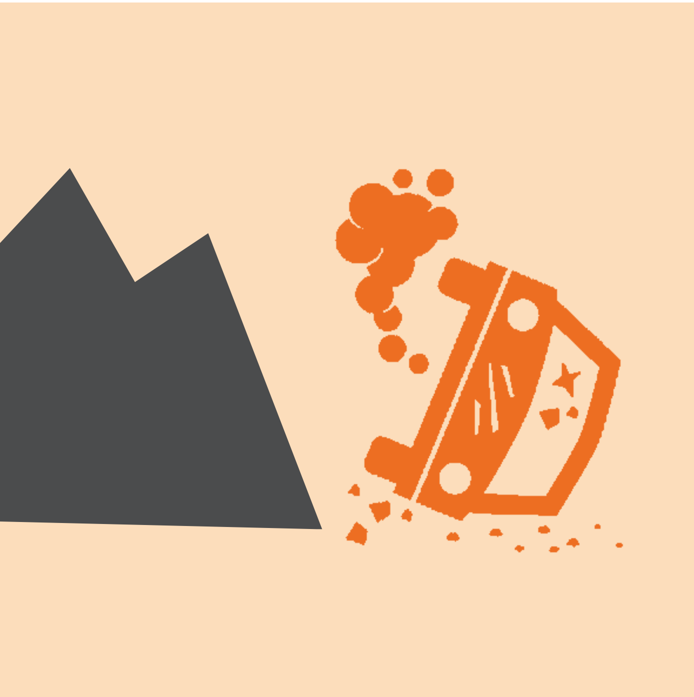
REDUCING DEATHS IN SINGLE VEHICLE COLLISIONS

PIN Flash Report 32

April 2017



European Transport Safety Council

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REDUCING DEATHS IN SINGLE VEHICLE COLLISIONS*

**The definition of fatal single motor vehicle collisions (SVCs) used in this report covers collisions involving only one motor vehicle when the driver, rider and/or passengers were killed but no pedestrian or cyclist was involved.*

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The PIN programme relies on panellists in the participating countries to provide data for their countries and to carry out quality assurance of the figures provided. This forms the basis for the PIN Flash reports and other PIN publications. In addition, all PIN panellists are involved in the review process of the reports to ensure the accuracy and reliability of the findings.

ETSC is grateful for the financial support for the PIN programme provided by Toyota Motor Europe, Volvo Group, the Swedish Transport Administration, the German Road Safety Council and the Norwegian Public Roads Administration.

ABOUT THE EUROPEAN TRANSPORT SAFETY COUNCIL (ETSC)

ETSC is a Brussels-based independent non-profit organisation dedicated to reducing the numbers of deaths and injuries in transport in Europe. Founded in 1993, ETSC provides an impartial source of expert advice on transport safety matters to the European Commission, the European Parliament and member states. It maintains its independence through funding from a variety of sources including membership subscriptions, the European Commission, and public and private sector support.

ABOUT THE ROAD SAFETY PERFORMANCE INDEX PROJECT

ETSC's Road Safety Performance Index (PIN) programme was set up in 2006 as a response to the first road safety target set by the European Union to halve road deaths between 2001 and 2010. In 2010, the European Union renewed its commitment to reduce road deaths by 50% by 2020, compared to 2010 levels.

By comparing Member State performance, the PIN serves to identify and promote best practice and inspire the kind of political leadership needed to deliver a road transport system that is as safe as possible.

The PIN covers all relevant areas of road safety including road user behaviour, infrastructure and vehicles, as well as road safety policymaking. Each year ETSC publishes PIN 'Flash' reports on specific areas of road safety. A list of topics covered by the PIN programme can be found on http://etsc.eu/projects/pin/.

Reducing deaths in single vehicle collisions is the 32nd PIN Flash report. The report covers 32 countries: the 28 member states of the European Union together with Israel, Norway, the Republic of Serbia and Switzerland.

CONTENTS

SINGLE VEHICLE COLLISIONS*

(SVCS) = 1/3 OF ROAD DEATHS IN THE EU

94,800

PEOPLE DIED IN SVCS IN THE LAST TEN YEARS

60%

OF SINGLE VEHICLE COLLISIONS OCCUR ON RURAL ROADS

THE MAJORITY OF DEATHS IN SVCS ARE CAR OCCUPANTS

MOTORCYCLIST DEATHS ARE DISPROPORTIONATELY HIGH

OCCUPANTS OF GOODS VEHICLES BELOW 3.5 TONNES AND HGVS ACCOUNT FOR 7% OF SVC DEATHS

BUS AND COACH OCCUPANTS FOR LESS THAN 1%

18-24 YEARS

2X

25-49 YEARS

RISK OF GETTING INVOLVED IN A FATAL COLLISION

IS TWICE AS HIGH FOR THE 18-24 AGE GROUP, COMPARED TO THE 25-49 AGE GROUP

MAIN CAUSES OF SVCS

DISTRACTION

DRINK DRIVING

FATIGUE

SPEED

**The definition of fatal single motor vehicle collisions (SVCs) covers collisions involving only one motor vehicle when the driver, rider and/or passengers were killed but no pedestrian or cyclist was involved.*

EXECUTIVE SUMMARY

A third of road deaths in the EU are caused by collisions that involve a single motorised vehicle where the driver, rider and/or passengers are killed but no other road users are involved. These single vehicle collisions (SVCs), and how to prevent them occurring, are the subject of this report.

Nearly 7300 road users lost their lives in 2015 in SVCs in the EU. Around 94,800 people have died in such collisions in the last ten years. [1]

Across the EU, the total number of people killed in SVCs was cut by 43% over the period 2005-2014. Deaths caused by collisions of this type have fallen a bit faster than road deaths overall (-41%) but slower than road deaths caused by multi-motor-vehicle collisions (-44%).

Over 60% of deaths in SVCs occur on rural roads. However, safer infrastructure and appropriate speed limits have helped reduce deaths on rural roads.

In the EU, 68% of all deaths in SVCs are car occupants. Powered two wheeler (PTW) users represent around a fifth of deaths in SVCs, while the distance travelled on these vehicles remains low compared to other modes of transport. Lorry occupants account for 7% of all deaths in SVCs with buses and coaches accounting for less than 1%.

Young drivers and riders are at a greater risk of becoming involved in fatal single vehicle collisions than any other road user age group. This risk is twice as high for the 18-24 age group compared to the 25-49 age group.

Data available from a few countries suggest that the range of casualty characteristics vary from country to country but the most common fatal SVC scenarios are the vehicle leaving a straight road or leaving the road when driving on a bend.

An in-depth study conducted in the Netherlands in 2011 found that distraction was the most frequent contributory factor related to human behaviour, involved in 31% of the SVCs studied. This was followed by speeding (27%), alcohol use (19%) and fatigue (17%). Young drivers appear to be involved in SVCs when distracted, choosing inadequate swerving manoeuvres to avoid another road user/object or when they incorrectly assess the traffic situation.

Key recommendations to Member States

- Implement the Infrastructure Safety Management Directive 2008/96 on all kinds of roads.
- Improve infrastructure safety on the whole network, applying the concepts of "self-explaining and self-enforcing roads" and "forgiving roadsides".
- Eliminate all removable obstacles from the roadside; install safe side barriers where the obstacles cannot be removed on rural roads and motorways.
- Install barriers friendly to powered two-wheelers in areas susceptible to motorcycle collisions.
- Conduct in-depth accident investigations in appropriate representative samples of collisions resulting in serious injuries and deaths, including single-vehicle collisions.

[1] Data from 24 EU member states. BG, LT, MT and SK are excluded due to insufficient data.

- Apply best practice in traffic law enforcement of speed limits, use of seat belts or helmets, and laws concerning drink driving and driver distraction.
- Introduce Graduated Driving Licence systems to address the high risks faced by new drivers, thus allowing them to gain initial driving experience under low-risk conditions between gaining the learner permit and fully licensed status.

Key recommendations to EU Institutions

- Support member states in collecting harmonised in-depth accident investigation data relating to fatal and serious injury collisions, including single-vehicle collisions.
- Introduce a safe system approach in Europe, as committed in the EC's 'First Milestone towards a Serious Injury Strategy' in 2013 [2].

Within the context of the review of the Infrastructure Safety Management Directive 2008/96:

- Extend application of the instruments of the Directive to cover all motorways, rural and urban roads;
- Set up guidelines for providing and maintaining road markings, effective safety barriers and sufficient width of obstacle-free roadsides.

Within the context of the revision of Regulation 2009/661 concerning Type-Approval Requirements for the General Safety of Motor Vehicles:

- Adopt legislation for fitting all new vehicles with an overridable assisting Intelligent Speed Assistance system, Autonomous Emergency Braking and advanced seat belt reminders on passenger seats;
- Introduce uniform standards for alcohol interlocks in Europe which ensure that vehicle interfaces make it possible to fit an alcohol interlock. As a first step towards wider use of alcohol interlocks, legislate to require their use by professional drivers;
- Mandate Event Data Recorders in all new vehicles and require the data to be made available for accident investigation;
- Upgrade type approval crash tests to be more closely aligned with the requirements of Euro NCAP crash tests.

[2] ETSC (2013) Response to the First Milestone Towards a Serious Injury Strategy, https://goo.gl/9bkVgM, European Commission (2013) First Milestone Towards a Serious Injury Strategy, https://goo.gl/8Kr1Z6

INTRODUCTION

23-year-old Robbie was driving at excessive speed, under the influence of alcohol and not wearing a seatbelt when he lost control of his car at a roundabout before being thrown through the windscreen. He died at the scene on a Saturday night. Brian crashed his motorcycle into a tree in the early hours of a Monday morning. He was 34 years old, and riding with a provisional motorcycle driving licence.[3]

A third of road deaths in the EU are like these two tragic examples; caused by collisions that involve a single motor vehicle where the driver, rider and/or passengers are killed but no other road users are involved. These single vehicle collisions (SVCs), and how to prevent them occurring, are the subject of this report.

Typically, SVCs can be instances of:

- vehicles running off the road and colliding with roadside objects;
- collisions with obstacles or animals on the road;
- rollovers.

Single vehicle collisions are the cause of 30% of reported road deaths.

Some of these collisions occur at junctions.

This particular category of collision is common, representing about a fifth of all reported motor vehicle collisions in the EU.[4] But SVCs are also more frequently fatal; they are the cause of 30% of reported road deaths, a proportion unchanged since 2006.

Nearly 7300 road users lost their lives in 2015 in SVCs in the EU. Around 94,800 people have died in such collisions in the last ten years.[5]

Across the EU, the total number of people killed in SVCs was cut by 43% over the period 2005-2014. Deaths caused by collisions of this type have fallen a bit faster than road deaths overall (-41%) but slower than road deaths caused by multi-motor-vehicle collisions (-44%).

Pan-European investigations of SVCs are lacking but investigation results from several countries indicate that one or more of the factors below are often involved in SVCs, though are not unique to this category:

- Speeding or driving too fast for the conditions;
- Drink or drug driving;
- Fatigue;
- Distraction;
- Young and inexperienced drivers;
- Unforgiving roadsides;
- Infrastructure characteristics (geometry, visibility);
- Environmental conditions (rain, ice, snow, fog);
- Technical failure of the vehicle;
- Non-use of seat-belts.

