LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

TECHNICAL AND SCIENTIFIC FOUNDATIONS FOR THE 2020-2030 ROAD SAFETY STRATEGY

Current situation and emerging challenges

REPORT 21/**2021 – DT/NPTS**
Revised version, June 2021

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Study for the Autoridade Nacional de Segurança Rodoviária

Lisbon • February 2021

R&D TRANSPORTATION

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The information and views set out in this report are those of the authors and do not necessarily reflect the official opinion of ANSR.

Title

TECHNICAL AND SCIENTIFIC FOUNDATIONS FOR THE 2020-2030 ROAD SAFETY STRATEGY
Current situation and emerging challenges

Authors

TRANSPORTATION DEPARTMENT

João Lourenço Cardoso
Senior Researcher with Habilitation, Head of Planning, Traffic and Safety Unit

Sandra Vieira Gomes
Assistant Researcher, Planning, Traffic and Safety Unit

Carlos Roque
Assistant Researcher, Planning, Traffic and Safety Unit

DELFT UNIVERSITY OF TECHNOLOGY

Fred Wegman
Professor

Collaboration

TRANSPORTATION DEPARTMENT

José Gil
Senior Technician, Planning, Traffic and Safety Unit

Cristina Sousa
Senior Technician, Planning, Traffic and Safety Unit

AV DO BRASIL 101 • 1700-066 LISBOA

e-mail: lnec@lnec.pt

www.lnec.pt

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TECHNICAL AND SCIENTIFIC FOUNDATIONS FOR THE 2020-2030 ROAD SAFETY STRATEGY

Current situation and emerging challenges

Abstract

The Portuguese Road Safety Authority (*Autoridade Nacional de Segurança Rodoviária – ANSR*) is developing for the Portuguese Government the country's road safety strategy for the coming period of 2021-2030. The activity comprises three steps: Stage 1, laying out the guiding principles of the National Road Safety Strategy: Vision Zero 2030; Stage 2, consisting in the preparation of technical-scientific reports for the new strategy, including the diagnosis of the current situation and the identification of emerging challenges, the building of the framework for the new strategy and the development of a methodology for preparing biennial action plans; and Stage 3, laying out the strategic vision and establishing the Action Plan 2021-2022.

Within the scope of these activities, ANSR requested the National Laboratory for Civil Engineering (*Laboratório Nacional de Engenharia Civil – LNEC*) to provide scientific and technical support to the development of Stage 2, to be delivered jointly with Prof. Fred Wegman, from the Delft University of Technology. This report refers to the first activity of Stage 2. It contains an assessment of the current road safety situation, including the analysis of main trends and a comparison with selected European countries resulting in an overview of the most relevant safety issues in Portugal. A review is also made of the status of Safe System principles in the existing road traffic; as well as a discussion of future aspects, that will most likely need to be addressed during the implementation of the strategy. Contributions received from the public and private stakeholders and from road safety experts are also examined, for consideration on the following activities of Stage 2.

Keywords: Road Safety / Strategy / Planning / Statistics

FUNDAMENTOS TÉCNICO-CIENTÍFICOS PARA A ESTRATÉGIA DE SEGURANÇA RODOVIÁRIA 2020-2030

Situação atual e desafios emergentes

Resumo

A Autoridade Nacional de Segurança Rodoviária (ANSR) está a desenvolver para o Governo português a estratégia de segurança rodoviária do país para a próxima década de 2021-2030. A atividade compreende três etapas: Fase 1, na qual se estabelecem os princípios orientadores da Estratégia Nacional de Segurança Rodoviária: Visão Zero 2030; Fase 2, que consiste na preparação de relatórios técnico-científicos para apoio à preparação da nova estratégia, incluindo o diagnóstico da situação atual e a identificação dos desafios emergentes, a elaboração do quadro metodológico para a nova estratégia e o desenvolvimento de uma metodologia para a preparação de planos de ação bienais; e Fase 3, na qual se estabelecerá a visão estratégica e se elaborará o Plano de Ação 2021-2022.

No âmbito destas atividades, a ANSR solicitou ao Laboratório Nacional de Engenharia Civil (LNEC) que prestasse apoio científico e técnico ao desenvolvimento da Fase 2, a ser realizado conjuntamente com o Prof. Fred Wegman, da Universidade de Tecnologia de *Delft*. Este relatório refere-se à primeira atividade da Fase 2. Contém uma avaliação da situação atual da segurança rodoviária, incluindo a análise das principais tendências e uma comparação com países europeus selecionados, e fornece uma visão clara das questões de segurança mais relevantes em Portugal. Igualmente, contém uma revisão do alinhamento do sistema rodoviário nacional com os princípios do Sistema Seguro, bem como uma discussão de aspetos futuros, que mais provavelmente terão de ser abordados durante a realização da estratégia. São também examinados os contributos obtidos dos intervenientes públicos e privados, bem como dos membros do Conselho de Peritos Não-Executivos, para consideração nas atividades seguintes da Fase 2.

Palavras-chave: Segurança rodoviária / Estratégia / Planeamento / Estatísticas

Executive summary

The Portuguese Road Safety Authority (*Autoridade Nacional de Segurança Rodoviária* – ANSR) is developing for the Portuguese Government the country's road safety strategy for the coming period of 2021-2030. This achievement comprises three stages: Stage 1, laying out the guiding principles of the National Road Safety Strategy: Vision Zero 2030; Stage 2, preparing technical-scientific reports for the new strategy, including the diagnosis of the current situation and the identification of emerging challenges, the building of the framework for the new strategy and the development of a methodology for preparing biennial action plans; and Stage 3, laying out the strategic vision and establishing the first Action Plan 2021-2022.

This report addresses the first activity of Stage 2, diagnosis, which was performed by LNEC and Prof. Fred Wegman, from the Delft University of Technology.

The report starts with a short summary review of the institutional setting of road safety policy implementation in Portugal. The second chapter contains a brief analysis of recent developments in road safety indicators for Portugal, including main trends and benchmarking with other European countries. Chapter 3 presents the results of the analysis of the implementation of the previous National Road Safety Strategy (PENSE2020), namely as regards its intermediate outcomes and bottlenecks. The alignment of major road traffic system characteristics with the Safe System principles is discussed in chapter 4. In the last two chapters future trends and the contributions obtained from the public and private stakeholders as well as from Non-Executive Experts Board members are examined.

For this diagnosis, data on police registered crashes, and on available exposure and performance indicators measurements were made available by ANSR, who also forwarded the PENSE2020 (*Plano Estratégico Nacional de Segurança Rodoviária*) evaluation reports made by its Scientific Monitoring Council, as well as the written contribution from public institutions and the general public, namely from *Prevenção Rodoviária Portuguesa* (PRP), who also shared reports and data from road user behaviour observation campaigns.

1 – Since the mid 1980s Portugal has experienced a considerable reduction both in the mortality rate (75% reduction in the number of fatalities per 100 000 inhabitants, from 1985 to 2019) and in the fatality rate (more than 90% reduction in the number of fatalities per million travelled kilometres, from 1985 to 2019). However, in the last decade the pace of improvement has slowed considerably, since 2016 no further reductions took place, and in 2019 Portugal registered almost 6.4 fatalities per 100 000 inhabitants, being the eight worst performer among the 32 countries analysed by ETSC (2000b) in their annual PIN report (Figure 1); in that year, the average for EU was 5.1 fatalities per 100 000 habitants.

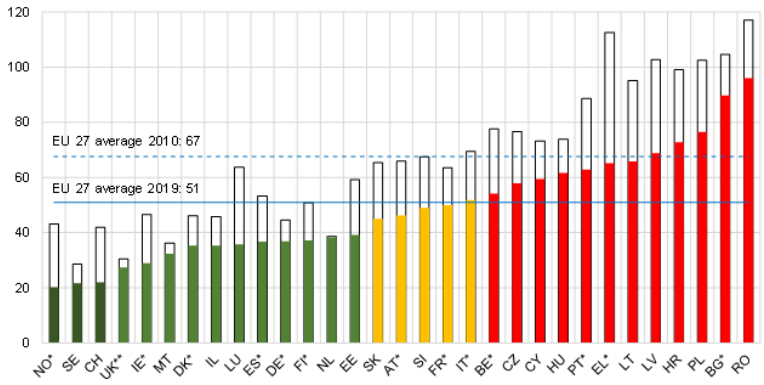

Figure 1 – Mortality (road deaths per million inhabitants) in 2019. Source; ETSC, 2020b

A closer look at the number of fatalities since the international definition of fatality was adopted by Portugal shows that in the last years of the past decade developments have been unfavourable (Figure 2): the number of fatalities decreased at an yearly average rate of -10.4% in the first five years (2010-2014) but increased by +2.0% yearly since 2015. This development is in line with the EU total; however, several countries (e.g. Norway, Switzerland and Ireland) maintained a downward trend in the last five years. The number of registered injury crashes showed a similar two phase development and the number of MAIS3+ serious injuries decreased in 2010-2014 (-2.8% yearly) but stabilized in 2015-2019 (+0.3%).

Overall, at the end of 2019, the forecast was that the PENSE2020 targets for casualties would not be met, assuming no exceptional circumstances would occur (such as the Covid19 pandemic).

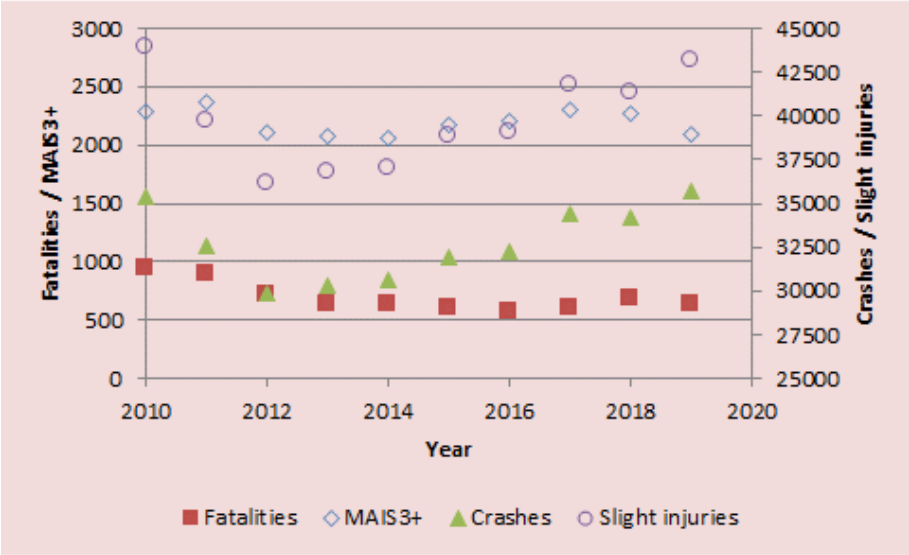

Figure 2 – Developments in the annual number of injury crashes and casualties (2010 2019)

2 – According to the Scientific Monitoring Council evaluation of PENSE2020 (reports for July 2017 to June 2019), a sizeable proportion of the planned actions were completed, even though the level of accomplishment for some was obtained at later stages of the execution period.

Analysis of the reports of the Scientific Monitoring Council of PENSE2020 allowed to identify some constraints to the implementation of the measures set by the plan, namely as relates to insufficient timely and predictable provision of financial resources, as well as scarce allocation of dedicated human resources by some public institutions. Delayed start or late accomplishment of some actions had an impact on related ensuing actions. The reported scope of accomplishment of some actions stated as completed does not allow to ascertain their full effectiveness. Difficulties in the evaluation process were mentioned by the Scientific Council, due to incomplete information about the realization of some measures and unclear specification of milestones, as well as incomplete follow-up on recommendations provided by the Council. Overall, full commitment to action implementation by the responsible entities (numbering 19) is not evident, and a description of accountability procedures is absent.

Involvement of the public sector and NGO's in the development of PENSE2020 was promoted by ANSR; the private sector, however, was not called for in the same manner, and their participation was scarce. Evidence of the active participation of municipalities in the realization of PENSE2020 is scant (only 16 municipal road safety plans have been developed), suggesting that deficient vertical coordination with municipalities was an unsolved issue. Nevertheless, no explicit reference to these issues was found in the evaluation reports.

No attempts have been made to estimate the impact of implementing PENSE2020 on the number of crashes and casualties. The targets for 2020 were 41 fatalities per million inhabitants (a 56% reduction from the 2010 value) and 178 serious injuries (MAIS3+) per million inhabitants (a 22% reduction from the 2010 value). In 2019 the following values were registered per million inhabitants: 64 fatalities and 213 MAIS3+ serious injuries.

3 – Road safety analysis uses data on the costs of unsafety, on crash and injuries frequencies, on safety performance indicators and on exposure (Figure 3).

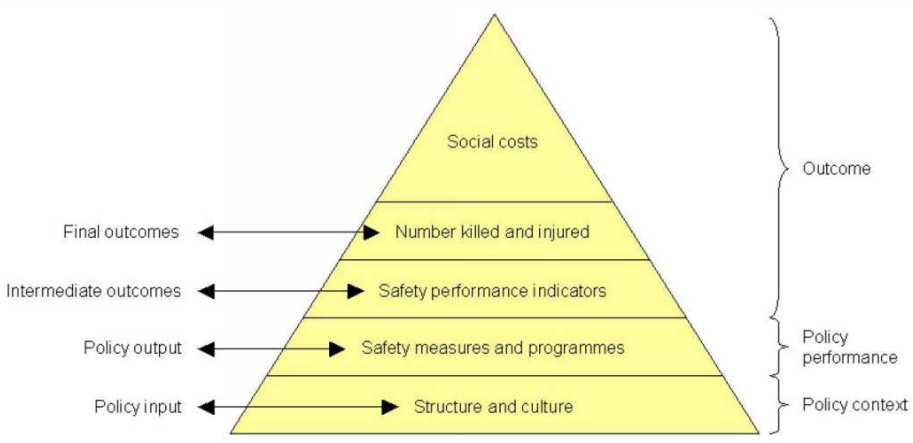

Figure 3 – The *SUNflower* project approach to the hierarchy of road safety

a) Current social costs estimates of the road safety burden in Portugal partially rely on contemporary aggregated data and are based on successive financial updates of an original study published in 1991, in which the human capital method was applied to detailed data from crashes which occurred in 1987. As today's characteristics of the traffic system are considerably different from the ones in that period, undoubtedly those estimates are outdated and do not reflect the current situation; also, currently, willingness-to-pay methods are preferred. Besides their use for safety management purposes, these costs are the basis for assessing safety related externalities in transport investment analysis (EC, 2019)
b) Existing data allows for a detailed picture of crash and injury frequencies, and associated factors; seemingly, a new procedure for registering MAIS3+ severe injury numbers will be available starting 2021. However, at this stage it is unknown if the linkage between police statistics and health statistics (hospitalizations) will allow for proper assessment of underreporting and full knowledge of the safety problem (i.e., the exact number of single vulnerable road user crash casualties).
c) Accuracy of some key variables registered in the crash data needs improvement, to be adequate for disaggregated use, namely regarding the type of location (e.g., separating urban from rural environments using location geographical coding), and manoeuvre descriptions (e.g., northing crash diagrams).
d) Full exploitation of crash data for road safety management is further hampered by the absence of detailed comprehensive and systematic time series data on fundamental exposure features, as well as on key safety performance indicators.
e) There is no evidence of a national road safety research and innovation strategy in Portugal, meaning that for the moment these activities are at best directed to fulfil international needs, rather than answering national research questions. Evidence on road safety knowledge related dissemination shows low activity – even within PENSE2020 actions dedicated for that purpose – and also shows that actually performed training sessions reached only but a small part of potential stakeholders and trainees.

