slippery and other) in France, Spain, Great Britain and Germany, 2004.

Data for Spain, France, Germany, Uk					
Road Conditions (2004)		Fatal	Serious	Slight	Sum
	Dry	494	7862	36364	44719
	Wet	90	1500	7188	8778
	Ice	5	108	331	444
	Slippery	2	67	200	268
	Others	3	18	49	70
	Sum	594	9555	44132	

Table 6.31.- Number of cyclist accident by road condition in 4 counties, 2004.

In order to extrapolate the data from 4 countries to the whole EU 25 countries, the margin value of each road condition and each accident severity should be given. As the Table 6.32 shows, the last row in the table is the statistic value of fatal, serious injured and slight injured cyclist accident in EU 25 counties in 2004, while the last column is the total number of cyclist accidents (including all of severities) in each road condition in EU 25 countries in 2004.

EU 25 Margins for Extrapolation						
Road Conditions and EU 25 Margins (2004)		Fatal	Serious	Slight	Sum	EU-25
	Dry	494	7862	36364	44719	**94480**
	Wet	90	1500	7188	8778	**13545**
	Ice	5	108	331	444	**795**
	Slippery	2	67	200	268	**1655**
	Others	3	18	49	70	**4665**
	Sum	594	9555	44132		
	EU-25	**2725**	**15588**	**94968**		

Table 6.32.- Margin value of extrapolation for EU-25, 2004.

Table 6.33 is the extrapolation result for EU-25 countries. According to the data in the table, it can be found that the severity of cyclist accident in different road condition is quite similar to that in weather condition, which means the weather condition has a much closed relationship with road condition; sometimes it decides the road condition.

Data extrapolated to EU 25 in 2004						
Road Conditions extrapolated to EU 25 (2004)		Fatal	Serious	Slight	Sum	EU-25
	Dry	2002	12494	78459	92955	**94480**
	Wet	266	1740	11320	13326	**13545**
	Ice	16	149	617	782	**795**
	Slippery	20	317	1291	1628	**1655**
	Others	420	889	3281	4590	**4665**
	Sum	2725	15588	94968	113281	
	EU-25	**2725**	**15588**	**94968**		

Table 6.33.- Number of cyclist accident by road condition in EU-25, 2004.

6.3.5 Scenarios for pedestrians and cyclists

6.3.5.a Scenarios for pedestrians

Taking into account the available extensive data from six countries: France, Germany, Great Britain, Greece, Italy and Spain, a pedestrian accident scenario pattern has been defined considering the main parameters to define the accident causation and to evaluate the effectiveness of the most promising safety systems.

Only the urban areas should be studied distinguishing between when the accident occurs in an intersection and when it happens in a crossing pass. Only cases where the pedestrian is hit by a passenger car will be objective to the study. The analysis will consider two main age groups for the pedestrian: young people (< 20) or elderly people (>60). This differentiation will lead to two groups of studied cases. In all of these scenarios, the visibility and conspicuity associated should be studied.

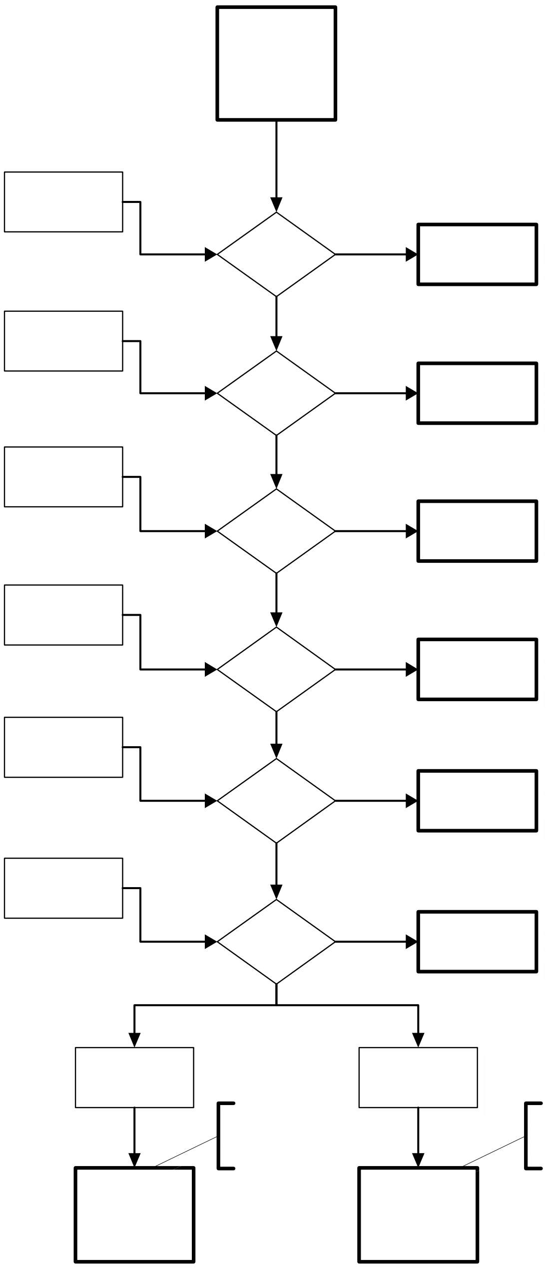

Figure 6.7.- Scenario study for pedestrian accident.

The diagram above shows the steps necessary to identify possible cases for in-depth studies (which would be studied in the following steps of Work Package 1). For all variables (severity, type of opponent, location, time, age and amount of data available) some special conditions are required. For a certain case, if these requirements are fulfilled, then this case should be suitable for future in-depth study. It is important to note that with this selection method, sex is not a determinative variable and, finally, cases are separated into two categories: crossing at intersections and crossing streets.

The selection of these cases will try to identify the following common scenarios regarding pedestrian accidents:

- ✓ **Car turning and pedestrian crossing the street (at corners).**
- ✓ **Pedestrian crossing a street with parked vehicles (reduced visibility) and vehicle approaching.**
- ✓ **Scholar area pedestrian accidents (young people).**
- ✓ **Commercial area pedestrian accidents.**

6.3.5.b Scenarios for cyclists

For the definition of the accident causation and the effective evaluation of the safety systems, it is necessary to perform analysis of the cyclist accidents separately from the other vulnerable road users like pedestrians. All the age groups will be analysed. The visibility of all the participants and the conspicuity of the environment will be central to the effort shown in the following steps. For the bicycles, the zone of the accident, differentiating between conventional roads on countryside and urban scenarios, will be the main point in order to group the studied cases.

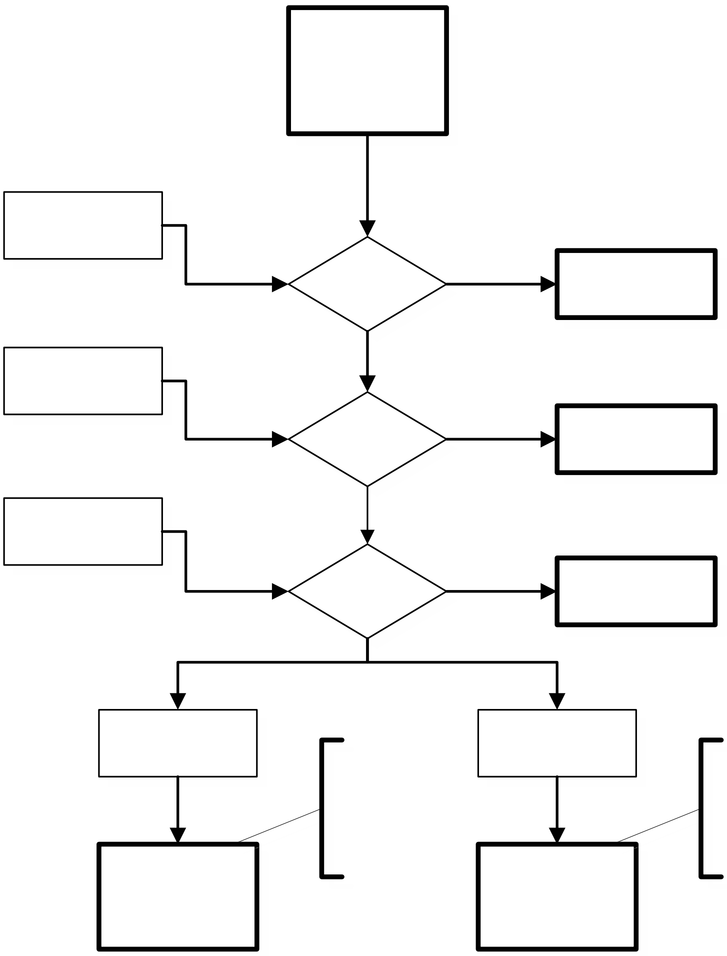

Figure 6.8.- Scenario study for cyclist accident.

The diagram above shows the steps necessary to identify possible cases for in-depth studies. For all variables (severity, type of opponent, location and amount of data available) some special conditions are required. For a certain case, if these requirements are fulfilled, then this case should be suitable for future in-depth study. It is important to note that with this selection method, sex, age, time and specific location are not determinative variables and, finally, cases are separated into two categories: urban and outside urban areas.

The selection of these cases will try to identify the following common scenarios regarding cyclist accidents:

✓ Outside urban areas
- **Straight road, cyclist in the road shoulder and car overtaking the cyclist.**
- **Curvy road, car driving and cyclist not visible (blind curve).**

✓ Urban areas
- **Cyclists in the bicycle lane and car invading it.**
- **Bicycle riding between lanes.**
- **Illicit turning at an intersection**

6.4 Conclusions

It is important to remark that there are few projects focused on the analysis of the accidents where at least one pedestrian or one cyclist (vulnerable user) is involved. Studying the results from these projects only conclusions about the passive safety measures could be found. Looking on the national statistics (at EU-27 level), the possible analysis to be carried out is reduced to establish relations between the fatalities and the gender, age,… of the road user. TRACE is giving a new step in the definition of the accident causation in Europe. The results presented here suppose an innovative work due to ,with the data from 6 countries and the statistical methodology defined in the project, the definition of the most relevant accident scenario has been achieved for the EU-27. The distribution of the fatalities, severe and slight injured people was considered from the light conditions (visibility), road circumstances (capacity in the avoidance of the accident), characteristics of the opponent vehicle (level of protection that the vehicle is offering to the vulnerable user) and weather and environment.

The conclusions taken over the analysis presented in the preceding chapters for vulnerable road users are presented here. These conclusions include the literature review, the dimension of the problem of vulnerable road users and the main characteristics of this type of accidents.

- There are few technical papers on accident causation. The industry is working to develop active and passive safety systems which may avoid these accidents or reduce the injuries produced. However, the accident scenarios are not well-known. Different regulations proposed by the governments around the world are supporting the efforts carried out by the automotive industry. New testing and simulation tools have been designed in order to develop the new systems. These standards will help to improve the level of safety provided to vulnerable road users, by combining active and passive systems. However, in several cases, the representation of these tools is uncertain due to the lack of knowledge in the field of pedestrian and cyclist accident causation.

- Although a general reduction in the number of all accidents can be appreciated over the studied countries, the reduction in VRU (vulnerable road users) is lower and even in some countries there is an increment.
- The statistics show the vulnerability of the pedestrians and cyclists in case of road traffic

accidents.

- While VRU to car accidents are the most common configuration with a very big distance to the next one, the most dangerous opponents in relative terms are trucks, which have the highest percentage of fatalities.
- Most pedestrian accidents take place in urban areas, whereas the distribution for cyclist accidents is equal between urban and rural areas.
- Generally, all countries present more casualties outside intersections than in pure intersections.
- While most pedestrian accidents are produced during daylight, the distribution between daylight and darkness for accidents involving cyclists is equal. It is also important to note that for all countries, the percentage of fatal accidents is bigger in darkness than in daylight.
- Most dangerous ages are the groups 0-19 and 60+ years, groups which represent the two extremes of life: youngest and oldest people. A common characteristic is that, in relative terms, percentage of fatal accidents is bigger for older people than younger.
- According to gender distribution, while male and female pedestrian urban accidents are equally distributed, all cyclist and rural pedestrian accidents tend to be considerably bigger for male than for female.
- At this first and basic level, it seems that the most significant parameters for the avoidance of the accident are related with the visibility of all participants and the conspicuity of the environment.
- The vulnerable road users need to be aware of the dangerous scenarios, and make themselves visible to others. The opposing participants should have tools to enhance visibility, especially in urban areas, for the pedestrians and in the countryside for the cyclists.
- The most promising systems for the next evaluation considering the potential avoidance of VRU accidents will be those able to calculate in a matter of seconds, the movement of pedestrians within the `capture zone´. The camera tracks the pedestrian movement and the information is correlated with the data received from the radar network (speed of and distance to object). These systems work with the objective of visibility improvement and pedestrian and cyclist conspicuity reduction.
- Estimations of the approximate reductions expected with vision enhancement systems in Germany (assuming 70% penetration of the passenger vehicle fleet) were reported. It was expected that 25% of vulnerable road user crashes occurring in low visibility would be affected, leading to a 17.5% reduction in these crashes, equating to a 0.1% reduction in all crashes. It was estimated that vision enhancement systems that include adaptive headlights have the potential to affect 30% of pedestrian fatalities and 15% of cyclist fatalities in Sweden. It was further predicted that by the year 2015, these systems would reduce pedestrian fatalities by 15% and bicyclist fatalities by 8%. The 'verified' potential of this system (based on other studies) to reduce all road fatalities is less than 0.5%, while the 'full' potential (an optimistic estimate based on full deployment) is 8%.
- Considering the pedestrians different scenarios were defined for the in-depth analysis: on the one hand, it is a high casuistic for pedestrians who do not obey the crossing zones, maybe because they are not respecting the traffic lights or maybe because they are crossing by a zone which is not enabled for it.; on the other hand, it is very common to find accidents at intersections, when a vehicle turning is not able to appreciate a pedestrian crossing, even there is a crossing zebra marked or not.
- Considering the cyclist different scenarios were defined for the in-depth analysis: Outside urban areas(straight road, cyclist in the road shoulder and car overtaking the cyclist and curvy road, car driving and cyclist not visible (blind curve)) and in the urban areas (cyclists in the bicycle lane and car invading it, bicycle riding between lanes, Illicit turning at an intersection).

6.4.1 Next steps

In the next stage, once time has defined the proposed scenarios, an in-depth analysis of the available data will be carried out with the intention of achieving the following objectives:

- To understand and identify the specific accident causes for the pedestrians and cyclists, mainly by means of micro level analyses performed on in-depth accident databases (intensive databases).

- To identify the risk of being involved in an accident for the pedestrians and cyclists.

The in-depth analysis will allows to answer questions like: Why the accidents (from pedestrians and cyclists point of view) happen?, What can we recommend to improve the safety,…

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7 Task 1.5: Elderly people and Gender related accidents

This chapter will be divided in two subchapters. The first one will be focused on elderly people and the second one on gender issues.

A.- Elderly people

7.1 Introduction

The role of age as an accident connected factor will be studied thoroughly, following the general methodology defined for TRACE operational work packages, and more specifically in the Work Package 1 'Road Users'. So it will be analysed on the basis of: 1) the background information given by the literature, 2) the statistical facts found in European databases, 3) the in-depth analysis of detailed accident data allowing going further in the comprehensive regard on the effect of age.

7.2 Main outcomes of the literature review

Literature review on the role of age in driving and an accident is abundant but sometimes contradictory. It deserves to be studied in detail in order to sort out the key factors associated with age and define the aspects which must be studied further.

7.2.1 Driving and accidents among the elderly

Over the next 30 years, a 40% increase in people over 65 is expected among the population of ECMT (European Conference of Ministers of Transport) member and associate countries and the proportion of those over 80 will double. This trend is associated with a cohort effect: as the level of health increases, the elderly continue to drive actively longer than before. Within 30 years, they will have a better level of education, higher incomes and resources than comparable people in the same age bracket just a few years ago. They will have a dynamic lifestyle, with an essential need for mobility and accessibility, and almost all elderly people will drive and will be used to the comfort and mobility that the automobile provides (ECMT, 2002).

Driving a car is a guarantee of physical, social and psychological autonomy for the elderly. But more than for other users, autonomy for elderly people depends on consequential safety (DSCR [Road Traffic and Safety Department], 1997). Most elderly people become physically fragile and vulnerable, making this population more susceptible to being injured or killed when involved in accidents. Thus, in France, the elderly age bracket (over the age of 65) underwent a 9.1% increase in the number of fatal accidents in 2005 compared with 2004 (ONISR [National Interministerial Road Safety Observatory], 2006). But this results from an extension in the definition of a what is "fatal" accident from 6 days to 30, showing a longer term fragility of elderly road users after having an accident.

It is therefore of utmost importance to look into the safety of the elderly at the wheel. Whether or not this group of users represents an excess risk on the road, the safety challenge lies in understanding the characteristics of driving and accidents among elderly drivers.

To answer these questions, this study follows three lines: firstly, the current question of excess driving risks among the elderly will be discussed; then we shall try to understand the influence of ageing factors in the population on their accidentality. The analysis of the specificities concerning the difficulties that elderly drivers encounter will constitute the last section of this introduction.

7.2.2 The question of excess risk

The question of excess risks among elderly drivers is the subject of debate. The risk corresponds to the number of accidents as a function of exposure. The population, the number of licensed drivers and the mileage covered are all measurements of exposure, however, and depending on which one is used, different sorts of risks are represented. This therefore poses a problem in estimating risks (Janke, 1991; Hakamies-Blomkvist, 2003; Fontaine, 2003; Langford et al., 2006). An explanation of the "low-mileage bias" is given in the box.

Surpassing the error of interpretation due to the "low mileage bias"

Much of the data on the risks involved in driving by the elderly correspond to the frequency of accidents per mile driven. But there is a low mileage bias, since the risk of accidents does not increase linearly with mileage and the risk of accidents among the elderly who drive shorter distances will therefore be overestimated: the elderly have more accidents per kilometre driven (10.8) than young people (8.3) (Hakamies-Blomqvist, 2003). But if we take the annual number of kilometres driven as a base, this disadvantage disappears (*ibid*).

Thus, as indicated in figure 1, for occasional drivers (fewer than 3,000 km driven per year), the accident rate per km driven among elderly drivers (over the age of 75) is comparable to that of young drivers (under the age of 20). It is much higher, however, than that of the rest of the population: this rate (per 1 million km driven) is 50.3 for those over 75 and 53.4 for those under 20, compared with 28.6 for the rest of the population (21-74 years). For more regular drivers (over 3,000 km/year), the highest accident rate concerns drivers under 20 (46.4 per 1 million km driven), whereas the lowest rate concerns the elderly (over 75), with 8 accidents per 1 million km driven, compared with 13.9 on average for the rest of the population (21-74 years).

It is therefore only in the case where the elderly person is an occasional driver that he has a higher risk of having a traffic accident than other drivers (Langford *et al.*, 2006).

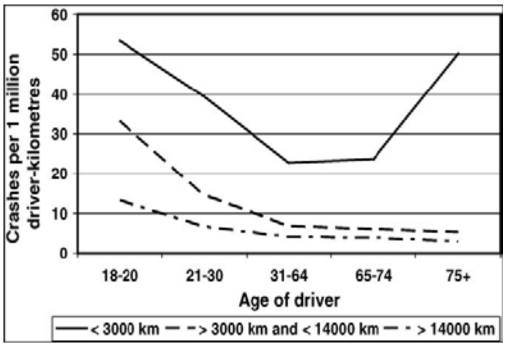

Figure 36: Number of accidents per year in terms of age, controlled by annual kilometres driven (Langford *et al*, 2006)

This can be explained by a loss of driving skills due to a lack of practice. It can also be explained by a difference in the kinds of itineraries that the elderly take, between those who drive little and those who drive many miles each year. Indeed, it appears that those who drive little have a tendency to do mainly urban driving, whereas those who drive a lot rather tend to drive long distances on motorways or national highways. There is a higher risk of interaction with other users in city driving, notably due to the higher number of intersections – we shall come back to this point later on. Cities thus appear to be particularly accident-prone places for the elderly (Binet *et al.*, 2001; Langford *et al.*, 2006). Moreover, elderly drivers insofar as possible avoid unfavourable environmental conditions (night, rain, unfamiliar roads, etc.) (Hakamies and Wahlstroem, 1998), which makes them unable to manage these conditions when confronted with them (Hill and Boyle, 2006).

It appears debatable to talk about "excess risk" concerning driving among elderly people. In fact, the value associated with the risk varies with the measurements used, which makes this notion subjective. We consequently feel it is more appropriate to speak in terms of "different risks" for elderly drivers.

In this sense, the quantitative analysis of accidentology is limited to description, and trying to understand the behaviour of the elderly may potentially shed more light on their accident typology in order to move toward optimum safety for these users.

7.2.3 Factors of decline: the impact on elderly driving

We shouldn't forget that ageing is, after all, quite a normal process. But even "normal" ageing is accompanied by a progressive alteration of human functions on the motor, sensorial and cognitive levels.

7.2.3.a Motricity

A point often made in the literature is that the elderly are very vulnerable physically (Maycock, 1997): the risk to elderly people of being be killed or seriously injured in a traffic accident is two to five times greater then the risk to young people, given their greater physical fragility (Department for Transport, 2001).

It is important to point out, however, that the elderly population is highly heterogeneous. Firstly, on the intra-individual level, each function or organ has its own ageing processes, leading to an asynchronism in changes to the sensorial, central and motor systems (Fozard and Nuttal, 1971). On the inter-individual level, the effects of ageing affect individuals differently: not only do the person's history and genetic makeup lead to a specific expression of ageing in the person in question, but the level of everyday physical activity also plays a major role (Pauzié, 1989, 2000). It seems difficult to us to attribute an incapacity to drive safely to a person of a given age. In this sense (the current debate on the notion of a driving threshold based on age), Hakamies-Blomqvist (1994) points out that "there is no justifiable ethical and scientific field for limiting people from driving just because they have reached an arbitrarily defined age as being too high to be able to drive". Despite all this, the age of 65 is generally given as the age "limit" at which one becomes "aged" (Assailly, 1999). According to Hill and Boyle (2006), it is the age at which men change their driving behaviour, whereas women do so at age 55. These changes are notably characterised by avoiding "high risk" traffic conditions (Ball et al., 1998; Vance et al., 2006).

It has also been noted that, in terms of motor activity among elderly people, there is a limitation of upper body movement, which causes them to check their blind spots less (Bayam et al., 2005). Furthermore, physical abilities which decline over time alter joint suppleness, muscle strength, coordination and manual dexterity (Gonthier, 1995; Davidse, 2006). These age-related changes can influence the ability to get in and out of the car and to operate the vehicle, as well as affecting injuries and physical recovery (Sivak, 1995). We should point out that the reduction in manual dexterity can also interfere with driver assistance systems which require coordinated finger movements (Eby, 1999).

7.2.3.b Sensorial factors

The main component that may have an impact on elderly driving is the decline in their visual functions. The influence of hearing (Davidse, 2006) and proprioception (GRAME, 2002) is more rarely brought up. And yet, these functions are useful in driving. Hearing can fulfil the spatial localisation function. A sound coming from one side will arrive at each ear with a slightly different intensity and with a slight time delay between the two. These cues make it possible to determine the position of a source in space (Department for Transport, 2004). It should be pointed out that neurosensorial hearing loss increases from 4% between the ages of 31 and 50 to 17% between 51 and 70, reaching 62% after the age of 70 (Browning, 1998). This hearing loss mainly concerns high-frequency sounds. This leads to an alteration of spatial sensitivity to sounds (Arnold and Lang, 1995; Maycock, 1997) and may thus affect the ability to determine the origin of a sound (Stephens, 1982), such as an approaching vehicle. Moreover, sound data constitute an alarm system. It becomes harder for older drivers to filter distracting sounds (Maycock, 1997).

On the other hand, the importance of proprioception must not be forgotten, as it enables us to determine the position of our body segments in space and, by changing speeds, to accelerate and brake without having to look at our hands or feet. Proprioceptive information from the muscles in the lower limbs enables drivers not only to determine the position of their feet in relation to the pedals, but also to control movement in order to brake or accelerate the vehicle (GRAME, 2002). This characteristic of vehicle speed control can place elderly drivers in a delicate situation since ageing is accompanied by a progressive decline in the ability to detect and process sensorial data from the lower limbs. This could lead to an increase in reaction time (which is already slow among the elderly, Salthouse, 1993) in using the pedals and the adoption of a so-called "conservative" strategy consisting in raising the foot high above the pedal. Moreover, the elderly make more "back and forth" movements of their right foot between the brake and the accelerator pedals than young people, which can lead to errors in activating the pedals (GRAME, 2002).

Concerning vision, we can see that the alteration of visual acuity notably poses a problem in terms of perception of the driving environment (Sivak et al., 1981; Baker et al., 2003). For example, road signs are generally designed so that a person driving at the regulatory speed limit for a given type of road and whose vision corresponds to the legal minimum for driving (5/10 binocular visual acuity) will have enough time to make a decision and to react safely. If the driver's visual capacities are below this threshold, he will not be able to see the signs in time to react correctly (Department for Transport, 2001). Moreover, the field of vision decreases with age, producing an increased insensitivity to peripheral signals (Department for Transport, 2001). Some changes appear at this level before the age of 55, but the decline becomes dramatic after 75 (Wolf, 1967). This type of alteration can notably pose problems at intersections. Visual recovery after glare, the perception of movement, as well as common deficiencies such as cataracts, glaucoma, etc. are all factors that may cause difficulties when driving (Wood, 1995; Gonthier, 1995).

7.2.3.c Cognitive factors

According to Owsley et al. (1991), even a slight visual deficit has a serious impact on driving performances if it is combined with a cognitive deficit, such as attention deficit. Divided (or "shared") attention, for example, declines with age (Hakamies-Blomqvist, 1996). Yet it is of particular importance in driving, in the relation with the information systems present in the passenger compartment (Lamble et al., 1999) and in gathering non-priority information at intersections (Bayam et al., 2005). The focus of attention and sustained attention also decline over time (Parasuraman, 1991). Thus, selective attention appears to be the attention process that is most affected by age. This process is used to sort relevant information when performing a task (Gabaude, 2003). Extracting a piece of information from a frequently changing visual scene and using it to take a decision such as to execute a movement may be the most basic characteristic of the driving task (Department for Transport, 2001). According to Hasher and Zacks (1988), it is the process of inhibiting (controlling access and temporary holding in the memory) non-relevant information which declines with age. Now in a driving situation, there are many visual stimuli and the non-selection of relevant information may have negative repercussions on the driving activity.

It has been demonstrated that a long task causes slower reaction times and deficiencies in vigilance among all individuals, and notably among the elderly, (Department for Transport, 2001). This problem of sustained attention can arise in complex intersections with dense traffic, where two traffic flows have to be managed for a potentially long period of time (Department for Transport, 2001). Taking psychotropic drugs by the elderly can also have serious secondary effects, notably on vigilance. The relative risk of accidents related to a decrease in vigilance is therefore not negligible, and it increases in case of even a small intake of alcohol (Assailly, 1999).

The slow reaction times among the elderly are a well-known factor. According to Simms (1993), there are significant relationships between reaction time and errors in vehicle control. Slowness and imprecision in taking decisions and actions, notably when sudden events occur (Caird et al., 2005), can also play a role in elderly driving, principally when starting up in an intersection.

Most elderly drivers have a great deal of driving experience. This experience can make them rigid in foreseeing the situations they are going to encounter (Van Elslande and Alberton, 1997). If a new situation appears similar to a well-known situation (when in fact it is completely different and requires different actions), mental models will operate counterproductively (Davidse, 2006).

Lastly, we should point out that diseases related to ageing, such as dementia, have a negative influence which increases with age: the latter affects, among other things, episodic memory (Lundberg et al., 1998), visuospatial skills, attention and judgement skills (Angley, 2001).

Generally, ageing attenuates overall resources for processing the information needed to analyse and interpret sensorial information. Correctly analysing and reacting to the information can then become difficult for an elderly person involved in a complex traffic situation (Department for Transport, 2001).

7.2.3.d Compensatory mechanisms

In a word, these elements are mainly found in difficult situations in which it is necessary to manage complexity and unexpectedness. For the elderly, most of these situations correspond to intersections (Hakamies-Blomqvist, 1993; Daigneault, 2002) and left-turn situations[42] (ECMT, 2002). For these situations, most elderly people are legally responsible for their accidents (74.1% compared with 39% for the medium-aged population according to Hakamies-Blomqvist, 1993) in that they are generally do not have the right-of-way. But it should be pointed out that the elderly have fewer accidents when they have right-of-way and when they are alone (Van Elslande, 2003). This appears to come from the driving style among the elderly: when they drive, they adapt their behaviour to the sensorial, motor and cognitive alterations presented above.

Compensatory mechanisms then appear. According to Hakamies-Blomqvist (1994), compensatory strategies can be observed at two levels: an avoidance strategy and a compensation strategy. The avoidance strategy can be seen in their limiting their exposure to external difficult driving conditions, such as driving in unfavourable weather conditions (rain, storms, etc.), on poor roads, at night and/or at rush hour. Insofar as possible, elderly drivers also avoid any divergence in terms of routes and vehicles. Knowing what is going to happen in advance (by taking the same known routes, for example) gives them time to think and act, thus compensating for the mental and physical decline mentioned above (Davidse, 2006). It should be pointed out that elderly drivers appear able to resist the temptation to take risks induced by their personal state modified by alcohol, being in a hurry or in an unusual emotional state when driving (Hakamies-Blomqvist, 1994). The elderly thus appear more than the average to adopt defences against the human factors that can influence their temporary capacities. Elderly drivers are less likely to seek out strong sensations (Zuckerman, 1994) and they have less of a tendency to take the initiative in manoeuvres in risky driving situations.

The second type of strategies, the compensation strategies, consists in dealing with potentially risky driving conditions by adopting a specific behaviour. This can mainly be seen in a reduction in the chosen travel speed (Hakamies-Blomqvist, 1994; Davidse, 2006). Vehicle control movements become more sequential, reducing the mental load caused by complex road situations (for example at intersections: first looking both ways, deciding to cross, to accelerate, etc.) (Hakamies-Blomqvist, 1993). Whatever the age, less sequential and more simultaneous control is correlated with driving experience and performance. Thus, switching to more sequential control may indicate the individual's adoption of a compensatory mechanism to reduce the decline in performance (Assailly, 1999).

Elderly drivers also have less of a tendency to overtake other vehicles, to swerve and to break traffic laws (Hakamies-Blomqvist, 1994; Davidse, 2000). As mentioned above, another strategy consists in managing the accelerator and brake pedals by lifting the foot higher (GRAME, 2002). Driving experience can also compensate for certain aspects such as the alteration of vision, by decreasing the quantity of information needed for recognising an object (traffic signs, etc.) (Pauzié, 1989).

Compensatory mechanisms can therefore be a sign of an age-related change in the organisation of behavioural skills (Hakamies-Blomqvist, 1994). A more prudent driving style has a safety effect and enables elderly drivers to avoid a certain number of accidents that they would not be responsible for (Hakamies-Blomqvist, 1996). There may therefore be a bias concerning this notion since, in the cases of avoided accidents, elderly drivers are not in the accident files, which artificially inflates their rate of responsibility (ibid.). On the other hand, the accidents for which they have legal liability are mainly those for which the elderly person does not have the possibility of exercising any control on his environment's kinetic parameters (Van Elslande, 2003). In such situations, the compensatory mechanisms are no longer effective.

[42] Manoeuvre in which the direction is changed toward the left, for which it is necessary to cut through the vehicle flow driving in the opposite direction (so "left turn" accounts for country driving on the right side of the road).

Factors of decline due to ageing can therefore have an impact on automobile driving by elderly people. Compensatory mechanisms, however, enable users to avoid a large number of traffic accidents. It thus appears that the alteration of human functions may have an impact on driving but not so much on accidentality among elderly drivers. If these functions impairments only play a relative role in accidents among the elderly, we still need to understand the driving contexts and the difficulties facing the elderly for which these functions do not act suitably, and whose situations lead to accidents.

7.2.4 Specificities of the difficulties encountered by the elderly

The situation that appears to pose the greatest problem to elderly drivers – and more specifically to elderly women (Bishu *et al.*, 1991; Garber, Srinivasan, 1991) – is driving at intersections (especially without right-of-way) and left-turn situations. According to Hauer (1988), nearly 40% of deaths and 60% of injuries among drivers over the age of 64 come from accidents occurring at intersections. In left-turn accidents, the forces related to impact are strong, which increases the tendency for damage and injury (Caird and Hancock, 2002). And we know that the elderly are physically vulnerable.

Driving at intersections is a complex task requiring controlled speed. These two demands place elderly drivers in difficult situations. All complex tasks give rise to many possibilities for errors which can reduce safety. Depending on the geometry of the intersection (number of directions to be observed, visibility, usual traffic speed on the main road), the elderly driver has to adapt to different constraints. Harms (1991) demonstrated that the mental load of a driver approaching and crossing an intersection is very heavy.

Generally, the over-involvement of elderly drivers in accidents occurring at intersections may be due to a problem of slow decision-making (Van Elslande, 2003), a weakening of visual capacities, problems of neck stiffness (Fontaine, 2003) or errors in activating the pedals (GRAME, 2002). According to Hakamies-Blomqvist (1996), driving at intersections is a costly task on the perceptive level (detection of objects, perception of movement, estimation of one's own speed and of that of others), attention (divided attention between different directions, selecting and focusing on relevant information and, consequently, ignoring useless information), motor level (quickly, sequentially handling vehicle components while driving in a particular environment), and requires reflection on the interaction with other users (foreseeing the behaviour of other drivers and reacting foreseeably oneself). Age-related changes decrease, among other aspects, the field of vision and acuity, divided and selective attention and motricity. Moreover, the slow approach speed of elderly drivers at intersections can lead to an erroneous interpretation of an intention to respect the right-of-way.

According to De Raedt and Ponjaert-Kristoffersen (2001), the cognitive functions at work at intersections depend on the type of accident: accidents in which the elderly driver collides with a vehicle with right-of-way coming from the right can mainly be connected with the decline in visual sweep and attention in the periphery of the field of vision (Ball *et al.*, 1993). On the other hand, accidents in which the elderly driver, starting off from a full stop, collides with a moving vehicle (left turns, for example) can be linked to more dynamic and more cognitive components of perception: estimating speeds, movements and distances, or the memory of past experiences (Guerrier *et al.*, 1999).

Concerning left-turn accidents among elderly drivers, and notably the influence of gender on left-turn accidentality, there is little, sometimes obscure, literature. On the one hand, Caird and Hancock (2002) assert that men (independently of age) are more frequently involved than women in LT situations. And on the other, Guerrier *et al.* (1999) claim that that elderly women have more left-turn difficulties than all other groups of users. Concerning the environmental context, the risk is higher in rural areas (2.6 times higher than for other drivers) than in urban areas (1.3 times higher) (Caird and Hancock, 2002). The problem in these situations would be more closely related to attention and perception than to decision-making processes (Hakamies-Blomqvist, 1994). According to Detweiler *et al.* (1996), working memory plays an important role in left-turn situations: waiting to perform a left turn involves processing, stocking and retrieving information and making a decision based on information that is constantly changing, such information being gathered from the surrounding traffic and supplied by the driver's vehicle. Working memory plays an important role in the selection of suitable vehicular gaps through its direct effect on decision-making time. Consequently, drivers who have weak working memory (the case of the elderly) are unable to gather and store relevant information, make urgent decisions (which means that the decision-making time is shorter) and choose smaller merging gaps than they should: to make a successful turn, the driver must find a suitable traffic merger gap, manoeuvre to place the vehicle in this gap and accelerate to the suitable speed (Guerrier *et al.*, 1999; Caird and Hancock, 2002). Foresight is thus a major component in "correctly" managing a left-turn: you have to foresee the decelerations and accelerations of other vehicles as well as foreseeing the arrival of other vehicles and pedestrian movements (Caird *et al.*, 2002). At the end of the day, the problem could also come from the organisation and speed of the resulting cognitive and motor actions (Keskinen *et al.*, 1998). According to Caird and Hancock (2002), benefiting from more time for making the decision to undertake a left-turn should reduce the risk of accident. The question of time pressure thus arises in intersection situations, and more specifically during left-turn manoeuvres.

Accidents at intersections generally involve several vehicles. The difficulties described above flow directly from the question of a specific interaction between different age groups. This may come from the fact that elderly drivers cannot control the driving speed of others, nor the speed with which intersection situations may change (Moore *et al.*, 1982). The higher left-turn accident rates among elderly drivers mainly correspond to collisions with young drivers (ages 17-19) and with other elderly drivers (over the age of 65). Concerning interaction with young people, we can speak of a conflict of generations between the elderly and young drivers. In fact, there is a difference in their attitudes: elderly drivers are careful and slow, whereas young drivers are intrepid and fast. For example, if a young driver is approaching while an elderly person seeks to turn left, a potentially dangerous combination with a very low margin of safety is created (Keskinen *et al.*, 1998).

Furthermore, the presence of passengers increases the risk of accidents among elderly drivers, except during night-time driving (Bayam *et al.*, 2005). According to Yaw Cheuk Hing *et al.* (2003), this is true for those over the age of 75; it appears that night-time driving is seen as being risky and leads the passengers to help the driver in his task. On the other hand, when the driver is over the age of 65 and male passengers are present, we observe more single-vehicle and liability accidents, which suggests the possibility of more risky behaviour due to subjective pressure related to the presence of their peers in the passenger compartment (Yaw Cheuk Hing *et al.*, 2003).

Lastly, we should point our that accidents among the elderly appear to be felt as occurring more suddenly than for other users, in that few actions are undertaken to avoid the accident (only 26.8% of elderly drivers attempt an accident avoidance action, compared with 55.4% for those between the ages of 26 and 40) (Hakamies-Blomqvist, 1993). This does not come from their slower reaction time since, with a bit more time, there is no more accident avoidance (Welford, 1980; Summala and Koivisto, 1990). This appears more to come from the slowness of elderly drivers' ability to grasp their driving environment.

In relation to all of these questions, the interest of Detailed Accident Studies and error analysis lies in that they provide an in-depth understanding of the specificities of driving and accidentality among the elderly. The analysis carried out at INRETS is thus based on specific, consequential qualitative data which will enable us to study elderly drivers and to compare this population with other road users.

7.2.5 Summary

To summarize, it should be pointed out the following key ideas:

- In Europe over the next 30 years, a 40% increase in people over 65 is expected and, at the same time, the elderly may continue to drive actively longer than before.
- The notion of 'excess risk'- often mentioned about elderly – is subjective. That's why it is prefered speaking in terms of "different risks" for elderly drivers.
- Some pathologies linked with age can impair driving behaviours and accident occurring.

- But ageing is a normal process. It corresponds to a progressive alteration of human functions which is liable to have effects on driving and accident occurring. Age can affect human functions at different levels:
  - The motor level - The limitation of upper body movement may prevent elderly drivers from checking their blind spots. The decline of physical abilities alters joint suppleness, muscle strength, coordination and manual dexterity. Consequently, it can affect the control of the vehicle, but also the level of injuries and physical recovery.
  - The sensorial level - The decline in visual functions is the main component of sensorial decline, particularly in terms of visual acuity, field of vision, visual recovery after glare, and perception of movement (this elements may pose problems in terms of perception of the driving environment). The decline of hearing and proprioception can also have effects on driving.
  - The cognitive level: attention processes are affected by age, with the decline of divided attention, sustained attention, and selective attention. Characteristics as slowness and imprecision in taking decisions and actions are also quite typical in elderly drivers. Generally speaking, ageing lessens overall resources needed for information processing.
- Elderly people use compensatory strategies to prevent the effects of age on their driving behaviour. Compensatory strategies can be observed at two levels:
  - The avoidance strategy: elderly limit their exposure to external difficult driving conditions, such as driving in unfavourable weather conditions (rain, storms, etc.), on weak roads, at night and/or at rush hour, and avoid changing in terms of routes and vehicles.
  - The compensation strategy: elderly adopt a specific behaviour when dealing with potentially risky driving conditions. This can mainly be seen in a reduction in the chosen travel speed, and the fewer tendencies to overtake other vehicles, to swerve and to break traffic laws.
- Compensatory strategies have a safety effect on driving, leading to more cautious driving style. But, in situations where the elderly does not have the possibility of exercising any control on his environment's kinetic parameters, these compensatory mechanisms are no longer effective.
- The situation that appears to pose the greatest problem to elderly drivers (and more specifically to elderly women) is driving at intersections, especially without right-of-way, and left-turn situations. This situation requires, at the same time, capacities at perceptive, attention, and motor levels; and is dependant on the interaction with other users.
- Concerning the environmental context, the risk of elderly road users' accidents is higher in rural areas (2.6 times higher than for other drivers) than in urban areas (1.3 times higher).
- The presence of passengers is considered to increase the risk of accidents among elderly drivers, except during night-time driving.
- Accidents among the elderly appear to be felt as occurring more suddenly than for other users, in that few actions are undertaken to avoid the accident (only 26.8% of elderly drivers attempt an accident avoidance action, compared with 55.4% for those between the ages of 26 and 40).

A comprehensive analysis of a broad descriptive database should bring more insights and more integrated results on the conditions in which accident are met by elderly road users.

7.3 Descriptive analysis

In this section, accidents among road users are looked into as a function of 'Age'. The question that will be studied throughout this section is the following: what differences can be observed between accidents involving road users of 65 years and over and those under 65 years, using the data found in national statistical files?

This descriptive analysis of national data constitutes an extension of the points raised in the literature review. And it will pave the way toward the essential questions that need to be understood using 'in-depth' detailed analysis of accident data.

7.3.1 Available data

7.3.1.a Period of data

Data considered in this task are concerned to years 2001 to 2004.

7.3.1.b Accidents considered in the study

The results below deal with the descriptive analysis of the risk of dying or of being hurt in a road accident as a driver or a pedestrian, comparing the accidents of users over 65 years with the accidents of users under 65.

7.3.1.c Involved countries and covered geographical area

Euro-25 level data were provided by Eurostat databases, allowing stating the general facts. The more precise data from 7 European countries were:

Country	Database	Data provider	Covered area
France	BAAC	LAB	Whole France
Germany	OGPAS	BASt	The data relate to the entire territory of the Federal Republic of Germany since 3 October 1990
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 7.A.1.-National database description for elderly people accidents.

Australia also was considered to obtain information from the national accident bases of each country, allowing a deeper analysis of the age question as regard to accidents. It is necessary to consider in this study the numerous disparities which exist in the various national databases. For example, it should be pointed out that an uninjured driver may be counted in the databases when one of his passengers is injured or killed (the case in France, Italy, Greece and Australia). A footnote will be specified if the uninjured are included in the injured category.

7.3.2 Analysis and methodologies

An important point to remember all along the results presented below is that the data dealt with in **this task only concern drivers** (of any kind of vehicles, i.e. including PTW and bicycles) **and pedestrians, excluding passengers**. The purpose of it is to analyse the specificity of the people involved who take a real part in the accident process, and not those who are passive in the situation and for who the involvement in an accident can be considered as a secondary consequence. These drivers and pedestrians studied will be considered as '**effective road users'**.

Below the distribution of these drivers and pedestrians involved in accidents according to different variables (modes of travel, road conditions, types of roads, reasons for travel, manoeuvres undertaken, etc.) will be observed so as to shed light on the particularities which may distinguish elderly and younger from the point of view of accidents in which these two sub-populations of road users are involved.

7.3.3 Results for Elderly people

7.3.3.a General data

Distribution of over 65 years in the European population

At the Europe-25 level, the percentage of the over 65 years represents 16.5% of the overall population (Eurostat).

Depending on the country considered, this part of over 65 years represents between 13.7% (Czech Republic) and 19.0% (Italy). In Australia, the over 65 years corresponds to 13.2% of the population (Figure 7.A.1).

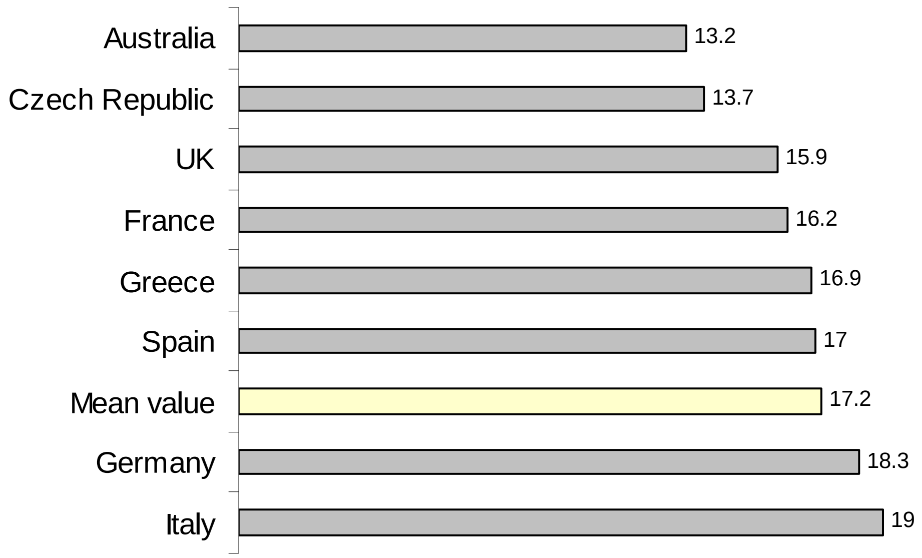

Figure 7.A.1.-Proportion of over 65 years in the population by country [43].

The part of the women over 65 years in the population is more important than the part of the men of the same age, in all the countries below (Table 7.A.2).

	Male	Female
France	6.6	9.6
Greece	7.6	9.3
Italy	7.8	11.2
Spain	7.2	9.8
GB	6.7	9.2
Australia	5.8	7.4

Table 7.A.2.-Proportion of male and female over 65 years by country.

[43] "Mean value" accounts for the European countries listed in the graph.

Proportion of over 65 years road users injured on the road

Over 65 years represent 7.3% of users injured on the road (Table 1, Annex2.5). This proportion is the most important in Greece and in France (respectively 10.5% and 8.1%) and the weakest for the Great Britain (6.1%).

The relative rate of injury is less important for users over 65 years (between 0.33 in Italy and 0.62 in Greece) than for users under 65 years.

Table 2 (Annex2.5), shows that whatever the considered country, the proportion of elderly women injured in road accidents is always higher than the proportion of elderly men (6.6% for male vs. 8.5% for female).

Proportion of over 65 years road users killed on the road

In the European countries detailed in Table 3 (Annex2.5), between 2001 and 2004, the users over 65 years represent 18.0% of the killed on the road. This proportion is the most important in Italy and Greece and the weakest in Spain.

The relative rate of road users over 65 years killed on the road is more elevated than the one of less than 65 years, in all the countries (1.06 in France and 1.35 in Czech Republic). Spain is an exception with a relative rate of 0.90. This rate is the highest in Australia: 1.38 (Table 3 in Annex2.5). Table 4 (Annex2.5) shows, as for injured people, that the proportion of women over 65 who died in an accident is higher than the same proportion for men (between 1.8 and 2.3 times more).

Conclusion on general data

Users of over 65 years represent 17.2% of the population and 18.0% of killed road users. That is a relative rate of 1.05. The proportion of accidents resulting in fatalities or injuries is higher for women over 65 years (between 1.8 and 2.3 times more) than for male of the same age bracket.

7.3.3.b Modes of travel

Distribution of injured road users by age as a function of the mode of travel

Whatever the age, the most injured road users are car drivers (Table 7.A.3). This result seems obvious considering the more important share in traffic for this type of vehicle.

	Under 65 years	65 and +
Car	**56.7**	**50.3**
Goods road vehicle	4.5	1.2
Motorcycle	9.9	1.7
Moped	7.3	2.7
Bicycle	10.3	16.2
Motor-coach bus	0.5	0.1
Pedestrian	**9.9**	**26.6**
Other	0.9	1.2
Total	100.0	100.0

Table 7.A.3.-Distribution of injured road users by age and mode of travel, between 2001 and 2004.

On the other hand, users of over 65 years are injured 2.7 times more in an accident as pedestrians that those of under 65 years (χ^2=266.4; $p<0.05$). They are also injured 1.6 times more in an accident as riders of bicycles than those under 65 years (χ^2=95.9). In compensation, they are 5.8 times less injured in an accident as a motorcycle rider than people aged under 65 (χ^2=141.6).

Distribution of killed road users by age as a function of the mode of travel

The analysis over the table below (Table 7.A.4) shows the distribution of fatalities of every age bracket according to the mode of travel.

	Under 65 years	65 and +
Car	53.0	37.5
Goods road vehicle	5.3	1.3
Motorcycle	**18.3**	**1.2**
Moped	4.8	3.2
Bicycle	**5.0**	**12.9**
Motor-coach bus	0.1	0.0
Pedestrian	**12.7**	**41.9**
Other	0.8	2.0
Total	100.0	100.0

Table 7.A.4.-Distribution of killed road users by age and mode of travel, between 2001 and 2004.

Road users over 65 years die in 41.9% of cases as pedestrians, against 12.7% for road users under 65 years, i.e. 3.3 times more. They are also 2.6 times more killed as cyclists. But, in compensation they are 15.3 times less killed as motorcyclists and 1.4 times less as car drivers.

Without referring to exposure data, it can be supposed that people over 65 years are more often pedestrian and cyclists, and a little less often drivers of cars and motorcycles, than people under 65 years.

If the distribution of pedestrians' fatalities according to gender' is studied (Table 7.A.5), it is observed that 30.5% of the male road users over 65 years killed on the road were pedestrians, vs. 11.0% for less than 65 years (2.8 times less). For women, 65.3% over 65 years killed on the road were pedestrians, vs. 21.2% for less than 65 years (3.1 times more).

	Under 65 years	65 and +
Male	11.0	**30.5**
Female	21.2	**65.3**
Both	12.7	41.9

Table 7.A.5.-Proportion of pedestrians' fatalities as a function of age and gender, between 2001 and 2004.

Taking into account the gender and the distribution by country (Table 5 in Annex2.5), it is observed that 100% of women over 65 years who died in Greece in a car accident were pedestrians (i.e.: never as a driver)[44].

As the population pyramid of the drivers' ages varies according to countries (Figure 7.A.1), it can be assumed that old drivers are slightly more represented in France or in Germany than in Greece; so exposure is certainly different according to the countries.

Besides, it is interesting to note that, whatever the country, the users who died the most as pedestrians in road accidents were aged over 65 years, and with a percentage always more important for women.

[44] As stated earlier, only 'effective' road users' are considered in this analysis (no passengers).

More than a woman out two who died in an accident as an effective road user was a pedestrian (between 55.7% in France and 100% in Greece).

The analysis of the distribution of the fatalities for every mode of travel as a function of age and gender is shown in Table 6 (Annex2.5). The results show that 42.3% of the pedestrians killed in a road accident were over 65 years old. It is particularly the case of women for who 57.9% of the pedestrians killed in a road accident were over 65 years old, versus 42.1% for women under 65 years. 36.5% of the cyclists killed in a road accident were more than 65 years old.

When looking at the percentage of fatalities of road users over 65 as a function of mode of travel and country (Table 7 in Annex2.5), it is seen that, according to the country, between 34.2% (Czech Republic) and 60.8% (Italy) of pedestrians killed in a road accident were over 65 years old.

This population represent 48.8% of people killed in "moped" in Czech Republic, which is 1.8 times more than in Germany and 7.4 times more than in France.

The effective road users over 65 also represent an important part of effective road users killed in bicycle: between 19.0% in Great Britain and 57.3% in Italy.

Conclusion on age and modes of travel

- 27.3% of road users over 65 years involved in a road accident are pedestrians; that are 2.7 times more than users under 65 years.
- 41.9% of road users over 65 years killed on the road are pedestrians, against 12.7% for users under 65 years.
- 42.3% of the pedestrians killed in a road accident were more than 65 years old.
- Effective road users over 65 years represent an important part of those killed on bicycle: between 19.0% in Great Britain and 57.3% in Italy.

In conclusion, two modes of travel are at risk for effective road users over 65 years: walking and cycling.

7.3.3.c Type of road

Users over 65 years are globally more likely to be accidented (injured or killed) in urban zone that those under 65 years (68.0% vs. 66.9% for the injured and 47.2% vs. 26.4% for the fatalities). Consequently to these results, the under 65 have more fatal accidents in the rural areas than the elderly (63.8% vs. 47.1%) and on motorway (9.7% vs. 5.7%) (see below Table 7.A.6) .

	Injured		Killed	
	Under 65 years	**65 and +**	**Under 65 years**	**65 and +**
Urban	66,9	**68,0**	26,4	**47,2**
Rural	26,7	25,8	**63,8**	47,1
Motorways	6,5	6,2	**9,7**	5,7
Total	100,0	100,0	100,0	100,0

Table 7.A.6.-Distribution of road users, injured and killed, as a function of age and type of road between 2001 and 2004.

Distribution of injured road users by age as a function of the type of road

The proportion of users over 65 years injured (Table 7.A.7) in an accident in urban zone is the strongest in Italy, with 93.4 %.

	Under 65 years			Over 65 years		
	Urban	**Rural**	**Motorways**	**Urban**	**Rural**	**Motorways**
France	69,6	23,4	6,9	70,1	26,0	3,9
Italy	91,6	6,9	1,5	**93,4**	5,9	0,7
Greece	81,7	15,5	2,9	80,8	17,3	1,9
GB	70,5	25,3	4,2	73,0	24,4	2,5
Czech Rep.	62,4	36,1	1,5	79,6	20,0	0,5
Germany	62,9	30,5	6,7	73,0	23,3	3,7
Spain	14,3	65,2	20,5	30,3	59,4	10,2
Mean value	**66,9**	**26,7**	**6,5**	**68,0**	**25,8**	**6,2**
Australia	71,8	23,1	5,1	67,7	29,6	2,7

Table 7.A.7.-Distribution of injured road users as a function of age, type of road and country, between 2001 and 2004.

Spain is different from the others European countries. The proportion of injured road users over 65 years in urban zone is indeed weak: 30.3 %. In turn, the proportion of injured road users over 65 years in rural zone is very important as regard to the other countries: 59.4 %.

Distribution of injured road users by age as a function of the type of road

In the studied countries, 47.2% of killed elderly road users (**Erreur ! Source du renvoi introuvable.**) died in urban zone vs. 26.4% for users less than 65 years (that is 1.8 times more). In compensation, the effective road users over 65 years are 1.4 times less killed in rural zone and 1.7 times less killed on highway than users under 65 years.

	Under 65 years			65 years and older		
	Urban	**Rural**	**Motorways**	**Urban**	**Rural**	**Motorways**
France	26,8	66,7	6,5	41,6	54,9	3,5
Italy	59,8	33,5	6,7	76,6	23,0	0,4
Greece	48,0	44,8	7,1	56,1	41,7	2,2
GB	37,4	56,7	5,9	62,6	35,9	1,5
Czech Rep.	37,1	59,7	3,2	66,6	32,4	1,0
Germany	20,9	67,5	11,7	53,6	42,5	3,8
Spain	14,3	65,2	20,5	30,3	59,4	10,2
Mean value	**26,4**	**63,8**	**9,7**	**47,2**	**47,1**	**5,7**
Australia	40,6	52,6	6,8	52,1	44,6	3,3

Table 7.A.8.-Distribution of killed road users by age, type of network and country, between 2001 and 2004.

In 5 out of 7 countries, killed road users proportion of over 65 years is more important in urban zone than in rural zone (from 1.3 times in Greece and Germany up to 3.3 times in Italy). Only France and Spain are different from the other countries with respectively 54.9% and 59.4% of killed road users in rural zone.

Let us note that only 5.7% of the users killed in European countries died on motorway, 3.3% of them in Australia. It is in Spain, in France and in Germany that this proportion is the strongest: 10.2%, 3.5% and 3.8% respectively.

Two hypotheses can be advanced to justify such an over-representation of over 65 years in the accidents occurring in urban zone: on the one hand the presence of intersections in city which are accident-liable situations for over 65 years; and on the other hand, road users over 65 years are particularly vulnerable as pedestrians, pedestrians who circulate particularly in urban zone.

Some assumptions can also be made to explain the observed differences between the various countries:

- Accident recording procedures can be different in every country.
- Distribution of kilometres of road according to the type of network in every country can be very different and thus lead to a different risk exposure according to the type of road, depending on the country.

Conclusion on age and type of road

- Effective road users over 65 years are globally more likely to be injured (68.0% vs. 66.9%) or killed (47.2% vs. 26.4%) in urban zone that those under 65 years.
- Except in Spain, this trend is true for all the European countries for which the information were available.

7.3.3.d Time of day

In Table 8 (Annex2.5) and Table 9 (Annex2.5), the results show that the elderly are 0.6 times less injured and 0.5 times less killed than the younger in the accidents happening during darkness. On the other hand, the effective road users of over 65 years are 1.2 times and 1.4 times more injured and killed respectively during daytime than the under 65 years.

As stated by Hakamies-Blomqvist (1994), this tendency can be related to compensatory strategies and more precisely to avoidance strategy that can be seen in the elderly limiting their exposure to external difficult driving conditions (as driving at night).

Accidents at dawn or dusk are the less represented and vary weakly according to age. Younger users are more injured or killed under these light conditions than the users over 65 years (respectively 3.9% vs. 3,1% for the injured road users and 5.1% vs. 3.5% for the killed ones). The same tendencies are found whatever the European country.

To conclude, it can be said that 'Elderly users are more injured of killed at daytime, this being as hypothesised above the result of an avoidance strategy (i.e.: limiting their exposure to external difficult driving conditions, as driving at night)'.

7.3.3.e Road conditions

Concerning the road conditions (Table 10 and Table 11 in Annex2.5), the users over 65 years are more injured and killed in accidents on dry road than the younger (78.4% versus 74,5% for the injured and 75.3% versus 73.3% for the killed). At the contrary, they are less involved in accidents happening on wet/snowy/slippery roads (21.5% vs. 25.5% for the injured road users and 24.6% vs. 26.8% for the fatalities). As for the time of the day, the strategy of avoidance mechanisms can be put forward (Hakamies-Blomqvist, 1994).

For the injured users, Greece is the only country where the distribution is more or less the same between the under and the over 65 years.

Concerning fatalities, differences between countries can be noted. In France, Greece, Czech Republic, Spain and Australia, the elderly are more often killed when the road is dry and at the contrary less often killed under 'wet road' condition. This trend is inverted for countries as Italy and GB.

To conclude, it can be said that for the elderly injured or killed, the majority of accidents happens on dry roads.

7.3.3.f Reason for travel

Data are only available for three countries: France, Greece and Spain. This lack of data shall not permit us to distinguish between injured and killed road users. The results (Annex2.5 in Table 12) are then referring to all road users accidented.

Additionally, much of the data categorised as 'others', at least for Greece, leads us to presume certain fragility in this variable.

As expected, the French effective users over 65 years are not concerned by accidents motivated by home/work-school journey (0.8%) or professional use (1.1%). On the opposite, elderly have 1.5 times more accidents during leisure journey. However those results do not apply in Greece and Spain. In Spain, the over 65 years are even more accidented on professional journey than the younger (32.7% vs. 17.8% respectively, that is 1.8 times more).

To conclude, drawing a conclusion from the reasons for travel is a difficult exercise as a small amount of information is available on this subject. Moreover, the results obtained from 3 countries do not behave in the same way.

7.3.3.g Type of accident

As shown in

Table 13 (Annex2.5), most of the injuries happening in the seven European countries are related to 'Two vehicles' accidents (more than 60% whatever the age of the users). Globally, the over 65 years users are especially concern by injuries due to car and pedestrian collision, whereas they are under-represented for the other types of accidents.

Attention should be brought on the Spanish percentage of car and pedestrian collisions: 45.7% of elderly are involved in those types of accidents, this result being 4.6 times more important than for the under 65 years. On the other hand, only 38.7% of the over 65 years are concerned by the other types of collisions which is far less than for the other countries (Germany: 72.6%, Czech Republic: 72.0%...). These particular results bring into light the need for clear definitions of those variables among countries.

For the fatalities (Table 14 in Annex2.5), the most represented accidents are those involving 2 vehicles but the proportion of under 65 years users is nevertheless important in the 'Single vehicle' accidents (44.6%of killed users vs. 39.5% for those killed in 'Single vehicle' accidents).

As for the injured users, the proportion of fatal accidents involving a car and a pedestrian is more important for the elderly than for the younger. However, the percentage of over 65 years involved in 'Two vehicles' accidents is the highest and is even more important than for the under 65 years (50.4% for the elderly, 44.6% for the younger).

Concerning the 'Multiple collision', for the injured as for the killed users, the proportion of the under of 65 years is always more important than the one of the over 65 years (except for the persons injured in GB).

To conclude, elderly effective users are concerned by accidents involving 'Two vehicles' and 'One vehicle and a pedestrian'. This last result is especially true for their fatal accidents.

7.3.3.h Pre-accident manoeuvres

Information on pre-accident manoeuvres is not available in the German, Greek and Czech databases.

Furthermore, the Spanish and Australian data do not distinguish between right-of-way and non right-of-way cases in intersections; they are grouped into a single category (intersection) (Table 15 and Table 16 in Annex2.5).

Given the wide differences between the various countries' databases, it is not felt that any comparison between countries is possible for this variable. It is interesting, however, to compare the differences between young and elderly drivers in each country.

Whether they are killed or injured, elderly drivers are more involved during the undertaking of specific manoeuvres or in accidents occurring at intersection than the younger. The last is especially true when those drivers do not have the right-of-way (for the countries in which this information is available). This trend is even more important in fatal accidents (Table 16 in Annex2.5) in which elderly road users are involved between 2.8 and 4.7 times more than the younger.

As a conclusion, it can be noted that elderly road users are especially concerned by accidents at intersection, with a special mention to the 'give-way' situations.

7.3.3.i Type of collision

Despite the lack of data (Germany, Greece and Spain), a certain homogeneity can be observed in Table 17 and Table 18 (Annex2.5). The first result observed for this variable is the large distribution of drivers in the 'Frontal accident' category. This is true for all types of road users (under and over 65) and countries.

But when compared to the young ones, the elderly road users are mainly injured in lateral accidents (Table 17 in Annex2.5: between 1.2 and 1.6 times more) in all the countries described, except for UK where the rear accidents are over represented.

In fatal accidents (Table 18 in Annex2.5) the distribution, by comparison to the young age bracket, is also important in the 'Lateral' category but it appears that a lot of elderly users are concerned by rear accidents. They are 1.4 to 1.6 times more involved in this type of crash than the under 65 years old. This trend is observed in half of the European countries available (France and UK).

To conclude, elderly drivers seem more prone to be involved in lateral and rear crashes. The first result is coherent with what has been found in the previous paragraph, i.e. the lateral crashes being more likely to occur at intersection.

7.3.3.j Day of the accident

In Table 19 and Table 20 (Annex2.5) it can be observed that whatever the age of the users, their accidents (fatal and others) occur mainly during the week (nearly 75% of the whole accidents). This trend is homogeneous from a country to another.

When compared to the users under 65 years old, it appears that the elderly drivers have more accidents during the week. The ratio is slightly different for the injured individuals (1.1 times) and a little bit more for the ones killed (1.2 times).

As noted earlier, exposure data on this particular aspect of accidents should enlighten such results.

7.3.4 Conclusions: Elderly people Issues statistical trends

Some general conclusions can be drawn from the statistical section:

- Depending on the degree of severity of the casualty, the elderly road users are more or less prone to be involved in accident. Indeed, we observe that the relative rate of injury is less important (between 0.33 and 0.62 times less) for users over 65 than for the younger. Inversely, we find that elderly users are more concerned by fatal accidents than the young ones.
- Those accidents occur mainly for car elderly car drivers. But over 65 years old users are also identified more often than younger in crashes involving bicycles and pedestrians. This last result is true for injury as well as fatal accidents. A special mention can be brought on female pedestrians who seem to be the most represented category.
- Effective road users over 65 years are globally more likely to be injured (68% vs. 66.9%) or killed (47.2% vs. 26.4%) in urban zone than those under 65 years old.
- Elderly users are more injured of killed at daytime, during the week and on dry roads, this being as hypothesised above the result of an avoidance strategy (i.e.: limiting their exposure to external difficult driving conditions, as driving at night).
- When looking at accidents configurations, several parameters seem to go toward the same direction: the seniors' accidents usually involve 'Two vehicles' or 'One vehicle and a pedestrian'; they are occurring mainly at intersection and more precisely when not having the right-of-way; at last, lateral - and rear - collisions are over represented in the data when compared to the younger users' crashes. All those trends are even more important when the results come to fatalities.

7.3.5 Conclusions: Elderly people in Traffic Accidents

Such a descriptive analysis over different quantitative national databases is both fruitful and not easy. It allows getting an accurate 'map' of the conditions under which effective road users are involved, injured or killed in an accident. Such results can be then further investigated through exposure data and in-depth accident analysis. So it is the case for the role of age and gender variables, for which it is needed to know more regarding their intervention in accident occurrence, beyond their descriptive statistical figures.

7.3.6 References

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B.- Gender issues in Traffic Accidents

7.4 Introduction

Driving an automobile is an activity mainly performed by men, but also – increasingly – by women. There are differences in terms of miles driven and accident rates depending on gender: women less frequently have driving licences, drive less and have fewer accidents than men. These elements appear to be at the origin of a least study of driving activities among women compared to men (Wylie, 1995).

Do these differences in driving and accident rates mean differences in driving depending on gender? If this is the case, what are these differences and where do they come from? Are there accident-causing characteristics related to each sex?

To answer these questions, this study was based on six lines of investigation: first of all, the driving characters of both sexes will be analysed; then the characteristics of accidents by driver gender will be examined; a certain number of variables will be looked at characterising exposure to risk by the two groups, then the influence of age on driving behaviours and accidents. It will be finished with a few words on physiological characteristics, as well as sociocultural aspects, which in the literature show a difference in driving and accidents depending on gender.

7.5 Main outcomes of the literature review

7.5.1 Gender and driving

Driving behaviour among women has changed in the last few decades. The proportion of women with driving licences has increased rapidly in industrialised countries, for example in the United Kingdom with an 83% increase in 20 years (the proportion rising from 30% in 1976 to 55% in 1996) or Finland with a 65% increase in 17 years (the proportion rising from 38% in 1980 to 63% in 1997) (Laapotti & Keskinen, 2004). The proportion of men with driving licences appears to have reached a peak (80%) from which there is a progressive rebalancing (McKenna et al., 1998; Meadows & Stradling, 1999). In France, the rate of driving licences among women has more than doubled in 25 years (CERTU, 2005). In 1974, 50% of French adults had licences; in 1999, this proportion had risen to 84%: it increased 1.3 times for men compared with 2.4 times for women. The share of kilometres driven by women also increased by 30% in 12 years (between 1982 and 1994), and the number of regular or occasional female drivers increased by 13% during the same period (Fontaine & Hubert, 1997). All studies thus agree that women drive more and more in most industrialised countries (Cerrelli, 1994; Massie et al., 1995; Laapotti et al., 2002; Mayhew et al., 2003).

According to Rosenbloom (1996), there have been major changes in the social role of women in the last few decades, which have affected their use of private vehicles. The progression of female activities, and more notably female employment, according to Hu and Young (1999) and CERTU (2005), constitutes one of the major changes since the 1960s in all European countries. Business travel by women tripled between 1977 and 1995 (Mallett, 1999), and women who work have a greater need for a car, both for going to work and to be able to combine their work with childcare and other household duties (Department for Transport, 2005).

Thus, today nearly one driver out of two is a woman, most of them young (60% are under the age of 45) and working (CERTU, 2005). And yet, it is among older women, with the renewal of generations, that access to cars through holding a driving licence has progressed the most in recent times (CERTU, 2005). For those in the 50-64 age group, it can be observed a 23% increase in the rate of driving licences among women between 1992 and 2002 (compared with just 1% among men), and this increase reaches 48% for women over the age of 65 (compared with 6% for men) (EMD, 2002).

Women have therefore been driving more over the last few decades. The gap in driving rates between men and women has thus tended to decrease. Men, however, still drive more kilometres than women: they drive 26km a day on average compared with 10 km for women, and spend more time than women in their cars (66 min vs. 58 min, respectively) (INRETS, 2001; CETE, 2002; Cedersund & Lewin 2005; Department for Transport, 2005). According to the SOFRES study (1998) in France, men drove 14,447km a year compared with 12,757km for women, or 13% more. Greater annual kilometrage combined with a higher number of licensed drivers lead to greater exposure to potential accidents for men compared with women (SIRC, 2004). But is there a gender-dependent difference in accident rates?

7.5.2 Gender and Accidents

According to Özkan and Lajunen (2006), gender – here, being a man – is a predictable variable for the number of accidents. Most gender studies (Europe, USA, etc.) show that men have higher accident rates than women. It would be interesting to take into account exposure variables to find out whether this over-representation corresponds to an excess risk. This gender difference is notably marked in the population under the age of 25, but also among elderly drivers (Evans, 1991; McKenna et al., 1998; Abdel-Aty & Abdelwahab, 2000; Waylen & McKenna, 2002). Only Kweon & Kockelman (2003) moderate these statements by asserting that, for all types of vehicles, there is no great difference in accident rates between men and women in the same age cohort. Drummond and Yeo (1992) assert that women are more often victims of bodily injury accidents[45] than men (34% higher rate of involvement). Laapotti and Keskinen (2004) point out that the results on the evolution of gender-related differences in traffic accidents are mixed: on the one hand, Forward et al. (1998) claim that the differences between men and women have decreased over time, women's attitudes and behaviours have become similar to men's; on the other, McKenna et al. (1998) think that, despite the fact that there has been a massive change in the female driving population, there is little proof that gender differences in accident diagrams have changed over time.

More particularly concerning non-fatal accidents, women run more of a risk of being injured than men. But this difference is exclusively explained by the number of accidents with minor injuries (corresponding to 49% of accidents leading to injuries among women vs. 31% for men) (Department for Transport, 2005). Moreover, according to these same authors, women have slightly fewer accidents without injuries than accidents with injuries (approximately 47% vs. 65% for men). According to Dobson et al. (1999), most accidents involving women only cause property damage.

Conversely, it can be seen an over-representation of men in traffic accidents leading to death, compared with women: in France since 1970, women have accounted for approximately one-quarter of fatalities in traffic accidents (Chiron et al., 2006). According to these same authors, one out of six drivers killed was a woman, which confirms that the risk of death for men in a traffic accident is greater than for women (significantly for drivers and pedestrians) (Martin et al., 2004). Men die more often as drivers than women: in Europe in 2003, among the men killed in traffic accidents, 73% were drivers (vs. 36% for women), 15% were passengers (vs. 42% for women) and 12% were pedestrians (vs. 22% for women) (SAFETYNET, 2005).

There are also differences in the evolution of fatalities as a function of gender. Some authors in fact assert that men have more and more fatal accidents: according to Martin et al. (2004), traffic fatalities among men have increased in recent years, as the incidence ratio[46] has increased from 2.7 in 1996 to 3.1 in 2001. Other authors, such as Mayhew et al. (2003), claim the opposite: the increase is greater for female drivers, with a rise in the number of traffic fatalities of 60% between 1975 and 1998 (vs. a 10%

[45] A bodily injury accident is defined as an accident causing injury or death.

[46] Fatalities among men / fatalities among women

drop for men). Attewell (1998) nuances these different claims by asserting that, depending on the distance covered, there is no gender difference in fatalities[47].

Thus, men drive more kilometres than women, have more accidents (notably fatal), while women are driving more and more and have more accidents causing minor injuries. According to Laapotti & Keskinen (2004), the evolution of gender differences in driving over the past fifteen years has been marked by the influence of alcohol behind the wheel among men, and notably the rate of collisions while driving in reverse by women. For other characteristics linked to the driving activity, gender differences appear to have remained stable.

The following section looks into the types of traffic accidents as a function of gender.

7.5.3 Characteristics of traffic accidents

Types of traffic accidents appear to vary by gender: men tend more than women to be involved in accidents occurring in bends, in dark weather, or while overtaking (Waylen & McKenna, 2002), whereas women have more accidents in intersections than men do (Waylen & McKenna, 2002; Department for Transport, 2005): nearly 50% of women's accidents occur in intersections, with the relative number of this type of accident increasing with age (Attewell, 1998). But these proportions should, of course, be viewed in relation to the types of itineraries driven.

The incidence of traffic accidents as a function of the type of itinerary driven differs by gender. In fact, men appear to have more accidents[48] during travel for work missions (1.3 times more than women), whereas women's accidents occur more often during travel between home and work (1.8 times more than men), especially among those between the ages of 35 and 40. It is interesting to observe that the men who have accidents during home–work itineraries are older (55-60 years vs. 35-40 years for women) (Chiron et al., 2005). Concerning private travel (during the working period), the rate of incidence of accidents is higher among women (1.2 times[49]) than among men, except during the retirement period, notably around 50-55 years, when men have 4..8 times[50] more bodily injury accidents then their female counterparts (ibid.). These last types of accidents mainly occur in towns.