[3] Names have been changed to protect the privacy of the families. Facts as reported in UK newspaper stories in 2016.
[4] Data provided by the European Commission, extracted from the CARE database upon ETSC's request.
[5] Data from 24 EU member states. BG, LT, MT and SK are excluded due to insufficient data.

Part I of this report contains ETSC's analysis on PIN countries' performance in reducing the number of deaths in single vehicle collisions. It gives an overview of the roads where deaths in SVCs occur, the road users involved, the age of drivers and vehicles and the most common collision scenarios. Part II of the report explains the main contributing factors for deaths in SVCs and gives recommendations on how to address the problem.

Single motor vehicle collisions with pedestrians and cyclists are not included in the scope of this report because they have different characteristics compared to single motor vehicle collisions (SVCs). Around 93% of pedestrian deaths occur after a collision with a single motor vehicle. Key road safety figures and measures addressing pedestrian and cyclist safety can be found in the ETSC publications PIN Flash 28 (2015) Making Walking and Cycling on Europe's Roads Safer and The European Union's Role in Promoting the Safety of Cycling (2016).
www.etsc.eu/publications

INDICATOR

The definition of fatal single motor vehicle collisions (SVCs) used in this report covers collisions involving only one motor vehicle when the driver, rider and/or passengers were killed but no pedestrian or cyclist was involved.

The difference between the average annual change in the number of deaths in single motor vehicle collisions (SVCs) and the corresponding reduction in the number of deaths in multi-motor-vehicle collisions over the period 2005-2014 is used as the main indicator of progress (Fig.1). People killed in SVCs include drivers and passengers in cars, heavy goods vehicles, buses and vans, as well as motorcycle and moped riders. SVCs can involve a vehicle running off the road and colliding with roadside objects, collisions with obstacles or animals on the road or rollovers. Some of those collisions occur at junctions.

The PIN countries are also compared according to mortality rates: the numbers of road users killed in SVCs per million inhabitants (Fig.2). Population data were retrieved from the Eurostat database.

This report covers fatal collisions only, but many more people are seriously injured in SVCs. Deaths occurring within 30 days as a consequence of a SVC collision are taken into account. Confirmed suicide and natural death should normally be excluded. However, in the case of Finland, suicides are included in national road collision statistics.

For Lithuania the number of road users killed is available for 2013 and 2014, for Slovakia from 2004 to 2010, for Malta from 2005 to 2010, for Bulgaria from 2008 to 2009. In 2012 a catastrophic bus collision in Switzerland in the Sierre Tunnel, in which 28 people lost their lives, was a SVC.

The numbers of road users killed in SVCs were retrieved by the European Commission from its CARE database upon ETSC's request*. Data for 2015 were provided by the PIN Panellists (see inside cover). Full time series for Ireland, Israel, Serbia and Switzerland were provided by the PIN Panellists, full time series for the Netherlands were provided by the Institute for Road Safety Research (SWOV). The full datasets are available in the Annexes.

* The EC CARE report on single vehicle accidents was published in 2016 and is available here: https://goo.gl/9DCLUA. The definition of a single vehicle collision in the CARE report also covers single bicycle collisions.

PART I
SINGLE MOTOR VEHICLE COLLISIONS - ANALYSIS OF THE LATEST DATA

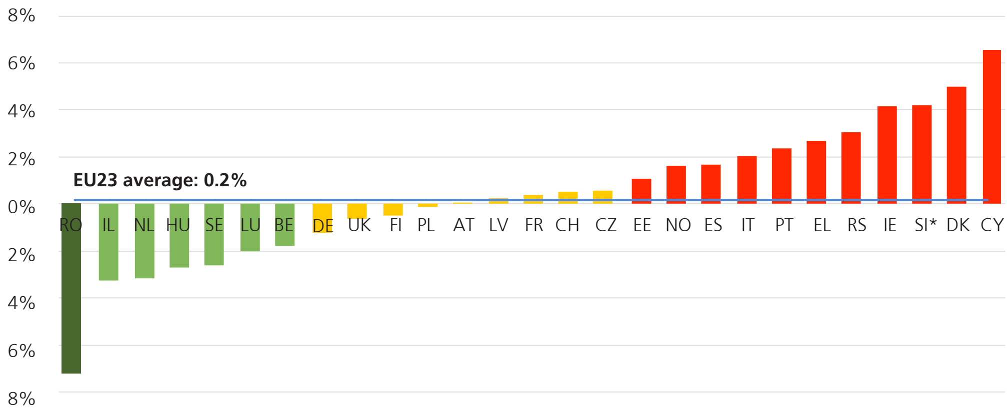
1.1 The number of deaths in SVCs has been decreasing at a slightly slower pace than deaths in multi-motor-vehicle collisions

Figure 1 shows country performance since 2005 in reducing deaths in single vehicle collisions compared with progress in reducing deaths that occurred in collisions involving more than one motor vehicle. In the EU, deaths in SVCs have been reduced by 0.2% per year more slowly than deaths in multi-motor-vehicle collisions. In 11 countries, progress in reducing deaths in SVCs has been faster than reducing deaths in multi-motor-vehicle collisions.

In Romania, deaths in SVCs were cut by 7% per year faster than road deaths in collisions involving more than one motorised vehicle on average since 2005, in Israel and the Netherlands by 3%, in Hungary and Sweden by 2.5%, in Luxembourg and Belgium by 2%.

In Cyprus, Denmark, Slovenia, Ireland, Serbia, Greece, Portugal, Italy, Spain, Norway and Estonia, developments in reducing deaths in SVCs were slower than the progress in reducing deaths in multi-motor-vehicle collisions.[6]

Fig.1 Difference between the average annual change (%) in the number of deaths in SVCs and the corresponding change in the number of deaths in multi-motor-vehicle collisions over the period 2005-2014, *2005-2013.
EU23 average: EU28 average excluding BG, HR, LT, MT and SK due to insufficient data in these countries.



NL

The Netherlands: upgrading roads on national network to three-star by 2020

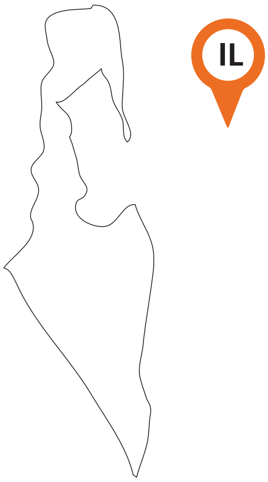
Road deaths in SVCs decreased by 3% per year faster than multi-motor vehicle collisions in the Netherlands following improvements in roadside infrastructure.

"The Dutch Government has committed to upgrade all two-star roads on the national network to three-star by 2020, based on the EuroRAP evaluation protocol 1.0. Measures have been taken to improve the safety of roadsides in the past couple of years, resulting in a sharper decrease of single vehicle collisions. If needed, the removal of obstacles too close to the road or the installation of a safety barrier are planned in conjunction with road maintenance programmes."
Peter Mak, Ministry of Transport, The Netherlands

EuroRAP EUROPEAN ROAD ASSESSMENT PROGRAMME

Find out more about the EuroRAP star rating scheme for roads at http://www.eurorap.org/protocols/star-ratings/

[6] It should be noted that reporting rates of road deaths may depend on the type of collision. Thus, if in some countries reporting rates have been changing, this may have affected single motor vehicle collisions differently from multi-motor-vehicle collisions.



Israel: efforts in providing forgiving roadsides starting to pay-off

In Israel the number of deaths in SVCs went down by 3% per year faster than road deaths in multi-motor-vehicle collisions, following the creation by the Ministry of Transport of a Committee for the approval of traffic and safety devices.

"Since the beginning of the 2000s forgiving roadsides have been systematically implemented. There is an obligation to install new-generation safety barriers, barrier terminals, crash cushions and other safety equipment when upgrading road sections or intersections, or when treating high risk sites. These activities are led by a Committee for the approval of traffic and safety devices that has been established by the Ministry of Transport. The Committee plays a major role both in the approval of roadside safety equipment and in the development of guidelines for their application."
Victoria Gitelman, Road Safety Research Center - Technion, Israel

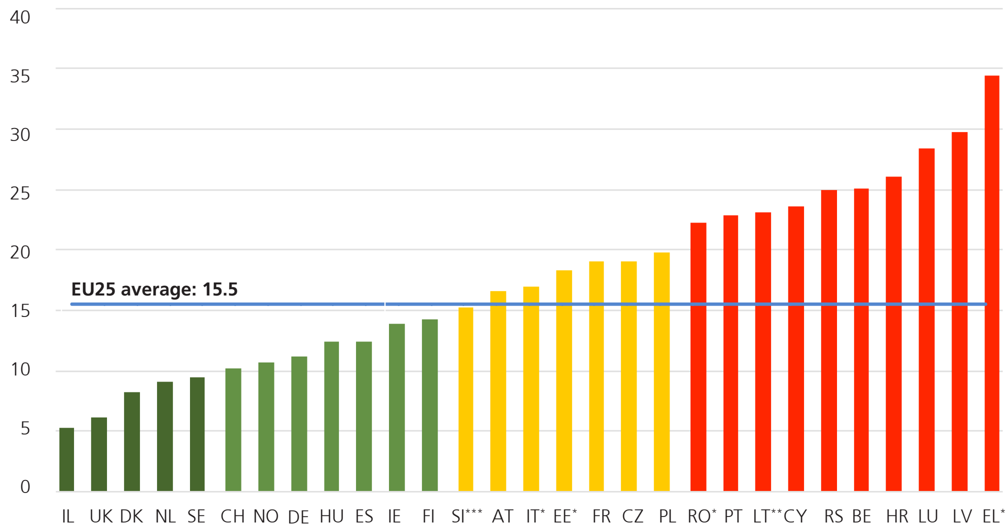
1.2 The mortality in SVCs differs by a factor of four between countries

Over 15 road users per million inhabitants lose their lives in SVCs on average in the EU each year. However, mortality in SVCs is four times higher in the group of countries listed at the bottom of the ranking compared to the top group (Fig.2).

Each year in Israel around five people per million inhabitants are killed in SVCs followed by the UK with six deaths, Denmark with eight, the Netherlands and Sweden with a rate of nine deaths per million inhabitants.

Mortality of motorists in SVCs is highest in Greece with 34 deaths per million inhabitants each year, followed by Latvia with 30, Luxembourg with 28 and Croatia with 26 deaths per million inhabitants.

Fig.2 Number of deaths in SVCs per million inhabitants over the period 2013-2015. *2012-2014, **2013-2014, ***2012-2013. EU25 average: EU28 excluding BG, MT and SK due to insufficient data in these countries.