4 – Analysis of collected data allowed to detect some relevant safety aspects, to consider while preparing the future road safety strategy.

a) In the period 2010-2019, 54% of the fatalities and 60% of killed and serious injured casualties (KSI) occurred in urban areas; in the period 2015-2019 the number of fatalities inside urban areas increased annually by +3.3%, and by 0.5% outside those areas. The percentage of fatalities in urban areas in Portugal (54%) is especially high, when compared with other European countries – where they barely reach 40%. The situation deteriorated further in these areas in the last five years.
b) Urban areas contribute significantly to the unsafety levels reported for road accidents in Portugal.

   The distribution of the road fatalities by road category was as follows (2015-2019): urban streets, 35%; interurban NRN roads, 21%; NRN roads through villages, 19%; motorways, 9%; and interurban IP's and IC's, 7%. In this period the number of fatalities increased on streets (+3.4%),

through roads (+2.6%) and interurban IP's (+7%), while diminishing on motorways (-2.2%). Single-vehicle crashes (35% of street fatalities and 28% of through road fatalities) increased in all urban road categories, and pedestrian fatalities (9% of the fatalities) reduced on interurban roads.

Single-vehicle crash fatalities in urban areas are increasing, hinting at inappropriate speed issues or increasing numbers of crashed unprotected vehicle occupants as possible contributing factors.

In the period 2010-2019, most pedestrian casualties occurred in urban areas: 80% of the pedestrians killed and 92% of those seriously injured.

c) In streets and through roads PTW occupants represented 30% of the fatalities and their number increased in the last five years. Except for motorways, there was an increase in the number of PTW occupant fatalities on interurban roads (they represent 19% of the fatalities in these roads). Data suggests that part of this increase may be explained by an increase in the number of motorcycles, which dates back to 2010.
d) Overall, in both periods, car occupants (45%), pedestrians (22%), moped riders (8%) and motorcyclists (15%) account for the majority of fatalities (4% for cyclists, and 7% for other vehicles). The distribution of KSI by vehicle category is similar, except for the percentage of bicyclists that has increased from 4% in 2010-2014 to 9% in 2015-2019.
e) The number of pedestrian fatalities has diminished in the period 2015-2019 on all interurban road categories and in streets and through roads. Nevertheless, the pedestrian mortality rate in Portugal (13.9 fatalities per million habitants) is higher than the EU average (10.4), being especially severe for pedestrians aged 65 or more: 35.1 fatalities per million inhabitants in Portugal vs. 25.1 - the average EU 28. Comparing with other European countries, the percentage of pedestrians hit by vans is much higher in Portugal; the same happens to the percentage of seriously injured pedestrians aged 65 or more.
f) The number of bicyclist fatalities (representing 10% on streets and through roads) has diminished in 2015-2019.
g) Overall, in 2015-2019 there was an increase in the mortality rate (fatalities per 100 000 inhabitants) in age groups 20-24 years (+15%), 30-34 (+5.9%) and over 65 years (+4.5%). This can be partially explained by an increase in the number of PTWs.

5 – Drink and drug driving remains a serious road safety problem in Portugal.

a) Observations on the prevalence of alcohol on drivers show an increase in violations, from 1.22% in 2008 (Houwing *et al.*, 2011) to 1.80% in 2013 (PRP, 2021c).
b) In the period 2010-2019, less than 4.5% of drivers tested by the police had a BAC above the 0.5 g/l legal limit; since 2010, the trend showed a decreasing tendency. Higher percentages of offenders were detected on moped riders (10.7%) and bicyclists (5.4%), and lower on bus and HGV drivers (0.9%) – according to INE, 2010-2018.
c) However, 28% of the crash fatalities had a BAC above 0.5 g/l: 33% for drivers and 21% for pedestrians. Developments show that the percentage of fatal drivers above 0.5 g/l increased in the period 2015-2019, the same occurred as regards the percentage of fatal drivers above

1.2 g/l. Overall the percentage of crashes involving alcohol is similar in urban and interurban roads.

d) Developments in the percentage of fatalities that tested positive for substances show and increasing trend, since 2010, especially as regards cannabis.

6 – Speeding is a serious problem in Portugal, as shown by international comparisons on the number of drivers running at speeds higher than the legal limit, on motorways, interurban roads and especially on urban streets. Statistics on speed distributions on interurban roads and urban streets, from 2004 and 2008, show a sizeable percentage of car drivers speeding by more than 30 km/h (20 km/h on urban streets), which correspond to a high excess danger of fatality and severe injury, as reported by research. Recent spot speed measurements do not allow to assume that the problem has been significantly reduced yet.

7 – In the period 2015-2019 there was a reduction in the number of police checks in Portuguese roads (except for alcohol tests) and a corresponding reduction in the number of detected violations, except for the number of no-driving licence detections. Concerning the other stages of enforcement, the numbers of both issued and paid fines has increased.

Automatic speed camera enforcement started in 2017 (77 speed camera sites by the end of 2020), which supposedly would partially offset the effects of lower numbers of standard police checks.

8 – An evaluation on how the four Safe System principles are adhered to in the Portuguese road transport system (regarding roads, speeds and user behaviour) resulted in the following findings:

a) Portugal has a comprehensive set of design and maintenance standards for interurban roads of the National Road Network that include elements of the concepts of self-explaining roads and forgiving roadsides. These standards are applied on a voluntary basis by some municipalities in their own interurban road networks. No national guidelines exist for the design of urban streets, but a document has been prepared within PENSE2020 for this effect (attending to Safe System principles), which is pending approval.

b) The Directive 2008/96/EC on road infrastructure safety management has been applied in Portugal, through a set of legislation. However, its application is only required on TERN roads. Furthermore, its implementation is not complete, as candidate road safety auditors cannot obtain in Portugal the corresponding professional permits yet, due to the absence of enabling regulation on their training.

c) Effective application of several technical documents with guidelines for safe roads aligned design elements is quite limited (e.g. for ensuring geometric design consistency, setting appropriate speed limits and signing dangerous interurban curves, as well as for designing safe roadsides). Nevertheless, crashes on inconsistent curves are still an issue on single carriageway interurban roads and there is a high percentage of run-off-road accidents and casualties on all interurban roads.

d) Effective application of the manual for setting speed limits on national roads is scarce, thus obstructing the potential for speed management approaches to the speed problem, despite the existence of multiannual national enforcement plans.

e) Compliance with road safety related traffic rules can be improved, to fulfil Safe System requirements, namely as regards seat belt and helmet use, avoiding speeding, drink and drug-driving as well as distracted driving.

9 – Registered trends and official population projections point to the need for impending changes in road infrastructure and vehicle human factor requirements. Usually design criteria parameters are decided upon selected statistics of relevant human perceptual and cognitive characteristic (e.g., reaction times) distributions. Changes in age distributions of candidate drivers will have an impact on corresponding distributions of human performance, which should be reflected in the road design parameters.

10 – Over 100 responses were collected from road safety stakeholders through the open survey handed by ANSR, stating several current road safety problems, namely: the unsafe conditions for vulnerable road users; the small consideration of road safety in sustainable mobility plans; difficulties in the implementation and evaluation of road safety campaigns; the importance of contributory factors in crashes with power two-wheelers and bicyclists; immaturity issues and lack of experience, impairment, and lifestyles associated to young drivers and the frailty and vulnerability of older drivers,; the quality of professional training; the unfitting application of signs and road markings; speeding and the absence of effective speed management; conflicts in the integration of road safety in urban design; the absence of comprehensive investigation on the causes of crashes; unfamiliarity with new road safety challenges introduced by ITS and ADAS devices and the pace of their market penetration, and uncertainty on how these gadgets will impact on driver distraction and inadvertent behavioural change. These will be considered in the next activity of Stage 2, for defining the main Safe System approach topics for *VisãoZero2030*.

11 – Summarising, road safety problems in urban areas, with pedestrians and PTW, and speeding and drink-driving were found to be most detrimental factors to road safety performance in Portugal, in recent years.

In the recent past, road safety management in Portugal has been underfunded, running on low human resources, and informed mostly on police-based records of crash occurrence data, thus lacking the desirable support of safety indicators and risk-exposure data. Furthermore, commitment from stakeholders to timely implementation of their agreed contributions has been deficient, possibly explained by a lack of clear rules for accountability.

These issues and an enlarged municipality intervention are the most pressing matters to consider when preparing *VisãoZero* 2030.

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1 | Introduction

1.1 Preface

The Portuguese Road Safety Authority (*Autoridade Nacional de Segurança Rodoviária – ANSR*) is developing for the Portuguese Government the country's road safety strategy for the coming period of 2021-2030. The activity comprises three steps: Stage 1, laying out the guiding principles of the National Road Safety Strategy: Vision Zero 2030; Stage 2, preparing the technical-scientific reports for the new strategy, including the diagnosis of the current situation and the identification of emerging challenges, the building of the framework for the new strategy, and the development of a methodology for preparing biennial action plans; and Stage 3, laying out the strategic vision and establishing the Action Plan 2021-2022.

Within the scope of these activities, ANSR requested LNEC to provide scientific and technical support to the development of Stage 2, to be delivered jointly with Prof Fred Wegman, from the Delft University of Technology.

As mentioned, Stage 2 consists of three activities:

- The assessment of the current road safety situation, providing a clear view of the most relevant safety issues in Portugal, the status of Safe System principles in the existing road traffic, as well as a discussion of future aspects, that will most likely need to be addressed in the near future.
- The establishment of the founding principles framing the advance of road safety policies for the next ten years and of the scientific background for the development of the new road safety strategy, including an overview of good practice in strategic goal and operational target setting and of cost-effective Safe System interventions, as well as the proposal of prospective key result areas for the 2020-2030 and viable enabling road safety interventions.
- The development of a methodology for the implementation of the envisioned biennial action plans according to the 'Plan-Do-Check-Act' framework, including the procedures for their development, budgeting approval and execution monitoring. A pilot measure demonstration is envisioned.

This report addresses the first activity of Stage 2. Following a summary review of the institutional setting of road safety policy implementation in Portugal, in chapter 2 an analysis is made of recent developments in road safety indicators, including main trends and benchmarking with other European countries. Chapter 3 contains the results of the analysis of the implementation of the previous National Road Safety Strategy (PENSE2020), namely as regards its intermediate outcomes and bottlenecks. The characteristics of the Portuguese road traffic system are benchmarked towards the Safe System principles in chapter 4. Future trends and the contributions obtained from the public and private stakeholders as well as Non-Executive Experts Board members are examined in chapter 5, with a discussion on how to address and incorporate them in the new strategy.

1.2 Road safety institutional framework in Portugal

As mentioned in the *Reference Document Vision Zero 2030* (ANSR, 2020c), the Decree Law 169-B/2019 of 3 December, approved the legal framework for the organisation and functioning of the XXII Constitutional Government, encompassing 19 ministries, of which three being especially relevant for road safety:

- Ministry of Internal Administration (MAI), responsible for ANSR – the Portuguese Road Safety Agency;
- Ministry of Infrastructures and Housing (MIH), which is responsible for the Institute of Mobility and Transport (IMT);
- Ministry of Health (MH) responsible for the medical emergency system and victim medical assistance and support.

Regarding the Portuguese road safety management institutional framework in the Mainland territory[1], it is important to mention the role of the following entities: the National Road Safety Authority (ANSR), the Institute for Mobility and Transport (IMT), the Mobility and Transport Authority (AMT), and the Municipalities. Three road infrastructure concessionaires also play a major role in road safety management: *Infraestruturas de Portugal* (IP), BRISA and ASCENDI (the former a State owned company and the latter being private companies).

National Road Safety Authority (ANSR) whose organic structure was approved according to the Regulatory Decree (RD) no. 28/2012 of 12 de March. The ANSR is a central service of the direct administration of the State, with administrative autonomy and no deconcentrated services. Its mission is to support the implementation of the Government's road safety policy, through planning and coordinating activities at the national Mainland level, as well as providing support to the enforcement of traffic related laws.

ANSR has no decentralized structures allowing direct interaction with citizens. Therefore, within the framework of the administrative traffic violation process interaction is ensured by the National Republican Guard and the Public Security Police, in accordance with MAI´s Order no. 3762/2012, published in the *Diário da República*, 2nd Series, no. 53, of 14 March 2012.

The following tasks of the ANSR are highlighted, as set out in the mentioned RD (no. 2 of the 2nd Article):

a) to contribute to the development of traffic and road safety policies;
b) to formulate the national road safety plan and monitor its implementation, as well as to prepare road safety related background documents, and to promote road safety studies, in particular on the causes and factors involved in crash occurrence;
c) to promote and support civic initiatives and partnerships with public and private entities, particularly in schools, as well as to promote information and awareness-raising campaigns that foster a culture of road safety and good driving practices;

[1] Regional institutions support regional governance in Azores and Madeira Regions.

d) to carry out road safety studies and to propose the adoption of measures aimed at traffic regulation and control;
e) to monitor compliance with legal provisions on traffic and safety, and ensure the processing and management of fines issued as a result of violations of the Highway Code and complementary legislation;
f) to standardise and coordinate the enforcement activities of the remainder entities involved in road matters, by issuing technical instructions and approving traffic control and monitoring equipment, and to exercise other powers committed by Law, namely the Highway Code and complementary legislation;
g) to contribute financially, in collaboration with the Directorate General of Infrastructure and Equipment of the Ministry of Internal Administration, to the acquisition of equipment and software applications to be used by MAI entities intervening in road matters, as mandated by the Government.

ANSR is the entity that carries out the planning, strategic coordination and support to the Government within road safety public policy, focusing on the formulation and implementation supervision of measures to raise awareness, prevent, monitor and deter risk increasing behaviour, in addition to providing, on a consultative basis and with a road safety perspective, support to entities with competence in the areas of road infrastructure and vehicle specifications.

The **Institute for Mobility and Transport (IMT)** is a public institute integrated in the indirect administration of the State, endowed with administrative and financial autonomy and its own assets. IMT is a central entity with jurisdiction over the entire Mainland National territory, has its headquarters in Lisbon and has, as decentralised services, Regional Directions for Mobility and Transport in each Portuguese Region: North, Centre, Lisbon and Tagus Valley, Alentejo, and Algarve.

The IMT pursues attributions of the Ministries of Internal Administration, Infrastructures and Housing, the Environment and Energy Transition, and the Sea, under the supervision and guidance of the Minister for Infrastructures and Housing. IMT’s mission includes the following:

- To support the Government in the implementation and evaluation of policies for mobility, land transport and road infrastructure sectors, ensuring their internal coordination with the traffic and safety subsystems and outlining strategies for intermodal transport.
- Supporting the Government in the preparation of legal and regulatory diplomas and in the preparation and launching of pre-contractual procedures in the land transport sectors, both in what relates to the economic aspects and to road infrastructures, within the scope of its attributions.
- Representing the Portuguese State, in conjunction with the Ministry of Foreign Affairs, in international bodies in the sectors of mobility, land transport and road infrastructure, without prejudice to the representation of the Mobility and Transport Authority (AMT) as a regulatory authority.