Women are mainly involved in collisions with at least one other party (for 66% of their accidents), and 24% as the only vehicle involved. This latter type of accident mainly concerns young drivers, among men even more so than among women (Attewell, 1998). It shall be seen further on that these data can be compared with risk exposure among young people, this exposure being linked to a certain type of driving. If those situations that the authors qualify as 'serious' are taken into account, i.e. without speed-related risk taking, women proportionally have more losses of control (33%) than men (24%) (Laapotti & Keskinen, 2004). After losing control of their vehicles, women often collide with another vehicle, whereas men tend more to have accidents as single vehicles, leading to their driving off the road (Laapotti & Keskinen, 1998, 2004). Generally, losses of control among men (for 40% of these cases) are typically characterised by driving under the influence of alcohol, at excessive speeds, on a non-slippery surface (this combination of factors being rare among the other types of accidents for men (3%) and even rarer for all types of accidents for women) (Laapotti & Keskinen, 1998). Losses of control among women (in 48% of this type of accidents) typically occur when they are driving at a normal (moderate) speed, without being under the influence of alcohol, but on a slippery surface (ibid.). According to Attewell (1998), most accidents among women (63%) occur in an area with a 60km/h sped limit. Nonetheless, the younger the female driver, the greater the share of accidents which occur in areas with higher speed limits (this variation as a function of age is not observed

[47] Study carried out in Australia; the results showed that the fatality rate had decreased over the past 20 years, for both male and female drivers.

[48] The accidents covered in this paragraph (results of Chiron et al., 2005) correspond to non-fatal accidents.

[49] The rate of occurrence of bodily injury accidents during private travel is 33 per 10,000 among women vs. 28 per 10,000 among men.

[50] The rate of occurrence of bodily injury accidents during retirement is 11 per 10,000 among women vs. 53 per 10,000 among men.

among men). If all types of accidents are taken into account, however, there is, according to the Department for Transport (2005), very little difference between sexes concerning weather conditions and road surface conditions at the time of collision.

As for the types of collisions, men have more rear-end collisions[51] (1.2 times) than women, whereas women have more accidents while manoeuvring in reverse[52] (1.3 times) (Laapotti & Keskinen, 2004). Women therefore have a greater share of main impacts in the rear of their vehicles, but also lateral collisions (Department for Transport, 2005), particularly common among older women drivers (over 55) (Attewell, 1998). It is interesting to note that, in the United Kingdom, men are more often involved in frontal impacts (Department for Transport, 2005), whereas in Finland, women have 1.4 times more frontal collisions than men (Laapotti & Keskinen, 2004). In Australia, young women also have a high rate of frontal collisions, but this rate is even higher among young men (Attewell, 1998).

Collisions happen more often the daytime than at night for both sexes, especially during rush hour, notably between 8 AM and 10 AM for women (Department for Transport, 2005). Women have more accidents during the week than men, and especially in October, November and February (Galer-Flyte et al., 2001). The changes in environmental luminosity at the beginning and end of the work day, making driving conditions more difficult, must contribute to this tendency (Department for Transport, 2005). Owens and Brooks (1995) point out that there is a clear increase in the number of accidents between cars and pedestrians or cycles at dusk, combined with reduced visibility. The proportion of women in this scenario is greater than that of men.

Accidents in reverse and losses of control unrelated to speed therefore appear to be more typical among women than among men. According to Laapotti & Keskinen (2004), these types of accidents are linked to problems of manoeuvring the vehicle and control in traffic situations. Storie (1977) put forward the hypothesis that female drivers are more subject to distraction and errors in perception then their male colleagues. Men's accidents are more linked to problems of motivations and self-control (Laapotti & Keskinen, 2004).

Such work hypotheses, however, require basing oneself on an analysis that is differentiated by gender for the related exposure variables. This analysis will shed more light on the differences observed to date in a more 'ecological' way.

7.5.4 Risk exposure

Interest among researchers concerning exposure variables has increased recently, notably for factors related to social situations which may influence driving (Lin & Fearn, 2003; Ulleberg, 2004).

7.5.4.a Job activities

Job activities are decisive in the use of cars among men and women (CERTU, 2005). According to Fontaine & Hubert (1997), travel related to job activities lead to more kilometres driven by men than by women. Working women travel more than other women (25% more). Forty-four percent of working women[53] work in the community where they live (vs. 38% of men) (CERTU, 2005). Their itineraries are therefore mainly short and urban (37% of kilometrage for women is urban vs. 30% of kilometrage for men) (Fontaine & Hubert, 1997). However, even when the home and place of work are not in the same community, the distances driven by women are shorter than those driven by men: on average, they drive 6.9 kilometres vs. 10.3 kilometres for men, or 1.5 times less (INSEE, 2003). According to CERTU (2005), the farther one is from the town centre, the greater the share of the

[51] The vehicle of the driver in question hits the rear of the vehicle in front of him/her.

[52] The vehicle of the driver in question (here, especially women) hits another vehicle when making a manoeuvre in reverse.

[53] Working or job-seeking population.

automobile in travel and this tendency is much sharper among men. A survey by EPFL[54] (2000) moderates these data, asserting that, in periurban residential areas, the use of cars by men and women – as drivers – is very similar (53% of travel for men vs. 49% for women). It should be pointed out, however, that even non-working women drive more in towns than men: 35% of the kilometres driven by women in general are in urban areas vs. 29% for men. Men, on the other hand, appear to drive more on highways and motorways (23% motorway itineraries) than women (18% motorway itineraries) (SOFRES 1998 and 1999).

It is interesting to observe that behaviour by men and by women concerning the driving activity appears to differ depending on whether they work or not: 61% of travel by those who work is undertaken as drivers (26% more often for men than for women) vs. 22% of travel by non-workers (15% more often for men than for women) (CERTU[55], 2005). Working women are 2.6 times more often drivers than other women (respectively in 54% of cases vs. 21%), 1.9 times less often passengers (respectively in 10% of cases vs. 19% for non-working women) and they use public transportation 3.1 times less (respectively in 10% of cases vs. 21%) (CERTU2, 2005). It should be pointed out, however, that independent of their professional activities, women use public transportation and walk more, and use cars and bicycles less than men. There is therefore a fairly strong distinction by sex in the use of travel modes (CERTU, 2005; Siren & Hakamies-Blomqvist, 2006).

7.5.4.b Types of itineraries

If women mainly drive in urban itineraries, it is also because they often undertake accompanying trips (mainly with children – these trips are usually short) or use their vehicles for running errands (Fontaine, 1988; Fontaine & Hubert, 1997; CERTU, 2005; Department for Transport, 2005). Most itineraries driven by women are thus related to household tasks. On this subject, for all individuals between the ages of 15 and 60 (excepting students and retirees) between 1986 and 1999, the trend is toward a balance between men and women (CERTU, 2005), which could in the future have an impact on men and women's travel. Dobson (1999) pointed out that children are transported by middle-aged women (45-50 years), whereas younger women spend more time travelling for leisure and tend more to travel in the evening or at night.

7.5.4.c Time of day

In terms of nighttime travel, young men are more concerned than young women (Fontaine & Hubert, 1997). The rate of fatal accidents is higher at night than during the day for both sexes, but with even greater risk for men (Massie et al., 1995). This proportion of fatal accidents occurring at night is exceptionally high for the youngest drivers (16-24 year age group), with rates nearly 3 times higher than for nighttime drivers in general (ibid.). For non-fatal accidents, men also have a higher rate of incidence than women (with 1.2 times more bodily injury accidents than women), especially for young people (20-24 years). This tendency is reversed in the daytime, when women have a rate of accidents leading to injuries 1.4 times higher than men (Massie et al., 1995).

According to the same authors, the rates of fatal accidents in the daytime are similar for both sexes, and the highest rates correspond to women over the age of 75. The elderly, especially women, have more non-fatal accidents in the daytime than at night. Behavioural factors, involving awareness of risk, behavioural mechanisms and low alcohol consumption should in part explain the similarity between daytime and night-time rates for the elderly in comparison with younger people (ibid.).

[54] Ecole Polytechnique Fédérale de Lausanne.

[55] According to the sources at EMD Grenoble, 2002.

Lastly, according to Forsyth et al. (1995), women in general drive less than men when the weather conditions are bad (Forsyth et al., 1995).

7.5.4.d Social life

A certain number of parameters related to social life condition driving and therefore exposure to accident risks. Mannering (1993) offered some data on the influence of social life on driving: households with high revenues as well as married drivers (men and women) go for longer periods without accidents. According to him, revenue is to be correlated with "maturity" (and certainly with age) and therefore associated with low risk-taking. It is also possible that drivers with high revenues have safer vehicles (braking systems, steering systems, tyre quality). Moreover, being married may change driving types (such as joint itineraries) and therefore exposure to accident risks (ibid.). According to Fontaine & Hubert (1997), the traditional attitude says that, when a couple is travelling, the man drives. But couples which have a car often only have one car (CERTU, 2005). On the other hand, women rather tend to drive when they are the only occupant of the vehicle, which is no doubt more often the case of women living alone. Several studies have confirmed these affirmations: only 14% of women drivers living in couples are behind the wheel when driving long distances, 94% of their partners declare that they are the main drivers (SOFRES, 2004; Parmentier et al., 2005).

7.5.4.e Type of vehicle

Between 1985 and 1995, the estimate of the total number of kilometres driven by women driving private cars increased by 43%, compared with just 7% for men (Attewell, 1998). According to Martin et al. (2004), women involved in accidents are mainly in cars (71.3% as passengers vs. 44.9% for men, 42.2% as drivers vs. 32.3% for men). The data from the Department for Transport (2005) round out these results: 42% of women have accidents when they are in a town car[56] vs. 23% of men, or 1.8 times more. This situation is a disadvantage for women, who are shorter and lighter than men (ibid.). Furthermore, the mass of a vehicle is a key factor determining the injuries resulting from collision (Thomas & Frampton, 1999). Bicycle and notably motorised two-wheeled vehicle usage is almost exclusively male (Martin et al., 2004). Now, a European report (ETSC, 1999) has shown that the estimates of mortality rates for these two modes of travel are significantly higher than those associated with automobiles (16 deaths for 100 million people per kilometre for motorized two-wheelers, 6.3 for bicycles and 0.8 for cars). Men also have a risk if serious injury that is greater than women when using a two-wheeler (Martin et al., 2004). Lastly, it should be pointed out that men drive 6 to 13 times more in pickups than women, whatever the age, but women have more accidents when they drive LTDs[57] than men (Kweon & Kockelman, 2003).

7.5.5 Age concerning to gender

The total number of kilometres driven by young men (under the age of 20) is nearly 1.5 times greater than that driven by young women. The same holds true for people in the middle-aged group (20-60 years), and this difference increases for older people (over 60): elderly men drive nearly twice as many kilometres as elderly women. This increase can certainly be attributed to the cultural norms of the past (Kweon & Kockelman, 2003). Women and men drive the largest annual number of kilometres in the 25-29 year age group (respectively 15,350 km/year and 18,746 km/year) (SOFRES, 1999). According to ENT (2002), people drive most frequently at a higher age (30-44 years), similarly for men and women.

It can be observed (as a function of the number of driving license holders) a decrease in the rates of hospitalisation and mortality with age, except for the oldest drivers, the highest rates being for the young and the elderly. After the age of 50, men and women have similar hospitalisation rates

[56] Category A and B vehicles in the United Kingdom.

[57] "light-duty trucks (LTD)": 4-wheel drives, minivans and pickups.

(Attewell, 1998). Among men killed on roads in Europe in 2003, most were between the ages of 21 and 49, with a peak for the 30-39 year-old age group (17.4% vs. 12.1% for women). For women, the majority of those killed on the road were over the age of 65, with a peak for those 75 and older (16.2% vs. 8.2% for men). Women between 30 and 49 years of age are also concerned by a large share of deaths related to traffic accidents (SAFETYNET, 2005).

7.5.5.a Young people behind the wheel

The literature concerning young drivers is particularly abundant. Traffic accidents are the main cause of death among young people between the ages of 15 and 29 in the developed European countries (Peden et al., 2002), whence the interest in this group of users. This is particularly the case for men: the proportion of young men involved in accidents is nearly twice as high[58] as that of young women (Kweon & Kockelman, 2003; Monarrez-Espino et al., 2006). It is even more significant to observe that young men have more accidents than young women for a constant number of kilometres driven (Lassarre et al., 2005). These authors conclude that young men have more accident-causing behaviours than young women. Furthermore, it appears that, among young people, the number of kilometres driven has a greater influence on accidents for men than for women[59], whereas there is no difference of this type among middle-aged people (Laapotti et al., 2006).

Before going further into detail on accidents among young male and female drivers, it should be looked into their driving contexts. The number of accidents occurring in an itinerary for running errands is over-represented[60] for young women and middle-aged people (Laapotti et al., 2006). Moreover, 30% of the itineraries driven by young people are motivated by leisure considerations: driving 'just for the fun of it' accounts for 24% of itineraries among young men and 18% of itineraries among young women (Laapotti et al., 2006). But the number of accidents linked to this type of itinerary is over-represented among young male drivers (Laapotti et al., 2006). Furthermore, young drivers often have friends as passengers (Rolls et al., 1991). Unlike elderly drivers, the presence of passengers with young drivers has a negative effect on safety, especially at night and when they are in groups (Lin & Fearn, 2003; Preusser et al., 1998). Among 16-19 year olds, the influence of the presence of passengers appears to be stronger for men than for women where damage-only accidents are concerned (Doherty et al., 1998).

For non-fatal accidents, women have a higher rate of hospitalisation than men, except for those in the 25-34 year old age group. This rate is 1.6 times higher than for men among young people under the age of 25 (Attewell, 1998). The rate of involvement in accidents in relation to the number of kilometres driven gives different results: the rate of men injured is higher than for women among those under the age of 25, whereas later, women have a higher rate whatever the age group (1.2 to 1.8 times more than men) (Massie et al., 1995). Men appear to suffer from more after-effects of accident than women, especially between the ages of 15 and 29 (between 20 and 29 years for women) (Martin et al, 2004).

For drivers, the risk of serious injury for men is significantly higher than for women up to the age of 64, and at a maximum between 16 and 24 (ibid.). According to Monarrez-Espino et al. (2006), accidents among young people are also more serious for men than for women, especially as a single vehicle, with more than 5 times as many deaths among men (whereas there is little difference between sexes for deaths due to collisions involving more than one vehicle). Thus, there seems to be a consensus that being a young male driver increases the risk of accidents, and notably serious accidents (Hasselberg et al., 2005; Ballesteros & Dischinger, 2002; Williams, 2003).

For young people (18-24 years of age), accidents among men are more deadly than among women (Williams, 2003). According to Doherty et al. (1998), men have significantly more fatal accidents than

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[58] For all ages from 18 to 29 and all types of accidents.

[59] On average, 20% of accidents among young men are correlated with the number of kilometres driven vs. 8% of accidents among young women.

[60] Compared with the share of itineraries for this reason.

women between the ages of 20 and 24 (also among those between 25 and 59 years), but not among those under 20[61].

Data per km driven lead in the same direction: men have a rate of fatal accidents 1.6 times higher than women. The difference in the risk of a fatal accident between male and female drivers is strongly age-dependent (Massie et al., 1995): it is particularly high (men having 1.6 to 2.5 times more risks than women) between the ages of 16 and 39. Remember that the rates of fatal accidents related to nighttime driving are exceptionally high for the youngest men (Massie et al., 1995). Moreover, young people have relatively high rates of accidents at weekends, especially men (Attewell, 1998). It has been also seen above that accidents among women involving only their own vehicles mainly concern young drivers and that the proportion of young people having this type of accident is even higher among men (Attewell, 1998). These last data, of course, remind us of the cliché of young men leaving a nightclub: drunk, driving fast and losing control of his vehicle. Beyond this stereotype, this configuration does appear to represent a significant share of the excess risk among young men.

Thus, there are several recurrent risk factors concerning young male drivers. Inexperience in driving and young age in this area could be markers for the adoption of risky behaviours among men (Arnett, 2002; Ballesteros & Dischinger, 2002; Williams, 2003). From one year to the next, beginner male drivers have a tendency to commit more traffic violations in the second year, but have fewer accidents (Lassarre et al., 2005). This risk of having an accident thus drops as young people acquire driving experience. On the other hand, at the same time, they gain in confidence in their driving ability and are encouraged to commit more traffic violations (ibid.). To this can be added a certain overestimation of their personal skills combined with an underestimation of the risk at hand: young male drivers have more confidence in their own driving skills than other drivers, and do not perceive certain driving situations as being as risky as other, experienced drivers might think (Finn & Bragg, 1986; Matthews & Moran, 1986). Young men (18-24 years), compared with their female counterparts, tend to have an exaggerated sense of their own driving skills and to attribute a lower risk to a variety of dangerous driving behaviours (Dejoy, 1992). According to this author, the problem is not that young men do not consider driving as a dangerous activity, but rather that the danger is not perceived as applying to them, stemming from an excessive feeling of control. Thus, young men are particularly optimistic when they judge the risk of driving situations requiring rapid driving "reflexes" or real skills in controlling the vehicle (Matthews & Moran, 1986). It is possible that young men can usually trust the rapidity of their reaction times (Sivak et al., 1981; Welford, 1977) to avoid accidents, but when they are confronted with additional demands brought about by the reduction of luminosity or by poor traffic conditions, they may be less successful in avoiding the accident (Massie et al., 1995).

Concerning risks related to speed, young male drivers exceed the speed limit in 48% of accident cases, whereas this proportion is 25% for middle-aged men and 18% for middle-aged women (Laapotti & Keskinen, 2004). Furthermore, men, and especially young men, are the most likely to drive under the influence of alcohol (Jonah, 1990; Anderson & Ingram, 2001) or even drugs (Lancaster & Ward, 2001). It should be pointed out that riskier driving behaviour among young women also appears to be related to the habitual consumption of alcohol, as well as to stress (Dobson et al, 1999).

7.5.5.b Middle-aged male and female drivers

Middle-aged men (25-59 years) drive more than young men (Laapotti et al., 2006). Women between 25 and 44 only drive 60% of the distance covered by men in the same age group. And after the age of 45, their itineraries account for less than half those of men (Massie et al, 1995).

Concerning accidents for those under 44, mortality rates for women are lower than for men (Attewell, 1998). According to Massie et al. (1995), men have 1.2 to 1.3 times the risk of having fatal accidents as women between 40 and 59 years of age.

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[61] As the study was carried out in Ontario, where the minimum age for a driving license is 16, the "under 20" category concerns people between 16 and 20 years of age.

Middle-aged women have fewer accidents than young female drivers: women between 45 and 50 have a mortality rate 5.6 times lower and hospital admission rates 5.8 times lower than young female drivers (15-24 years) (Attewell, 1998; Dobson et al., 1999). They commit much fewer errors and traffic violations than young female drivers (18-23 years) (Dobson et al., 1999). Despite this, there is no difference in the types of accidents[62] between women in the two age groups (ibid.).

The influence of the presence of passengers appears to be opposite for the sexes: for 25-59 year olds, the presence of passengers has a safety effect on women's driving for all types of accidents[63] (for cases of fatal accidents, for example, the rate of involvement per 100 million km driven is 1.3 when the female driver is alone vs. 0.8 when accompanied), whereas the accident rate (fatal only) for men in this age group is 1.5 times higher with a passenger present than when they are alone (the rate of involvement being 1.4 when they are alone vs. 2.1 when accompanied) (Doherty et al., 1998).

7.5.5.c Elderly male and female drivers

Whether or not a person has a driving license is a major factor behind mobility problems. Having a driving license is strongly linked to other factors affecting mobility, including age, gender and the residential sector. Among these factors, gender is particularly important insofar as women have licenses less often even though they generally live longer than men (Siren & Hakamies-Blomqvist, 2004). There are in fact fewer elderly women who have driving licenses than elderly men or young women (Polk, 1998; Rosenbloom, 1995, 2001; Cedersund & Lewin, 2005). Elderly men therefore have greater access to cars and stop driving later than women (Cedersund & Lewin, 2005). Thus, whereas elderly men drive so long as their health allows, elderly women tend to stop driving at an earlier age and in better health (Eberhard, 1996; Hakamies-Blomqvist & Wahlström, 1998; Jette & Branch, 1992; Siren et al., 2004). Moreover, women who stop driving feel that it is a definitive decision, whereas 1/3 of men hope to be able to start driving again later (Cedersund & Lewin, 2005). According to these authors, in 10-20 years, elderly women will certainly have the same behaviours toward cars as elderly men today (Cedersund & Lewin, 2005).

Elderly men (65%) consider the use of a personal vehicle to be necessary more than elderly women (43%) (Hakamies-Blomqvist & Wahlström, 1998). Elderly women avoid difficult driving situations (wet roads, nighttime driving, winter driving, etc.) more frequently than men (ibid.), due to the fact that they more commonly feel moderate to strong stress than men in all difficult driving situations except for driving long distances (ibid.).

The older a women is when she gets her driving license, the more likely she is to have an accident, whereas this is not the case for men (Mannering, 1993). Furthermore, elderly men have 1.7 times more accidents than elderly women, but are 2.0 times more exposed than women (Kweon & Kockelman, 2003). As for the seriousness of the accident, the probability that an elderly woman will be injured in an accident is greater than for an elderly man (Islam & Mannering, 2006), but only for the oldest (Fontaine & Hubert, 1997). Conversely, for fatal accidents, there is no difference in risk as a function of gender for those over the age of 60 (the number of deaths per 100 million miles driven is 4.49 for men vs. 4.45 for women) (Massie et al., 1995).

7.5.6 *From physiology to social representations*

Men and women have different morphologies: there are differences in heights and weights between the two sexes, differences in body resistance to impacts, as well as differences in interaction between morphology and vehicle safety design. These elements work toward fragility for women (Mannering, 1993; Evans, 2000; Ulfarsson & Mannering, 2004). And yet, according to Abdel-Aty & Abdelwahab (2001), female drivers appear to be less subject to serious bodily injury accidents than men.

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[62] Intersection, rear-end collision, angular collision, and collision with another object.

[63] Damage-only, bodily injury and fatal accidents.

It appears that the influence of gender on the seriousness of an accident depends on the type of collision. According to Ulfarsson et al. (2004), when a vehicle starts moving and hits another, there is a greater probability of serious injury for men and minor injury for women (as drivers), whereas running into a guard rail or railing will cause more serious injury among women than among men (as drivers). Bedard et al. (2002) confirmed this idea by stating that, in accidents involving a single vehicle against a stationary obstacle, women have a higher risk of dying than men. These opposite effects between the two sexes suggest that a combination of behavioural and physiological factors significantly affect the seriousness of the driver's injuries.

Whatever the region of the body considered, men suffer more often from serious lesions[64], for all user categories. The same holds true for minor lesions, except for the neck and cervical spine, which are twice as frequent among women (for all categories of users) (Martin et al., 2004). Welsh & Lenard (2001) point out that, as drivers or front-seat passengers, women appear to be more vulnerable to frontal collisions, leading to the aforementioned injuries as well as injuries to the legs. According to Martin et al. (2004), women more often have contusions and damage to internal organs (including nerve roots) whereas men more often suffer from fractures, sprains, dislocations and flesh wounds.

In a totally different area, several studies have shown a positive correlation between levels of testosterone and the search for sensations (Daitzman et al., 1978; Daitzman & Zuckerman, 1980; Dabbs & Morris, 1990; Bogaert & Fisher, 1995; Gerra et al., 1999), which is in line with many studies showing that men engage in such behaviours more often, regardless of their education, socialisation and other factors (SIRC, 2004). The search for sensations can thus translate into driving under the influence of alcohol (Attewell, 1998) or drugs, by risky manoeuvres, by various traffic violations (Stradling, 2000; Brusque et al., 2004; Laapotti & Keskinen, 2004; Lassarre et al., 2005), as it is described above concerning young drivers. Independent of age, the probability of being intoxicated (alcohol) is 3.2 times higher for male drivers than for females. The difference between men and women increased between 1984 and 1989 and between 1990 and 1995, with men driving even more under the influence of alcohol (Laapotti & Keskinen, 2004). Figures for the United Kingdom indicating mainly male risk-taking are particularly striking: in 2002, eighty-eight percent of all traffic violations, 83% of speeding violations and 97% of alcohol-related violations were committed by men (SIRC, 2004). Men are more often held responsible for their accidents than women (Norris et al., 2000; Claret et al., 2003; Chandraratna et al., 2006). Furthermore, there is a consensus among the studies on the fact that, in general, men are more aggressive than women on the road and elsewhere (SIRC, 2004). It is interesting to note that some studies did not find any gender difference in aggressive driving behaviours (ibid.). According to Crick & Grotpeter (1995), it is how aggressiveness is expressed that differs between genders, and not the level of aggressiveness (e.g. frequent tooting of the horn among men, Turner & McClure, 2003).

According to Laapotti & Keskinen (1998), risky driving habits play a greater role in losses of control (at night, in light traffic) by men than other types of accidents. According to these authors, losses of control among women are much less influenced by motivational factors than by less skill in handling the vehicle. According to Assailly (2001), the fact that the excess risk among men has remained identical for 40 years indicates that women's resistance to taking risks and behaviours in violation of traffic laws is very strong and highly socially 'engrained'. Women's view of the automobile remains very neutral and the road is not seen as a 'relevant' field for taking risks (ibid.). For example, women are significantly more likely to abstain from drinking before driving (NHTSA, 1995; Shinar et al., 2001). They are more interested in the social aspects of life, whereas men are more competitive and more interested in technical questions (Badger et al., 1998; Jones et al., 2000; Lupaschuk & Yewchuk, 1999). Thus, female drivers appear to be more oriented toward safety than men, with a greater feeling of obligation to obey the traffic regulations, and a tendency to view the regulations positively (Yagil, 1998; Meadows & Stradling, 1999; Medevielle & Cauzard, 2002). According to Vernet (2001), men do not really accept the rules laid down in traffic regulations until their family situation changes (as a father, as more children come along) or if they have loved ones who have been victims of accidents. In

[64] AIS ≥ 3.

terms of social roles, cultural beliefs hold that masculinity is related to perceptive and motor skills, whereas femininity is associated with safety skills (Özkan & Lajunen, 2006).

Thus, the general situation of the driver's life, his/her personality and behaviour other than when driving, have an effect on driving behaviour (Tillmann & Hobbs, 1949; McGuire, 1976; Evans, 1991; Gregersen & Berg, 1994; Jessor, 1987). Gender differences in the use of cars appear to be based on individual factors which are a function of preferences, attitudes, value judgements and experience, which at the same time are functions of the type of itinerary driven (Cedersund & Lewin, 2005). Men consider cars more as being their property than women do, and as the only method of transportation possible (Cedersund & Lewin, 2005). According to Vernet (2001), it can be considered that men reaffirm their identity through their vehicles, whereas women see their vehicles on a purely utility level.

7.5.7 Conclusions

The idea that this literature review stands out may be the fact that men have a tendency to have more accidents than women and to drive in a more risky manner. And yet, beyond the tautological outlook which leads us to say that men have more accidents because they are men, it is important to consider intra-group variability (not all men behave in the same way) on the one hand, and, on the other, the cultural and social overdetermination of behaviours, as well as exposure variables. But it must also be taken into account the fact that these different elements interact together. A large part of this review of the question was dedicated to the influence of exposure variables on automobile driving by men and women. An analysis by Martin et al. (2004[65]) reflects the influence of these variables on a large part of male accidents: men have a higher risk of being responsible for a fatal accident (1.14 times) than women, but they are also 3 times more often under the influence of cannabis, twice as often under the influence of alcohol and more willingly ride motorised two-wheeled vehicles. According to these studies, if this were not the case, men would not present any specific excess risk: 'being a man is not in and of itself an insurmountable handicap!'.

7.5.8 Summary

The following key ideas should be pointed out:

- Driving behaviour among women has changed: more women have driving licences; they drive more and are more active professionally.
- Men still drive more than women (approximately 13% more km a year), and still have more traffic accidents than women, especially young drivers (main cause of death among 15-29 year olds in developed European countries).
- 25-29 years: ages at which men and women drive the most, with an increased risk of personal injury accidents and fatal accidents for men.
- 40-59 years: men have 1.3 more risk of fatal accidents than women.
- Elderly drives: men drive twice as many km as women, and have 1.7 times more accidents than women (no gender difference concerning the risk of fatal accidents).
- Men, compared with the opposite sex, are less respectful of traffic regulations and appear to tend to engage in risky driving (speed, alcohol, telephoning while driving). Women, however, appear to be becoming more aggressive and to drive under the influence of alcohol more than before.
- Characteristics of driving among men:
    - Motorway and highway travel,

[65] Quoted in Axes No. 13, 2006.

- Leisure travel (24% for young men, with passengers) and business missions,
- Motorised two-wheelers are also driven (almost exclusively by men).
- Characteristics typical of accidents among men:
  - ✓ Accidents during business missions (1.3 times more than women),
  - ✓ In bends,
  - ✓ In dark weather,
  - ✓ Week-ends,
  - ✓ Night (especially young drivers, fatal accidents),
  - ✓ Serious injuries (young drivers),
  - ✓ Accidents as a lone vehicle (5 times more deaths among young men than young women),
  - ✓ Involving speed and alcohol (young drivers),

    => Accidents linked to motivations and self-control.

– Characteristics of driving among women:
  - Urban travel (37% vs. 30% of mileage among men),
  - Travel to accompany children, household tasks, grocery shopping (45-50 year olds): short distances,
  - Leisure travel (evening or night), shopping (young drivers),
  - Often without passengers (if the husband is present, he does the driving).
  - Characteristics typical of accidents among women:
    - ✓ Accidents between home and work (1.8 times more than men) or private travel (1.2 times more),
    - ✓ Damage-only accidents or with minor injuries,
    - ✓ In intersections (for nearly half of their accidents),
    - ✓ In towns,
    - ✓ Collisions with third parties (66% of their accidents), often after losing control,
    - ✓ On slippery surfaces,

      => Accidents linked to handling the vehicle and controlling traffic situations.

7.6 Descriptive Analysis

In this section, accidents among road users are looked into as a function of 'Gender'. The question that will be studied throughout this section is the following: what differences can be observed between accidents involving men and accidents involving women, using the data found in national statistical files?

This descriptive analysis of national data constitutes an extension of the points raised in the review of the question in the literature. It will pave the way toward the essential questions that need to be understood using 'in-depth' detailed analysis of the data.

7.6.1 Available data

7.6.1.a Period of data

As for the analysis of the role of 'Age' presented in the previous section, data considered in this task are concerned to years 2001 to 2004.

7.6.1.b Accidents considered in the study

The results below deal with the descriptive analysis of the risk of dying or of being hurt in a road accident as a driver or a pedestrian, comparing the accidents of male and female road users.

7.6.1.c Involved countries and covered geographical area

As for the analysis of the role of Age presented in the previous section, Euro-25 level data were provided by Eurostat databases, allowing stating the general facts. The more precise data are taken from the national accident databases of 7 European countries (France, Italy, Greece, Great Britain, Czech Republic, Germany and Spain) and Australia, allowing a deeper analysis of the gender issues regarding accidents.

Country	Database	Data provider	Covered area
France	BAAC	LAB	Whole France
Germany	OGPAS	BASt	The data relate to the entire territory of the Federal Republic of Germany since 3 October 1990
Great Britain	STATS19	VSRC	The whole of Great Britain (England, Wales, Scotland but not Northern Ireland)
Greece	Greek Nat. Stat.	HIT	Whole Greece
Italy	SISS	Elasis	Milano Province, Mantova Province, Naples City, Salerno City, Sorrento City.
Spain	DGT	Cidaut	Whole Spain
Czech Republic	CDV	CDV	Whole Czech Republic

Table 7.B.1.-National database description for elderly people accidents.

These data cover bodily injury accidents and fatal accidents. It should be pointed out that an uninjured driver may be counted in the databases when one of his passengers is injured or killed (the case in France, Italy, Greece and Australia). A footnote will be specified if the uninjured are included in the injured category.

7.6.2 Analysis and methodology

In the same way as in the Age study, the results described below are for drivers of vehicles (automobiles and two-wheelers) and pedestrians, passengers being excluded from the analysis. The objective of this analysis is indeed to study the problems encountered by people who are effectively involved in the accident, which excludes passive people such as passengers. It will be referred to these drivers, riders, cyclists and pedestrians generically with the term 'effective road users'.

Below the distribution of these drivers and pedestrians involved in accidents according to different variables will be observed (modes of travel, road conditions, types of roads, reasons for travel, manoeuvres undertaken, etc.) so as to shed light on the particularities which may distinguish men from women from the point of view of accidents that these two sub-populations of effective road users are involved in.

7.6.3 Results for gender issues

7.6.3.a General data

Share of men and women in the European population

The distribution of the Europe-25 population between male and female is the following: 48.8% and 51.2% respectively. The average percentage of men in the population varies fairly little by country (Figure 7.B.1): it is between 48.1% (Czech Republic) and 49.6% (Greece)[66].

In Australia, men account for 49.3% of the population.

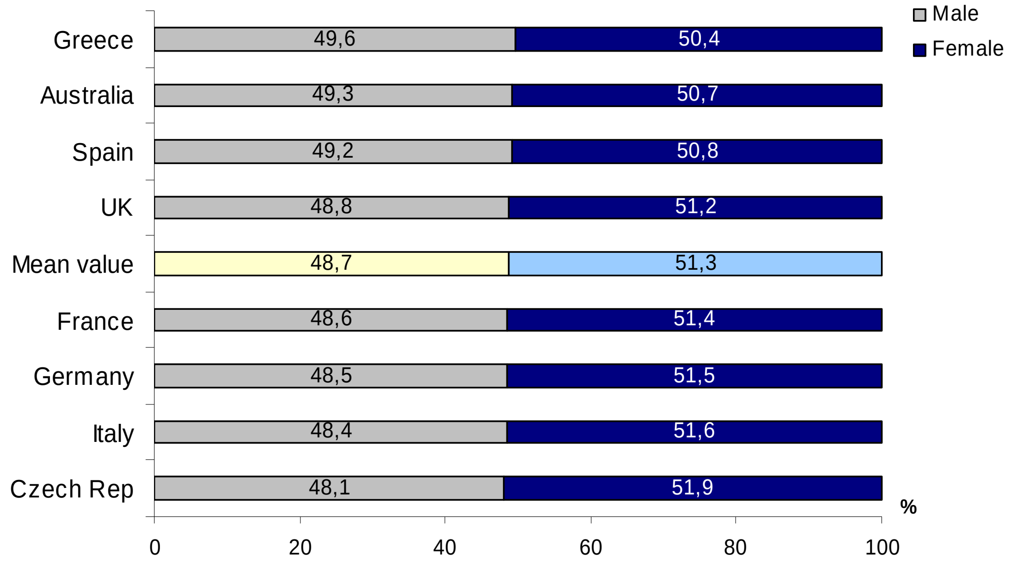

Figure 7.B.1.-Share of men and women in the population by country.

It can thus be observed a relatively isomorphic distribution between men and women in the countries studied. But for a better definition of the 'exposure conditions' for traffic accident risks among these populations, it is needed to know, for each sex, not only the number of people who drive, but also the number of kilometres they drive. The ideal situation would be to know what types of itineraries they drive as well.

Share of male and female users injured in traffic accidents

In the seven European countries studied, men account for between 62.1 and 84.0% of users injured in traffic accidents, whereas they account for between 48.1 and 49.6% of the population. So they show a relative a relative rate of being injured, as compared to women, between 1.32 in the Great Britain and 1.69 in Greece (Table 21 in Annex2.5).

Women, on the other hand, account for 51.3% of the population in these countries, but correspond to just 32.1% of injured users in traffic accidents. So they show a relative rate of being injured, as compared to men, between 0.32 in Greece and 0.69 in the Great Britain (Table 22 in Annex2.5).

Proportionally to the population of the countries in question, male road users are therefore injured in accidents significantly more than women.

[66] France, Spain and GB: average for the years 2001 to 2004, Italy: average from 2002 to 2004, Germany: average for 2003 and 2004, Czech Republic: data for the year 1999, Greece: data for the year 2001.

However, Table 23 in Annex2.5 shows that whatever the considered country, the proportion of elderly women injured in road accidents is always higher than the proportion of elderly men (6.6% for male vs. 8.5% for female).

Share of male and female users in fatal traffic accidents

Men account for between 77.3 and 85.9% of traffic fatalities, for a relative rate between 1.59 in Germany and 1.75 in Spain (Table 24 in Annex2.5). Women, on the other hand, have a relative rate between 0.28 in Spain and 0.44 in Germany (Table 25 in Annex2.5).

Male users, therefore, not only have more traffic accidents than women, but they are also killed much more frequently than women.

In fact, male users are injured 2.1 times more and killed 4.2 times more on roads than women.

It can be, however, presumed that the share of men in the traffic is still larger today than the share of women and that this difference is greater in certain countries (Greece, Czech Republic) than in others (France, Germany).

It must be noted that the previous results must be revised when considering the age of the road users: Table 26 in Annex2.5 shows, as for injured people, that the proportion of women over 65 who died in an accident is higher than the same proportion for men (between 1.8 and 2.3 times more).

Conclusion on general data

- The average proportion of men in the population of these seven European countries is 48.7%, whereas that of women is 51.3%.
- Male users account for 67.9% of road users (drivers, riders, cyclists and pedestrians) injured in accidents, for a relative rate of 1.4.
- Men account for 80.7% of effective road users killed in accidents, for a relative rate of 1.66.
- These results only account when the interaction of gender and age is not considered. As described above, the over 65 years female users are more injured (1.2 times on the average) and killed (between 1.8 and 2.3 times more) than the male of the same bracket.

7.6.3.b Modes of travel

Distribution of injured road users as a function of mode of travel

Men and women are injured most in accidents as drivers of private vehicles, which seem normal given the larger fleet of this type of vehicle on the roads (Table 7.B.2).

	Male	Female
Car	**51,6**	**65,5**
Goods road vehicle	**6,0**	0,7
Motorcycle	**12,7**	2,2
Moped	**8,4**	3,8
Bicycle	10,5	**11,0**
Motor-coach bus	0,6	0,1
Pedestrian	9,1	**16,1**
Other	1,1	0,5
Total	100,0	100,0

Table 7.B.2.-Distribution of users injured as a function of gender and mode of travel between 2001 and 2004

Women are proportionally even more represented in accidents related to the automobile mode of travel than are men (65.5% vs. 51.6%, respectively).

According to the data from the GB Department for Transport (2005), 42% of women have an accident when they are in a 'town' car[67] vs. just 23% of men, or 1.8 times more.

A detailed analysis of our descriptive data (Table 7.B.2) shows that male drivers are injured 8.5 times more often in accidents as drivers of 'goods road vehicles' than women (χ^2=241.1 ; $p<0.05$). They are also injured 5.7 times more often in accidents as motorcycle drivers than women (χ^2=331.5 ; $p<0.05$), 2.2 more often on mopeds (χ^2=165.8 ; $p<0.05$) and 5.2 more often as 'motor-coaches-buses' drivers (χ^2=65.08; $p<0.05$). On the other hand, they are injured 1.8 times less than women as pedestrians (χ^2=205.1 ; $p<0.05$) and 1.1 times less when riding bicycles (χ^2=16.5 ; $p<0.05$).

In terms of exposure to risk, it can be seen that, according to Martin et al. (2004), the use of two-wheelers and notably powered two-wheelers is almost exclusively masculine.

Distribution of users killed by gender as a function of the mode of travel

Here, analysis of the distribution of users killed in accidents as a function of the mode of travel (Table 7.B.3).

	Male	Female
Car	**49,7**	**51,5**
Goods road vehicle	5,4	0,9
Motorcycle	**18,3**	2,3
Moped	**5,2**	1,9
Bicycle	6,0	**7,8**
Motor-coach bus	0,1	0,0
Pedestrian	14,1	**35,0**
Other	1,1	0,5
Total	100,0	100,0

Table 7.B.3.-Distribution of users killed as a function of gender and mode of travel between 2001 and 2004.

It can be seen that men die in 18.3% of cases as motorcycle drivers vs. 2.3% for women, or 7.9 times more often (χ^2=47.5 ; $p<0.05$).

A European report (ETSC, 1999) showed that estimates of fatality rates for this mode of travel are sharply higher than those associated with the automobile (16 deaths per 100 million people.km for powered two-wheelers). Moreover, Martin et al., (2004) indicate that men have a risk of serious injury greater than women when using a two-wheeler. It should be noted that the younger are the ones almost exclusively concern with this tendency (Table 7.B.4).

	Male	Female
Under 65 years	18.03	2.29
Over 65 years	0.27	0.01
Total	**18.3**	**2.3**

Table 7.B.4.- Distribution of killed motorcycle riders as a function of gender and age between 2001 and 2004.

[67] Category A and B vehicles in GB.

They are also killed 6.0 times more often as drivers of 'goods road vehicles' (χ^2=23.1 ; p<0.05) and 2.7 times more often as moped drivers (χ^2=16.7 ; p<0.05) than women.

On the other hand, they are killed 2.5 times less often as pedestrians than women (χ^2=58.0 ; p<0.05) and 1.3 times less often as cyclists (χ^2=7.7 ; p<0.05). Additional information is given when a share of under and over 65 years is done on these results (Table 7.B.5).

	Male	Female
Under 65 years	9.4	14.7
Over 65 years	4.7	20.3
Total	**14.1**	**35.0**

Table 7.B.5.- Distribution of killed pedestrians as a function of gender and age between 2001 and 2004.

It has been seen that, for all 7 countries, men were killed more often as drivers of 'goods road vehicles' than women[68]. This is particularly true in Spain where they are killed 3.7 more often, in the Great Britain, 10.5 times more often and in France, 7 times more often.

Whatever the country, men are proportionally killed more often as motorcycle drivers than women: between 6.1 times more often (Greece) and 11 more often (Italy). The difference between men and women is greatest in Italy and in the Czech Republic, respectively 11 and 10.6 times more often.

For mopeds, the difference between men and women is fairly constant from country to country: between 2.0 (Czech Republic) and 2.8 (France and Greece) times more deaths for men than women among moped drivers.

There is therefore certain homogeneity for all powered two-wheelers: men die more often than women behind their handlebars.

On the other hand, countries differ quite a bit for bicycle riders. In three of the seven European countries under consideration, men are killed between 1.1 and 1.5 times less often than women as cyclists (Czech Republic, Italy and Germany). In the Great Britain and France, on the other hand, men are killed 1.2 times more often than women as cyclists, 2.5 more in Spain and 4.0 times more in Greece.

For this mode of travel, the average is therefore favourable to men, but this hides national particularities, probably related to differences in risk exposure (corresponding to the varying intensity of use of this mode depending on the country).

Distribution of fatalities by mode of travel as a function of gender

This section deals with the distribution of fatalities for each mode of travel as a function of gender (Table 7.B.6).

	Male	Female
Car	80,2	**19,8**
Goods road vehicle	96,2	3,8
Motorcycle	**97,1**	2,9
Moped	91,9	8,1
Bicycle	76,4	**23,6**
Motor-coach bus	93,4	6,6
Pedestrian	62,8	**37,2**
Other	90,0	10,0

Table 7.B.6.- Proportion of fatalities as a function of gender and mode of travel.

[68] See Table 27 and Table 28 for calculation of the ratios of this section

Men account for 97.1% of motorcycle deaths on the road. This very high figure could lead us to believe that there is a very high excess risk for men with this type of vehicle. But the exposure data show that 97% of motorcycle drivers are men, meaning the risk is basically the same for men and women.

The three modes de transports in which women are killed most often are as pedestrians, on bicycles and in private cars, whereas for men the most fatal modes are motorcycles, 'goods road vehicles' and 'motor-coaches-buses'.

Table 29 and Table 30 in Annex2.5 provide information on the proportion of men and women killed by mode of travel.

Whatever the mode of travel, male fatalities on the road are always over-represented in relation to women. This is notably the case for powered two-wheelers, for which 97.1% and 91.9% of the fatalities for motorcycles and mopeds, respectively, are men. It is for pedestrians that the difference between men and women is the smallest: 62.8% of pedestrians killed are men.

It can be concluded:

- Given the fleet in circulation, male and female users are more often killed and injured on the road in cars.
- Men are injured 5.7 times more often in accidents than women as motorcycle drivers and 2.2 times more as moped drivers
- Men die 7.9 more often than women as motorcycle drives. On the other hand, women are killed 2.5 times more often than men as pedestrians and 1.3 times more often as cyclists.

Therefore:

- **Four modes of travel are more often identified in accidents involving men than women: motorcycles, mopeds, goods road vehicles and motor coaches-buses.**
- **Two modes of travel are more often identified in accidents involving women than men: pedestrians and cyclists.**

7.6.3.c Type of road

Most bodily injury accidents occur in urban areas, with more than 3 out of 5. Female users are injured more in urban areas, whereas male users are injured 1.1 times more than women in rural areas (Table 7.B.7).

	Injured[69]		Killed	
	Male	**Female**	**Male**	**Female**
Urban	**64.8**	**69.9**	27.8	39.4
Rural	27.6	24.8	**62.0**	**54.5**
Motorways	7.6	5.3	10.2	6.1
Total	100,0	100,0	100,0	100,0

Table 7.B.7.-Distribution of users injured and killed as a function of gender and by type of road.

On the other hand, the majority of fatal accidents occur in rural areas, with 3 out of 5 male users killed and 1 out of 2 women killed. Men are thus mostly killed in rural areas: they are killed 2.2 times more than in urban areas vs. 1.4 times more for women.

Women are injured or killed more often than men in urban areas. Men are mainly killed in rural areas.

It should be pointed out, however, that according to many studies, men drive more on roads and motorways than women, who are involved in more urban travel (Fontaine and Hubert, 1997, SOFRES

[69] Some uninjured users are included for: France, Italy, Greece.

1998, 1999) given that women mainly drive to accompany others or for errands (Fontaine, 1988; Fontaine and Hubert, 1997; CERTU, 2005; Department for Transport, 2005).

It would therefore be very useful to understand this trend more precisely in terms of exposure to be able to evaluate the existence of a real excess risk.

Distribution of users injured by gender as a function of the type of road

Men are injured in urban areas the most in Italy and Greece: 8 out of 10 injuries (Table 7.B.8). On the other hand, only 8% of injuries in Italy occur in rural areas. Lastly, it is on Spanish motorways that men are proportionally injured the most: 13.0% vs. 6.4% in the other 6 European countries.

It can be observed the same tendencies for women in these countries: nearly 9 injured women out of 10 are injured in urban areas in Italy and Greece. Whatever the country, women are injured between 1.0 (Great Britain) and 1.2 (Czech Republic, Spain) times more than men as road users in these areas. As for men it is on Spanish motorway that women are the most injured: 11.0% vs. 6.4% for the 6 other countries.

	Male			Female		
	Urban	**Rural**	**Motorways**	**Urban**	**Rural**	**Motorways**
France[70]	67,8	24,8	7,4	73,9	21,2	4,9
Italy	**84,0**	8,0	7,9	**88,5**	6,9	4,6
Greece	**80,6**	16,6	2,9	**88,7**	9,2	2,2
GB[71]	70,3	25,6	4,1	72,0	24,1	3,9
Czech Rep.	60,7	37,6	1,7	72,0	27,2	0,8
Germany	61,6	31,2	7,2	67,0	27,8	5,2
Spain	53,7	33,4	13,0	61,9	27,2	11,0
Mean value	**64,8**	**27,6**	**7,6**	**68,9**	**24,8**	**5,3**
Australia	70,6	24,0	5,4	73,1	22,7	4,2

Table 7.B.8.- Distribution of users injured as a function of gender and type of road.

The difference between men and women in rural areas is greatest in Greece and the Czech Republic: men are proportionally injured 1.8 (χ^2=12.45 ; p<0.05) and 1.4 (χ^2=29.6 ; p<0.05) times more than women.

On motorways, men are proportionally injured more often than women in 6 of the seven European countries in question, as well as in Australia. In the Czech Republic, men are injured 2.0 times (χ^2=10.2 ; p<0.05) as often, 1.7 times ((χ^2=28.3 ; p<0.05) in Italy and 1.5 times (χ^2=37.2 ; p<0.05) in France.

Distribution of users killed by gender as a function of the type of road

In the seven European countries studied, 62.0% of men killed on the road die in rural areas, 54.5% of women (Table 7.B.9).

[70] Uninjured included in non fatal for : France, Italy, Greece and Australia.

[71] Uninjured not included in non fatal for: GB, Czech Republic, Germany and Spain.

	Male			Female		
	Urban	Rural	Motorways	Urban	Rural	Motorways
France	28,6	65,0	6,4	32,1	**63,5**	4,4
Italy	**55,2**	30,2	**14,6**	75,0	24,0	1,0
Greece	**48,0**	46,0	6,0	62,0	30,2	7,8
GB	39,7	54,9	5,5	51,9	44,7	3,4
Czech Rep.	39,6	57,2	3,1	56,4	41,6	2,0
Germany	23,8	64,8	**11,4**	39,3	**54,9**	5,8
Spain	15,5	65,1	19,5	28,0	56,9	15,1
Mean value	27,8	62,0	10,2	39,4	54,5	6,0
Australia	41,9	51,3	6,8	45,3	50,8	3,9

Table 7.B.9.- Distribution of users killed as a function of gender and type of road.

It is in Italy (55.2%) and Greece (48.0%) that men are killed in urban areas the most. In these two countries, the proportion of men killed in urban areas is higher than in rural areas, unlike in the other countries studies. It is in Italy (14.6%), Germany (11.4%) and Spain (19.5%) that men are killed the most on motorways. Such a result shows a difference in behaviour between men and women (speed, risk taking, etc.). A detailed examination of accident data should shed more light on this subject.

In France, Germany and Spain, women are proportionally killed more often in rural areas than in urban areas. For all the other countries, they are killed more often in urban areas.

Whatever the country, women are proportionally killed more often in urban areas than men. It is in Spain and Germany that the difference between men and women is the greatest on the urban level: women are killed there 1.8 and 1.7 times (χ^2=21.4 ; $p<0.05$) as often as men.

Men area systematically killed more often in rural areas than women. This is particularly the case in Greece (1.5 times more; χ^2=4,1) and in the Czech Republic (1.4 times more; χ^2=7.8).

Lastly, on motorways, men are killed 14.1 times more often than women in Italy, 2.0 times (χ^2=11,4) more often in Germany.

In the purpose of extending the results from the seven European countries at a Euro-25 level, it has been possible to realize, with the help of IPFP (Iterative Proportional Fitting Procedure), the following table (Table 7.B.10).

	Male	Female
Rural	68,0	60,5
Urban	23,8	34,6
Motorways	8,2	4,9
Total	100,0	100,0

Table 7.B.10.- Extension of the Euro-7 level data on road type and gender at a Euro-25 level.

This table shows that Males are 1.1 times and 1.7 times more killed in rural areas and motorways respectively than Females.

Those last are 1.5 times more killed in urban areas than men are.

Accidents in rural areas are the ones presenting the most important risk for men as for women (68% of men and 60,5% of women fatalities happen in those areas).

However, to increase our understanding of the differences in accidents among men and women according to the type of road, exposure data for each country should be needed on two points:

- the number of linear kilometres for each type of road;
- the number of kilometres driven by each sex on each type of road.

Furthermore, it must be brought up the same questions as those relating to the influence of age (see above):

- Procedures for recording accidents may differ from one country to another,
- The distribution of road kilometres as a function of the type of network in each country may be very different and therefore lead to different exposures in each country for the type of road.

It can be concluded that:

- Most bodily injury accidents occur in urban areas, with more than 3 out of 5.
- On the other hand, the majority of fatal accidents occur in rural areas, with 3 out of 5 male users killed and 1 out of 2 women killed.

7.6.3.d Time of day

Men are more often injured in night time accidents than women: 27.3% vs. 20.1% in Europe (χ^2=148.7 ; $p<0.05$) and 26.0% vs. 20.0% in Australia (χ^2=23.5 ; $p<0.05$) (Table 31 in Annex2.5).

On the other hand, men are injured significantly less often during the daytime than women: 0.9 times less in Europe and Australia.

Here again, it would be useful to have exposure data on night time driving for men and women to measure the excess risk among men at night.

It is interesting to note that it can be observed little difference between the genders here at dawn or dusk (with the same slight superiority in accidents for men). Owens and Brooks (1995) point out that there is a clear increase in the occurrence of accidents between cars and pedestrians or cycles at dusk, in combination with reduced visibility (the proportion of women in this scenario is greater than men).

Moreover, men are significantly[72] more often killed than women in accidents at night: between 1.1 times more (Greece) and 1.7 times more (Australia) (

Table 32 in Annex2.5). On the other hand, they are killed less often than women in the daytime: between 0.9 times less often in Greece, the Czech Republic and Germany, and 0.7 times less in Australia.

According to the data in the literature, the rate of fatal accidents is globally higher at night than during the day for both sexes, with a real greater risk for men (Massie et al., 1995). This proportion of fatal accidents occurring at night is exceptionally high for the youngest users (16-24 year olds) (ibid.). Concerning non-fatal accidents, men also have a higher rate of incidence than women. This tendency is reversed in the daytime, when women have a rate of accidents causing injuries that is 1.4 times higher than men (Massie et al., 1995). The data have been corresponded to those in the international literature.

As for the risk of having an accident, exposure data would be needed to agree upon a possible excess risk for men killed at night in traffic accidents.

It can be concluded that most of the accidents happen during daytime but it can be noted a slight difference for:

- Male as they however have an over-risk of accident compared to women at night (1.4 times more when injured and 1.3 times more when killed).

[72] χ^2=22.4 ; $p<0.05$

- and Female who tend to be more injured (1.1 times) and killed (1.2 times) during the day time.

7.6.3.e Road conditions

Seven men and seven women out of ten injured in an accident as driver, rider, cyclist or pedestrian were travelling on a dry road (Table 33 in Annex2.5). Two hypotheses can be given to explain this phenomenon:

- The most common weather conditions in the countries studied tend toward dry road conditions;
- A certain number of drivers reduce their travel under overly unfavourable conditions.

A few more than one driver out of five is involved in an accident on wet roads. In 5 of the 6 European countries and Australia, women are significantly[73] more involved under these wet types of conditions.

According to Laapotti and Keskinen (1998), this is indeed the case for loss of control among women: 48% of this type of accident typically occur when they are driving at normal (moderate) speeds, not under the influence of alcohol, but on a slippery surface (while loss of control among men is typically characterised by driving under the influence of alcohol, at excessive speeds, but on a non-slippery surface).

And yet, women seem to tend to avoid difficult driving situations (such as wet roads, at night, etc.) more frequently than men do, because they more commonly feel stress in these types of driving situations than men (Hakamies-Blomqvist and Wahlström, 1998).

It is in the Czech Republic and the Great Britain that the proportion of injuries in accidents on snowy or icy roads is the greatest. Women are more often involved than men in these cases: 1.2 times more in the Czech Republic (χ^2=7.6 ; $p<0.05$) and 1.1 times more in the Great Britain (χ^2=9.2 ; $p<0.05$).

Quite logically, the same trends are found for those killed as for all users injured in accidents: 7 men and 7 women out of 10 are killed on dry roads in Europe and 8 men and women out of 10 in Australia (

Table 34 in Annex2.5). The same hypothesis is emitted here as to the excess exposure of drivers, both men and women, under these types of conditions directly linked to a lower frequency of wet roads.

[73] χ^2 between 5.9 and 19.9, $p<0.05$

It has been seen that in 5 of the European countries and in Australia, women are significantly more often injured than men on wet roads. They are killed significantly more than men only in France (χ^2=8.4 ; p<0.05), Spain (χ^2=2.5 ; p<0.05) and the Great Britain (χ^2=5.5 ; p<0.05). In the other countries (Italy, Czech Republic, Greece and Australia) they are killed under these conditions in proportions similar to men.

It can be concluded that:

- Seven men and seven women out of ten injured in an accident as effective road users were travelling on a dry road. In most of the countries studied, women are significantly more involved under these types of conditions.
- Quite logically, the same trends are found for those killed as for all users injured in accidents: 7 men and 7 women out of 10 are killed on dry roads in Europe. In half of the countries observed, women show similar trends to men.

7.6.3.f Reason for travel

Data are only available for three countries: France, Greece and Spain.

Much of the data categorised as 'others', at least for Greece (53.8%) and Spain (35.6%), leads us to presume a certain fragility in this variable.

Whatever the country, men are injured between 1.5 (Spain, χ^2=53.7 ; p<0.05) and 2.7 (France, χ^2=108.2 ; p<0.05) times more often in accidents during business travel than women (Table 35 in Annex2.5).

In France and Spain, women are injured 1.2 and 1.1 times more often in an accident when travelling between home and work or between home and school than men (respectively, χ^2=38.8, χ^2=5.9 ; p<0.05), whereas, conversely in Greece, men are involved 1.3 times more during this type of travel than women (χ^2=8.4 ; p<0.05).

According to Chiron et al. (2005), men do indeed appear to have more (nonfatal) accidents when on work missions (1.3 times more than women), whereas accidents among women tend to occur during travel between home and work (1.8 times more than men), especially women in the 35-40 age group. Once again, the drivers' exposure must be taken into account: travel related to professional activities leads to more kilometres begin driven by men than women (Fontaine and Hubert, 1997), which could in part explain their excess accidents in this type of travel.

Concerning private travel (i.e. non-professional), the rate of accident incidence is higher for women (1.2 times), probably linked to their greater frequency in this type of travel.

It can be concluded that whatever the country, men are injured between 1.5 and 2.7 times more often in accidents during business travel than women, and women when travelling between home and work or between home and school.

7.6.3.g Type of accident

Male users are injured between 1.2 times (Italy, Czech Republic) and 1.5 times (Great Britain) more often in 'single vehicle' accidents than women[74] (Table 36 in Annex2.5).

Attewell (1998) agrees with this: women are mainly involved in collisions with at least one other user (for 66% of their accidents), and 24% as the only vehicle involved. This second type of accident mainly concerns young drivers, men even more so than women. But is so happens that accidents involving young people are more serious for men than for women, especially as a vehicle alone with more than

[74] χ^2 between 12.5 and 81.2 ; p<0.05

5 times as many deaths among men (whereas there is little difference in terms of gender for deaths due to collisions with more than one vehicles) (Monarrez-Espino et al., 2006).

In France and Italy, women are injured more often in accidents involving a pedestrian than men[75]. In Spain, they are injured 2.7 times ($\chi^2 = 120.0$; $p<0.05$) more often than men in accidents involving a pedestrian, while in other the countries (Greece, Great Britain, Czech Republic, Germany, Australia), men are more often involved in this type of accident[76].

Lastly, in 6 of the 8 countries studied, women are more often injured in multiple collisions than men (between 1.1 and 1.2 times more[77]).

In all of the countries studied here, more than 3 accidents out of 5 are accidents involving 2 vehicles.

Concerning fatalities, accidents involving 2 vehicles also account for the largest proportion for all users (Table 37 in Annex2.5). It is interesting to see, however, that the percentage of those killed in 'single vehicle' accidents is higher (37.7% for men vs. 25.0% for women) than the percentage of those injured (18.0% for men vs. 13.1% for women). This shows that this type of accident brings about a very high level of seriousness for all road users, and even more so for men, who are killed 1.5 times more often than women ($\chi^2 = 25.0$; $p<0.05$).

It can be concluded that:

- Male users are injured between 1.2 times and 1.5 times more often in 'single vehicle' accidents than women.
- On the other hand, in 6 of the 8 countries studied, women are more often injured in multiple collisions than men (between 1.1 and 1.2 times more).
- In all the countries studied here, more than 3 accidents out of 5 are involving 2 vehicles.

7.6.3.h Pre-accident manoeuvres

Information on pre-accident manoeuvres is not available in the German and Czech databases. Moreover, the Greek data contain approximately 70% of data labelled as 'others' or 'unknown'.

Furthermore, the Spanish and Australian data do not distinguish between right-of-way and non right-of-way cases in intersections; they are grouped into a single category (intersection).

Given the wide differences between the various countries' databases, it is not felt that any comparison between countries is possible for this variable. It is interesting, however, to compare the differences between male and female drivers in each country.

Men are injured more often in loss-of-control accidents than women: between 1.1 times more in Italy and 3.5 times more in Australia (Table 38 in Annex2.5), which tends to confirm the results obtained above for 'single vehicle' accidents[78].

According to Laapotti and Keskinen (2004), this is not the case if the situations that these authors qualify as 'serious' are taken into account, in other words without taking risks related to speed: women then have proportionally more losses of control (33%) than men (24%). But, in general, losses of control by men (for 40%) are typically characterised by driving under the influence of alcohol, at excessive speed and on a non-slippery surface (Laapotti and Keskinen, 1998).

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[75] France : $\chi^2 = 99.9$; $p<0.05$ – Italy : $\chi^2 = 51.3$; $p<0.05$

[76] χ^2 between 1.9 and 11.8 ; $p<0.05$

[77] χ^2 between 2.7 and 30.3 ; $p<0.05$

[78] We should consider that 'loss of control' accidents may involve a second user.

Furthermore, it can be seen that men are also injured more often during overtaking or lane changing, between 1.3 times (in Spain) and 1.8 times (in Italy). This is in agreement with the results obtained by Waylen and McKenna (2002).

Lastly, they are more often injured in link accidents than women: between 1.0 times more in Australia and Italy and 1.2 times more in France.

On the other hand, the 3 pre-accident situations in which women are injured more often than men are: intersections, with and without right-of-way (between 1.1 and 1.5 times more), specific manoeuvres (between 1.3 times in France, Italy and Spain and 1.5 times in the Great Britain) and, lastly, when the vehicle is stopped (between 1.1 times more in Italy and 1.6 times more in Spain).

The same differences are found in the types of critical pre-accident situations for fatalities: overall, whether they have right-of-way or not, women are killed more often in accidents at intersections than men (Table 39 in Annex2.5). Likewise, they are killed between 1.1 (Spain) and 2.8 (Italy) times more often in accidents when performing specific manoeuvres than men.

In the three countries where losses of control have been identified (France, Italy and Australia), men are killed more often in this type of accident: between 1.1 times more than women in France and 3.4 times more in Australia.

In Australia, the Great Britain and Italy, men are killed 3.1, 1.4 and 1.7 times, respectively, in 'driving around a bend' accidents than women.

Thus, the 'loss of vehicle control' situation is, among others, a variable which appears to represent a strong feature differentiating between men and women's accidents.

And yet, this notion is not so easily seen in the databases. Either it is not entered, or it is entered heterogeneously or with a questionable level of reliability. This question will be dealt with in more detail using Detailed Accident Studies. And more generally, all manoeuvres will have to be looked into in detail to better understand the specific difficulties encountered differentially by men and women on the road.

It can be concluded that:

- The 'loss of vehicle control' situation is, among others, a variable which appears to represent a strong feature differentiating between men and women's accidents. Indeed, men are injured more often in these type of accidents than women (between 1.1 and 3.5 times more), which tends to confirm the results obtained above for 'single vehicle' accidents. Men are also killed more often in losses of control (between 1.1 and 3.5 times more).
- Additionally, there is an over-representation of Male for manoeuvres such as overtaking or lane changing. They are more often injured in link accidents than women.
- On the other hand, the 3 pre-accident situations in which women are injured more often than men are: intersections, with and without right-of-way, specific manoeuvres and, lastly, when the vehicle is stopped. Lastly, whether they have right-of-way or not, women are killed more often in accidents at intersections than men.

7.6.3.i Type of collision

Male road users are injured, in all of the countries for which data are available, between 1.0 (France, $\chi^2=24.2$; $p<0.05$) and 1.3 (Czech Republic, $\chi^2=12.4$; $p<0.05$) times more often than women in frontal collisions. On the other hand, women are injured more often in rear-end collision accidents (Table 40 in Annex2.5).

Independently of gender, it can be seen a certain disparity in the most frequent types of collisions depending on the countries considered. In France, the Great Britain and Australia, frontal collisions are more common, whether for women or men. In Italy and the Czech Republic, lateral collisions are the most heavily represented.

The data in the literature confirm that women indeed have a greater share of lateral collisions (Department for Transport, 2005), particularly common among elderly female drivers (Attewell, 1998). The literature also points out the fact that the type of collision varies both by gender and by country: in the Great Britain, men are more involved in frontal collisions (Department for Transport, 2005), whereas in Finland, women have 1.4 times more frontal collision accidents than men (Laapotti and Keskinen, 2004). In Australia, young women also have a high rate of frontal collisions, but this rate is even higher among young men (Attewell, 1998).

For those killed, it can be seen the same trend as for those injured in France, the Great Britain and Australia: the most common fatal accidents are first those related to frontal collisions, then lateral collisions. For these three countries, the proportion of fatal accidents due to multiple collisions or rear-end collisions remain more marginal for both women and men (Table 41 in Annex2.5).

Men more often have fatal accidents in collisions of the frontal type. On the other hand, women are more exposed to fatal accidents in lateral collisions. But Italy stands out from the other countries for this tendency.

In France, and Italy, men are killed 1.3 (χ^2=2.9 ; $p<0.05$) and 4.6, respectively, in accidents with multiple collisions than women.

On average, the distribution of fatal accidents between men and women is basically the same as that of accidents with injuries alone. 65.7% of men vs. 60.1% of women (i.e. 1.1 times more) are killed in accidents with rear-end collisions. Lastly, 31.2% of women vs. 24.1% of men (i.e. 1.3 times more) are killed in lateral collisions.

It can be concluded that:

- Male road users are injured, in all the countries for which data are available, between 1.0 and 1.3 times more often than women in frontal collisions. On the other hand, women are injured more often in rear-end collision accidents.
- For road users killed, the same trend can be seen as for those injured: the most common fatal accidents are first related to frontal collisions, then lateral collisions. On average, the distribution of fatal accidents between men and women is basically the same as for accidents with only injuries.

7.6.3.j Day of the accident

Women have 1.1 times as many accidents as men during the week, whatever the country. It is in Italy (78.8%) that women are injured the most in accidents during the week, the lowest rate (67.9%) being in Greece (Table 42 in Annex2.5).

Such an observation has already been made by Galer-Flyte et al. (2001): women have more accidents during the week than men. These authors even point our that this is notably the case in the months of October, November and February, when the changes in environmental luminosity at the beginning and end of the workday make driving conditions more difficult (Department for Transport, 2005).

On the other hand, men are more often involved than women in week-end accidents. The Australians (35.4%), ahead of the French (34.7%), have the highest rate of accidents at week-ends.

According to Attewell (1998), it is mainly young men who are concerned by these week-end accidents.

For the users killed, the same week/week-end distribution trends is found as for those injured, i.e. that women have more fatal accidents than men during the week and that men are killed more often in accidents that occur at week-ends (Table 43 in Annex2.5).

The percentage of men and women killed is, however, still higher during the week (given the larger number of days). But, for certain countries (France, Great Britain and Australia), it can be seen that the difference in the percentage seems small between accidents during the week and at week-ends. This attests to specific issues related to this period.

It can be concluded:

- Women have 1.1 times as many accidents as men during the week, whatever the country.
- On the other hand, men are more often involved than women in week-end accidents.
- For the users killed, the same week/week-end distribution trends is found as for those injured, i.e. that women have more fatal accidents than men during the week and that men are killed more often in accidents that occur at week-ends.

7.6.4 Conclusion: Gender Issues statistical trends

These are the general conclusions for this issue:

- Men are more prone to traffic accidents than women.

  In the seven European countries studied, where the proportion of men is 48.7%, there is a variance in traffic accident victims between men and women: men account for 67.9% of those injured and 80.7% of those killed on the road. Men and women are most frequently involved in accidents in cars. When motorcycles are looked, it can bee seen that men are involved 5.7 times more often and killed 7.9 times more often than women.

- The most common pre-accident situations

  Loss of vehicle control is a phenomenon that happens more often to men than to women: the number of fatalities varies between 1.1 times more (in France) and 3.4 times more (in Australia) for men than for women. Women are more often involved than men in accidents at intersections and when performing specific manoeuvres.

- The most common conditions encountered

  64.8% of men are injured in accidents in urban areas and 65.1% are killed in rural areas. Women are more often injured in urban areas (69.9%) and less often killed in rural areas (56.9%) than men.

  Moreover, men are more often injured than women in accidents occurring at night, on dry roads and at week-ends.

  More than 6 accidents out of 10 involve 2 vehicles and women are involved in these accidents more (47.4% vs. 45.1%).

  In the average of 7 European countries, men have 1.4 times more accidents and 1.5 times more fatalities than women in accidents involving a single vehicle.

  As for the types of collisions, men are involved on average 1.1 times more in frontal collisions than women. Women on average have 1.4 times more rear-end collision accidents than men.

  Concerning the type of transport, women are injured more as drivers of cars, and secondly as pedestrians (16.1% of women's accidents are as pedestrians vs. 9.1% for men). This figure rises to 35.0% when speaking of women killed as pedestrians vs. 14.1% for men. Consequently, more than one-third of women killed on the road are pedestrians.

- Comparison with the bibliography

  The data in the literature corroborate some of these results and are a complement to certain aspects. It can be observed that men tend to have more accidents as single vehicles (loss of control), in bends, in dark weather and at weekends. On the other hand, women are more prone to accidents in collisions with third parties, at intersections, in urban areas and which are not fatal.

These observations should be qualified using exposure data, however, for example women drive when they are alone and less when their spouses are present (notably at weekends). The following factors should therefore be taken into account: work-related activities, social life, travel time, the number of kilometres driven, etc.

Alcohol and speed are two factors characteristic of accidents involving men. These questions need to be studied further by analysing the data in Detailed Accident Studies to find out whether these are typical characteristics of the loss of control among men. Women, on the other hand, run greater risks on wet carriageways.

It can be concluded that:

- The analysis of detailed data should provide more precise answers to the questions posed by the study of European data as should an examination of the literature.
- The descriptive analysis having enabled us to shed light on the differences in 'behaviour' among those involved in accident depending on gender, how these differences are still need to be seen fit into the details of accident data studied in-depth.
- One essential point concerns the loss of vehicle control by men. Indeed, men are much more frequently involved than women. It would be interesting to look further into this question to shed light on the principal mechanisms (beyond the factors put forward by the bibliography, such as speeding and alcohol).
- Another question that will also have to be answered concerns the over-representation of men involved in accidents: is this a phenomenon of excess risk for men due to characteristics in their driving or does it simply depend on exposure variables?
- Women appear to have excess risk on wet carriageways. On the other hand, the literature indicates that they have a tendency to avoid difficult driving situations. What might the causes of the excess risk be: is it a stress situation that causes them to react poorly, a lack of experience in these situations, excessive speed, a lack of appreciation of stopping distances in such conditions, etc.
- An interesting point is that the number of people killed in accidents involving a single vehicle is high given the lower number of accidents (the most numerous accidents are those involving 2 vehicles). This affirmation is notably true for men, who are killed 1.5 times more in this type of accident than women.
- On the question of luminosity, the study on European data indicates that there is little difference between accidents among men and women. Yet the literature seems to indicate that women are more involved than men in accidents between a vehicle and a pedestrian or bicycle in dark periods. It would therefore be useful to undertake a detailed analysis of which prototypical accident scenarios occur at different times of day.

7.6.5 Conclusion: Gender Issues in Traffic Accidents

Gender issues in accidents through literature and statistical facts show all the complexity which can be hidden behind an apparently simple dichotomist factor. Analysing the role of gender from a too simple point of view would be neglecting this complexity, and thus leads to a misleading understanding of the differences between men and women as roads users and accidents victims. That is why, in the frame of this Task 1.5 contributing to TRACE project, the analysis has been made in detail and will be completed by the In-depth study of accident data allowing to go deeper in the comprehension of the role of this differential parameter that is gender.

7.6.6 References

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8 Conclusions

The general objective of the TRACE project is to provide the scientific community, the stakeholders, the suppliers, the vehicle industry and other Integrated Safety program participants with an overview of the road accident causation issues in Europe, and possibly overseas, based on the analysis of any current available databases which include accident, injury, insurance, medical and exposure data (including driver behaviour in normal driving conditions). In accordance with these objectives, TRACE is divided into 3 series of technical Workpackages:

- ✓ The Operational Workpackages (WP1 Road Users – WP2 Types of driving situations and types of accident situations – WP3 Types of risk factors – WP4 Evaluation of the effectiveness of safety functions in terms of expected (or observed) accidents avoided and lives saved).
- ✓ The Methodologies Workpackages (WP5 Analysis of Human factors – WP7 Statistical Methods – WP6 Determination of Safety Functions).
- ✓ The Data Supply Workpackage (WP8).

This report is placed within 'Work Package 1: Road Users'. The main objectives of this work package are to identify problems and the magnitude of problems for the different road users (Passenger Car Drivers; Powered Two Wheeler Riders; Van, Bus and Truck Drivers; Pedestrians and Cyclists and, at last, Elderly people and Gender related accident) through macro level analysis of different accident databases (extensive databases); to understand and identify the specific accident causes for each one of the different road users considered, mainly by means of micro level analyses performed on in-depth accident databases (intensive databases) and finally, to identify the risk of being involved in an accident for the different road user categories.

The results obtained in this report have been related to first two steps of WP1 (literature review descriptive statistical analysis). These results have been focused on obtaining the main goal of this level, the identification of the main problems and the magnitude of the problems related to each road user point of view. This analysis has been performed separately for each road user category, so different specifications of each group have been identified.