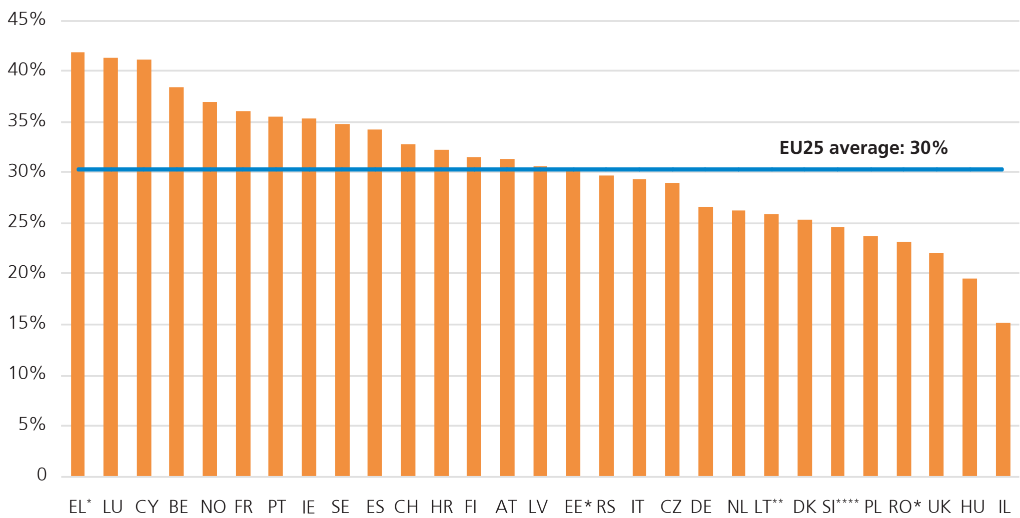


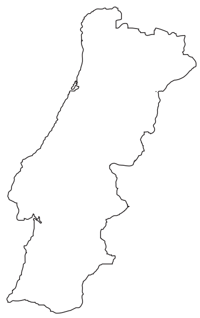
1.3 30% of all road deaths in the EU occur in SVCs

In the EU as a whole, deaths in single vehicle collisions represented 30% of all road deaths in 2014, a proportion unchanged since 2006.

42% of all road deaths in Greece occur in SVCs, 41% in Luxembourg and Cyprus, 38% in Belgium, 37% in Norway and 36% France (Fig.3).

Fig.3 Deaths in SVCs as a proportion (%) of all road deaths by country, average years 2013-2015, *2012-2014, **2013-2014, ***2011-2013.
EU25 average: EU28 excluding BG, MT and SK due to insufficient data in these countries.





Portugal: an urgent need for a safe system approach

674 road deaths occurred in SVCs in Portugal in the last three years, accounting for 35% of all road deaths over that period.

"Sadly, the safety of roadsides has a generally low importance in Portugal. We also lack a comprehensive speed management strategy at the national and local level. We urgently need to implement the safe system approach if we want to decrease the number of people killed in SVCs on our roads."
João Cardoso, National Laboratory for Civil Engineering (LNEC), Portugal

Denmark: high safety standards on rural roads

140 road users lost their lives in SVCs in Denmark in the last three years, representing 25% of all road deaths over that period.

"The proportion of deaths in single vehicle collisions in Denmark is lower than the EU average of 30%. This can be partially explained by the fact that the general speed limits on rural roads in Denmark are 80 km/h while in many European countries the speed limits on such roads are 90 or 100 km/h. The Danish Road Directorate says the average speed on rural roads is only a little above the limit. Moreover, rural roads in Denmark have relatively high safety standards. Denmark is also a small country without the long, monotonous journeys that create distractions and sleepiness in some other countries."
Jesper Sølund, Danish Road Safety Council

1.4 Over 60% of deaths in SVCs occur on rural roads

In the group of 22 countries that collect up-to-date data, around 62% of all deaths in SVCs occur on non-motorway rural roads, 8% on motorways and 28% on urban roads (Fig.4).

93% of SVCs collisions occur on rural roads in Norway, 79% in Latvia and Estonia, 77% in Ireland, 74% in Finland and Germany. In contrast, 25% of all road deaths in SVCs occur on rural roads in Serbia, 34% in Croatia and 44% in Portugal.

In the Netherlands as many as 15% of deaths in SVCs occur on motorways, 13% in Slovenia and Luxembourg, 12% in Croatia and Belgium.

In Serbia 71% of fatal SVCs occur on urban roads, 54% in Croatia, 50% in Israel and 49% in Romania.

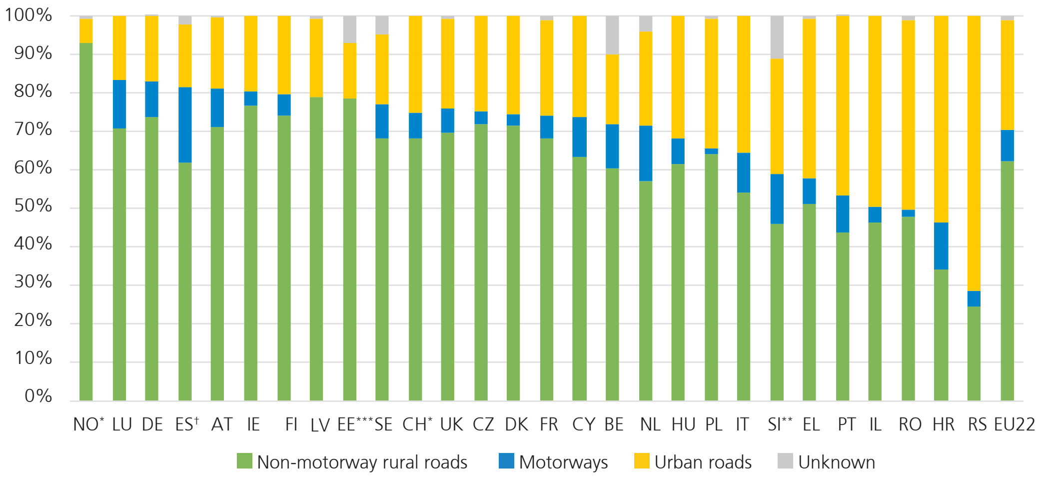


Fig.4 Proportion (%) of deaths in SVCs by road type (rural non-motorways roads, motorways, urban roads) ranked by non-motorway rural roads and motorways together, average years 2012-2014. *2013-2014, **2012-2013, ***2014. †Data on motorways also include autovias. EU22 average: EU28 excluding BG, EE, LT, MT, SI and SK due to insufficient data in these countries. Note: categorisation of urban-rural roads might differ from country to country.

Croatia: more cameras in urban areas needed to improve safety

In Croatia around 54% of all deaths in SVCs occur on urban roads. This is partly due to the categorisation of urban roads – small settlements are regarded as urban areas. 12% of deaths in SVCs in Croatia occur on motorways, compared to 8% EU average.

"Urban roads certainly need infrastructure improvements. There are not enough safety cameras on these roads which would deter drivers from speeding and, therefore, help to prevent serious collisions."
Sanja Veić, Ministry of Interior, Croatia

1.5 68% of those killed in SVCs are car occupants

In the EU, 68% of all deaths in SVCs are car occupants (Fig.5). Powered two wheeler (PTW) users represent around a fifth (21%) of deaths in SVCs, while the proportion of these vehicles on the roads remains low compared to other modes of transport.[7] Lorry occupants account for 7% of all deaths in SVCs, buses and coaches account for less than 1%.

The largest proportion of those killed in SVCs in Lithuania are car occupants, accounting for 83%, followed by Estonia (81%), Poland, Romania and the Czech Republic (79%).

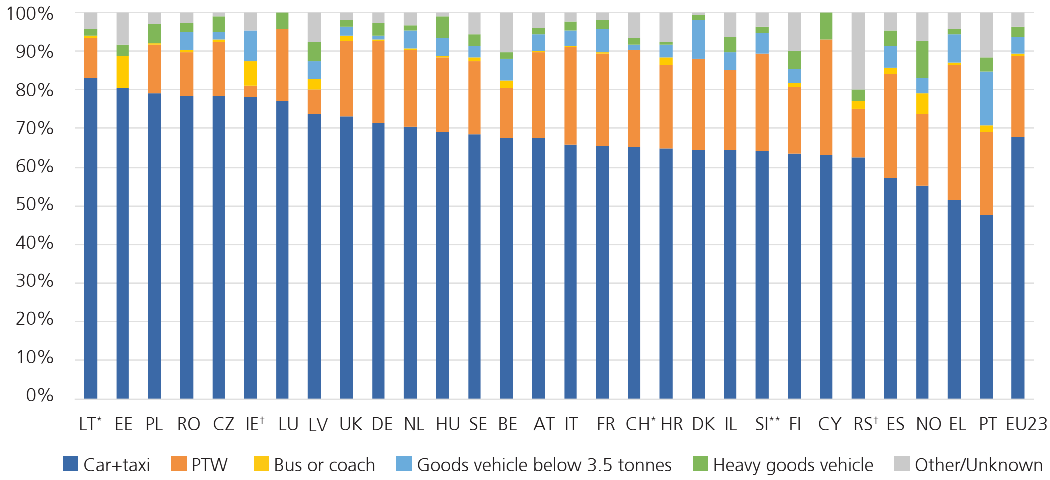
PTW users account for 35% of all deaths in SVCs in Greece, 30% in Cyprus, 27% in Spain, 25% in Slovenia, Italy and Switzerland, 24% in France and Denmark.

[7] Unpublished ESRA survey results provided by the Swiss Council for Accident Prevention (bfu) upon ETSC request. According to the ESRA survey, 1.1% of respondents from 17 European countries indicated that they used motorcycles or mopeds as the most frequently used modes of transport in the last 12 months.

Occupants of goods vehicles under 3.5 tonnes and HGVs represent 18% of all deaths in SVCs in Portugal, 14% in Norway, 11% in Denmark and 10% in Hungary, Spain and Latvia.

Differences among countries can be partly explained by different mobility patterns.

Fig.5 Proportion (%) of deaths in SVCs by road user group, average years 2012-2014. *2013-2014, **2012-2013. EU23 average: EU28 excluding BG, MT, SK, SI and LT due to insufficient data. †Lorries under 3.5t and HGVs are merged in the HGV category.

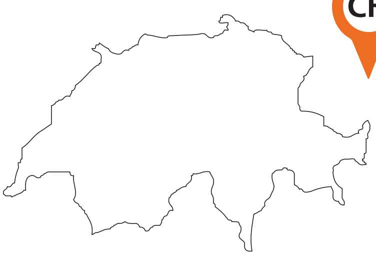


EL

Greece: improvements in helmet wearing rates could save 200 lives each year

390 PTW riders and passengers have been killed in SVCs in the last three years in Greece, representing 35% of all deaths in SVCs.

"In general, motorcyclists are the road user group that is benefitting the least from road safety improvements in Greece. Perhaps this is one more consequence of the economic crisis - users are switching from cars to motorcycles. It is unfortunate that only 75% of riders and even less - 46% of - passengers are wearing a helmet when riding. Greece sometimes runs campaigns to encourage helmet use, but the figures on helmet wearing rates clearly indicate that we need to increase police enforcement activities targeting PTW riders. If the helmet use rate increased to 95%, 200 lives of all PTW riders could be saved annually out of a total of 800 road user deaths."
George Yannis, Technical University of Athens



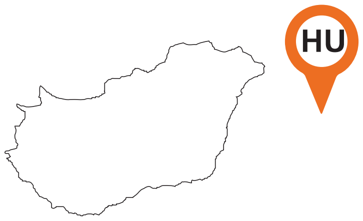
CH

Switzerland: one in four deaths in a SVC is a PTW rider or passenger

Out of 286 deaths in SVCs that occurred in the last three years, 70 were PTW riders and passengers, accounting for 25% of all deaths in SVCs. This can be partially related to the fact that the motorcycle helmet law does not mandate fastening the helmet chin strap. Moreover, use of a PTW as the most frequent mode of transport in Switzerland is slightly higher than the EU average. In the ESRA survey, 1.7% of respondents claimed that they used a motorcycle as the most frequent mode of transport in the last year in Switzerland compared to 1.1% EU average.[8]

"Still too many people lose their lives in Switzerland while riding a motorcycle or a moped. While Swiss traffic law requires PTW users to wear helmets, there is no legal obligation to fasten them. In case of a collision the head of the rider or passenger violently rebounds or rotates after crashing into a hard object. There is a considerable chance that a strong force generated by the collision will remove the helmet if it is not fastened. The consequences of such collisions are very severe. This problem could be reduced if the legislation obliged all the riders to attach the chin strap and if riders received sufficient public information on the importance of buckling up their helmet."
Steffen Niemann, Swiss Council for Accident Prevention

[8] Unpublished ESRA survey results which were provided by the Swiss Council for Accident Prevention (bfu) upon ETSC request.