IMT's responsibilities in mobility and land transport include the following:

- To ensure, within the framework of its duties and in liaison with the ANSR, that best practices in road safety are applied;
- To promote the definition and updating of the regulatory framework for the inland transport sector, in particular the access to and permanence of transport activities and their professions, as well as the conditions for the issue of qualifications and professional certificates;
- To authorize, license and supervise the exercise of inland transport and complementary activities, including the coordination of the licensing and management process of logistics platforms and other facilities, in accordance with the applicable legislation;
- To certify land transport professionals and promote the qualification of drivers, to recognize, license and supervise the training and examination entities subject to their supervision, to define training policies and to guarantee and supervise their implementation;
- To define the conditions for issuing, validating, exchanging and withdrawing driving licences and transport related professional certificates;
- To monitor the implementation of the social regulations in the field of road transport, as the national authority responsible for implementing the corresponding control appliances (tachographs);
- To approve, homologate and certify vehicles and equipment related to land transport systems, guaranteeing compliance to the required technical and safety standards, as well as licensing the entities involved in certification and inspection processes;
- To promote technical improvements in road and rail vehicles, including components, equipment, materials as well as infrastructure, maintenance workshops and other means of operating rail transport, in accordance with the applicable legal standards and technological developments, with the aim of improving the safe and efficient operation of road and rail transport, the interoperability and the reduction of negative environmental impacts;
- To ensure the management of national transport sector registers, in particular for vehicles, railway infrastructure, vehicle inspection centres, drivers, driving schools, transport companies and complementary activities, public passenger transport services and transport professionals;
- To monitor the development of territorial management instruments, as well as sectoral instruments on a national scale;

IMT's competence in the field of road infrastructure includes specific matters relating to the National Road Network (motorways and trunk roads):

- Promoting the quality and safety of road infrastructure;
- Defining regulatory standards applicable to the road infrastructure sector related to quality and safety, after evaluating their impact with reference to the contractual standards in force, and monitoring the compliance of operators in the sector with their obligations;
- Collaborating with ANSR in the elaboration of National Road Safety Plans;
- Participating in the definition of the road infrastructure regime and status;
- Participating in the management of the road network and enforcing the rules and obligations applicable to it, in accordance with the law and with concession and sub-concession contracts,

without prejudice to AMT's responsibilities as regulatory authority or to the responsibilities entrusted to other entities;

- Exercising the functions provided for in legal or contractual instruments, namely in the National Roads Statute, in the National Road Plan and in road infrastructure concession and sub-concession contracts, without prejudice to AMT's attributions as regulatory authority or to the responsibilities entrusted to other entities;
- Supporting studies as well as technical and scientific dissemination activities, at national and international levels;
- Exercising, within the scope of the management and operation of the road network, the powers and competences attributed to the State, by law or by contract, unless these expressly provide for the intervention of the members of the Government responsible for the areas of finance and transport, or of other public entities, without prejudice to the faculty of sub-delegation, carrying out a careful and effective management that guarantees the safeguarding of the public interests at stake;
- Providing the management of standards and processes of the electronic identification of vehicles system, of authorisation of users of the electronic identification of vehicles system, of management of electronic devices and technology certification, and of public traffic events, for the purpose of collecting tolls and other road charges. IMT also manages the information systems related to the approval and supervision of systems of automatic identification of electronic devices (road side equipment, RSE) and of operation of its own RSE.

The **Mobility and Transport Authority (AMT)** is a legal person governed by Public Law with the nature of an independent administrative entity, endowed with administrative, financial and management autonomy, as well as its own assets.

The AMT's mission is to regulate and supervise the sector of mobility and land, river and rail transports, and their infrastructures, and economic activity in the commercial ports and maritime transport sector, as services of general economic interest and activities based on networks, through its powers of regulation, supervision, inspection and sanction, with powers to protect the rights and interests of consumers and to promote and defend competition in the private, public, cooperative and social sectors, under the terms of these statutes and other legal instruments.

Municipalities have full administrative competence in the management of municipal infrastructures and their operation. The Mainland area of Portugal is divided in 278 municipalities. The Decree of Law no. 50/2018 of 16 August[2] establishes the framework for the transfer of powers to local authorities and to intermunicipal entities (groups of municipalities with geographical affinity), putting into practice the principles of subsidiarity, administrative decentralisation and autonomy of local government.

In Chapter II, Article 21, on Transport and Means of Communication, it is stated that:

[2] Decreto de Lei n.º 50/2018 de 16 de agosto

1) Without prejudice to the powers of the intermunicipal entities, the management of all roads in urban areas and the equipment and infrastructures integrated in them is the responsibility of the municipal entities, except for the:
   a) Sections of roads operated under a concession or sub-concession regime, during the period in which such operation is maintained;
   b) Sections of road or road which are part of a Main or Complementary Itinerary;
   c) Reserved technical channel of roads, as defined in Article 3, point j) of the Statute of Roads of the National Road Network.

In view of the provisions of Article 3, point f) of Law No. 33/98 of 18 July[3], Municipal Safety Councils were established, and taking into account Law No. 106/2015 of 25 August[4] (first amendment to Law No. 33/98), one of their tasks is to estimate the numbers of road crashes and, taking into account the national road safety strategy, to formulate proposals for actions that may contribute to the reduction of road crashes in each municipality.

With regard to the powers of the Municipal Safety Council, and in accordance with Article 4, for the pursuit of the objectives set out in Article 3, it is for the Council to deliver an opinion on the outcomes of road crashes occurring in their municipal area, and develop a set of proposals for the Municipal Road Safety Plan.

Mainland municipalities are responsible for the management of over 80000 km of roads and streets, which corresponds to approximately 85% of the total Portuguese road network.

Municipalities also have a key role in the implementation of basic education policy, civil protection, and urban and transport policies related to micromobility, and in ensuring that safety is embedded in their definition and implementation, namely as concerns the adaptation of urban design, infrastructure design and maintenance and in laying out and enforcing traffic rules and control.

Currently, the National Road Network (NRN) comprises 14313 km, including 3122 km of motorways and 3796 km of roads intended to be handed to municipalities (see section 4.2.2).

Infraestruturas de Portugal **(IP[5])** is the concessionaire of most of the NRN. Only a small part of this network (1589 km) is managed indirectly, through sub-concessions and joint partnerships with private road operators.

A small part of the NRN (2621 km) is operated by other (private) concessionaires, such as **BRISA** (1 628 km of motorways) and **ASCENDI** (535 km of motorways); contract management for these concessions is supervised by IMT.

The ***Direção-Geral do Território*** (Directorate-General for Territory management) was created by Dec. Lei 77/2012, of January the 12th, as a central service integrated into the direct administration of the

[3] Lei no.º 33/98 de 18 de julho

[4] Lei no.º 106/2015 de 25 de agosto

[5] https://www.infraestruturasdeportugal.pt/pt-pt/rede/rodoviaria

State, within the Ministry of the Environment and the Climatic Action (MAAC). Its mission includes to pursue public land use and urban planning policies in accordance with the aims, general principles and objectives of the respective Basic Law. Its tasks include supervising the implementation of the National Programme of Territorial Planning (PNPOT), approved on 5 September 2019, and, within the framework of the cities policy, stimulating and managing the URBACT Programme, namely in relation to the action plans within the National Circular Cities Initiative, as well as supervise the quality of sustainable urban mobility plans.

The Ministry of Justice (MJ) is responsible for devising, conducting, implementing and evaluating the policy of Justice defined by the Assembly of the Republic and the Government, and to ensure the Government's relations with the Courts and the Public Prosecutor's Office, the Superior Council of the Magistracy and the Superior Council of the Administrative and Fiscal Courts.

In the existing Portuguese institutional arrangement, road infrastructure safety management is a responsibility of the Ministry of Infrastructures and Housing (MIH), the 278 Mainland municipalities, road concessionaires (such as IP, BRISA and ASCENDI); vehicle homologation and technical inspection are under the MIH, with driver training and transport operator licensing; emergency services are supervised by the Ministry of Internal Administration (MAI) and Ministry of Health (MH), this latter ministry being responsible for medical treatment and victim recovery; whilst ANSR, the coordinator of road safety policies and supervisor of the traffic violation registry, and the police forces responsible for enforcement (GNR and PSP) are under the authority of MAI.

In view of this structure, the implementation of efficient and effective road safety measures requires great horizontal coordination between the five mentioned ministries and the close alignment of the acting institutions under the MAI and MIH, as well as vertical coordination with the 278 municipalities.

2 | Road Safety indicators – current situation and recent developments

2.1 Available information

To prepare this status of the current road safety situation in Portugal, data on registered crash records were analysed for the period starting in 2010, since that was the year in which follow-up procedures on hospitalized crash injuries were established, allowing to count the number of fatalities according to the international definition (death within 30 days, due to crash produced injuries). Unless stated differently, in this report the numbers of fatalities for years 2010-2019 refer to this definition; the numbers of fatalities in previous years refer to those deaths that occurred at the crash scene or during transport to hospital. Serious injuries refer to those victims that were admitted to hospital as in-patients for more than 24 hours, and did not die within 30 days. Since 2017, estimations on the number of serious injuries according to the MAIS3+ definition were made, using the national hospital discharge database, the Health Ministry applying the EC's AAAM converter to the ICD9-CM and ICD10CM/PCS codes to calculate the MAIS score. Such values are currently available for the period 2010-2019 (see Figure 2.6). Generally, all crash data were obtained from the ANSR's crash data base (which were registered by the police forces, with a crash form – BEAV), except stated otherwise.

A comparison between data on the number of BEAV's serious injuries and the number of casualties discharged from hospitals in the three-year period 2012-2014, shows that the numbers of motorized vehicle severe injuries in the BEAV are higher than the corresponding numbers in hospitals: 2778 injuries on cars and heavy vehicles vs 1434 hospitalized, and 213 other vehicles' casualties vs. 78 hospitalized. For the rest of the victims, the numbers of hospital casualties are higher than the numbers of serious injuries in the BEAV (see Table 2.1). The differences are especially important for two-wheeled vehicles. In part, these differences may be explained by the selection of relevant records from the Hospital Morbidity Database (containing only hospital admissions); in fact, only hospitalized patients with the first external cause of injury corresponding to traffic accidents (E810 to E819 and E826) were retained (Santiago *et al.*, 2019). Additionally, one limitation of this study was that it covered only public hospital units, as private hospital institutions are not covered by the Hospital Morbidity Database.

Table 2.1 – Numbers of hospitalization due to traffic crash and BEAV registered serious victims (2012-2014)

Road user	Hospitalized	Serious injury
Cars and heavy vehicles	1434	2778
Motorcycles and mopeds	1746	1399
Bicyclists	745	265
Pedestrians	1260	1242
Other vehicles	78	213
TOTAL	5263	5897

Linkage between the two data bases is not straightforward and such efforts using existing common local and time elements have not met great success. Taking the Hospital Morbidity Database as a reference, it was possible to link the data made available by the police in 8102 cases, about 21.6%. The connection to the emergency services (INEM) data was possible in only 62 cases, about 0.17%. As can be concluded by the differences between the different databases' links, there are cases that are not found in hospitals or caught by INEM. It is important to emphasize that BDMH only counts victims who gave rise to hospital admission (Santiago *et al.*, 2019).

Furthermore, in that study, the current data existing at the INEM does not allow the use of automatic algorithms for linkage with BEAV and hospital discharge data. This linkage could be beneficial, as when triggering medical emergency services through the application SIADEM (Integrated System for Medical Emergency Attendance and Dispatch), INEM collects information that allows for typifying and identifying the incoming emergency calls' geographic location.

The existence of cases not identified as traffic accidents in the hospital data, but existing in the police database and vice-versa is a limitation referred in the literature (ITF/OECD, 2011 and Watson *et al.*, 2015), and properly addressed for example by the Dutch (Bos *et al.*, 2019).

There are no published studies on the underreporting of crashes or victims in Portugal.

Seemingly, a new procedure for registering the number of MAIS3+ severe injuries in Portugal will be available starting in 2021, as a result of PENSE2020. In this procedure, the police has direct access to health (hospitalizations) database, allowing the verification of data on their recorded accidents. However, it is unknown which methods are being used to correct for underreporting of, for example, single vulnerable road user crashes.

In road safety research and management, data on crash and injuries frequencies are not sufficient, as usually risk analysis provides better insight on possible preventive and corrective safety interventions, both from the public health approach and the socio-technical system view point.

Exposure data are required to obtain risk estimates, those being defined as the probability of being involved (or injured) in a road crash, and calculated as the number of crashes (or casualties) divided by the amount of road user exposure over a time period. These risk figures may also concern the probability of being injured once involved in a road crash (severity rates), calculated as the number of casualties divided by the number of road crashes (or persons involved in road crashes). Risk figures may be used for different purposes, such as international comparisons, monitoring of road safety problems, in-depth road accident analyses and research, road and traffic operations analyses, epidemiological analyses etc.; however, their main use concerns the comparison of safety performance among different units, populations or countries.

Preferably, the selection of exposure measure should be based on its theoretical importance. However, quite often the preferred exposure measure is unavailable or exists at an inadequate level of disaggregation. In such cases, an alternative (proxy) exposure measure may have to be selected.

The exposure measures can be roughly classified into two groups: those connected to traffic estimates, such as road length, vehicle-kilometres, fuel consumption and vehicle fleet; and those related to persons

at risk evaluations, such as person-kilometres, population, number of trips, time in traffic and driver population.

At the national level, time series exposure data for the analysed period is available on population, vehicle fleet, and to some extent on driver population, as provided by the Statistics Institute of Portugal (*Instituto Nacional de Estatística* – INE). There are no official data on motorized vehicles' travelled distance at the national level, and the sole known source is based on estimations using an old model developed at LNEC, using international comparisons of travelled distance, disaggregated vehicle fleet composition and fuel sales by type (Cardoso, 2005). However, it is known from work at LNEC that estimations so produced are conservative (Azevedo, 2008).

At the regional and local levels, the only systematic data available on travelled distances is limited to the National Road Network, where traffic counts and estimation on each road link are regularly undertaken and made available by *Infraestruturas de Portugal* (IP) as regards their concessioned network. Travelled distance on the motorway network is published by the *Instituto da Mobilidade e Transportes* (IMT), based on traffic counts on toll boots. This data was used in the PENSE2020 action A20.80 for the detection of hazardous locations (see 2.2.1).

Intermediate outcomes are related to aspects in the functioning of the traffic system that are believed to be causally related to the crash occurrence, or to resulting deaths and serious injuries, such as safe traffic speeds, infrastructure safety rating (linked to the self-explaining and forgiving road concepts), safety belt and protective equipment (e.g. helmets and children restraint systems), drinking and driving, distraction, vehicle safety (active and passive) and post-crash care and trauma recovery. The quantification of these commonly used intermediate outcomes is obtained by means of safety performance indicators or key performance indicators.

Despite some promising steps taken in the beginning of the century (e.g. the speed measurement campaigns made in 2000, 2002 and 2004) and the measurement campaigns on indicators related to several of the above mentioned safety aspects (e.g. within the SafetyNet project, in 2004, and MAI sponsored study in 2013), continuous time series on Portuguese key performance indicators are not publicly available yet. Therefore, the potential is small for attempting to explain registered developments in road safety final outcomes by correlations with changes in road user behaviour aspects or modifications in road infrastructure overall characteristics.

Whenever available, existing spot information on key performance indicators was used to support the analysis. For instance, even though there are only two sets of data on drinking and driving prevalence (Houwing *et al.*, 2011 and PRP, 2021c), time series data is available on the rate of violations detected in off-road police tests and on the tests carried out to serious and fatal victims, as well as crash involved drivers.

For international comparisons, exposure and crash data, as well as data on some intermediate outcomes, were collected from ETSC PIN project, from ITF's International Traffic Safety Data and Analysis Group (IRTAD), and from the E-Survey of Road Users' Attitudes (ESRA).

2.2 National data

The annual developments in the Portuguese mortality indicators from both the public health (mortality rate – fatalities per 100 000 inhabitants) and the mobility (fatality rate – fatalities per million vehicle.km) perspective are presented in Figure 2.1 to Figure 2.3, for the period 1980 to 2019. The mortality indicators shown reflect only the fatalities occurred at the crash scene or during transport to the hospital.

Since the mid 1980s Portugal has experienced a considerable reduction both in the mortality rate (75% reduction in the number of fatalities per 100 000 inhabitants, from 1985 to 2019) and in the fatality rate (more than 90% reduction in the number of fatalities per million travelled kilometres, from 1985 to 2019).