The intention of the descriptive statistical analysis performed and detailed in this report has been to obtain the main general situations/factors/parameters (targets) where the accidents (from each road user point of view) are happening. These targets have been selected on the basis of the frequency or severity of the accidents for the different road users. The approach has been to analyse the personal, technical and environmental conditions in which the accident has happened to find an appropriate understanding of the circumstances upon which the accident occurs. Examples of these targets are: age, driving experience/training, professional occupation, cohabitation with other road users, gender, light, time/day/month, specific type of vehicle, speed… Apart from that, the analysis of the detailed data done during this report has provided more precise answers to the questions posed by the study of European data as should an examination of the literature.

Therefore, detailed information from several European countries (provided by WP8 'Data Supply') has allowed a well-balanced description of the accident situation among European Union, using several extensive accident databases, literature review and some statistical methods to extrapolate results from TRACE available databases at European level, in some cases, to a EU27 level.

One of the outputs of this report, apart of identifying the main accident problems for each road user at macroscopic level, is to determine what next in – depth analyses of this work package should focus on in the following steps with more detail looking at information that is not available within macroscopic databases. Therefore, in the incoming 'in – depth analysis' step (report D1.2 '*Road users and accident causation. Part 2: In-depth accident causation analysis*'), the main accident causation mechanism will be provided for each of the identified problems at macroscopic level. Microscopic accident databases will provide information able to tackle the three basic pillars of safety: the driver, the environment and the vehicle. Only looking at the whole picture of each accident with deep detail it can be stated what set of factors can be considered as causes of the accident.

Finally, a risk analysis over information from each road user, will estimate what is the risk of being involved in an accident for each of the different road users groups taking into consideration the exposure to the different causation mechanisms identified in the incoming in – depth analysis. Also, the study of these risk factors will also help to answer questions related to aspects as over-representation of specific variables in accidents (a phenomenon of excess risk for those variables or simply depending on exposure).

Summarizing, this deliverable has allowed answering relevant questions considered at the beginning of the first two steps in the 'Work Package 1' (In-depth and risk analyses). Questions related to updating diagnosis of road traffic safety in Europe and knowing the main accident scenarios and characteristics from each road user point of view (for the evaluation of the effectiveness of existing safety devices, the determination of the most promising safety systems or the identification of the configurations not addressed by present technologies) have been gathered.

9 Discussions

Due to the ambitious objective of the research planned for this report, limitations and difficulties have been present across the Descriptive Analysis, both of scientific and management nature. That is why the following points for discussion need to be pointed out.

First consideration is concerning to the period of time studied in the descriptive analysis of the extensive databases available for TRACE. This analysis has been focused on a four year period, from 2001 to 2004, instead of only one year (except Greek data which were only available from the year 2004). The fact that data from last four years have been used instead of using only last year data is due to two reasons. The first one is the need for having enough quantity of data, and the second reason is that it has been found the trends for different aspects have remained approximately constant. Therefore, although analysis over only one year could have been also undertaken, to take into consideration a four year period has allowed a higher quantity of information including possible different trends during this period.

Other aspect to be discussed is about queries performed over extensive databases. It is obvious to think that statistical data available in public reports are just limited to show some overviews or trends that are useful only to understand the general situation of a specific accidental problem, but they are not deep enough to analyse detailed aspects or issues which can help to answer different questions like Who? How? Where? What?.... This is the reason specific data are needed, being only available when detailed and specific queries have been made over national databases. One important problem of doing these detailed queries is the fact of lack of harmonisation between definition variables, definition of options of each variable and lack of some variables in some databases while these are available in other ones. For solving these reverses, the following considerations have been taken into account:

- ✓ Definitions and explanations of variables were given from Work Package 8 'Data Supply' to obtain a common harmonization in database queries and analysis.
- ✓ In case of lack of information from any TRACE extensive database (variables not available), queries and analysis have been done only over databases with that information available.

In the Annex 1 ('Expansion of national data to EU-27 level'), a useful statistical method has been detailed for the extrapolation of findings obtained after analysis over TRACE extensive databases. Although this methodology is possible to be applied to operational work packages ('WP1: Road Users'; 'WP2: Types of driving situations and types of accident situations' and 'WP3: Types of risk factors'), in the case of WP1, it has not been able to apply it to all the tasks (road user points of view). The reason of this impossibility has been the lack of information of 'margin data' needed for the extrapolation and coming from EU-25 or EU-27 countries (although for the last two countries belonging to European Union it is nearly impossible to obtain very specific information related to accidental situation). On other hand, some detailed statistics have been found in the literature review of each task including information at the whole European level.

At last, the analyses developed for the Descriptive Analysis are not able to provide scientific knowledge on accident causation. It has to be recalled that its objective was to detect the main problems, accident characteristics for each road user. In-depth analysis and Risk analysis will provide the results on the accident causation for each road user group.

From this study realized in WP1, it can be summarized in the following analysis:

Opportunities

- Update diagnosis of road traffic safety in Europe and provide some general descriptive and exposure figures at EU27 level.
- Update knowledge of main accident scenarios.
- Define the main scenarios from each road user point of view for the following steps in 'Work Package 1' (In-depth and risk analyses) which will help for:
    - The evaluation of the effectiveness of existing safety devices.
    - The determination of the most promising safety systems.
    - The identification of the configurations not addressed by present technologies.
- The lack of data put in evidence in this report can be a good opportunity to other projects as Safetynet to complete its definition of the real needs for both descriptive and exposure data.

Threats

- The lack of some accident and exposure data at the European level does not allow providing a more complete picture on EU27 general situation.

10 References

In this chapter references used in this deliverable are shown, except references from chapters '3. Task 1.1: Passenger Car Drivers', '4. Task 1.2: Powered Two Wheeler Riders', '5. Task 1.3: Van, Bus and Truck Drivers', '6. Task 1.4: Pedestrian and Cyclists' and '7. Task 1.5: Elderly People and Gender related accidents' which have been detailed in the respective chapters:

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- ✓ Special gratitude to the following National Databases:

  STATS19 Data from Great Britain: National Accident Data for Great Britain are collected by police forces and collated by the GB Department for Transport. The data are made available to the Vehicle Safety Research Centre, Ergonomics and Safety Research Institute, at Loughborough University by the GB Department for Transport. The Department for Transport and those who carried out the original collection of the data bear no responsibility for the further analysis or interpretation of it.

  SISS – Sistema Integrato Sicurezza Stradale - Data from Italy: Accident Data are collected and collated for local administrations by police across Milan province, Mantova province, Naples city, Sorrento city and Salerno city (Italy) . The data are made available to ELASIS and to National Institute of Statistics by local administrations. The local administrations and who carried out the original collection of the data bear no responsibility for the further analysis or interpretation of it.

  EDN (Traffic Accidents Registration) Data from the Czech Republic: National Accident Data for the Czech Republic are collected by the Czech Police forces. The data are made available to CDV (Transport Research Centre). CDV bears no responsibility for the further analysis or interpretation of it.

  BAAC (Bulletin d'Analyse des Accidents Corporels): National accident database for France collected by police, CRS and Gendarmerie forces and provided by ONISR (Observatoire National Interministériel de Sécurité Routière). The data are made available to the Laboratory of Accidentology, Biomechanics and human behaviour PSA Peugeot-Citroën, Renault.

  Spanish Road Accidents database is carried out by a public organisation called DGT (Dirección General de Tráfico), dependent of the Ministry of the Interior. Information contained in DGT Spanish Road Accidents Database is collected by police forces, when an accident occurs. The data are made available for CIDAUT since 1993. The Department for Transport and those who carried out the original collection of the data bear no responsibility for the further analysis or interpretation of it.

12 List of Abbreviations

ABS: Antilock Brake System.
AT: Austria.
BE: Belgium.
BL: Bulgaria.
CARS: Competitive Automotive Regulatory System.
CY: Cyprus.
CZ: Czech Republic.
DE: Germany.
DGT: Dirección General de Tráfico.
DK: Denmark.
EC: European Commission.
ECMT: European Conference of Ministers of Transport.
EE: Estonia.
EEVC: European Enhanced Vehicle-safety Committee.
EEVC WG: European Enhanced Vehicle-safety Committee Working Group.
EL: Greece.
ES: Spain.
EU: European Union.
Euro NCAP: Euro New Car Assessment Programme.
FI: Finland.
FR: France.
GDP: Gross Domestic Product.
GDV: Gross Vehicle Weight.
GNP: Gross National Product.
HU: Hungary.
IE: Ireland.
IT: Italy.
LT: Lithuania.
LU: Luxembourg.
LV: Latvia.
MT: Malta.
NL: Netherlands.
NGO: Non-Governmental Organization.
OR: Odds Ratio.
PL: Poland.
PT: Portugal.
PTW: Powered Two Wheeler.
RO: Romania.
SE: Sweden.
SK: Slovakia.
SL: Slovenia.
TRACE: Traffic Accident Causation in Europe.

UK: United Kingdom.
WG: Working Group.
WP: Work Package.

13 Annex 1: Expansion of national data to EU-27 level

Most of specific information used during each task (the five road user) has been obtained from the extensive databases available for the TRACE project. As it has been detailed during the report, around 5 or 6 extensive databases have been used for these specific queries. Due to the difficulty of obtaining these specific characteristics for the rest of the European countries, a statistical method has been developed in TRACE (Work Package 7 'Statistical Methods') to extend data from TRACE extensive databases to European level. Although the method has been perfectly detailed, in some occasions it has been impossible to do the extension due to lack of information. In the following chapters, this methodology is explained.

13.1 Expansion of regional or national accident data to EU-27 level

Valid identification of accident causes frequently requires in-depth traffic accident investigations. As is well known, in-depth accident studies are rare and do not cover complete countries or even EU-27. Therefore, no direct estimation of EU population totals is possible. However, statistics at the EU level or national statistics from EU-27 member states provide some structural information on accidents and road users involved. In this situation an important research target of TRACE is to create synthetic frequency tables at EU-27 level by combining (1) data from regional in-depth studies with (2) structural road user data from European or national traffic accident statistics under an appropriate statistical model.

TRACE is restricted to the use of existing and accessible accident and exposure data from selected European countries. Despite this, accident causation issues at EU-27 level are to be addressed in the TRACE project. Thus, the problem arises to expand accident data from selected countries to the European level. For these purposes at least some basic auxiliary information on traffic accidents at EU-27 level is necessary which can be found in sources like ECE, IRTAD, ERSO and ETSC. Again, the target is to expand traffic accident data from a few countries (where the data is available) to EU-27 level under certain assumptions which seem to be sufficiently realistic and acceptable.

As an example the expansion of a table of fatality counts given some external marginal totals is considered. A three-dimensional frequency table from an in-depth study may show fatalities by (1) type of traffic participation, (2) age group and (3) accident cause attributed to fatally injured road user. Two one-dimensional margins for EU-27 are available from IRTAD:

- ✓ fatalities by type of traffic participation
- ✓ fatalities by age group

By combining the data sources, a three-dimensional table at EU-27 level of fatalities broken down by (1) traffic participation, (2) age group and (3) accident cause attributed to fatally injured road user is to be built.

From a statistical point of view we are faced with the problem of adjusting (or raking) a multi-dimensional contingency table to satisfy some external information about the margins of the table. This problem can be solved using the so-called iterative proportional fitting procedure.

13.2 Adjusting a table of counts to satisfy some marginal constraints

A multi-dimensional contingency table of observed count data serves as initial or starting table. Then, the iterative proportional fitting procedure (IPFP) is applied to adjust the starting table to certain one- or higher-dimensional marginal distributions which represent the external information. The adjusted table is an easily calculated solution to a table which satisfies the marginal constraints and preserves those main and interaction effects for which no external margins are available. Applied to our expansion problem, the adjusted table produced by the IPFP combines different data sources in a way that all information available at the European level is used and only the missing information is taken from the regional or national data bases.

To illustrate the algorithm we consider a three-way starting table x = {xijk} which is to be adjusted to three two-dimensional margins denoted by Xij+, Xi+k and X+jk.

The IPFP takes the initial table

(0) $m_{ijk}(0) = x_{ijk}$ for all i, j, k.

As the initial table is to be adjusted to three margins, the r-th iteration (r=1, 2, …) consists of three steps which form:

(1) $m_{ijk}(r|1) = m_{ijk}(r-1|3) \cdot X_{ij}+/m_{ij}+(r-1|3)$,

(2) $m_{ijk}(r|2) = m_{ijk}(r||1) \cdot X_{i+j}/m_{i+j}(r|1)$,

(3) $m_{ijk}(r|3) = m_{ijk}(r|2) \cdot X_{+ij}/m_{+ij}(r|2)$.

Steps 1, 2 and 3 are repeated until the change in the adjusted counts at the end of a cycle is sufficiently small. Clearly, after the final iteration also the adjusted and external margins are sufficiently close.

For a detailed discussion of convergence and some other properties of the algorithm see, for instance, Bishop, Y.M.M., Fienberg, S.E., and Holland, P.W. (1975) Discrete Multivariate Analysis. MIT Press, Cambridge, Mass. The IPFP is not only a computational technique for adjusting tables of counts. Rather, the IPFP is a commonly used algorithm for maximum likelihood estimation in log-linear models. This algorithm forms the core of several log-linear computer packages (see McCullagh, P. and Nelder, J.A. (1992) Generalized Linear Models. Second Edition, Chapman & Hall, London, p. 183).

As an adjustment procedure the IPFP goes back to Deming, W.E. and Stephan, F.F. (1940) On a least squares adjustment of a sampled frequency table when the expected marginal totals are known. Ann. Math. Statist. 11, 427-444. Therefore, the IFPF is sometimes also called Deming-Stephan algorithm.

14 Annex 2: Tables and figures

In this Annex, some tables and figures are shown, which have been used to analyse the different situation for each road user.

14.1 Annex 2.1: Passenger car drivers

No information related to chapter 3 'Task 1.1: Passenger car drivers' is included in this annex.

14.2 Annex 2.2: Powered Two Wheelers

Information related to chapter 4 'Task 1.2: Powered Two Wheelers' is included in this annex.

Age group	0-14		15-24		25-44		45-64		>64		un-known	%fem. from known
Gender	fem.	male	fem.	male	fem.	male	fem.	male	fem.	male		
BE	0,7	0,0	2,6	17,0	2,6	56,9	1,3	17,6	0,7	0,7	0	7,8
DK	0,0	0,0	2,2	31,1	0,0	20,0	4,4	28,9	0,0	13,3	0	6,7
EE	0,0	0,0	0,0	28,6	0,0	42,9	0,0	0,0	0,0	14,3	14,3	0
EL	0,0	1,1	3,1	30,0	4,2	41,8	0,9	10,7	0,7	6,8	0,9	8,8
ES	0,2	1,0	3,5	24,3	3,3	47,9	0,8	12,3	0,2	5,5	1,0	8,1
FR	0,2	0,6	3,8	32,5	3,4	40,7	1,7	14,3	0,5	2,4	0	9,5
IE**	0,0	0,0	0,0	25,5	0,0	65,5	0,0	5,5	0,0	0,0	3,6	0
IT*	0,3	1,1	2,7	23,3	3,8	45,4	0,8	13,0	0,5	6,1	3,1	8,3
LU***	-	-	-	-	-	-	-	-	-	-	-	-
HU	0,0	0,0	4,3	18,6	1,4	46,4	0,7	21,4	0,7	6,4	0	7,1
MT	0,0	0,0	0,0	33,3	0,0	66,7	0,0	0,0	0,0	0,0	0	0,0
NL**	0,0	1,1	5,8	20,6	2,1	37,6	1,6	16,9	1,6	12,7	0	11,1
AT	0,0	0,0	5,0	28,1	5,0	33,8	0,0	19,4	0,0	8,6	0	10,1
PL	0,0	2,9	1,0	34,3	2,4	38,1	1,0	11,4	0,5	7,1	1,4	4,8
PT	0,0	0,0	1,9	23,7	2,7	47,0	0,8	13,6	0,8	8,5	1,0	6,3
FI	0,0	2,8	2,8	22,2	5,6	44,4	0,0	19,4	0,0	2,8	0	8,3
SE	0,0	0,0	1,9	24,1	7,4	35,2	1,9	25,9	0,0	3,7	0	11,1
UK	0,0	0,7	0,7	21,4	2,1	51,9	0,7	19,5	0,2	2,7	0,2	3,6
Moped	0,3	2,3	6,0	36,9	2,7	18,4	1,7	14,9	1,3	14,1	1,3	12,4
Motor cycle	0,1	0,3	1,8	22,1	3,4	54,0	0,8	14,3	0,1	2,0	1,1	6,6
EU-18	0,2	0,8	2,9	26,0	3,2	44,6	1,0	14,4	0,5	5,2	1,1	7,9

* Data from 2004
** Data from 2003
*** Data from 2002

Source: CARE Database / EC
Date of query: November 2007

Table1_Annex2.2.-Percentage of Motorcycle and Moped rider fatalities by age and gender (2005).

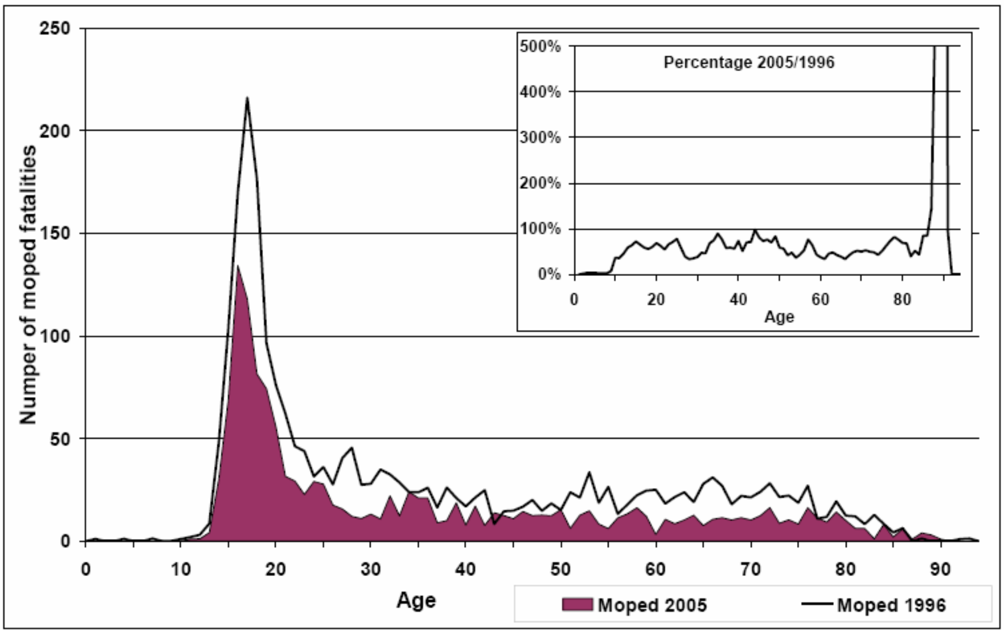


Figure 1_Annex2.2.-Aged distribution of rider fatalities in 1996 and 2005, both EU-14.

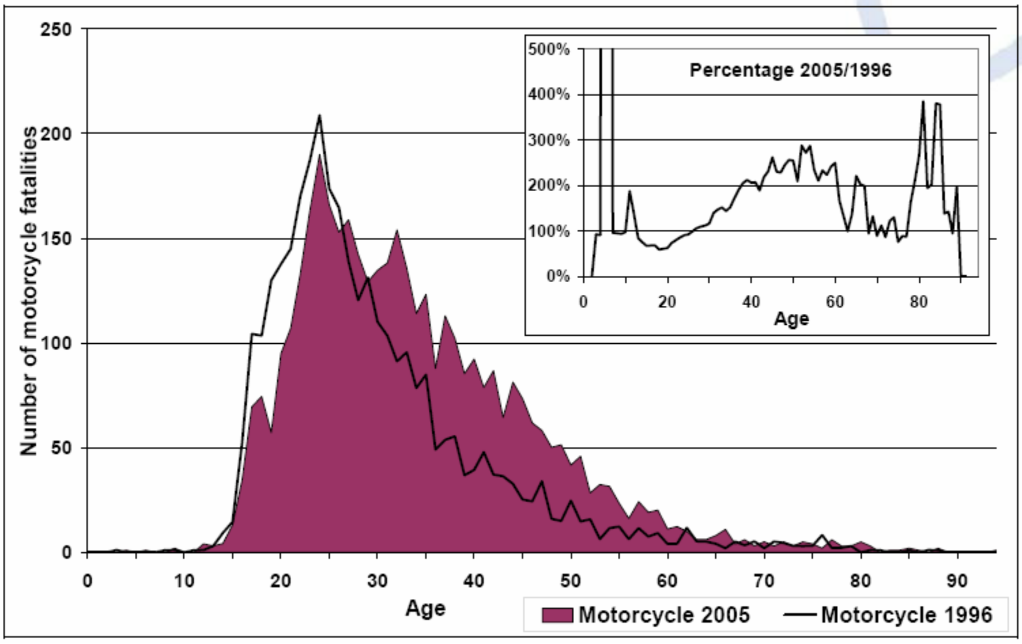


Figure 2_Annex2.2.-Age distribution of motorcycle rider fatalities in 1996 and 20051, both EU-14.

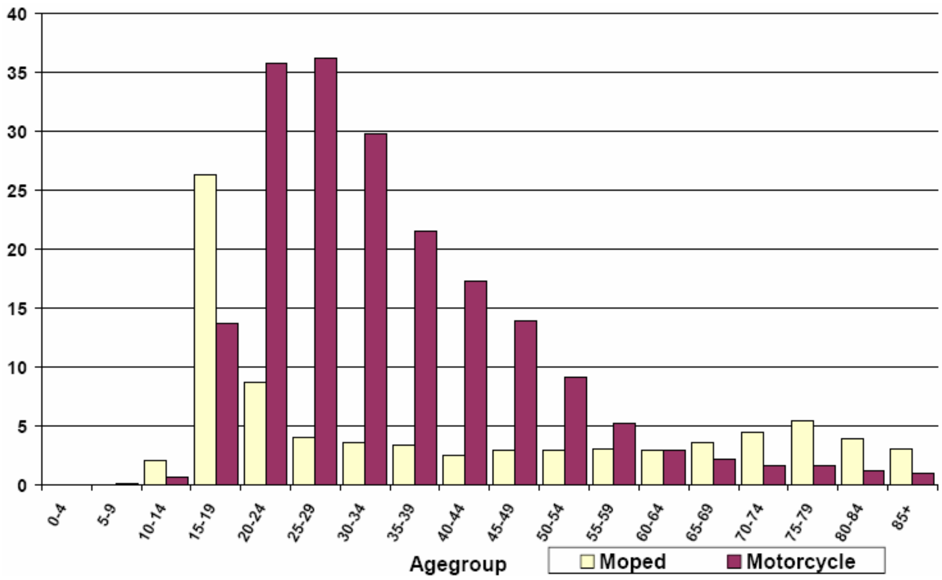


Figure 3_Annex2.2.-Fatalities per million population by age group – EU-14.

	Fatalities Moped			Fatalities Motorcycle			PTW fatalities as percentage of all fatalities by road type		
	Inside urban area	Outside urban area		Inside urban area	Outside urban area		Inside urban area	Outside urban area	
		Non motor-way	Motor-way		Non motor-way	Motor-way		Non motor-way	Motor-way
BE	13	17	0	35	82	6	18,8%	14,7%	3,7%
DK	14	15	0	6	10	0	21,1%	12,2%	0,0%
EE	0	2	0	3	2	0	6,5%	3,3%	-
EL	37	19	2	260	120	19	39,2%	17,6%	18,9%
ES	138	174	0	114	344	14	31,9%	15,1%	6,4%
FR	178	177	1	346	504	42	31,5%	20,4%	13,3%
IE**	-	-	-	17	37	1	19,1%	15,4%	12,5%
IT*	241	147	0	500	508	62	32,1%	24,6%	9,6%
LU***	0	0	0	0	0	0	0,0%	0,0%	0,0%
HU	22	18	0	51	48	1	14,6%	9,1%	2,1%
MT	0	0	0	3	0	0	17,6%	-	-
NL**	55	38	1	22	52	21	22,3%	16,9%	14,6%
AT	12	29	0	17	80	1	14,4%	22,9%	1,1%
PL	23	30	0	94	63	0	4,7%	3,2%	0,0%
PT	71	35	0	106	73	9	32,9%	17,7%	9,3%
FI	1	3	0	12	19	1	12,9%	8,2%	10,0%
SE	4	4	0	14	30	2	17,0%	11,0%	8,3%
UK	17	6	0	200	343	18	16,7%	19,1%	8,7%
EU-18	826	714	4	1.800	2.315	197	22,6%	15,8%	9,3%
%	53,5	46,2	0,3	41,7	53,7	4,6			

* Data from 2004
** Data from 2003
*** Data from 2002

Source: CARE Database / EC
Date of query: November 2007
For IE and UK, see also the notes to tables 1 and 2

Table 3_Annex2.2.-The number of motorcycle and moped rider fatalities by area and road type, 2005.

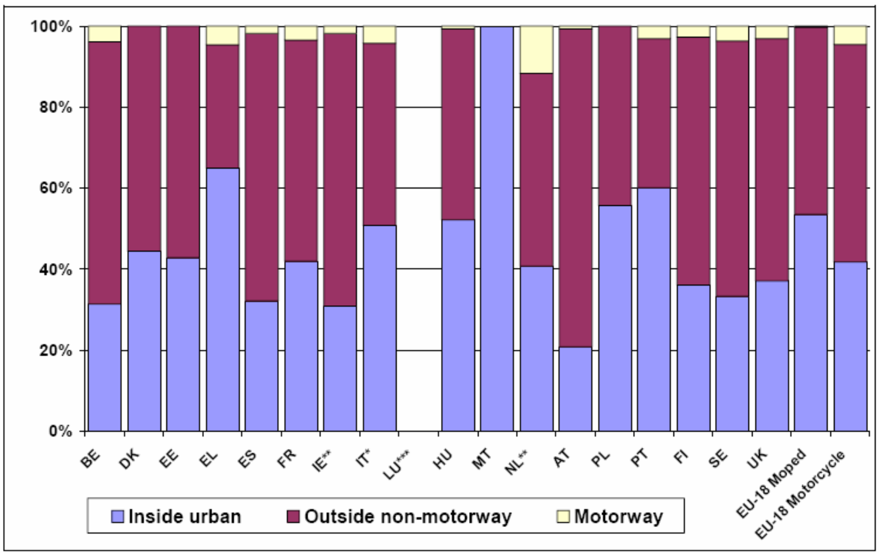


Figure 4_Annex2.2.-The distribution of PTW fatalities by area type and road type, 2005.

	Not at junction	At junction					Not defined	Total
		cross-road	t or y junction	level crossing	round-about	other junction type / unknown		
BE	109	0	0	0	0	44	0	153
DK	28	8	0	0	0	9	0	45
EE	2	1	1	0	0	2	1	7
EL	417	0	0	0	0	40	0	457
ES	544	100	98	0	17	25	0	784
FR	1.006	83	83	5	26	45	0	1.248
IE**	0	6	6	0	0	1	42	55
IT*	905	258	0	1	29	265	0	1.458
LU***	0	0	0	0	0	0	0	0
HU	92	46	0	1	0	1	0	140
MT	0	0	0	0	0	0	3	3
NL**	112	41	34	0	1	1	0	189
AT	72	25	11	2	0	0	29	139
PL	163	47	0	0	0	0	0	210
PT	161	29	46	1	3	5	50	294
FI	28	0	0	0	0	7	1	36
SE	0	19	0	0	0	0	35	54
UK	317	31	155	0	15	66	0	584
EU-18	3.955	1.740					161	5.856
%	67,5%	29,7%					2,8%	100%
EU-18 At junction		694	434	10	92	510		
% junction type		39,9%	24,9%	0,6%	5,3%	29,3%		

* Data from 2004
** Data from 2003
*** Data from 2002

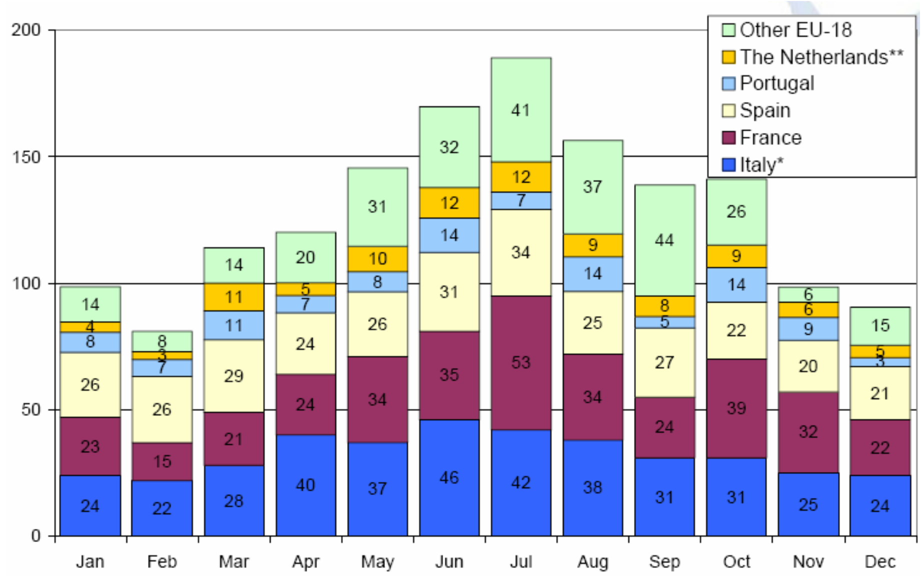
Source: CARE Database / EC
Date of query: November 2007

Table 4_Annex2.2.-The number of motorcycle and moped occupant fatalities by junction type, 2005.

	Not at junction	At junction	Not defined
Pedestrian	75,7%	21,6%	2,7%
Bicycle	61,0%	37,2%	1,8%
Moped	63,9%	34,1%	1,9%
Motorcycle	68,8%	28,1%	3,0%
Car + taxi	80,5%	15,8%	3,7%
Lorry, under 3.5 tonnes	80,0%	12,6%	7,4%
Heavy goods vehicle	85,4%	10,0%	4,5%
Other / Unknown	78,2%	18,6%	3,2%
EU-18 all modes	76,2%	20,4%	3,3%

Source: CARE Database / EC
Date of query: November 2007

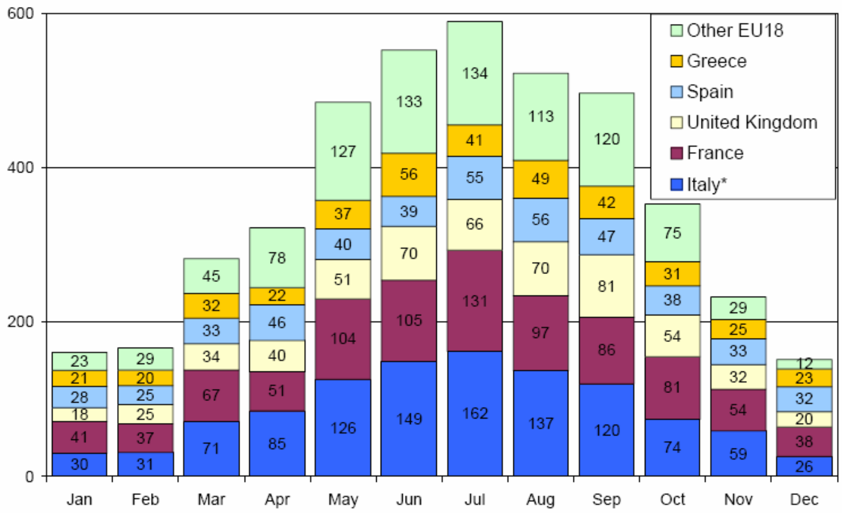
Table 5_Annex2.2.-Fatalities by junction type and mode of transport – EU18, 2005.



* Data from 2004
** Data from 2003

Source: CARE Database / EC
Date of query: November 2007

Figure 5_Annex2.2.-Moped fatalities by month – top 5 countries and other EU-18, 2005.



* Data from 2004

Source: CARE Database / EC
Date of query: November 2007

Figure 6_Annex2.2.-Motorcycle fatalities by month – top 5 countries and other EU-18, 2005.

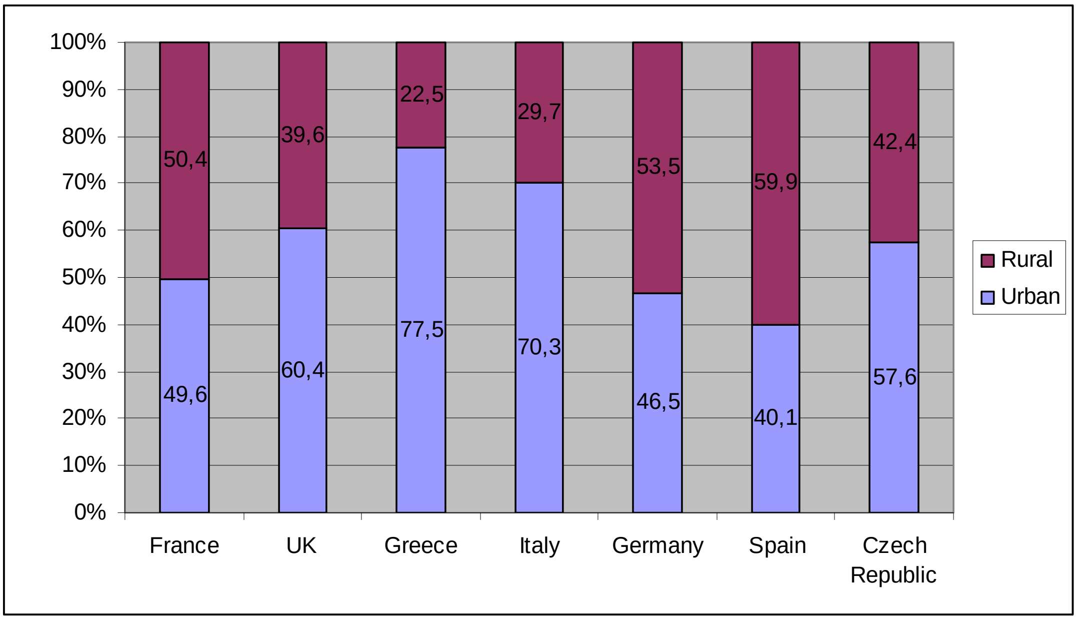


Figure5_Annex2.2.- Accident area of motorcycle accidents (2001–2004) for France, GB, Greece, Italy, Germany, Spain and Czech Republic.

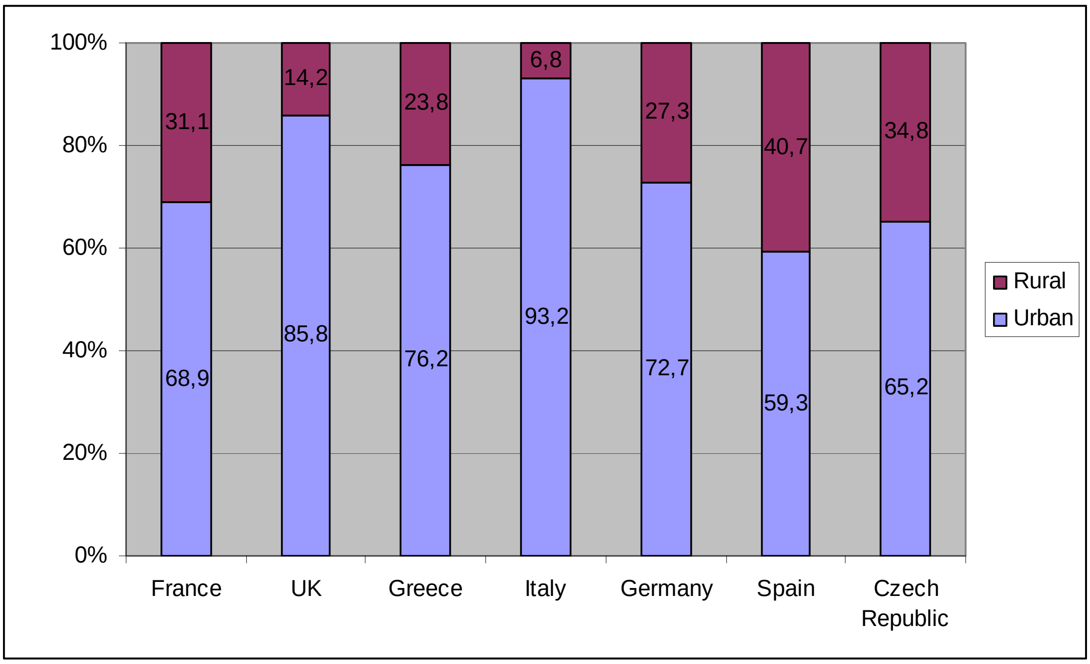


Figure6_Annex2.2.- Accident area of moped accidents (2001–2004) for France, GB, Greece, Italy, Germany, Spain and Czech Republic.

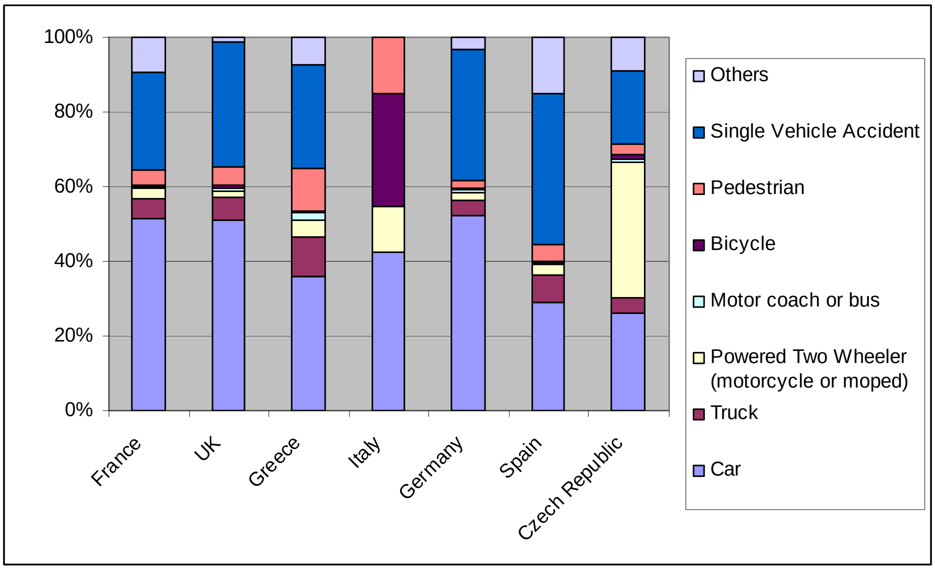


Figure7_Annex2.2.- Most usual accidents opponents of motorcycles (2001–2004) for France, GB, Greece, Italy, Germany, Spain and Czech Republic.

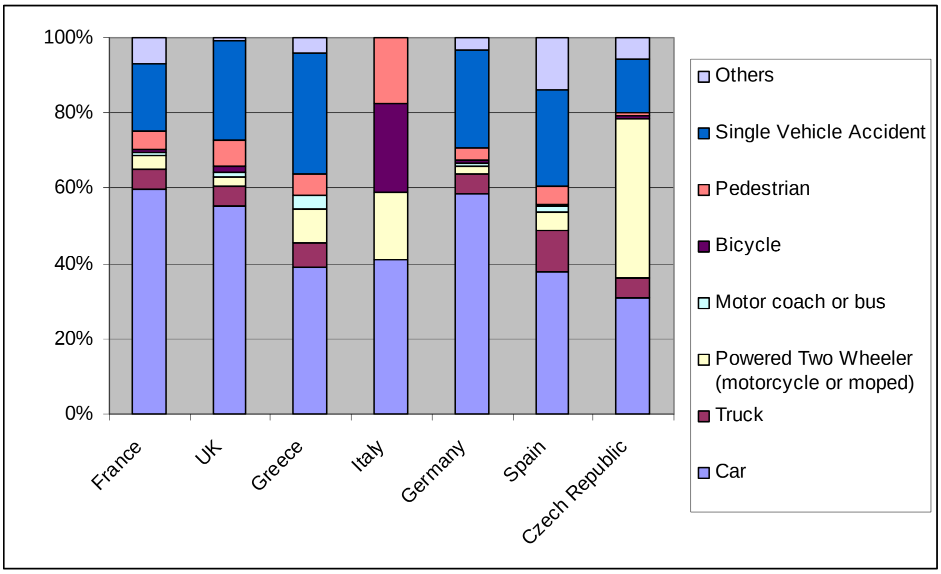


Figure8_Annex2.2.- Most usual accidents opponents of mopeds (2001–2004) for France, GB, Greece, Italy, Germany, Spain and Czech Republic.

14.3 Annex 2.3: Vans, Bus and Truck Drivers

Information related to chapter 5 'Task 1.3: Vans, Bus and Truck Drivers' is included in this annex.

14.3.1.a Importance of the accident, tables and graphics

Kind of vehicle		Accidents with				
		killed persons	seriously injured persons	slightly injured persons	Unknown	Total
Goods road vehicle	Number	1,255	8,103	29,827	0	39,185
	%	*3.2*	*20.7*	*76.1*	*0.0*	*100.0*
Bus	Number	107	1,017	4,456	0	5,580
	%	*1.9*	*18.2*	*79.9*	*0.0*	*100.0*
All road user	Number	6,005	74,306	277,500	0	357,811
	%	*1.7*	*20.8*	*77.6*	*0.0*	*100.0*

Table1_Annex2.3.- Importance of the accident (Germany average 2001/2004).

Kind of vehicle		Accidents with				
		killed persons	seriously injured persons	slightly injured persons	Unknown	Total
Goods road vehicle	Number	1,089	2,071	9,506	0	12,666
	%	*8.6*	*16.4*	*75.0*	*0.0*	*100.0*
Bus	Number	100	246	1,960	0	2,305
	%	*4.3*	*10.6*	*85.0*	*0.0*	*100.0*
All road user	Number	6,445	21,571	106,294	0	134,310
	%	*4.8*	*16.1*	*79.1*	*0.0*	*100.0*

Table2_Annex2.3.- Importance of the accident (France average 2001/2004).

Kind of vehicle		Accidents with				
		killed persons	seriously injured persons	slightly injured persons	Unknown	Total
Goods road vehicle	Number	714	3,711	23,410	0	27,835
	%	*2.6*	*13.3*	*84.1*	*0.0*	*100.0*
Bus	Number	153	1,348	10,525	0	12,026
	%	*1.3*	*11.2*	*87.5*	*0.0*	*100.0*
All road user	Number	3,131	29,443	185,478	0	218,051
	%	*1.4*	*13.5*	*85.1*	*0.0*	*100.0*

Table3_Annex2.3.- Importance of the accident (GB average 2001/2004).

Kind of vehicle		Accidents with killed persons	Accidents with seriously injured persons	Accidents with slightly injured persons	Accidents with Unknown	Accidents with Total
Goods road vehicle	Number	326	292	1,561	0	2,178
	%	*14.9*	*13.4*	*71.7*	*0.0*	*100.0*
Bus	Number	41	47	358	0	446
	%	*9.1*	*10.5*	*80.4*	*0.0*	*100.0*
All road user	Number	1,442	1,857	12,350	0	15,649
	%	*9.2*	*11.9*	*78.9*	*0.0*	*100.0*

Table4_Annex2.3.- Importance of the accident (Greece average 2001/2004).

Kind of vehicle		Accidents with killed persons	Accidents with seriously injured persons	Accidents with slightly injured persons	Accidents with ISTAT - injured	Accidents with Unknown	Accidents with Total
Goods road vehicle	Number	14	5	103	855	160	1136.75
	%	*1.3*	*0.4*	*9.0*	*75.2*	*14.1*	100
Bus	Number	1	0	9	264	8	280.5
	%	*0.3*	*0.0*	*3.0*	*93.9*	*2.8*	100
All road user	Number	257	301	2,398	20924.75	598	24476.75
	%	*1.0*	*1.2*	*9.8*	*85.5*	*2.4*	100

Table5_Annex2.3.- Importance of the accident (Italy average 2001/2004).

Kind of vehicle		Accidents with killed persons	Accidents with seriously injured persons	Accidents with slightly injured persons	Accidents with Unknown	Accidents with Total
Goods road vehicle	Number	1,278	4,967	20,535	1,749	28,528
	%	*4.5*	*17.4*	*72.0*	*6.1*	*100.0*
Bus	Number	100	471	3,246	488	4,304
	%	*2.3*	*10.9*	*75.4*	*11.3*	*100.0*
All road user	Number	4,581	25,878	121,176	9742.5	161,377
	%	**2.8**	**16.0**	**75.1**	**6.0**	**100.0**

Table6_Annex2.3.- Importance of the accident (Spain average 2001/2004).

Kind of vehicle		Accidents with killed persons	Accidents with seriously injured persons	Accidents with slightly injured persons	Unknown	Total
Goods road vehicle	Number	199	380	1,499	0	2,078
	%	*9.6*	*18.3*	*72.1*	*0.0*	*100.0*
Bus	Number	38	90	483	0	611
	%	*6.3*	*14.6*	*79.1*	*0.0*	*100.0*
All road user	Number	1,233	4,149	20,618	0	25,999
	%	*4.7*	*16.0*	*79.3*	*0.0*	*100.0*

Table7_Annex2.3.- Importance of the accident (Czech Republic average 2001/2004).

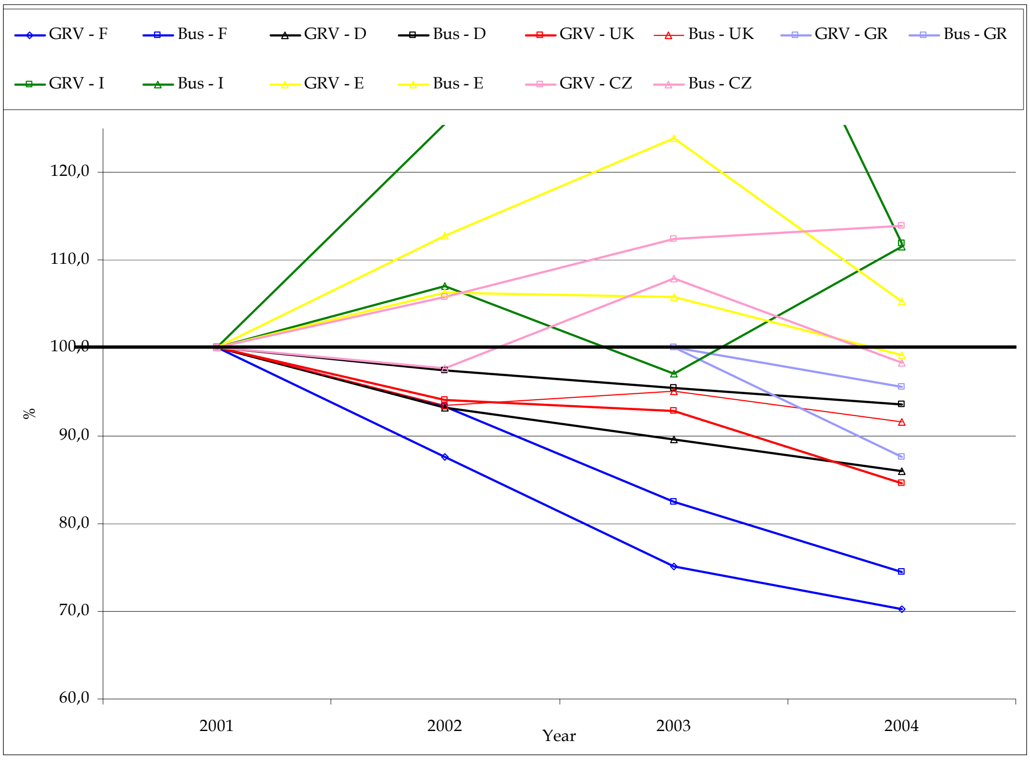


Figure1_Annex2.3.- Evolution of the accidents in goods vehicles (2001/2004).

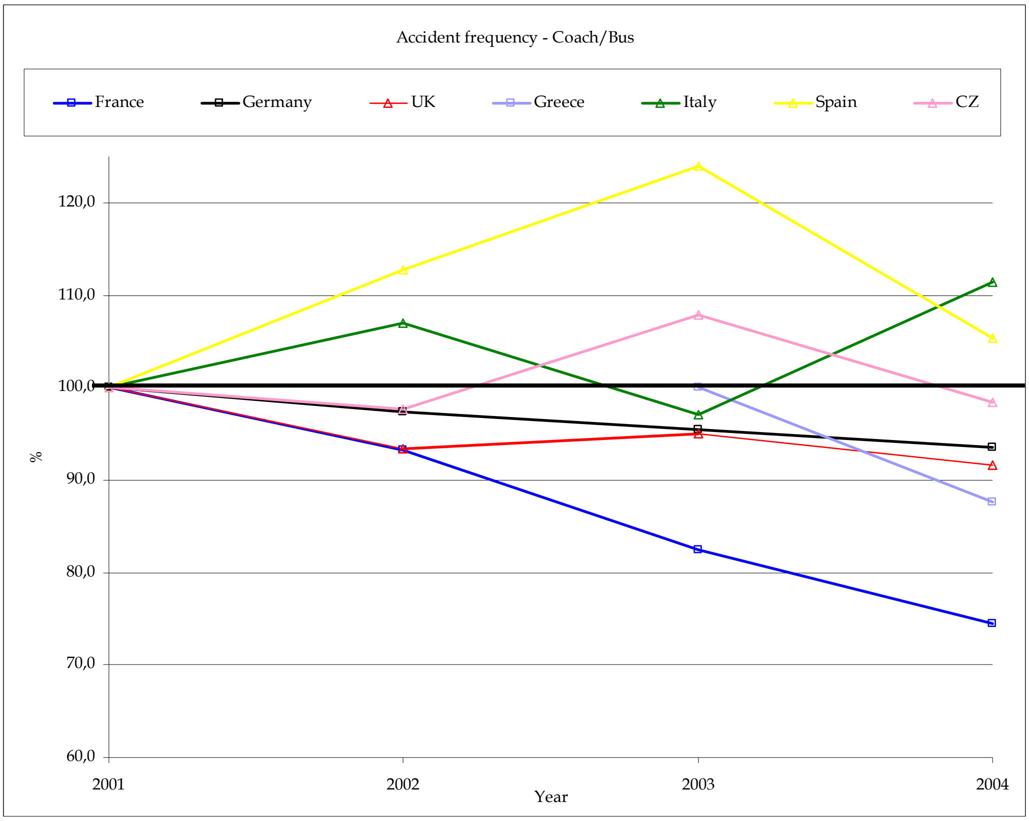


Figure2_Annex2.3.- Evolution of the accidents in coaches/buses (2001/2004).

14.3.1.b Location of the accident, tables and graphics

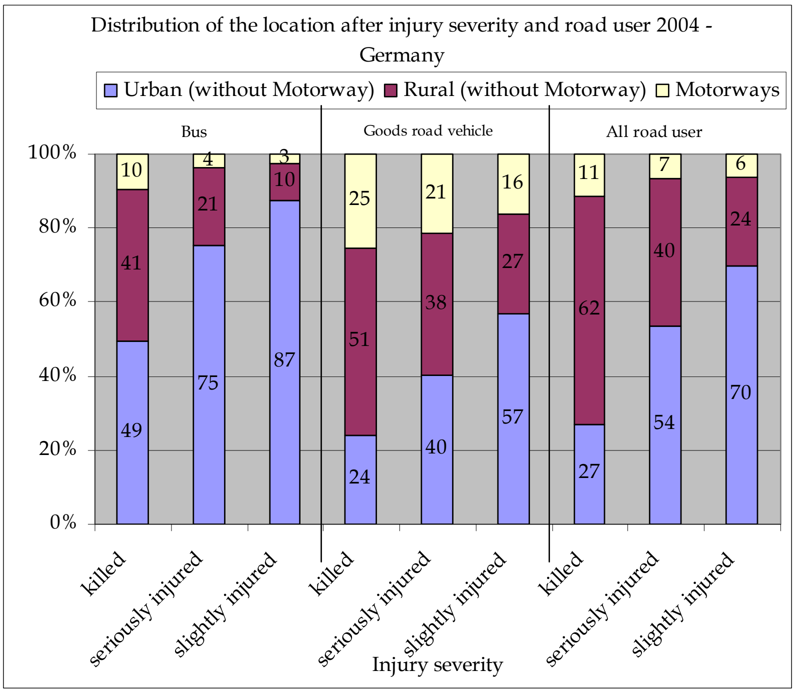


Figure3_Annex2.3.- Location of the accidents (Germany, average 2001/2004).

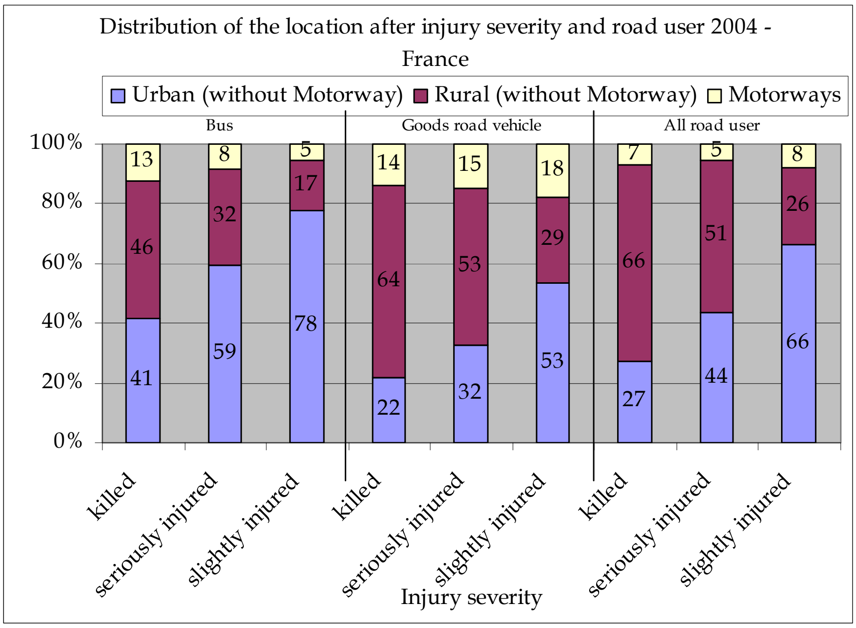


Figure4_Annex2.3.- Location of the accidents (France, average 2001/2004).

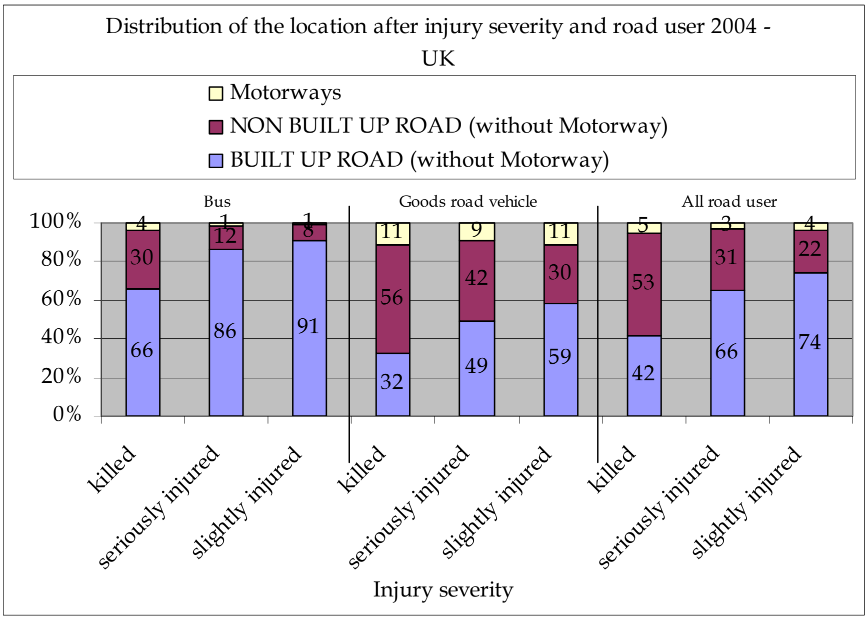


Figure5_Annex2.3.- Location of the accidents (GB, average 2001/2004).

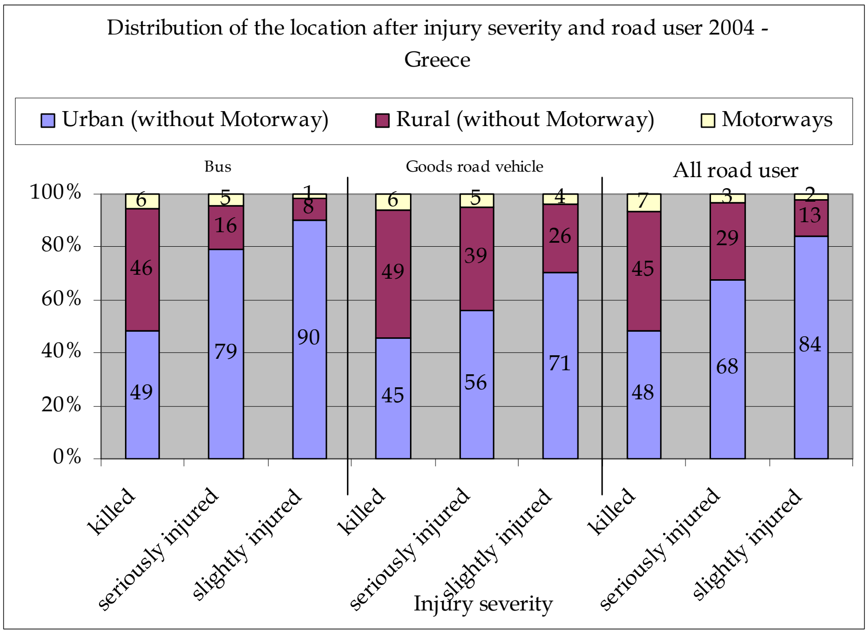


Figure6_Annex2.3.- Location of the accidents (Greece, average 2001/2004).

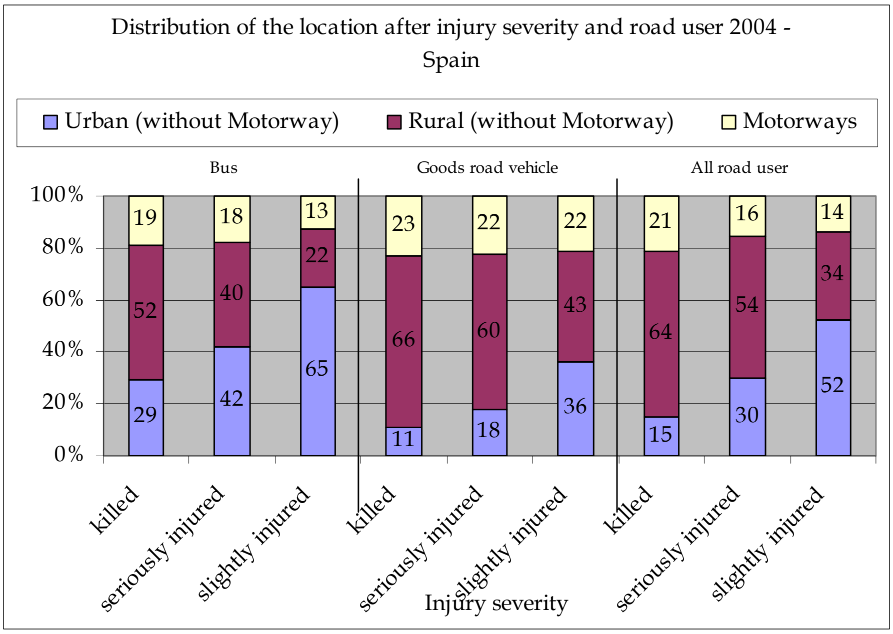


Figure7_Annex2.3.- Location of the accidents (Spain, average 2001/2004).

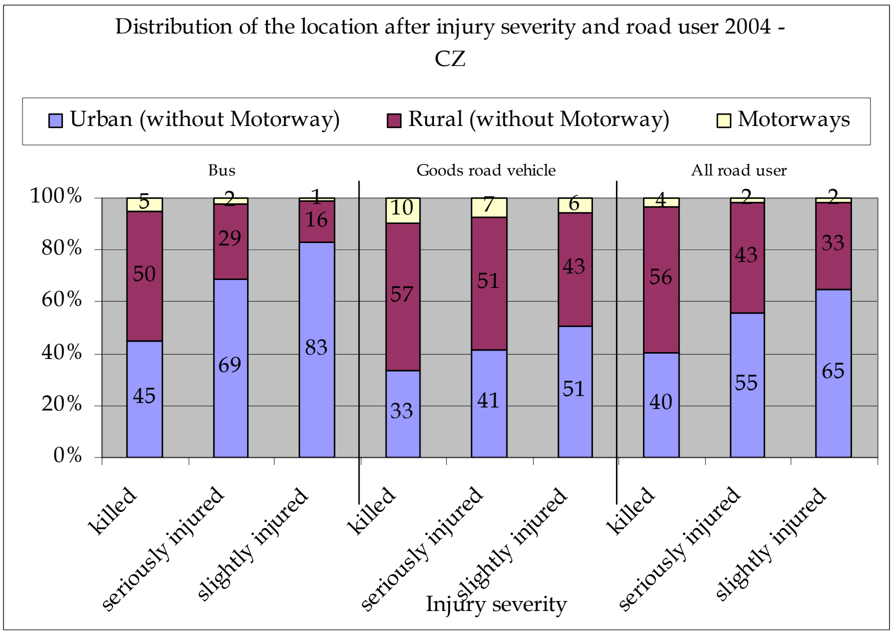


Figure8_Annex2.3.- Location of the accidents (CZ, average 2001/2004).

14.3.1.c Light conditions, tables and graphics

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	30,158	77	4,589	82	259,788	73
Dawn or dusk	1,841	5	271	5	18,456	5
Darkness	7,186	18	720	13	79,567	22
Total	39,185	100	5,580	100	357,811	100

Table8_Annex2.3.- Light conditions (Germany, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	27,861.0	*76.0*	4,801.0	*80.8*	270,269.0	*68.7*
Dawn or dusk	2,035.0	*5.5*	348.0	*5.9*	22,030.0	*5.6*
Darkness	6,771.0	*18.5*	792.0	*13.3*	100,971.0	*25.7*
Total	36,667.0	*100.0*	5,941.0	*100.0*	393,270.0	*100.0*

Table9_Annex2.3.- Light conditions (France, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	90217	81.0	39863	82.9	630368	72.3
Dawn or dusk		0.0		0.0		0.0
Darkness	21123	19.0	8242	17.1	241837	27.7
Total	111340	100.0	48105	100.0	872205	100.0

Table10_Annex2.3.- Light conditions (GB, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	1641	*77.1*	340	*81.7*	10142	*65.2*
Dawn or dusk		*0.0*		*0.0*		*0.0*
Darkness	487	*22.9*	76	*18.3*	5405	*34.8*
Total	2128	*100.0*	416	*100.0*	15547	*100.0*

Table11_Annex2.3.- Light conditions (Greece, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	1569	*85.3*	80	*86.0*	13367	*71.4*
Dawn or dusk	119	*6.5*	4	*4.3*	1641	*8.8*
Darkness	152	*8.3*	9	*9.7*	3704	*19.8*
Total	1840	*100.0*	93	*100.0*	18712	*100.0*

Table12_Annex2.3.- Light conditions (Italy, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	49266	*74.2*	6010	*76.2*	255872	*65.1*
Dawn or dusk	2746	*4.1*	269	*3.4*	16777	*4.3*
Darkness	14389	*21.7*	1611	*20.4*	120173	*30.6*
Total	66401	*100.0*	7890	*100.0*	392822	*100.0*

Table13_Annex2.3.- Light conditions (Spain, average 2001/2004).

Light condition	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Daylight	11119	*78.0*	1924	*78.7*	72976	*70.2*
Dawn or dusk	464	*3.3*	83	*3.4*	3731	*3.6*
Darkness	2674	*18.8*	437	*17.9*	27289	*26.2*
Total	14257	*100.0*	2444	*100.0*	103996	*100.0*

Table14_Annex2.3.- Light conditions (CZ, average 2001/2004).

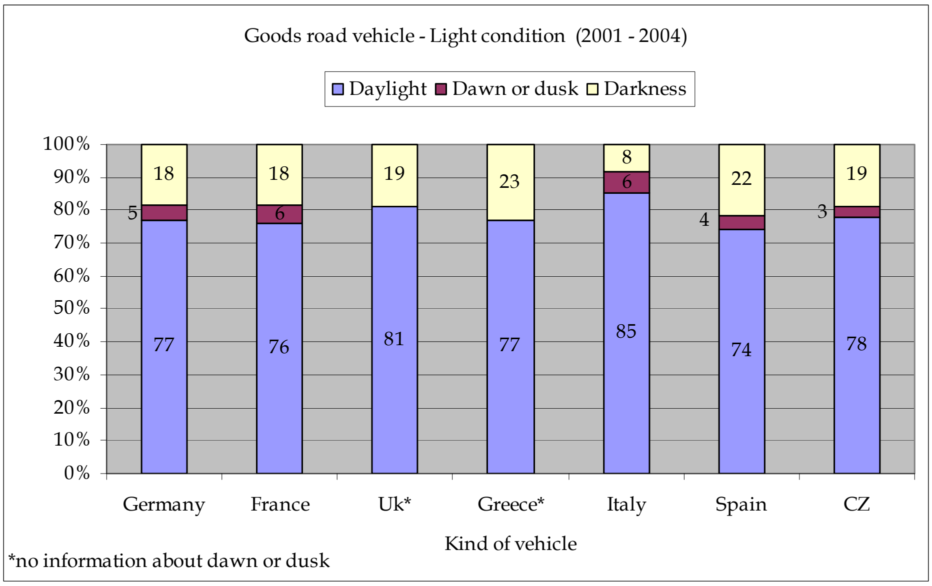


Figure9_Annex2.3.- Light conditions in goods vehicle (average 2001/2004).

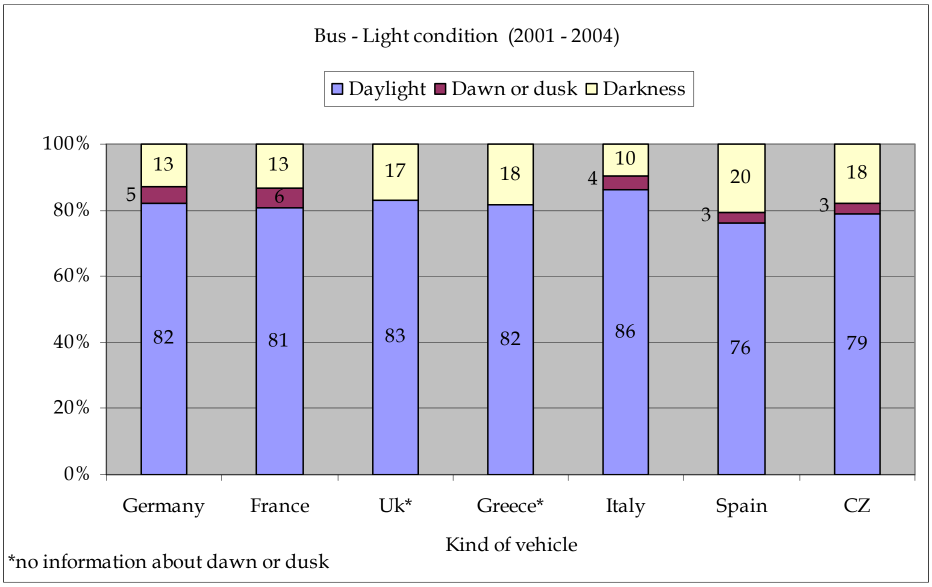


Figure10_Annex2.3.- Light conditions in bus/coach (average 2001/2004).

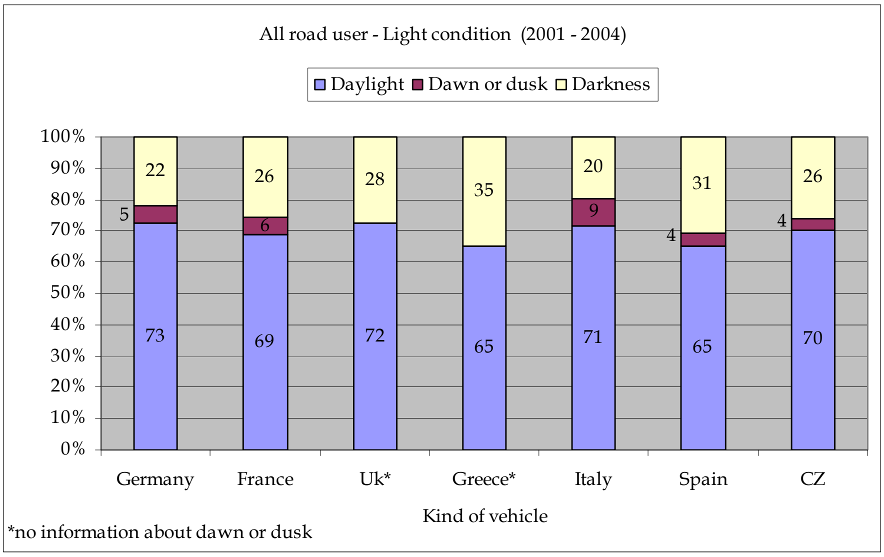


Figure11_Annex2.3.- Light conditions in bus/coach (average 2001/2004).

14.3.1.d Opponent vehicle

Opponent	Accidents with personal damage of					
	Goods road vehicle < 3,5t		Goods road vehicle > 3,5t		Bus	
	Number	%	Number	%	Number	%
Singe vehicle accident	1,519	*17.9*	932	*9.8*	414	*20.9*
Two-wheeled motor cycle	569	*6.7*	868	*9.1*	128	*6.5*
Passenger car	4,160	*49.1*	4,755	*50.0*	617	*31.2*
Bus	73	*0.9*	85	*0.9*	36	*1.8*
Bicycle	810	*9.5*	1,419	*14.9*	236	*11.9*
Pedestrian	385	*4.5*	787	*8.3*	427	*21.6*
Goods road vehicle	667	*7.9*	451	*4.7*	63	*3.2*
Other/Unknown	298	*3.5*	210	*2.2*	58	*2.9*
Total	8,479	*100.0*	9,505	*100.0*	1,978	*100.0*

Table15_Annex2.3.-Opponent vehicle (Germany_Average_2001/2004).

Opponent	Accidents with personal damage of					
	Goods road vehicle < 3,5t		Goods road vehicle>3,5t		Bus	
	Number	%	Number	%	Number	%
Singe vehicle accident			3,647	9.1	184	3.1
Passenger car			14,533	36.4	2,194	36.6
Pedestrian			3,156	7.9	1,594	26.6
Bicycle			1,159	2.9	261	4.4
Goods road vehicle			2,972	7.4	265	4.4
Two-wheeled motor cycle			6,000	15.0	701	11.7
Coach/Bus			265	0.7	135	2.3
Other vehicle			99	0.0	18	0.3
Other person			0	0.0	0	0.0
Unknown			390	1.2	85	1.4
3 road user and more			7,719	19.3	563	9.4
Total			39,940	100.0	6000	100.0

Table16_Annex2.3.-Opponent vehicle (France_Average_2001/2004).

Opponent	Accidents with personal damage of					
	Delivery van and motor lorry		Semi-trailer truck		Bus	
	Number	%	Number	%	Number	%
Singe vehicle accident	11,785	15.78	3,123	21.77	19,671	44.42
Passenger car	38,787	51.94	8,249	57.50	10,969	24.77
Pedestrian	8,948	11.98	561	3.91	8,728	19.71
Bicycle	3,918	5.25	298	2.08	1,627	3.67
Goods road vehicle	3,927	5.26	1,460	10.18	1,608	3.63
Two-wheeled motor cycle	5,184	6.94	333	2.32	944	2.13
Coach/Bus	1,467	1.96	172	1.20	486	1.10
Other vehicle	654	0.88	149	1.04	247	0.56
Other person	0	0.00	0	0.00	0	0.00
Total	74,670	100.00	14,345	100.00	44,280	100.00

Table17_Annex2.3.-Opponent vehicle (GB_Average_2001/2004).

Opponent	Accidents with personal damage of					
	Truck < 3,5t		Truck > 3,5t		Bus	
	Number	%	Number	%	Number	%
Singe vehicle accident	134	*8.5*	36	*5.9*	92	*22.1*
Passenger car	471	*30.0*	201	*33.1*	115	*27.6*
Pedestrian	202	*12.9*	84	*13.8*	75	*18.0*
Bicycle	24	*1.5*	6	*1.0*	1	*0.2*
Goods road vehicle	81	*5.2*	44	*7.2*	18	*4.3*
Two-wheeled motor cycle	432	*27.5*	138	*22.7*	64	*15.4*
Coach/Bus	11	*0.7*	7	*1.2*	3	*0.7*
Other vehicle	214	*13.6*	92	*15.1*	48	*11.5*
Other person	0	*0.0*	0	*0.0*	0	*0.0*
Total	1,569	*100.0*	608	*100.0*	416	*100.0*

Table18_Annex2.3.-Opponent vehicle (Greece_Average_2001/2004).