Hungary

10% of all deaths in SVCs are lorry occupants; on average 11 per year.

"We have relatively high levels of transit traffic in Hungary. Frequently lorry drivers are on the road for long hours without taking breaks. The drivers are fatigued and this results in falling asleep at the wheel or lack of concentration. Moreover, seat belt wearing rates among lorry occupants could be relatively low."
Péter Holló, Institute for Transport Sciences (KTI), Hungary

Norway

14% of all deaths in SVCs are occupants of goods vehicles under 3.5 tonnes and HGVs, on average eight per year.

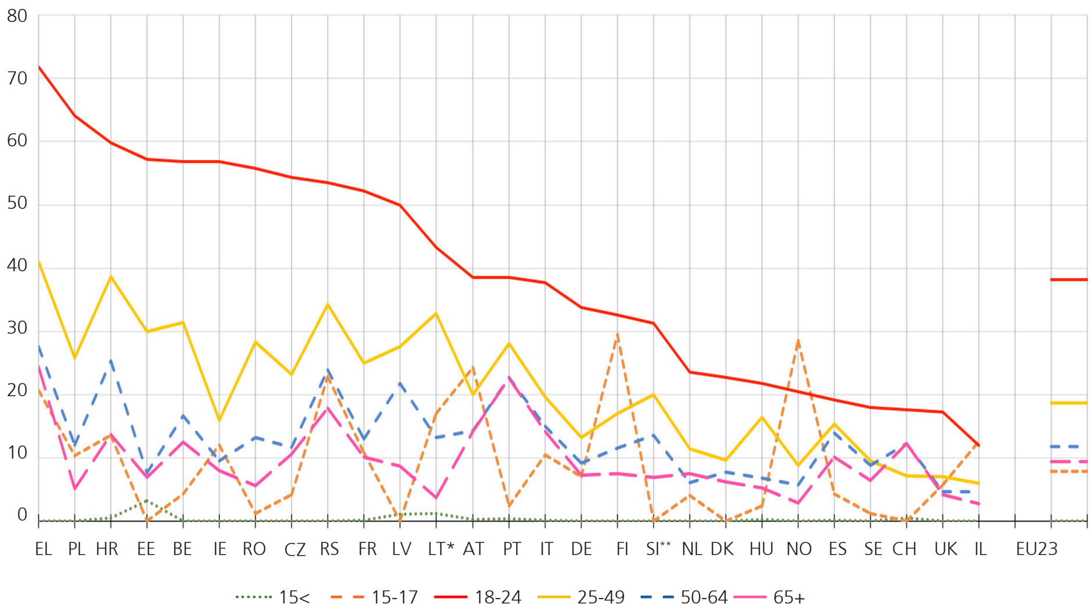
"In Norway we have more heavy goods traffic than in many other countries due to dispersed business locations and a strong economy, and much of this traffic is on narrow roads with many curves and hills. This may explain the higher proportion of lorry occupant deaths than in other PIN countries."
Michael Sørensen, Institute of Transport Economics, Norway

1.6 Young drivers and riders at a greater risk

Young drivers and riders are at a greater risk of becoming involved in fatal single vehicle collisions than any other road user age group (Fig.6). In the EU23, around 38 young drivers and riders aged 18-24 are involved in fatal SVCs per million-population of this age group. This risk is twice as high as in the 25-49 age group where 19 drivers are involved in fatal SVCs per million inhabitants of this age group. Twelve drivers aged 50-64 and nine who are 65 or older are involved in SVCs per million inhabitants of the respective age groups.

There are 72 drivers/riders aged 18-24 involved in fatal SVCs per million inhabitants of this age group in Greece, 64 in Poland, 60 in Croatia and 57 in Estonia, Belgium and Ireland. In contrast, there are 12 riders/drivers aged 18-24 involved in fatal SVCs per million inhabitants of this age group in Israel, 17 in the UK, 18 in Switzerland and Sweden.

Fig.6 Average number of drivers/riders involved in fatal SVCs in 2012-2014 per million inhabitants in 2014 by driver age for each of the age groups under 15, 15-17, 18-24, 25-49, 50-64, 65+. *2013-2014, **2012-2013. EU23 average: EU28 excluding BG, LT, MT, SK and SI due to insufficient data. CY and LU are excluded from the figure as the number of drivers involved in fatal SVCs does not exceed 20.



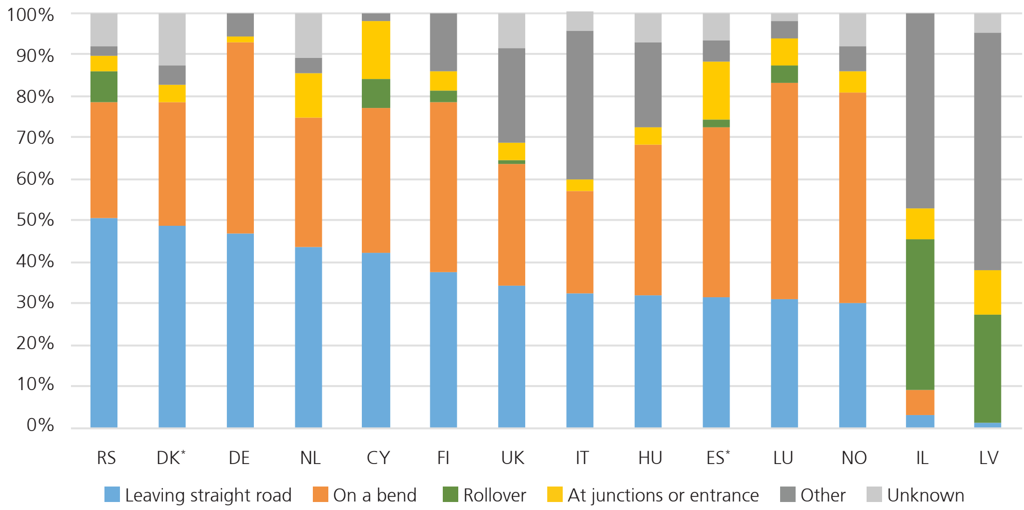
Research findings gathered in the report "Reducing casualties involving young drivers and riders in Europe", which has been published in the framework of ETSC's YEARS project funded by the European Commission, Young Europeans Acting for Road Safety,[9] show that numerous countermeasures are effective in reducing the high numbers of young people involved in fatal collisions. Introduction of hazard perception training systems, accompanied driving, graduated licensing systems and zero tolerance on drink driving are among the most effective countermeasures in addressing young road user risks.

1.7 The most common fatal SVC scenarios

There is a general lack of representative pan-European in-depth collision data to aid the development of safety policy, regulation and technological advancement.

Data available from a few countries suggest that the range of casualty characteristics vary from country to country but the most common fatal SVC scenarios are the vehicle leaving a straight road or leaving the road when driving on a bend (Fig.7). However, comparison between countries on collision characteristics is difficult due to possible differences in coding.

Fig.7 Proportion (%) of the number of road deaths in SVCs by the type of collision, average years 2012-2014; *2014 data.
IE is excluded from the figure due to a different coding system but the data are included in the background tables.



The Czech Republic: addressing SVCs in bends

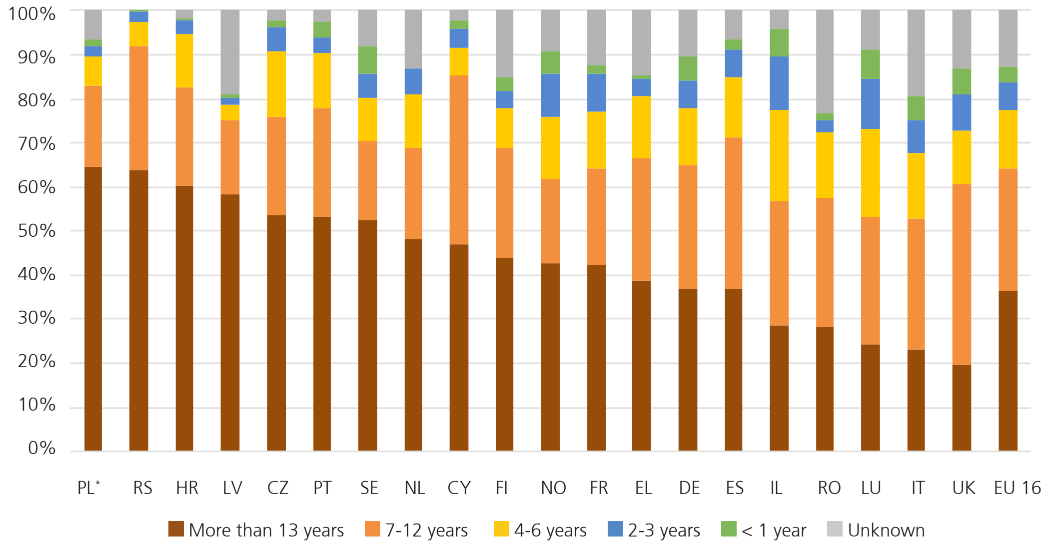
"We are currently working on ways to reduce the number of run-off-road collisions in road bends. CDV has developed cost-effective guidelines for consistent and self-explaining road signing focusing on risks on bends. CDV is urging the National Road Safety Agency to apply the guidelines on the whole national road network in order to achieve an expected 10 to 25% reductions in all SVCs."
Jiří Ambros, Transport Research Centre (CDV), the Czech Republic

[9] ETSC (2017), Reducing casualties involving your drivers and riders in Europe, https://goo.gl/1ARGHP

1.8 36% of all vehicles involved in fatal SVCs are older than 13 years

According to the European car manufacturer association (ACEA), cars on the EU's roads are on average 9.7 years old.[10] Therefore, it is perhaps not surprising that in the EU 36% of all vehicles involved in fatal SVCs are older than 13 years and 28% are 7 to 12 years old (Fig.8). 4-6 years old vehicles are involved in 13%, 2-3 years old in 6% and less than 1 year-old in 3% of all fatal SVCs. In the other 13% of fatal SVCs the age of the vehicle is not known.

Fig.8 Proportion (%) of all vehicles involved in a fatal SVCs by vehicle age, average years 2012-2014, *2014. EU16 average: EU28 excluding AT, BE, BG, DK, EE, HU, IE, LT, MT, PL, SI and SK due to insufficient data.