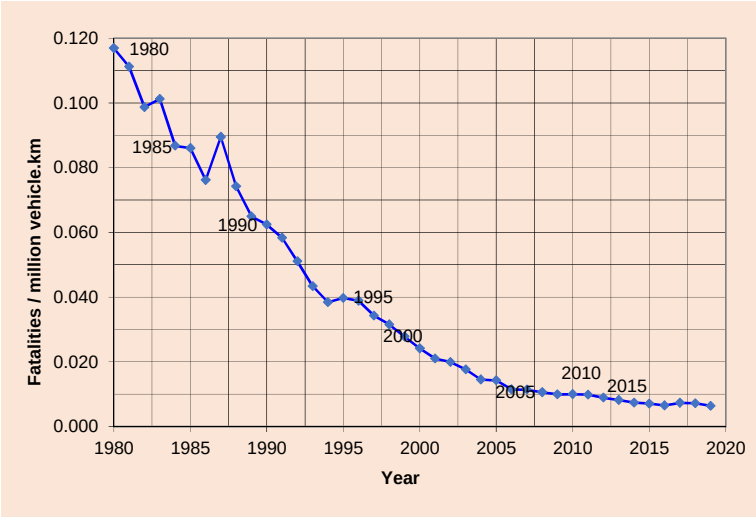


Figure 2.1 – Developments in the fatality rate (1980 2019)

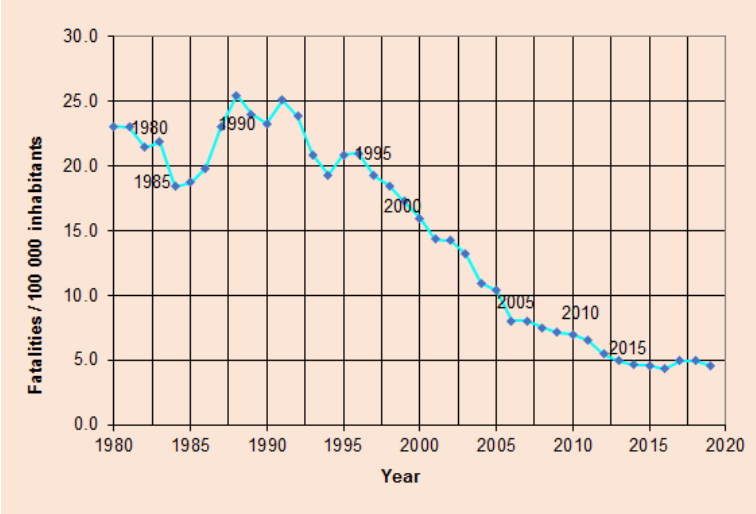


Figure 2.2 – Developments in the mortality rate (1980 2019)

Figure 2.3 – Developments in health and socio-technic crash indicators (1980-2019)

From 1980 to 1995, the reduction of the indicator from the motorisation point of view was considerably higher than that the one for the public health indicator, which can be explained by the steep increase in the motorisation rate, resulting from the generalised access to the private motorised vehicles, and the modernization of main trunk roads in line with the beginning of the implementation of the new National Road Plan.

Developments in traffic volumes and the numbers of fatalities and of serious injuries are presented in Figure 2.4. Registered data on the number of fatalities according to the 30 days (following crash occurrence) international definition are available since 2010: the corresponding numbers are represented in the figure. Overall, traffic increased monotonously until 2004 and remained more or less stable (with small spot reductions) in the following years, especially following the financial crises of 2011; the numbers of fatalities and severely injured victims show a decreasing trend since the late 1980s, with a stabilization in the number of serious injuries since 2012.

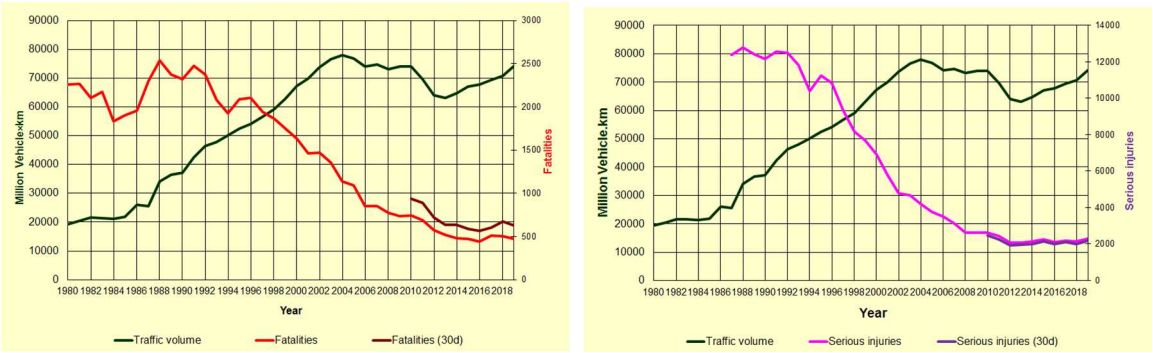


Figure 2.4 – Developments in annual traffic volumes and the annual numbers of fatalities and serious injuries (1980-2019)

Figure 2.5 shows a comparative representation of this century's developments in the fatality rates, by population, traffic volume and car fleet (using the values for year 2000 as reference). The similarity in developments is mostly explained by the small variation in the number of inhabitants and vehicles, and the irregular variation in traffic volumes.

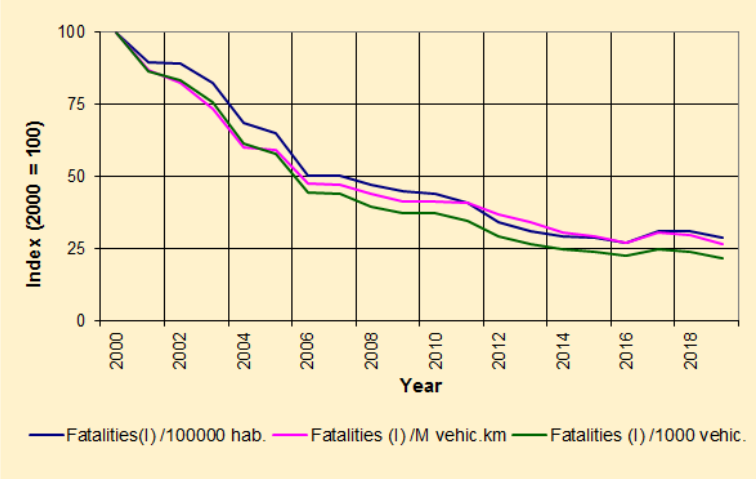


Figure 2.5 – Developments in the fatality (on-site) rates, per 100 000 inhabitants, million travelled kilometres and 1000 vehicles (2000-2019)

Since registration of the number of 30 days fatalities started, the ratio between their annual numbers and the corresponding number of fatalities on arrival to hospital varied significantly, between the minimum of 1.18 and the maximum of 1.33, averaging 1.27 (see Table 2.2), without a clear time trend. This variation deserves to be analysed, to ensure the existing procedure for producing the 30-day fatality registering is effective and is being successfully implemented.

Table 2.2 – Relation between the annual number of fatalities on-site and in the 30 days following the crash

Year	On-site or transport	30 days	Ratio
2010	741	937	1.26
2011	689	891	1.29
2012	573	718	1.25
2013	518	637	1.23
2014	482	638	1.32
2015	473	593	1.25
2016	445	563	1.27
2017	510	602	1.18
2018	508	675	1.33
2019	474	626	1.32

In the following sections, unless stated otherwise, the international definition of fatality will be used, and serious injuries correspond to those victims that were admitted as hospital in-patients (24 hours or more) and had not deceased within the 30 days period since the crash. Victims are disaggregated into two types: the number of fatalities, and the aggregated number of fatalities and serious injuries (KSI).

Available data on road safety final outcomes (crash data and victims) and intermediate outcomes (safety performance indicators) were analysed for the period between 2010 and 2019; when available and relevant, data on road safety related outputs (e.g. alcohol testing and enforcement activity) is referenced, as well.

Overall, the number of casualties diminished in that period, with a yearly average reduction rate of -6.1% in the case of fatalities and -0.8% in the numbers of MAIS3+ casualties; the number of injury crashes shows a smaller yearly rate of decrease (-1.0%)[6]. However, two distinct periods can be detected in the development over time (Figure 2.6), which may be broadly represented by considering the half periods 2010-2014 and 2015-2019. This latter half-period is especially important for future consideration, as it shows what will most likely be the result of a *status quo* scenario for road safety interventions.

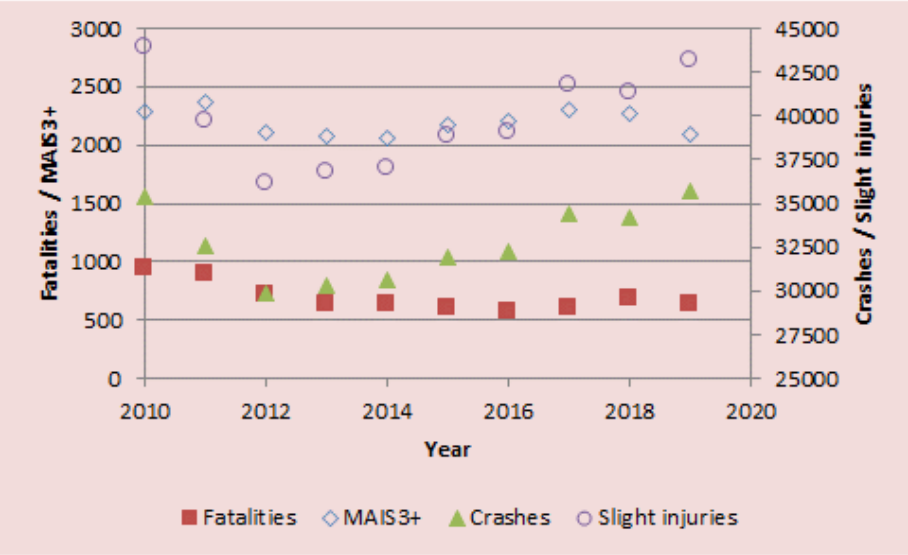


Figure 2.6 – Development in the annual number of injury crashes and casualties (2010-2019)

Fatalities decreased yearly by -10.4% between 2010 and 2014, and increased by +2% between 2015 and 2019; the numbers of MAIS3+ injuries decreased by -2.8% in the first half-period, and increased by +0.3% in the second; the number of crashes decreased by -4.8% and increased by +2.7% in the period 2015-2019.

[6] Yearly rates of reduction are similar when considering the old fatality definition (deceased victim on the spot or upon arrival at hospital).

In the period 2010-2019, traffic decreased severely due to the economic crisis started in 2010, and increased slightly since 2013; nevertheless, annual traffic volumes reached the 2010 level only in 2019 (Figure 2.4). Overall, in the period 2010-2014 traffic volumes decreased at an average rate of -4.2%, and increased with an average rate of +2.2% in the period 2015-2019.

In the same period the number of vehicles (cars, buses, coaches and heavy goods vehicles) increased by 0.6% annually (2010-2019); overall, in the period 2010-2014 the number of vehicles decreased by 0,3% annually, and it increased by 2,8% in the period 2015-2019.

In summary, between the mid 1980s and 2010 Portugal experienced a considerable reduction both in the mortality rate and in the fatality rate; in the last decade the pace of improvement has slowed considerably, since 2016 no further reduction took place, and in 2019 Portugal registered almost 64 fatalities and 213 MAIS3+ serious injuries per million inhabitants.

2.2.1 Type of area and road category

Overall, 54% of the fatalities (30 days definition) and 60% of the killed and seriously injured victims occurred in urban areas, during the period 2010 to 2019 (Figure 2.7).

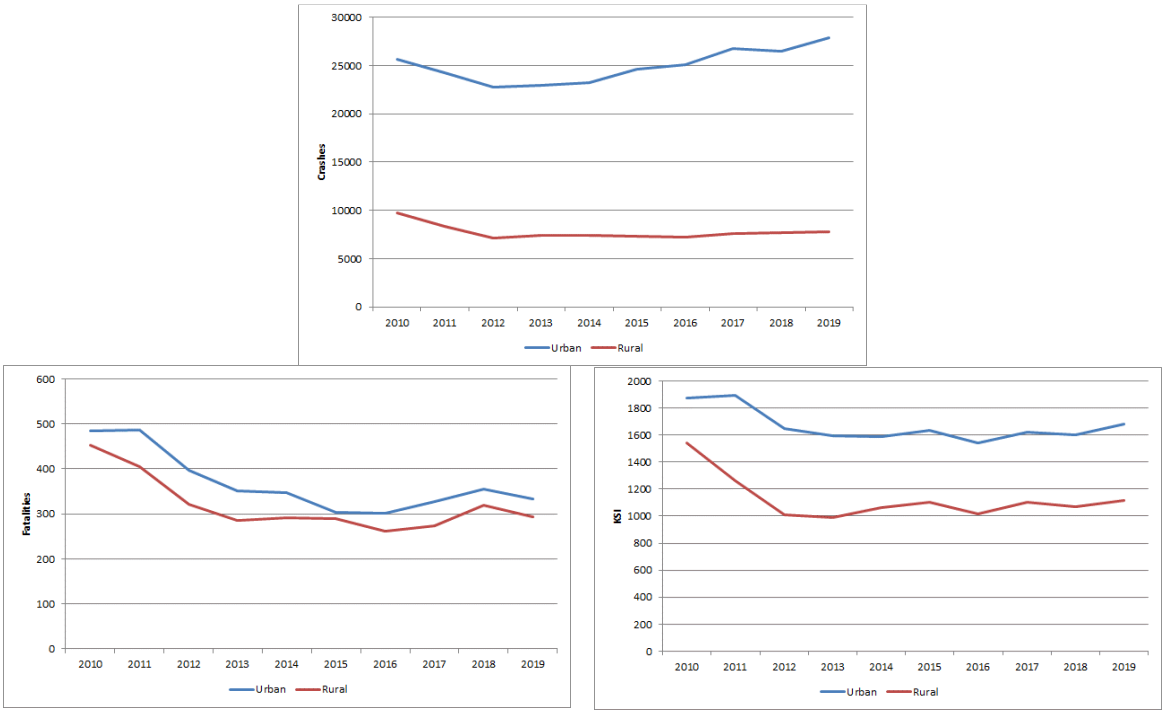


Figure 2.7 – Development in the annual number of crashes, fatalities and KSI by type of area (2010-2019)

Despite a general increase in the number of crashes inside urban areas since 2012, the number of crashes diminished in the period 2010-14 at an annual average rate of -3.4% inside urban areas and -8.7% outside of those areas; in the period 2015-19 a slight increase was observed both inside (+3%) and outside (+1.7%) urban areas.

In the period 2010-2014 the numbers of fatalities and KSI reduced significantly, both inside and outside urban areas (Figure 2.8). In the period 2015-2019 the number of fatalities increased annually by +3.3% in urban areas and by +0.5% outside urban areas; while the numbers of KSI reduced by -0.6% outside urban areas and basically remained constant inside urban areas (-0.1%).