Opponent	Accidents with personal damage of					
	Truck < 3,5t		Truck > 3,5t		Bus	
	Number	%	Number	%	Number	%
Singe vehicle accident	6,236	*9.4*	4,593	*14.7*	1,221	*10.6*
Passenger car	16,163	*24.4*	8,386	*26.9*	2,927	*25.5*
Pedestrian	3,651	*5.5*	692	*2.2*	1,131	*9.8*
Bicycle	605	*0.9*	184	*0.6*	88	*0.8*
Goods road vehicle	31,511	*47.7*	15,567	*49.9*	572	*5.0*
Two-wheeled motor cycle	7,136	*10.8*	1,334	*4.3*	876	*7.6*
Coach/Bus	402	*0.6*	170	*0.5*	4,621	*40.2*
Other vehicle	407	*0.6*	281	*0.9*	62	*0.5*
Total	66,111	*100.0*	31,207	*100.0*	11,498	*100.0*

Table19_Annex2.3.-Opponent vehicle (Spain_Average_2001/2004).

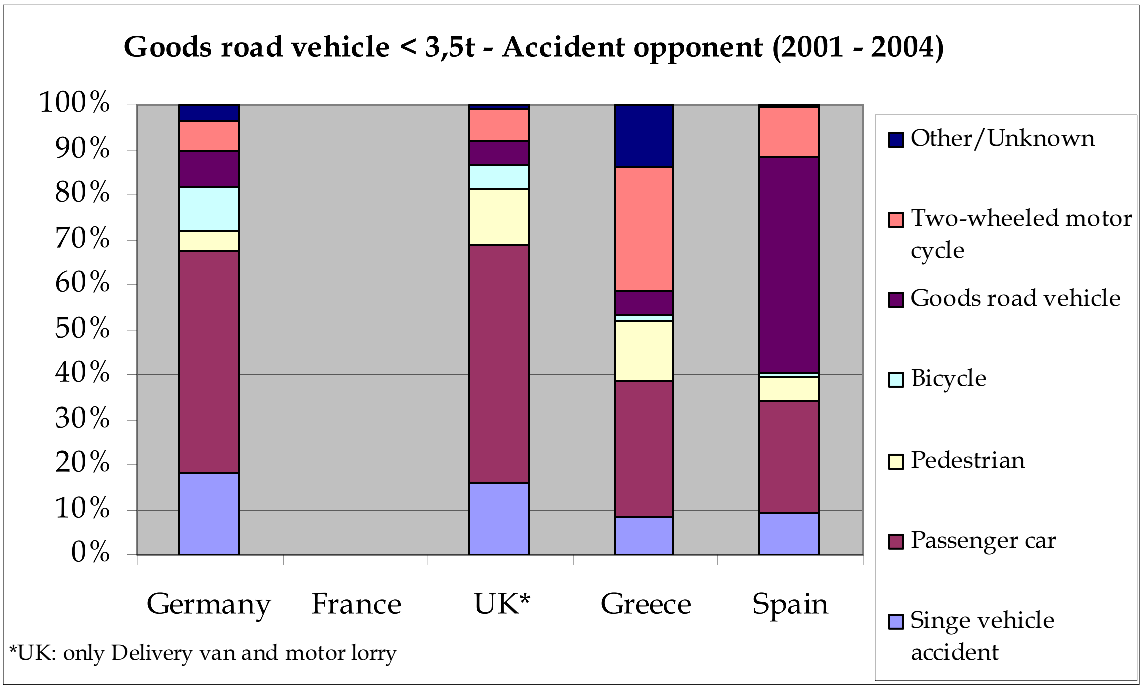


Figure12_Annex2.3.-Goods vehicle<3,5t_Opponent vehicle (2001/2004).

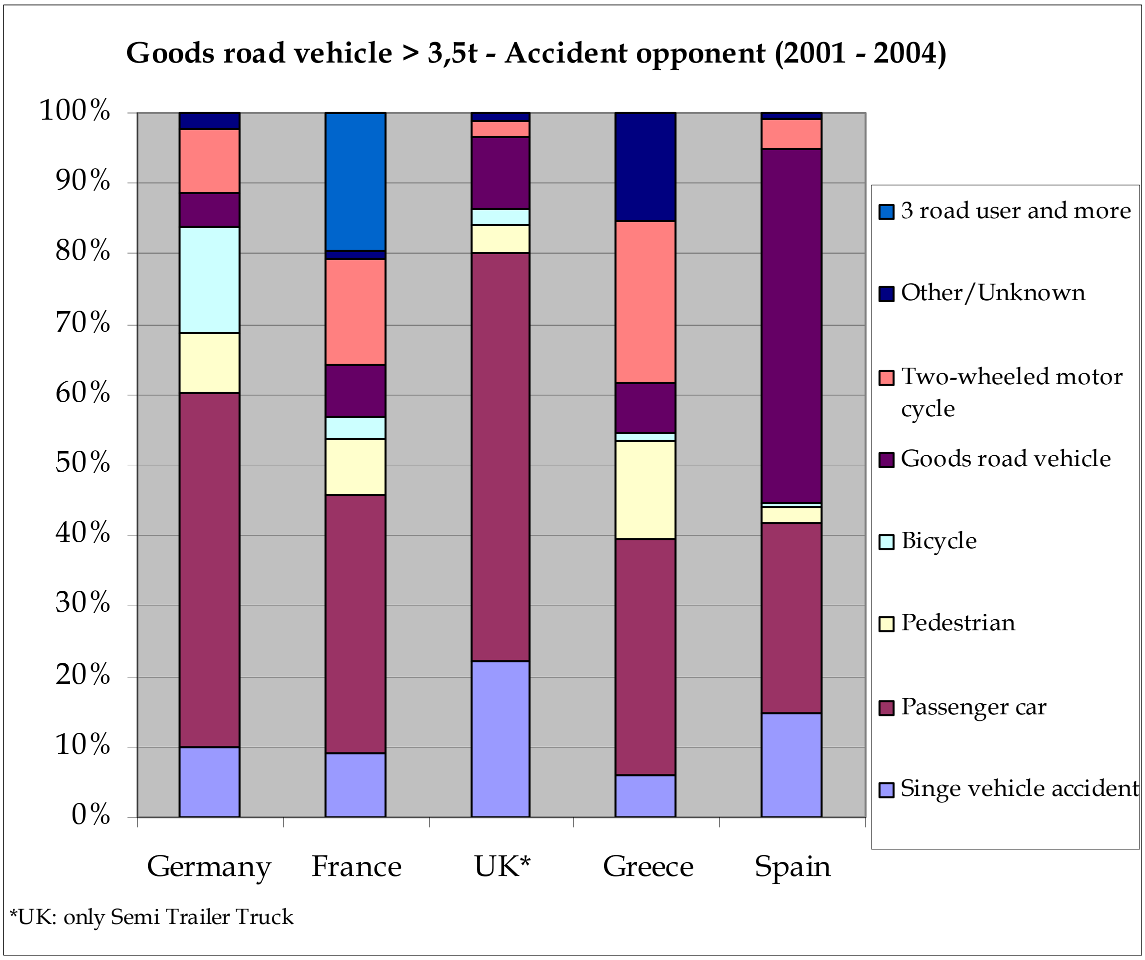


Figure13_Annex2.3.-Goods vehicle>3,5t_Opponent vehicle (2001/2004).

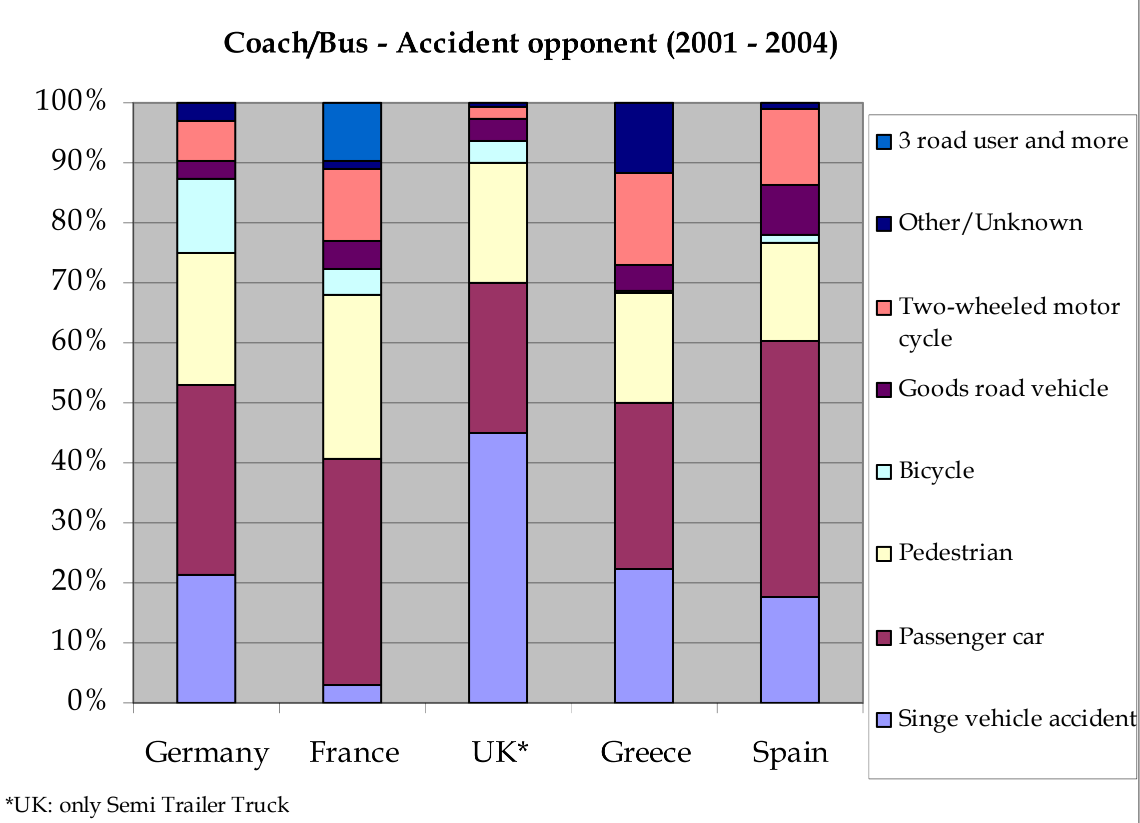


Figure14_Annex2.3.-Coach/Bus_Opponent vehicle (2001/2004).

14.3.1.e Type of Accident

Type of accident	Injury accidents of					
	Truck < 3,5t		Truck > 3,5t		Coach/bus	
	Number	%	Number	%	Number	%
Driving accident	2607	14.46	2311	14.51	416	7.45
Accident caused by turning off, turning into a road or by cross	6432	35.68	4442	27.90	1864	33.40
Accident caused by crossing the road	619	3.43	297	1.86	550	9.85
Accident involved stationary vehicles	597	3.31	531	3.33	233	4.17
Accident between vehicles moving along in carriageway	6097	33.82	6660	41.82	1465	26.26
Other accident	1677	9.30	1684	10.58	1053	18.88
Total	18029	100.00	15924	100.00	5580	100.00

Table20_Annex2.3.-Type of Accident (Germany_2001/2004).

Type of accident	Injury accidents of					
	Truck < 3,5t		Truck > 3,5t		Coach/bus	
	Number	%	Number	%	Number	%
Driving accident	2972	17.78	5713	31.32	826	15.70
Accident caused by turning off, turning into a road or by cross	3945	23.60	2559	14.03	1185	22.53
Accident caused by crossing the road	1356	8.11	574	3.15	1064	20.23
Accident involved stationary vehicles	242	1.45	282	1.55	62	1.18
Accident between vehicles moving along in carriageway	4155	24.85	4685	25.69	1224	23.27
Other accident	4049	24.22	4426	24.27	899	17.09
Total	16719	100.00	18239	100.00	5260	100.00
Unknown	1204	7.20	1451	7.96	681	12.95

Table21_Annex2.3.-Type of Accident (France_2001/2004).

Type of accident	Injury accidents of Truck < 3,5t Number	 %	 Truck > 3,5t Number	 %	 Coach/bus Number	 %
Driving accident	36905	56.17	29144	58.15	26368	54.89
Accident caused by turning off, turning into a road or by cross	8799	13.39	5112	10.20	4193	8.73
Accident caused by crossing the road						
Accident involved stationary vehicles	4823	7.34	3238	6.46	9344	19.45
Accident between vehicles moving along in carriageway	8631	13.14	9029	18.02	4136	8.61
Other accident	6541	9.96	3595	7.17	3997	8.32
Total	65699	100.00	50118	100.00	48038	100.00
Unknown	76		58		67	

Table22_Annex2.3.-Type of Accident (GB_2001/2004).

Type of accident	Injury accidents of Truck < 3,5t Number	 %	 Truck > 3,5t Number	 %	 Coach/bus Number	 %
Driving accident	197	12.56	86	14.14	65	15.63
Accident caused by turning off, turning into a road or by cross	638	40.66	210	34.54	121	29.09
Accident caused by crossing the road	4	0.25	2	0.33	0	0.00
Accident involved stationary vehicles	7	0.45	3	0.49	18	4.33
Accident between vehicles moving along in carriageway	415	26.45	169	27.80	80	19.23
Other accident	308	19.63	138	22.70	132	31.73
Total	1569	100.00	608	100.00	416	100.00

Table23_Annex2.3.-Type of Accident (Greece_2001/2004).

Type of accident	Injury accidents of Truck < 3,5t Number	 %	 Truck > 3,5t Number	 %	 Coach/bus Number	 %
Driving accident						
Accident caused by turning off, turning into a road or by cross	1501	46.11	244	34.51	123	58.57
Accident caused by crossing the road	147	4.52	26	3.68	13	6.19
Accident involved stationary vehicles	380	11.67	88	12.45	18	8.57
Accident between vehicles moving along in carriageway	1151	35.36	334	47.24	50	23.81
Other accident	76	2.33	15	2.12	6	2.86
Total	3255	100.00	707	100.00	210	100.00

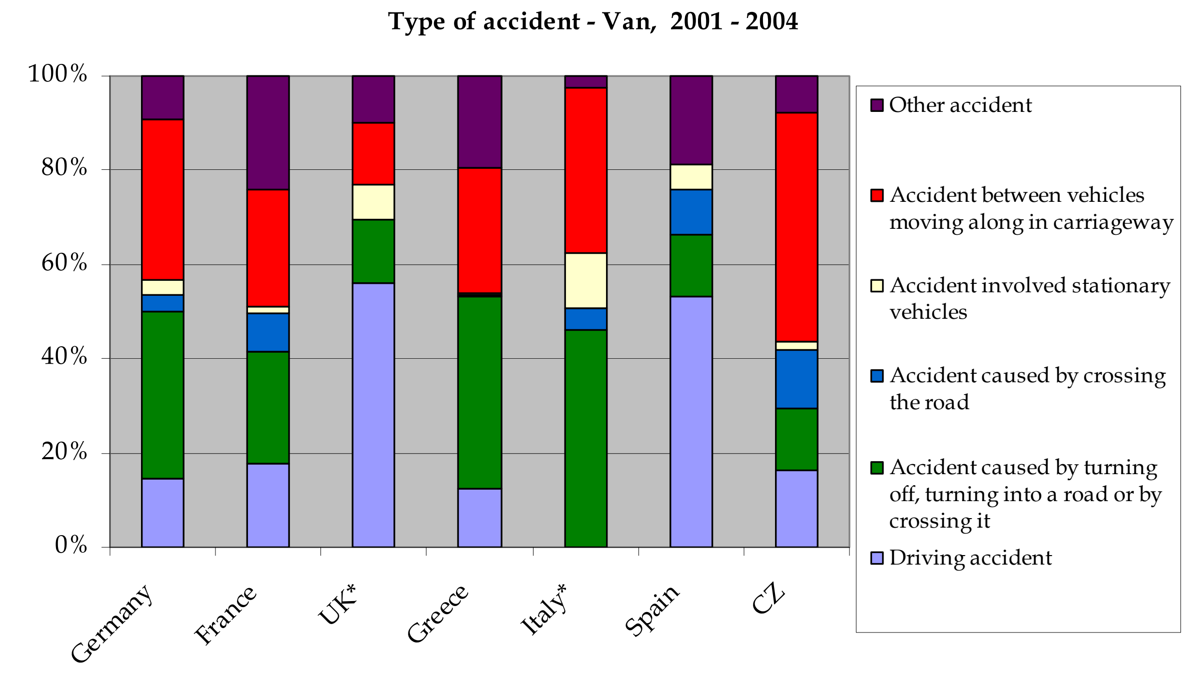
Table24_Annex2.3.-Type of Accident (Italy_2001/2004).

Type of accident	Injury accidents of Truck < 3,5t Number	 %	 Truck > 3,5t Number	 %	 Coach/bus Number	 %
Driving accident	36964	53.24	19798	60.88	5701	49.54
Accident caused by turning off, turning into a road or by cross	9019	12.99	3551	10.92	1451	12.61
Accident caused by crossing the road	6616	9.53	1482	4.56	1095	9.52
Accident involved stationary vehicles	3742	5.39	1130	3.47	811	7.05
Accident between vehicles moving along in carriageway						
Other accident	13086	18.85	6559	20.17	2450	21.29
Total	69427	100.00	32520	100.00	11508	100.00

Table25_Annex2.3.-Type of Accident (Spain_2001/2004).

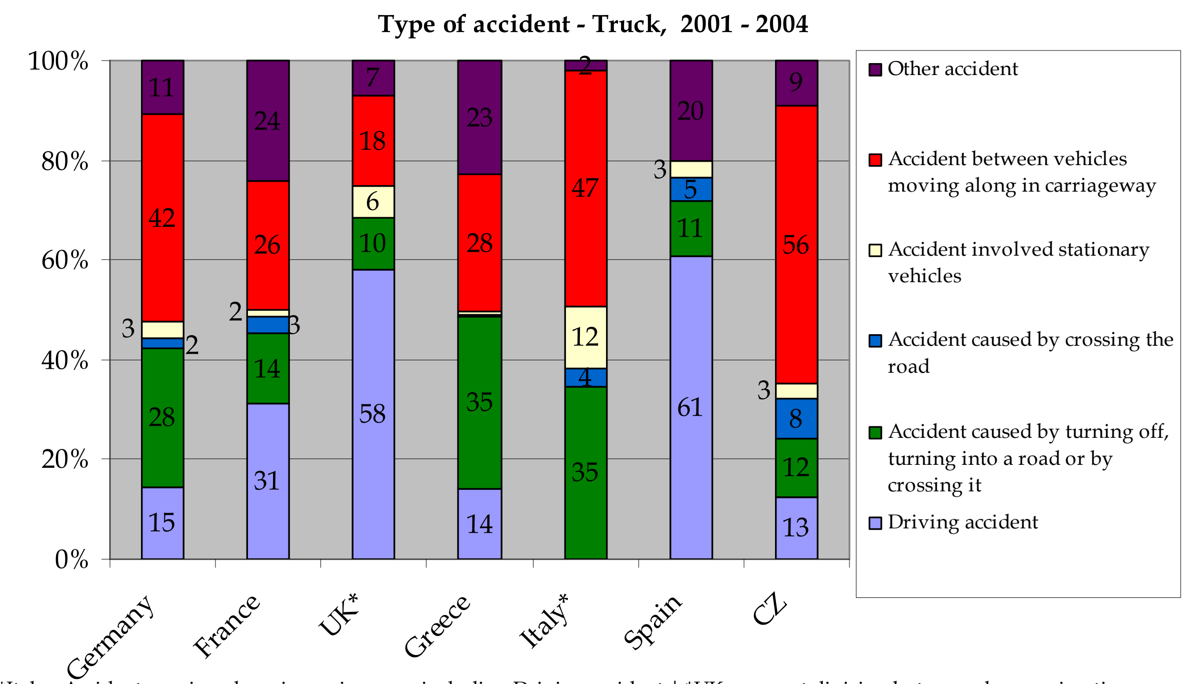
Type of accident	Injury accidents of Truck < 3,5t Number	 %	 Truck > 3,5t Number	 %	 Coach/bus Number	 %
Driving accident	1044	16.14	1045	12.58	100	4.09
Accident caused by turning off, turning into a road or by cross	861	13.31	965	11.61	258	10.56
Accident caused by crossing the road	791	12.23	654	7.87	405	16.57
Accident involved stationary vehicles	125	1.93	257	3.09	30	1.23
Accident between vehicles moving along in carriageway	3131	48.42	4626	55.67	1007	41.20
Other accident	515	7.96	763	9.18	644	26.35
Total	6467	100.00	8310	100.00	2444	100.00

Table26_Annex2.3.-Type of Accident (CZ_2001/2004).



*Italy: Accident moving along in carriageway including Driving accident | *UK: no exact division but a good approximation

Figure15_Annex2.3.-Van_Type of Accident(2001/2004).



*Italy: Accident moving along in carriageway including Driving accident | *UK: no exact division but a good approximation

Figure16_Annex2.3.-Truck_Type of Accident(2001/2004).

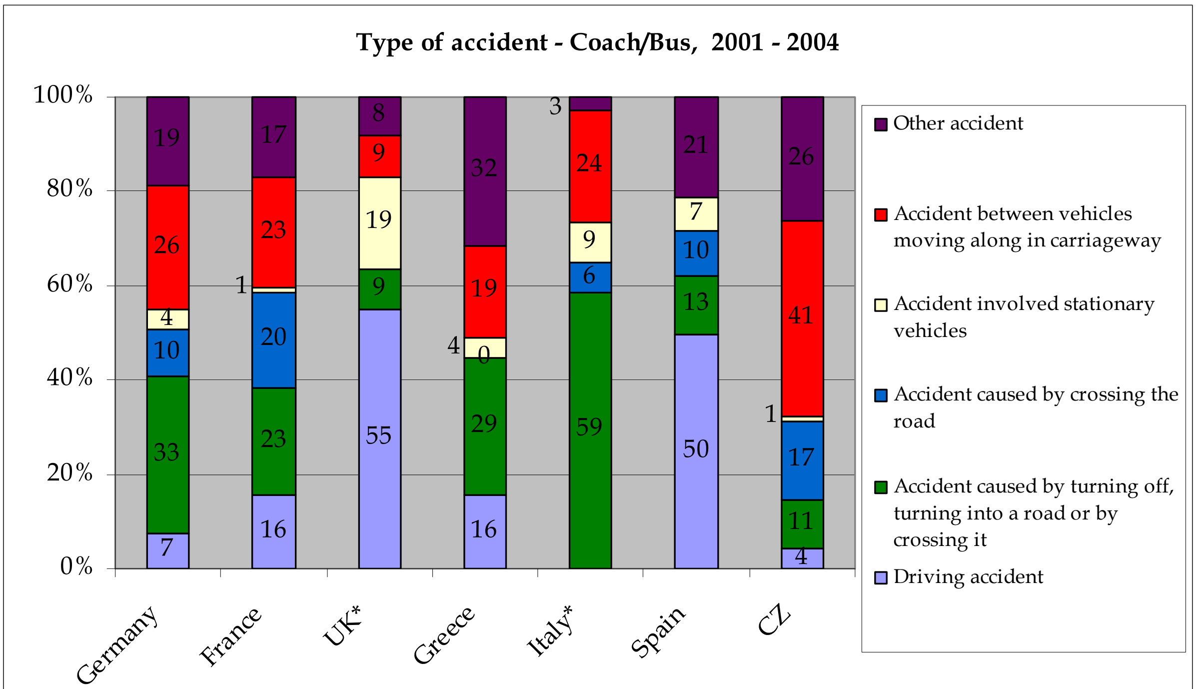


Figure17_Annex2.3.-Coach/Bus_Type of Accident(2001/2004).

14.3.1.f Causation

Accident causation	Injury accidents of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Influence of alcohol	593	1.9	6	0.2	24,458	5.6
Overfatigue	323	1.0	4	0.1	1,912	0.4
Unadapted speed	5,314	17.2	280	10.8	79,107	18.1
Distance	5,470	17.7	363	13.9	51,117	11.7
Overtaking	1,542	5.0	122	4.7	17,831	4.1
Driving side by side	1,242	4.0	41	1.6	5,749	1.3
Priority, precedence	3,607	11.7	252	9.7	64,786	14.8
Driving past	132	0.4	23	0.9	1,496	0.3
Mistakes made when turning or reversing	3,509	11.4	210	8.1	53,104	12.1
Mistakes made when entering the flow of traffic	897	2.9	93	3.6	25,693	5.9
Improper behaviour towards pedestrians	943	3.1	352	13.5	16,021	3.7
Others	7,290	23.6	856	32.9	96,974	22.1
Total	30,861	100.0	2,599	100.0	438,246	100.0

Table27_Annex2.3.-Causation (Germany_2001/2004).

Accident causation	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Influence of alcohol	930	7.9	11	1.0	31,484	14.2
Overfatigue	867	7.4	25	2.2	11,869	5.4
Unadapted speed						
Distance						
Overtaking	789	6.7	61	5.3	22,961	10.4
Driving side by side		0.0		0.0		0.0
Priority, precedence	4,329	36.8	477	41.7	83,221	37.7
Driving past						
Mistakes made when turning	3,324	28.3	489	42.7	57,846	26.2
Mistakes made when entering the flow of traffic	1,512	12.9	81	7.1	13,639	6.2
Improper behaviour towards pedestrians						
Others	0	0.0	0	0.0	0	0.0
Total	11,751	100.0	1,144	100.0	221,020	100.0
Unknown	30,016		5,031		489,135	

Table28_Annex2.3.-Causation (France_2001/2004).

Accident causation	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Influence of alcohol	65	*0.6*	2	*0.2*	1180	*0.8*
Overfatigue	0	*0.0*	0	*0.0*	38	*0.0*
Unadapted speed	1725	*16.3*	109	*11.1*	15681	*10.7*
Distance	1321	*12.5*	89	*9.1*	8652	*5.9*
Overtaking	103	*1.0*	6	*0.6*	2307	*1.6*
Driving side by side	13	*0.1*	3	*0.3*	91	*0.1*
Priority, precedence/Driving past	1704	*16.1*	58	*5.9*	22947	*15.7*
Driving past						
Mistakes made when turning	427	*4.0*	24	*2.4*	3983	*2.7*
Mistakes made when entering the flow of traffic	160	*1.5*	3	*0.3*	2928	*2.0*
Improper behaviour towards pedestrians	173	*1.6*	27	*2.7*	2390	*1.6*
Others	4840	*45.8*	657	*66.9*	85612	*58.6*
Vehicle damage	41	*0.4*	4	*0.4*	246	*0.2*
Total	10572	*100.0*	982	*100.0*	146055	*100.0*
Unknown	28100		4922		340524	

Table29_Annex2.3.-Causation (Italy_2001/2004).

Accident causation	Accidents with personal damage of					
	Goods road vehicle		Coach/bus		All road user	
	Number	%	Number	%	Number	%
Distraction	53,121	33	5,290	32	245,007	31
Driver's lack of experience	5,752	4	557	3	26,464	3
Alcohol or drugs	4,663	3	367	2	28,012	4
Drowsiness or illness	4,218	3	160	1	14,193	2
Inadequate velocity	18,139	11	1,135	7	89,229	11
Disobeying a circulation order	52,202	32	5,178	31	266,294	33
State of the carriageway	1,581	1	193	1	8,880	1
State of the signals	200	0	24	0	1,079	0
Working	396	0	24	0	1,552	0
Vehicle failure	2,033	1	163	1	5,504	1
Weather	1,553	1	148	1	5,467	1
Other factor	4,903	3	1,062	6	27,228	3
Without opinion	12,502	8	2,332	14	79,745	10
Total	161,263	100	16,633	100	798,654	100

Table30_Annex2.3.-Causation (Spain_2001/2004).

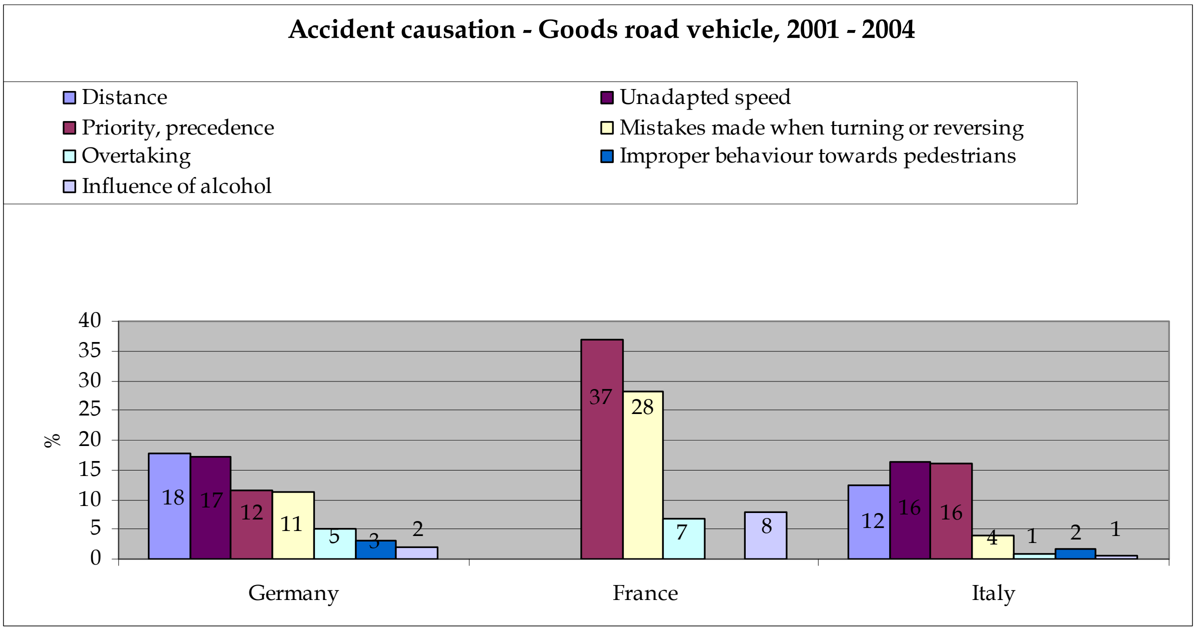


Figure18_Annex2.3.-Goods vehicle_Causation(2001/2004).

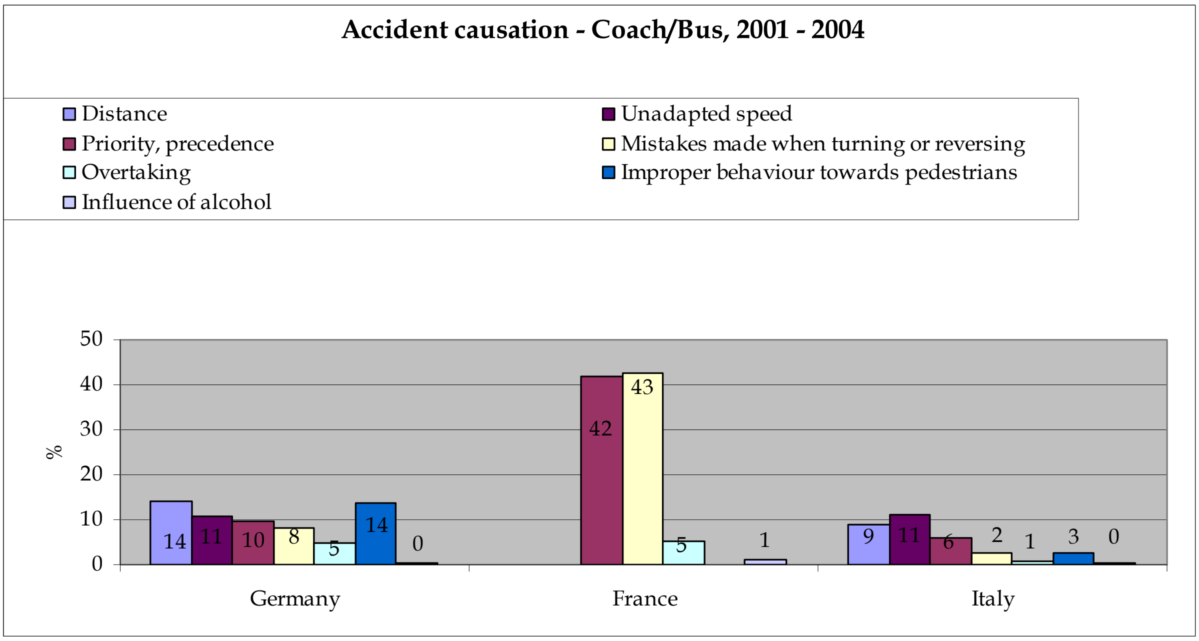


Figure19_Annex2.3.-Coach/Bus_Causation(2001/2004).

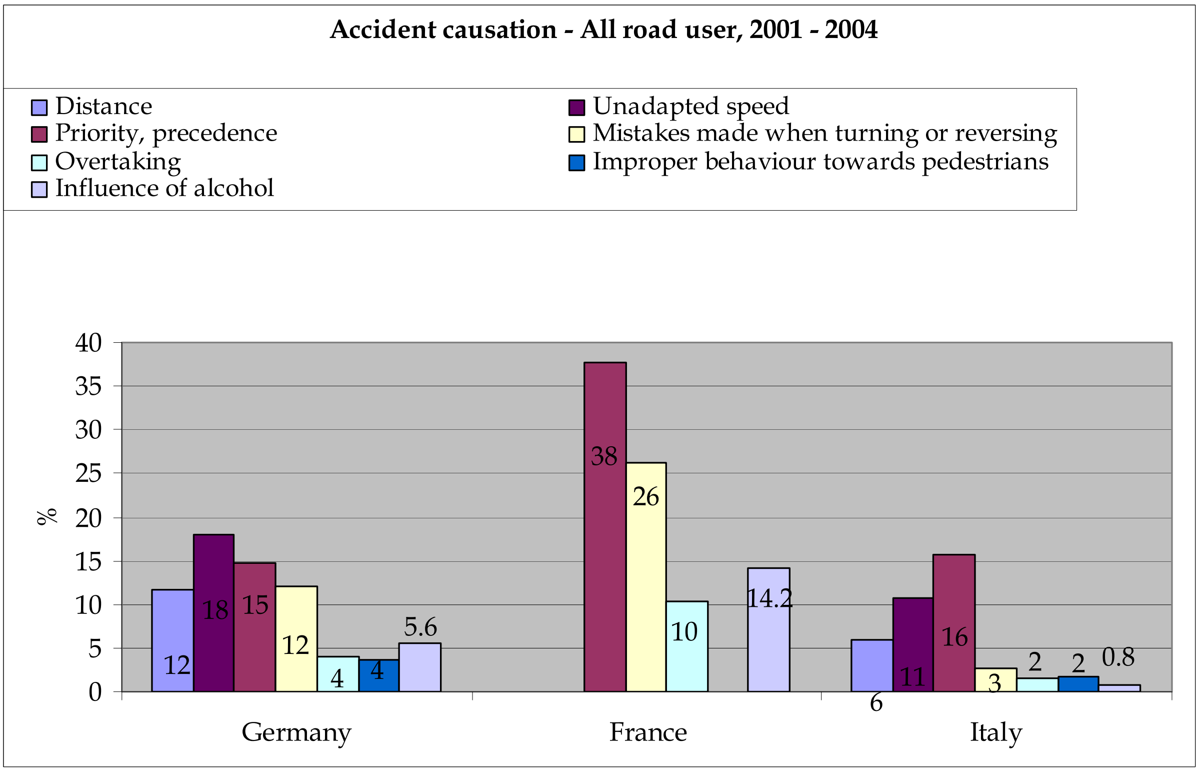


Figure20_Annex2.3.-All Road Users_Causation(2001/2004).

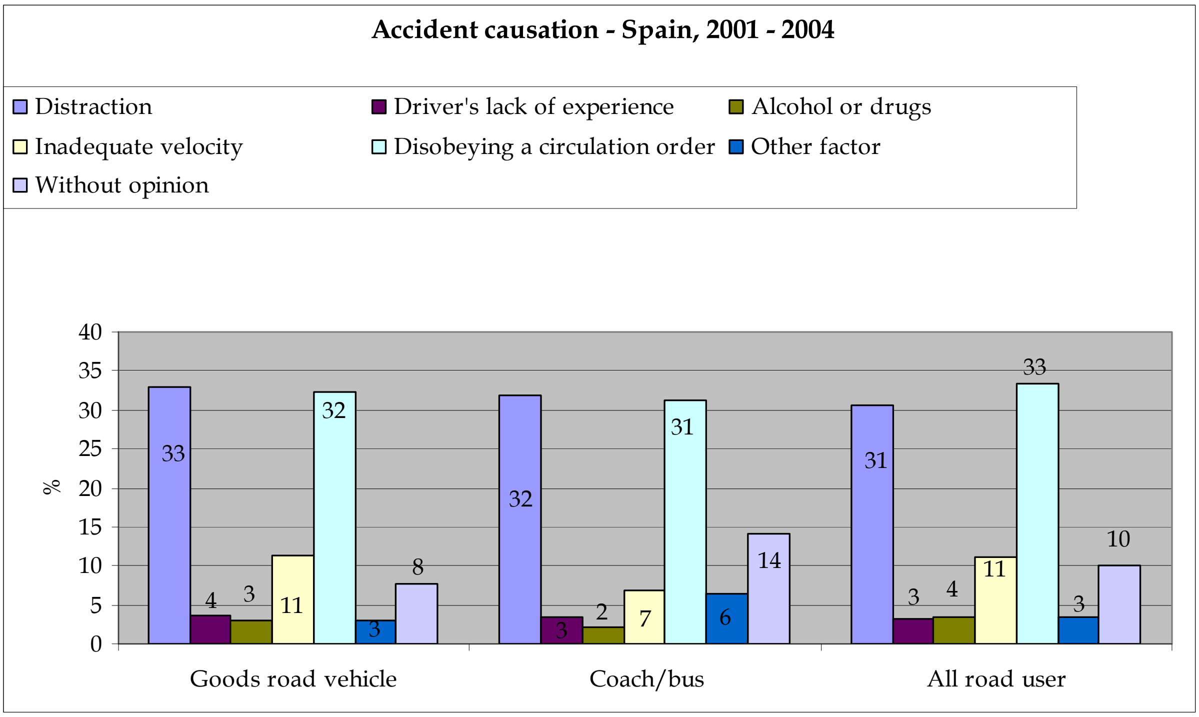


Figure21_Annex2.3.-Causation(Spain_2001/2004).

14.4 Annex 2.4: Pedestrian and Cyclists

Information related to chapter 6 'Task 1.4: Pedestrian and Cyclists' is included in this annex.

14.4.1 Pedestrians

14.4.1.a Importance of the accident graphics

The purpose of this chapter is to appreciate the percentage of pedestrian involved in those accidents. Analyzing the evolution over the 4 years studied, a reduction of the absolute number of all accidents can be appreciated for all countries. This constant reduction is not that big for vulnerable road users and, and there is even a small increment in Germany.

In general terms, comparing importance distribution, pedestrian fatal accidents have a biggest percentage than the ones concerning all users. This can not be applied to France, where the biggest percentage is for all accidents, instead of pedestrians. Serious accidents are more frequent than fatal accidents in all countries and, as it happens with fatal accidents, the percentage of serious injuries is bigger for pedestrians than for the rest of users, with the exception of France also. Finally, slight accidents are the most common, but in this case the percentage regarding pedestrians is minor than the one for the rest of users, which is a consequence of the fact that accidents concerning pedestrians tend to be more fatal or serious. This reasoning can not be made for Spain, where the accidents regarding pedestrians use to cause slight injuries in most cases.

FRANCE		Fatal	Serious	Slight
	Pedestrians	4,44	17,39	78,15
	All users	5,87	18,03	76,09
GERMANY		Fatal	Serious	Slight
	Pedestrians	2,32	28,38	69,29
	All users	1,67	20,75	77,56
GREAT BRITAIN		Fatal	Serious	Slight
	Pedestrians	2,09	20,41	77,49
	All users	1,43	13,49	85,07
GREECE		Fatal	Serious	Slight
	Pedestrians	9,43	13,16	77,39
	All users	9,21	11,86	78,91
SPAIN		Fatal	Serious	Slight
	Pedestrians	5,17	23,80	71,01
	All users	3,72	19,52	76,74

Table 1_Annex2.6.- Importance of the accident.

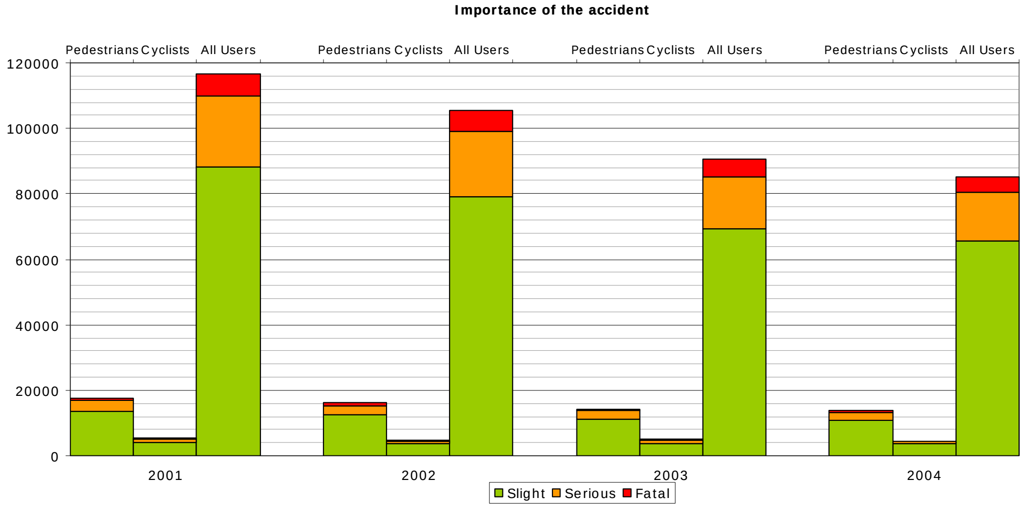


Figure 1_Annex2.6.- Importance of the accident (France_2001/2004).

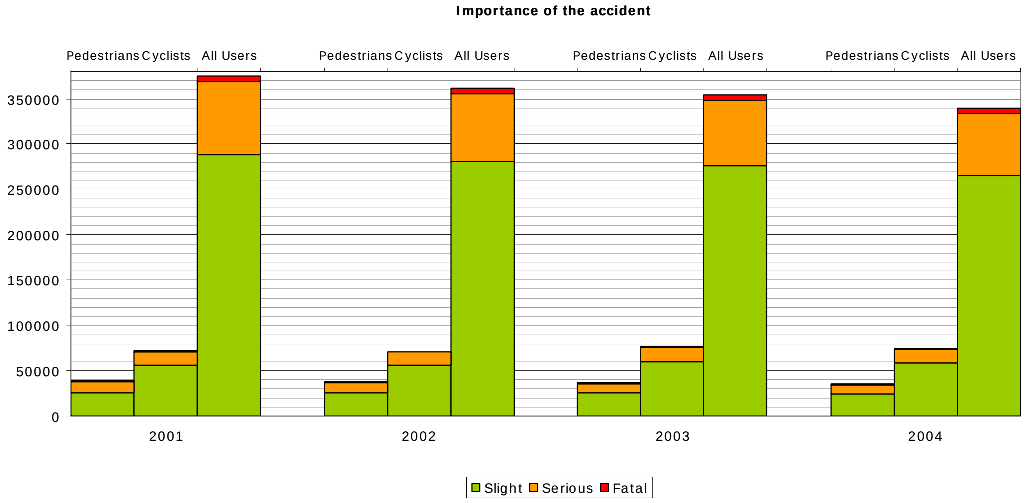


Figure 2_Annex2.6.- Importance of the accident (Germany_2001/2004).

Figure 3_Annex2.6.- Importance of the accident (Great Britain_2001/2004).

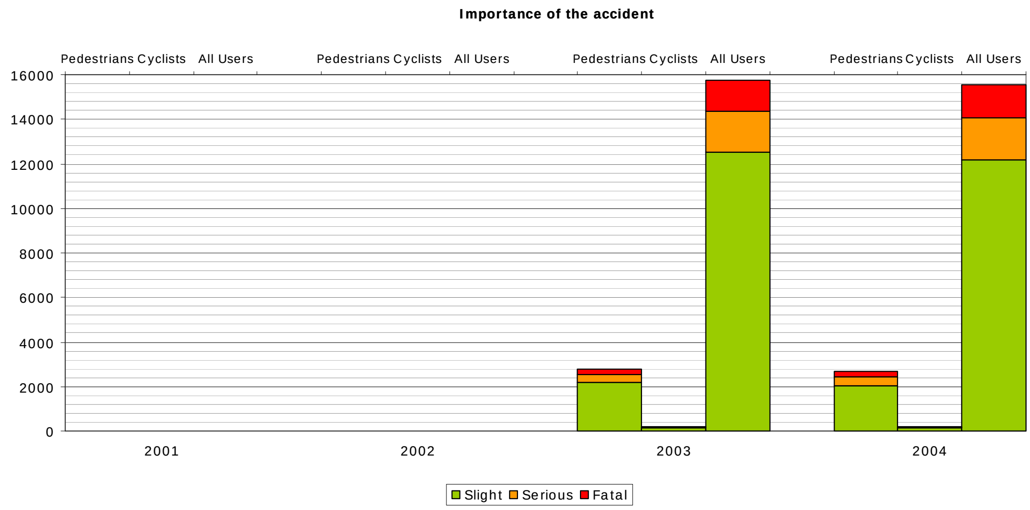


Figure 4_Annex2.6.- Importance of the accident (Greece_2001/2004).

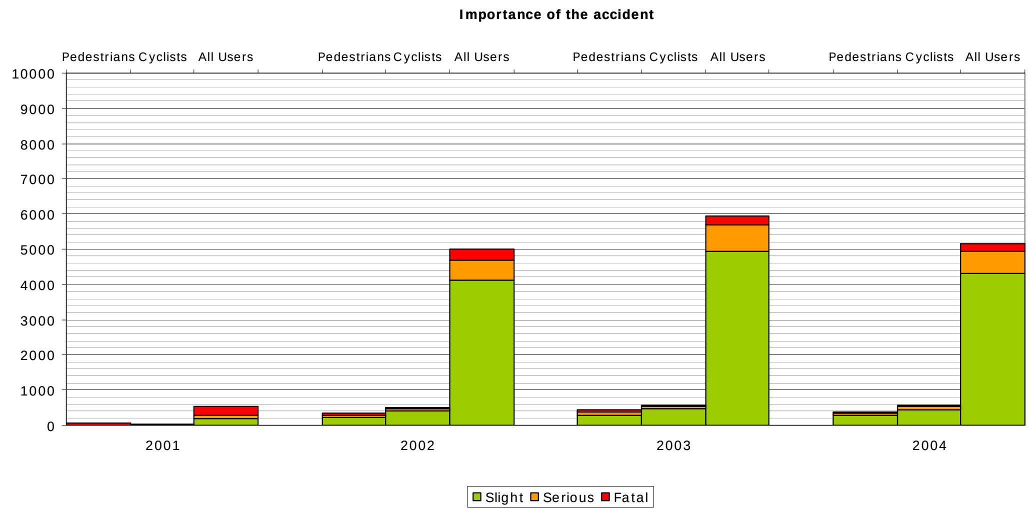


Figure 5_Annex2.6.- Importance of the accident (Italy_2001/2004).

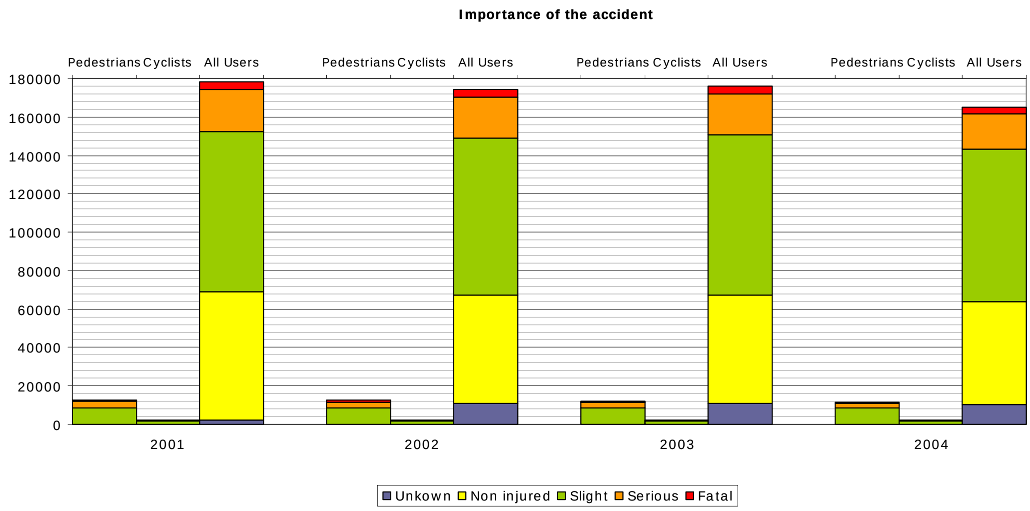


Figure 6_Annex2.6.- Importance of the accident (Italy_2001/2004).

14.4.1.b Type of casualties

Casualties distribution present the same characteristics than accidents, even for the German rising number of vulnerable users accidents and for the French more fatal general accidents. There has been a constant reduction of the total number of casualties, which is directly related to the reduction of the total number of accidents.

Nevertheless, this chapter is important so as to see the differences between the countries, mainly between Germany, Great Britain and Greece, which are the two extremes of the severity of casualties. Regarding fatal accidents, whereas Germany and Great Britain can boast of having the lowest percentage rate of fatal injuries regarding pedestrians and also the rest of users, Greece has to take into consideration the fact that fatal injuries to pedestrians concern 8% of the global number accidents, and 7% to the rest of users, which can not be casual and must have an explanation. Then, France and Spain present similar tendencies.

		Fatal	Serious	Slight
FRANCE	Pedestrians	4,25	16,95	78,8
	All users	4,77	15,98	79,25
		Fatal	Serious	Slight
GERMANY	Pedestrians	2,1	26,3	71,6
	All users	1,38	18,4	80,22
		Fatal	Serious	Slight
GREAT BRITAIN	Pedestrians	2,02	19,93	78,04
	All users	1,15	11,6	87,25
		Fatal	Serious	Slight
GREECE	Pedestrians	8,18	12,31	79,51
	All users	7,41	10,74	81,85
		Fatal	Serious	Slight
SPAIN	Pedestrians	4,98	23,28	71,74
	All users	3,02	17,04	79,94

Table 2_Annex2.6.- Type of casualties.

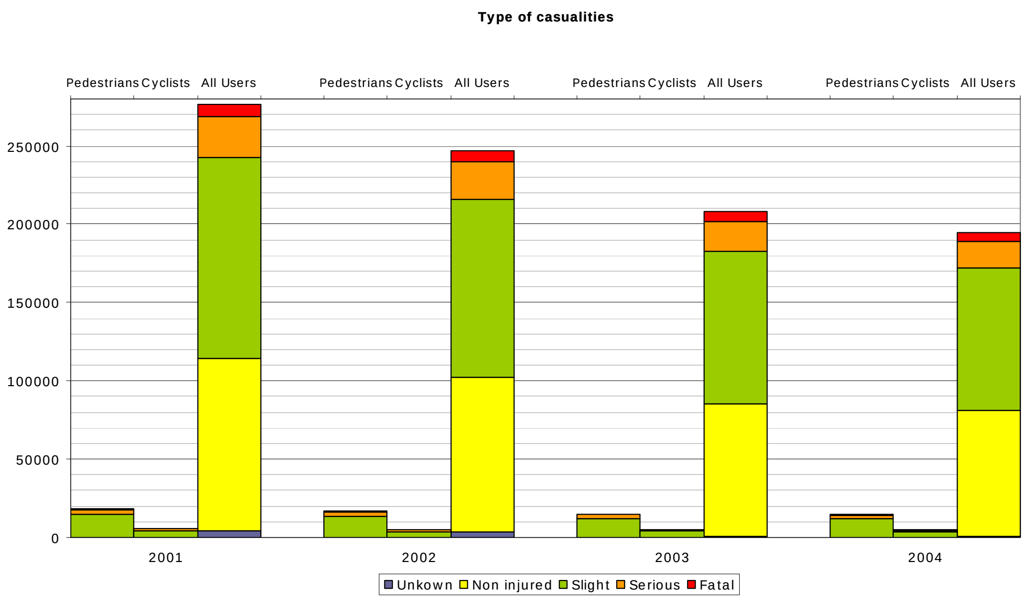


Figure 7_Annex2.6.- Type of casualties (France_2001/2004).

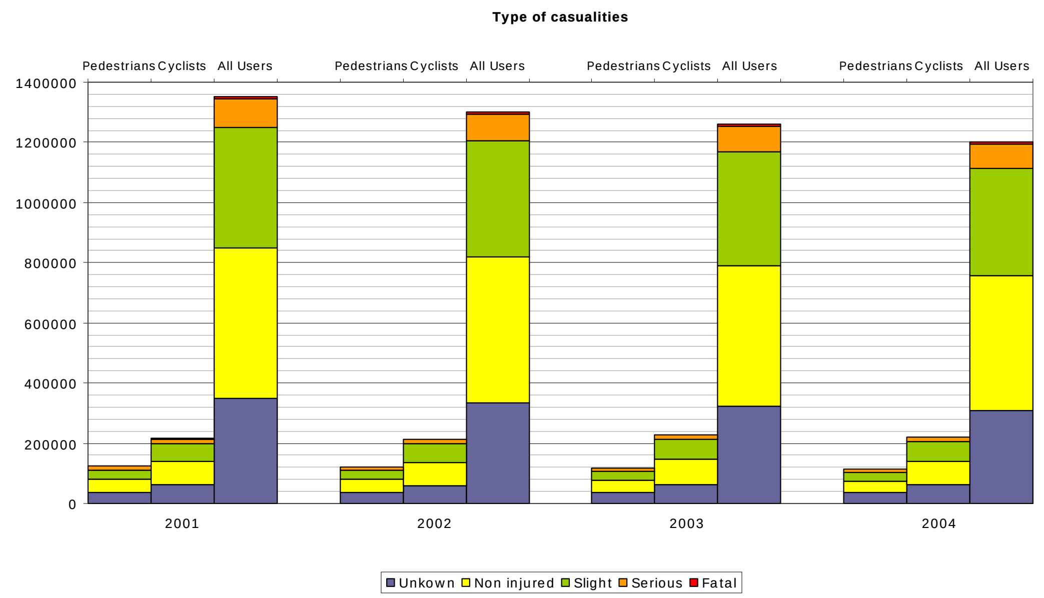


Figure 8- (Germany_2001/2004).

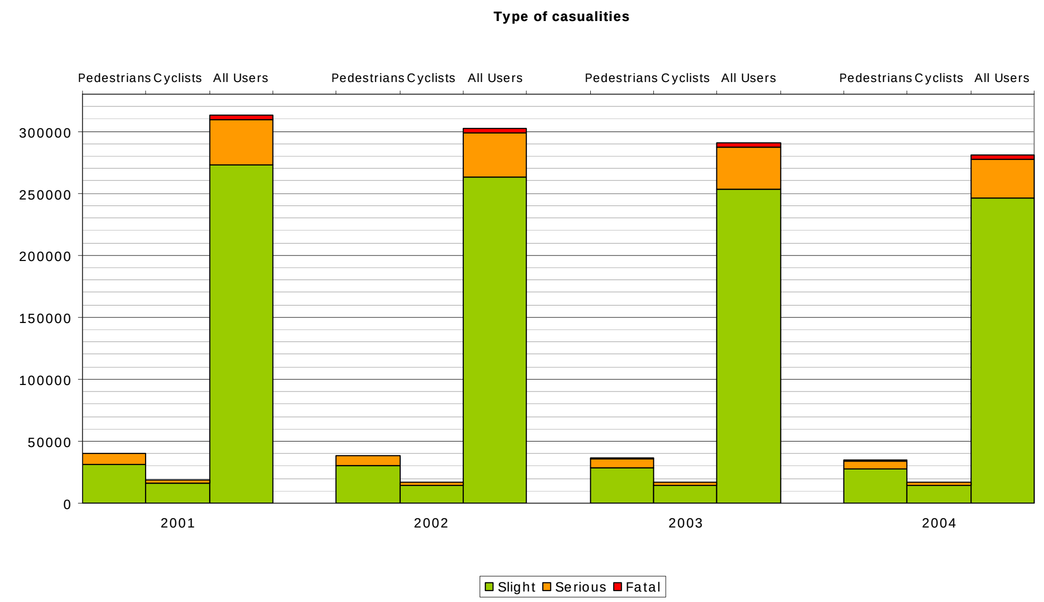


Figure 9_Annex2.6.- Type of casualties (Great Britain_2001/2004).

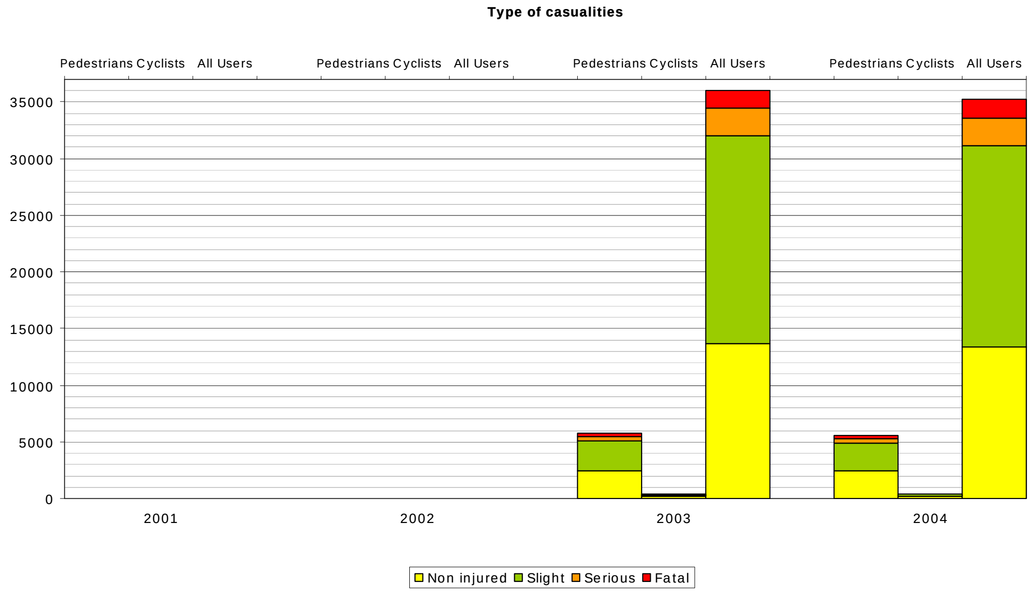


Figure 10_Annex2.6.- Type of casualties (Greece_2001/2004).

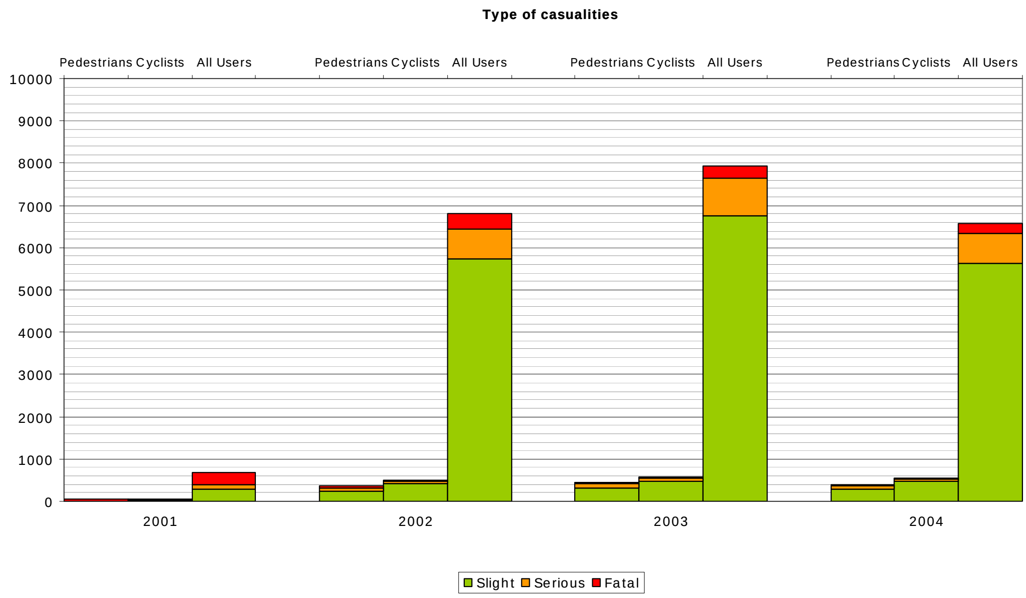


Figure 11-._Annex2.6.- Type of casualties (Italy_2001/2004).

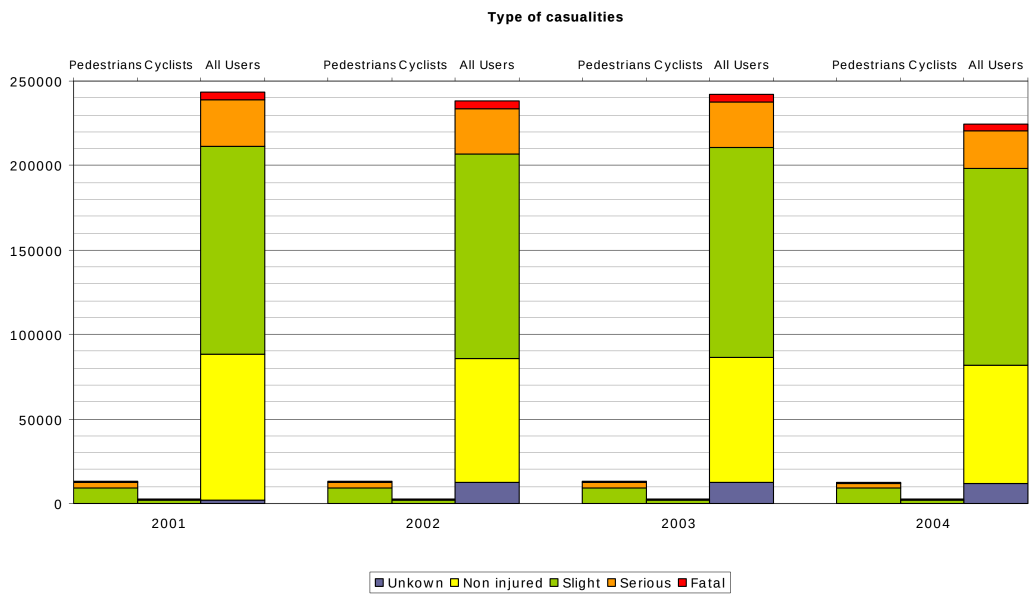


Figure 12_Annex2.6.- Type of casualties (Spain_2001/2004).

14.4.1.c Type of accident opponent

Talking in absolute number, passenger cars are, with great difference, the first rival for pedestrians in all the countries. Then, the second rival changes depending on the country; in Spain and Greece, motorcycles and moped are also an important cause of pedestrian and cyclists accidents, whereas in France, Germany and Great Britain it is more divided into trucks, motorcycles and other causes. In general, the global number of accidents regarding passenger cars has been slightly reduced, but not significantly in any country.

Apart from the prominence of accidents involving cars, the most relevant common characteristic of all countries is the fact that accidents caused between trucks and passengers have the higher rate of fatal and serious injuries, especially in France and Spain. Slight injuries are caused in a similar rate by cars, trucks, motorcycles, buses, moped and other in all the countries. In Spain, the situation is a bit different, as the secondary opponent are not the trucks, as it occurs in the rest of the countries, but moped. In general, accidents caused by trucks, buses, motorcycles and moped have not been reduced at all in the last 4 years.

	Fatal	Serious	Slight	
FRANCE	4,30	18,04	77,65	**Car**
	27,63	26,43	45,93	**Truck**
	5,32	16,55	78,11	**Bus**
	4,34	17,10	78,54	**Motorcycle**
	1,27	13,92	84,79	**Moped**
	3,85	14,66	81,48	**Other**
	Fatal	Serious	Slight	
GERMANY	1,98	29,16	68,84	**Car**
	6,23	32,97	60,78	**Truck**
	2,39	27,64	69,95	**Bus**
	2,56	28,64	68,78	**Motorcycle**
	0,36	25,02	74,60	**Moped**
	0,25	20,13	79,60	**Other**

	Fatal	Serious	Slight	
GREAT BRITAIN	1,66	19,98	78,35	**Car**
	5,71	20,83	73,44	**Truck**
	3,03	18,31	78,65	**Bus**
	2,21	21,35	76,43	**Motorcycle**
	0,39	15,03	84,57	**Moped**
	2,24	19,15	78,60	**Other**
	Fatal	Serious	Slight	
GREECE	9,79	13,52	76,67	**Car**
	24,12	12,23	63,63	**Truck**
	8	17,33	74,66	**Bus**
	4,56	15,61	79,82	**Motorcycle**
	5,63	15,49	78,87	**Moped**
	13,60	11,56	74,82	**Other**
	Fatal	Serious	Slight	
SPAIN	4,84	24,82	70,33	**Car**
	9,79	24,50	65,69	**Truck**
	5,81	25,05	69,13	**Bus**
	2,20	17,40	80,38	**Motorcycle**
	1,03	19,16	79,80	**Moped**
	6,21	21,46	72,31	**Other**

Table 3_Annex2.6.- Type of opponent.

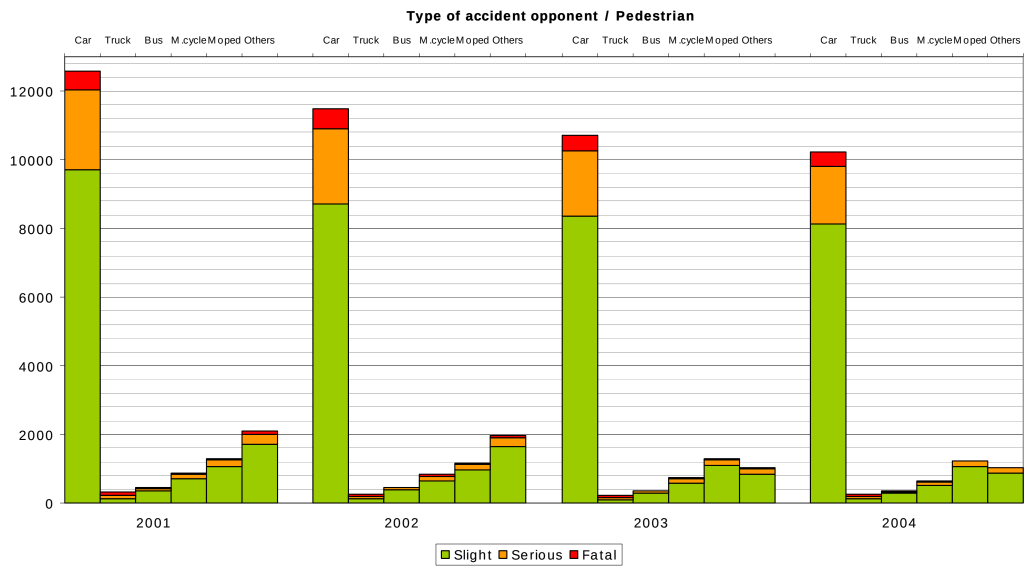


Figure 13_Annex2.6.- Type of accident opponent (France_2001/2004).

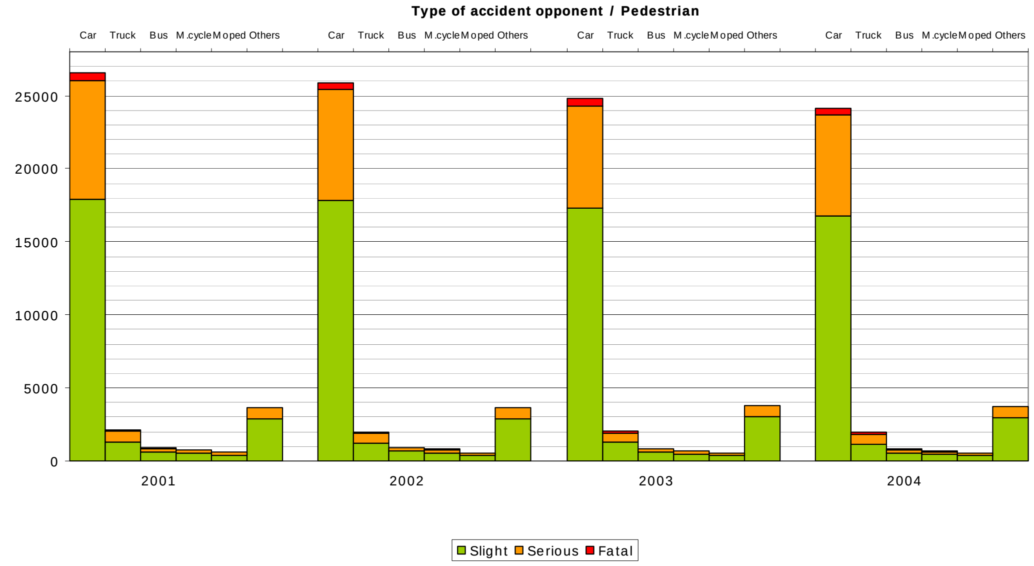


Figure 14_Annex2.6.- Type of accident opponent (Germany_2001/2004).

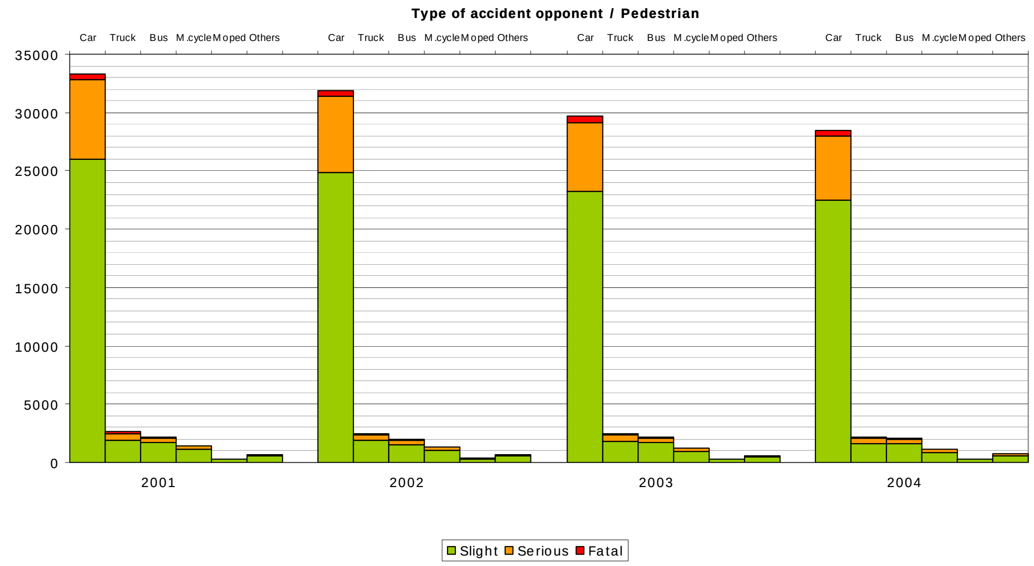


Figure 15_Annex2.6.- Type of accident opponent (Great Britain_2001/2004).

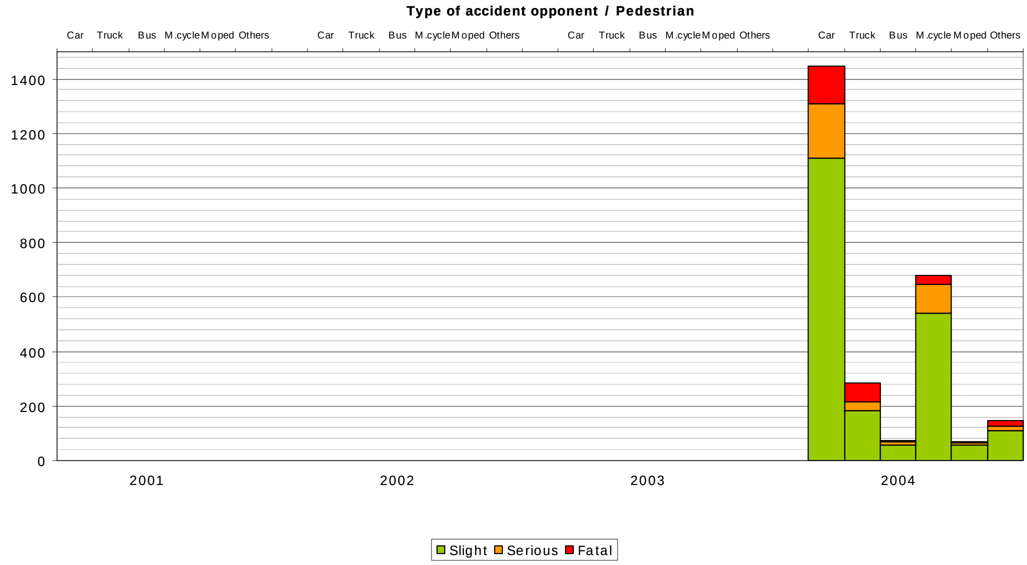


Figure 16_Annex2.6.- Type of accident opponent (Greece_2001/2004).