It is generally observed that there is a relation between the age of a driver and the age of a car. Young people tend to drive smaller and older cars.[11] These cars often have a lower crashworthiness and lack new safety technologies. Therefore, the high proportion (36%) of vehicles involved in SVCs that are older than 13 years might be the outcome of the driving patterns and economic situation of young drivers. Moreover, some countries have an older car fleet and older vehicle involvement in fatal collisions is more prevalent: 72% of all cars are older than 10 years in Latvia, 71% in Poland, 57% in Portugal, 55% in Finland.[12]

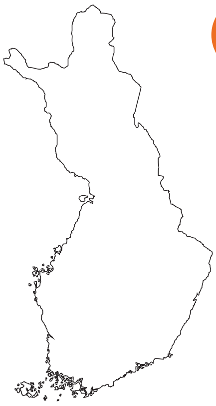
The outcome of SVCs depends on a number of factors, one of them being the vehicle's ability to protect its occupants and the usage of restraint systems. Generally, new cars sold in the EU have higher levels of active and passive protection than older ones. Yet, Euro NCAP test results show that the safety levels even of new cars differ between models and that this difference could make the crucial difference between life or death.[13]

[10] ACEA, Average Vehicle Age, https://goo.gl/Nuvlsz
[11] ETSC (2017), Reducing casualties involving your drivers and riders in Europe, https://goo.gl/1ARGHP
[12] ACEA, The automobile industry pocket guide 2015-2016.
[13] ETSC (2015), PIN Flash 30, How safe are new cars sold in the EU? https://goo.gl/R5vFJa

1.9 Suicides in SVCs

Suicide in a motor vehicle collision typically involves either a single vehicle collision or a head-on collision of a vehicle with a heavy goods vehicle. Academic studies estimate that between 1 and 7% of all driver deaths are suicides.[14] According to the European Commission's definition of road deaths, suicides should be excluded from the member states' records of road deaths, and thus also from SVC figures. However, it is at times difficult to definitely determine whether the death in a collision was a suicide.

For example in the Netherlands victims of a fatal suicide collision are included in road death figures, whereas the suicide committer is excluded.



FI

Finland: Why suicides are included in Finnish road death figures

"There has been long-lasting discussion on whether or not road traffic suicides should be separated from other road deaths in our official figures. No decision has been made yet. One issue is that even though the forensic post-mortem reports are available, so most suicides can be identified, we have so called unclear suicide-collisions that cannot be easily identified from one information source. This affects the reliability of the suicide figures. The shared interpretation is that if suicides are to be excluded from the official road death statistics they should still be reported visibly alongside the statistics. This would be justified since these suicides are made in road traffic and they may endanger, traumatise and incapacitate other road users."
Ilkka Nummelin, Finish Motor Insurers Centre (VALT)

[14] Monash University, Accident research centre, Suicide and natural deaths in road traffic – review (2013), https://goo.gl/H99Bdm

PART II
SCOPE FOR IMPROVEMENT IN ADDRESSING SINGLE VEHICLE COLLISIONS

2.1 Human factors in SVCs

A combination of factors can lead to SVCs. Given that only one vehicle is involved, it is generally recognised that the person in the best position to avoid the collision is the driver or rider of the vehicle. Motorist error such as choosing inappropriate driving speed, driving when fatigued, under the influence or distracted can contribute to a collision; driver age and gender can also play a role.

Knowing that human errors are not only undesirable but also inevitable, road infrastructure characteristics, rural/urban environment, roadside design and curve existence are even more important factors. Environmental circumstances such as weather and lighting conditions or technical failure of the vehicle can also lead to SVCs.

There are few in-depth research studies across Europe which focus on SVCs. More research has been done in Australia and the US, but due to differences in vehicle fleet and mobility patterns, these results may have limited applicability in Europe.

Distraction was the most frequent contributory factor to single vehicle collisions according to a Dutch in-depth study of real world crashes.

An in-depth study conducted by SWOV in 2011 analysed 115 run-off road vehicle collisions (i.e. mostly, but not always single vehicle) which occurred on rural roads in two Dutch provinces (Zeeland and Zuid Holland) over the period 2009-2010. Distraction was the most frequent contributory factor related to human behaviour, involved in 31% of the SVCs studied, followed by speeding (27%), alcohol use (19%) and fatigue (17%). Young drivers appear to be involved in SVCs when distracted, choosing inadequate swerving manoeuvres to avoid another road user/object or when they incorrectly assess the traffic situation.[15]

When a SVC becomes inevitable, the outcome is highly dependent on driving speed, the interaction between the vehicle and the roadside environment, the ability of the vehicle to protect its occupants and the usage of restraint systems.

Experience from the best performing countries and those with the fastest progress shows that deaths in SVCs can be prevented through a combination of well-known and cost-effective measures including safe road design, infrastructure safety management and increased enforcement. Of course, other factors such as vehicle fleet and mobility patterns play a role too.[16]

[15] SWOV (2011), Run-off-road crashes in the Province of Zeeland: characteristics and possible solutions, https://goo.gl/yuaQwF
[16] ETSC (2011), PIN Road Safety Report 5, Reducing deaths on rural roads – a priority for the UN Decade of Action, https://goo.gl/QSUxsN

Recommendations to Member States

- Apply best practice in traffic law enforcement of speed limits, use of seat belts or helmets, and laws concerning drink driving and driver distraction.
- Set enforcement plans with yearly targets for numbers of checks and compliance with traffic laws, in particular addressing the priority areas of speeding, drink and drug driving, illegal use of mobile phone and lack of use of seat belt.
- Install safety cameras able to detect speeding riders and enforce motorcyclists' compliance with speed limits.
- Enforce the compulsory wearing and fastening of helmets for PTW riders.
- Introduce Graduated Driving Licence systems to address the high risks faced by new drivers, thus allowing them to gain initial driving experience under low-risk conditions between gaining the learner permit and fully licensed status.
- Introduce a stricter demerit system during a probationary period for newly-licensed drivers with penalties such as loss of licence or mandatory traffic risk awareness training.

Recommendations to EU institutions

Within the context of the revision of Regulation 2009/661 concerning Type-Approval Requirements for the General Safety of Motor Vehicles:

- Adopt legislation for fitting all new vehicles with an overridable assisting Intelligent Speed Assistance system, Autonomous Emergency Braking, advanced seat belt reminders on passenger seats and event data recorders;
- Introduce uniform standards for alcohol interlocks in Europe which ensure that vehicle interfaces make it possible to fit an alcohol interlock. As a first step towards wider use of alcohol interlocks, legislate to require their use by professional drivers;
- Upgrade type approval collision tests to be more closely aligned with the requirements of Euro NCAP crash tests.

Within the context of the revision of Directive 2015/413 concerning cross-border exchange of information on road safety related traffic offences:

- Revise the Directive to strengthen the enforcement chain, including mandatory notification of the owner of the vehicle by the country of offence;
- Publish best practice guidelines on enforcement and sanctions in the field of road safety and thereby encourage member states to achieve high standards on enforcement methods and practice and a greater convergence of road-safety related traffic rules building on the EC Recommendation on Enforcement in the field of Road Safety.

For more information and ETSC recommendations on traffic law enforcement and vehicle safety read ETSC's PIN Flash report 31 (2016): "How traffic law enforcement can contribute to safer roads" and PIN Flash report 30 (2016): "How safe are new cars sold in the EU? An analysis of the market penetration of Euro NCAP-rated cars".
Both reports are available at www.etsc.eu/PIN

2.2 Road design factors in SVCs

Many current road designs result from decades of construction and maintenance in times when safety issues were not considered to the same extent as they are now. Today, road features on many roads no longer meet the latest safety requirements. Moreover, traffic conditions and volumes may have changed since the road was designed and built.[17] All new road projects should therefore be submitted to a road safety audit to assess the performance of the road, including from the perspective of vulnerable road users. Regular road safety inspections on the existing network are crucial to identify and remove or treat dangerous road features.

The majority of SVCs are run-off-road collisions.

The majority of SVCs are run-off-road collisions where a vehicle leaves the road, enters the roadside and has at least one interaction with either the roadside equipment or the roadside itself (Fig.7). Another frequent scenario in SVCs is vehicle leaving the road on a bend.

In the SWOV in-depth study mentioned above, 40% of the 115 cases analysed had too narrow obstacle-free zones which contributed to about 40% of the run-off-road collisions. A lack of recovery space deprived the driver of the possibility of coming to a safe standstill. In SVCs which occurred on road bends, 86% of the bends had a curve radius that was too tight for the speed limit.[18]

Therefore, three of the main infrastructure factors which determine the severity of SVCs are the design of the roadside, curve radius and the type of objects present on the roadside. These objects could potentially become hazardous. Due to the poor energy-absorbing properties of many roadside objects, an impact would result in severe or fatal injuries to occupants.[19]

Measures to improve the safety on road network and roadsides are well known. They include safe, forgiving, self-explaining and self-enforcing road design and infrastructure safety management. The RISER project conducted on behalf of the European Commission has developed best practice guidelines addressing roadside safety in SVC scenarios.[20] The Conference of European Directors of Roads (CEDR) has produced forgiving roadside design guidelines.[21] Transport Infrastructure Ireland endorsed those guidelines as National Guidelines. The EU institutions have adopted the Infrastructure safety management Directive (see below).[22] EuroRAP ranks road safety performance across different EU member states. However, knowledge about safe road design and effective risk management is not fully applied even in the best performing countries.[23]

2.2.1 The EU Infrastructure Safety Management Directive

Successful implementation of road safety infrastructure management requires an adequate level of investment, supporting regulation, availability of relevant road safety data and adequate institutional management capacity.[24]

In 2008, the EU adopted the Infrastructure Safety Management Directive which requires member states to apply the following four instruments on the Trans-European Road Network (TERN):

[17] ETSC (2011), PIN Road Safety Report 5, Reducing deaths on rural roads – a priority for the UN Decade of Action, https://goo.gl/QSUxsN
[18] SWOV (2011), Run-off-road crashes in the Province of Zeeland: characteristics and possible solutions, https://goo.gl/yuaQwF
[19] RISER (2003), Roadside Infrastructure for Safety European Roads, https://goo.gl/Xp0tsI
[20] Ibid
[21] CEDR (2012), Forgiving roadsides design guide, https://goo.gl/gM4hsB
[22] Directive 2008/96/EC of the European Parliament and of the Council on road infrastructure safety management, https://goo.gl/4QLUCC
[23] ETSC (2011), PIN Road Safety Report 5, Reducing deaths on rural roads – a priority for the UN Decade of Action, https://goo.gl/QSUxsN
[24] OECD-ITF (2015), Road Infrastructure Safety Management, https://goo.gl/OkHXAd

- **Road safety impact assessments:** these demonstrate the road safety implications of different planning alternatives for a road project, whether construction of new infrastructure or rehabilitation of existing infrastructure, by analogy with environmental impact assessment.
- **Road safety audits:** independent technical checks aimed at identifying unsafe features of a road project and making proposals for remedying them.
- **Network safety management:** targeting remedial measures at parts of the network with high concentrations of collisions (e.g. high-risk road sections) and/or a high potential to avoid collisions in the future.
- **Safety inspections:** carried out as part of regular road maintenance, these enable the detection and hence reduction of collision risk in a preventive way through low cost measures.