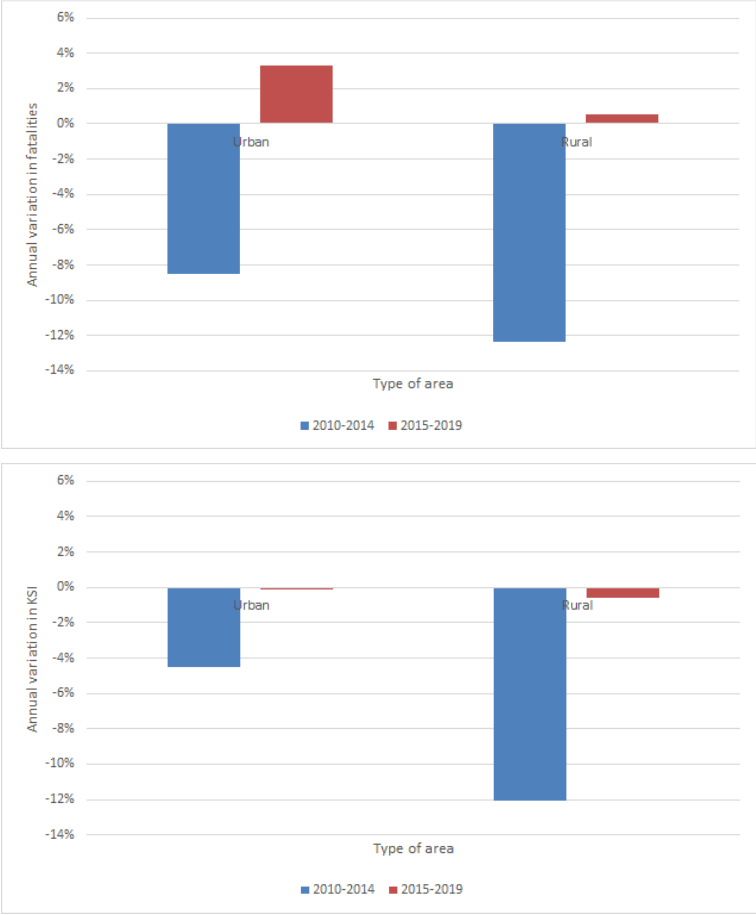


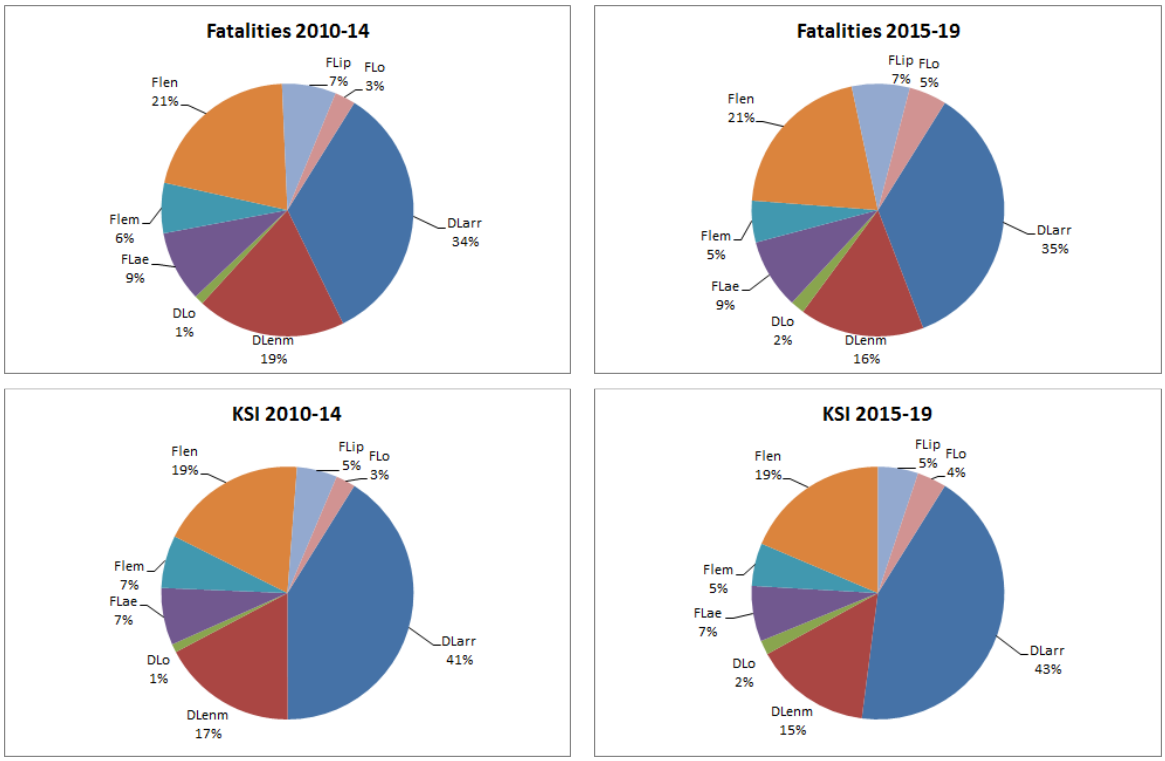
Figure 2.8 – Annual variation in the number of fatalities and KSI per type of area (2010-2014, 2015-2019)

It may be concluded that road safety developments in urban areas were less favourable than on rural roads.

Figure 2.9 presents the distribution of fatalities and KSI by road category in the periods 2010-2014 and 2015-2019. Streets (DLarr) and roads through villages (DLenm[7]) account for the majority of urban KSI, other urban roads (DLo) having a minor contribution. Outside urban areas, trunk roads (Flen) account for almost half the number of rural KSI; motorways (FLae) and municipal roads (Flem) have a similar share, and main and complimentary itineraries (Flip) and other roads (Flo) have a minor contribution.

[7] It is worth mentioning that not all through roads (DLenm) correspond to effective urban road environment, as there are cases where village signs (mandating the 50 km/h urban speed limit) are posted at considerable distance from the start of the corresponding village.

There were no significant changes in the share of KSI per roads outside urban areas, whilst the DLarr and the DLo percentages increased slightly.



Urban roads (DL): DLarr – streets; DLenm – roads through villages; DLo – other urban roads
Rural roads (FL): FLae – motorways; Flip – trunk NRN roads; Flen – NRN roads; FLem – municipal roads; FLo – other roads

Figure 2.9 – Distribution of fatalities and KSI by road category, inside and outside of urban areas (2010-2014 and 2015-2019)

Figure 2.10 presents the average reduction in the number of crashes and victims by road category in the periods 2010-2014 and 2015-2019.

Fatalities increased by 3.4% and 2.6% in streets and through roads respectively, in the period 2015-2019, as well as in IP/IC's (7.0%) and other non-urban roads (2.1%). It also shows that in the period 2015-2019 the reductions in the number of KSI in through roads (-2.6% in DLenm) were partially offset by the increase in the number of KSI in urban streets (+0.6%), there being four times more victims in streets than in through roads. Outside urban areas, the situation improved significantly on motorways (FLae, -2.4%) and trunk roads (FLen, -3.4%) in both periods.

Developments by road category in the period 2015-2019 are further detailed regarding the road user category in section 2.2.3

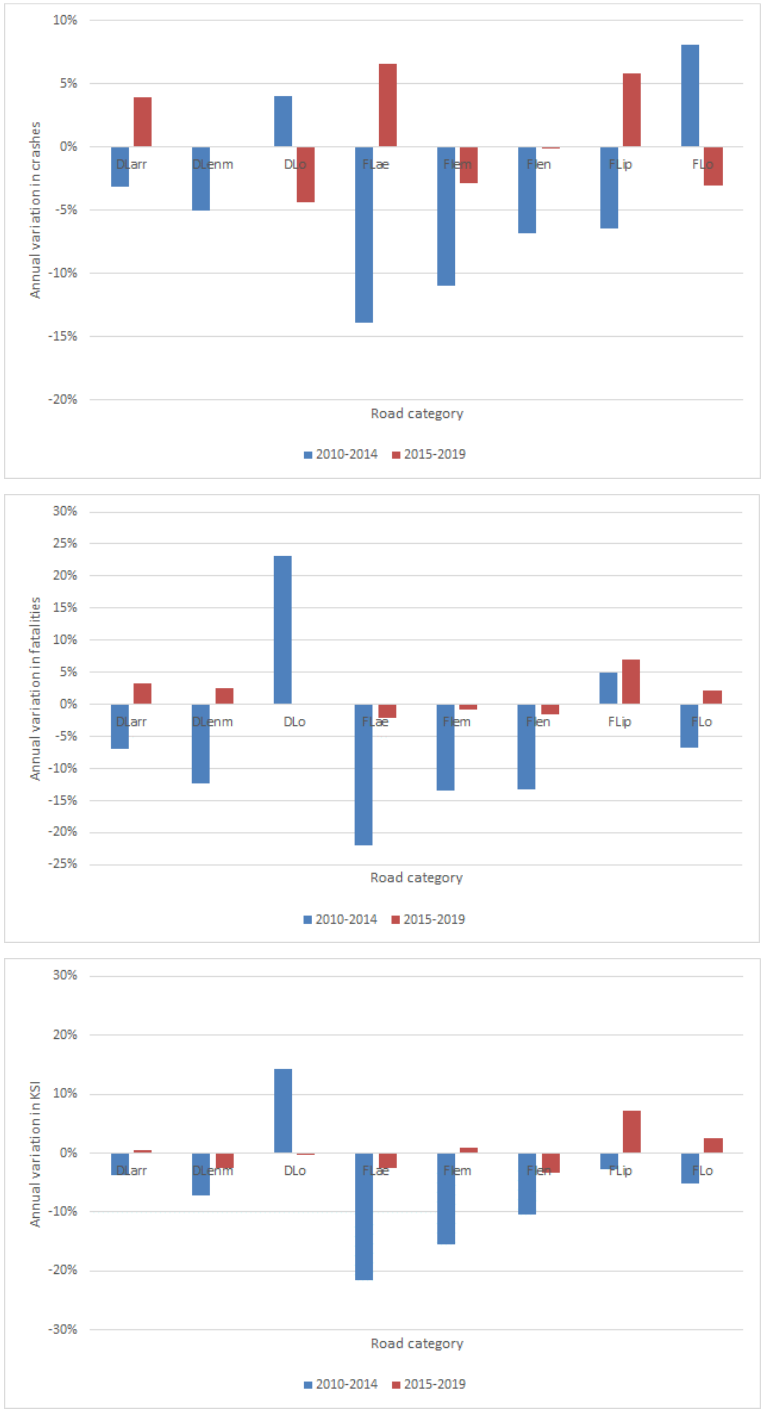


Figure 2.10 – Annual variation in the number of crashes, fatalities and KSI by road category (2010-2014 and 2015-2019)

Detailed spatio-temporal analysis of these data at the district (*distrito*) level was not carried out, as previous works (Jarrett et. al., 1994) showed that district is not an adequate level of disaggregation, due to serious population imbalance, and the required detailed data on exposure and socio-economic characteristics at the municipal level is a lengthy process, involving diverse and scattered data sources (Ribeiro, Turkman and Cardoso, 2011, and Ribeiro, 2012). In those studies, it was also evidenced the need for differentiating long distance traffic from municipal traffic and for considering seasonal variations

in resident population (e.g., due to tourism), when aiming at supporting regional and local road safety interventions.

Existing data on crashes occurred on the National Road Network (NRN) enables the Portuguese authorities and the road infrastructure operators to run a high crash frequency site treatment programme, that was included in the PENSE2020 (action A20.80).

Within PENSE2020 two types of definition of high crash frequency sitesk were applied to the NRN: one based on the annual number of registered injury crashes per 200 m, whose results are usually included in the ANSRs' annual road safety reports; and the other using the methodology developed at LNEC (see, e.g. Cardoso, 1998 or Eenink *et al.*, 2006), using the empirical Bayes estimate of the expected number of crashes at each location to sort road sections according to their crash frequency and rate (crashes per travelled distance). The first method is run annually, as mentioned; the second method is used on an *ad hoc* basis, despite its ability to be also ran annually.

According to ANSR's reports, a high crash frequency site is a section of the NRN (up to 200 m long) where at least five injury crashes were registered in a given year, and resulting in a severity indicator greater than 20. Despite being based on crash frequencies, the detection criterion has not changed since its definition in the 1990s.

Table 2.3 contains a summary of the high crash frequency site detection according to that definition, showing that in 2019 the number of sections is higher than in 2015, and that high crash frequency sites account for almost 1% of the injury crashes, fatalities and severity indicator, and 0.5% of the KSI registered in the country (NRN and other roads and streets). As a comparison reference, in 1998 a total of 211 high crash frequency sites were identified in the NRN.

Table 2.3 – Key indicators for high crash frequency sites detected annually between 2015 and 2019

Year	Number of high crash frequency sites	Length (km)	Crashes		Fatalities		KSI		Severity Indicator	
2015	30	4.6	179	0.6%	2	0.4%	15	0.6%	1059	0.6%
2016	36	6.0	219	0.7%	2	0.4%	16	0.6%	1273	0.7%
2017	50	8..2	306	0.9%	1	0.2%	16	0.6%	1543	0.8%
2018	60	9.6	378	1.1%	3	0.6%	13	0.5%	1945	1.0%
2019	56	10.1	364	1.0%	5	1.1%	15	0.5%	2097	1.0%

A comparison between the annual list of high crash frequency sites shows that some of those lists share common elements (e.g., 21 high crash frequency sites were detected both in 2019 and 2018, and seven these are shown in the 2015 and 2016 lists). Currently, the total number of casualties on accident high crash frequency sites is small, when compared to the national total.

The method developed by LNEC is not applied on a yearly basis, although that is possible. In this method, due consideration is made to the fact that traffic data is available on the NRN. The NRN was divided in six road categories (four single carriageway and two dual carriageway categories), and for each road category, unique crash frequency models were fitted to five year registered data taken from ANSR's crash database. In this method, road sections are 250 m long in single carriageway roads and 500 m in dual carriageway roads, reflecting differences in typical road crash scenarios and practical ability to implement safety interventions. Additionally, intersections and interchanges are treated separately from road links.

The method is applied to five year data sets, using the developed models to estimate the expected number of crashes in each road category and correcting this value with the registered number of crashes in the analysed five year period, to produce an estimate of the expected number of crashes in each road section. In this way, it is possible to account for the influence of traffic on crash frequency and mitigate the disturbing effect of crash randomness; road categorization also contributes to account for differences in crash risk due to major road design and environment characteristics.

Following the calculation of the expected number of crashes in each road section, road sections in each category are sorted by their crash frequency and crash rate, and those that belong to the 99.90 percentile of their corresponding distributions are identified as hazardous locations, and selected for further analysis and possible intervention.

In the most recent application of this method, crash data for the period 2013-2017 were used (Cardoso, 2019).

Overall, 76% of the crashes on single carriageway NRN roads occurred on links, corresponding to 86% of the on-site fatalities and 82% of the KSI registered in those roads; on dual carriageway roads, 88% of crashes occurred on links, corresponding to 93% the fatalities and 92% of KSI registered in those roads.

The following results were obtained:

- On single carriageway roads, 225 hazardous locations were detected, totalling 58.7 km (0.51% of the analysed NRN road length) where 2624 crashes were registered, corresponding to 7.9% of the crashes, 4.8% of fatalities and 7.0% of the total Severity Indicator for those roads.
- On dual carriageway roads, 39 hazardous locations were detected, totalling 20.3 km, which corresponds to 0.3% of the analysed road length. In these locations, 470 crashes were registered, matching 4.1% of the crashes, 2.7% of the fatalities and 3.3% of the Severity Indicator registered on these roads.

Table 2.4 summarizes the contribution of hazardous locations to the link crash outcomes in each of the six road categories.