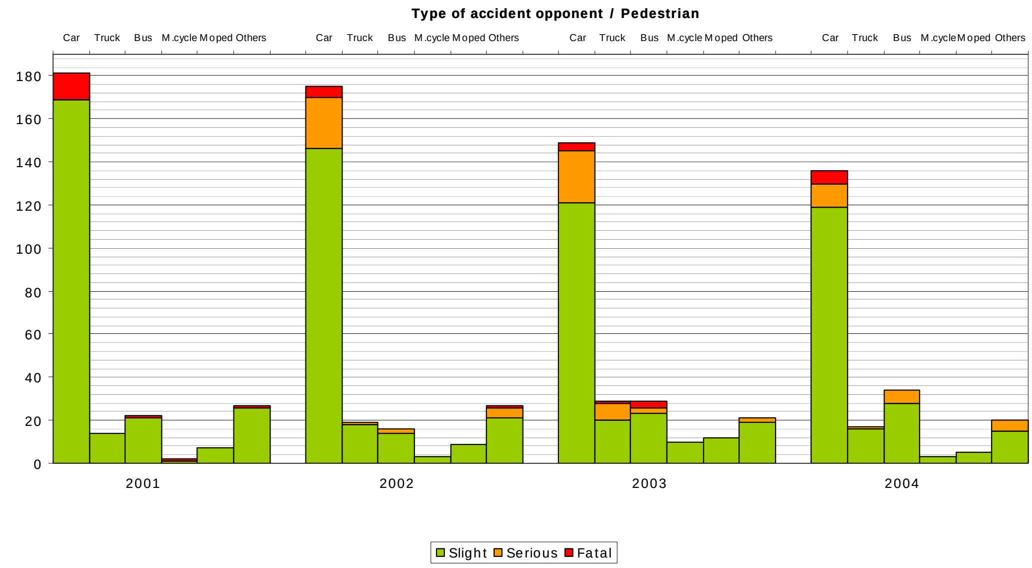


Figure 17_Annex2.6.- Type of accident opponent (Italy_2001/2004).

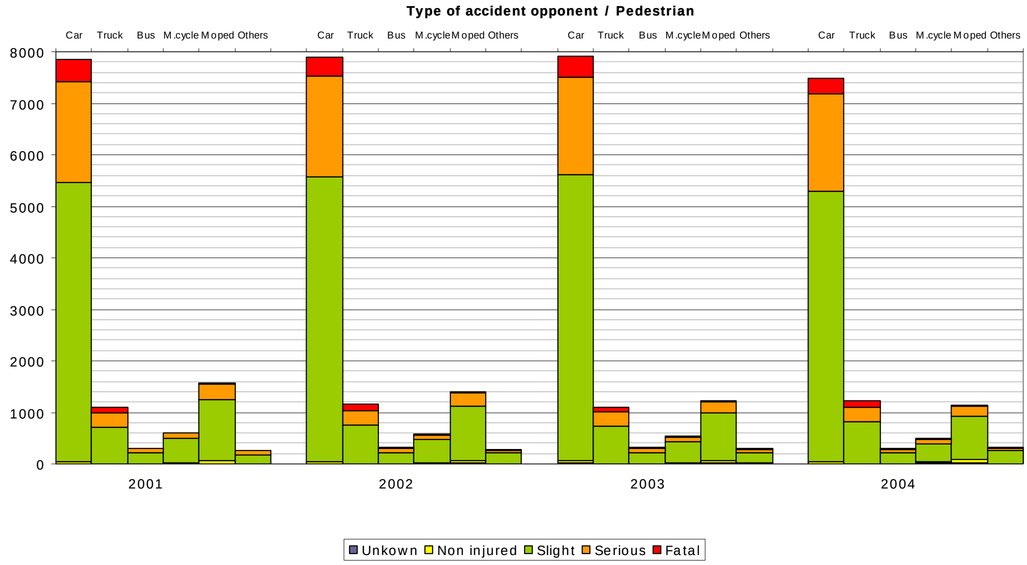


Figure 18_Annex2.6.- Type of accident opponent (Spain_2001/2004).

14.4.1.d Location

This chapter tries to locate and make a difference between accidents occurring in urban or rural areas, and relate them to the location or not in an intersection. The data represented is, like always, the average of the 4 years, as it gives a true approach of the data collected from each year.

In all the countries, urban areas present more than 90% of the accidents and less than 10% corresponds to rural area, as expected. Some of the partners distinguish between Dedicated and Non-Dedicated paths, but is does not help to make more conclusions.

Regarding the separation between intersection and non-intersection accidents, it seems that the majority of them do not take place in an intersection. The only exception is Great Britain, the only country in which the number of accidents occurring in intersections is higher.

In general, accidents taking place in rural areas have a more elevated percentage of fatal injuries, especially the ones happening in non-intersections, as in France, Great Britain, Greece and Spain. Serious injuries are also more commonly caused in rural areas than in urban areas, which give an idea of the severity of the accident. On the contrary, slight injuries use to be caused on accidents taking place in urban areas.

FRANCE		Fatal	Serious	Slight	
	Intersection	2,62	16,61	80,76	**Urban**
	No intersection	3,20	16,27	80,52	
		Fatal	Serious	Slight	
	Intersection	16,42	31,67	51,90	**Rural**
	No intersection	24,86	31,17	43,95	

GERMANY		Fatal	Serious	Slight	
	Intersection	1,67	28,03	70,28	**Urban**
	No intersection	1,70	27,73	70,56	
		Fatal	Serious	Slight	
	Intersection	13,93	42,11	43,95	**Rural**
	No intersection	10,83	36,66	52,49	

GREAT BRITAIN		Fatal	Serious	Slight	
	Intersection	1,61	19,61	78,76	Urban
	No intersection	1,54	20,43	78,01	
		Fatal	Serious	Slight	Rural
	Intersection	13,97	30,50	55,52	
	No intersection	15,44	31,13	53,41	

GREECE		Fatal	Serious	Slight	
	Intersection	6,43	11,81	81,75	Urban
	No intersection	8,46	14,64	76,89	
		Fatal	Serious	Slight	Rural
	Intersection	41,37	3,44	55,17	
	No intersection	38,23	20	41,76	

SPAIN		Fatal	Serious	Slight	
	Intersection	1,83	18,55	79,60	Urban
	No intersection	2,71	22,06	75,21	
		Fatal	Serious	Slight	Rural
	Intersection	17,13	39,74	43,11	
	No intersection	21,07	41,59	37,33	

Table 4_Annex2.6.- Location.

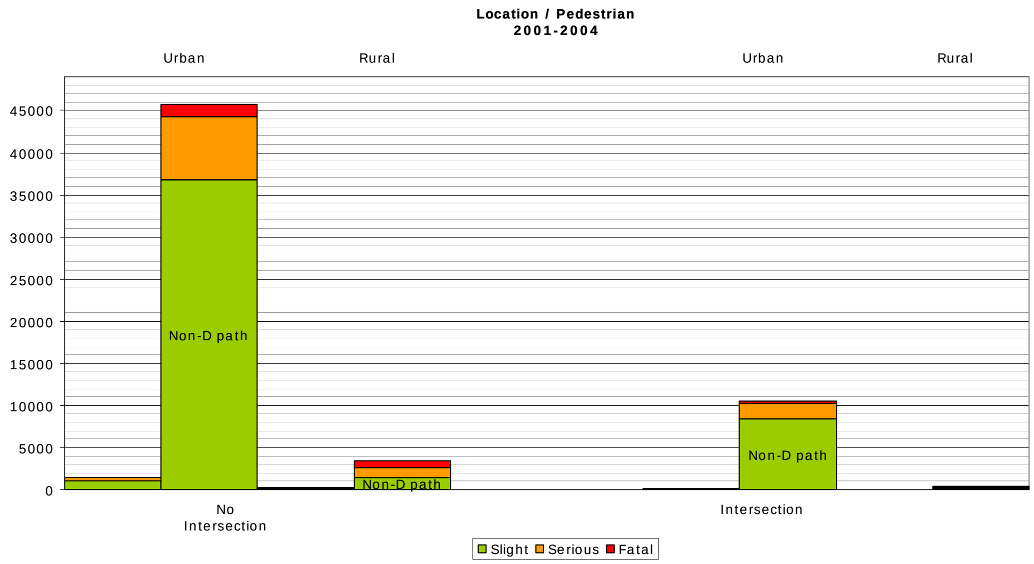


Figure 19_Annex2.6.- Location of accident (France_2001/2004).

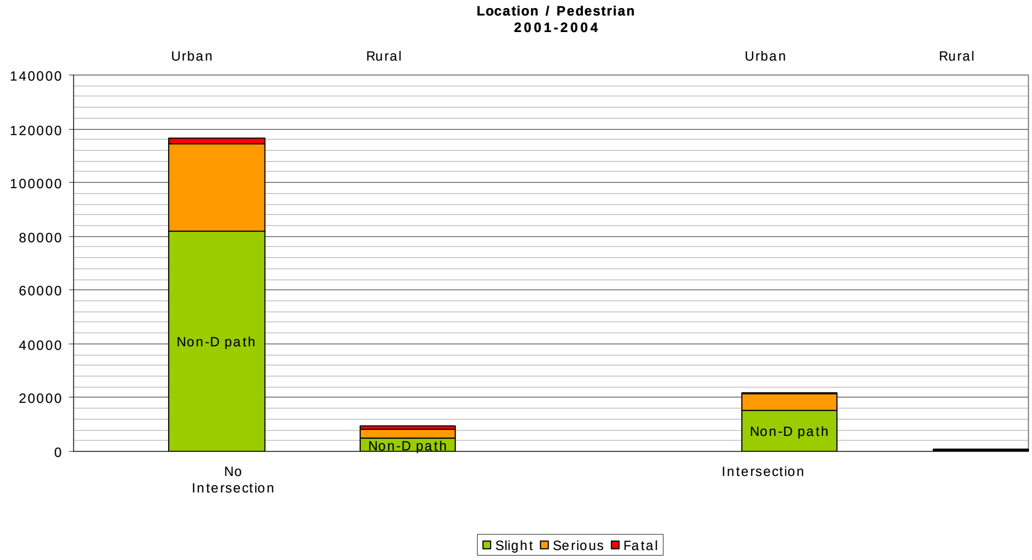


Figure 20_Annex2.6.- Location of accident (Germany_2001/2004).

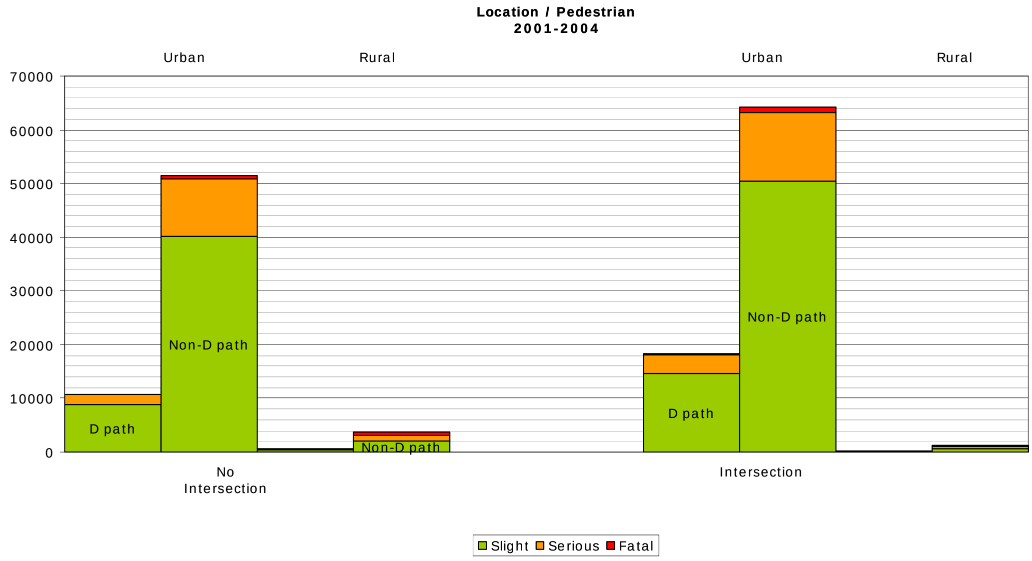


Figure 21_Annex2.6.- Location of accident (Great Britain_2001/2004).

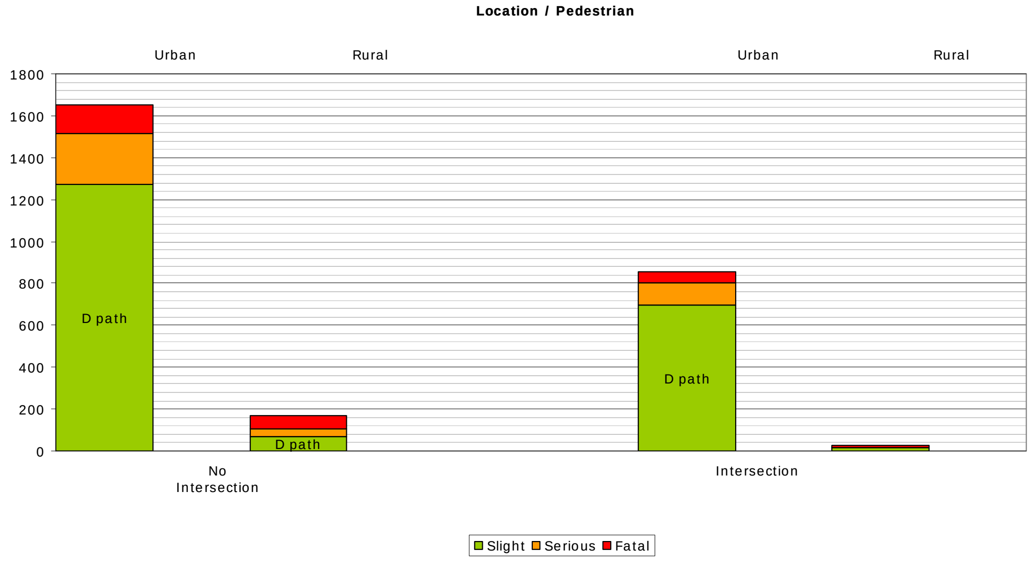


Figure 22_Annex2.6.- Location of accident (Greece_2001/2004).

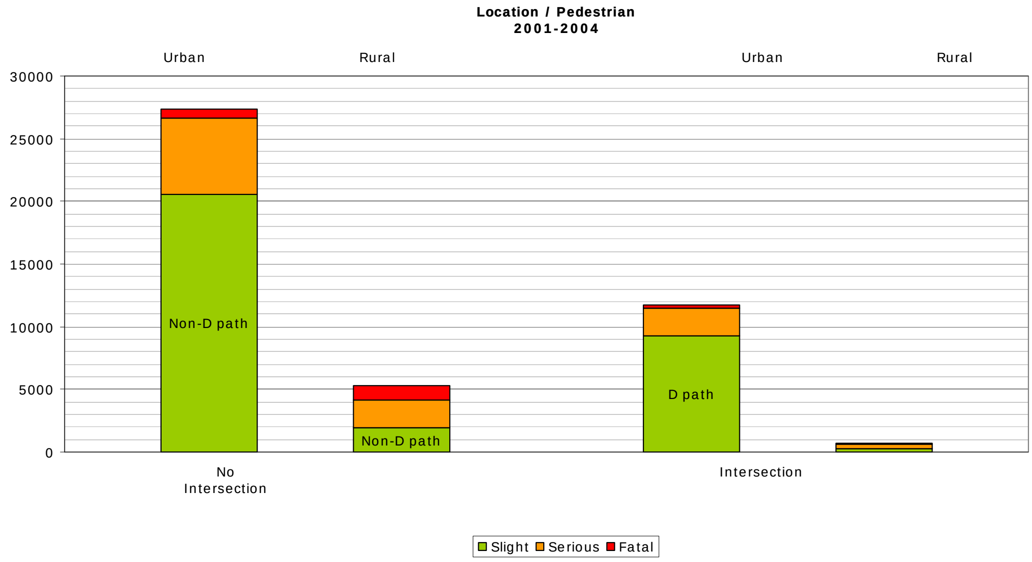


Figure 23_Annex2.6.- Location of accident (Spain_2001/2004).

14.4.1.e Road grip related circumstances

In order to classify accidents according to road conditions (dry, wet, ice, slippery, etc), this chapter focuses on analyzing the influence of external factors that can interfere in an accident. It will also evaluate these factors separately in urban and rural roads. Regarding urban roads, most accidents happen on dry road, which proves that accidents cannot be only justified due to weather conditions, but its influence is undeniable. Nowadays, passenger cars incorporate a lot of primary systems, such as ESP, that avoid the car to loose control even in emergency situations, for example under rain conditions. In Germany and Great Britain the difference between dry road accidents and wet road accidents is not as big as in other countries, which shows that accidents involving pedestrians occur under any circumstance.

Concerning rural roads, the number of accidents is still little in comparison to urban accidents, with the exception of Greece, at least for the available data from 2004. The data from Italy, in spite of being interesting due to its elevated rate of fatal injuries occurring in urban roads can not be taken into consideration as it is not sufficiently significant. As concluded in the preceding chapter, the rates of fatal and serious injuries are higher in rural roads. An important data is that, in all the countries, the relative percentage of fatal, serious and slight injuries is similar under any road grip circumstance, which means that once the accident is unavoidable, the consequences are the same for each case.

		Fatal	Serious	Slight	
FRANCE	Dry	2,96	16,00	81,03	Urban
	Wet	3,48	17,58	78,93	
	Ice	3,15	21,05	75,78	
	Slippery	0	5,55	94,44	
	Other	5,02	17,87	77,09	
	Unknown	2,14	11,35	86,50	
	Dry	21,96	31,11	46,91	Rural
	Wet	24,78	31,08	44,13	
	Ice	18,18	27,27	54,54	
	Slippery	14,28	42,85	42,85	
	Other	9,09	36,36	54,54	
	Unknown	17,03	23,71	59,27	

		Fatal	Serious	Slight	
GERMANY	Dry	1,34	24,37	74,28	Urban
	Wet	2,16	30,02	67,81	
	Ice	1,43	27,48	71,08	
	Slippery	1,31	26,81	71,87	
	Other	0	0	0	
	Unknown	0	0	0	
	Dry	7,40	31,51	61,08	Rural
	Wet	10,26	35,88	53,85	
	Ice	3,59	37,84	58,56	
	Slippery	7,37	34,42	58,19	
	Other	0	0	0	
	Unknown	0	0	0	

		Fatal	Serious	Slight	
GREAT BRITAIN	Dry	1,39	19,06	79,54	Urban
	Wet	2,09	21,10	76,80	
	Ice	1,17	18,50	80,32	
	Slippery	1,38	20,83	77,77	
	Other	0	0	0	
	Unknown	0,75	11,27	87,96	
	Dry	12,86	29,21	57,92	Rural
	Wet	15,80	31,55	52,63	
	Ice	2,81	35,91	61,26	
	Slippery	0	23,52	76,47	
	Other	0	0	0	
	Unknown	16,66	16,66	66,66	

		Fatal	Serious	Slight	

GREECE	Dry	6,49	12,47	81,02	**Urban**
	Wet	9,70	14,5668	75,72	
	Ice	8,33	16,66	75	
	Slippery	0	0	0	
	Other	18,18	0	81,81	
	Unknown	0	0	0	
	Dry	6,49	12,47	81,02	**Rural**
	Wet	9,70	14,56	75,72	
	Ice	8,33	16,66	75	
	Slippery	0	0	0	
	Other	18,18	0	81,81	
	Unknown	0	0	0	

		Fatal	Serious	Slight	
ITALY	Dry	14,38	17,80	67,80	**Urban**
	Wet	19,31	22,74	57,93	
	Ice	33,33	16,66	50	
	Slippery	50	50	0	
	Other	0	0	100	
	Unknown	26,31	5,26	68,42	
	Dry	33,33	17,94	48,71	**Rural**
	Wet	60	10	30	
	Ice	100	0	0	
	Slippery	0	0	0	
	Other	0	0	0	
	Unknown	100	0	0	

		Fatal	Serious	Slight	
SPAIN	Dry	2,38	20,03	77,57	**Urban**
	Wet	2,47	23,61	73,90	
	Ice	2,43	21,95	75,60	
	Slippery	0	0	0	
	Other	2,45	18,20	79,34	
	Unknown	0	0	0	
	Dry	20,96	40,28	38,74	**Rural**
	Wet	18,55	40,84	40,59	
	Ice	14,58	39,58	45,83	
	Slippery	0	0	0	
	Other	12,74	45,09	42,15	
	Unknown	0	0	0	

Table 5_Annex2.6.- Road grip related circumstances.

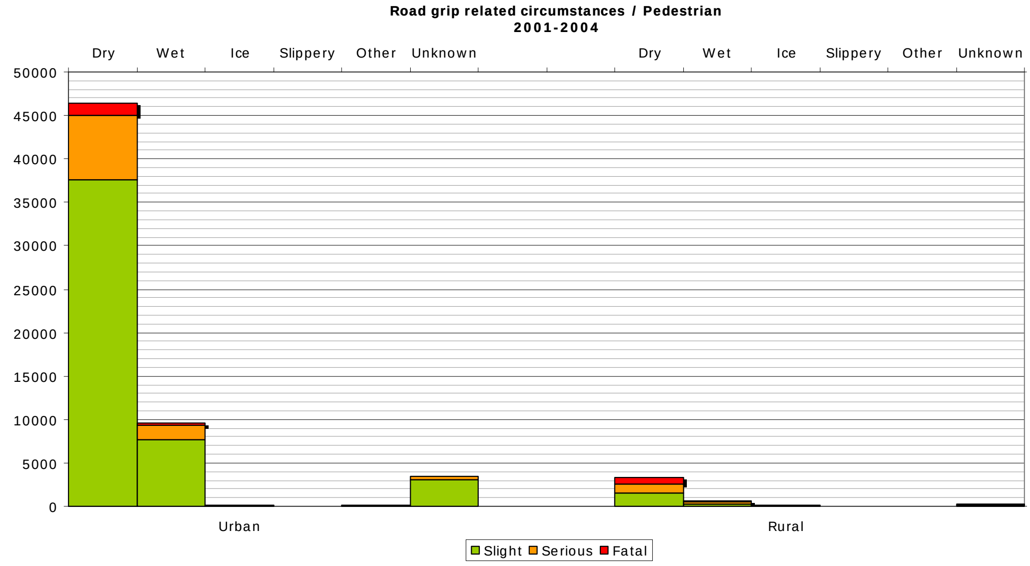


Figure 24_Annex2.6.- Road grip related circumstances (France_2001/2004).

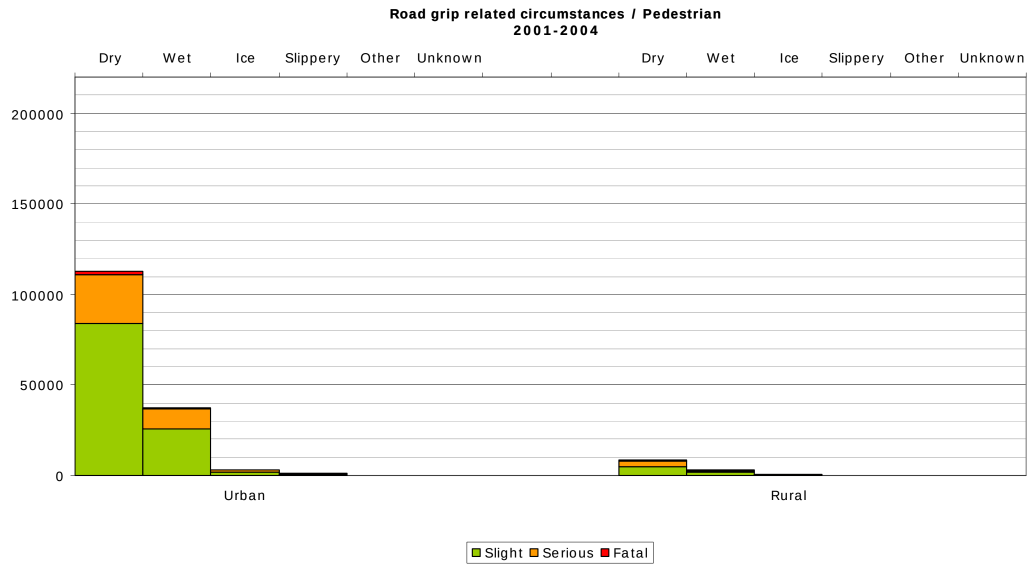


Figure 25_Annex2.6.- Road grip related circumstances (Germany_2001/2004).

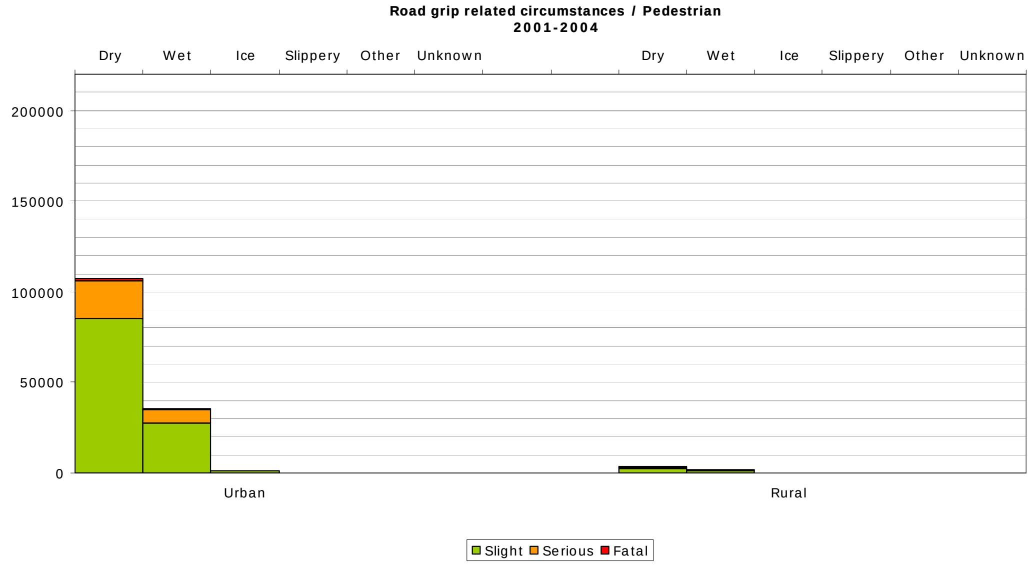


Figure 26_Annex2.6.- Road grip related circumstances (Great Britain_2001/2004).

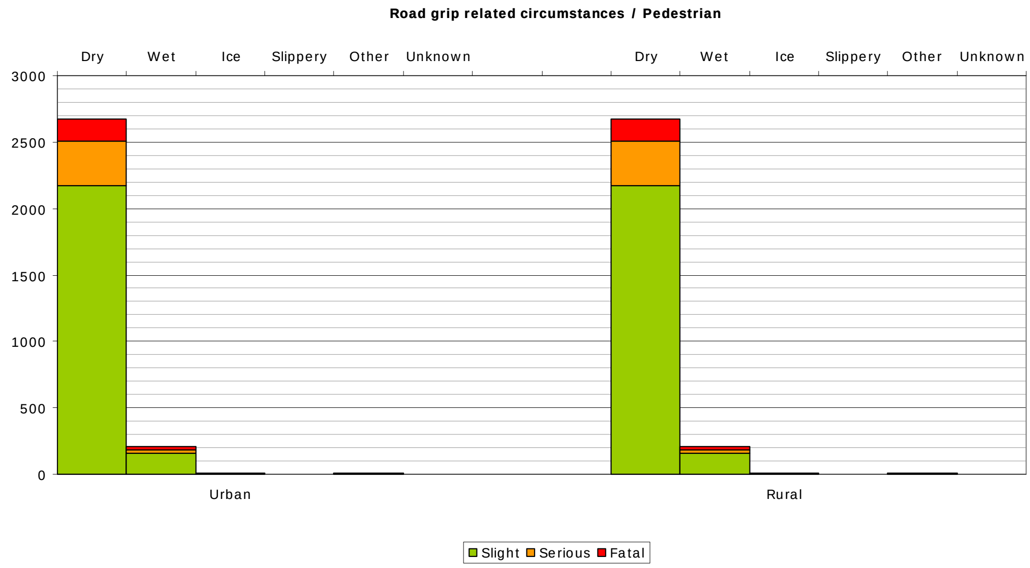


Figure 27_Annex2.6.- Road grip related circumstances (Greece_2001/2004).

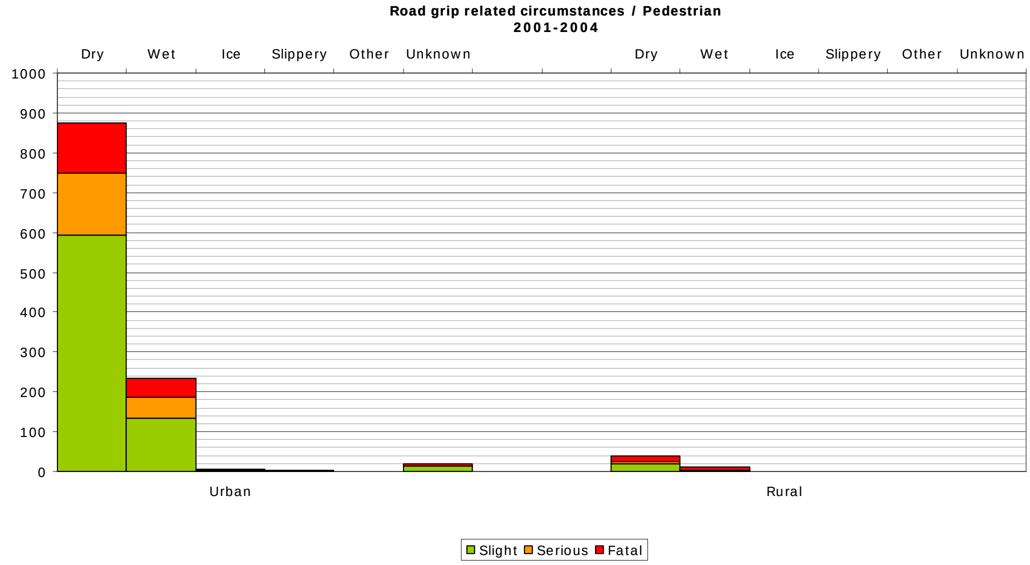


Figure 28_Annex2.6.- Road grip related circumstances (Italy_2001/2004).

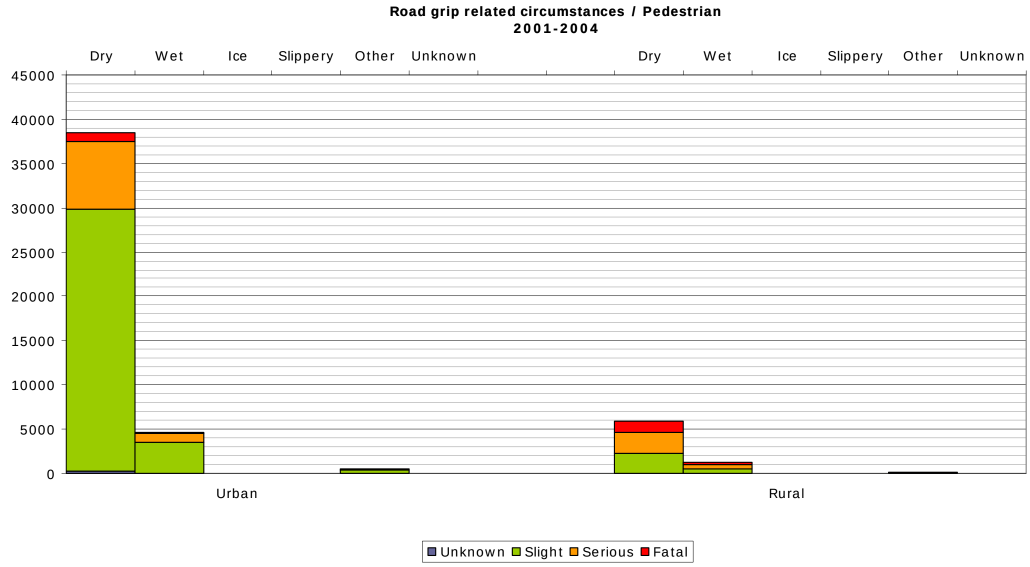


Figure 29_Annex2.6.- Road grip related circumstances (Spain_2001/2004).

14.4.1.f Specific accident location

Only France could provide data for this classification. In absolute numbers, most accidents happened close to a social spot, and the difference to other specific locations is too high, but rural accidents remain as the most harmful for pedestrians. It would be interesting to study the origin of this data and how this classification is given.

		Fatal	Serious	Slight
FRANCE	**Near school**	2,80	17,50	79,69
	Social spot	3,01	15,97	81,01
	Industrial	0	0	0
	Rural	27,07	32,10	40,81
	Other	0	0	0
	Unknown	20,97	30,50	48,52

Table 6_Annex2.6.- Specific accident location.

14.4.1.g Weather conditions

This classification is very similar to the road grip conditions, as it is directly related, but additional evidences can be concluded. The information regarding Germany was not included, as we had no sufficient data to give reliable results and conclusions.

First, comparing the percentage of fatal injuries occurring in urban areas, it can be stated that in France and Spain, fog is a relevant factor and causes the highest relative rate of fatal injuries to pedestrians. In addition, snow is the first cause of serious injuries also in both countries. On the contrary, dry and wet weather conditions are the most fatal situation in urban roads in Great Britain.

When analysing the situation in rural areas, similar tendencies can be appreciated in Spain and France. Once more, fog is the most relevant and harmful factor for pedestrians, as accidents produced under fog conditions cause the higher relative percentage of fatal and serious injuries. In Great Britain, the situation changes a little from accidents occurring in urban areas under dry, wet and fog weather conditions cause similar injuries (fatal, serious and slight) to pedestrians.

		Fatal	Serious	Slight	
FRANCE	Dry	2,83	15,40	81,76	Urban
	Wet	3,19	17,30	79,50	
	Snow	2,67	26,20	71,12	
	Fog	4,57	21,56	73,85	
	Other	6,27	23,71	70,00	
	Dry	20,98	30,23	48,77	Rural
	Wet	24,00	31,34	44,64	
	Snow	14,54	27,27	58,18	
	Fog	38,57	38,57	22,85	
	Other	27,72	34,65	37,62	

		Fatal	Serious	Slight	
GREAT BRITAIN	Dry	1,55	19,58	78,85	Urban
	Wet	1,75	20,18	78,05	
	Snow	0,62	17,15	82,21	
	Fog	0,98	21,37	77,64	
	Other	1,18	15,85	82,96	
	Dry	13,12	30,15	56,71	Rural
	Wet	16,49	29,74	53,75	
	Snow	0	24,13	75,86	
	Fog	14,94	32,18	52,87	
	Other	13,58	29,01	57,40	

		Fatal	Serious	Slight	
GREECE	Dry	6,55	12,11	81,33	Urban
	Wet	12,25	16,12	71,61	
	Snow	0	50	50	
	Fog	0	50	50	
	Other	0	0	0	
	Dry	30,90	19,54	49,54	Rural
	Wet	31,57	5,23	63,15	
	Snow	0	0	0	

	Fog	0	0	0	
	Other	0	0	0	

		Fatal	Serious	Slight	
ITALY	Dry	17,30	18,07	64,61	Urban
	Wet	16,66	23,21	60,11	
	Snow	20	20	60	
	Fog	40	20	40	
	Other	7,27	18,18	74,54	
	Dry	36,11	13,88	50	Rural
	Wet	42,85	14,28	42,85	
	Snow	100	0	0	
	Fog	50	50	0	
	Other	66,66	0	33,33	

		Fatal	Serious	Slight	
SPAIN	Dry	2,39	20,06	77,54	Urban
	Wet	2,30	23,22	74,46	
	Snow	5,40	35,15	59,45	
	Fog	6,06	21,96	71,96	
	Other	2,48	22,06	75,45	

	Dry	20,95	40,08	38,96	Rural
	Wet	16,63	41,42	41,94	
	Snow	10	40	50	
	Fog	26,02	43,83	30,13	
	Other	22,22	47,22	30,55	

Table 7_Annex2.6.- Weather conditions.

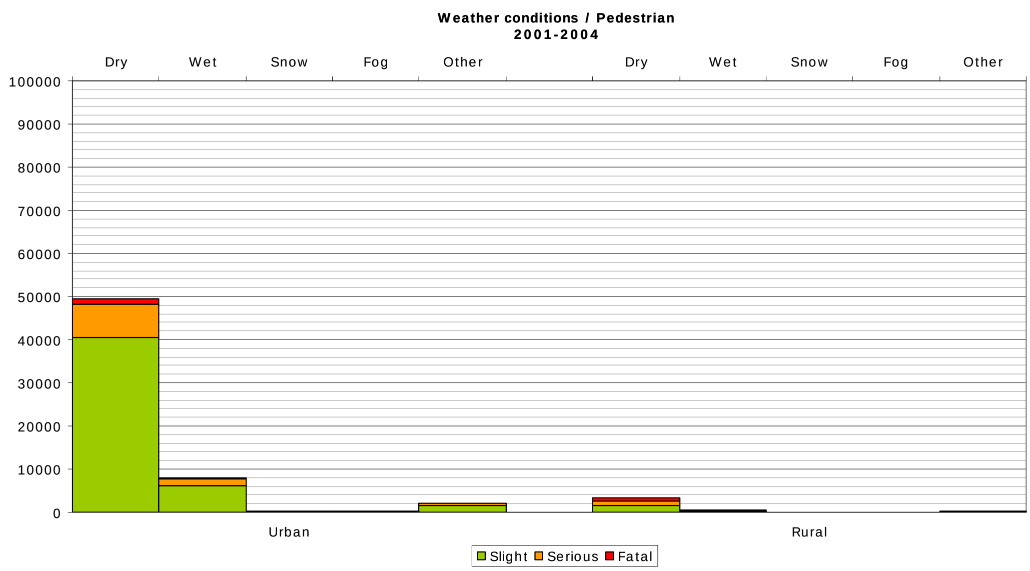


Figure 30_Annex2.6.- Weather conditions (France_2001/2004).

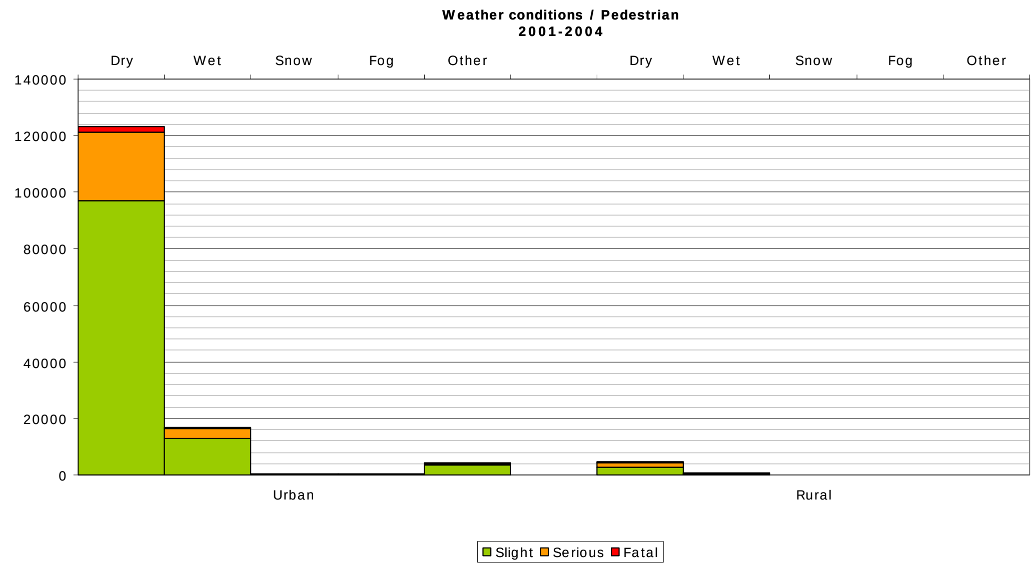


Figure 31_Annex2.6.- Weather conditions (Great Britain_2001/2004).

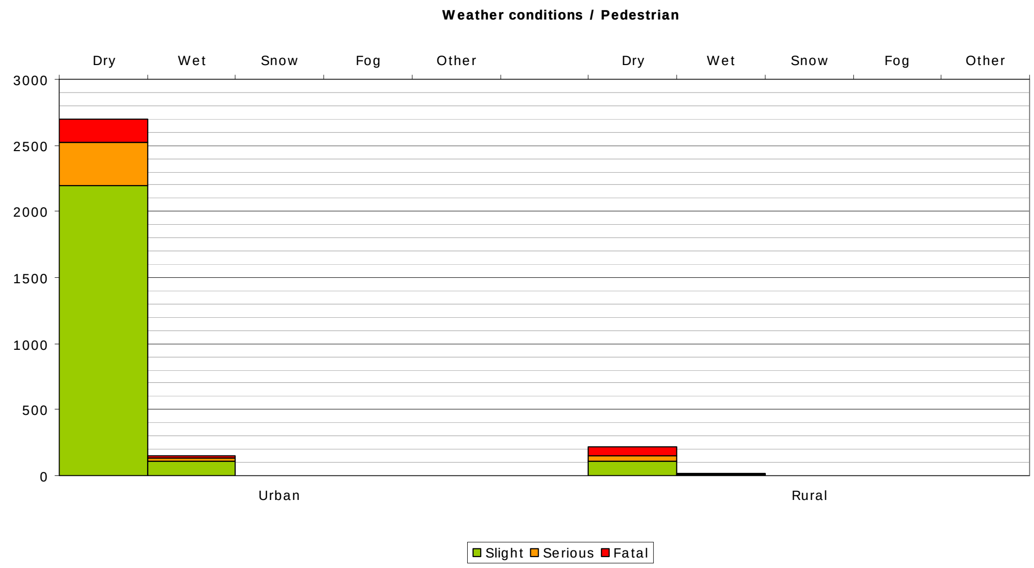


Figure 32_Annex2.6.- Weather conditions (Greece_2001/2004).

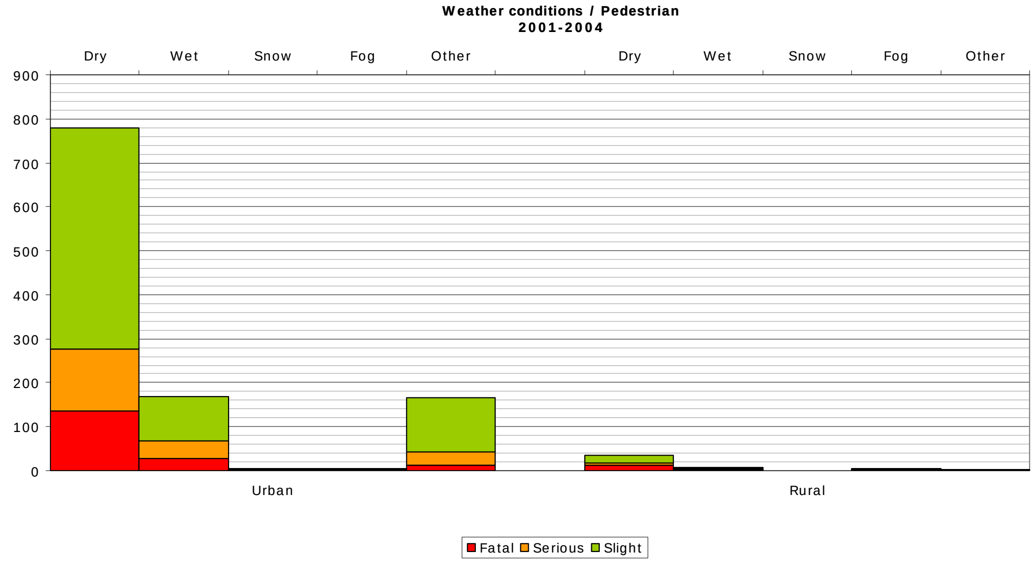


Figure 33_Annex2.6.- Weather conditions (Italy_2001/2004).

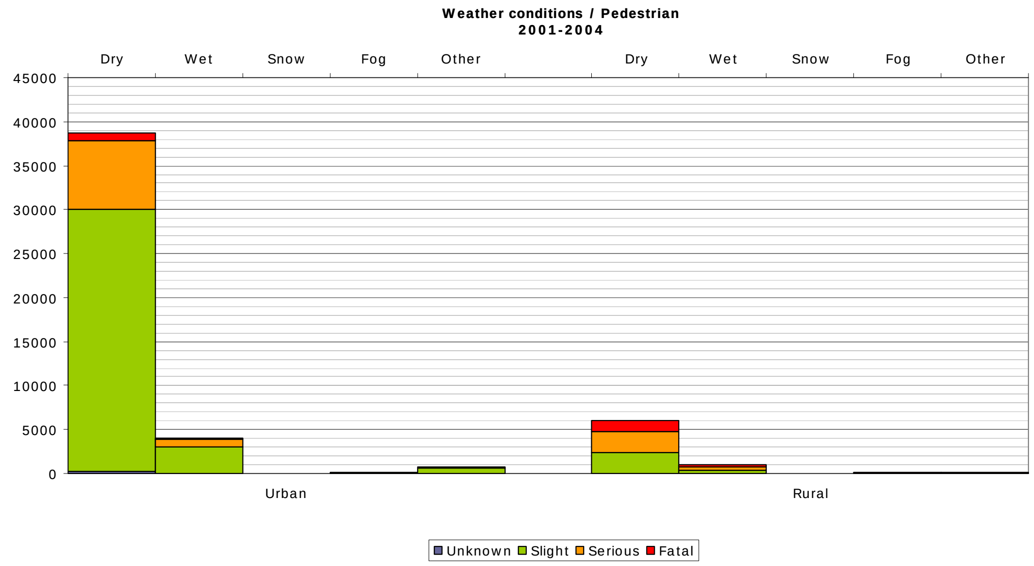


Figure 34_Annex2.6.- Weather conditions (Spain_2001/2004).

14.4.1.h Light conditions

The differentiation between urban and rural areas is very important in this case. Talking in absolute numbers, and regarding pedestrian accidents in urban roads, the majority of them occur with daylight. In Spain and France the difference between daylight and darkness accidents is higher, but in the other countries it stills reasonably similar. It is also important to note that for all countries, the relative percentage of fatal and serious accidents is bigger in darkness than in daylight, surely due to the severity of the impact when the driver cannot visualize the pedestrian.

Regarding rural accidents, it must be noted that there is no difference between the number of accidents occurring with daylight or in the night, but accidents with darkness still being more harmful and fatal for pedestrians, mainly in Greece, Great Britain, Spain and France.

		Fatal	Serious	Slight	
FRANCE	Daylight	2,47	15,11	82,40	Urban
	Dawn	3,39	16,68	79,92	
	Darkness	5,02	19,41	75,55	
	Daylight	11,28	29,43	59,28	Rural
	Dawn	19,69	36,74	43,56	
	Darkness	35,24	31,53	33,22	
		Fatal	Serious	Slight	
GERMANY	Daylight	1,09	23,99	74,91	Urban
	Dawn	1,18	24,22	74,59	
	Darkness	2,92	31,40	65,66	
	Daylight	4,33	28,92	66,74	Rural
	Dawn	6,79	33,39	59,80	
	Darkness	11,52	36,34	52,12	

		Fatal	Serious	Slight	
GREAT BRITAIN	Daylight	1,23	17,84	80,92	Urban
	Dawn	0	0	0	
	Darkness	2,40	23,93	73,66	
	Daylight	7,43	27,40	65,15	Rural
	Dawn	0	0	0	
	Darkness	21,06	33,41	45,52	

		Fatal	Serious	Slight	
GREECE	Daylight	5,63	12,14	82,21	Urban
	Dawn	0	0	0	
	Darkness	9,62	13,71	76,65	
	Daylight	26,66	21,48	51,85	Rural
	Dawn	0	0	0	
	Darkness	37,27	14,54	48,18	

		Fatal	Serious	Slight	
ITALY	Daylight	2,12	20,49	77,38	Urban
	Dawn	0	21,34	78,65	
	Darkness	7,84	30,06	62,09	
	Daylight	11,11	0	88,88	Rural
	Dawn	66,66	0	33,33	
	Darkness	25	25	50	

		Fatal	Serious	Slight	
SPAIN	Daylight	2,06	19,32	78,61	Urban
	Dawn	3,135	20,75	76,11	
	Darkness	3,20	23,32	73,47	
	Daylight	12,70	41,84	45,45	Rural
	Dawn	21,25	38,02	40,71	
	Darkness	29,20	39,06	31,72	

Table 8_Annex2.6.- Light conditions.

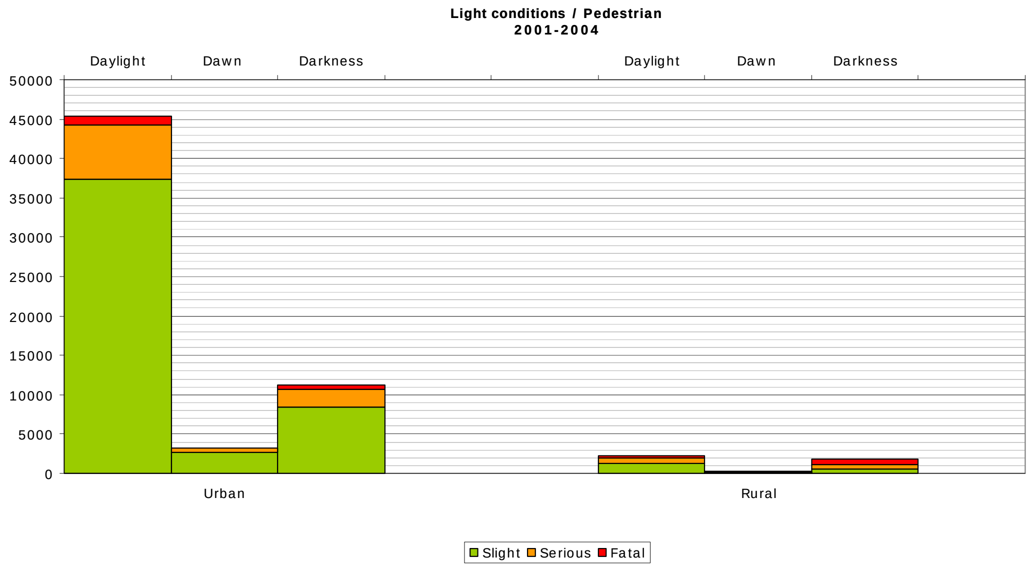


Figure 35_Annex2.6.- Light conditions (France_2001/2004).

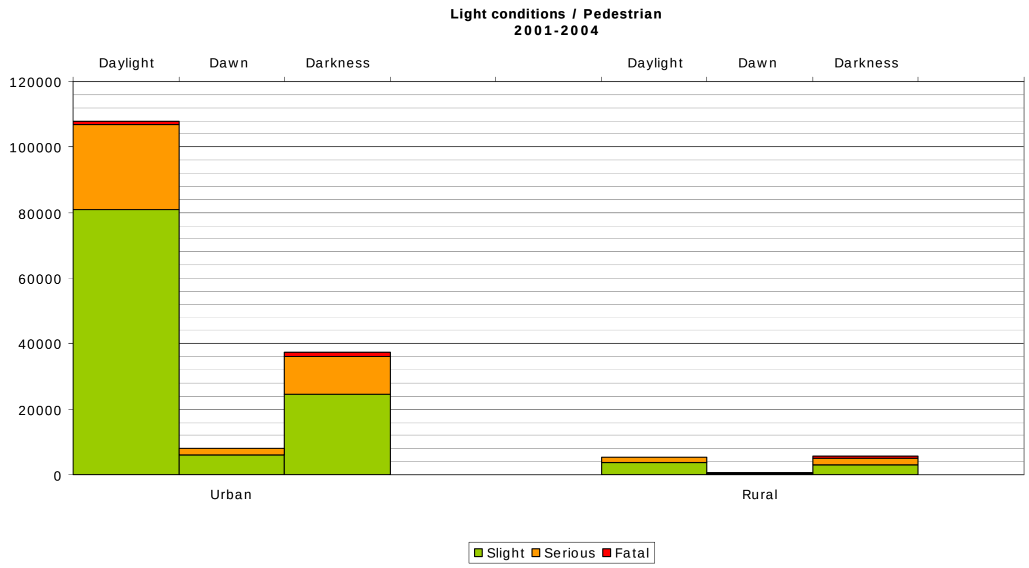


Figure 36_Annex2.6.- Light conditions (Germany_2001/2004).

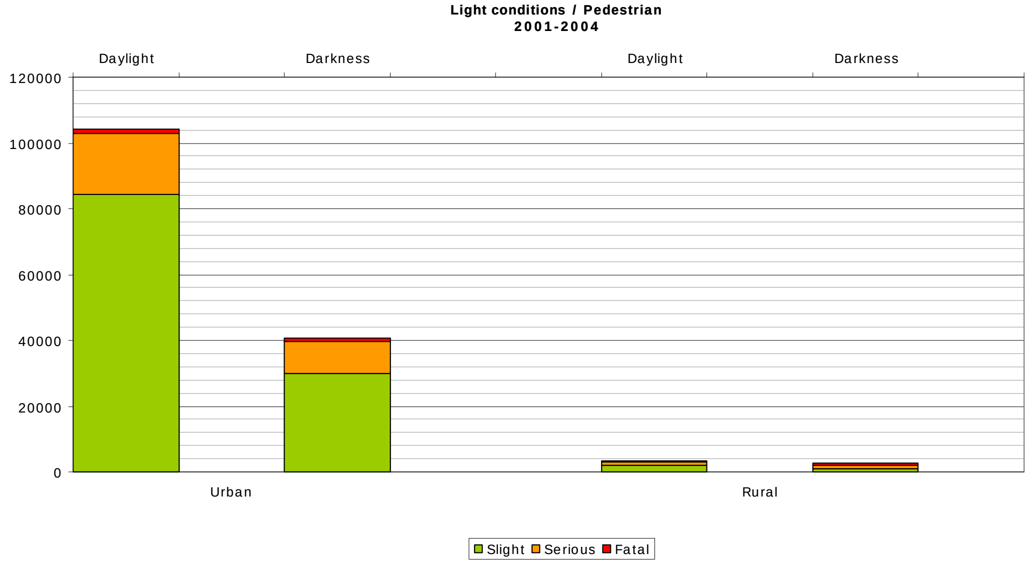


Figure 37_Annex2.6.- Light conditions (Great Britain_2001/2004).

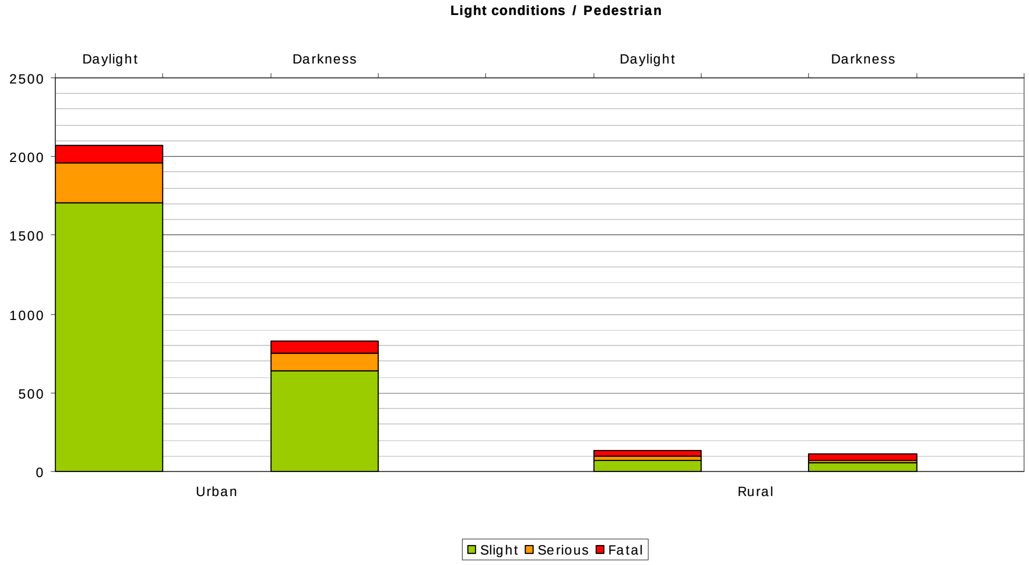


Figure 38_Annex2.6.- Light conditions (Greece_2001/2004).

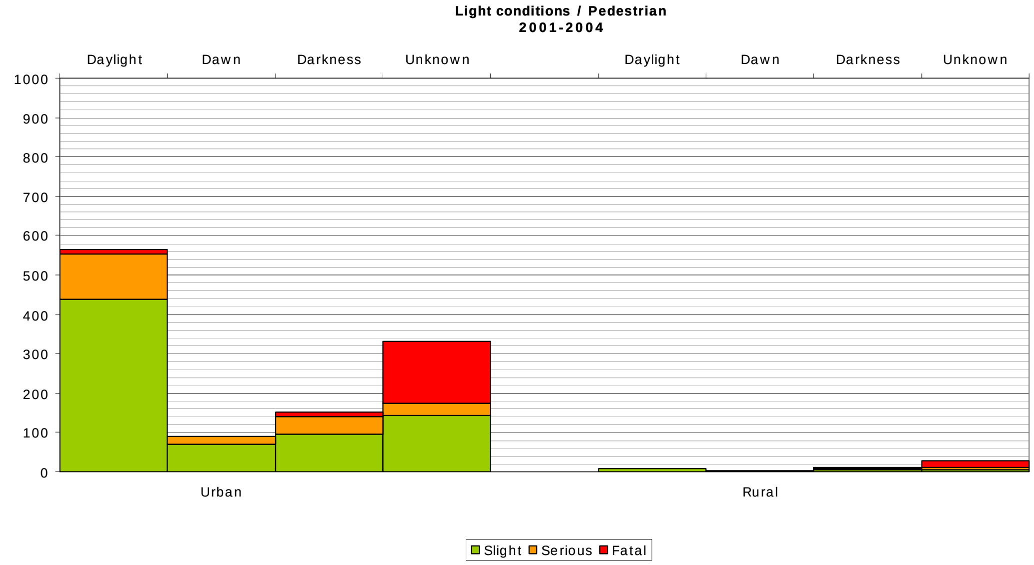


Figure 39_Annex2.6.- Light conditions (Italy_2001/2004).

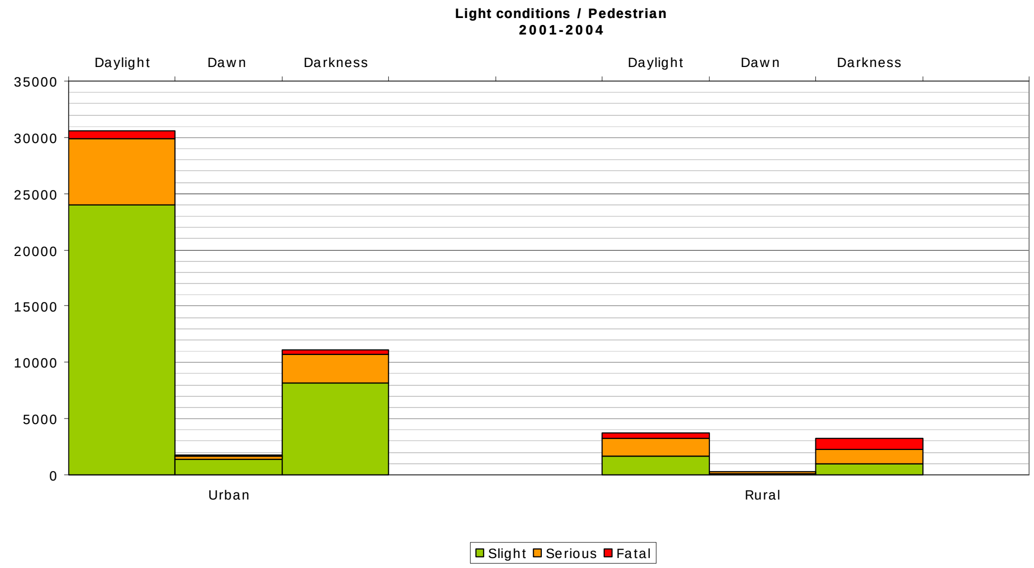


Figure 40_Annex2.6.- Light conditions (Spain_2001/2004).

14.4.1.i Age

In this chapter, the age of pedestrians involved in the accidents is classified. A first division has been made so that child and teenagers are grouped together, so as to see the relevance of accidents involving the youngest part of the population. Then, the rest of the population has been grouped in divisions of ten years, and finally elderly people, which are considered to be older than 60 years, are also grouped together.

Analysing the results, it can be concluded that while in France, Germany and Great Britain, absolute number of young people accidents is bigger than older people ones (but not much), in Greece, Italy and Spain it happens on the opposite way (but with great difference). Nevertheless, there is one important thing in common: the most dangerous ages are the groups 0-19 and +60 years, the ones which represent both the youngest and the oldest people. This is a significant detail, as it shows that people is more vulnerable during the two extremes of life.

In relative terms, percentage of fatal and serious accidents is bigger for older people than the rest, both for urban and rural areas. The minor rate of fatal injuries is for child and teenagers, but then it changes to get more equalled when referring to the serious and slight ones.

		Fatal	Serious	Slight	
FRANCE	0-19 years	1,11	11,52	87,36	Urban
	20-29 years	1,22	9,18	89,59	
	30-39 years	1,74	11,97	86,27	
	40-49 years	2,44	14,46	83,08	
	50-59 years	2,57	17,04	80,37	
	60+ years	6,75	25,43	67,80	
	0-19 years	10,44	28,80	60,74	Rural
	20-29 years	20,18	31,02	48,79	
	30-39 years	26,27	29,55	44,17	
	40-49 years	28,88	29,42	41,69	
	50-59 years	21,81	35,59	42,59	
	60+ years	29,94	32,02	38,03	

		Fatal	Serious	Slight	
GERMANY	0-19 years	0,43	25,60	73,95	Urban
	20-29 years	0,66	17,92	81,40	
	30-39 years	0,92	18,30	80,77	
	40-49 years	1,22	21,93	76,83	
	50-59 years	1,62	24,94	73,42	
	60+ years	4,27	35,43	60,28	
	0-19 years	4,78	35,74	59,46	Rural
	20-29 years	7,599	31,40	60,99	
	30-39 years	6,31	29,76	63,91	
	40-49 years	8,73	29,88	61,37	
	50-59 years	8,10	31,49	60,40	
	60+ years	14,36	34,87	50,76	

		Fatal	Serious	Slight	
GREAT BRITAIN	0-19 years	0,58	18,51	80,89	Urban
	20-29 years	1,04	18,26	80,69	
	30-39 years	1,29	18,35	80,34	
	40-49 years	1,74	20,31	77,94	
	50-59 years	2,43	20,61	76,95	
	60+ years	5,41	26,53	68,04	
	0-19 years	8,43	32,49	59,06	Rural
	20-29 years	17,08	31,10	51,81	
	30-39 years	13,03	28,17	58,78	
	40-49 years	12,68	29,77	57,54	
	50-59 years	17,73	27,47	54,78	
	60+ years	21,14	31,57	47,28	

		Fatal	Serious	Slight	
GREECE	0-19 years	5,23	10,47	84,29	Urban
	20-29 years	1,87	9,85	88,26	
	30-39 years	3,90	10,09	85,99	
	40-49 years	6,32	10,12	83,54	
	50-59 years	4,90	12,07	83,01	
	60+ years	10,43	14,89	74,66	
	0-19 years	12,5	12,5	75	Rural
	20-29 years	8,57	20	71,42	
	30-39 years	17,64	14,70	67,64	
	40-49 years	41,17	20,58	38,23	
	50-59 years	37,5	20,83	41,66	
	60+ years	46,23	17,20	36,55	

		Fatal	Serious	Slight	
ITALY	0-19 years	4,29	8,58	87,11	Urban
	20-29 years	15,71	12,85	71,42	
	30-39 years	3,33	10,83	85,83	
	40-49 years	7,27	17,27	75,45	
	50-59 years	11,32	22,64	66,03	
	60+ years	22,88	19,49	57,62	
	0-19 years	75	0	25	Rural
	20-29 years	57,14	0	42,85	
	30-39 years	0	33,33	66,66	
	40-49 years	40	0	60	
	50-59 years	40	0	60	
	60+ years	40	0	60	

		Fatal	Serious	Slight	
SPAIN	0-19 years	1,01	16,94	82,03	Urban
	20-29 years	1,12	15,48	83,39	
	30-39 years	1,36	16,90	81,72	
	40-49 years	1,95	16,85	81,18	
	50-59 years	1,68	20,95	77,36	
	60+ years	4,58	26,54	68,87	
	0-19 years	9,20	38,63	52,15	Rural
	20-29 years	17,89	39,15	42,94	
	30-39 years	20,35	40,05	39,59	
	40-49 years	22,91	39,26	37,81	
	50-59 years	24,29	40,56	35,14	
	60+ years	23,83	44,06	32,10	

Table 9_Annex2.6.- Age of the pedestrian.

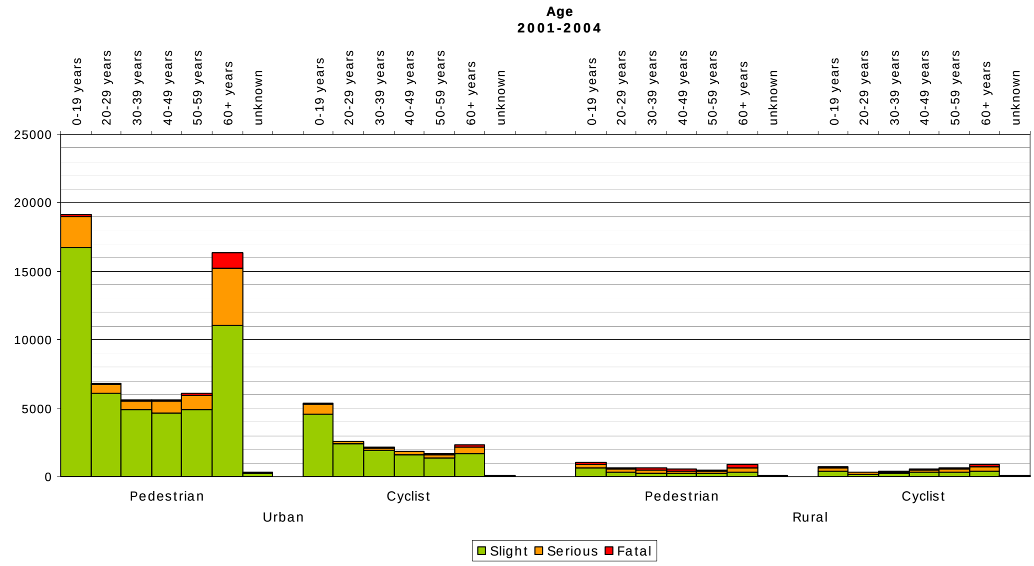


Figure 41_Annex2.6.- Age of the pedestrian (France_2001/2004).

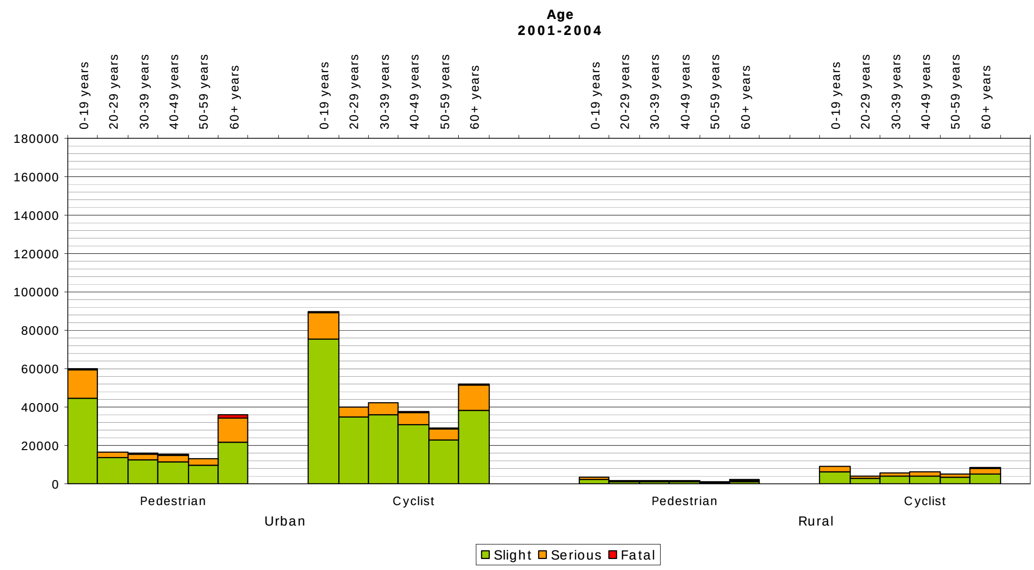


Figure 42_Annex2.6.- Age of the pedestrian (Germany_2001/2004).

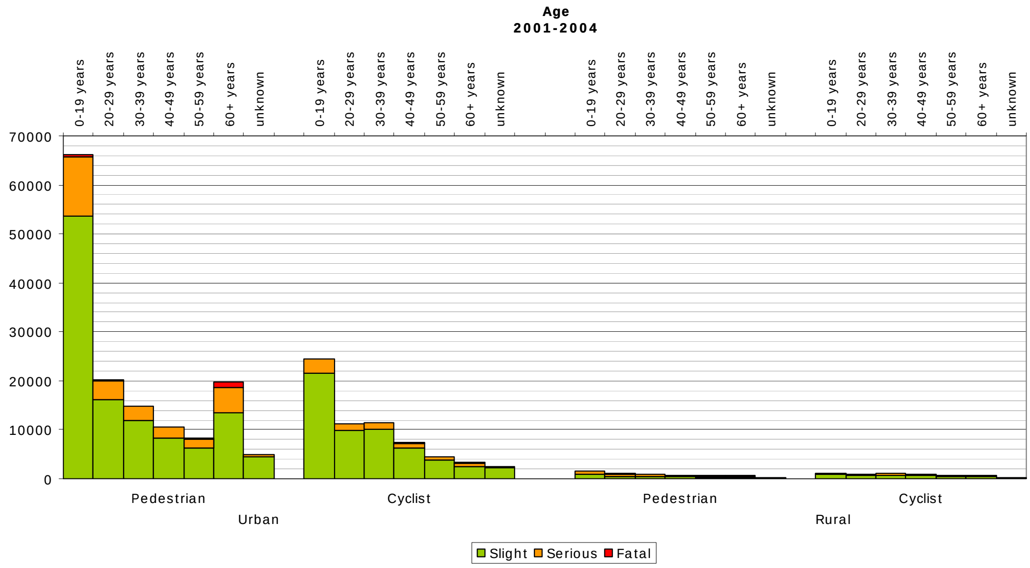


Figure 43_Annex2.6.- Age of the pedestrian (Great Britain_2001/2004).

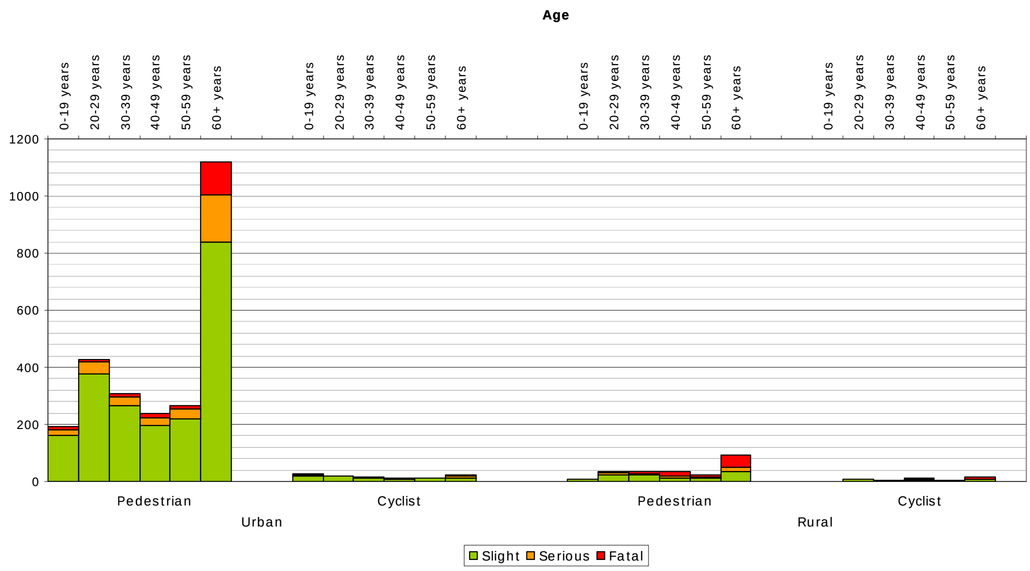


Figure 44_Annex2.6.- Age of the pedestrian (Greece_2001/2004).