The Directive aims to promote the objective that safety must be integrated in all phases of planning, design and operation of road infrastructure. It must be regarded in its own right alongside but separately from economic and environmental analysis. Member states are encouraged but not mandated to apply the provisions of the Directive to national road transport infrastructure which is not included in the TERN network.[25]

An evaluation study funded by the European Commission states that one of the benefits of the Directive is a "common language" for carrying out road infrastructure safety management which relies upon a harmonised legislative framework. The study states that the main weakness of this Directive is the limited scope of its application - it would have the highest potential if extended to non-TERN network where the majority of severe and fatal collisions occur.[26]

2.2.2 Self-explaining and self-enforcing roads

Self-explaining and self-enforcing roads are concepts of road design that seek to reduce the number of collisions on the whole road network. Self-explaining roads seek to prevent driving errors and self-enforcing roads aim to prevent motorists from offending against the traffic laws.

The self-explaining roads approach uses simplicity and consistency of design and function to reduce driver stress and errors. Self-explaining roads are predictable through clear road type characteristics that show the driver what road type they are driving on, which driving speed is expected and appropriate given the function of the road, and which other types of road users share the space. This makes the traffic system more predictable and prevents unexpected and inappropriate behaviour resulting in collisions.[27]

One aspect of self-explaining road design is that different classes of roads should be distinctive in design and function, and within each class features such as width of carriageway, road markings, signing, and use of street lighting would be consistent throughout the route. The environment effectively provides a "label" for the particular type of road and there would thus be less need for separate traffic control devices such as additional traffic signs to regulate traffic behaviour. It is generally known that multiple road signs in complex traffic situations can lead to an information overload and an increased risk of driving errors.[28]

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[25] ETSC (2015), PIN Flash report 28, Ranking EU progress on improving motorway safety, https://goo.gl/eyWXsi
[26] TML (2014), Study of the effectiveness and on the improvement of the EU legislative framework on road infrastructure safety management (Directive 2008/96/EC), Ex-Post Evaluation, https://goo.gl/hKAJgE
[27] European Commission, Self-explaining roads, https://goo.gl/iJGeKC
[28] Ibid

The self-explaining road concept is inherent in design for the highest and safest road class – motorways. Yet on lower class roads, which are the most dangerous by their characteristics, consistency in design is often lacking.[29]

The layout of self-enforcing roads aims to prevent road users from driving at inappropriate speeds. Self-enforcing roads employ engineering measures such as alignment, markings, road narrowing, rumble-strips, chicanes and road humps.

2.2.3 Forgiving roads

The first priority of forgiving roads is to reduce the consequences when a collision happens. It is generally accepted that one of the key issues in fatal single vehicle run-off-road collisions is the design of the roadsides, which are often unforgiving.[30]

A roadside is called unforgiving if there are:

- stiff hazardous objects placed at an inappropriate distance from the road;
- steep unprotected slopes on the roadside too close to the road;
- too narrow curves with sharp radius;
- canals and ditches too close to the road.

At times, roadside features such as barriers might also be hazardous if they have an errant design. The RISER database analysed 41 SVC cases where a barrier was the only obstacle involved. In 14 cases the end of the barrier had been hit. Such collisions result in a barrier entering the passenger compartment if the barrier ends are not designed or protected properly. In the case of an inappropriate barrier terminal, a car could also drive on top of the barrier and hit the construction that was supposed to be protected by the barrier. [31]

Examples of roadside features for which the forgiving roadsides design can be developed are properly designed barrier terminals, rumble strips and wide shoulders.[32] Roadside treatments seek to either redirect the vehicle onto the carriageway after the impact with a barrier or safely decelerate the vehicle.

The Conference of European Directors of Roads (CEDR) has published a practical guide on forgiving roadsides design based on harmonised collection of best practice treatments to make roadsides forgiving.[33]

Within the SAVeRS project a set of transnational single vehicle run-off road collision prediction models have been developed using data from Austria, Ireland, Italy, Sweden and the UK. Vehicle restraint guidelines and a software tool were developed to allow road designers and road administrators to select the most appropriate vehicle restraint system solutions in different road and traffic conditions.[34]

Luxembourg: guidelines for traffic calming measures on urban roads

The Luxembourg government has produced guidelines on urban planning and traffic calming measures to guide local authorities in implementing a coherent urban traffic system across the country[35]: 30 km/h zones are increasingly implemented in residential areas in Luxembourg.

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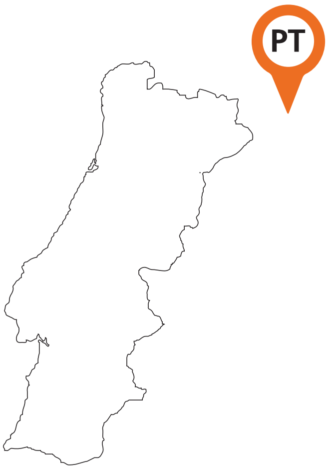
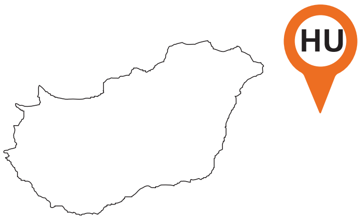
[29] Ibid
[30] CEDR (2012), Forgiving roadsides design guide, https://goo.gl/gM4hsB
[31] Ibid
[32] Ibid
[33] Ibid
[34] Selection of the Most Appropriate Roadside Vehicle Restraint System – The SAVeRS Project (2016), https://goo.gl/2USLa9
[35] Ministère du Développement durable et des Infrastructures (2013), Apaisement du trafic à l'intérieur des agglomerations, https://goo.gl/2HJrXv



Portugal: guidelines and software for forgiving roadside design

Guidelines on forgiving roadside design have been developed by the National Laboratory for Civil Engineering (LNEC) upon the request of the Portuguese Highway Agency. In addition, LNEC has produced software which helps road designers to choose and apply cost-beneficial solutions for roadside safety interventions in order to address run-off-road collisions on interurban roads. The software helps to improve roadside design and re-design procedures. This tool is distributed to road authorities, municipalities and relevant technical experts within the context of the progressive revision of Portuguese road design standards.

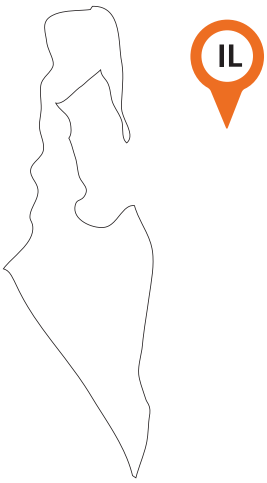
"Opportunities for the application of recommendations delivered by LNEC for new road design are scant, due to reductions in public spending. Efforts are made to apply the recommendations in road maintenance and re-designing activities on roads selected for upgrades. It is recognised that full implementation of the forgiving roadsides approach on Portuguese roadways will be a slow process, as it involves a new paradigm in road design and requires changes in existing procedures. Furthermore, EN1317[36] *provides standard European specifications on restraint systems' performance but does not yet deliver harmonised standards for terminals and transitions between different types of safety barriers, which is further slowing down the process of forgiving roadside implementation."*
João Cardoso, National Laboratory for Civil engineering (LNEC)



Hungary: technical guidelines for self-explaining road design would bring added value to road safety audits

In line with the EU infrastructure safety management Directive, road safety audits and inspections are being carried out and improvements can already be seen on the existing network.

"Yet, so far there are no guidelines with precise technical characteristics for self-explaining road design in Hungary. We are urging the responsible authorities to produce such guidelines building on the experience of other EU countries and promote them amongst auditors and transport planners."
Péter Holló, Institute for Transport Sciences (KTI), Hungary



Israel: guidelines on setting speed limits – a step towards self-explaining roads

Guidelines on setting speed limits were published by the Ministry of Transport in 2010 to improve driver compliance with legal speed limits.

"The guidelines define a new road hierarchy and a system approach in determining speeds for each road type. Road segments with similar geometric characteristics should have the same speed limits and those speed limits have to be easily recognisable by drivers. However, Israel still needs engineering tools that can help to fully implement the new approach - matching road characteristics to the designated speeds, i.e. making the roads actually self-explaining to the drivers."
Victoria Gitelman, Road Safety Research Center - Technion, Israel

[36] EN 1317 is a European Norm established in 1998 that defines common testing and certification procedures for road restraint systems.

Recommendations to Member States

- Implement the Infrastructure Safety Management Directive 2008/96 on all kinds of roads.
- Improve infrastructure safety on the whole network applying the concepts of "self-explaining and self-enforcing roads" and "forgiving roadsides".
- Eliminate removable obstacles from the roadside; if they cannot be removed, they should be protected by well-designed barriers.
- Ensure that barrier terminals at both ends are crashworthy. Shield or replace hard roadside objects with deformable structures.
- Design safer slopes and ditches to prevent rollovers, or put barriers in place.
- Improve road curve consistency when possible. Provide drivers with a clear picture of the sharpness of the curve prior to curve entry and apply speed reduction treatments when flattening the curve is not possible.
- Install barriers friendly to powered two-wheelers in areas susceptible to motorcycle collisions if roadside obstacles in these areas cannot be removed.
- Address the specific needs of PTW users in road design and maintenance (provide good winter maintenance, use anti-skid surfaces).
- Install rumble strips to alert drivers who drift from the carriageway.
- Complete EuroRAP or Network Safety Management assessment of rural network and review findings regularly for action. Set a target of upgrading roads to 3-star or better on all roads and 4-star or better on roads with high traffic volume.
- Apply road safety management principles to non-motorway rural roads to identify the most critical locations for single vehicle crashes and to identify the most cost-effective solutions.

Recommendations to EU institutions

- Introduce a safe system approach in Europe, as committed in the EC's 'First Milestone towards a Serious Injury Strategy' in 2013[37].

Within the context of the review of the Infrastructure Safety Management Directive 2008/96:

- Extend the application of the instruments of the Directive to cover all motorways, rural and urban roads.
- Extend the rules to tunnels covered by the Tunnel Directive 2004/54 and uphold the effects of the Tunnel Directive.
- Set up guidelines for the provision and maintenance of road markings and safety barriers.
- Support common EU curricula for auditors and inspectors.

[37] ETSC (2013) Response to the First Milestone Towards a Serious Injury Strategy, https://goo.gl/9bkVgM, European Commission (2013) First Milestone Towards a Serious Injury Strategy, https://goo.gl/8Kr1Z6

2.3 In-depth accident investigation

Thorough harmonised pan-European in-depth accident investigation data would support the identification of the areas that need immediate attention in developing collision countermeasures and support the evaluation of measures implemented in the EU. Currently only a small number of European countries systematically collect such data.[38]

The EU funded project DaCoTa built a network of 22 in-depth accident investigation teams in 19 countries. The final deliverable was a harmonised in-depth collision investigation protocol and the creation of tools supporting the accident investigation teams on data collection: 99 collisions were investigated in a pilot study. The database was developed in order to store in-depth accident data in a harmonised way and facilitate the exchange of data collected.[39]

Recommendations to Member States

- Conduct in-depth accident investigations in appropriate representative samples of collisions resulting in serious injuries and deaths, including single-vehicle collisions.
- Apply the DaCoTa in-depth road accident investigation methodology to contribute to comparable data across the EU.