Table 2.4 – Key indicators for hazardous locations detected for the period 2013-2017

Road category	Number of carriageways	Length	Crashes	Severity Indicator
A	Single	0.46%	8.7%	8.0%
B		0.52%	7.2%	6.3%
C		0.65%	6.9%	5.5%
D		1.01%	8.2%	7.8%
E	Dual	0.24%	4.7%	4.0%
F		0.63%	3.5%	2.3%

As in previous applications of the method (e.g., in 1998, 2007 and 2013), it could be concluded that a significant percentage of crashes occurred in a limited collection of road sections, hinting at the existence of specific local problems, which deserve further detailed inspection of the detected sites and analysis of its crashes, in order to devise and implement appropriate safety interventions. This applies to both dual carriageway and single carriageway roads. Fatalities on the NRN urban and rural roads account for 51% of the national total, indicating that hazardous location interventions are a promising method to set priorities for safety improvement on the NRN.

2.2.2 Distribution by type of crash

Figure 2.11 presents the annual average number of crashes and victims by crash type in the periods from 2010 to 2019. Overall, in that period collisions accounted for 51% of the crashes and 39% of the fatalities, single-vehicle crashes (SVC) were 33% of the crashes and 39% of the fatalities, and hit pedestrians (16% of the crashes) originated 22% of the fatalities.

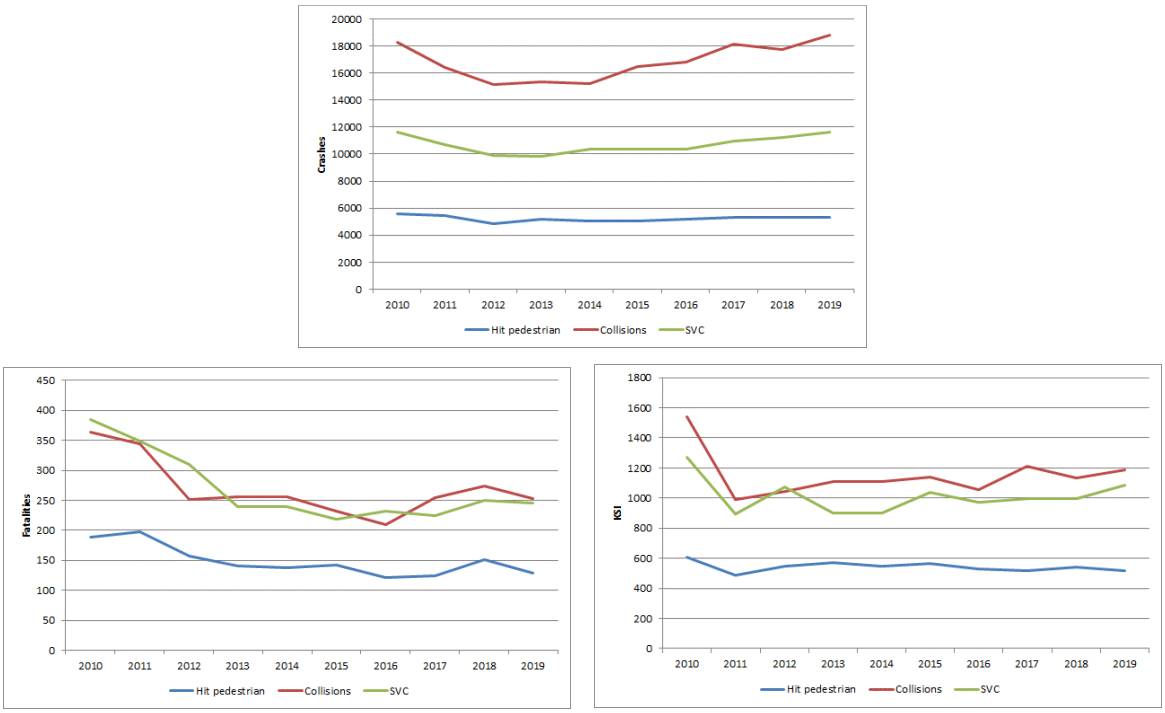


Figure 2.11 – Development in the annual number of crashes, fatalities and KSI by crash type (2010-2019)

The number of crashes diminished in the period 2010-14 at an annual average rate of -3.0% for hit pedestrians, -5.6% for collisions and -4.5% in the case of single-vehicle crashes; however, in the period 2015-19 an increase was observed: +1.5% of pedestrians hit, +3.2% of collisions and +2.6% single-vehicle crashes (Figure 2.12).

Figure 2.12 also shows that developments in the number of pedestrian victims were still favourable in the period 2015-19 (-2.2% in fatalities and -2.4% KSI), even though the number of fatalities in collision and single-vehicle crashes increased by 3%.

Figure 2.12 – Annual variation in the annual number of crashes, fatalities and KSI by crash type (2010-2014 and 2015-2019)

Figure 2.13 shows the rate of average yearly variation in the numbers of crashes, fatalities and KSI per crash type, in each major rural road category.

On motorways, despite an increased number of crashes (+6.6% annually) the number of casualties diminished – except for fatalities and KSI in collisions, which increased by +1.7%, and +7.3%. On IP/IC/EN roads, the total number of crashes increased (+1.3%), but the number of fatalities (-1.3%) and KSI (-1.3%) diminished; crashes (+2.7%), fatalities (+2.8%) and KSI (+1.2%) in collisions showed an

increasing trend. On other rural road categories, reductions were also obtained in the total numbers of crashes, fatalities and KSI.

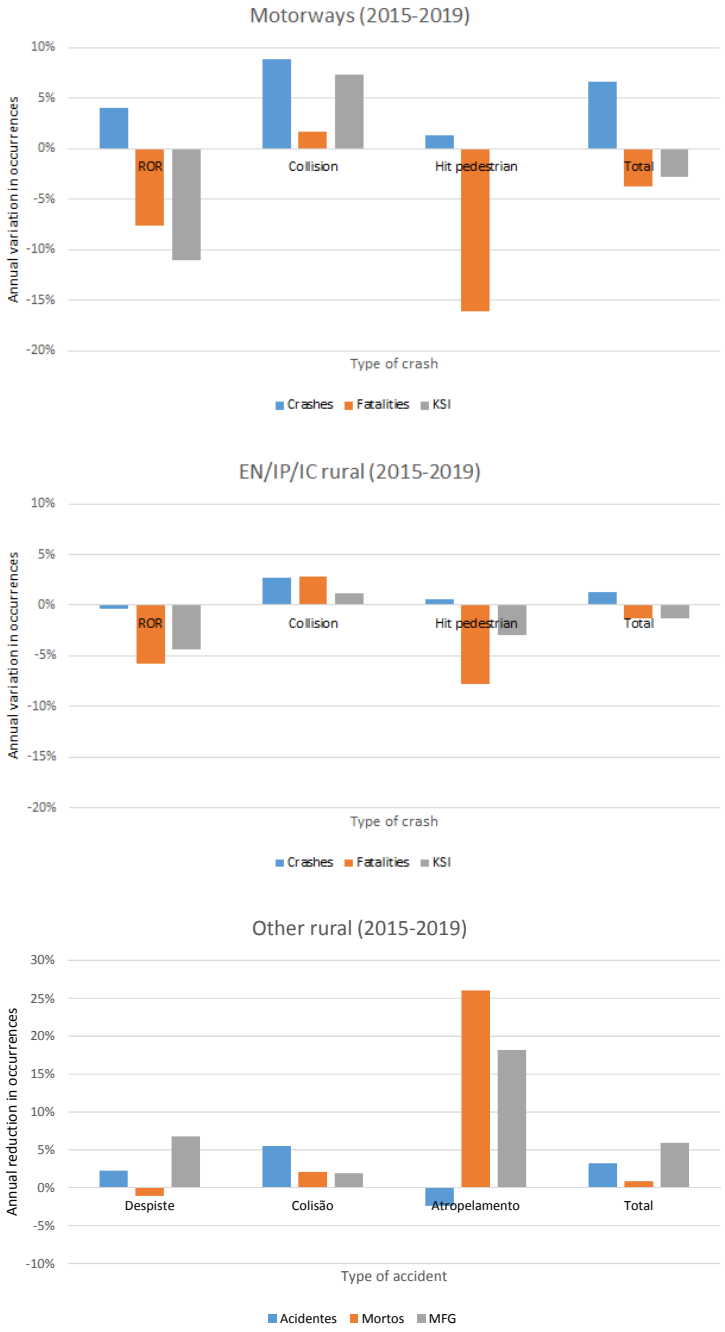


Figure 2.13 – Average yearly variation in the annual number of crashes, fatalities and KSI by crash type and rural road category (2015-2019)

Figure 2.14 shows the rate of average yearly variation in the annual numbers of crashes, fatalities and KSI per crash type, in each major urban road category.

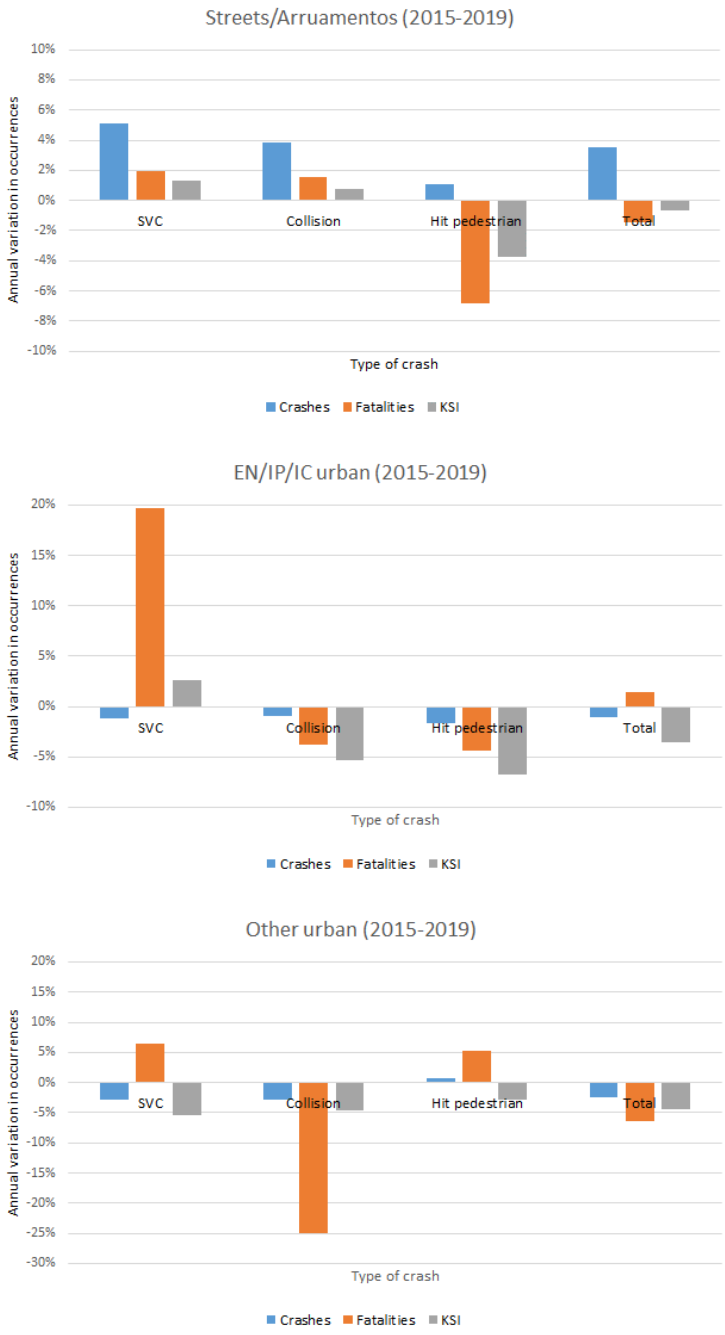


Figure 2.14 – Average yearly variation in the annual number of crashes, fatalities and KSI by crash type and urban road category (2015-2019)

Despite an overall increase in the number of crashes, the number of victims in streets (*arruamentos*) showed a slight decrease (-1.4% fatalities and -0.6% KSI). This trend was not common to all crash types. The number of pedestrian fatalities (-6.8%) and KSI (-3.8%) decreased in this period; however, fatalities (+1.9%) and KSI (+1.3%) due to single-vehicle crashes showed an increase in numbers. It should be noted that pedestrians account for 37% of the fatal victims in streets and 34% of the KSI; while single-vehicle crashes (SVC) correspond to 35% of the fatalities and 31% of KSI.

Fatalities due to SVC increased on all urban road categories, especially in IP/IC/EN-National Road Network through roads (+19.7%). The number of KSI due to SVC increased in streets (+1.3%) and other EN/IP/IC (NRN) urban roads (+2.6%), and reduced in other urban roads (-5.3%).

SVC account for a high percentage of crashes and victims in urban roads: 35% fatalities on streets, 28% fatalities on EN/IP/IC urban roads, and reaching almost half the fatalities (49%) and KSI (48%) in other urban roads

2.2.3 Distribution by road user

Figure 2.15 shows the distribution of fatalities and KSI by type of vehicle, in the periods 2010-2014 and 2015-2019.

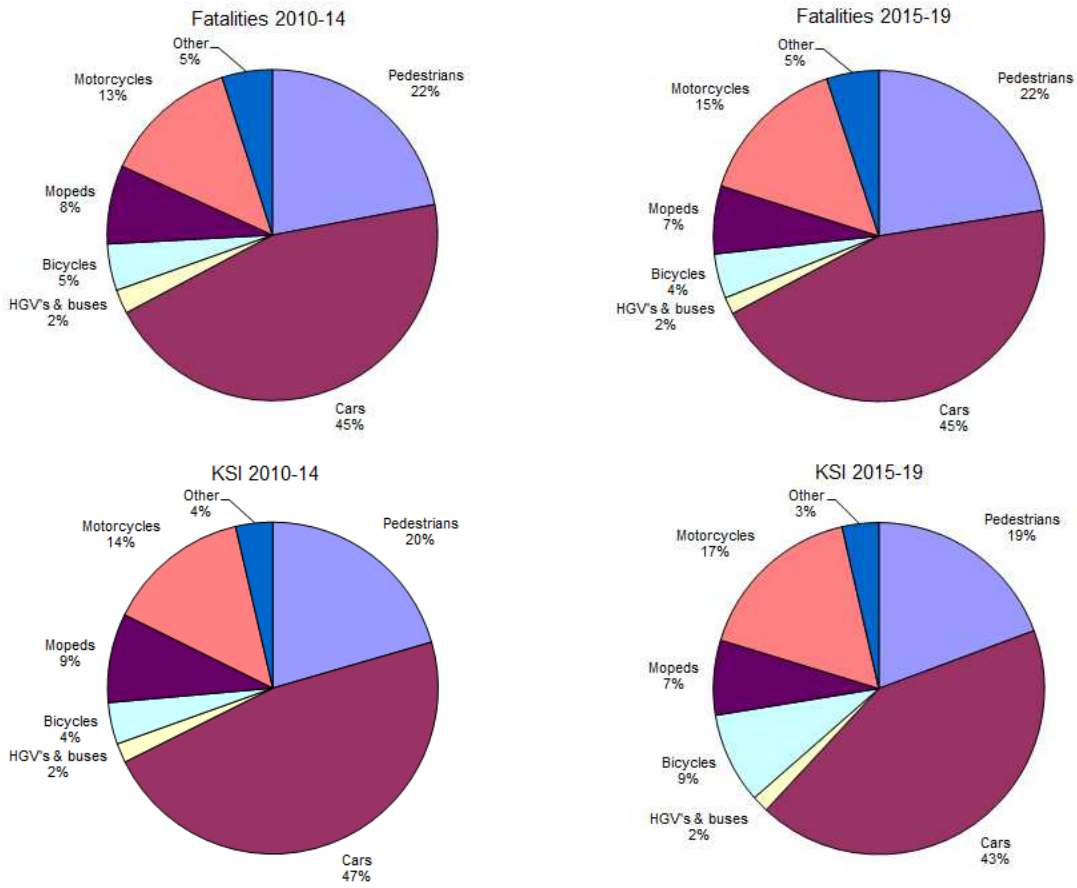


Figure 2.15 – Distribution of the number of fatalities and KSI by vehicle category (2010-2014 and 2015-2019)

The distributions of fatalities and KSI per vehicle category are similar in 2010-2014, except for minor differences regarding pedestrians (22% for KSI, and 20% for fatalities). In 2015-2019, the percentage of KSI bicyclists (9%) is higher than the percentage of bicyclist fatalities (4%) in the previous period. Aside from KSI cyclists the distributions of fatalities and KSI per vehicle type show only minor differences between the two periods; however, in the case of PTW, there was an increase in the share of fatal and KSI motorcyclists.