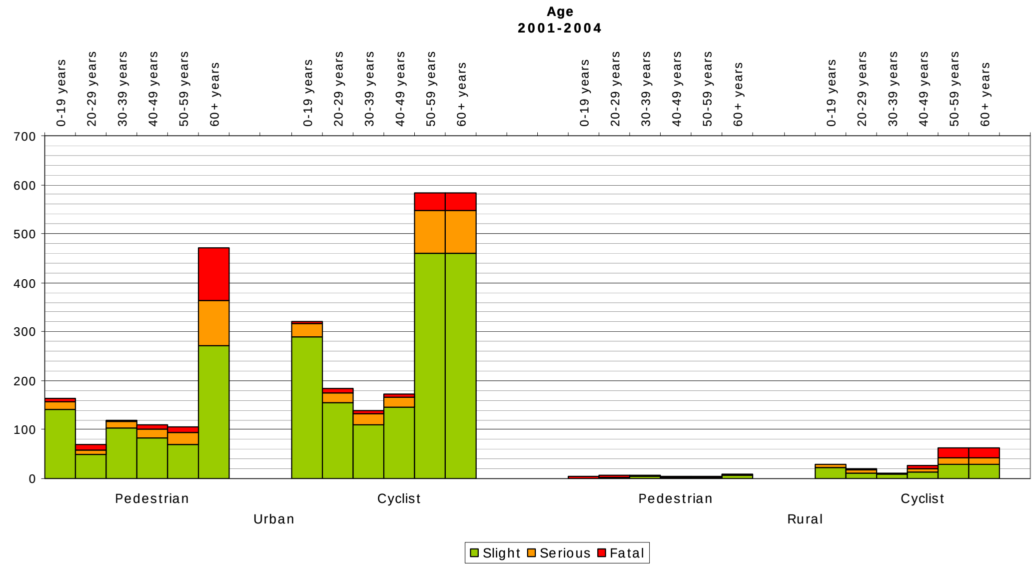


Figure 45_Annex2.6.- Age of the pedestrian (Italy_2001/2004).

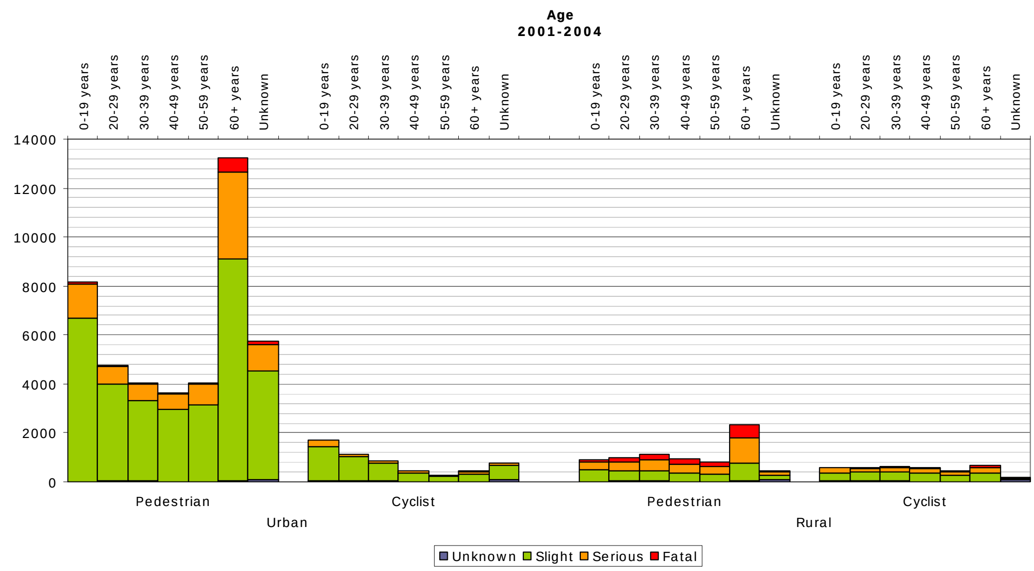


Figure 46_Annex2.6.- Age of the pedestrian (Spain_2001/2004).

14.4.1.j Gender

According to gender distribution, the number of accidents regarding pedestrians in urban roads tends to be equal between males and females in France and in Germany, whereas in Great Britain and Greece the percentage is a bit greater for males. On the contrary, the number of accidents involving pedestrian females in Spain is bigger than for males. Then, when considering relative percentages, there are not great differences about the distribution of fatal, serious and slight injuries.

Concerning pedestrians in rural roads, the number of accidents is higher for males than for females in all the cases, which must have an explanation that we are not able to determine. Then, there is an important difference between males and females when analysing the results of the relative percentages, as it can be noted that accidents are generally more fatal to males than to females.

		Fatal	Serious	Slight	
FRANCE	Male	3,23	16,02	80,73	Urban
	Female	2,77	15,99	81,23	
	Male	24,70	31,33	43,96	Rural
	Female	16,42	29,62	53,94	

		Fatal	Serious	Slight	
GERMANY	Male	1,48	24,76	73,74	Urban
	Female	1,65	27,00	71,33	
	Male	8,71	32,71	58,57	Rural
	Female	6,88	33,49	59,62	

		Fatal	Serious	Slight	
GREAT BRITAIN	Male	1,66	20,62	77,70	Urban
	Female	1,41	18,04	80,53	
	Male	14,67	31,09	54,22	Rural
	Female	10,42	27,41	62,15	

		Fatal	Serious	Slight	
GREECE	Male	6,49	13,62	79,87	Urban
	Female	7,17	11,33	81,49	
	Male	30,18	20,75	49,05	Rural
	Female	33,72	13,95	52,32	

		Fatal	Serious	Slight	
ITALY	Male	19,23	18,46	62,30	Urban
	Female	13,37	18,59	68,02	
	Male	83,58	12,68	3,73	Rural
	Female	87,93	6,89	5,17	

		Fatal	Serious	Slight	
SPAIN	Male	2,84	20,82	76,32	Urban
	Female	2,11	20,1	77,76	
	Male	22,53	40,04	37,40	Rural
	Female	16,43	42,34	41,22	

Table 10_Annex2.6.- Gender.

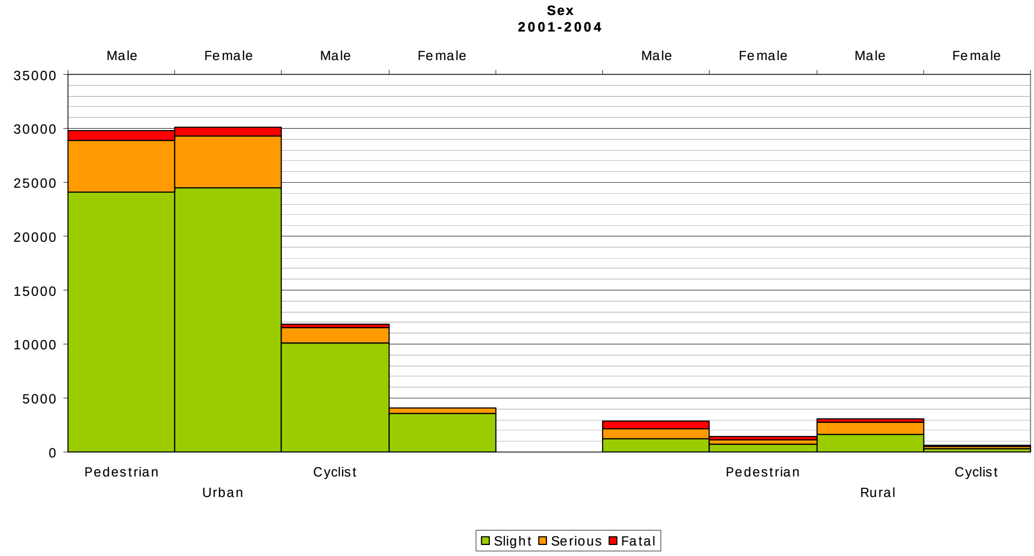


Figure 47_Annex2.6.- Gender (France_2001/2004).

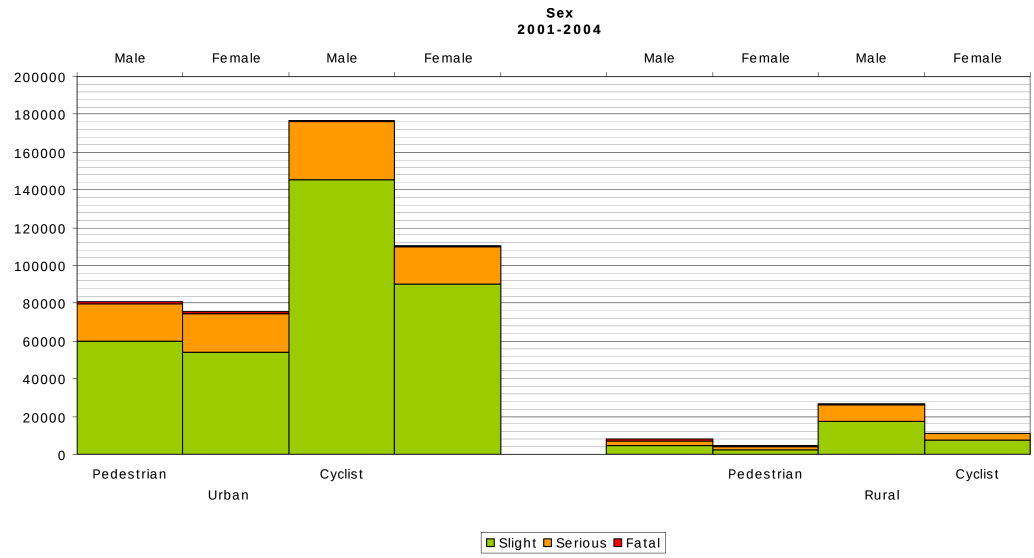


Figure 48_Annex2.6.- Gender (Germany_2001/2004).

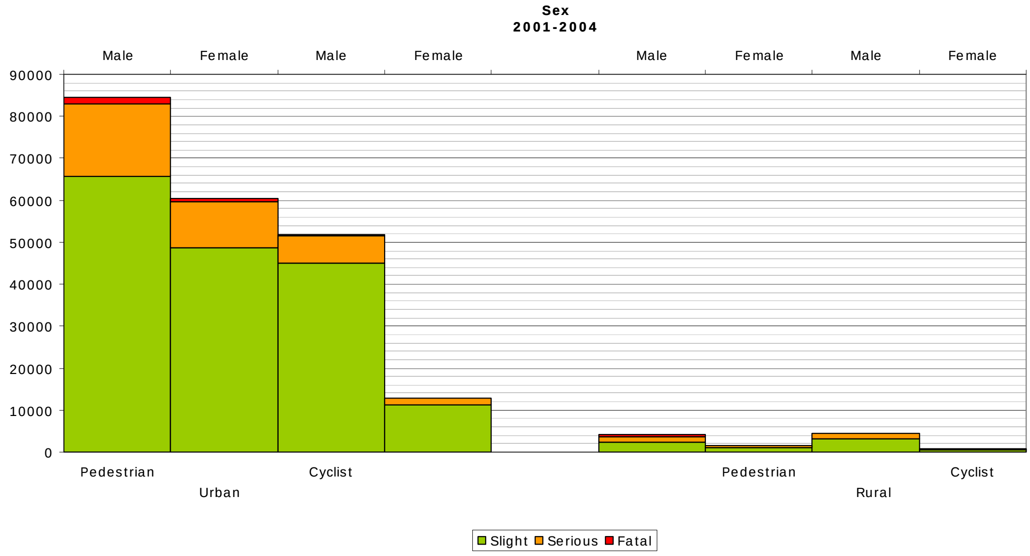


Figure 49_Annex2.6.- Gender (Great Britain_2001/2004).

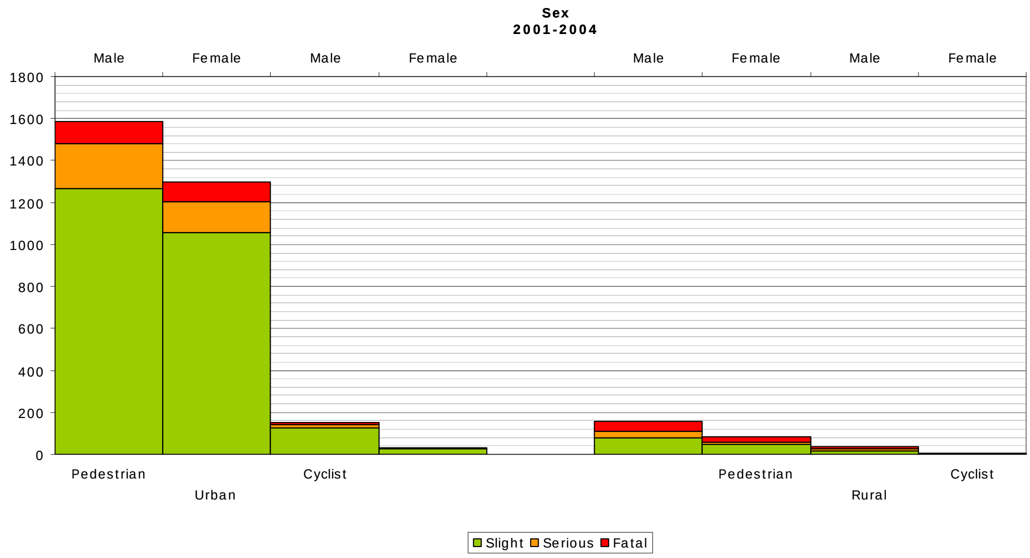


Figure 50_Annex2.6.- Gender (Greece_2001/2004).

Figure 51_Annex2.6.- Gender (Italy_2001/2004).

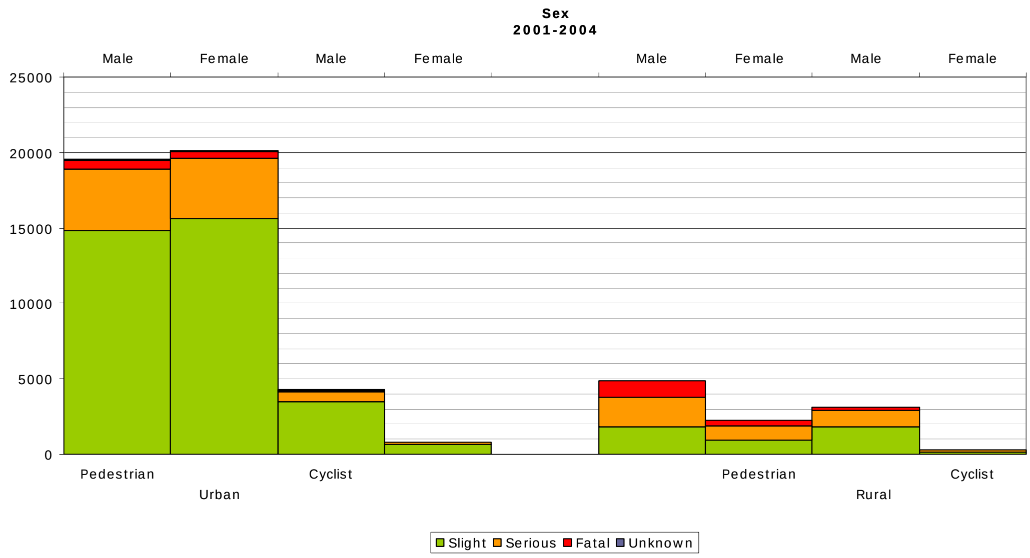


Figure 52_Annex2.6.- Gender (Spain_2001/2004).

14.4.1.k Opponent vehicle age

The purpose of this chapter is to study if there is any relation between the age of the car involved in the accident and the injuries caused to the pedestrian, as well as to give an approximation of the percentage of the different ages of the passenger cars. The cars have been divided in groups of five years, which is a reasonable period of time because cars improve a lot from one period to another.

In general terms, the number of accidents for 0-4 year old vehicles is higher than the number for 5-9 year old and older. This data is interesting but it would be interesting to compare these results with the vehicle age distribution for each country.

An important data given by the statistics is that, despite the new technologies and the recent developments than have been introduced to the majority of cars, the percentage of fatal injuries as well as serious injuries caused to pedestrians in urban roads stills very similar (there has only been a reduction of 1% or 2% in the las10 years), which means that security systems for pedestrians should be more taken into consideration in the future. In rural areas, it is confirmed that accidents are more harmful than in urban areas, but any important conclusion can be extracted.

		Fatal	Serious	Slight	
FRANCE	0-4 years	3,30	16,26	80,42	Urban
	5-9 years	3,19	17,01	79,79	
	10 years +	3,55	18,75	77,69	
	0-4 years	26,51	29,04	44,44	Rural
	5-9 years	22,90	33,68	43,41	
	10 years +	20,93	33,21	45,84	

		Fatal	Serious	Slight	
GERMANY	0-4 years	1,32	28,10	70,56	Urban
	5-9 years	1,53	29,75	68,70	
	10 years +	1,53	30,26	68,19	
	0-4 years	10,30	33,83	55,85	Rural
	5-9 years	8,91	37,00	54,07	
	10 years +	11,69	37,82	50,47	

		Fatal	Serious	Slight	
GREAT BRITAIN	0-4 years	1,70	19,55	78,74	Urban
	5-9 years	1,63	19,97	78,38	
	10 years +	1,62	20,32	78,04	
	0-4 years	15,83	31,11	53,03	Rural
	5-9 years	13,74	31,07	55,17	
	10 years +	11,52	29,02	59,44	

		Fatal	Serious	Slight	
GREECE	0-4 years	6,75	13,58	79,66	Urban
	5-9 years	5,59	12,82	81,57	
	10 years +	9,76	10,78	79,45	
	0-4 years	29,35	18,34	52,29	Rural
	5-9 years	32,07	18,86	49,05	
	10 years +	32,85	18,57	48,57	

		Fatal	Serious	Slight	
ITALY	0-4 years	38,25	38,79	22,95	Urban
	5-9 years	38,46	38,46	23,07	
	10 years +	39,00	40,42	20,56	
	0-4 years	47,05	17,64	35,29	Rural
	5-9 years	38,88	27,77	33,33	
	10 years +	50	0	50	

		Fatal	Serious	Slight	
SPAIN	0-4 years	2,64	23,91	73,43	Urban
	5-9 years	2,84	26,05	71,10	
	10 years +	3,23	26,35	70,40	
	0-4 years	22,54	39,15	38,30	Rural
	5-9 years	20,26	41,75	37,98	
	10 years +	19,51	44,51	35,96	

Table 11_Annex2.6.- Opponent vehicle age.

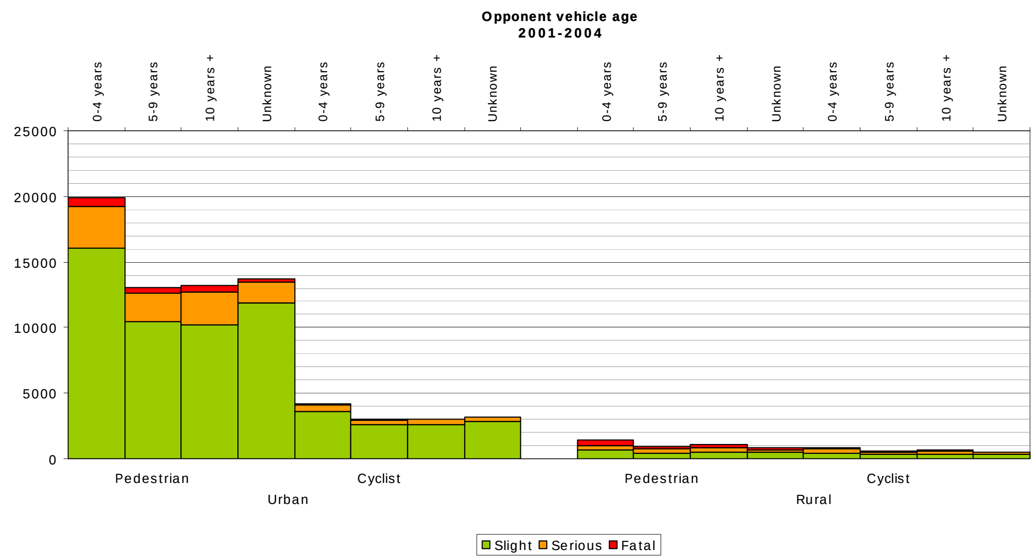


Figure 53_Annex2.6.- Opponent vehicle age (France_2001/2004).

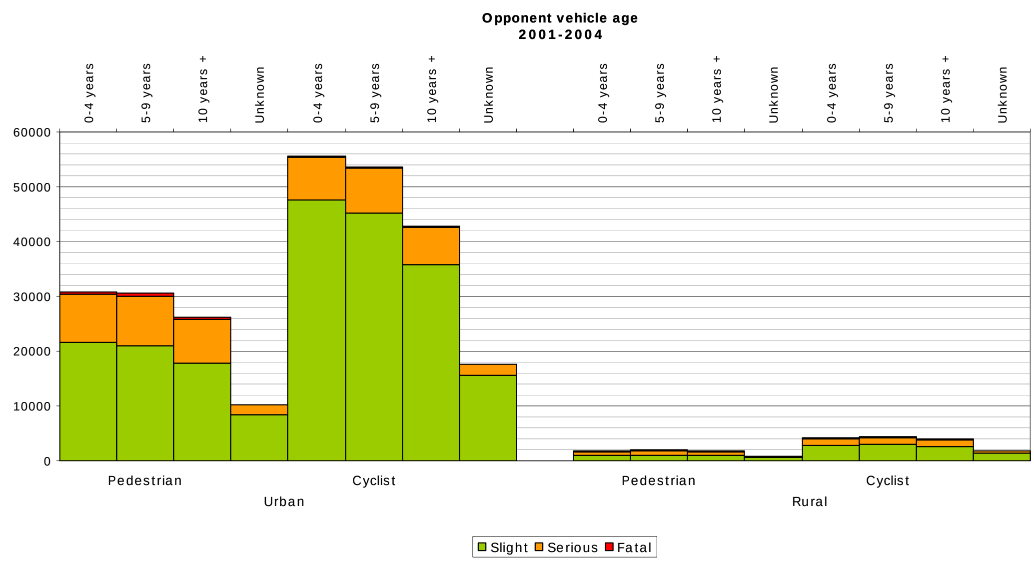


Figure 54_Annex2.6.- Opponent vehicle age (Germany_2001/2004).

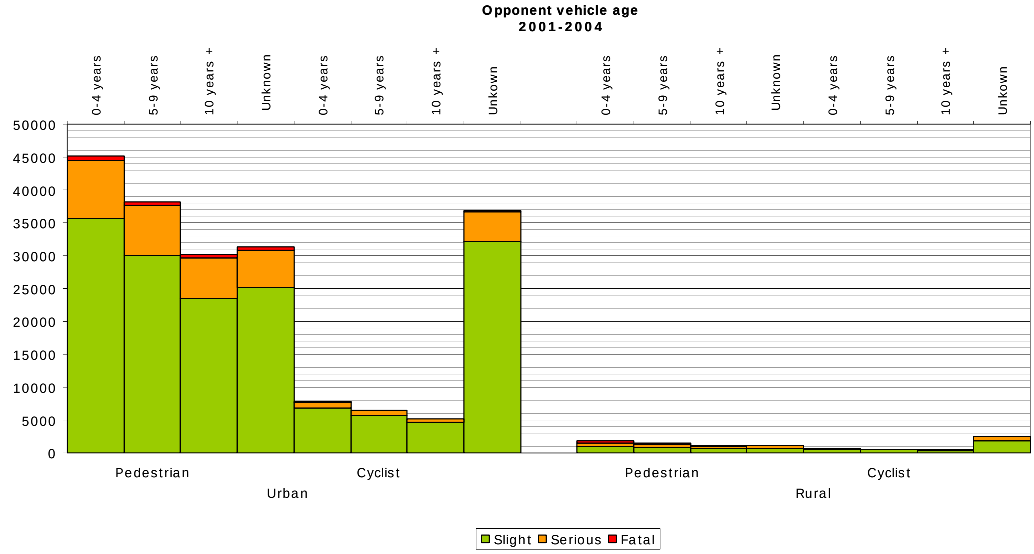


Figure 55_Annex2.6.- Opponent vehicle age (Great Britain_2001/2004).

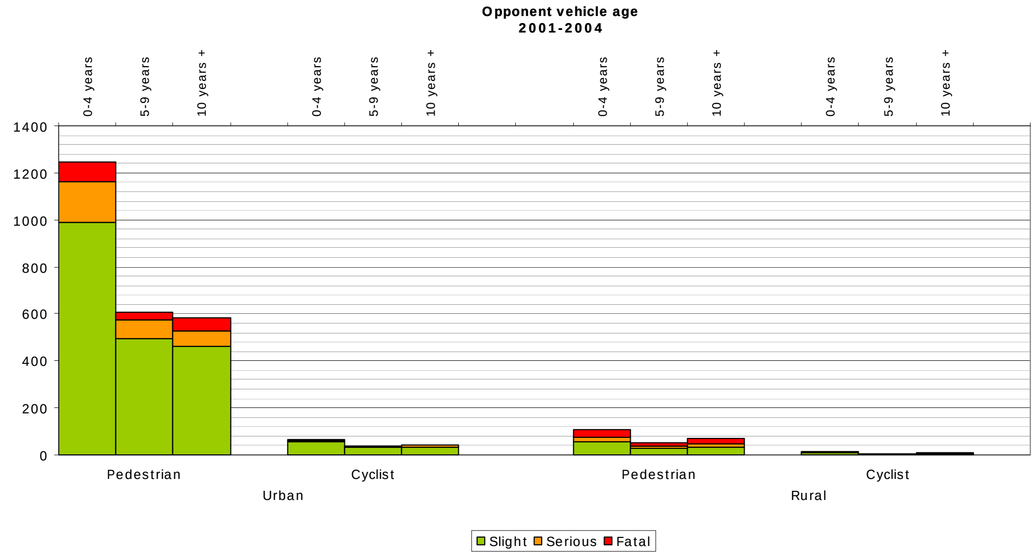


Figure 56_Annex2.6.- Opponent vehicle age (Greece_2001/2004).

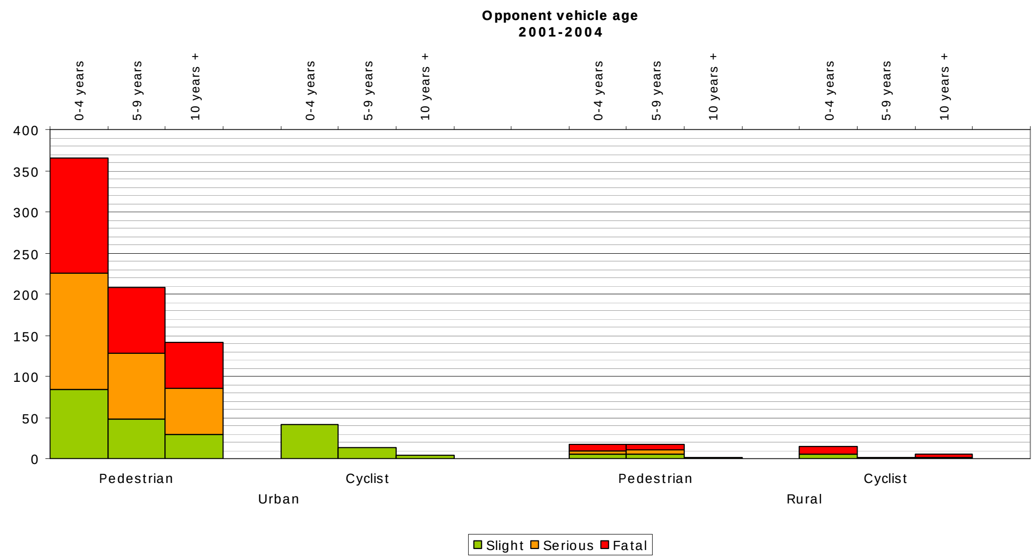


Figure 57_Annex2.6.- Opponent vehicle age (Italy_2001/2004).

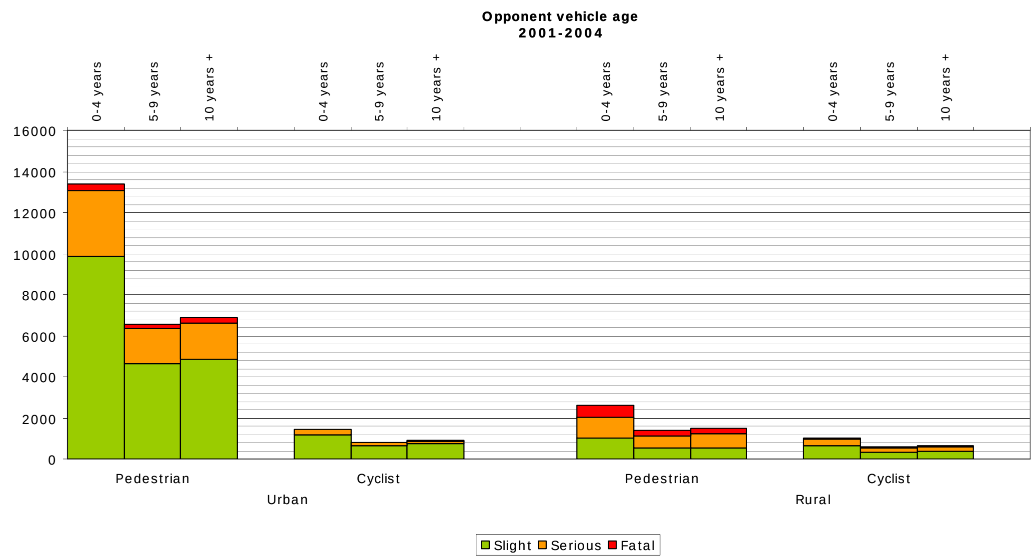


Figure 58_Annex2.6.- Opponent vehicle age (Spain_2001/2004).

14.4.2 Cyclists

All tables of data obtained from different countries referred to cyclist accidents are presented here.

14.4.2.a Importance of the accident graphics

The purpose of this chapter is to appreciate the percentage of cyclists involved in those accidents. Analyzing the evolution over the 4 years studied, a reduction of the absolute number of all accidents can be appreciated for all countries. This constant reduction is not that big for vulnerable road users and, and there is even a small increment in Germany.

In general terms, comparing importance distribution, cyclists fatal accidents have a lowest percentage than the ones concerning all users which is the contrary of what happened with pedestrians. This can not be applied to Greece, where the biggest percentage is for cyclists, instead of the rest of users. Serious accidents are more frequent than fatal accidents in all countries and, as it happens with fatal accidents, the percentage of serious injuries is lower for cyclists than for the rest of users, with the exception of Greece and Spain also. Finally, slight accidents are the most common, but in this case the relative percentages do not contribute to any important conclusion, as the results change a lot from one country to another. As a curiosity, the distribution of fatal and serious accident for pedestrian tends to be higher than for cyclists, with a considerable difference, except for Greece.

		Fatal	Serious	Slight
FRANCE	Cyclists	4,23	16,88	78,88
	All users	5,87	18,03	76,09
		Fatal	Serious	Slight
GERMANY	Cyclists	0,80	20,33	78,86
	All users	1,67	20,73	77,56
		Fatal	Serious	Slight
GREAT BRITAIN	Cyclists	0,74	13,52	85,73
	All users	1,43	13,49	85,07
		Fatal	Serious	Slight
GREECE	Cyclists	11,57	16,91	71,51
	All users	9,21	11,86	78,91
		Fatal	Serious	Slight
SPAIN	Cyclists	3,63	22,29	74,07
	All users	3,72	19,52	76,74

Table 12_Annex2.6.- Importance of the accident.

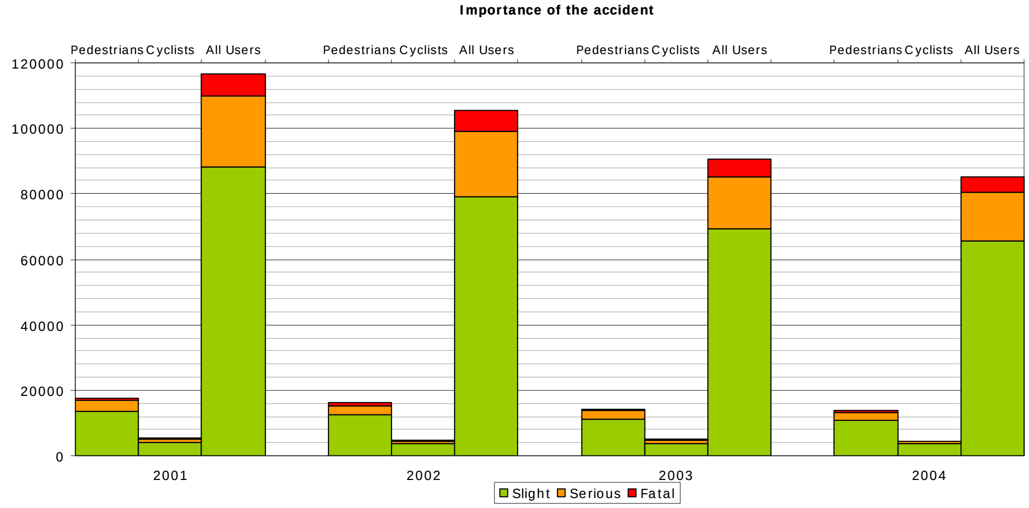


Figure 59_Annex2.6.- Importance of the accident (France_2001/2004).

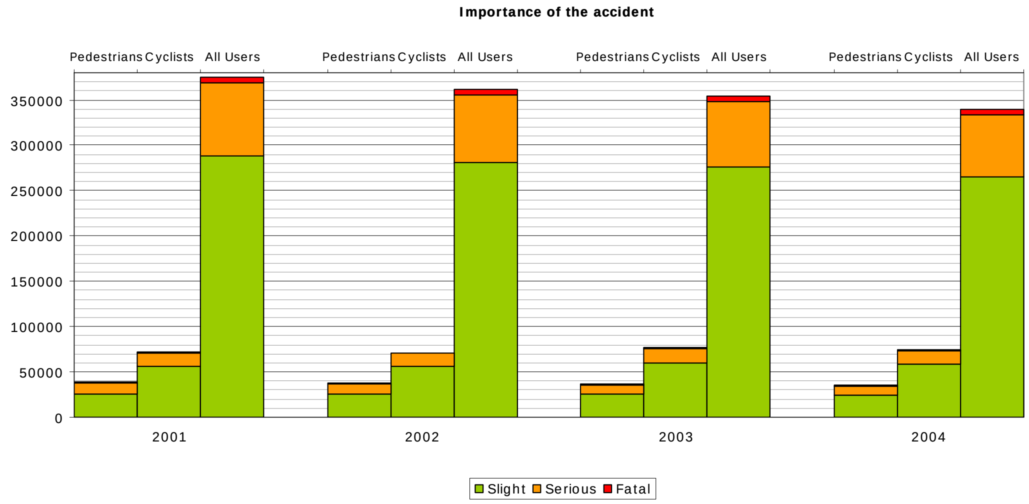


Figure 60_Annex2.6.- Importance of the accident (Germany_2001/2004).

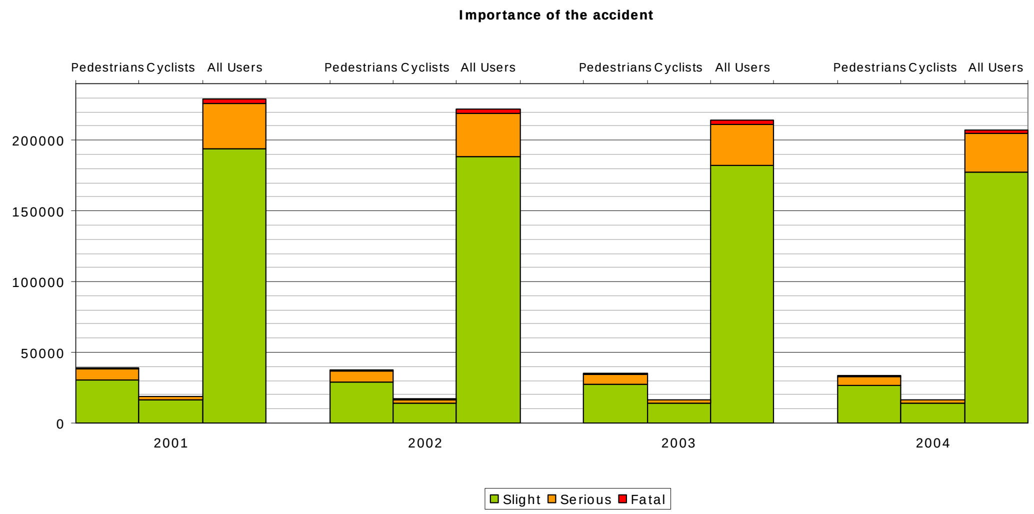


Figure 61_Annex2.6.- Importance of the accident (Great Britain_2001/2004).

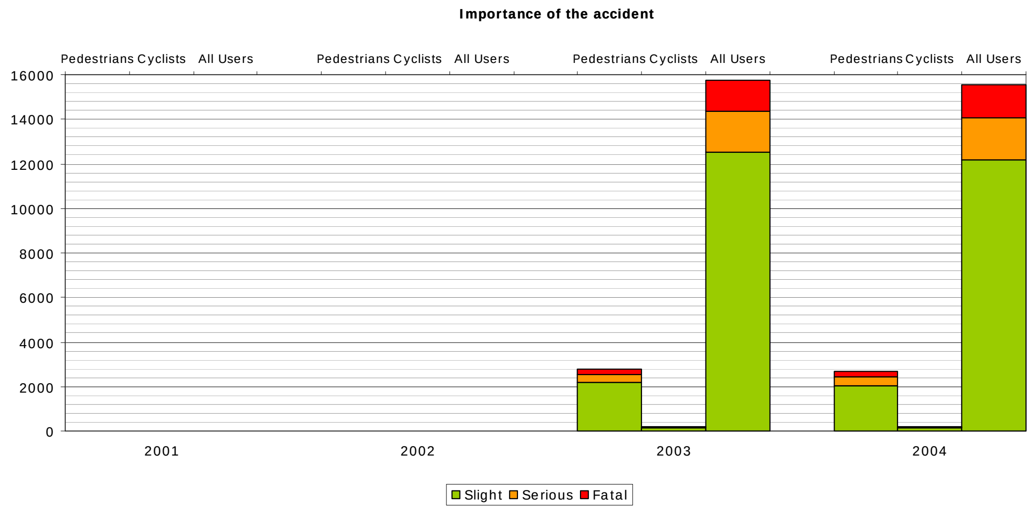


Figure 62_Annex2.6.- Importance of the accident (Greece_2001/2004).

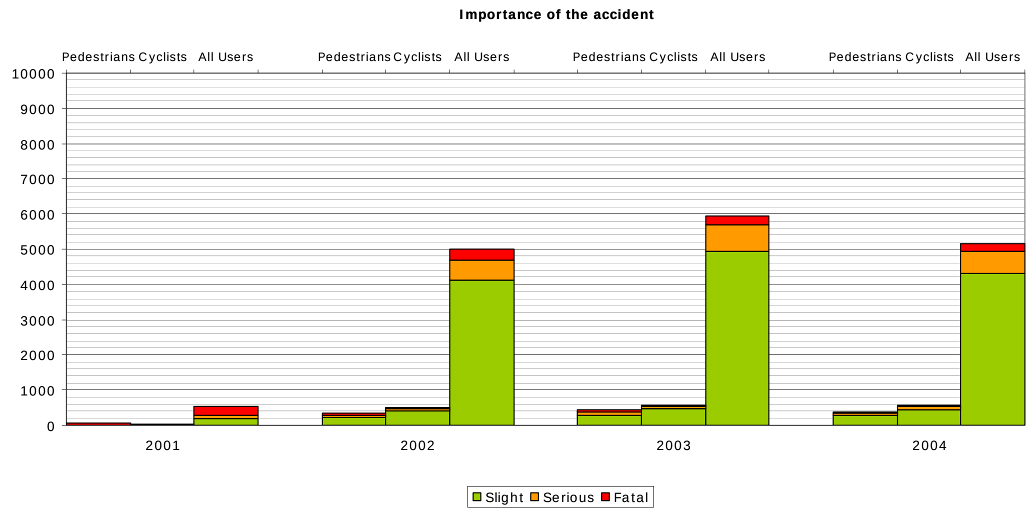


Figure 63_Annex2.6.- Importance of the accident (Italy_2001/2004).

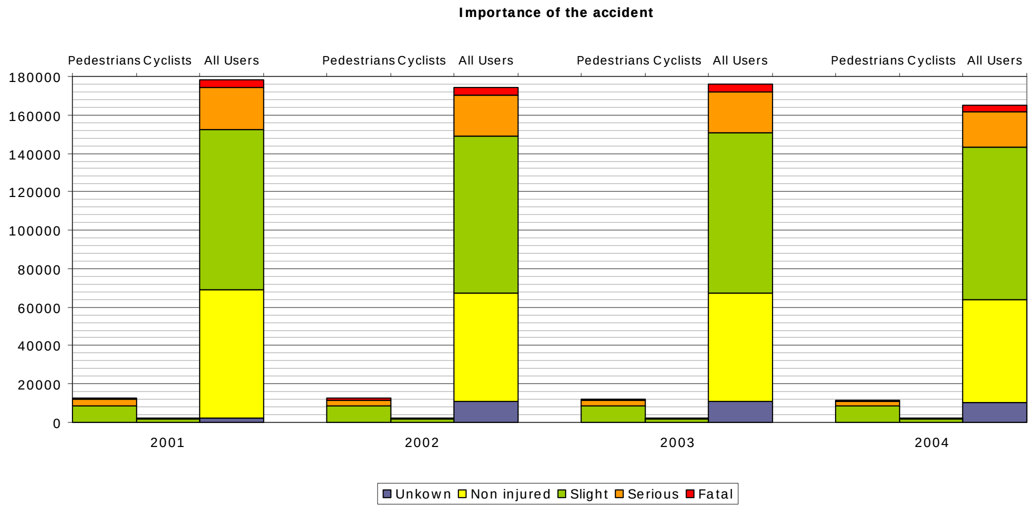


Figure 64_Annex2.6.- Importance of the accident (Spain_2001/2004).

14.4.2.b Type of casualties

Casualties distribution present the same characteristics than accidents, even for the German rising number of vulnerable users accidents and for the French more fatal general accidents. There has been a constant reduction of the total number of casualties, which is directly related to the reduction of the total number of accidents.

Nevertheless, this chapter is important so as to see the differences between the countries, mainly between Germany ands Greece, which are the two extremes of the severity of casualties. Regarding fatal accidents, whereas Germany can boast of having the lowest percentage rate of fatal injuries regarding cyclists and also the rest of injuries, Greece has to take into consideration the fact that fatal injuries to cyclists concern 10% of the global number accidents, and 7% to the rest of users, which can not be casual and must have an explanation. Then, Great Britain, France and Spain present similar tendencies.

		Fatal	Serious	Slight
FRANCE	Cyclists	4,12	16,63	79,25
	All users	4,77	15,98	79,25
GERMANY		Fatal	Serious	Slight
	Cyclists	0,76	19,36	79,88
	All users	1,38	18,4	80,22
GREAT BRITAIN		Fatal	Serious	Slight
	Cyclists	4,12	16,63	79,25
	All users	1,15	11,6	87,25
GREECE		Fatal	Serious	Slight
	Cyclists	10,89	15,53	73,58
	All users	7,41	10,74	81,85
SPAIN		Fatal	Serious	Slight
	Cyclists	3,57	22,04	74,39
	All users	3,02	17,04	79,94

Table 13_Annex2.6.- Type of casualties.

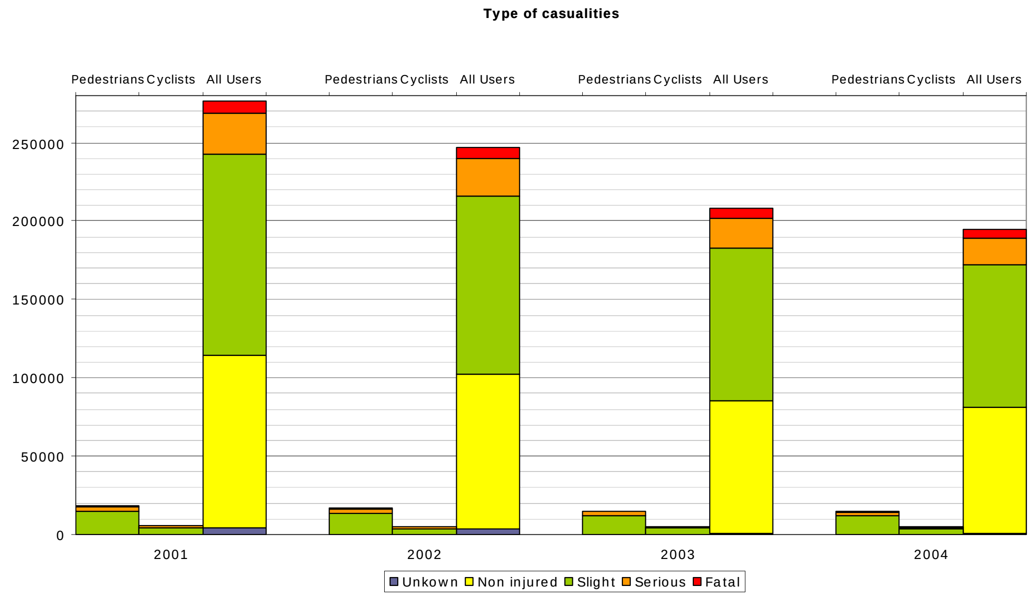


Figure 65_Annex2.6.- Type of casualties (France_2001/2004).

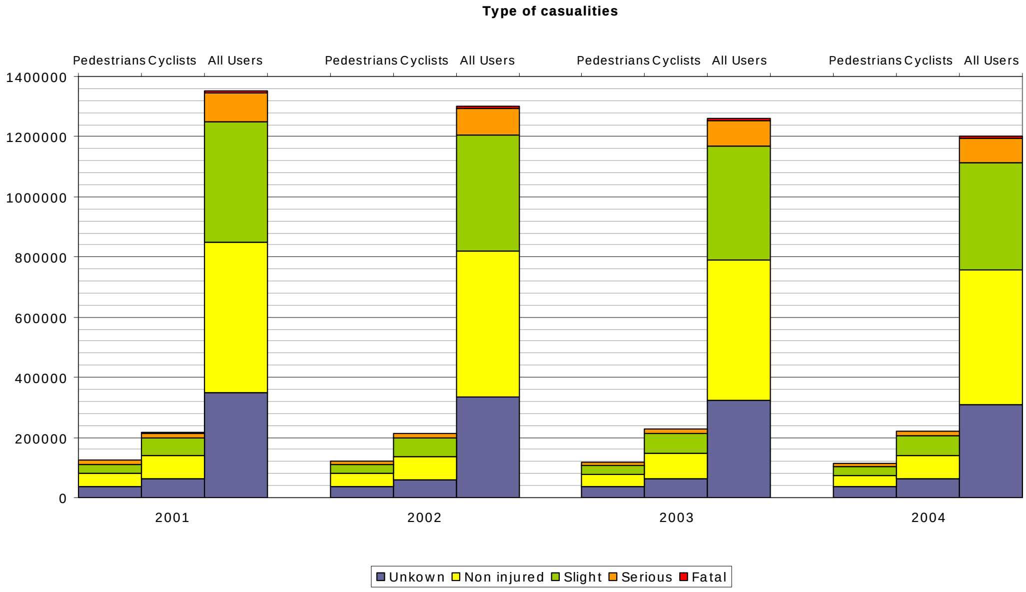


Figure 66_Annex2.6.- Type of casualties (Germany_2001/2004).

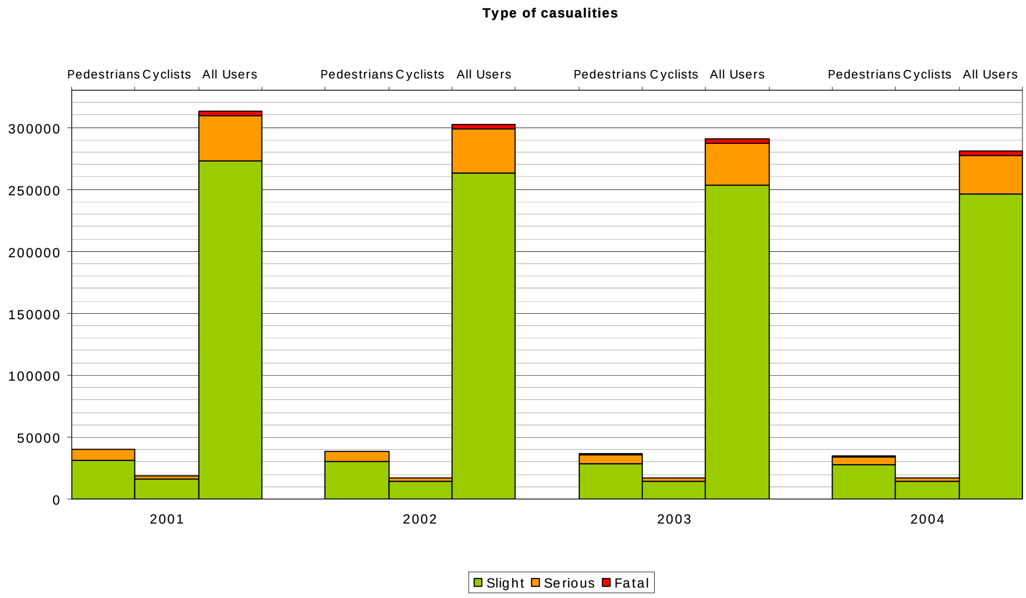


Figure 67_Annex2.6.- Type of casualties (Great Britain_2001/2004).

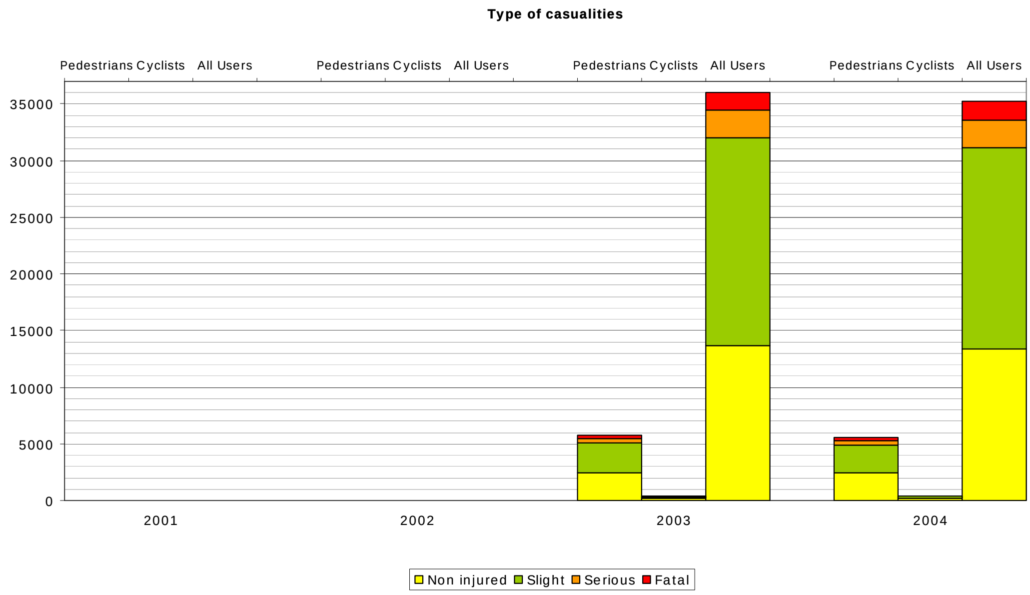


Figure 68_Annex2.6.- Type of casualties (Greece_2001/2004).

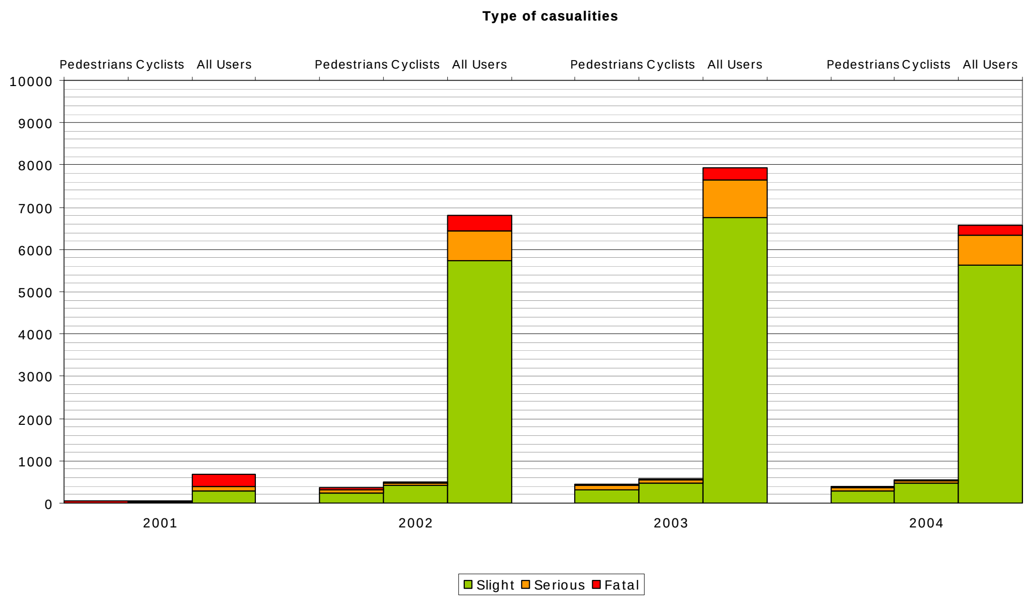


Figure 69_Annex2.6.- Type of casualties (Italy_2001/2004).

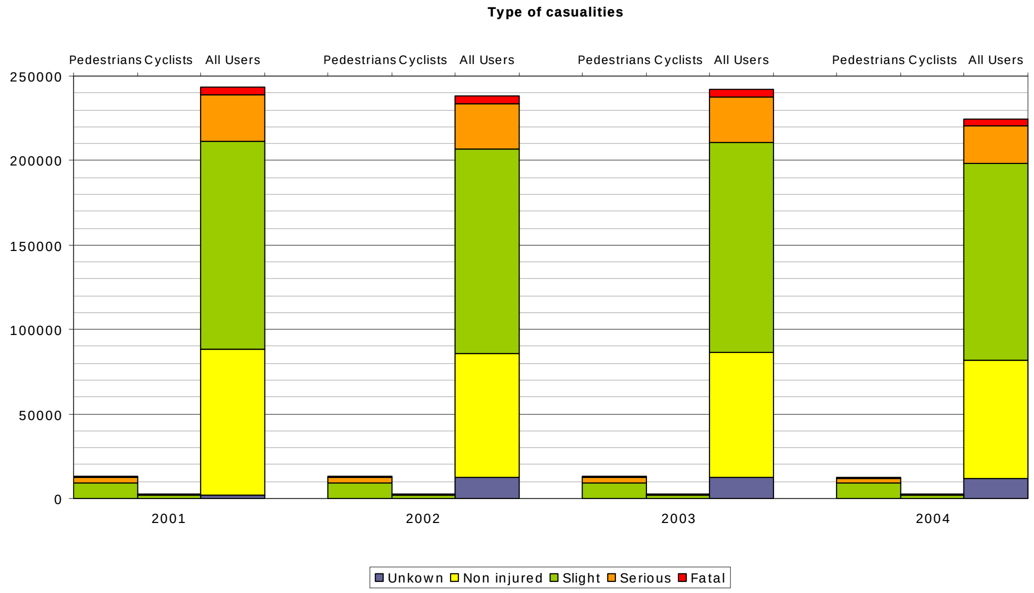


Figure 70_Annex2.6.- Type of casualties (Spain_2001/2004).

14.4.2.c Type of accident opponent

Talking in absolute number, passenger cars are, with great difference, the first rival for cyclists in all the countries. Then, the second rival changes depending on the country; in Spain and Greece, motorcycles and moped are also an important cause of cyclists accidents, whereas in France, Germany and Great Britain it is more divided into trucks, motorcycles and other causes. In general, the global number of accidents regarding passenger cars has been slightly reduced, but not significantly in any country.

Apart from the prominence of accidents involving cars, the most relevant common characteristic of all countries is the fact that accidents caused between trucks and cyclists have the higher rate of fatal and serious injuries, especially in France and Spain. Slight injuries are caused in a similar rate by cars, trucks, motorcycles, buses, moped and other in all the countries. Once more, Germany and Great Britain are the countries within a major elative percentage of slight injuries.

	Fatal	Serious	Slight	
FRANCE	3,03	15,44	81,3	**Car**
	17,36	27,42	55,22	**Truck**
	5,60	16,91	77,49	**Bus**
	4,09	15,98	79,91	**Motorcycle**
	2,35	15,36	82,28	**Moped**
	5,04	15,03	79,92	**Other**
	Fatal	Serious	Slight	
GERMANY	0,56	15,90	83,53	**Car**
	3,19	22,21	74,59	**Truck**
	1,44	21,13	77,48	**Bus**
	1,55	26,05	72,38	**Motorcycle**
	0,12	17,91	81,95	**Moped**
	0,25	23,70	76,03	**Other**
	Fatal	Serious	Slight	

GREAT BRITAIN	0,47	12,32	87,20	**Car**
	2,91	17,96	79,06	**Truck**
	1,19	12,89	85,91	**Bus**
	1,15	16,12	82,72	**Motorcycle**
	0	12,15	87,84	**Moped**
	1,04	16,51	82,43	**Other**
	Fatal	Serious	Slight	
GREECE	9,79	13,52	76,67	**Car**
	24,12	12,23	63,63	**Truck**
	8	17,33	74,66	**Bus**
	4,56	15,61	79,82	**Motorcycle**
	5,63	15,49	78,87	**Moped**
	13,60	11,56	74,82	**Other**
	Fatal	Serious	Slight	
SPAIN	2,79	19,98	77,21	**Car**
	9,39	29,57	61,02	**Truck**
	8,89	25,83	65,27	**Bus**
	2,44	18,87	78,68	**Motorcycle**
	0,26	14,20	85,53	**Moped**
	3,50	21,44	75,04	**Other**

Table 14_Annex2.6.- Type of accident opponent.

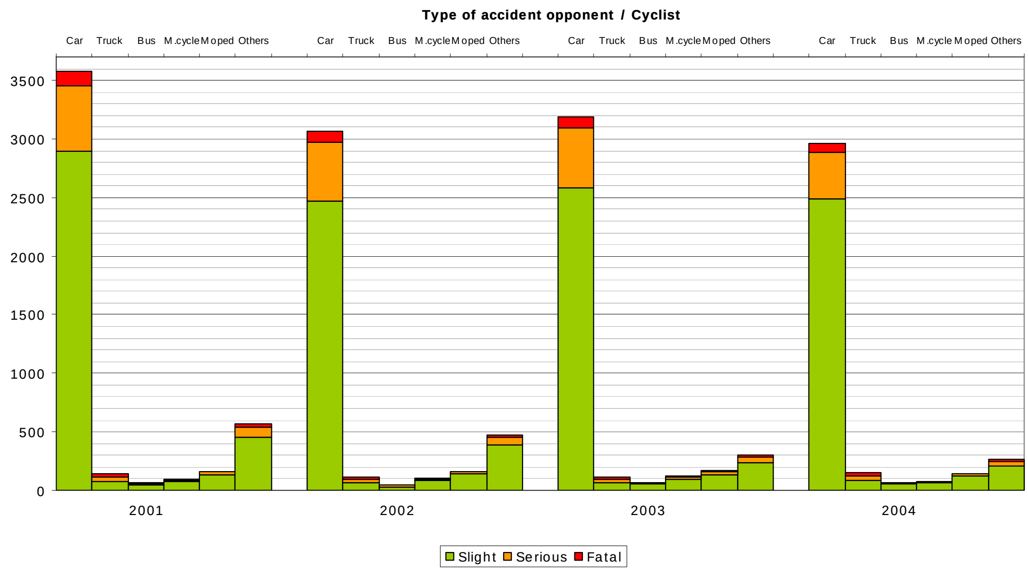


Figure 71_Annex2.6.- Type of accident opponent (France_2001/2004).

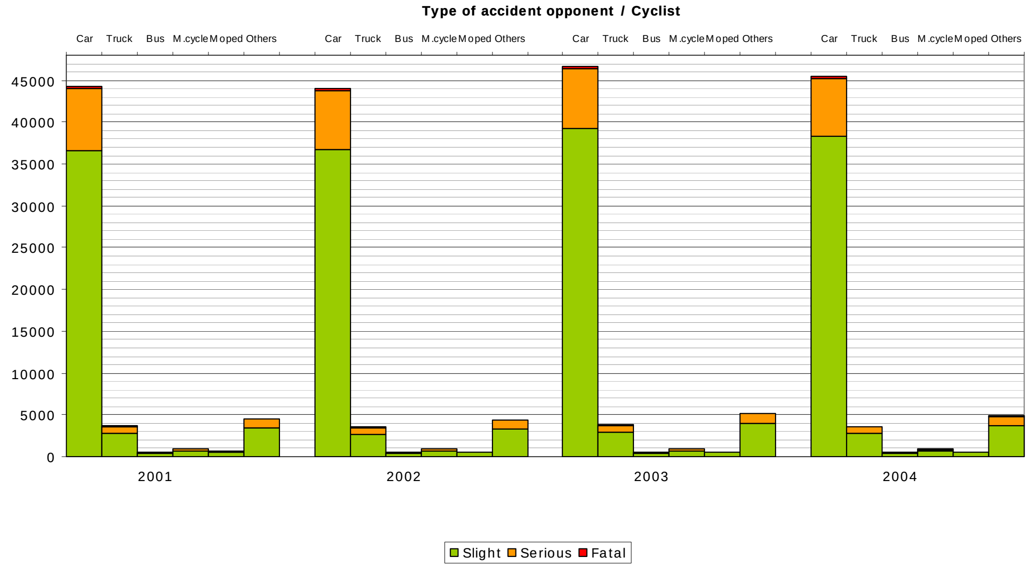


Figure 72_Annex2.6.- Type of accident opponent (Germany_2001/2004).

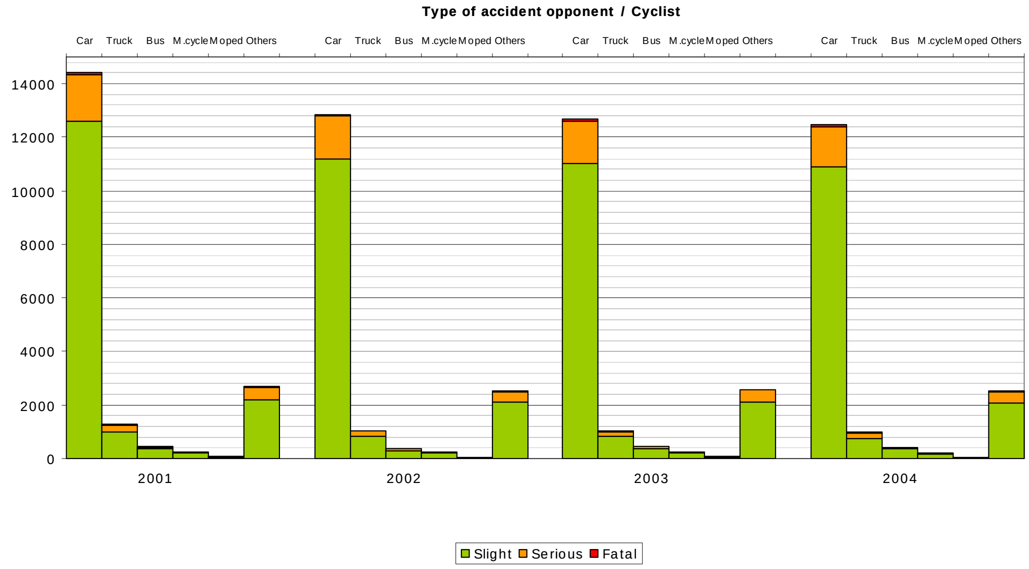


Figure 73_Annex2.6.- Type of accident opponent (Great Britain_2001/2004).

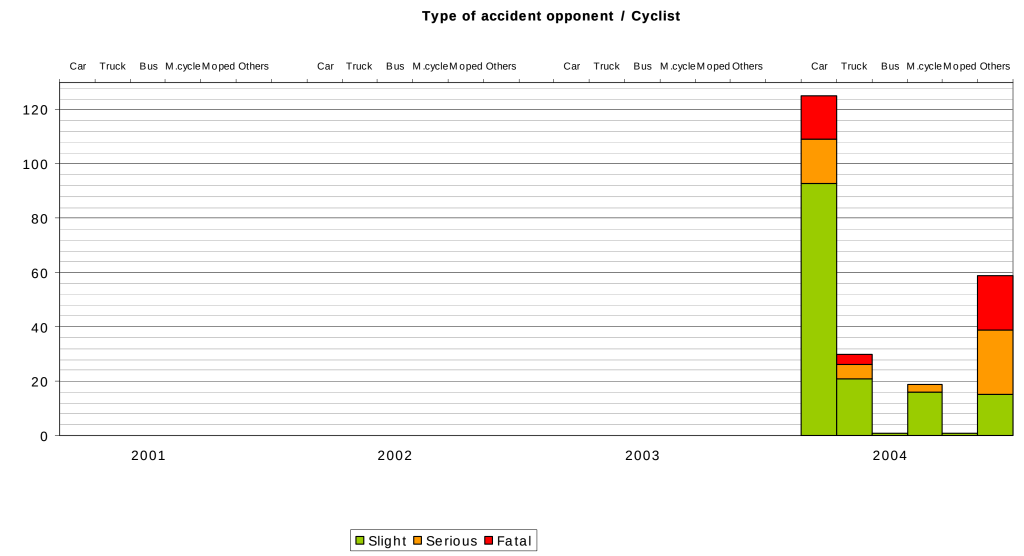


Figure 74_Annex2.6.- Type of accident opponent (Greece_2001/2004).

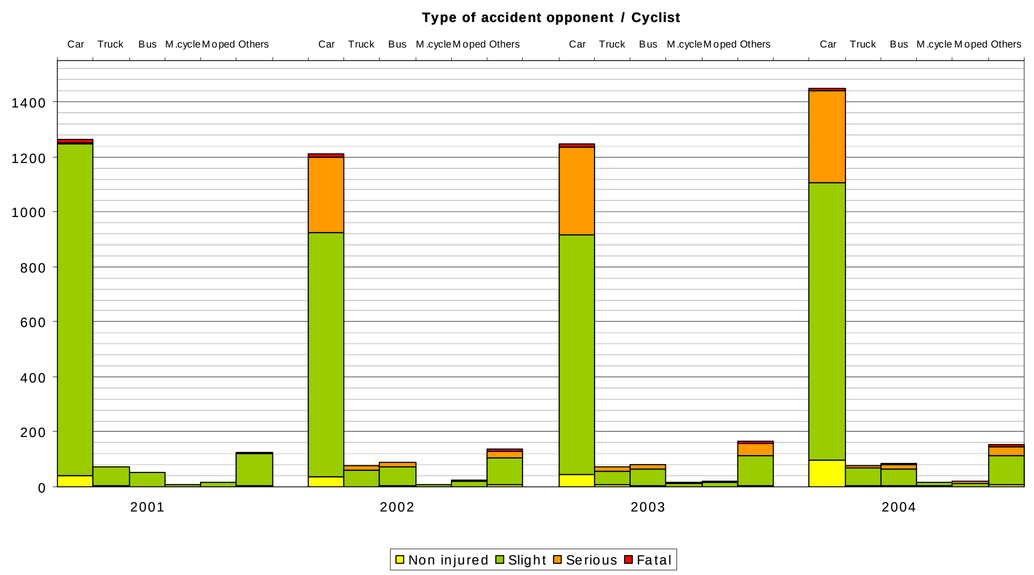


Figure 75_Annex2.6.- Type of accident opponent (Italy_2001/2004).

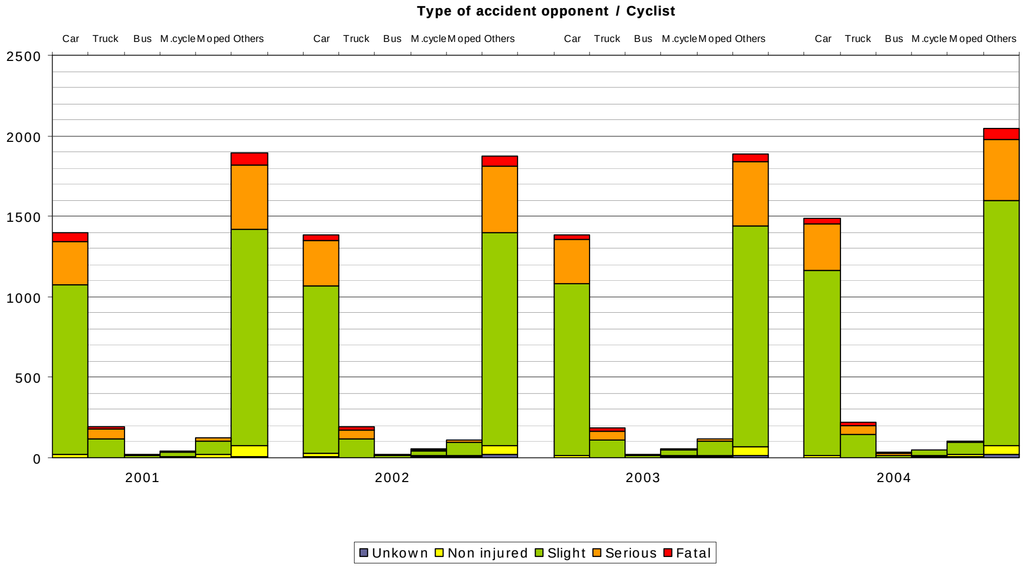


Figure 76_Annex2.6.- Type of accident opponent (Spain_2001/2004).

14.4.2.d Location

This chapter tries to locate and make a difference between accidents occurring in urban or rural areas, and relate them to the location or not in an intersection. The data represented is the average of the 4 years, as it gives a true approach of the data collected from each year.

In all the countries, urban areas present more than 90% of the accidents and less than 10% corresponds to rural area, as expected. The only exception is Spain, where the difference is not so big and the number of accidents in rural areas is also big.

Regarding the separation between intersection and non-intersection accidents, it seems that the majority of them do not take place in an intersection. The only exception is Great Britain, the only country in which the number of accidents occurring in intersections is higher, as it happened also with pedestrian accidents.

In general, accidents taking place in rural areas have a more elevated percentage of fatal injuries, especially the ones happening in non-intersections, as in France, Great Britain, Greece and Spain. Serious injuries are also more commonly caused in rural areas than in urban areas, which give an idea of the severity of the accident. On the contrary, slight injuries use to be caused on accidents taking place in urban areas.

		Fatal	Serious	Slight	
FRANCE	Intersection	1,95	13,12	84,92	**Urban**
	No intersection	2,46	12,45	85,07	
		Fatal	Serious	Slight	
	Intersection	10,52	36,50	52,97	**Rural**
	No intersection	14,40	36,44	49,14	

		Fatal	Serious	Slight	
GERMANY	Intersection	0,61	17,42	81,97	**Urban**
	No intersection	0,49	18,64	80,85	
		Fatal	Serious	Slight	**Rural**
	Intersection	5,06	33,69	61,23	

	No intersection	2,94	36,66	60,39	

		Fatal	Serious	Slight	
GREAT BRITAIN	Intersection	0,41	12,10	87,47	**Urban**
	No intersection	0,64	13,49	85,86	
		Fatal	Serious	Slight	**Rural**
	Intersection	2,73	21,39	75,87	
	No intersection	5,19	27,25	67,54	

		Fatal	Serious	Slight	
GREECE	Intersection	4,93	12,34	82,71	**Urban**
	No intersection	8,43	16,86	74,69	
		Fatal	Serious	Slight	**Rural**
	Intersection	50	25	25	
	No intersection	35,29	14,70	50	

		Fatal	Serious	Slight	
SPAIN	Intersection	1,02	13,85	85,11	**Urban**
	No intersection	0,76	15,01	84,22	
		Fatal	Serious	Slight	**Rural**
	Intersection	5,92	29,81	64,26	
	No intersection	9,47	35,43	55,09	

Table 15_Annex2.6.- Location of the accident.

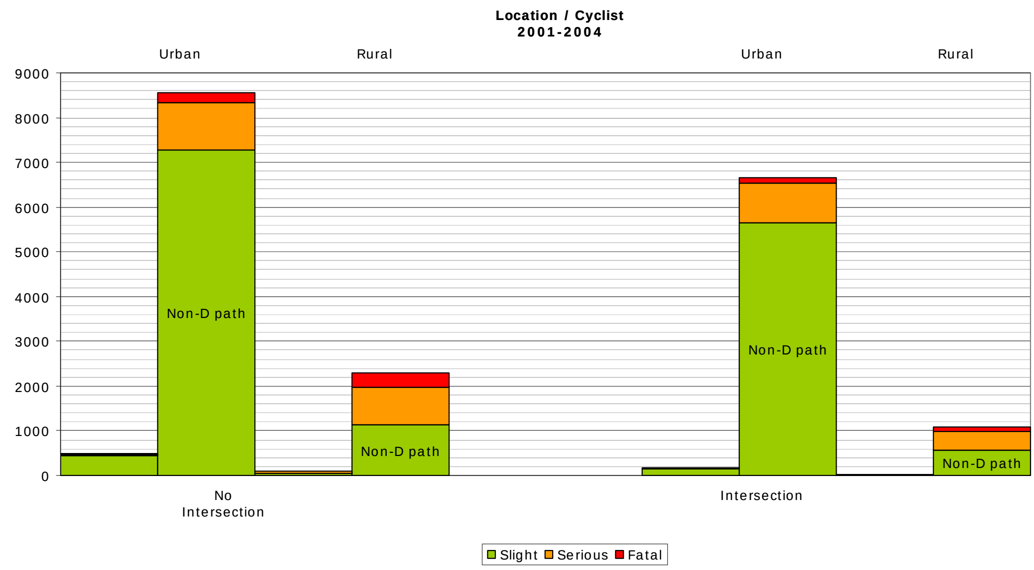


Figure 77_Annex2.6.- Location of the accident (France_2001/2004).