Recommendations to EU institutions

- Support member states in collecting harmonised in-depth accident investigation data relating to fatal and serious injury collisions, including single-vehicle collisions.
- Build up on the DaCoTa deliverable related to in-depth accident investigation in creating a pan-European in-depth accident investigation database.

Within the context of the revision of Regulation 2009/661 concerning Type-Approval Requirements for the General Safety of Motor Vehicles:

- Mandate Event Data Recorders in all new vehicles and require the data to be made available for accident investigation.

[38] DaCoTa, Road Safety Knowledge System, https://goo.gl/50G6Vb

[39] DaCoTa (2012), Deliverable 2.5 Final Report on the Pan-European In-Depth Accident Investigations Network, https://goo.gl/d3OUuK

ANNEXES

Country	ISO Code
Austria	AT
Belgium	BE
Bulgaria	BG
Croatia	HR
Cyprus	CY
Czech Republic	CZ
Denmark	DK
Estonia	EE
Finland	FI
France	FR
Germany	DE
Greece	EL
Hungary	HU
Ireland	IE
Israel	IL
Italy	IT
Latvia	LV
Lithuania	LT
Luxembourg	LU
Malta	MT
Norway	NO
Poland	PL
Portugal	PT
Romania	RO
Serbia	RS
Slovakia	SK
Slovenia	SI
Spain	ES
Sweden	SE
Switzerland	CH
The Netherlands	NL
United Kingdom	UK

Table 1 (Fig.1) Road deaths in single vehicle collisions between 2004-2015.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Difference between the average annual change (%) in the number of deaths in SVCs and the corresponding change in number of multi-motor vehicle collisions over the period 2005-2014 (Fig,1)
RO	961	668	562	672	844	714	549	482	504	415	409	n/a	-7.2%
IL	98	81	75	88	106	45	66	62	48	40	39	54	-3.3%
NL	271	270	234	227	252	224	170	160	177	147	142	173	-3.2%
HU	267	278	303	269	219	210	114	134	102	120	107	138	-2.7%
SE	182	173	155	165	144	143	98	100	91	94	75	106	-2.6%
LU	18	24	19	19	14	19	18	11	17	17	14	17	-2.0%
BE	555	476	459	458	412	414	347	346	308	297	257	294	-1.8%
DE	1,811	1,639	1,545	1,469	1,301	1,262	1,039	1,174	1,015	896	894	929	-1.2%
UK	852	828	861	741	646	612	431	468	407	415	403	378	-0.6%
FI**	113	122	117	108	117	105	76	92	62	92	70	73	-0.5%
PL	1,191	1,282	1,237	1,468	1,421	1,179	902	1,030	894	842	727	685	-0.1%
AT	304	271	256	228	237	221	186	180	173	133	144	150	0.1%
LV	145	117	113	98	118	81	70	50	42	47	68	62	0.2%
FR	2,112	1,936	1,766	1,693	1,562	1,684	1,517	1,444	1,373	1,144	1,209	1,311	0.4%
CH*	156	162	110	146	130	116	102	87	119	89	78	84	0.5%
CZ	393	372	305	379	302	293	219	225	215	188	202	211	0.6%
EE	n/a	47	60	79	34	32	22	29	19	25	28	n/a	1.1%
NO	87	73	78	75	106	75	70	58	44	73	50	44	1.6%
ES	1,702	1,546	1,445	1,316	1,121	998	827	702	712	565	590	578	1.7%
IT	1,666	1,662	1,624	1,420	1,267	1,234	1,182	1,140	1,109	1,060	916	n/a	2.1%
PT	439	477	374	376	359	228	357	324	297	227	237	210	2.4%
EL	601	631	635	612	568	551	497	445	429	380	307	n/a	2.7%
RS	250	224	240	248	259	259	185	239	230	188	177	167	3.1%
IE	130	112	106	117	92	90	82	70	63	74	64	55	4.2%
SI***	54	44	55	61	38	32	28	27	38	25	n/a	n/a	4.2%
DK	78	72	71	83	104	87	70	66	47	50	47	43	5.0%
CY	33	38	25	24	19	26	21	25	20	19	18	23	6.6%
BG	n/a				378	356	n/a						n/a
HR	n/a			237	225	218	157	173	154	124	93	113	n/a
LT	n/a									65	70	n/a	n/a
MT	n/a	3	3	5	1	5	7	n/a					n/a
SK	129	169	145	168	162	109	87	n/a					n/a
EU24	14,162	13,322	12,564	12,319	11,416	10,657	8,979	8,897	8,268	7,396	7,046	7,230[†]	0.2%

Source: number of deaths in SVCs provided by the European Commission from CARE database upon ETSC's request. Data for the year 2015 was provided by the PIN panellists. Full time series for Ireland, Israel, Serbia and Switzerland were provided by the PIN Panellists, full time series for the Netherlands were provided by the Institute for Road Safety Research (SWOV).
EU24 average: EU28 average excluding BG, LT, MT and SK due to insufficient data in these countries.
*CH - in 2012 a dramatic bus collision in Switzerland in the Sierre Tunnel occurred, in which 28 people lost their lives.
**FI - suicides are included in the statistics.
***SI - average years 2005-2013.
[†]An estimate number taking into account that 2015 data were not availbale in EE, EL, IT, SI and RO at the time of publication.

Table 2 (Fig.2) Number of deaths in single vehicle collisions per million inhabitants over the period 2013-2015.

	2012	2013	2014	2015	Inhabitants 2015	Deaths in SVCs per mln. inhabitants over the period 2013-2015 (Fig.2)
IL	48	40	39	54	8,464,100	5.2
UK	407	415	403	378	64,767,100	6.2
DK	47	50	47	43	5,659,700	8.2
NL	177	147	142	173	16,900,700	9.1
SE	91	94	75	106	9,747,400	9.4
CH	119	89	78	84	8,236,600	10.2
NO	44	73	50	44	5,179,469	10.7
DE	1,015	896	894	929	81,174,000	11.2
HU	102	120	107	138	9,849,000	12.4
ES	712	565	590	578	46,439,900	12.4
IE	63	74	64	55	4,625,900	13.9
FI	62	92	70	73	5,471,800	14.3
SI***	38	25	n/a	n/a	2,062,900	15.3
AT	173	133	144	150	8,584,900	16.6
IT	1,109	1,060	916	n/a	60,795,600	16.9
EE*	19	25	28	n/a	1,313,300	18.3
FR	1,373	1,144	1,209	1,311	64,277,242	19.0
CZ	215	188	202	211	10,538,300	19.0
PL	894	842	727	685	38,005,600	19.8
RO*	504	415	409	n/a	19,861,400	22.3
PT	297	227	237	210	9,839,140	22.8
LT**	n/a	65	70	n/a	2,921,300	23.1
CY	20	19	18	23	847,000	23.6
RS	230	188	177	167	8,871,895	25.0
BE	308	297	257	294	11,258,400	25.1
HR	154	124	93	113	4,225,300	26.0
LU	17	17	14	17	563,000	28.4
LV	42	47	68	62	1,986,100	29.7
EL*	429	380	307	n/a	10,812,500	34.4
BG	n/a	n/a	n/a	n/a	7,153,784	n/a
MT	n/a	n/a	n/a	n/a	434,403	n/a
SK	n/a	n/a	n/a	n/a	5,426,252	n/a
EU25	8,333	7,461	7,116	7,300†	492,527,482	15.5

Source: number of deaths in SVCs provided by the European Commission, CARE database. Population figures completed with Eurostat data. Population figures for Israel and Portugal provided by the PIN panellists.
EU25 average: EU28 excluding BG, MT and SK due to insufficient data in these countries.
†An estimate number taking into account that 2015 data were not available in EE, EL, IT, LT, SI and RO at the time of publication.
*EE, EL, RO - average number of deaths in SVCs per million inhabitants, average years 2012-2014.
**LT - average number of deaths in SVCs per million inhabitants, average years 2013-2014.
***SI - average number of deaths in SVCs per million inhabitants, average years 2012-2013.

Table 3 (Fig.3) Deaths in single vehicle collisions as a proportion (%) of all road deaths by country, average years 2013-2015.

	Average number of deaths in SVCs in 2013-2015 or the last three years available	Deaths in SVCs as a proportion (%) of all road deaths in 2013-2015 or the last three years available (Fig.3)
EL*	372	42%
LU	16	41%
CY	20	41%
BE	283	38%
NO	56	37%
FR	1,221	36%
PT	225	35%
IE	64	35%
SE	92	35%
ES	578	34%
CH	84	33%
HR	110	32%
FI	78	31%
AT	142	31%
LV	59	31%
EE*	24	30%
RS	177	30%
IT	1,028	29%
CZ	200	29%
DE	906	27%
NL	154	26%
LT**	68	26%
DK	47	25%
PL	751	24%
RO*	443	23%
SI***	30	23%
UK	399	22%
HU	122	20%
IL	44	15%
BG	n/a	n/a
MT	n/a	n/a
SK	n/a	n/a
EU25	7,300	30%

EU25 average: EU28 excluding BG, MT and SK due to insufficient data in these countries.
*EE, EL, RO - average number of deaths in SVCs, average years 2012-2014.
**LT - average number of deaths in SVCs, average years 2013-2014.
***SI - average number of deaths in SVCs, average years 2011-2013.

Table 4 (Fig.4) Proportion (%) of deaths in SVCs by road type (rural non-motorways roads, motorways, urban roads), average years 2012-2014.

	Average number of deaths in SVCs by road type, average years 2012-2014				Proportion (%) of deaths in SVCs by road type, average years 2012-2014 (Fig.4)			
	Non-motorway rural roads	Motorways	Urban roads	Unknown	Non-motorway rural roads	Motorways	Urban roads	Unknown
NO*	57	0	4	1	93%	0%	7%	1%
LU	11	2	3	0	71%	13%	17%	0%
DE	690	85	158	3	74%	9%	17%	0%
ES†	385	123	101	14	62%	20%	16%	2%
AT	106	15	28	1	71%	10%	18%	1%
IE	51	2	13	0	77%	3%	20%	0%
FI	55	4	15	0	74%	5%	21%	0%
LV	41	n/a	11	1	79%	n/a	20%	1%
EE***	22	n/a	4	2	79%	n/a	14%	7%
SE	59	8	16	4	68%	9%	18%	5%
UK	285	24	95	4	70%	6%	23%	1%
CZ	145	7	50	0	72%	3%	25%	0%
CH*‡	57	6	21	0	68%	7%	25%	0%
DK	34	1	12	0	72%	3%	26%	0%
FR	844	76	304	18	68%	6%	25%	1%
CY	12	2	5	0	63%	11%	26%	0%
BE	173	33	51	29	60%	12%	18%	10%
NL	88	23	38	7	57%	15%	24%	4%
HU	67	7	35	0	61%	7%	32%	0%
PL	525	14	275	8	64%	2%	33%	1%
IT	555	106	367	0	54%	10%	36%	0%
SI**	15	4	10	4	46%	13%	30%	11%
EL	190	25	154	3	51%	7%	41%	1%
PT	111	25	118	0	44%	10%	46%	0%
IL	20	2	21	0	46%	4%	50%	0%
RO	212	7	218	6	48%	2%	49%	1%
HR	42	15	66	0	34%	12%	54%	0%
RS	49	8	141	0	25%	4%	71%	0%
BG	n/a							
LT	n/a							
MT	n/a							
SK	n/a							
EU22	4,683	605	2,132	97	62%	8%	28%	1%

EU22 average: EU28 excluding BG, EE, SI, LT, MT and SK due to insufficient data in these countries.
*CH, NO - average number of deaths in SVCs by road type, average years 2013-2014.
**SI - average number of deaths in SVCs by road type, average years 2012-2013.
***EE - number of deaths in SVCs by road type in 2014.
†ES - data on motorways also include autovias.
‡CH - in 2012 a dramatic bus collision in the Sierre Tunnel occurred, in which 28 people lost their lives. To avoid misinterpretation of data, 2012 SVC figures are excluded from Table 5 and Figure 5.