Cars (+1.9%) and motorcycles (+12.3%) showed positive yearly rates of variation in the number of fatalities, in the period 2015-2019 (see Figure 2.16). Bicycles (+7.1% in 2010-2014 and + 20.9% in 2015-2019) and other vehicles (+18.4% in 2010-2014 and + 2.7% in 2015-2019) show yearly increase in the number of KSI for the whole decade. The number of KSI motorcyclist victims decreased at a yearly rate of -6.8% in the period 2010-2014, but increased by 8.9% annually in the period 2015-2019.

Figure 2.16 – Average yearly variation in the annual number of fatalities and KSI by type of vehicle (2010-2014 and 2015-2019)

Figure 2.17 and Figure 2.18 refer to the distribution of driver fatalities and KSI per type of vehicle and major interurban road category. In these graphics, mopeds and motorcyclists (PTW) are aggregated, to reduce the impact of random variation.

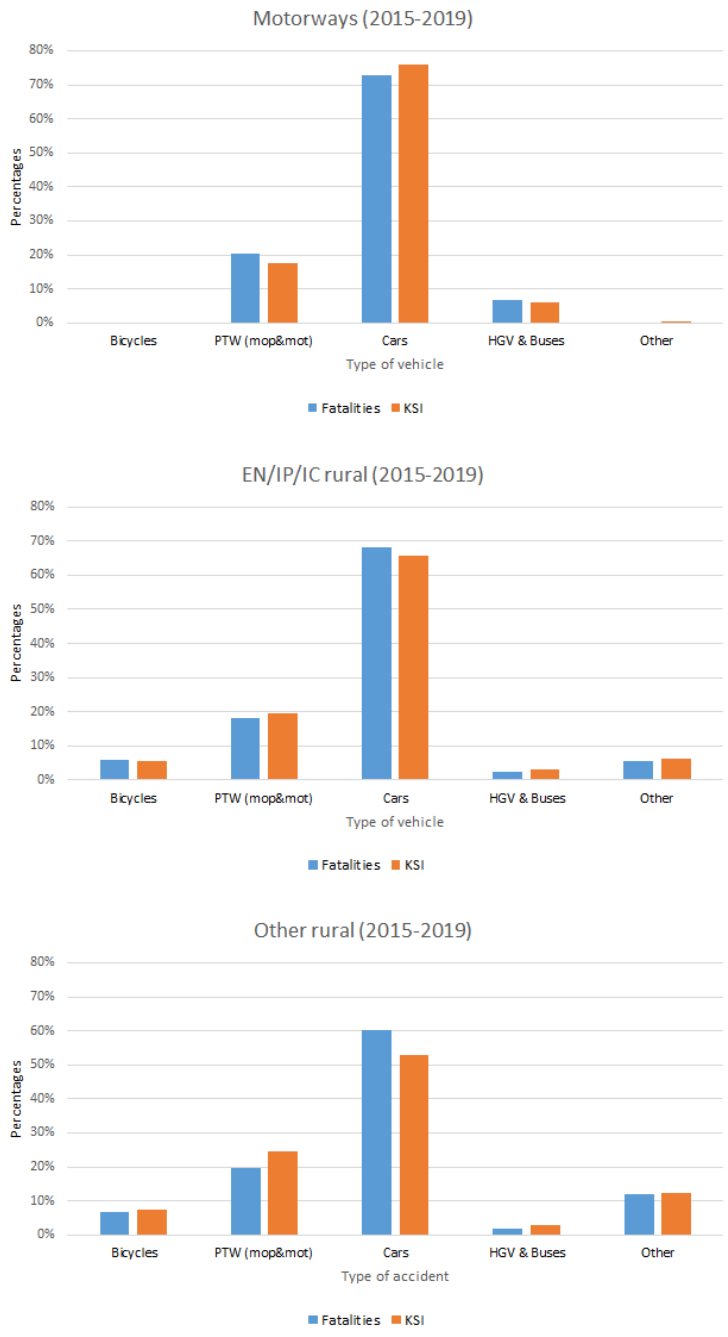


Figure 2.17 – Distribution of driver casualties per vehicle type and main rural road category (2015-2019)

PTW represent a sizeable percentage of the crashes and casualties in all interurban road categories (Figure 2.17), and the developments in the period 2015-2019 (Figure 2.18) show a significant increase in the number of PTW KSI on motorways (+14.7% annually), EN/IP/IC roads (+8.8%) and other roads (12.0%). Regarding fatalities, there was an increase on EN/IP/IC (+4.0%) and other roads (+25.3%). On other rural roads, the number of fatalities and KSI related to other vehicles diminished (-1.3% and -9.0%).

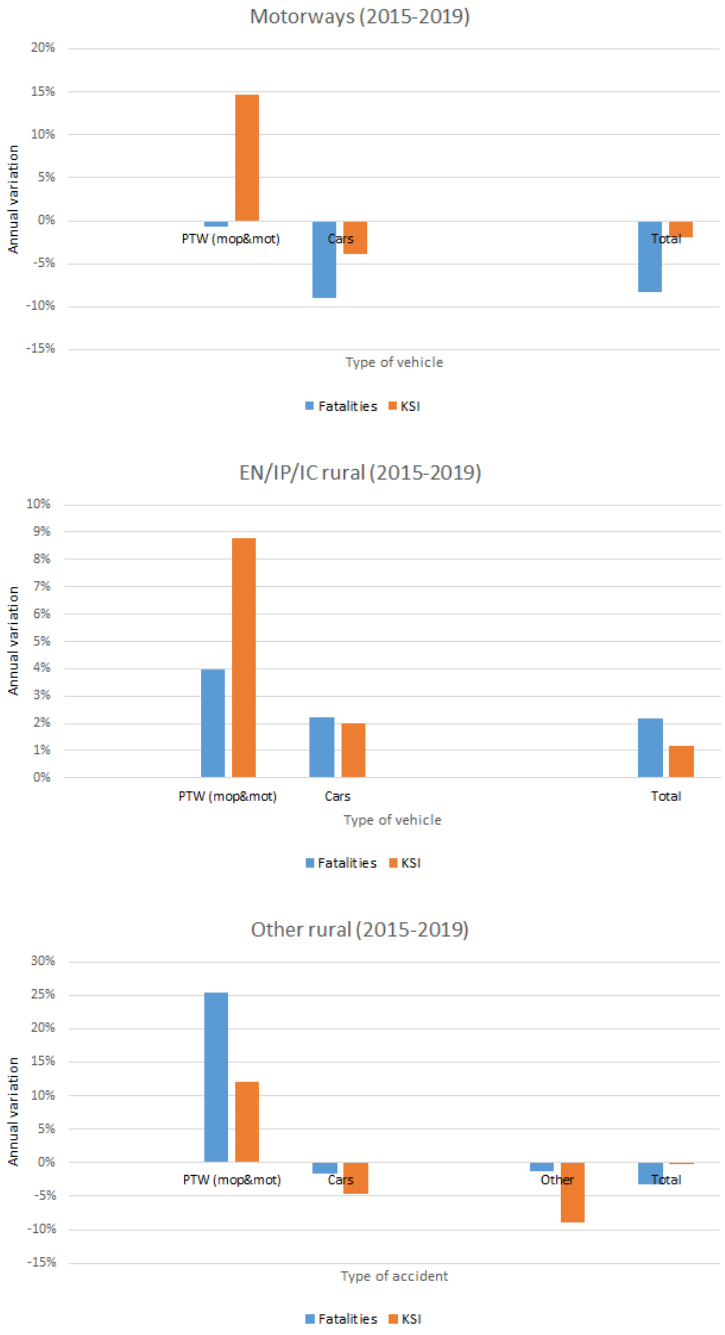


Figure 2.18 – Average yearly variation in the annual number of driver casualties by rural road category and type of vehicle (2015-2019)

Figure 2.19 and Figure 2.20 refer to the distribution of driver fatalities and KSI per type of vehicle and major urban road category, in the period 2015-2019. As in the previous two figures, mopeds and motorcyclists are aggregated (PTW).

Unprotected road user drivers represent almost half of the KSI in urban streets category: bicyclists accounting for 13% of KSI (10% fatalities), and PTW for 35% of KSI (30% fatalities). Drivers of other

vehicles are a high percentage of fatalities and KSI on all urban roads (17%). Car drivers are almost 50% of KSI victims on through roads, being 33% on streets (Figure 2.19).

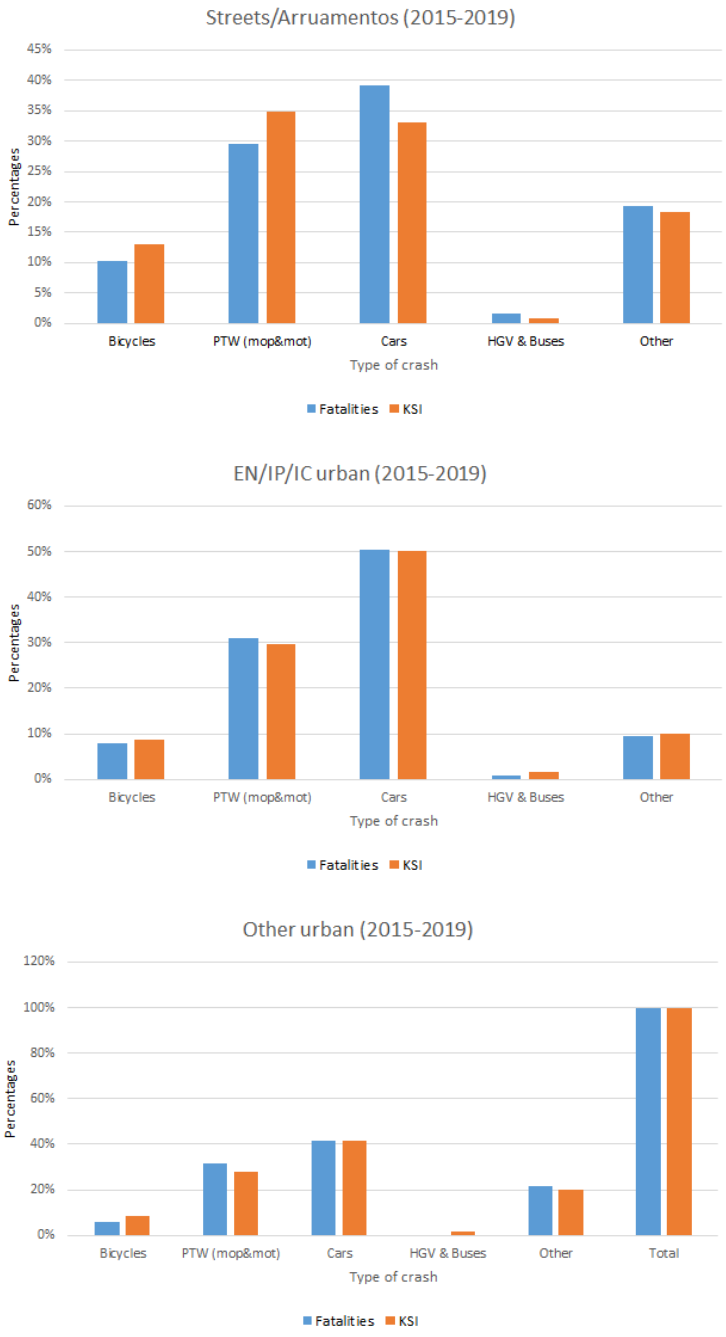


Figure 2.19 – Distribution of driver casualties per vehicle type and main urban road category (2015-2019)

Overall, the development in the period 2015-2019 (Figure 2.20) shows an increase of KSI in streets (+2.2%) and reductions in the other two road categories (-1.8% on through roads and -3.5% on other urban roads). On streets, there was a decrease in the number of fatalities and KSI bicyclists (-14.6%

and -3.3%) and an increase in the number of fatal and KSI PTW drivers (+3.7% and +7.2%). On through roads, PTW fatalities increased substantially (+30.9%) KSI increased by +3.9%; KSI car drivers also increased (+1.6%); while bicyclists (-19.9%) and drivers of other vehicles (-16.6%) had reductions in their annual numbers of KSI. On other urban roads category, bicyclists (+4.5%) and PTW (+9.7%) had an increase in the number of driver KSI, while car and other vehicles drivers (-6.7% and -15.0%) had reductions.

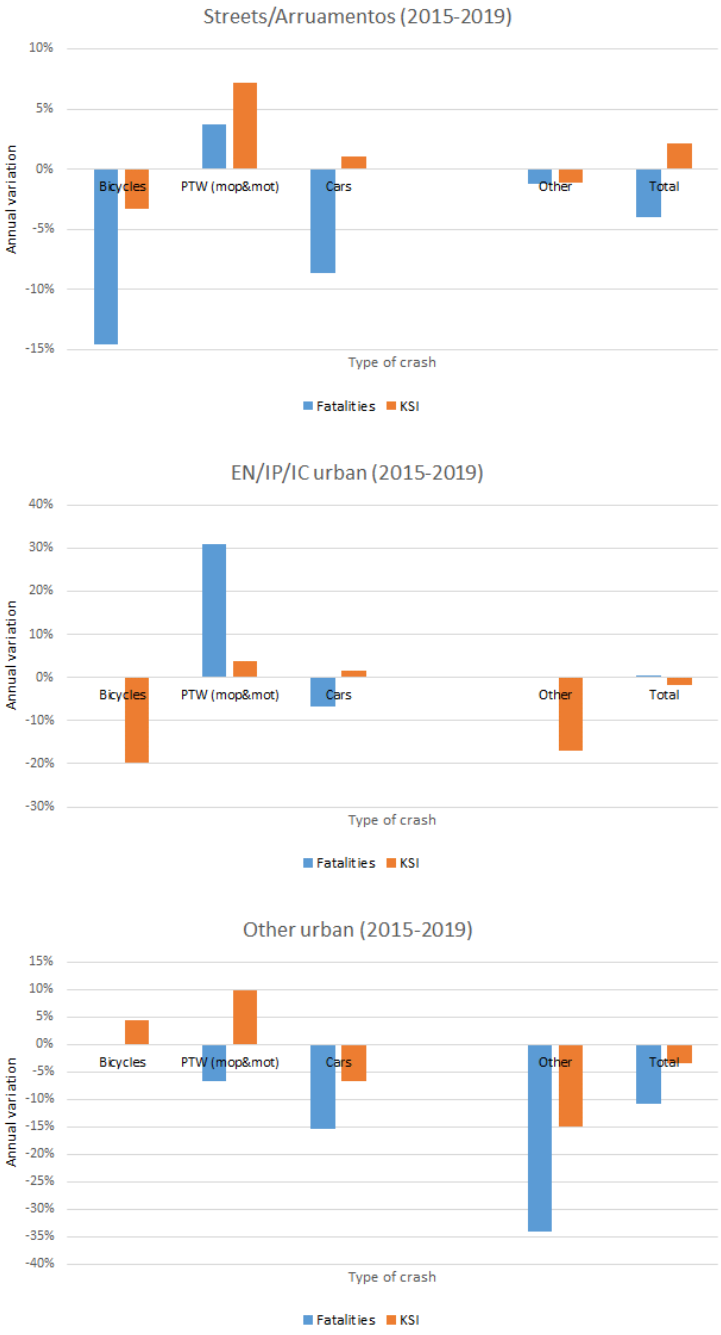


Figure 2.20 – Average yearly variation in the annual number of occurrences by urban road category and type of vehicle (2015-2019)

2.2.4 Distribution by road user group

Pedestrians correspond to 23% of the Portuguese fatalities (20% of the KSI) in the period 2015-2019. Similar percentages were registered in 2010-2014 (Figure 2.21).