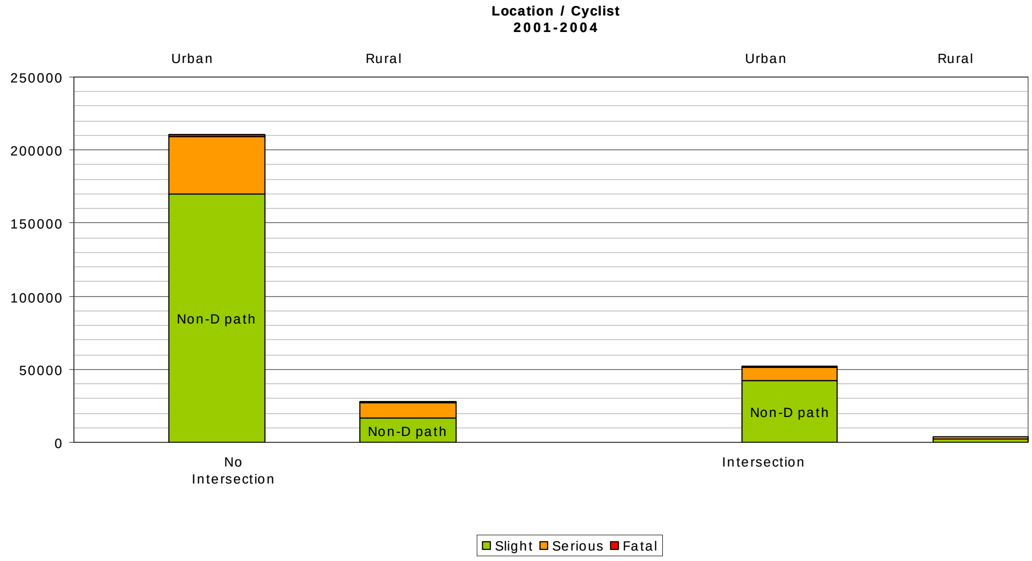


Figure 78_Annex2.6.- Location of the accident (Germany_2001/2004).

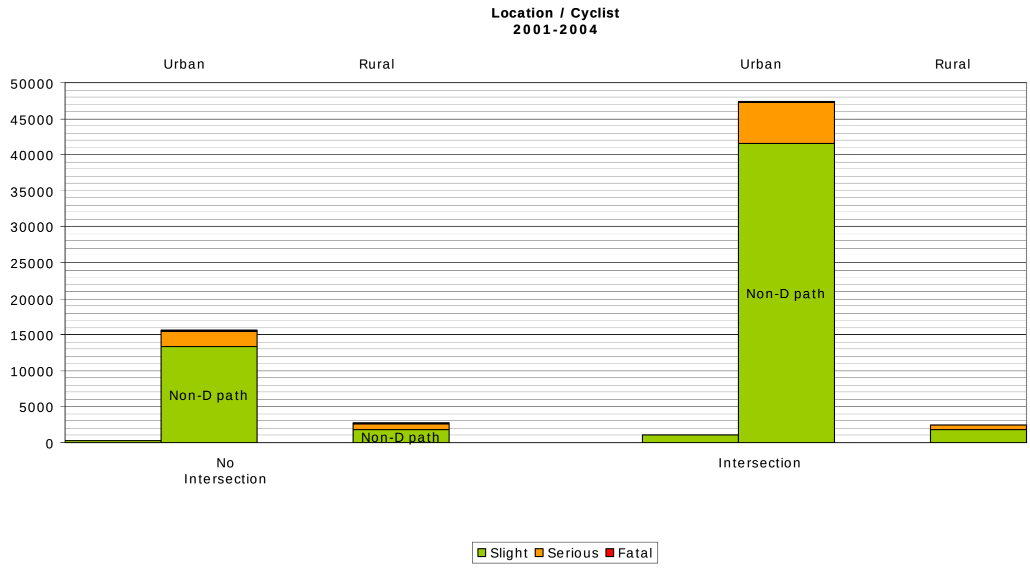


Figure 79_Annex2.6.- Location of the accident (Great Britain_2001/2004).

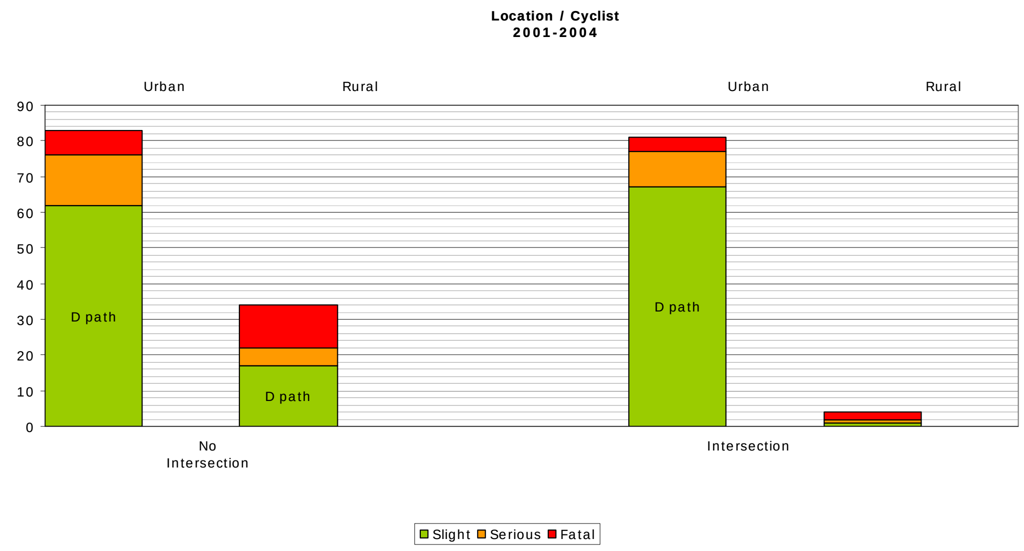


Figure 80_Annex2.6.- Location of the accident (Greece_2001/2004).

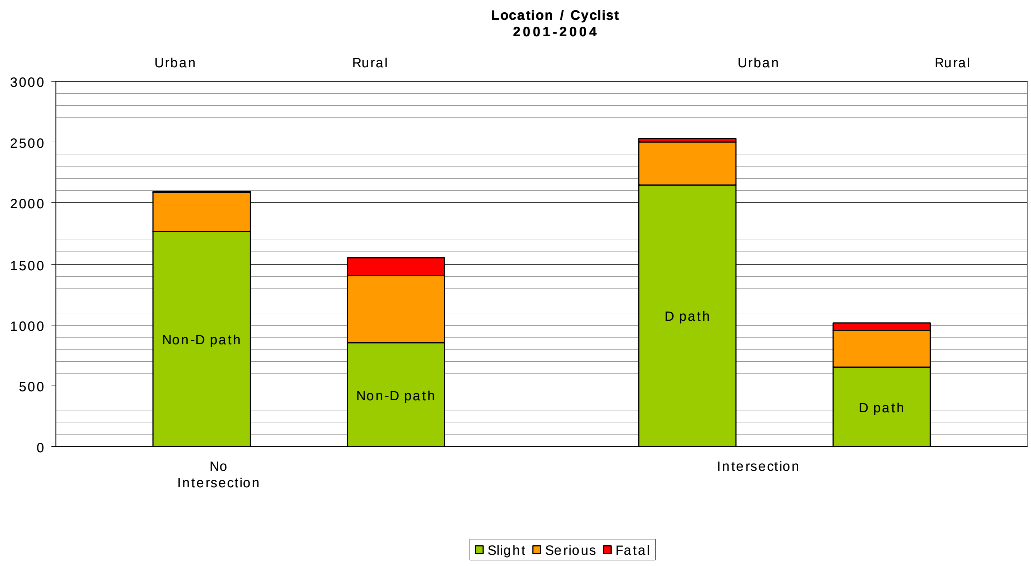


Figure 81_Annex2.6.- Location of the accident (Spain_2001/2004).

14.4.2.e Road grip related circumstances

In order to classify accidents according to road conditions (dry, wet, ice, slippery, etc), this chapter focuses on analyzing the influence of external factors that can interfere in an accident. It will also evaluate these factors separately in urban and rural roads.

In urban roads, the majority of accidents take place on dry road, which proves that accidents cannot be only justified due to weather conditions, but its influence is undeniable. Nowadays, passenger cars incorporate a lot of primary systems, such as ESP, that avoid the car to loose control even in emergency situations, for example under rain conditions. In Germany and Great Britain the difference between dry road accidents and wet road accidents is not as big as in other countries, which shows that accidents involving pedestrians occur under any circumstance.

Concerning rural roads, the number of accidents is still little in comparison to urban accidents, with the exception of Greece, at least for the available data from 2004. The data from Italy, in spite of being interesting due to its elevated rate of fatal injuries occurring in urban roads can not be taken into consideration as it is not sufficiently significant. As concluded in the preceding chapter, the rates of fatal and serious injuries are higher in rural roads. An important data is that, in all the countries, the relative percentage of fatal, serious and slight injuries is similar under any road grip circumstance, which means that once the accident is unavoidable, the consequences are the same for each case.

		Fatal	Serious	Slight	
FRANCE	Dry	2,15	12,92	84,91	Urban
	Wet	2,81	9,63	87,54	
	Ice	4	20	76	
	Slippery	0	20	80	
	Other	3,17	25,39	71,42	
	Unknown	1,29	5,39	93,30	
	Dry	12,24	35,35	52,39	Rural
	Wet	15,16	35,01	49,81	
	Ice	12,5	12,5	75	
	Slippery	100	0	0	
	Other	15,21	36,95	47,82	
	Unknown	10,20	12,24	77,55	

		Fatal	Serious	Slight	
GERMANY	Dry	0,47	17,30	82,22	Urban
	Wet	0,57	18,34	81,07	
	Ice	0,65	26,64	72,70	
	Slippery	0,36	21,00	78,63	
	Other	0	0	0	
	Unknown	0	0	0	
	Dry	2,73	33,18	64,07	Rural
	Wet	3,41	32,38	64,20	
	Ice	2,31	38,41	59,27	
	Slippery	0,95	40,11	58,93	
	Other	0	0	0	
	Unknown	0	0	0	

		Fatal	Serious	Slight	
GREAT BRITAIN	Dry	0,45	12,43	87,10	Urban
	Wet	0,49	12,44	87,05	
	Ice	0,66	14,34	84,98	
	Slippery	0	16,12	83,87	
	Other	0	0	0	
	Unknown	0,71	6,42	92,85	
	Dry	3,87	24,74	71,37	Rural
	Wet	4,44	23,38	72,17	
	Ice	4,28	21,42	74,28	
	Slippery	0	25	75	

	Other	0	0	0	
	Unknown	0	10	90	

		Fatal	Serious	Slight	
GREECE	Dry	6,54	12,5	80,95	**Urban**
	Wet	0	21,42	78,57	
	Ice	0	0	100	
	Slippery	0	0	0	
	Other	0	0	0	
	Unknown	0	0	0	
	Dry	6,54	12,5	80,95	**Rural**
	Wet	0	21,42	78,57	
	Ice	0	0	100	
	Slippery	0	0	0	
	Other	0	0	0	
	Unknown	0	0	0	

		Fatal	Serious	Slight	
ITALY	Dry	4,61	13,14	82,23	**Urban**
	Wet	2,05	15,75	82,19	
	Ice	0	0	100	
	Slippery	0	0	100	
	Other	0	0	100	
	Unknown	11,11	5,55	83,33	
	Dry	18,49	23,28	58,21	**Rural**
	Wet	20	30	50	
	Ice	100	0	0	
	Slippery	0	0	0	
	Other	0	0	0	
	Unknown	100	0	0	

		Fatal	Serious	Slight	
SPAIN	Dry	1,08	14,75	84,15	**Urban**
	Wet	1,14	14,88	83,96	
	Ice	0	0	0	
	Slippery	0	0	0	
	Other	0,74	17,16	82,08	
	Unknown	0	0	0	
	Dry	7,51	33,39	59,09	**Rural**
	Wet	5,96	30,46	63,57	
	Ice	33,33	33,33	33,33	
	Slippery	0	0	0	
	Other	6,89	33,33	59,77	
	Unknown	0	0	0	

Table 16_Annex2.6.- Area.

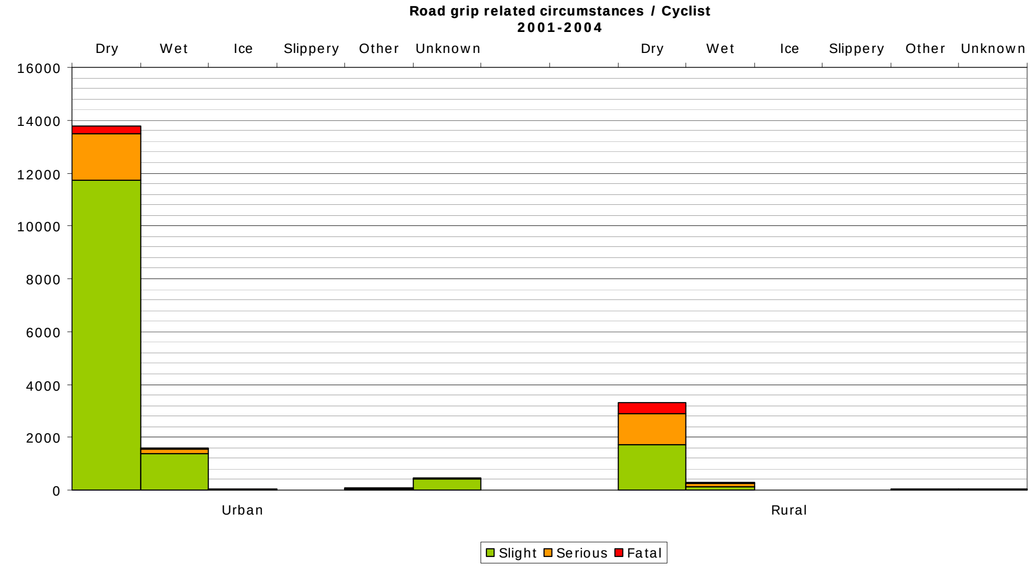


Figure 82_Annex2.6.- Road grip related circumstances (France_2001/2004).

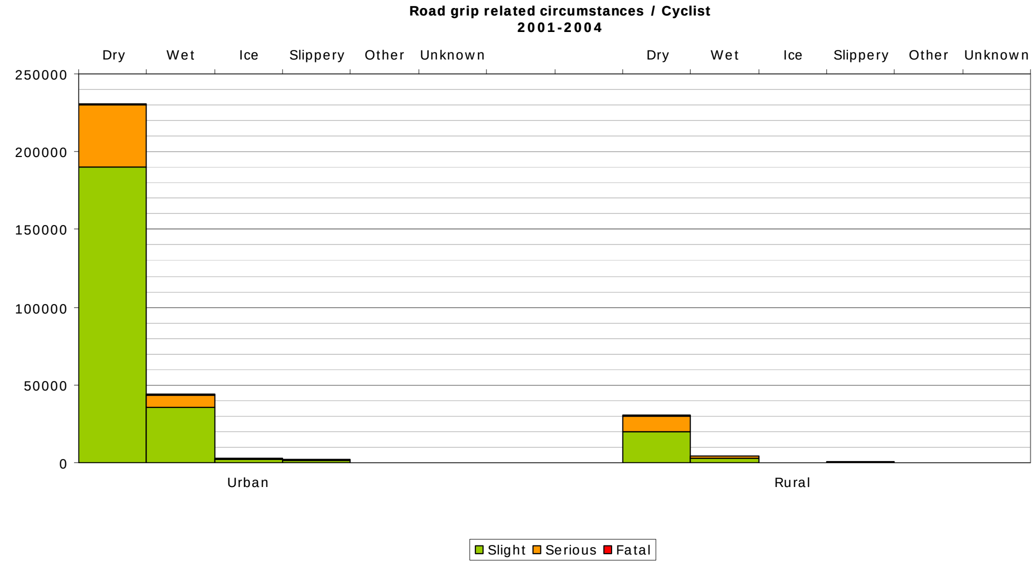


Figure 83_Annex2.6.- Road grip related circumstances (Germany_2001/2004).

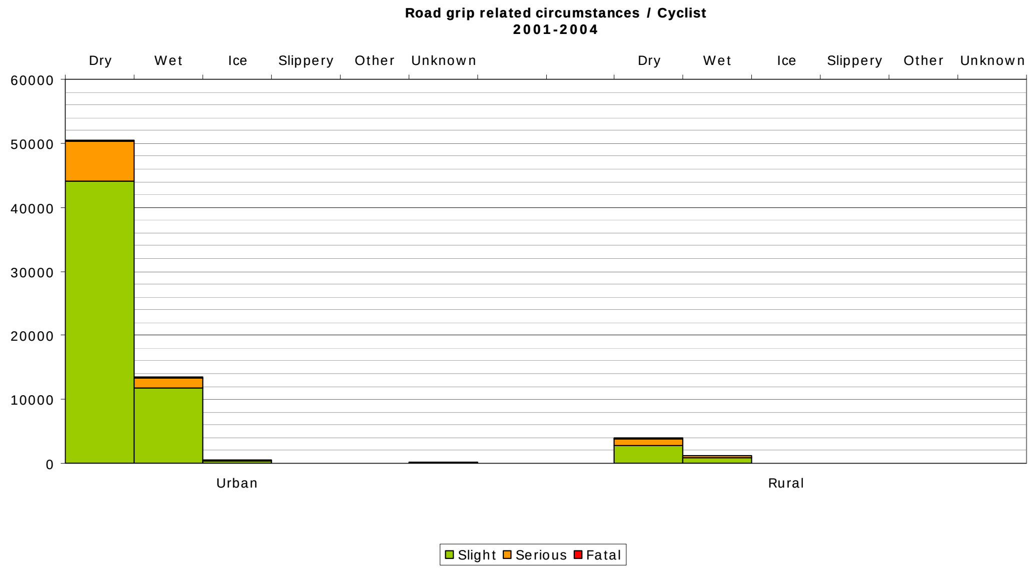


Figure 84_Annex2.6.- Road grip related circumstances (Great Britain_2001/2004).

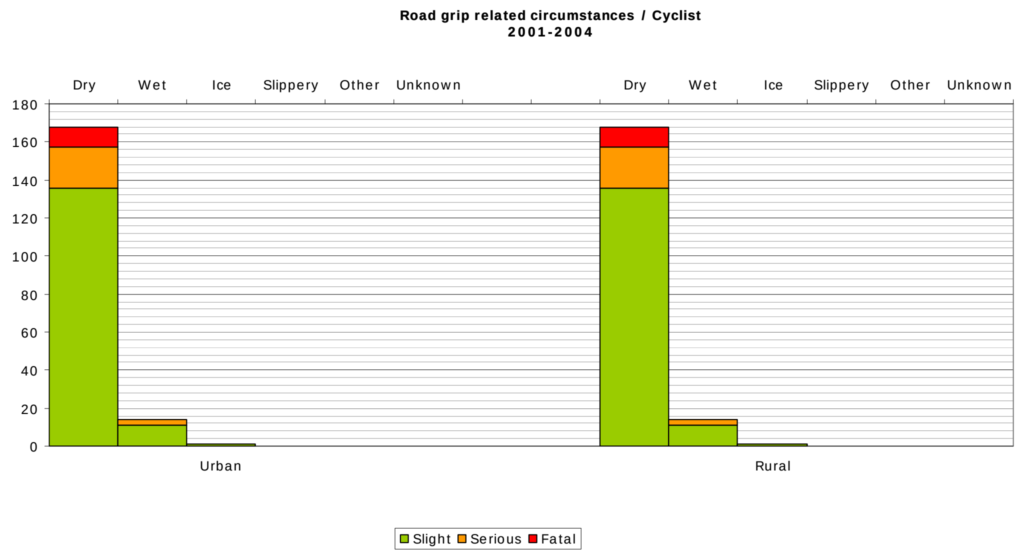


Figure 85_Annex2.6.- Road grip related circumstances (Greece_2001/2004).

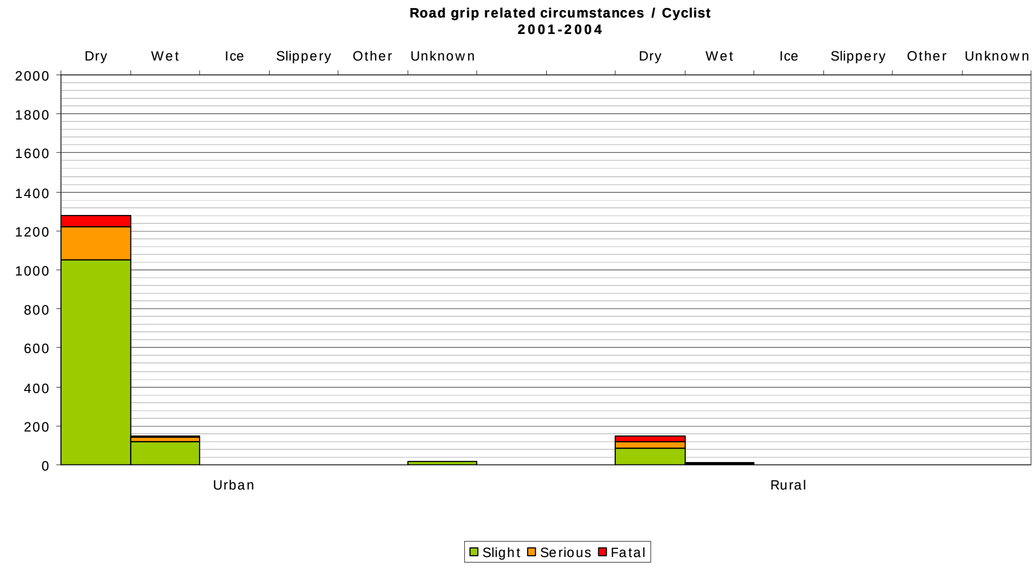


Figure 86_Annex2.6.- Road grip related circumstances (Italy_2001/2004).

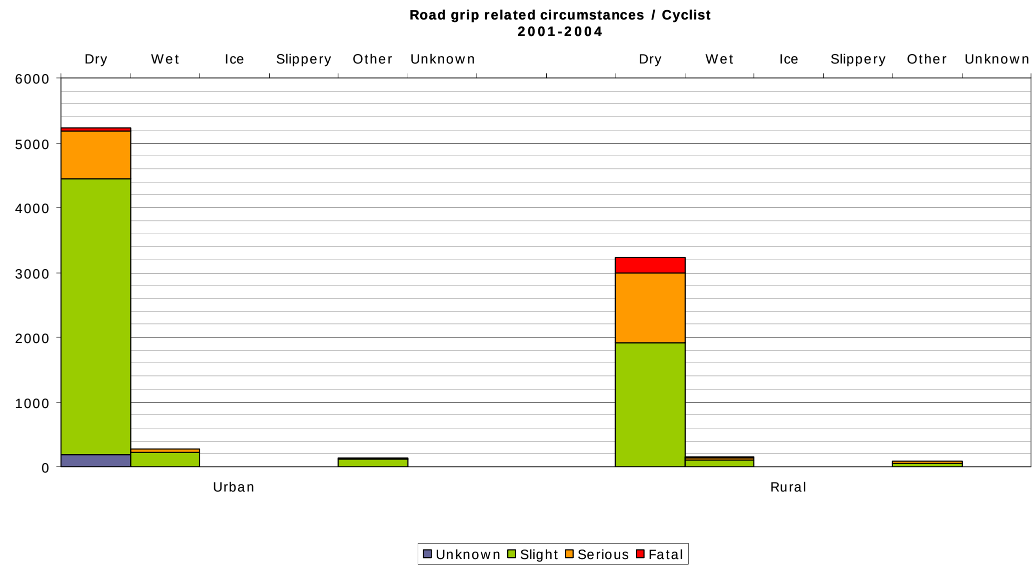


Figure 87_Annex2.6.- Road grip related circumstances (Spain_2001/2004).

14.4.2.f Specific accident location

Only France could provide data for this classification. In absolute numbers, most accidents happened close to a social spot, but rural accidents remain as the most harmful for cyclists. The difference to other specific locations is too high. It would be interesting to study the origin of this data and how this classification is given.

		Fatal	Serious	Slight
FRANCE	**Near school**	6,52	11,91	86,52
	Social spot	5,33	12,45	85,33
	Industrial	0	0	0
	Rural	18,34	34,60	48,06
	Other	0	0	0
	Unknown	13,23	34,35	53,23

Table 17_Annex2.6.- Specific accident location.

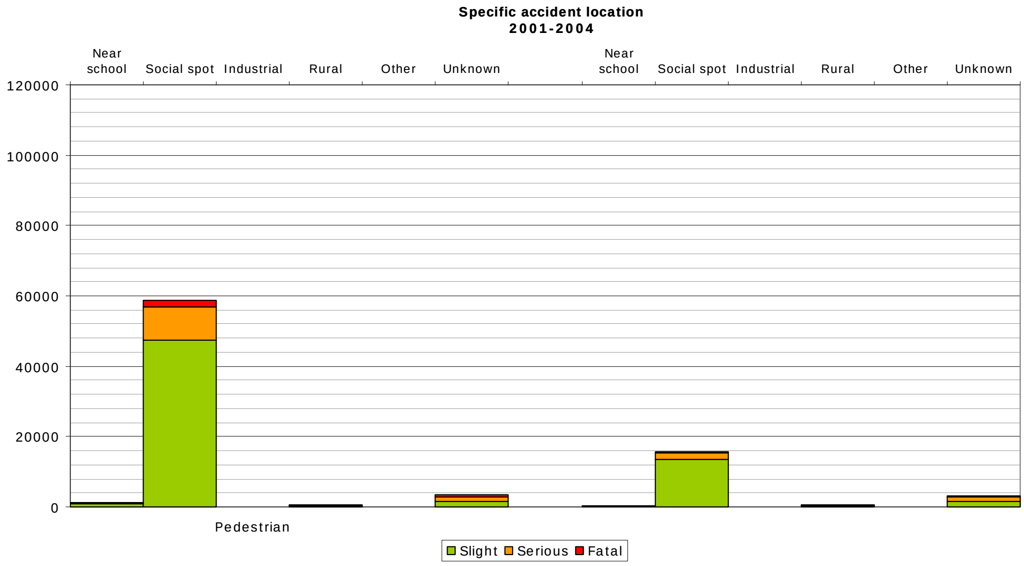


Figure 88_Annex2.6.- Specific accident location (France_2001/2004).

14.4.2.g Weather conditions

This classification is very similar to the road grip conditions, as it is directly related, but additional evidences can be concluded. The information regarding Germany and Greece was not included, as we had no sufficient data to give reliable results and conclusions.

First, comparing the percentage of fatal injuries occurring in urban areas, it can be stated that in France and Spain, fog is a relevant factor and causes the highest relative rate of fatal injuries to cyclists. On the contrary, a snow weather condition is the most fatal situation in urban roads in Great Britain, but with a lower relative percentage.

When analysing rural areas, the situation changes a lot in many countries. In France, accidents occurring under dry and wet circumstances are the ones that cause most serious injuries to cyclists, despite of the fact that fog remains as the first cause of fatal injuries. The same contradictions can be analysed in Great Britain and Spain, where the majority of fatal accidents take place when the weather is dry, but the serious ones happen under fog conditions.

		Fatal	Serious	Slight	
FRANCE	Dry	2,06	12,49	85,43	Urban
	Wet	1,89	9,04	89,06	
	Snow	0	6,25	93,75	
	Fog	5	12,5	82,5	
	Other	6,57	18,98	74,43	
	Dry	12,24	34,6225	53,13	Rural
	Wet	10,69	33,68	55,61	
	Snow	0	0	100	
	Fog	33,33	22,22	44,44	
	Other	15,98	42,21	41,80	

		Fatal	Serious	Slight	
GRE AT BRIT AIN	Dry	0,48	12,56	86,9507	Urban
	Wet	0,31	11,87	87,81	

	Snow	1,86	11,21	86,91	
	Fog	0,88	11,01	88,10	
	Other	0,32	11,04	88,62	
	Dry	4,10	24,73	71,15	**Rural**
	Wet	3,15	23,10	73,73	
	Snow	0	0	100	
	Fog	2,85	37,14	60	
	Other	3,82	14,64	81,52	

		Fatal	Serious	Slight	
ITALY	Dry	4,95	13,333	81,70	**Urban**
	Wet	0,97	16,50	82,52	
	Snow	0	0	100	
	Fog	0	50	50	
	Other	3,04	9,75	87,19	
	Dry	17,55	24,42	58,01	**Rural**
	Wet	22,22	33,33	44,44	
	Snow	0	0	0	
	Fog	100	0	0	
	Other	20	13,33	66,66	

		Fatal	Serious	Slight	
SPAIN	Dry	1,00	14,87	84,11	**Urban**
	Wet	0	15,10	84,89	
	Snow	0	0	0	
	Fog	14,28	7,14	78,57	
	Other	6,49	11,68	81,81	
	Dry	7,49	33,22	59,28	**Rural**
	Wet	6,60	30,18	63,20	
	Snow	0	0	100	
	Fog	0	41,66	58,33	
	Other	7,93	39,68	52,38	

Table 18_Annex2.6.- Weather conditions.

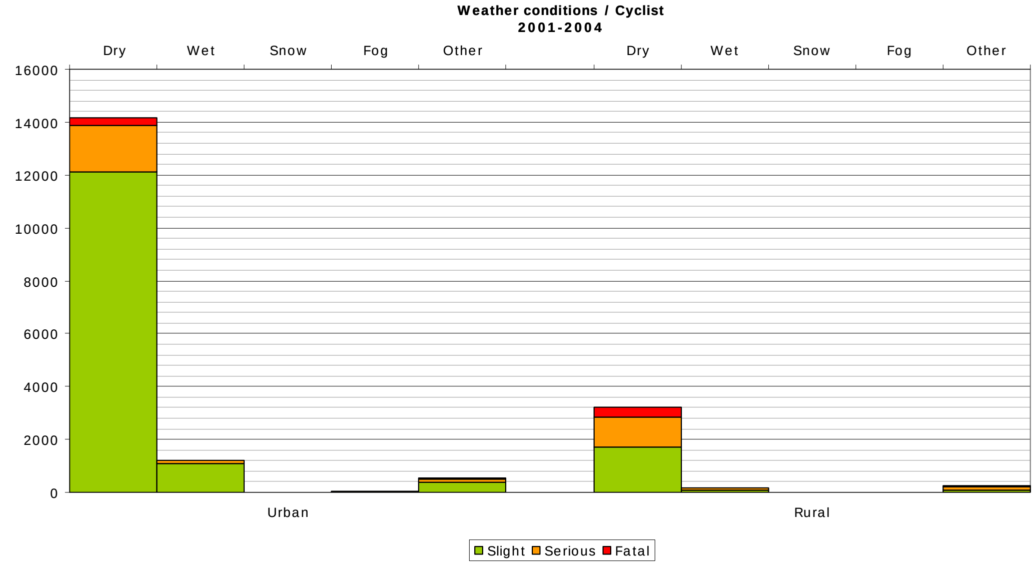


Figure 89_Annex2.6.- Weather conditions (France_2001/2004).

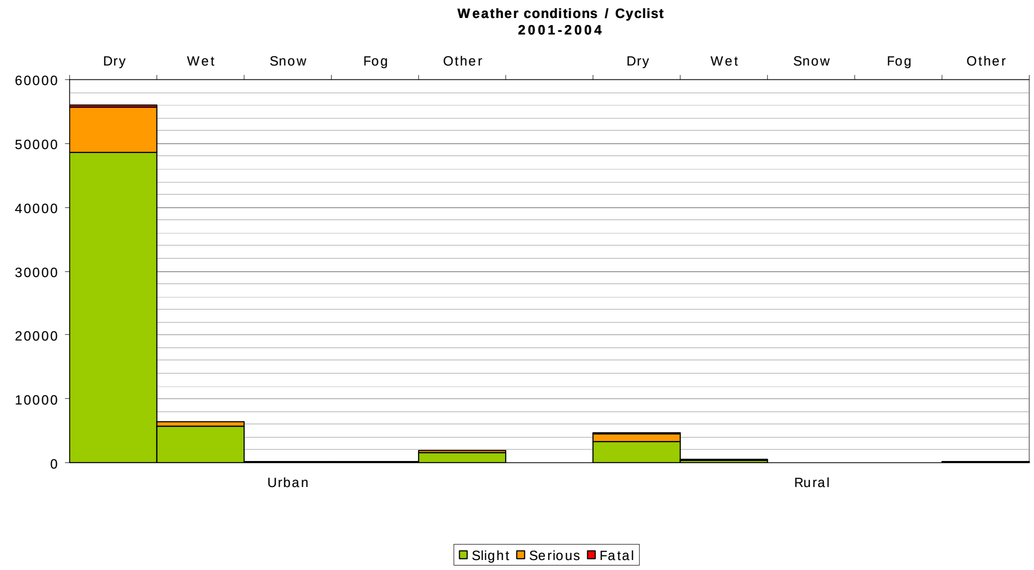


Figure 90_Annex2.6.- Weather conditions (Great Britain_2001/2004).

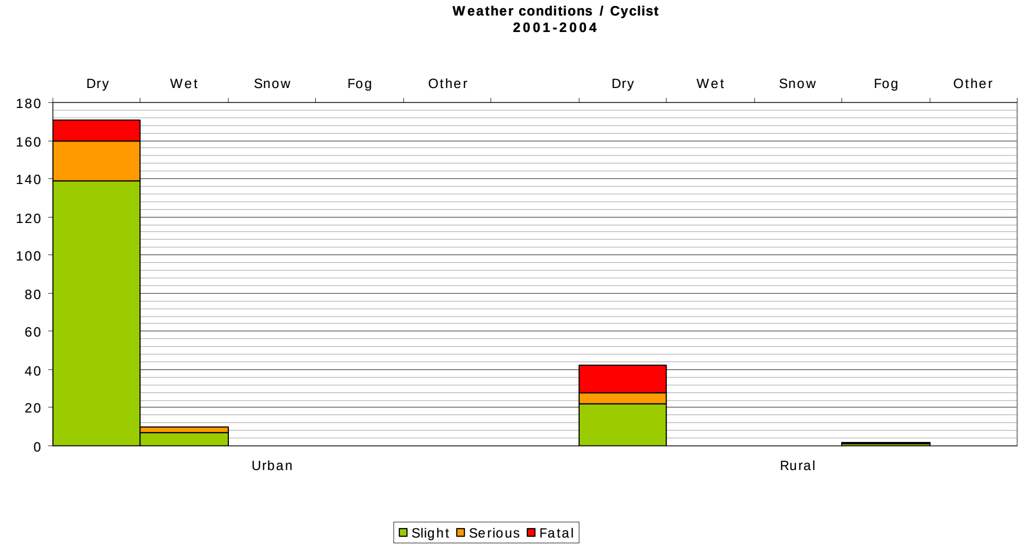


Figure 91_Annex2.6.- Weather conditions (Greece_2001/2004).

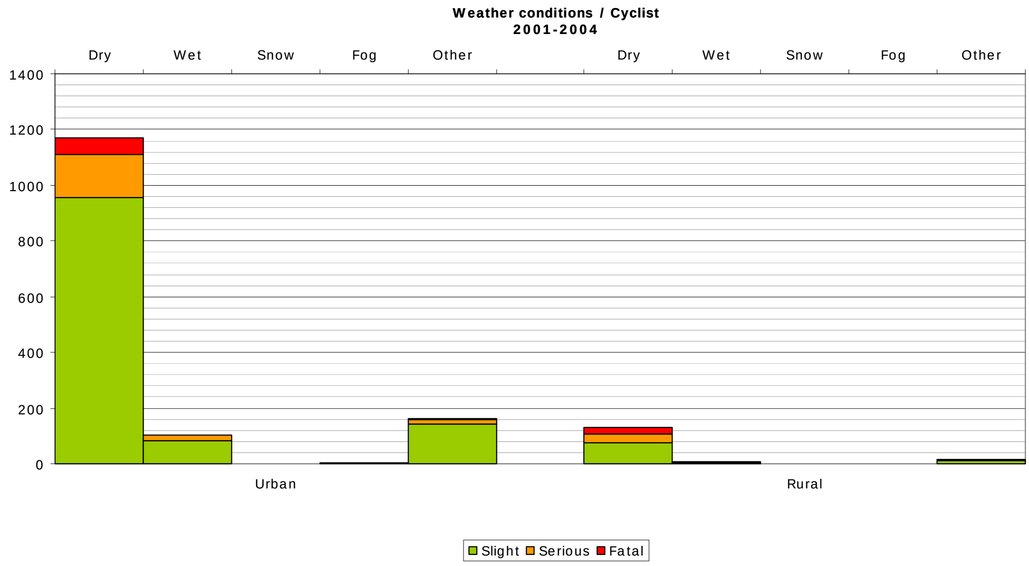


Figure 92_Annex2.6.- Weather conditions (Italy_2001/2004).

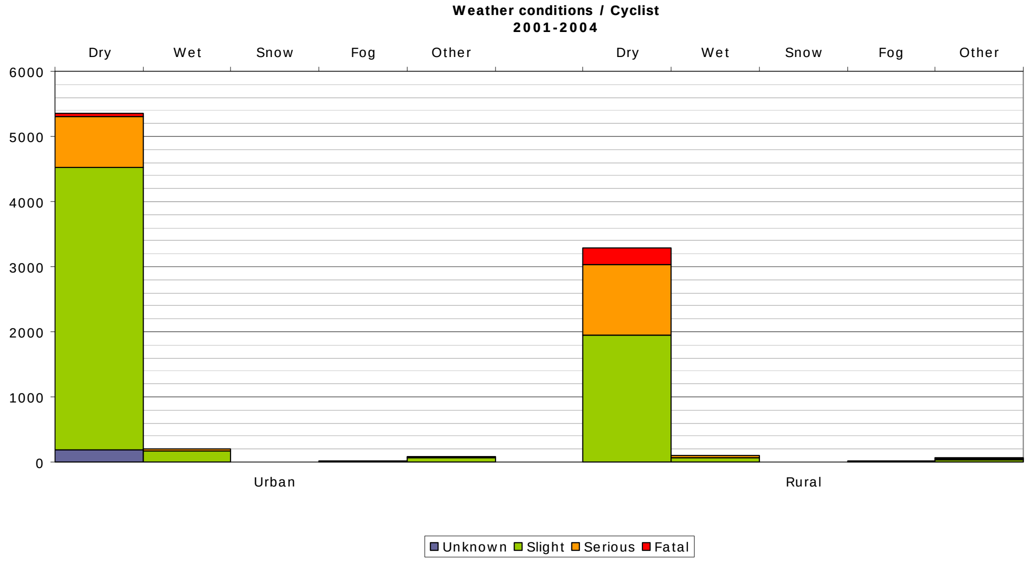


Figure 93_Annex2.6.- Weather conditions (Spain_2001/2004).

14.4.2.h Light conditions

The differentiation between urban and rural areas is very important in this case. Regarding cyclist accidents in urban roads, the majority of them occur with daylight. It is also important to note that for all countries, the relative percentage of fatal accidents is similar in darkness than in daylight.

Regarding rural accidents, it must be noted that there is also a big difference between the absolute number of accidents occurring with daylight or in the night, but accidents with darkness still being more harmful and fatal for cyclists, mainly in Greece, Spain and France.

Darkness seems to be an important relative parameter in rural accidents, as the distribution of fatal and serious accidents is higher at night.

		Fatal	Serious	Slight	
FRANCE	Daylight	2,12	12,72	85,15	**Urban**
	Dawn	2,77	11,37	85,84	
	Darkness	2,59	10,77	86,62	
	Daylight	11,26	35,25	53,47	**Rural**
	Dawn	12,5	35,29	52,20	
	Darkness	22,93	32,53	44,53	

		Fatal	Serious	Slight	
GERMANY	Daylight	0,46	16,97	82,55	**Urban**
	Dawn	0,50	17,24	82,25	
	Darkness	0,63	21,48	77,88	
	Daylight	2,59	32,88	64,52	**Rural**
	Dawn	3,68	33,96	62,34	
	Darkness	3,76	34,54	61,69	

		Fatal	Serious	Slight	
GREAT BRITAIN	Daylight	0,43	12,02	87,54	**Urban**
	Dawn	0	0	0	

	Darkness	0,59	14,12	85,27	
	Daylight	3,39	23,63	72,97	**Rural**
	Dawn	0	0	0	
	Darkness	6,31	27,05	66,63	

		Fatal	Serious	Slight	
GREECE	Daylight	4,72	14,96	80,31	**Urban**
	Dawn	0	0	0	
	Darkness	8,92	8,92	82,14	
	Daylight	26,66	16,66	56,66	**Rural**
	Dawn	0	0	0	
	Darkness	50	7,14	42,85	

		Fatal	Serious	Slight	
ITALY	Daylight	1,61	12,61	85,77	**Urban**
	Dawn	0	15,05	84,94	
	Darkness	1,94	19,41	78,64	
	Daylight	1,19	25	73,80	**Rural**
	Dawn	10	30	60	
	Darkness	15,78	15,78	68,42	

		Fatal	Serious	Slight	
SPAIN	Daylight	1,03	15,08	83,87	**Urban**
	Dawn	2,58	18,53	78,87	
	Darkness	0,93	12,74	86,32	
	Daylight	6,39	33,00	60,59	**Rural**
	Dawn	4,37	38,68	56,93	
	Darkness	17,51	33,33	49,15	

Table 19_Annex2.6.- Light conditions.

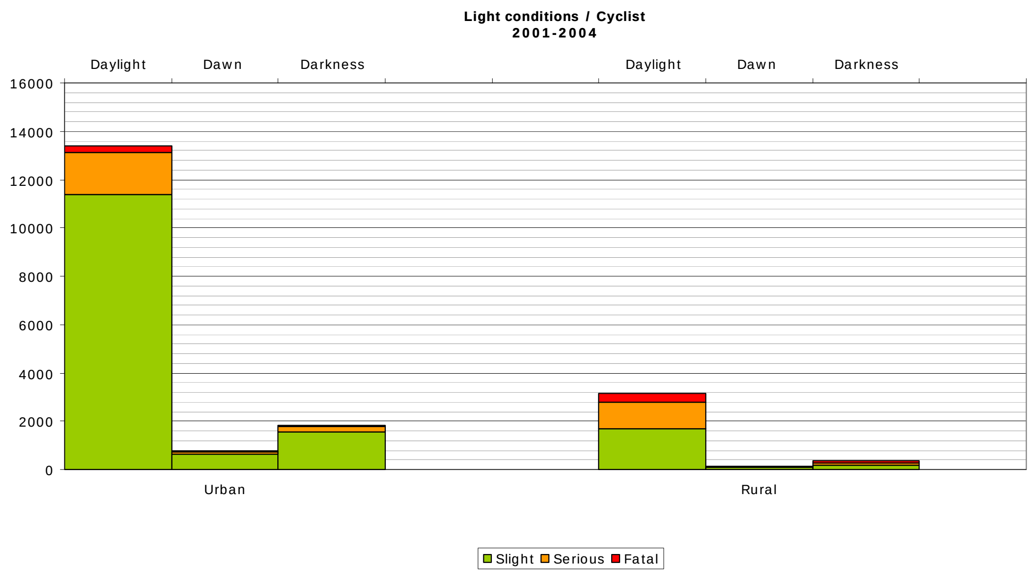


Figure 94_Annex2.6.- Light conditions (France_2001/2004).

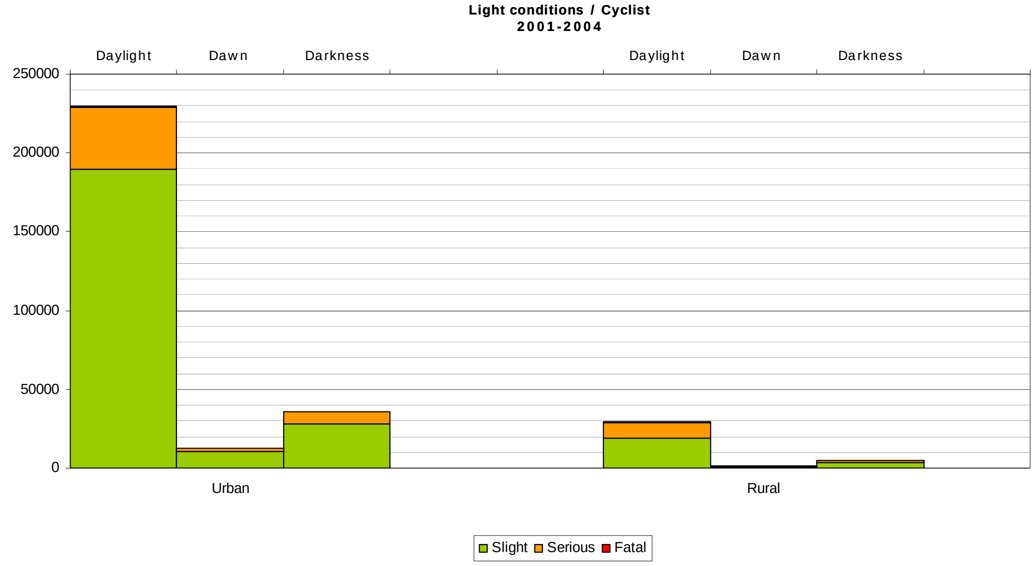


Figure 95_Annex2.6.- Light conditions (Germany_2001/2004).

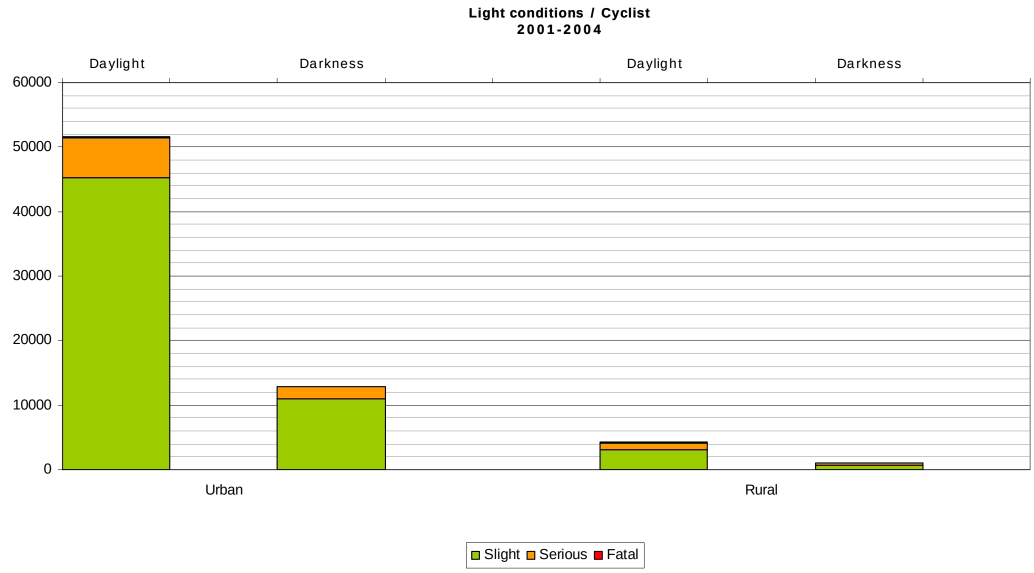


Figure 96_Annex2.6.- Light conditions (Great Britain_2001/2004).

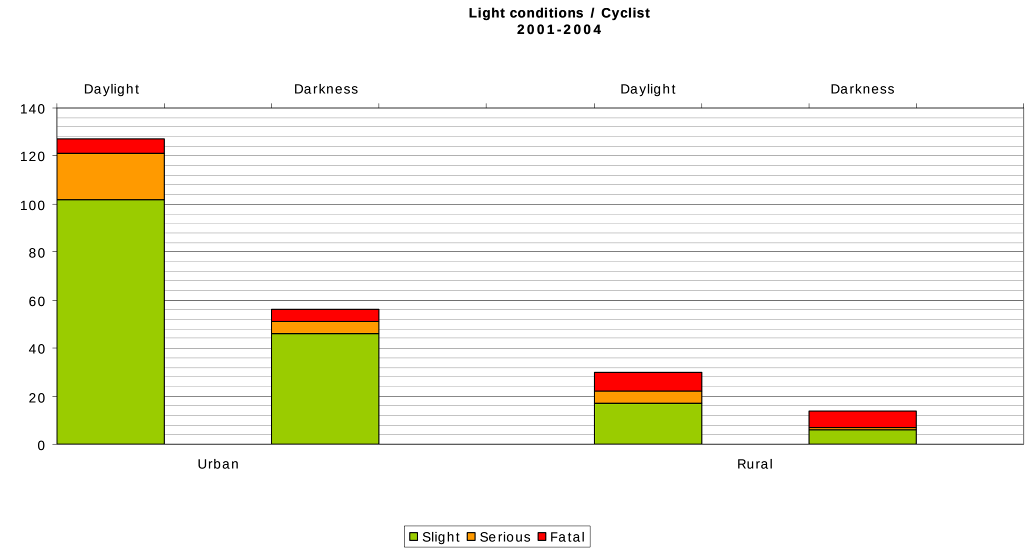


Figure 97_Annex2.6.- Light conditions (Greece_2001/2004).

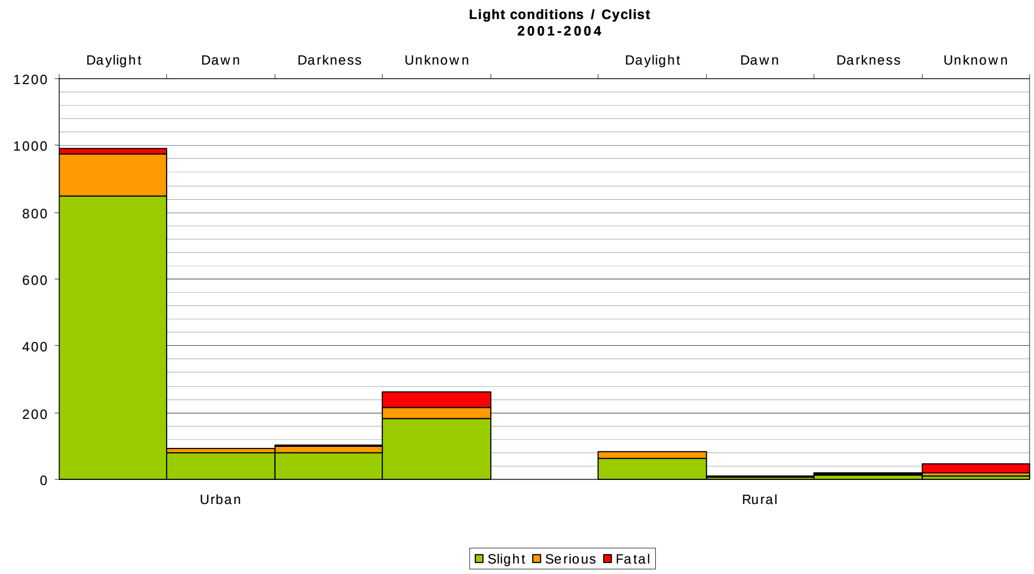


Figure 98_Annex2.6.- Light conditions (Italy_2001/2004).

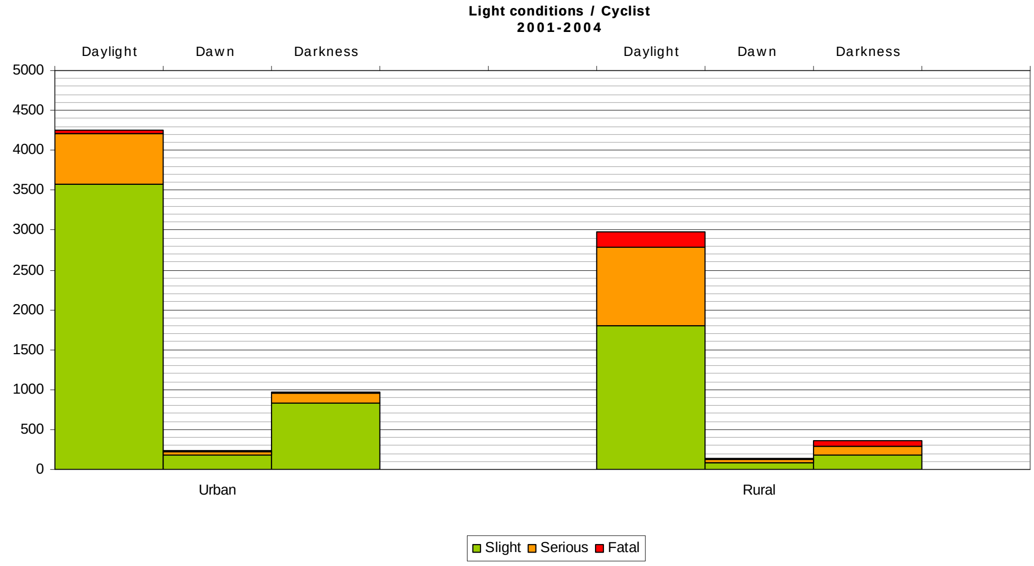


Figure 99_Annex2.6.- Light conditions (Spain_2001/2004).

14.4.2.i Age

In this chapter, the age of cyclists involved in accidents is classified. A first division has been made so that child and teenagers are grouped together, so as to see the relevance of accidents involving the youngest part of the population. Then, the rest of the population has been grouped in divisions of ten years, and finally elderly people, which are considered to be older than 60 years, are also grouped together.

While in France, Germany, Spain and Great Britain, absolute number of young people accidents is bigger than older people ones (but not much), in Greece it is very similar and in Italy it happens on the opposite way (but with great difference). Nevertheless, there is one important thing in common: the most dangerous ages are the groups 0-19 and +60 years, the ones which represent both the youngest and the oldest people. This is a significant detail, as it shows that people is more vulnerable during the two extremes of life.

In relative terms, percentage of fatal and serious accidents is bigger for older people than the rest, both for urban and rural areas. The minor rate of fatal injuries is for child and teenagers, but then it changes to get more equalled when referring to the serious and slight ones.

		Fatal	Serious	Slight	
FRANCE	0-19 years	1,46	13,24	85,29	Urban
	20-29 years	1,05	5,48	93,46	
	30-39 years	1,07	8,07	90,84	
	40-49 years	1,87	10,83	87,28	
	50-59 years	2,59	14,75	82,65	
	60+ years	6,29	21,32	72,37	
	0-19 years	7,50	35,74	56,75	Rural
	20-29 years	7,81	31,25	60,93	
	30-39 years	9,33	31,2	59,46	
	40-49 years	12,97	32,54	54,47	
	50-59 years	12,24	34,80	52,94	
	60+ years	20,19	37,63	42,16	

		Fatal	Serious	Slight	
GEMANY	0-19 years	0,18	15,42	84,39	Urban
	20-29 years	0,15	13,95	85,88	
	30-39 years	0,24	14,95	84,79	
	40-49 years	0,38	17,23	82,38	
	50-59 years	0,55	20,34	79,09	
	60+ years	1,44	25,13	73,41	
	0-19 years	1,65	29,68	68,65	Rural
	20-29 years	1,14	28,72	70,13	
	30-39 years	1,32	30,32	68,34	
	40-49 years	1,86	32,53	65,59	
	50-59 years	2,30	33,55	64,13	
	60+ years	6,01	37,53	56,44	

		Fatal	Serious	Slight	
GREAT BRITAIN	0-19 years	0,34	11,45	88,19	Urban
	20-29 years	0,39	11,58	88,02	
	30-39 years	0,33	12,23	87,43	
	40-49 years	0,36	14,38	85,24	
	50-59 years	0,73	15,44	83,81	
	60+ years	2,19	19,16	78,63	
	0-19 years	2,34	23,55	74,09	Rural
	20-29 years	2,88	17,71	79,39	
	30-39 years	2,47	23,95	73,57	
	40-49 years	5,11	25,22	69,66	
	50-59 years	5,60	31,51	62,87	
	60+ years	9,04	28,66	62,28	

		Fatal	Serious	Slight	
GREECE	0-19 years	11,53	19,23	69,23	Urban
	20-29 years	0	0	100	
	30-39 years	6,66	6,66	86,66	
	40-49 years	10	10	80	
	50-59 years	9,09	0	90,90	
	60+ years	21,73	21,73	56,52	
	0-19 years	0	0	0	Rural
	20-29 years	0	12,5	87,5	
	30-39 years	50	0	50	
	40-49 years	20	30	50	
	50-59 years	50	0	50	
	60+ years	50	7,14	42,85	

		Fatal	Serious	Slight	
ITALY	0-19 years	1,24	8,72	90,03	Urban
	20-29 years	4,91	10,38	84,69	
	30-39 years	3,62	17,39	78,98	
	40-49 years	4,04	11,56	84,39	
	50-59 years	6,003	15,26	78,73	

	60+ years	6,00	15,26	78,73	
	0-19 years	3,33	23,33	73,33	**Rural**
	20-29 years	14,28	28,57	57,14	
	30-39 years	8,33	8,33	83,33	
	40-49 years	19,23	26,92	53,84	
	50-59 years	30,64	22,58	46,77	
	60+ years	30,64	22,58	46,77	

		Fatal	Serious	Slight	
SPAIN	0-19 years	0,41	17,16	82,41	**Urban**
	20-29 years	0,73	10,16	89,10	
	30-39 years	0,35	12,21	87,42	
	40-49 years	1,77	17,51	80,70	
	50-59 years	2,56	17,21	80,21	
	60+ years	5,23	22,32	72,43	
	0-19 years	4,21	39,19	56,59	**Rural**
	20-29 years	6,18	28,82	64,99	
	30-39 years	5,47	31,28	63,24	
	40-49 years	6,52	29,62	63,84	
	50-59 years	7,01	37,10	55,88	
	60+ years	14,76	34,50	50,73	

Table 20_Annex2.6.- Age of the cyclist.

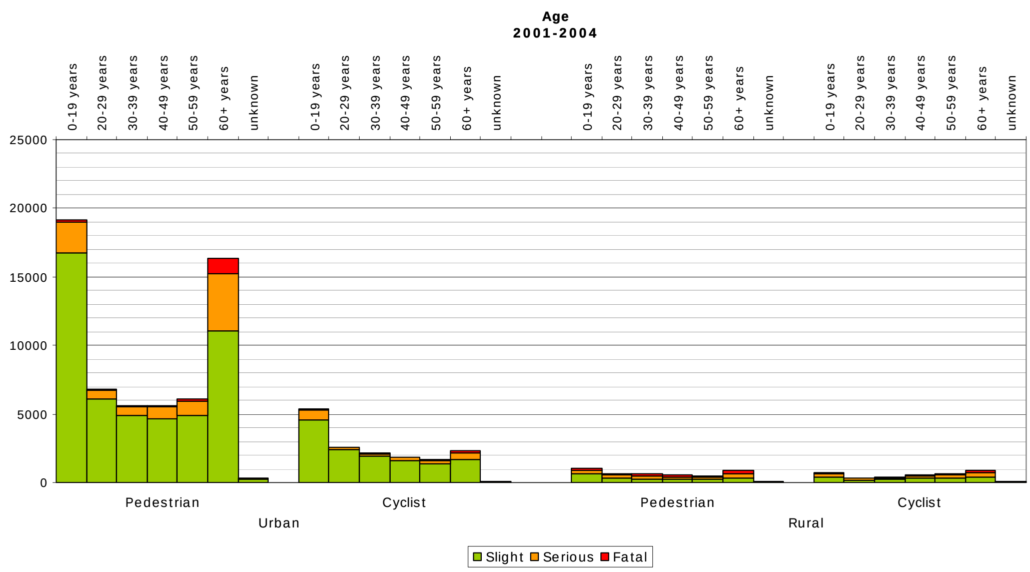


Figure 100_Annex2.6.- Age of the cyclist (France_2001/2004).

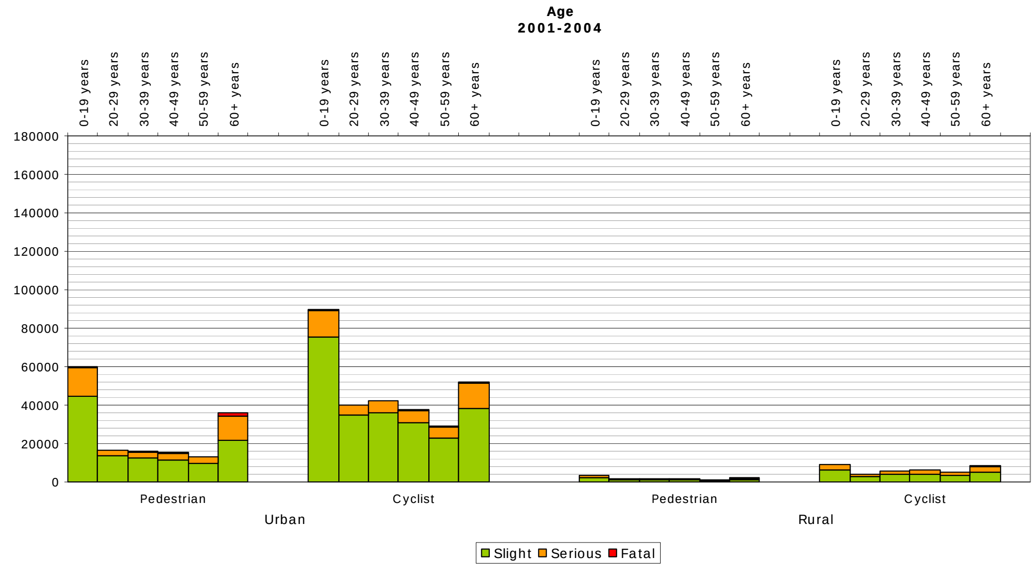


Figure 101_Annex2.6.- Age of the cyclist (Germany_2001/2004).

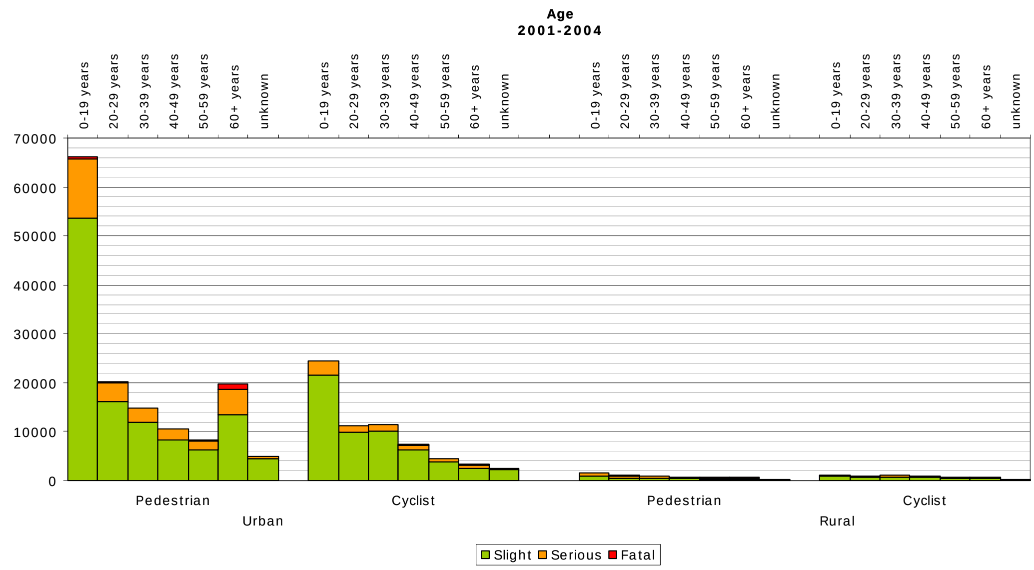


Figure 102_Annex2.6.- Age of the cyclist (Great Britain_2001/2004).

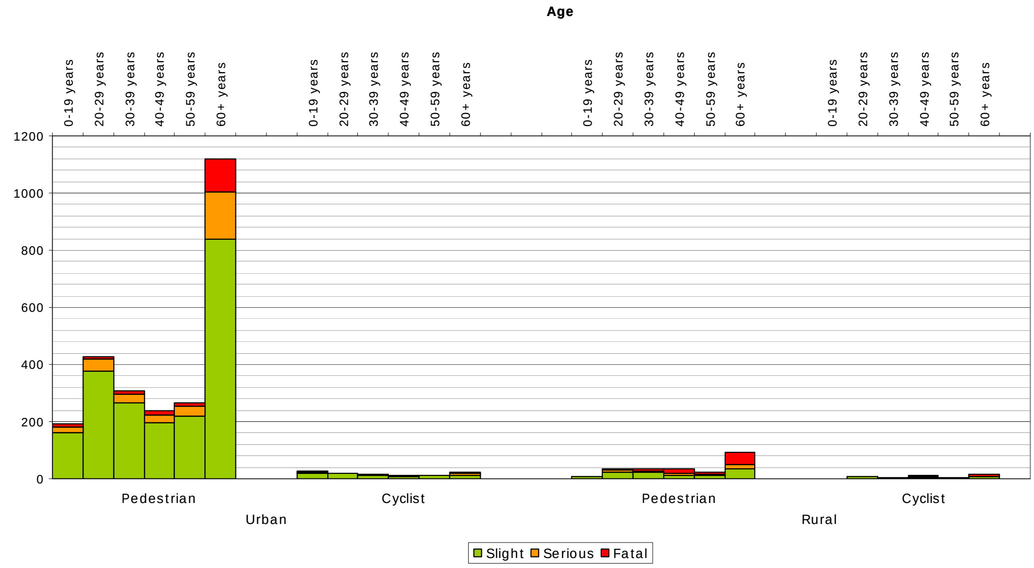


Figure 103_Annex2.6.- Age of the cyclist (Greece_2001/2004).

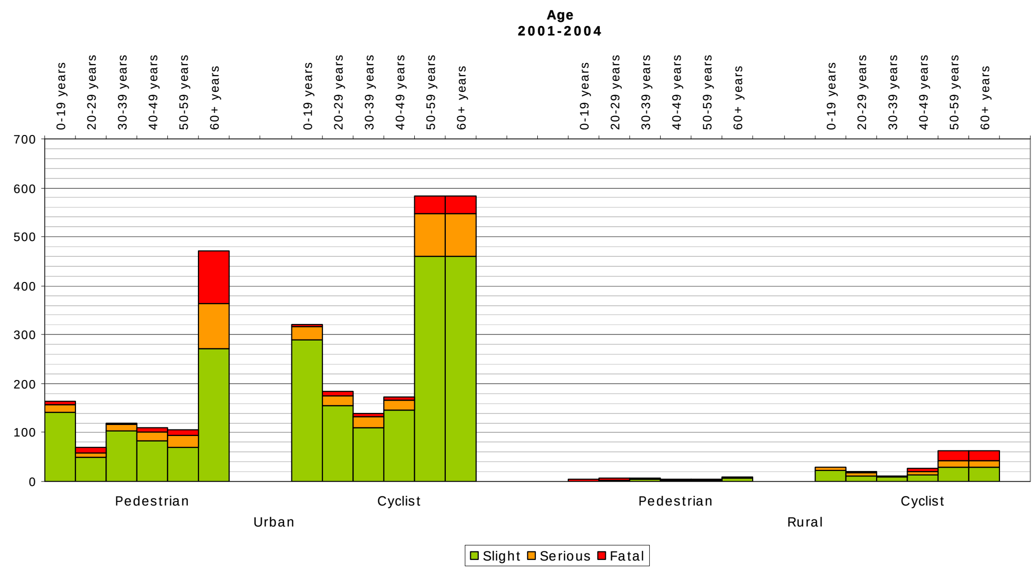


Figure 104_Annex2.6.- Age of the cyclist (Italy_2001/2004).

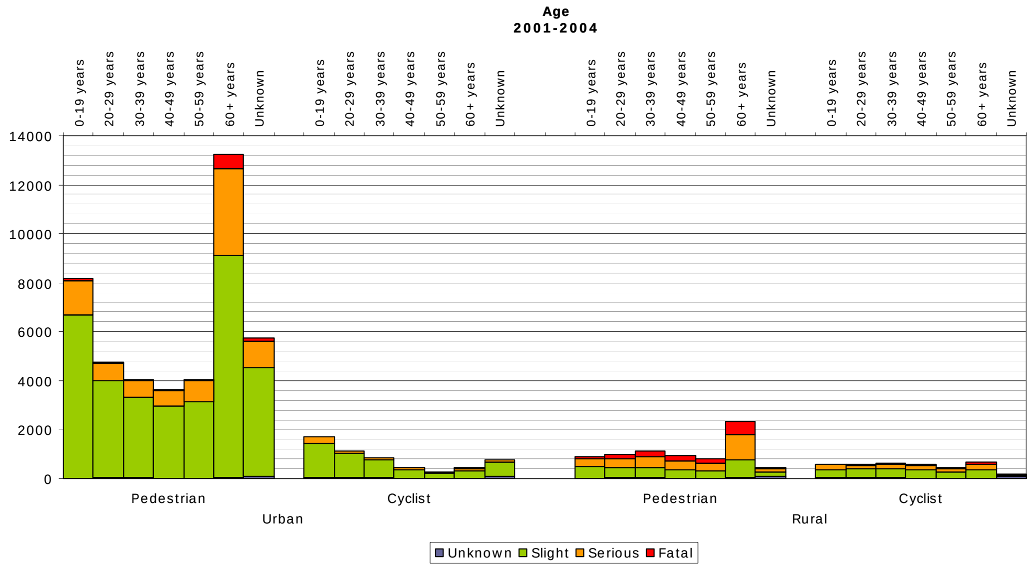


Figure 105_Annex2.6.- Age of the cyclist (Spain_2001/2004).

14.4.2.j Gender

According to sex distribution, the percentage of accidents regarding cyclists in urban roads tends to be considerably higher for males than for females, surely because males use to practice this sport a lot more than females. The same observation can be applied for cyclists in rural roads.

In general, the absolute number of fatal injuries is higher in rural roads than in urban roads, which is dramatically emphasized in Spain. Furthermore, the relative percentage of fatal and serious injuries is a lot higher in rural roads, without any difference between males and females. As a curiosity, the percentage of fatal injuries in urban and rural roads is lower for cyclists (males and females) than for pedestrians. Finally, and as usual, Germany presents the lowest rate of fatal injuries, in accordance to the other parameters analysed before.

		Fatal	Serious	Slight	
FRANCE	Male	2,35	12,51	85,13	**Urban**
	Female	1,77	12,25	85,97	
	Male	12,64	35,61	51,73	**Rural**
	Female	11,73	31,52	56,74	

		Fatal	Serious	Slight	
GERMANY	Male	0,50	17,45	82,04	**Urban**
	Female	0,44	17,82	81,72	
	Male	2,86	32,87	64,25	**Rural**
	Female	2,38	32,55	65,06	

		Fatal	Serious	Slight	
GREAT BRITAIN	Male	0,46	12,72	86,81	**Urban**
	Female	0,47	11,32	88,18	
	Male	4,09	24,72	71,17	**Rural**
	Female	3,43	22,16	74,39	

		Fatal	Serious	Slight	
GREECE	Male	6,66	11,33	82	**Urban**
	Female	3,03	21,21	75,75	
	Male	38,46	15,38	46,15	**Rural**
	Female	0	0	100	

		Fatal	Serious	Slight	
ITALY	Male	5,21	13,69	81,08	**Urban**
	Female	2,82	12,09	85,08	
	Male	85,54	6,39	8,05	**Rural**
	Female	90,12	4,93	4,93	

		Fatal	Serious	Slight	
SPAIN	Male	1,23	15,25	83,50	**Urban**
	Female	0,63	13,97	85,38	
	Male	7,71	33,25	59,02	**Rural**
	Female	5,11	33,44	61,43	

Table 21_Annex2.6.- Gender of the cyclist.

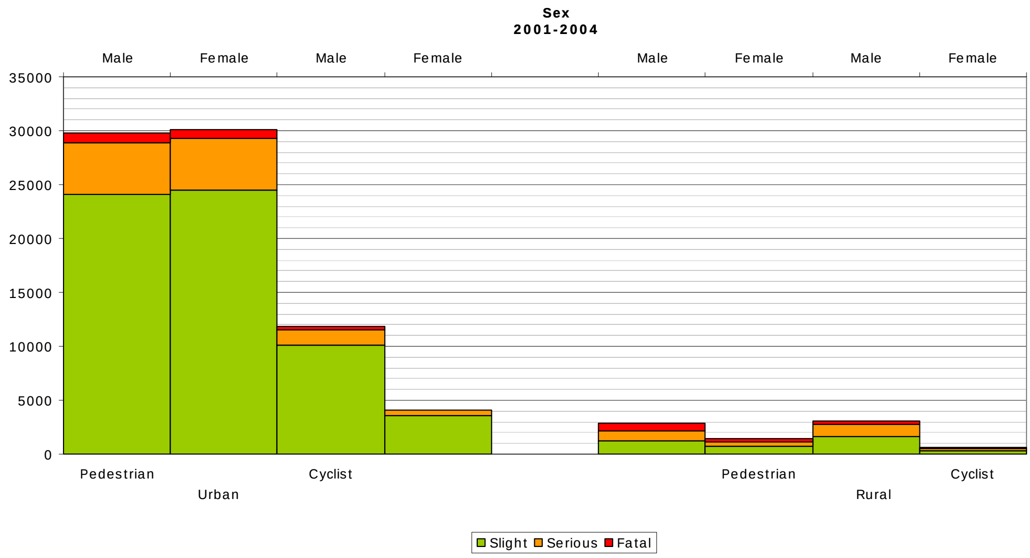


Figure 106_Annex2.6.- Gender of the cyclist (France_2001/2004).