Note: categorisation of urban-rural roads might differ from country to country. There are no motorways in EE and LV.

Table 5 (Fig.5) Proportion (%) of deaths in SVCs by road user group, average years 2012-2014.

	Average number of deaths in SVCs by road type, average years 2012-2014						Proportion (%) of deaths in SVCs by road user group, average years 2012-2014 (Fig.5)					
	Car + taxi	Heavy goods vehicle	Lorry, under 3.5 tonnes	PTW	Bus or coach	Other/ Unknown	Car + taxi	Heavy goods vehicle	Lorry, under 3.5 tonnes	PTW	Bus or coach	Other/ Unknown
LT*	56	1	0	7	1	3	83%	1%	0%	10%	1%	4%
EE	19	1	0	0	2	2	81%	3%	0%	0%	8%	8%
PL	650	40	0	103	4	24	79%	5%	0%	13%	0%	3%
RO	348	10	21	49	3	12	79%	2%	5%	11%	1%	3%
CZ	158	8	4	28	2	2	79%	4%	2%	14%	1%	1%
IE***	52	5	n/a	4	2	3	78%	8%	n/a	6%	3%	4%
LU	12	1	0	3	0	0	77%	4%	0%	19%	0%	0%
LV	39	3	2	3	1	4	74%	5%	4%	6%	3%	8%
UK	299	7	9	79	6	9	73%	2%	2%	19%	2%	2%
DE	669	32	8	199	3	24	72%	3%	1%	21%	0%	3%
NL	109	2	7	31	0	5	70%	1%	5%	20%	0%	3%
HU	76	6	5	21	0	1	69%	6%	5%	19%	0%	1%
SE	59	2	3	16	1	5	68%	3%	3%	19%	1%	6%
BE	194	4	17	37	5	30	68%	1%	6%	13%	2%	10%
AT	101	3	6	33	0	6	68%	2%	4%	22%	0%	4%
IT	678	25	40	257	4	25	66%	2%	4%	25%	0%	2%
FR	813	28	72	299	4	26	65%	2%	6%	24%	0%	2%
CH*‡	55	2	1	21	0	6	65%	2%	1%	25%	0%	7%
HR	80	1	4	26	3	9	65%	1%	3%	21%	2%	8%
DK	31	1	5	11	0	0	65%	1%	10%	24%	0%	1%
IL	27	2	2	9	0	3	65%	4%	5%	20%	0%	6%
SI**	18	1	2	7	0	1	64%	2%	5%	25%	0%	4%
FI	47	4	3	13	1	7	63%	5%	4%	17%	1%	10%
CY	12	1	0	6	0	0	63%	7%	0%	30%	0%	0%
RS***	124	6	n/a	25	4	39	63%	3%	n/a	13%	2%	20%
ES	356	25	35	167	10	29	57%	4%	6%	27%	2%	5%
NO	31	5	2	10	3	4	55%	10%	4%	19%	5%	7%
EL	192	5	26	130	3	16	52%	1%	7%	35%	1%	4%
PT	121	10	35	54	4	29	48%	4%	14%	21%	2%	12%
BG	n/a											
MT	n/a											
SK	n/a											
EU23	5,118	217	307	1,570	60	268	68%	3%	4%	21%	1%	4%

EU23 average: EU28 excluding BG, MT, SK, SI and LT due to insufficient data.
*LT, CH - average number of deaths in SVCs by road user group, average years 2013-2014.
**SI - average number of deaths in SVCs by road user group, average years 2012-2013.
***IE, RS - lorries and HGVs are merged in the HGV category.
‡CH - in 2012 a dramatic bus collision in the Sierre Tunnel occurred, in which 28 people lost their lives. To avoid misinterpretation of data, 2012 SVC figures are excluded from Table 5 and Figure 5.

Table 6 (Fig.6) Average number of drivers/riders involved in fatal SVCs in 2012-2014 per million inhabitants in 2014 by driver age for each of the age group under 15<, 15-17, 18-24, 25-49, 50-64, 65+.

	Total number of drivers/riders involved in fatal SVCs by age group. average years 2012-2014						Drivers/riders involved in fatal SVCs by age group per million inhabitnats of each age group. average years 2012-2014 (Fig.6)					
	15<	15-17	18-24	25-49	50-64	65+	15<	15-17	18-24	25-49	50-64	65+
EL	0	6	62	159	57	55	0.0	20.7	71.8	41.1	27.6	24.4
PL	0	11	234	357	97	29	0.0	10.3	64.1	25.8	12.0	5.2
LU	0	0	3	9	2	1	0.0	0.0	60.3	42.6	22.7	8.6
HR	0	2	22	55	23	11	0.5	13.5	59.8	38.7	25.3	13.7
CY	0	0	6	8	1	1	0.0	0.0	59.5	24.9	6.4	5.6
EE	1	0	7	14	2	2	3.2	0.0	57.2	29.9	7.6	6.9
BE	0	1	58	118	37	25	0.0	4.3	56.9	31.4	16.6	12.5
IE	0	2	22	27	7	5	0.0	12.1	56.9	15.9	9.5	8.0
RO	0	1	97	208	52	18	0.0	1.2	55.8	28.3	13.2	5.6
CZ	0	1	48	91	24	19	0.0	4.1	54.4	23.2	11.7	10.6
RS	0	4	33	83	39	23	0.0	22.9	53.5	34.2	23.9	17.9
FR	2	21	306	533	166	121	0.1	10.8	52.2	25.0	13.0	10.2
LV	0	0	9	19	9	3	1.1	0.0	50.0	27.6	21.8	8.7
LT*	1	2	13	32	8	2	1.2	17.0	43.3	32.8	13.2	3.7
AT	0	6	30	60	24	22	0.3	24.2	38.5	20.0	14.3	14.1
PT	1	1	32	102	47	47	0.4	2.4	38.5	28.1	22.7	22.7
IT	1	15	171	418	182	184	0.1	10.5	37.8	19.6	15.0	14.1
DE	0	14	227	356	160	124	0.0	7.1	33.8	13.2	9.1	7.3
FI	0	5	16	29	13	8	0.0	29.5	32.6	17.1	11.5	7.6
SI**	0	0	5	15	6	3	0.0	0.0	31.3	20.0	13.5	7.0
NL	0	2	37	64	21	22	0.0	4.0	23.6	11.5	6.1	7.6
DK	0	0	12	18	8	6	0.0	0.0	22.7	9.7	7.8	6.2
HU	0	1	20	58	14	9	0.2	2.5	21.8	16.4	6.7	5.2
NO	0	1	8	24	10	8	0.0	28.6	20.4	8.9	5.7	2.9
ES	1	5	66	272	121	85	0.1	4.4	19.2	15.3	13.9	10.1
SE	0	0	17	30	15	12	0.0	1.2	18.0	9.5	8.8	6.4
CH	1	0	12	21	20	18	0.5	0.0	17.6	7.1	12.2	12.3
UK	0	11	108	153	54	47	0.0	5.7	17.2	7.0	4.6	4.2
IL†	0	5	10	16	5	2	0.0	12.6	12.0	6.0	4.7	2.7
BG	n/a											
MT	n/a											
SK	n/a											
EU23	6	103	1,610	3,159	1,138	855	0.1	7.9	38.1	18.7	11.7	9.4

EU23 average: EU28 excluding BG, LT, MT, SK and SI due to insufficient data.
Note: Table 6 includes all drivers involved in fatal single vehicle collisions, not all of these drivers were killed.
*LT - average number of drivers involved in fatal in SVCs by driver age group, average years 2013-2014.
**SI - average number of drivers involved in fatal in SVCs by driver age group, average years 2012-2013.
†IL - for Israel data agegroups are: 15<; 15-19; 20-24; 25-49; 50-64; 65+.

Table 7 (Fig.7) Proportion (%) of the number of road deaths in single vehicle collisions by the type of collision, average years 2012-2014.

	Leaving straight road	In a bend	Rollover	In junctions or entrance	Other	Unknown
RS	51%	28%	7%	4%	3%	8%
DK*	49%	30%	0%	4%	4%	13%
DE	47%	46%	0%	1%	6%	0%
NL	44%	31%	0%	11%	3%	11%
CY	42%	35%	7%	14%	2%	0%
FI	38%	41%	3%	5%	14%	0%
UK	34%	29%	1%	4%	23%	8%
IT**	33%	24%	0%	3%	35%	8%
HU	32%	36%	0%	4%	20%	7%
ES*	32%	41%	2%	14%	5%	7%
LU	31%	52%	4%	6%	4%	2%
NO	30%	51%	0%	5%	6%	8%
IL	3%	6%	36%	7%	47%	0%
LV	1%	0%	26%	10%	57%	5%
IE***	83%	36%	0%	30%	1%	0%

*DK, ES - 2014 data.
**IT - data estimated by Automobile Club d'Italia (ACI) based on ISTAT data.
***IE - data provided by the Ireland's Road Safety Authority (RSA). In Ireland figures are not mutually exclusive and there may be more than one type of road collission associated with the single vehicle collisions, average years 2012-2013.
Note: comparison between countries on collision characteristics is difficult due to possible differences in coding.

Table 8 (Fig.8) Proportion (%) of all vehicles involved in a fatal single vehicle collision by vehicle age, average years 2012-2014.

	More than 13 years	7-12 years	4-6 years	2-3 years	<1 year	Unknown
PL*	65%	18%	7%	2%	2%	6%
RS	64%	28%	6%	2%	0%	0%
HR	60%	22%	12%	3%	0%	2%
LV	58%	17%	4%	2%	1%	19%
CZ	54%	22%	15%	5%	2%	2%
PT	53%	25%	12%	4%	3%	3%
SE	52%	18%	10%	5%	6%	8%
NL	48%	21%	12%	6%	0%	13%
CY	47%	38%	6%	4%	2%	2%
FI	44%	25%	9%	4%	3%	15%
NO	43%	19%	14%	10%	5%	9%
FR	42%	22%	13%	9%	2%	12%
EL	39%	28%	14%	4%	1%	15%
DE	37%	28%	13%	6%	5%	10%
ES	37%	34%	14%	6%	2%	6%
IL	28%	28%	21%	12%	6%	4%
RO	28%	29%	15%	3%	2%	23%
LU	24%	29%	20%	11%	7%	9%
IT	23%	30%	15%	7%	5%	20%
UK	20%	41%	12%	8%	6%	13%
EU 16	36%	28%	13%	6%	3%	13%

EU16 average: EU28 excluding AT, BE, BG, DK, EE, HU, IE, LT, MT, PL, SI and SK due to insufficient data.
*PL - 2014 data.

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