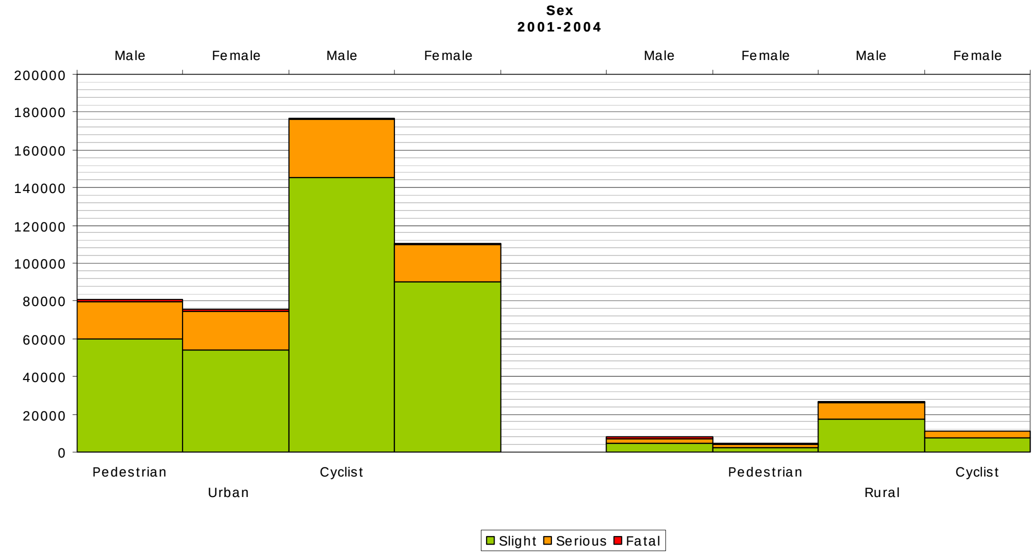


Figure 107_Annex2.6.- Gender of the cyclist (Germany_2001/2004).

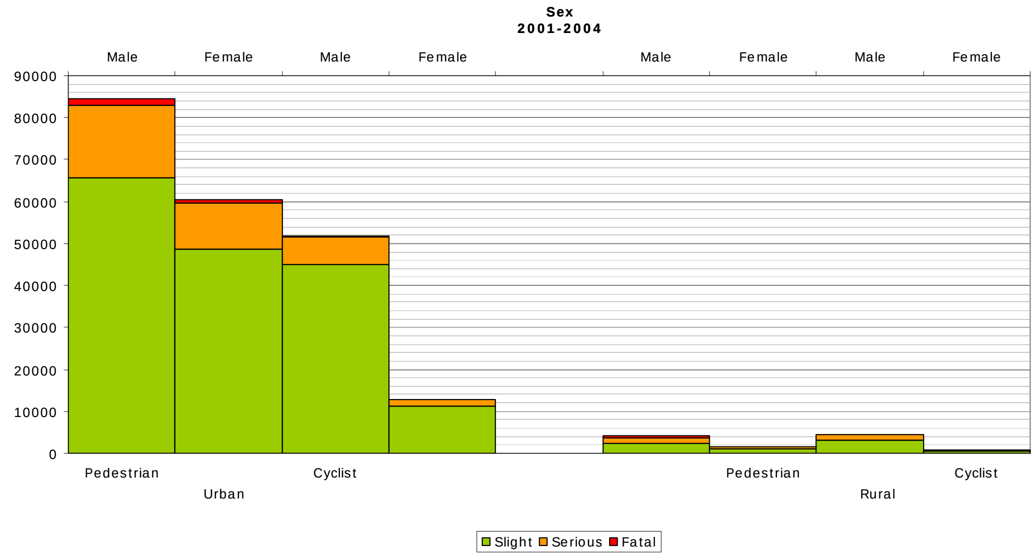


Figure 108_Annex2.6.- Gender of the cyclist (Great Britain_2001/2004).

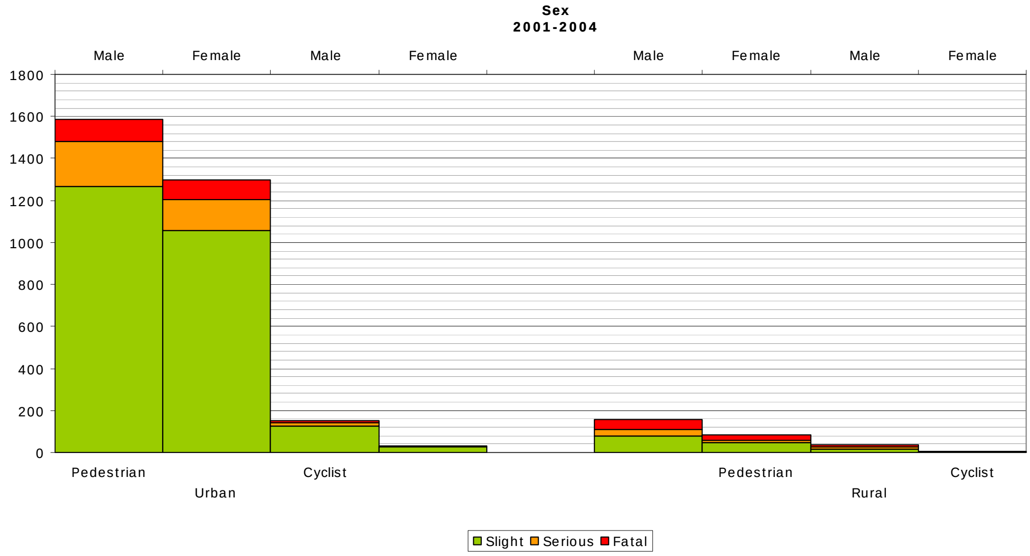


Figure 109_Annex2.6.- Gender of the cyclist (Greece_2001/2004).

Figure 110_Annex2.6.- Gender of the cyclist (Italy_2001/2004).

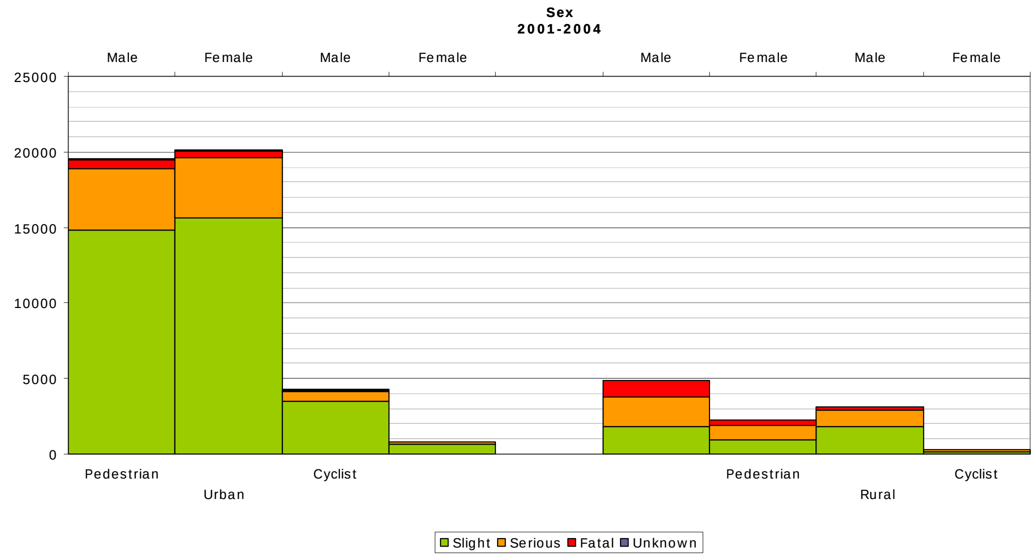


Figure 111_Annex2.6.- Gender of the cyclist (Spain_2001/2004).

14.4.2.k Opponent vehicle age

The purpose of this chapter is to study if there is any relation between the age of the car involved in the accident and the injuries caused to the cyclist, as well as to give an approximation of the percentage of the different ages of the passenger cars. The cars have been divided in groups of five years, which is a reasonable period of time because cars improve a lot from one period to another.

In absolute numbers, the number of accidents for 0-4 year old vehicles is higher than the number for 5-9 year old and older. This data is interesting but it would be interesting to compare these results with the vehicle age distribution for each country.

An important data given by the statistics is that, despite the new technologies and the recent developments than have been introduced to the majority of cars, the percentage of fatal injuries as well as serious injuries caused to pedestrians in urban roads stills very similar (there has only been a reduction of 1% or 2% in the las10 years), which means that security systems for cyclists should be more taken into consideration in the future. In rural areas, it is confirmed that accidents are more harmful than in urban areas, but any important conclusion can be extracted.

		Fatal	Serious	Slight	
FRANCE	0-4 years	2,44	11,87	85,68	**Urban**
	5-9 years	2,11	12,53	85,35	
	10 years +	2,13	13,99	83,86	
	0-4 years	13,06	34,79	52,13	**Rural**
	5-9 years	12,41	37,07	50,51	
	10 years +	14,30	37,61	48,08	
		Fatal	Serious	Slight	
GERMANY	0-4 years	0,24	13,96	85,78	**Urban**
	5-9 years	0,30	15,33	84,36	
	10 years +	0,36	15,99	83,64	
	0-4 years	3,30	28,3	68,32	**Rural**
	5-9 years	4,03	30,51	65,45	

	10 years +	4,52	31,82	63,65	

		Fatal	Serious	Slight	
GREAT BRITAIN	0-4 years	0,48	12,54	86,96	**Urban**
	5-9 years	0,40	11,73	87,86	
	10 years +	0,28	11,64	88,06	
	0-4 years	4,39	23,33	72,27	**Rural**
	5-9 years	2,80	23,99	73,20	
	10 years +	3,09	26,59	70,30	

		Fatal	Serious	Slight	
GREECE	0-4 years	7,46	10,44	82,08	**Urban**
	5-9 years	0	13,15	86,84	
	10 years +	6,97	13,95	79,06	
	0-4 years	35,71	0	64,28	**Rural**
	5-9 years	14,28	14,28	71,42	
	10 years +	60	10	30	

		Fatal	Serious	Slight	
ITALY	0-4 years	0	0	100	**Urban**
	5-9 years	0	7,14	92,85	
	10 years +	0	0	100	
	0-4 years	66,66	0	33,33	**Rural**
	5-9 years	50	0	50	
	10 years +	66,66	0	33,33	

		Fatal	Serious	Slight	
SPAIN	0-4 years	1,03	18,65	80,31	**Urban**
	5-9 years	0,86	17,16	81,97	
	10 years +	1,47	16,87	81,65	
	0-4 years	8,58	30,95	60,46	**Rural**
	5-9 years	8,86	34,95	56,17	
	10 years +	7,89	35,20	56,90	

Table 22_Annex2.6.- Opponent vehicle age.

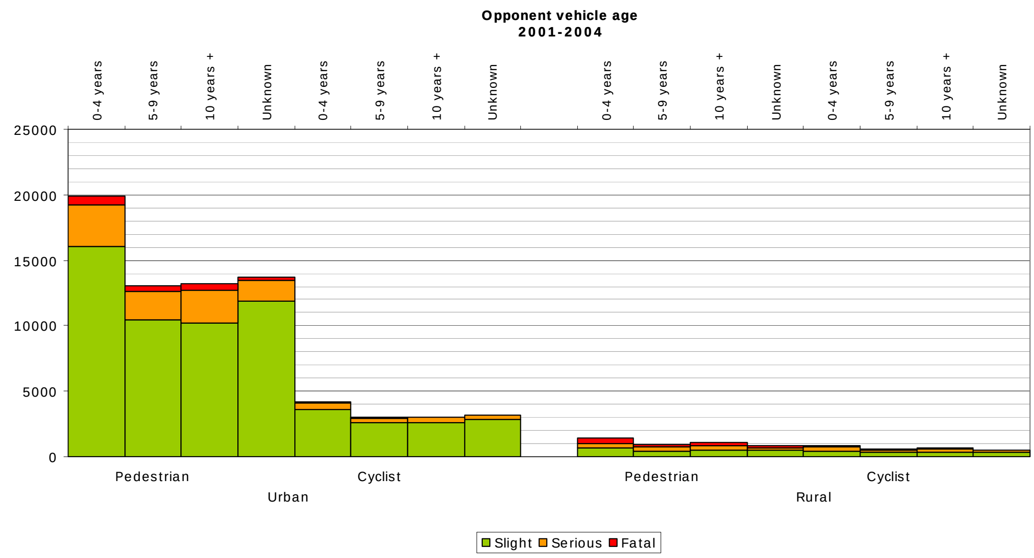


Figure 112_Annex2.6.- Opponent vehicle age (France_2001/2004).

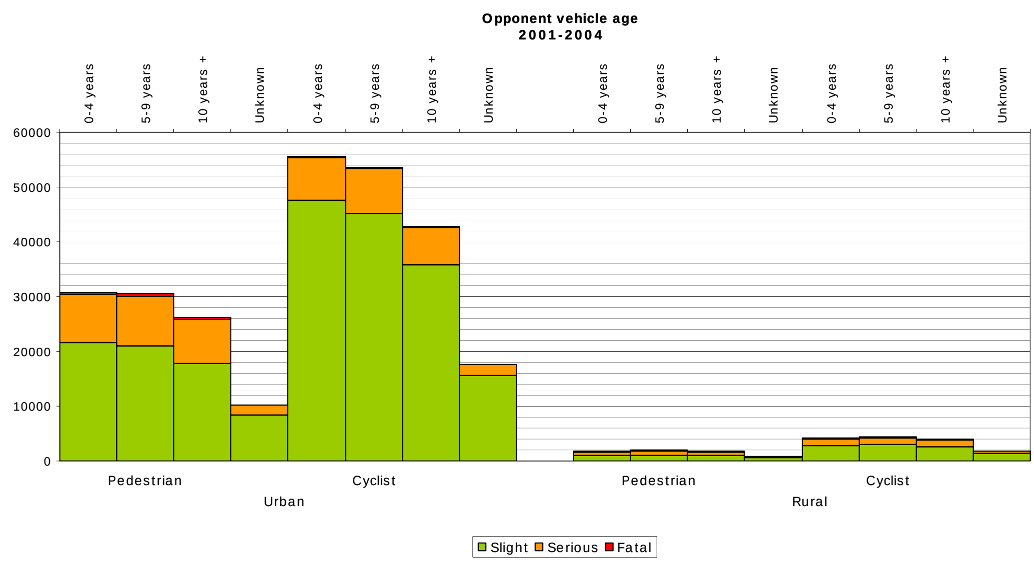


Figure 113_Annex2.6.- Opponent vehicle age (Germany_2001/2004).

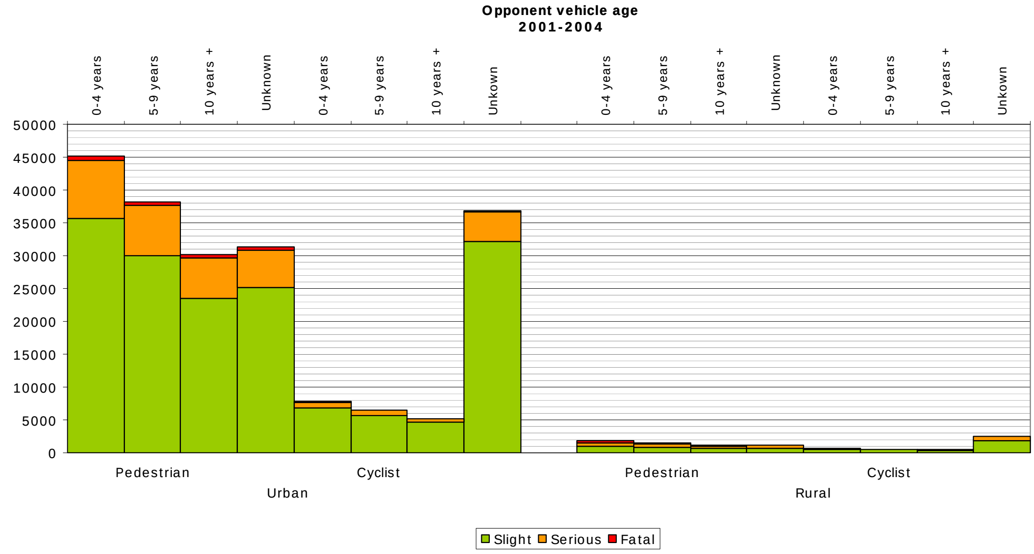


Figure 114_Annex2.6.- Opponent vehicle age (Great Britain_2001/2004).

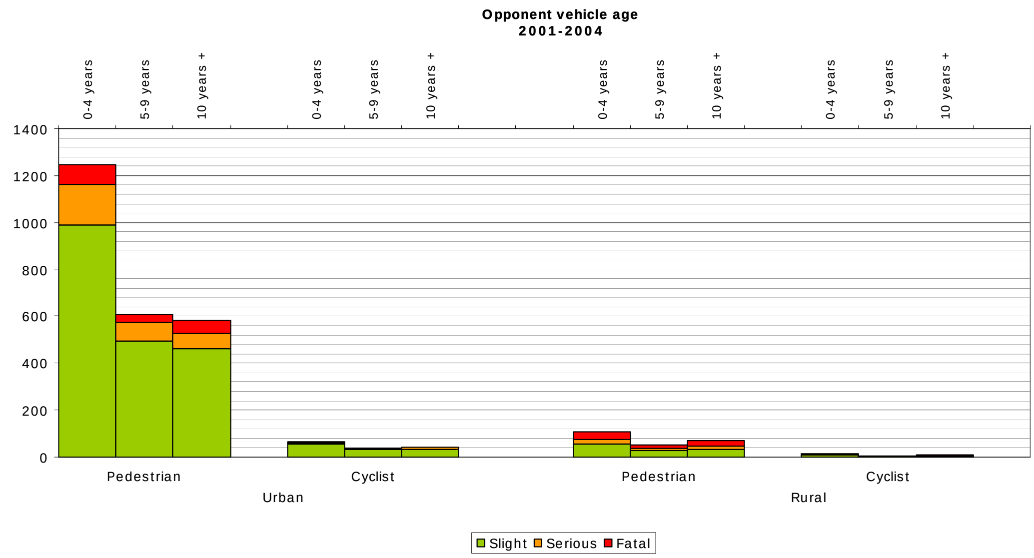


Figure 115_Annex2.6.- Opponent vehicle age (Greece_2001/2004).

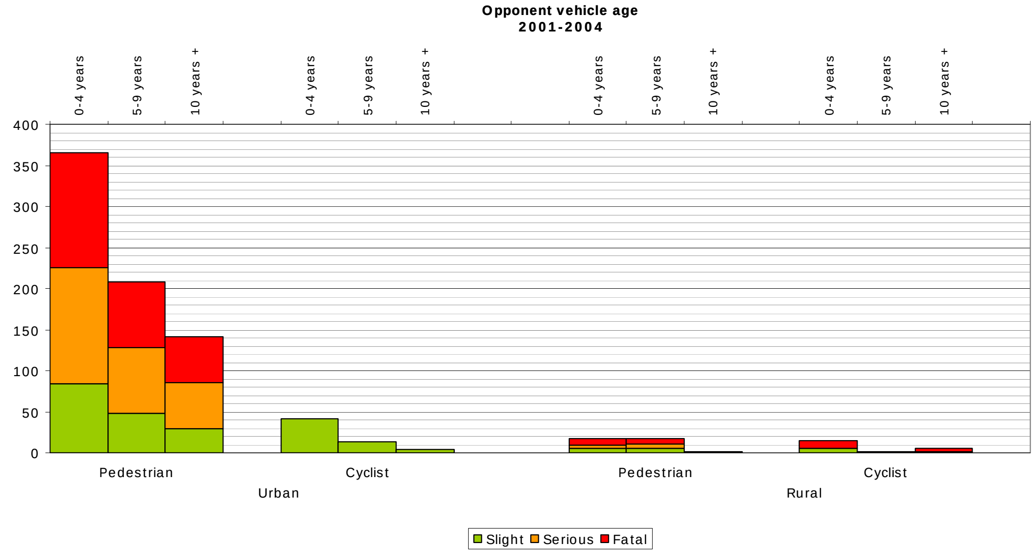


Figure 116_Annex2.6.- Opponent vehicle age (Italy_2001/2004).

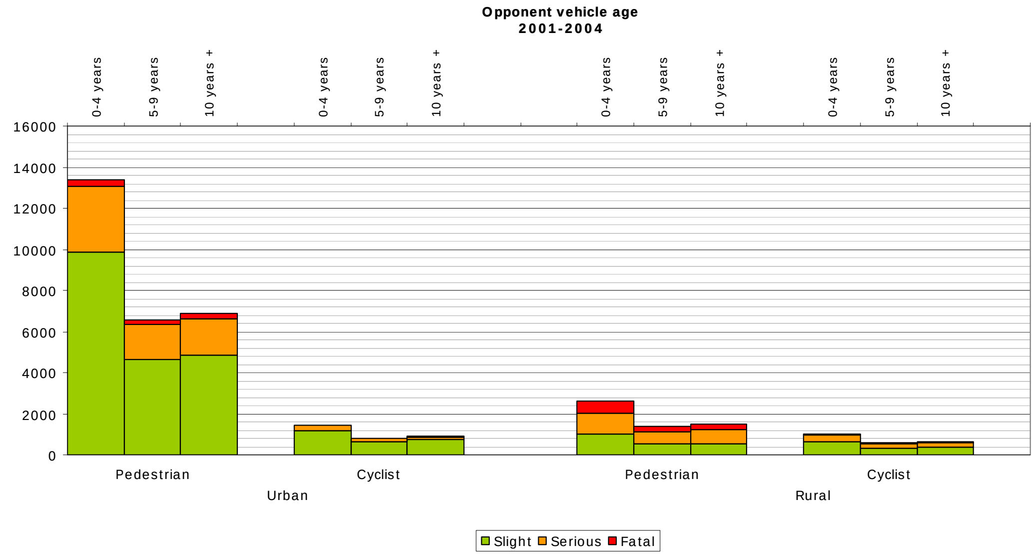


Figure 117_Annex2.6.- Opponent vehicle age (Spain_2001/2004).

14.5 Annex 2.5: Elderly people and Gender related accidents

Information related to chapter 7 'Task 1.5: Elderly people and Gender related accidents' is included in this annex.

14.5.1 *Elderly people*

	% of injured (1)	% of population (2)	Relative rate (2)/(1)
France	**8.1**	16.2	0.50
Italy	6.3	19.0	0.33
GB	6.1	15.9	0.38
Czech Republic	7.5	13.7	0.55
Germany	7.9	18.3	0.43
Greece	**10.5**	16.9	0.62
Spain	6.7	17.0	0.39
Mean value	**7.3**	**17.2**	**0.42**
Australia	7.7	13.2	0.58

Table 1_Annex2.5.-Proportion of over 65 years injured on the road between 2001 and 2004.

	Both	Male	Female
France	8.1	6.7	11.6
Italy	6.3	5.7	8.0
GB	6.1	5.8	6.7
Czech Republic	7.5	6.4	10.6
Germany	7.9	7.3	8.8
Greece	10.5	8.9	18.0
Spain	6.7	6.2	8.2
Mean value	**7.3**	**6.6**	**8.5**
Australia	7.7	7.8	7.7

Table 2_Annex2.5.-Proportion of Male and Female over 65 years injured on the road between 2001 and 2004.

	% of fatal (1)	% of population (2)	Relative rate (1)/(2)
France	17.2	16.2	1.06
Italy	**20.8**	19.0	1.09
GB	18.5	15.9	1.16
Czech Republic	18.5	13.7	**1.35**
Germany	19.7	18.3	1.08
Greece	**20.7**	16.9	1.22
Spain	15.3	17.0	0.90
Mean value	**18.0**	**17.2**	**1.05**
Australia	18.2	13.2	1.38

Table 3_Annex2.5.-Distribution of over 65 years road users killed on the road by country between 2001 and 2004.

	Both	Male (1)	Female (2)	Relative rate(2)/(1)
France	**17.2**	14.7	27.8	1,9
Italy	**20.8**	18.2	34.2	1,9
GB	18.5	14.7	33.2	**2,3**
Czech Republic	18.5	15.8	31.8	2,0
Germany	19.7	15.8	32.9	2,1
Greece	**20.7**	18.5	33.3	1,8
Spain	15.3	13.5	26.2	1,9
Mean value	**18.6**	**15.3**	**31.3**	**2,0**
Australia	18.2	14.3	32.0	2,2

Table 4_Annex2.5.-Proportion of road users over 65 years killed on the road as a function of Gender between 2001 and 2004.

	Male		Female	
	Under 65	65 and +	Under 65	65 and +
France	7.2	24.7	14.5	55.7
Italy	7.8	30.6	22.0	75.8
GB	19.5	43.6	34.5	68.8
Czech Rep	19.8	37.2	37.4	81.9
Germany	9.2	24.2	15.8	59.5
Greece	8.8	38.2	46.3	100.0
Spain	10.4	35.9	25.6	87.2
Mean value	**11.0**	**30.5**	**21.2**	**65.3**
Australia	13.6	30.5	26.0	47.6

Table 5_Annex2.5.-Proportion of pedestrians fatalities as a function of age, gender and country, between 2001 and 2004.

	Both		Male		Female	
	Under 65 years	65 and +	Under 65 years	65 and +	Under 65 years	65 and +
Car	86.4	13.6	86.4	13.6	86.5	13.5
Goods road vehicle	94.9	5.1	94.9	5.1	94.5	5.5
Motorcycle	98.6	1.4	98.5	1.5	99.4	0.6
Moped	87.0	13.0	86.7	13.3	90.7	9.3
Bicycle	63.5	**36.5**	65.0	35.0	58.4	41.6
Motor-coach bus	94.5	5.5	94.1	5.9	100.0	0.0
Pedestrian	57.7	**42.3**	67.0	33.0	42.1	**57.9**
Other	64.9	35.1	65.4	34.6	60.8	39.2

Table 6_Annex2.5.-Percentage of fatalities as a function of mode of travel and as a function of age and gender, between 2001 and 2004.

	Car	Goods road vehicle	Motorcycle	**Moped**	**Bicycle**	Motor-coach bus	**Pedestrian**	Other
France	16.1	3.0	0.6	6.6	33.4	0.0	46.3	44.2
Italy	18.2	7.7	0.5	11.5	**57.3**	0.0	**60.8**	13.0
GB	16.8	4.3	1.4	8.8	**19.0**	14.3	35.4	44.3
Greece	11.2	21.2	4.0	26.9	37.5	0.0	51.4	48.9
Germany	12.4	4.9	2.2	27.1	43.4	5.6	46.9	29.9
Czech Republic	10.1	2.4	2.8	**48.8**	27.8	0.0	**34.2**	22.7
Spain	9.9	6.0	0.4	13.5	31.1	0.0	41.9	30.7
Mean value	13.6	5.1	1.4	**13.0**	36.5	5.5	**42.3**	35.1
Australia	18.5	7.4	2.1	0.0	19.2	0.0	34.2	0.0

Table 7_Annex2.5.-Proportion of killed road users over 65 years as a function of mode of travel and country, between 2001 and 2004.

		Daylight	**Dawn or dusk**	**Darkness**
France[79]	Under 65 (1)	69,9	5,7	24,5
	Over 65 (2)	84,9	3,5	11,5
	(2)/(1)	**1,2**	**0,6**	**0,5**
Greece	Under 65 (1)	66,0	0,0	34,0
	Over 65 (2)	79,7	0,0	20,3
	(2)/(1)	**1,2**		**0,6**
GB[80]	Under 65 (1)	72,0	0,0	28,0
	Over 65 (2)	84,6	0,0	15,4
	(2)/(1)	**1,2**		**0,6**
Czech Republic	Under 65 (1)	69,1	3,7	27,2
	Over 65 (2)	83,7	2,6	13,7
	(2)/(1)	**1,2**	**0,7**	**0,5**
Germany	Under 65 (1)	71,7	5,4	22,9
	Over 65 (2)	86,2	3,0	10,8
	(2)/(1)	**1,2**	**0,6**	**0,5**
Spain	Under 65 (1)	64,5	4,3	31,2
	Over 65 (2)	80,0	3,8	16,1
	(2)/(1)	**1,2**	**0,9**	**0,5**
Mean value	Under 65 (1)	70,5	3,9	25,6
	Over 65 (2)	81,7	3,1	15,2
	(2)/(1)	**1,2**	**0,8**	**0,6**
Australia	Under 65 (1)	66,9	8,5	24,7
	Over 65 (2)	83,9	5,3	10,8
	(2)/(1)	**1,3**	**0,6**	**0,4**

NB: No data for Italy, as more than 80% of the data is lacking for this variable

Table 8_Annex2.5.-Distribution of users injured as a function of luminosity, age and country.

[79] Uninjured included in non fatal for France, Italy, Greece and Australia

[80] Uninjured not included in non fatal for : GB, Czech Republic, and Spain

		Daylight	Dawn or dusk	Darkness
France	Under 65 (1)	51,7	6,9	41,4
	Over 65 (2)	78,2	4,4	17,4
	(2)/(1)	**1,5**	**0,6**	**0,4**
Greece	Under 65 (1)	52,3		47,7
	Over 65 (2)	70,8		29,2
	(2)/(1)	**1,4**		**0,6**
GB	Under 65 (1)	55,3		44,7
	Over 65 (2)	75,9		24,1
	(2)/(1)	**1,4**		**0,5**
Czech Republic	Under 65 (1)	53,4	4,7	42,0
	Over 65 (2)	71,0	3,3	25,7
	(2)/(1)	**1,3**	**0,7**	**0,6**
Germany	Under 65 (1)	56,4	5,9	37,7
	Over 65 (2)	73,4	3,8	22,7
	(2)/(1)	**1,3**	**0,7**	**0,6**
Spain	Under 65 (1)	50,8	5,7	43,5
	Over 65 (2)	71,0	5,3	23,6
	(2)/(1)	**1,4**	**0,9**	**0,5**
Mean value	Under 65 (1)	53,6	5,1	41,4
	Over 65 (2)	74,5	3,5	21,9
	(2)/(1)	**1,4**	**0,7**	**0,5**
Australia	Under 65 (1)	42,6	11,0	45,6
	Over 65 (2)	71,4	11,7	15,5
	(2)/(1)	**1,7**	**1,1**	**0,3**

NB: No data for Italy, as more than 80% of the data is lacking for this variable

Table 9_Annex2.5.-Distribution of users killed as a function of luminosity, age and country.

		Dry	Wet/Damp	Snow/Frost/Ice	Slippery
France[81]	Under 65 (1)	80,4	18,6	0,8	0,3
	Over 65 (2)	83,3	16,1	0,4	0,2
	(2)/(1)	**1,0**	**0,9**	**0,6**	**0,6**
Italy	Under 65 (1)	79,8	19,1	0,6	0,5
	Over 65 (2)	82,6	16,7	0,3	0,4
	(2)/(1)	**1,0**	**0,9**	**0,6**	**0,6**
Greece	Under 65 (1)	90,4	9,0	0,5	0,1
	Over 65 (2)	90,3	9,2	0,4	0,1
	(2)/(1)	**1,0**	**1,0**	**0,8**	**0,8**
GB[82]	Under 65 (1)	64,5	32,9	2,1	0,5
	Over 65 (2)	68,5	29,9	1,3	0,3
	(2)/(1)	**1,1**	**0,9**	**0,6**	**0,6**
Czech Republic	Under 65 (1)	69,8	23,6	6,5	0,1
	Over 65 (2)	73,0	23,2	3,8	0,0
	(2)/(1)	**1,0**	**1,0**	**0,6**	**0,4**
Spain	Under 65 (1)	83,1	15,3	0,4	1,1

[81] Uninjured included in non fatal for : France, Italy, Greece and Australia
[82] Uninjured not included in non fatal for : GB, Czech Republic, and Spain

	Over 65 (2)	86,3	12,9	0,2	0,6
	(2)/(1)	**1,0**	**0,8**	**0,5**	**0,5**
Mean value	Under 65 (1)	74,5	23,5	1,5	0,5
	Over 65 (2)	78,4	20,4	0,8	0,3
	(2)/(1)	**1,1**	**0,9**	**0,6**	**0,6**
Australia	Under 65 (1)	81,1	18,6	0,1	0,2
	Over 65 (2)	85,6	14,3	0,1	0,0
	(2)/(1)	**1,1**	**0,8**	**1,0**	**0,.2**

NB: No data for Germany, as 50% of the data is lacking for this variable

Table 10_Annex2.5.-Distribution of users injured as a function of road condition, gender and country

		Dry	Wet/Damp	Snow/Frost/Ice	Slippery
France	Under 65 (1)	78,4	20,0	1,3	0,3
	Over 65 (2)	80,5	18,7	0,7	0,1
	(2)/(1)	**1,0**	**0,9**	**0,5**	**0,4**
Italy	Under 65 (1)	80,5	17,5	1,0	1,0
	Over 65 (2)	75,6	21,9	1,2	1,2
	(2)/(1)	**0,9**	**1,2**	**1,2**	**1,2**
Greece	Under 65 (1)	86,2	12,3	1,6	0,0
	Over 65 (2)	90,7	8,6	0,7	0,0
	(2)/(1)	**1,1**	**0,7**	**0,5**	
GB	Under 65 (1)	65,3	32,9	1,6	0,2
	Over 65 (2)	65,1	34,1	0,6	0,1
	(2)/(1)	**1,0**	**1,0**	**0,4**	**0,7**
Czech Republic	Under 65 (1)	70,3	24,0	5,7	0,0
	Over 65 (2)	72,2	25,0	2,8	0,0
	(2)/(1)	**1,0**	**1,0**	**0,5**	
Spain	Under 65 (1)	81,0	17,5	0,6	0,9
	Over 65 (2)	86,2	12,5	0,3	1,0
	(2)/(1)	**1,1**	**0,7**	**0,5**	**1,1**
Mean value	Under 65 (1)	73,3	23,8	2,4	0,6
	Over 65 (2)	75,3	23,1	1,1	0,4
	(2)/(1)	**1,0**	**1,0**	**0,5**	**0,8**
Australia	Under 65 (1)	83,0	16,6	0,0	0,4
	Over 65 (2)	84,2	15,8	0,0	0,0
	(2)/(1)	**1,0**	**1,0**		**0,0**

NB: No data for Germany, as 50% of the data is lacking for this variable

Table 11_Annex2.5.-Distribution of users killed as a function of road condition, gender and country.

	France		Greece		Spain	
	Under 65	**Over 65**	**Under 65**	**Over 65**	**Under 65**	**Over 65**
Home/work-School	15,8	0,8	25,5	16,0	9,5	3,4
Leisure	50,1	74,2	11,4	8,8	36,5	39,1
Others	18,9	17,1	52,2	69,5	36,3	24,9
Professional use	13,6	1,1	10,9	5,7	17,8	32,7
Shopping	1,6	6,8	0,0	0,0	0,0	0,0

Table 12_Annex2.5.-Distribution of users in accidents as a function of the reason for travel, gender and country.

		Single vehicle	One vehicle and pedestrian	Two vehicles	Multiple collision
France	Under 65 (1)	11,0	14,6	61,3	13,1
	Over 65 (2)	6,6	32,0	51,8	9,5
	(2)/(1)	**0,6**	**2,2**	**0,8**	**0,7**
Italy	Under 65 (1)	7,2	6,9	69,6	16,4
	Over 65 (2)	4,0	19,6	64,2	12,2
	(2)/(1)	**0,6**	**2,9**	**0,9**	**0,7**
GB	Under 65 (1)	15,0	0,6	68,6	15,8
	Over 65 (2)	13,1	0,5	70,2	16,2
	(2)/(1)	**0,9**	**0,8**	**1,0**	**1,0**
Czech Republic	Under 65 (1)	34,5	0,7	57,2	7,5
	Over 65 (2)	21,1	0,7	72,0	6,3
	(2)/(1)	**0,6**	**0,9**	**1,3**	**0,8**
Germany	Under 65 (1)	18,9	1,0	66,3	13,8
	Over 65 (2)	15,5	1,2	72,6	10,6
	(2)/(1)	**0,8**	**1,3**	**1,1**	**0,8**
Spain	Under 65 (1)	25,3	10,0	60,0	4,7
	Over 65 (2)	12,9	45,7	38,7	2,7
	(2)/(1)	**0,5**	**4,6**	**0,6**	**0,6**
Mean value	Under 65 (1)	16,6	5,2	65,1	13,1
	Over 65 (2)	11,9	14,9	62,8	10,4
	(2)/(1)	**0,7**	**2,9**	**1,0**	**0,8**
Australia	Under 65 (1)	15,2	4,5	60,9	19,3
	Over 65 (2)	11,2	5,1	68,4	15,3
	(2)/(1)	**0,7**	**1,1**	**1,1**	**0,8**

Table 13_ Annex2.5.- Distribution of users injured as a function of type of accident, age and country.

		Single vehicle	One vehicle and pedestrian	Two vehicles	Multiple collision
France	Under 65 (1)	40,5	7,5	42,7	9,4
	Over 65 (2)	18,3	33,4	42,4	6,0
	(2)/(1)	**0,5**	**4,5**	**1,0**	**0,6**
Italy	Under 65 (1)	23,7	8,4	51,5	16,4
	Over 65 (2)	11,6	40,7	44,8	2,9
	(2)/(1)	**0,5**	**4,8**	**0,9**	**0,2**
GB	Under 65 (1)	32,9	0,3	47,3	19,5
	Over 65 (2)	17,6	0,4	64,2	17,8
	(2)/(1)	**0,5**	**1,3**	**1,4**	**0,9**
Czech Republic	Under 65 (1)	40,3	0,4	49,7	9,6
	Over 65 (2)	33,8	0,3	59,3	6,7
	(2)/(1)	**0,8**	**0,6**	**1,2**	**0,7**
Germany	Under 65 (1)	40,2	0,1	44,9	14,9
	Over 65 (2)	22,2	0,3	65,4	12,0
	(2)/(1)	**0,6**	**4,0**	**1,5**	**0,8**
Spain	Under 65 (1)	41,7	11,5	44,1	2,6
	Over 65 (2)	14,0	47,8	36,8	1,4
	(2)/(1)	**0,3**	**4,1**	**0,8**	**0,5**

Mean value	Under 65 (1)	39,5	4,8	44,6	11,1
	Over 65 (2)	18,9	22,9	50,4	7,8
	(2)/(1)	**0,5**	**4,7**	**1,1**	**0,5**
Australia	Under 65 (1)	48,1	0,1	42,5	9,3
	Over 65 (2)	29,1	0,0	66,4	4,5
	(2)/(1)	**0,6**	**0,0**	**1,6**	**0,5**

Table 14_Annex2.5.-Distribution of users killed as a function of type of accident, age and country.

	France			Italy			GB			Spain			Australia		
	Under 65 (1)	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**
Vehicle stopped	2,5	1,9	0,8	2,2	1,9	0,9	10,0	5,8	0,6	2,6	1,7	0,7			
Circulate in current section	8,8	6,4	0,7	15,7	14,2	0,9	54,4	50,9	0,9	66,2	60,6	0,9	45,7	42,1	0,9
Negotiate a curve	2,6	2,7	1,0	4,4	4,9	1,1	11,1	7,9	0,7				3,9	2,2	0,6
Overtaking-lane changing	3,0	2,1	0,7	1,4	0,5	0,4	6,4	4,3	0,7	4,6	2,4	0,5	23,5	21,4	0,9
Intersection										11,0	12,7	**1,2**	17,0	24,1	**1,4**
Priority in intersection	12,5	12,0	1,0	21,0	17,8	0,8	2,2	3,3	**1,5**						
Not priority in intersection	12,0	17,7	**1,5**	11,5	19,1	**1,7**	9,8	15,9	**1,6**						
Loss of control of the vehicle	15,9	12,8	0,8	3,1	1,4	0,5							2,3	0,5	0,2
Specific manoeuvre	4,9	7,8	**1,6**	3,9	6,0	**1,5**	6,0	11,9	**2,0**	12,5	19,7	**1,6**			
Others or unknown	37,8	36,5	1,0	36,8	34,1	0,9	0,1	0,1	1,1	3,0	2,9	1,0	7,6	9,6	**1,3**

Table 15_Annex2.5.-Distribution of users injured as a function of age, pre-accident manoeuvre and country.

	France			Italy			GB			Spain			Australia		
	Under 65 (1)	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**	**Under 65 (1)**	**Over 65 (2)**	**(2)/(1)**
Vehicle stopped	0,5	0,3	0,5	0,8	0,0	-	1,2	1,0	0,8	0,5	0,5	0,9	0,0	0,0	
Circulate in current section	6,8	6,3	0,9	14,4	14,5	1,0	56,2	64,2	1,1	79,4	58,9	0,7	64,1	58,7	0,9
Negotiate a curve	2,6	2,8	1,1	1,1	6,2	**5,7**	28,1	11,2	0,4				14,6	7,0	0,5
Overtaking-lane changing	2,4	1,5	0,6	3,4	1,4	0,4	10,0	3,6	0,4	6,1	3,0	0,5	8,4	8,9	1,1
Intersection										3,4	15,9	**4,6**	7,4	17,8	**2,4**
Priority in intersection	5,2	12,6	**2,4**	13,6	6,9	0,5	0,6	2,3	**3,9**						
Not priority in intersection	4,8	13,3	**2,8**	4,2	13,8	**3,3**	2,2	10,6	**4,7**						
Loss of control of the vehicle	56,4	38,5	0,7	8,2	1,4	0,2							2,5	0,9	0,4
Specific manoeuvre	1,5	5,8	**3,9**	1,5	2,1	**1,3**	1,6	7,1	**4,5**	6,0	18,0	**3,0**	0,0	0,0	
Others or unknown	19,9	19,0	1,0	52,9	53,8	1,0	0,1	0,1	**1,5**	4,6	3,8	0,8	3,0	6,6	**2,2**

Table 16_Annex2.5.-Distribution of users killed as a function of age, pre-accident manoeuvre and country.

		Front	Rear	Lateral	Multiple
France	Under 65 (1)	71,6	15,0	11,2	2,2
	Over 65 (2)	71,2	13,7	13,9	1,2
	(2)/(1)	1,0	0,9	**1,2**	0,5
Italy	Under 65 (1)	23,9	17,2	58,5	0,5
	Over 65 (2)	19,4	12,2	68,4	0,0
	(2)/(1)	0,8	0,7	**1,2**	0,0
UK	Under 65 (1)	65,4	4,5	30,1	0,0
	Over 65 (2)	56,3	16,6	27,2	0,0
	(2)/(1)	0,9	**3,7**	0,9	
Czech Republic	Under 65 (1)	42,2	11,1	31,9	14,7
	Over 65 (2)	28,7	9,9	51,8	9,6
	(2)/(1)	0,7	0,9	**1,6**	0,7
Europe	Under 65 (1)	66,9	5,5	23,3	4,3
	Over 65 (2)	57,9	7,5	31,3	3,2
	(2)/(1)	0,9	**1,4**	**1,3**	0,8
Australia	Under 65 (1)	53,8	12,9	33,3	0,0
	Over 65 (2)	49,5	12,1	38,4	0,0
	(2)/(1)	0,9	0,9	**1,2**	

NB: No data for Greece, Spain and Germany as nearly 70% of the data are "others" or missing for this variable

Table 17_Annex2.5.-Distribution of users injured as a function of the type of collision, gender and country.

		Front	Rear	Lateral	Multiple
France	Under 65 (1)	70,5	4,9	19,4	5,1
	Over 65 (2)	61,7	6,8	27,6	3,9
	(2)/(1)	0,9	**1,4**	**1,4**	0,8
Italy	Under 65 (1)	23,9	17,2	58,5	0,5
	Over 65 (2)	19,4	12,2	68,4	0,0
	(2)/(1)	0,8	0,7	**1,2**	0,0
UK	Under 65 (1)	65,4	4,5	30,1	0,0
	Over 65 (2)	57,9	7,0	35,1	0,0
	(2)/(1)	0,9	**1,6**	**1,2**	
Czech Republic	Under 65 (1)	42,2	11,1	31,9	14,7
	Over 65 (2)	28,7	9,9	51,8	9,6
	(2)/(1)	0,7	0,9	**1,6**	0,7
Europe	Under 65 (1)	66,9	5,5	23,3	4,3
	Over 65 (2)	57,9	7,5	31,3	3,2
	(2)/(1)	0,9	**1,4**	**1,3**	0,8
Australia	Under 65 (1)	55,2	2,6	42,2	0,0
	Over 65 (2)	42,9	4,8	52,4	0,0
	(2)/(1)	0,8	**1,8**	**1,2**	

NB: No data for Greece, Spain and Germany as nearly 70% of the data are "others" or missing for this variable

Table 18_Annex2.5.-Distribution of users killed as a function of the type of collision, gender and country.

		During the week days	During the week ends
France	Under 65 (1)	66,7	33,3
	Over 65 (2)	69,9	30,1
	(2)/(1)	1,0	0,9
Italy	Under 65 (1)	74,2	25,8
	Over 65 (2)	78,8	21,2
	(2)/(1)	**1,1**	0,8
Greece	Under 65 (1)	65,8	34,2
	Over 65 (2)	67,9	32,1
	(2)/(1)	1,0	0,9
UK	Under 65 (1)	70,1	29,9
	Over 65 (2)	74,0	26,0
	(2)/(1)	**1,1**	0,9
Germany	Under 65 (1)	72,4	27,6
	Over 65 (2)	76,7	23,3
	(2)/(1)	**1,1**	0,8
Spain	Under 65 (1)	71,6	28,4
	Over 65 (2)	76,6	23,4
	(2)/(1)	**1,1**	0,8
Europe	Under 65 (1)	70,8	29,2
	Over 65 (2)	74,8	25,2
	(2)/(1)	**1,1**	0,9
Australia	Under 65 (1)	66,4	33,6
	Over 65 (2)	72,4	27,6
	(2)/(1)	**1,1**	0,8

NB: No data for the Czech Republic for this variable

Table 19_Annex2.5.-Distribution of users injured as a function of the moment of the week, age and country.

		During the week days	During the week ends
France	Under 65 (1)	57,0	43,0
	Over 65 (2)	70,2	29,8
	(2)/(1)	**1,2**	0,7
Italy	Under 65 (1)	61,7	38,3
	Over 65 (2)	76,2	23,8
	(2)/(1)	**1,2**	0,6
Greece	Under 65 (1)	63,1	36,9
	Over 65 (2)	61,6	38,4
	(2)/(1)	1,0	1,0
UK	Under 65 (1)	59,6	40,4
	Over 65 (2)	73,3	26,7
	(2)/(1)	**1,2**	0,7
Germany	Under 65 (1)	62,5	37,5
	Over 65 (2)	75,1	24,9

	(2)/(1)	**1,2**	0,7
Spain	Under 65 (1)	64,2	35,8
	Over 65 (2)	75,7	24,3
	(2)/(1)	**1,2**	0,7
Europe	Under 65 (1)	60,7	39,3
	Over 65 (2)	73,2	26,8
	(2)/(1)	**1,2**	0,7
Australia	Under 65 (1)	54,6	45,4
	Over 65 (2)	75,6	24,4
	(2)/(1)	**1,4**	0,5

NB: No data for the Czech Republic for this variable

Table 20_Annex2.5.-Distribution of users killed as a function of the moment of the week, age and country.

14.5.2 Gender issues

	% of accidented (1)	**% of population (2)**	**Relative rate (1)/(2)**
France	73,7	48,6	1,52
Italy	77,4	48,4	1,60
GB	64,6	48,8	1,32
Czech Republic	73,5	48,1	1,53
Germany	62,1	48,5	1,28
Greece	84,0	49,6	1,69
Spain	76,2	49,2	1,55
Mean value	**67,9**	**48,7**	**1.39**
Australia	63,3	49,3	1,28

Table 21_Annex2.5.-Proportion of male users injured by country.

	% of accidented (1)	**% of population (2)**	**Relative rate (1)/(2)**
France	26,3	51,4	0,51
Italy	22,6	51,6	0,44
GB	35,4	51,2	0,69
Czech Republic	26,5	51,9	0,51
Germany	37,9	51,5	0,74
Greece	16,0	50,4	0,32
Spain	23,8	50,8	0,47
Mean value	**32,1**	**51,3**	**0.63**
Australia	36,7	50,7	0,72

Table 22_Annex2.5.-Proportion of female users injured by country.

	Both	Male	Female
France	8.1	6.7	11.6
Italy	6.3	5.7	8.0
GB	6.1	5.8	6.7
Czech Republic	7.5	6.4	10.6
Germany	7.9	7.3	8.8
Greece	10.5	8.9	18.0
Spain	6.7	6.2	8.2
Mean value	**7.3**	**6.6**	**8.5**
Australia	7.7	7.8	7.7

Table 23_Annex2.5.-Proportion of Male and Female over 65 years injured on the road between 2001 and 2004.

	% of fatal (1)	% of population (2)	Relative rate (1)/(2)
France	80,7	48,6	1,66
Italy	84,1	48,4	1,74
GB	79,7	48,8	1,63
Czech Republic	82,6	48,1	1,72
Germany	77,3	48,5	1,59
Greece	85,3	49,6	1,72
Spain	85,9	49,2	1,75
Mean value	**80,7**	**48,7**	**1.66**
Australia	78,1	49,3	1,58

Table 24_Annex2.5.-Proportion of male users killed by country.

	% of fatal (1)	% of population (2)	Relative rate (1)/(2)
France	19,3	51,4	0,38
Italy	15,9	51,6	0,31
GB	20,3	51,2	0,40
Czech Republic	17,4	51,9	0,34
Germany	22,7	51,5	0,44
Greece	14,7	50,4	0,29
Spain	14,1	50,8	0,28
Mean value	**19,3**	**51,3**	**0,38**
Australia	21,9	50,7	0,43

Table 25_Annex2.5.-Proportion of female users killed by country.

	Both	Male (1)	Female (2)	Relative rate(2)/(1)
France	**17.2**	14.7	27.8	1,9
Italy	**20.8**	18.2	34.2	1,9
GB	18.5	14.7	33.2	**2,3**
Czech Republic	18.5	15.8	31.8	2,0
Germany	19.7	15.8	32.9	2,1
Greece	**20.7**	18.5	33.3	1,8
Spain	15.3	13.5	26.2	1,9
Mean value	**18.6**	**15.3**	**31.3**	**2,0**
Australia	18.2	14.3	32.0	2,2

Table 26_Annex2.5.-Proportion of road users over 65 years killed on the road as a function of Gender between 2001 and 2004.

	Car	Goods road vehicle	Motorcycle	Moped	Bicycle	Motor-coach bus	Pedestrian	Other
France	**54,6**	**3,5**	**19,1**	**8,1**	**4,0**	0,0	9,8	0,8
Italy	**36,1**	4,8	**22,7**	**9,3**	10,7	0,3	13,6	2,5
GB	40,8	**4,2**	**25,3**	**0,8**	**4,9**	0,2	23,1	0,7
Czech Rep	46,9	4,4	**10,0**	**1,0**	13,6	0,5	23,0	0,6
Germany	50,2	4,6	**20,3**	**2,7**	9,5	0,1	11,6	1,1
Greece	40,7	5,7	**28,5**	**4,4**	**2,1**	0,0	14,8	3,9
Spain	51,7	**10,6**	**10,2**	**8,7**	**2,6**	0,1	14,4	1,7
Mean value	49,7	5,4	**18,3**	**5,2**	6,0	0,1	14,1	1,1
Australia	54,4	5,8	**19,8**	**0,0**	2,5	0,1	16,1	1,3

Table 27_Annex2.5.-Percentage of men killed as a function of the mode of travel and country between 2001 and 2004.

	Car	Goods road vehicle	Motorcycle	Moped	Bicycle	Motor-coach bus	Pedestrian	Other
France	**64,5**	**0,5**	2,2	2,9	3,5	0,0	**26,0**	0,5
Italy	28,5	2,1	2,1	3,6	**13,0**	0,0	**50,3**	0,5
GB	45,3	**0,4**	3,0	0,4	4,1	0,1	**46,0**	0,7
Czech Rep	31,0	1,1	0,9	0,5	**14,5**	0,0	**51,9**	0,1
Germany	50,3	0,6	2,7	1,0	**14,7**	0,0	**30,2**	0,5
Greece	**25,0**	1,0	4,7	1,6	0,5	0,0	**66,1**	1,0
Spain	47,5	**2,9**	1,4	4,4	1,0	0,0	**42,2**	0,6
Mean value	51,5	0,9	2,3	1,9	7,8	0,0	**35,0**	0,5
Australia	60,9	0,4	3,1	0,0	1,2	0,0	**32,8**	1,6

Table 28_Annex2.5.-Percentage of women killed as a function of the mode of travel and country between 2001 and 2004.

	Car	Goods road vehicle	Motorcycle	Moped	Bicycle	Motor-coach bus	Pedestrian	Other
France	78,0	97,0	97,4	92,1	82,9	100,0	61,1	88,5
Italy	87,0	92,5	98,3	93,1	81,3	100,0	58,9	96,2
GB	77,9	97,4	97,1	90,2	82,3	85,7	66,3	81,3
Greece	90,4	97,0	97,2	94,2	95,8	0,0	56,5	95,6
Germany	77,2	96,1	96,3	89,8	68,7	88,9	56,6	88,2
Czech Republic	87,8	95,1	98,1	90,2	81,7	100,0	67,8	95,5
Spain	86,9	95,7	97,8	92,4	93,9	100,0	67,6	94,1
Mean value	**80,2**	**96,2**	**97,1**	**91,9**	**76,4**	**93,4**	**62,8**	**90,0**
Australia	76,1	98,1	95,8	0,0	88,5	100,0	63,6	75,0

Table 29_Annex2.5.-Proportion of men killed as a function of the mode of travel.

	Car	Goods road vehicle	Motorcycle	Moped	Bicycle	Motor-coach bus	Pedestrian	Other
France	22,0	3,0	2,6	7,9	17,1	0,0	38,9	11,5
Italy	13,0	7,5	1,7	6,9	18,7	0,0	41,1	3,8
GB	22,1	2,6	2,9	9,8	17,7	14,3	33,7	18,8
Greece	9,6	3,0	2,8	5,8	4,2	0,0	43,5	4,4
Germany	22,8	3,9	3,7	10,2	31,3	11,1	43,4	11,8
Czech Republic	12,2	4,9	1,9	9,8	18,3	0,0	32,2	4,5
Spain	13,1	4,3	2,2	7,6	6,1	0,0	32,4	5,9
Mean value	**19,8**	**3,8**	**2,9**	**8,1**	**23,6**	**6,6**	**37,2**	**10,0**
Australia	23,9	1,9	4,2	0,0	11,5	0,0	36,4	25,0

Table 30_Annex2.5.-Proportion of women killed as a function of the mode of travel.

		Daylight	**Dawn or dusk**	**Darkness**
France[83]	Male (1)	68,7	5,7	25,7
	Female (2)	76,1	5,2	18,8
	(1)/(2)	0,9	1,1	**1,4**
Greece	Male (1)	65,4	0,0	34,6
	Female (2)	73,6	0,0	26,4
	(1)/(2)	0,9		**1,3**
GB[84]	Male (1)	69,8	0,0	30,2
	Female (2)	77,6	0,0	22,4
	(1)/(2)	0,9		**1,3**
Czech Republic	Male (1)	67,6	3,7	28,7
	Female (2)	75,1	3,6	21,3
	(1)/(2)	0,9	1,0	**1,3**
Germany	Male (1)	70,3	5,3	24,4
	Female (2)	76,5	5,1	18,4
	(1)/(2)	0,9	1,0	**1,3**
Spain	Male (1)	63,2	4,4	32,4
	Female (2)	71,5	4,1	24,4
	(1)/(2)	0,9	1,1	**1,3**
Mean value	Male (1)	68,8	3,9	27,3
	Female (2)	76,3	3,7	20,1
	(1)/(2)	0,9	1,1	**1,4**
Australia	Male (1)	65,3	8,7	26,0
	Female (2)	72,5	7,5	20,0
	(1)/(2)	0,9	1,2	**1,3**

NB: No data for Italy, as more than 80% of the data is lacking for this variable

Table 31_Annex2.5.-Distribution of users injured as a function of luminosity, gender and country.

83 Not injured included in non fatal for : France, Greece and Australia
84 Not injured not included in non fatal for : UK, Czech Republic, Germany and Spain

		Daylight	Dawn or dusk	Darkness
France	Male (1)	53,6	6,5	**39,9**
	Female (2)	67,5	6,1	26,4
	(1)/(2)	0,8	1,1	**1,5**
Greece	Male (1)	55,4	0,0	**44,6**
	Female (2)	**59,9**	0,0	40,1
	(1)/(2)	**0,9**		**1,1**
GB	Male (1)	56,9	0,0	**43,1**
	Female (2)	67,5	0,0	32,5
	(1)/(2)	0,8		**1,3**
Czech Republic	Male (1)	55,2	4,5	**40,3**
	Female (2)	**62,1**	4,2	33,8
	(1)/(2)	**0,9**	1,1	**1,2**
Germany	Male (1)	58,1	5,5	**36,5**
	Female (2)	**65,5**	5,5	29,0
	(1)/(2)	**0,9**	1,0	**1,3**
Spain	Male (1)	52,4	5,6	**42,0**
	Female (2)	61,9	5,6	32,5
	(1)/(2)	0,8	1,0	**1,3**
Mean value	Male (1)	55,3	4,8	**39,9**
	Female (2)	65,7	4,7	29,7
	(1)/(2)	0,8	1,0	**1,3**
Australia	Male (1)	44,1	11,6	**44,3**
	Female (2)	**63,6**	9,9	26,5
	(1)/(2)	**0,7**	1,2	**1,7**

Table 32_Annex2.5.-Distribution of users killed as a function of luminosity, gender and country.

		Dry	Wet/Damp	Snow/Frost/Ice	Slippery
France[85]	Male (1)	81,2	**17,9**	0,7	0,3
	Female (2)	79,0	**19,9**	0,9	0,2
	(1)/(2)	**1,0**	**0,9**	0,8	1,1
Italy	Male (1)	80,0	**18,9**	0,5	0,6
	Female (2)	78,8	**20,1**	0,6	0,4
	(1)/(2)	**1,0**	**0,9**	0,8	1,3
Greece	Male (1)	90,0	**9,3**	0,6	0,1
	Female (2)	91,6	**7,9**	0,5	0,1
	(1)/(2)	**1,0**	**1,2**	1,3	1,2
GB[86]	Male (1)	65,8	**31,8**	**1,9**	0,5
	Female (2)	63,4	**33,9**	**2,2**	0,4
	(1)/(2)	**1,0**	**0,9**	**0,9**	1,1
Czech Republic	Male (1)	70,9	**23,1**	**5,9**	0,1
	Female (2)	67,8	**24,9**	**7,3**	0,1
	(1)/(2)	**1,0**	**0,9**	**0,8**	1,7
Spain	Male (1)	83,5	**14,9**	0,4	1,2
	Female (2)	82,8	**15,9**	0,4	0,9
	(1)/(2)	**1,0**	**0,9**	1,1	1,3
Mean value	Male (1)	76,0	**22,2**	1,3	0,5
	Female (2)	72,1	**25,8**	1,6	0,4

	(1)/(2)	**1,0**	**0,9**	0,8	2,9
Australia	Male (1)	81,9	**17,8**	0,1	0,2
	Female (2)	80,8	**19,1**	0,1	0,1
	(1)/(2)	**1,0**	**0,9**	1,2	2,9

NB: No data for Germany, as 50% of the data is lacking for this variable

Table 33_Annex2.5.-Distribution of users injured as a function of road condition, gender and country.

		Dry	Wet/Damp	Snow/Frost/Ice	Slippery
France	Male (1)	80,1	**18,6**	1,1	0,2
	Female (2)	73,3	**24,5**	1,8	0,4
	(1)/(2)	**1,1**	**0,8**	0,6	0,5
Italy	Male (1)	80,7	17,6	0,7	0,9
	Female (2)	73,8	23,5	1,6	1,1
	(1)/(2)	**1,1**	0,7	0,4	0,8
Greece	Male (1)	87,0	**11,7**	1,4	0,0
	Female (2)	88,5	**9,9**	1,6	0,0
	(1)/(2)	**1,0**	**1,2**	0,9	
GB	Male (1)	66,6	31,9	1,4	0,2
	Female (2)	60,2	38,1	1,5	0,3
	(1)/(2)	**1,1**	0,8	0,9	0,7
Czech Republic	Male (1)	71,2	23,9	4,9	0,0
	Female (2)	68,7	25,0	6,3	0,0
	(1)/(2)	**1,0**	1,0	0,8	
Spain	Male (1)	82,1	**16,4**	0,6	1,0
	Female (2)	80,3	**18,7**	0,3	0,6
	(1)/(2)	**1,0**	**0,9**	1,8	1,5
Mean value	Male (1)	77,3	21,0	1,3	0,4
	Female (2)	71,5	26,3	1,8	0,4
	(1)/(2)	**1,1**	0,8	0,7	1,0
Australia	Male (1)	83,4	16,3	0,0	0,3
	Female (2)	83,1	16,9	0,0	0,0
	(1)/(2)	**1,0**	1,0		

Table 34_Annex2.5.-Distribution of users killed as a function of road condition, gender and country.

	France		**Greece**		**Spain**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Leisure	51,8	52,5	11,9	7,5	37,3	33,8
Professional use	**15,1**	**5,6**	**11,5**	**4,7**	**20,0**	**13,6**
Home/work-School	**13,7**	**17,3**	**25,6**	**19,7**	**9,0**	**9,5**
Shopping	1,4	3,7	0,0	0,0	0,0	0,0
Others	17,9	20,9	51,1	68,1	33,7	43,1

Table 35_Annex2.5.-Distribution of users in accidents as a function of the reason for travel, gender and country.

		Single vehicle	One vehicle and pedestrian	Two vehicles	Multiple collision
France[87]	Male (1)	12,5	13,2	61,6	12,7
	Female (2)	8,8	22,9	55,6	12,7
	(1)/(2)	1,4	0,6	1,1	1,0
Italy	Male (1)	8,1	5,9	67,2	18,8
	Female (2)	6,6	11,9	64,9	16,6
	(1)/(2)	1,2	0,5	1,0	1,1
Greece[88]	Male (1)	0,0	20,9	68,3	10,8
	Female (2)	0,0	16,7	70,7	12,6
	(1)/(2)		1,3	1,0	0,9
GB	Male (1)	17,1	0,7	67,5	14,8
	Female (2)	11,2	0,5	70,7	17,7
	(1)/(2)	1,5	1,4	1,0	0,8
Czech Republic	Male (1)	35,4	0,8	56,5	7,4
	Female (2)	29,6	0,5	61,9	8,0
	(1)/(2)	1,2	1,5	0,9	0,9
Germany	Male (1)	21,0	1,1	65,0	12,9
	Female (2)	15,3	0,9	69,0	14,8
	(1)/(2)	1,4	1,2	0,9	0,9
Spain	Male (1)	26,9	9,2	59,6	4,3
	Female (2)	17,6	24,9	52,4	5,1
	(1)/(2)	1,5	0,4	1,1	0,8
Mean value	Male (1)	18,0	5,3	64,1	12,6
	Female (2)	13,1	7,4	65,3	14,2
	(1)/(2)	1,4	0,7	1,0	0,9
Australia[2]	Male (1)	17,2	4,6	59,8	18,4
	Female (2)	11,6	4,4	64,1	19,9
	(1)/(2)	1,5	1,1	0,9	0,9

Table 36_Annex2.5.-Distribution of users injured as a function of type of accident, gender and country.

		Single vehicle	One vehicle and pedestrian	Two vehicles	Multiple collision
France	Male (1)	39,7	8,9	42,8	8,6
	Female (2)	24,0	24,8	41,8	9,4
	(1)/(2)	1,7	0,4	1,0	0,9
Italy	Male (1)	22,0	12,5	48,3	17,2
	Female (2)	7,7	48,1	35,0	9,3
	(1)/(2)	2,9	0,3	1,4	1,9
Greece	Male (1)	0,0	43,3	49,2	7,5
	Female (2)	0,0	41,5	40,0	18,5
	(1)/(2)		1,0	1,2	0,4
GB	Male (1)	32,3	0,4	48,1	19,2
	Female (2)	22,7	0,2	57,4	19,8
	(1)/(2)	1,4	2,1	0,8	1,0
Czech Republic	Male (1)	40,5	0,4	49,7	9,4
	Female (2)	31,2	0,3	60,2	8,4

	(1)/(2)	1,3	1,5	0,8	1,1
Germany	Male (1)	39,2	0,1	46,1	14,6
	Female (2)	30,4	0,3	55,6	13,7
	(1)/(2)	1,3	0,3	0,8	1,1
Spain	Male (1)	39,7	13,9	43,9	2,5
	Female (2)	20,0	41,5	36,2	2,3
	(1)/(2)	2,0	0,3	1,2	1,1
Mean value	Male (1)	37,7	6,7	45,1	10,5
	Female (2)	25,0	16,8	47,4	10,7
	(1)/(2)	1,5	0,4	1,0	1,0
Australia	Male (1)	46,7	0,1	45,2	7,9
	Female (2)	39,7	0,0	48,9	11,5
	(1)/(2)	1,2		0,9	0,7

Table 37_Annex2.5.-Distribution of users killed as a function of type of accident, gender and country.

	France		Italy		GB		Spain		Australia	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Vehicle stopped	2,2	3,1	2,1	2,4	8,2	12,4	2,3	3,5	0,0	0,0
Circulate in current section	9,0	7,6	16,5	15,8	56,4	50,5	67,0	62,0	45,8	45,0
Negotiate a curve	2,7	2,6	3,9	4,8	11,9	8,9	0,0	0,0	4,2	3,1
Overtaking-lane changing	3,2	2,1	1,4	0,8	7,3	4,5	4,8	3,7	22,7	24,3
Intersection							10,7	12,5	16,5	19,1
Priority in intersection	12,1	13,4	20,2	21,4	2,2	2,5				
Not priority in intersection	12,1	13,4	10,4	13,3	8,5	13,0	0,0	0,0	0,0	0,0
Loss of control of the vehicle	16,4	13,6	2,8	2,6	0,0	0,0	0,0	0,0	2,9	0,8
Specific manoeuvre	4,8	6,0	3,6	4,5	5,4	8,0	12,1	15,3	0,0	0,0
Others or unknown	37,5	38,2	39,0	34,3	0,1	0,1	3,1	2,9	7,9	7,6

Table 38_Annex2.5.-Distribution of users injured as a function of gender, pre-accident manoeuvre and country.

	France		Italy		GB		Spain		Australia	
	Male	**Femal e**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Vehicle stopped	0,5	0,5	1,2	1,0	1,1	1,3	0,5	0,6	0,0	0,0
Circulate in current section	6,6	7,1	12,3	19,8	57,3	59,7	77,5	75,3	60,5	71,9
Negotiate a curve	2,4	3,6	**1,8**	**1,0**	**26,3**	**19,4**	0,0	0,0	**15,6**	**5,1**
Overtaking-lane changing	2,4	1,9	2,5	5,2	9,3	6,8	5,6	7,1	9,4	5,1
Intersection							**4,6**	**4,9**	**8,1**	**13,7**
Priority in	**6,0**	**6,8**	**12,5**	**12,5**	**0,8**	**1,3**				

intersection										
Not priority in intersection	**6,0**	**5,8**	**5,4**	**7,3**	**3,1**	**6,3**				
Loss of control of the vehicle	**54,6**	**51,4**	**6,2**	**4,2**	0,0	0,0	0,0	0,0	**2,6**	**0,8**
Specific manoeuvre	1,9	2,7	1,1	3,1	1,9	5,3	7,1	8,0	0,0	0,0
Others or unknown	19,7	20,1	56,9	45,8	0,1	0,0	4,7	4,1	3,7	3,5

Table 39_Annex2.5.-Distribution of users killed as a function of gender, pre-accident manoeuvre and country.

		Front	Rear	Lateral	Multiple
France[89]	Male (1)	72,3	13,7	11,6	2,4
	Female (2)	69,1	17,5	11,6	1,7
	(1)/(2)	1,0	0,8	1,0	1,4
Italy	Male (1)	5,0	20,3	66,9	7,8
	Female (2)	4,7	22,2	66,8	6,2
	(1)/(2)	1,1	0,9	1,0	1,3
GB[90]	Male (1)	56,0	18,9	25,1	0,0
	Female (2)	47,1	29,0	23,9	0,0
	(1)/(2)	1,2	0,7	1,1	
Czech Republic	Male (1)	27,2	15,2	46,5	11,1
	Female (2)	21,5	18,6	49,0	10,9
	(1)/(2)	1,3	0,8	0,9	1,0
Mean value	Male (1)	54,9	16,7	25,9	2,5
	Female (2)	49,8	24,1	24,6	1,5
	(1)/(2)	1,1	0,7	1,1	1,6
Australia	Male (1)	54,1	13,1	32,8	0,0
	Female (2)	48,4	19,0	32,6	0,0
	(1)/(2)	1,1	0,7	1,0	

NB: No data for Greece, Spain and Germany as nearly 70% of the data are "others" or missing for this variable

Table 40_Annex2.5.-Distribution of users injured as a function of the type of collision, gender and country.

		Front	Rear	Lateral	Multiple
France[91]	Male (1)	70,5	5,2	19,2	5,2
	Female (2)	63,3	5,3	27,5	3,9
	(1)/(2)	1,1	1,0	0,7	1,3
Italy	Male (1)	20,0	14,4	59,4	6,2
	Female (2)	41,9	12,2	44,6	1,4
	(1)/(2)	0,5	1,2	1,3	4,6
GB[92]	Male (1)	65,7	4,8	29,5	0,0
	Female (2)	58,4	4,7	37,0	0,0
	(1)/(2)	1,1	1,0	0,8	
Czech Republic	Male (1)	40,8	11,1	33,6	14,4
	Female (2)	38,0	10,0	41,0	11,1
	(1)/(2)	1,1	1,1	0,8	1,3

Mean value	Male (1)	65,7	5,8	24,1	4,4
	Female (2)	60,1	5,5	31,2	3,2
	(1)/(2)	1,1	1,0	0,8	1,4
Australia	Male (1)	54,6	4,0	41,4	0,0
	Female (2)	45,6	3,1	51,3	0,0
	(1)/(2)	1,2		0,8	

Table 41_Annex2.5.-Distribution of users killed as a function of the type of collision, gender and country.

		During the week days	**During the week ends**
France	Male (1)	65,3	34,7
	Female (2)	70,5	29,5
	(1)/(2)	0,9	1,2
Italy	Male (1)	72,6	27,4
	Female (2)	78,8	21,2
	(1)/(2)	0,9	1,3
Greece	Male (1)	65,5	34,5
	Female (2)	67,9	32,1
	(1)/(2)	1,0	1,1
GB	Male (1)	68,5	31,5
	Female (2)	73,5	26,5
	(1)/(2)	0,9	1,2
Germany	Male (1)	70,3	29,7
	Female (2)	76,5	23,5
	(1)/(2)	0,9	1,3
Spain	Male (1)	70,0	30,0
	Female (2)	77,2	22,8
	(1)/(2)	0,9	1,3
Mean value	Male (1)	69,0	31,0
	Female (2)	74,9	25,1
	(1)/(2)	0,9	1,2
Australia	Male (1)	64,6	35,4
	Female (2)	70,6	29,4
	(1)/(2)	0,9	1,2

NB: No data for the Czech Republic for this variable

Table 42_Annex2.5.-Distribution of users injured as a function of the day of the week, gender and country.

		During the week days	**During the week ends**
France	Male (1)	57,5	42,5
	Female (2)	67,1	32,9
	(1)/(2)	0,9	1,3
Italy	Male (1)	64,9	35,1
	Female (2)	67,9	32,1
	(1)/(2)	1,0	1,1
Greece	Male (1)	62,1	37,9
	Female (2)	66,1	33,9
	(1)/(2)	0,9	1,1

GB	Male (1)	60,5	39,5
	Female (2)	68,8	31,2
	(1)/(2)	0,9	1,3
Germany	Male (1)	62,6	37,4
	Female (2)	72,9	27,1
	(1)/(2)	0,9	1,4
Spain	Male (1)	64,8	35,2
	Female (2)	72,9	27,1
	(1)/(2)	0,9	1,3
Mean value	Male (1)	61,2	38,8
	Female (2)	70,3	29,7
	(1)/(2)	0,9	1,3
Australia	Male (1)	56,5	43,5
	Female (2)	65,6	34,4
	(1)/(2)	0,9	1,3

Table 43_Annex2.5.-Distribution of users killed as a function of the day of the week, gender and country.