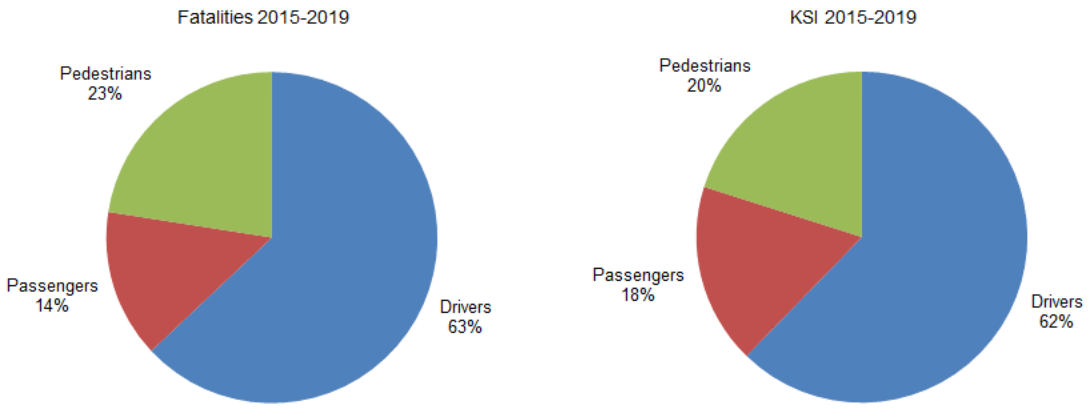


Figure 2.21 – Distribution of the number of fatalities and KSI by road user group (2015-2019)

A recent study on pedestrian safety showed that 80% of the pedestrians killed and 92% of those seriously injured occurred inside urban areas, in the period 2010-2019. The age groups most at risk of being hit are young people aged 15-19 and pedestrians aged 70 and over; also, more than half (55%) of pedestrians killed in road crashes are 65 years of age or older (PRP, 2021d). In this study reference is made to PRP's observational studies showing problems in zebra crossing operation: 22% of pedestrians crossing outside of zebra crossing at a distance of less than 50 m from the corresponding marking; and 26% of vehicle drivers forcing their way against a crossing pedestrian.

The mortality rate of pedestrians in Portugal (13.9 fatalities per million inhabitants) was considerably higher than the EU 28 average (10.4) in the three year period 2016-2019, as will be referred in section 2.3.1. This difference was especially severe for pedestrians aged 65 or more: 35.1 fatalities per million inhabitants in Portugal vs. 25.1 - the average EU28.

The distributions of pedestrian mortality and KSI rates per age group show local maxima at ages 20-24 or 15-19, and an upward trend starting at age group 30-34 with maximum values for those aged 65 or more years (Figure 2.22).

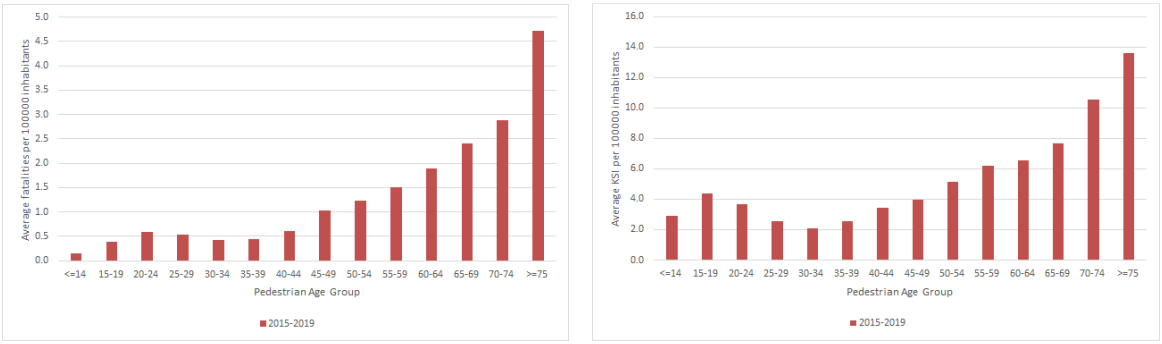


Figure 2.22 – Pedestrian casualty rates by age group (2015-2019)

Overall, developments in the period 2015-2019 were especially unfavourable for the age groups 20-24 and 25-29 years old, with marked increases in mortality rates; age groups 0-19 and 30-44 showed decreases in the mortality rate (Figure 2.23).

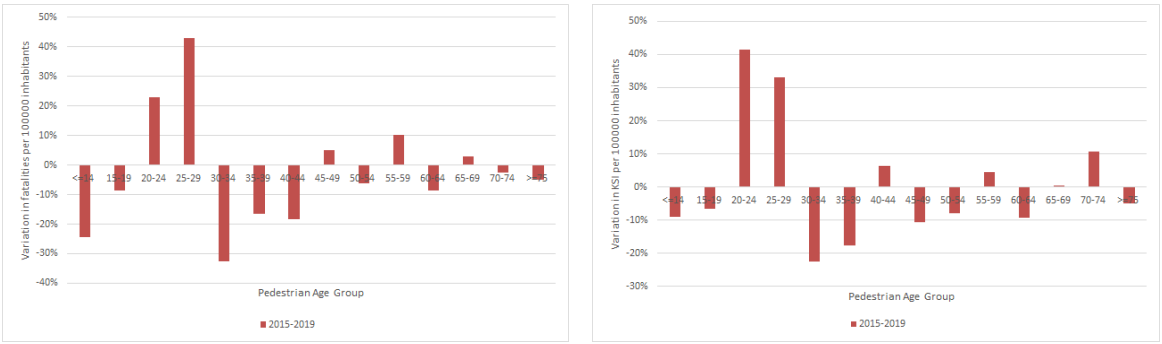


Figure 2.23 – Developments in pedestrian mortality and KSI rates by age group (2015-2019)

The average variation in the number of victims by road user group in the periods 2010-2014 and 2015-2019 is presented in Figure 2.24. Important yearly reduction rates in the number of pedestrian fatalities and KSI were obtained in both periods, but greater in 2010-2014 (-7.9% and -2.8%) than in 2015-2019 (-1.8% and -2.2%). In the latter period, the number of fatally injured drivers and passengers increased at a yearly rate of +3%.

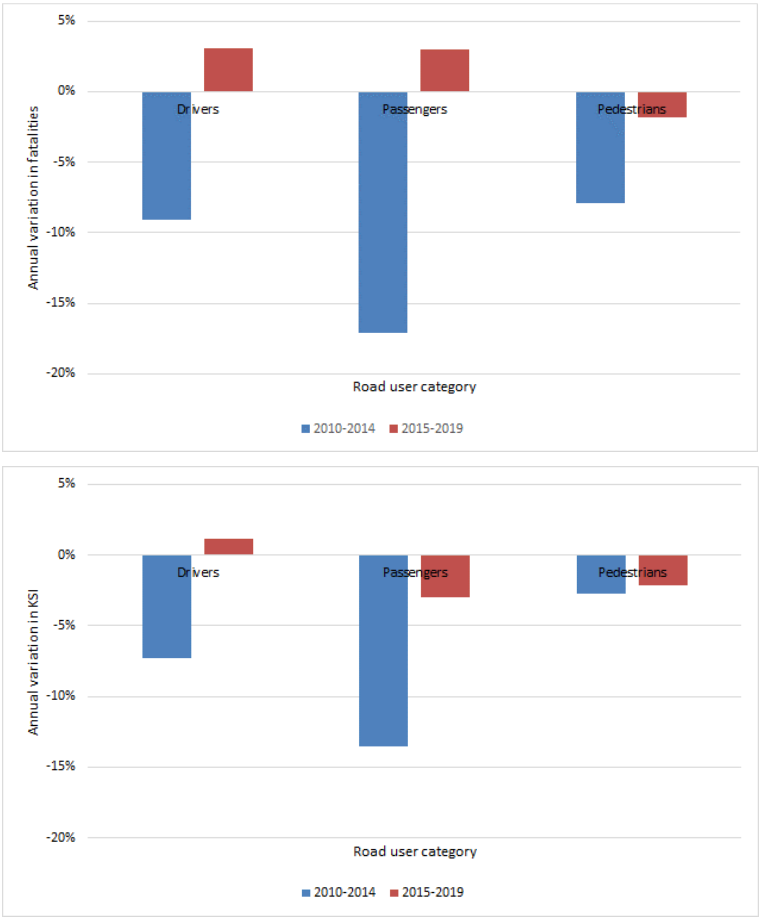


Figure 2.24 – Average yearly annual variation in the number of fatalities and KSI by road user group (2010-2014 and 2015-2019)

Distribution of crash casualties by gender is not even. Most fatalities and KSI are male (78% of registered fatalities and 74% KSI, in the period 2015-2019), as shown in Figure 2.25.

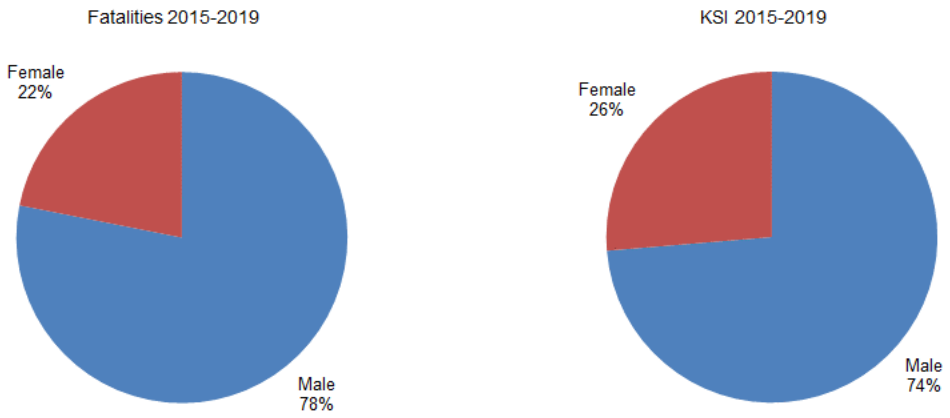
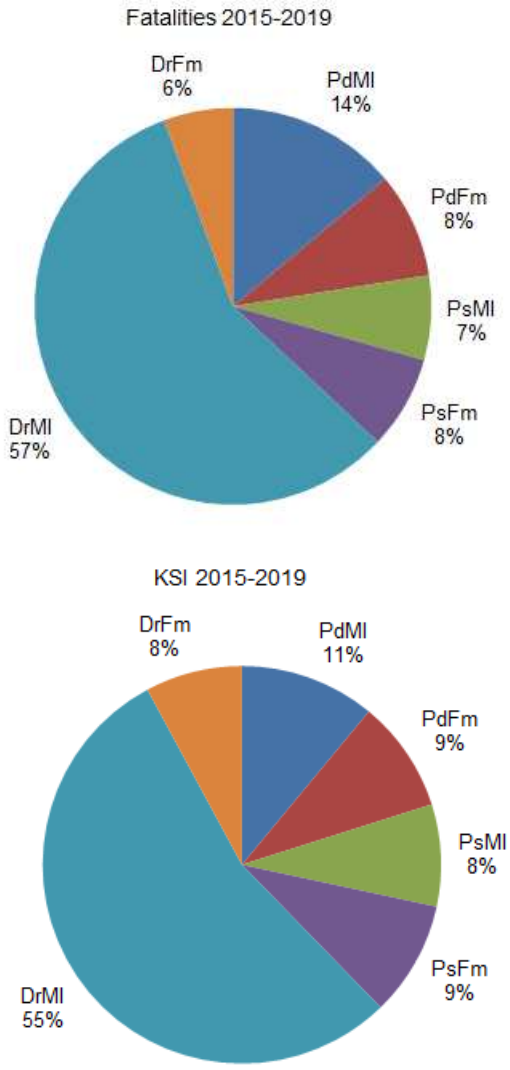


Figure 2.25 – Distribution of the number of fatalities and KSI by road user sex (2015-2019)

Gender casualties' imbalance is not equal among different road user groups, as shown in Figure 2.26. Male fatalities are 51% of the passenger fatalities, 62% of the pedestrians and 91% of the drivers; they account to 49% of the KSI passenger, 54% of the pedestrians and 87% of the drivers.

This suggests that differences in exposure may partially explain the observed discrepancy; however, the remarkably high percentage of male driver serious casualties is a clear indication that even generic road safety campaigns need to be addressing this distinctive target group (see section 2.2.6.3).



DrMl – male driver, PdMl – male pedestrian; PsMl – male passenger
DrFm – female driver; PdFm – female pedestrian; PsFm – female passenger

Figure 2.26 – Distribution of the number of fatalities and KSI by road user group and sex (2015-2019)

The average reductions in the number of victims by road user group and sex in the periods 2010-2014 and 2015-2019 are presented in Figure 2.27. In the period 2010-2015 yearly reductions in the number of fatalities among male drivers (-9.4%) and passengers (-19.4%) were bigger than for females. In the

last five years (2015-2019) the number of female casualties increased, the same happening to male driver fatalities.

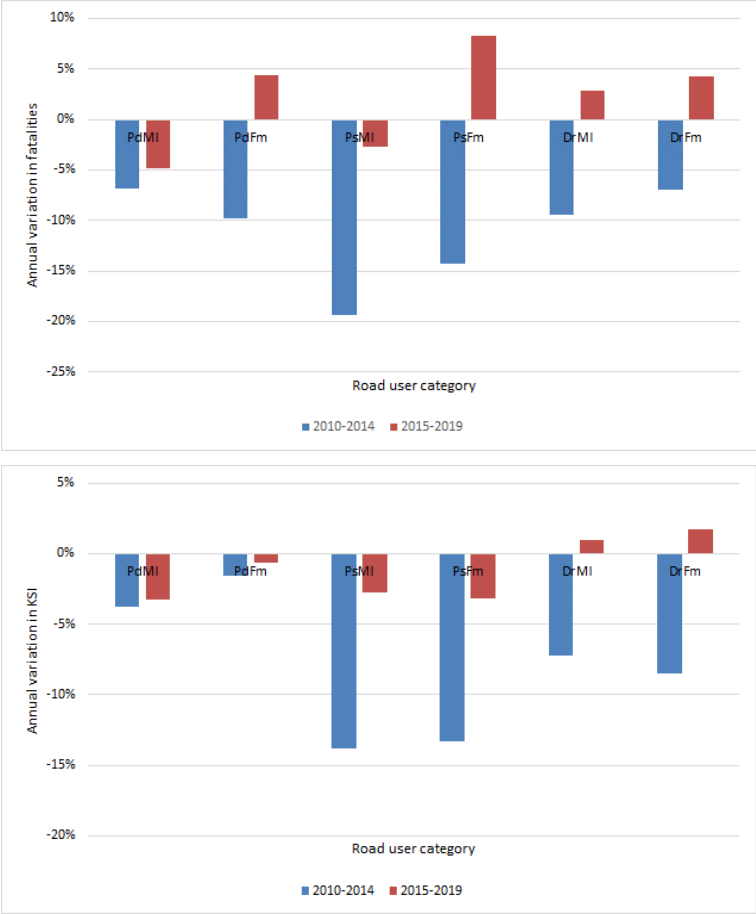


Figure 2.27 – Average yearly annual variation in the number of fatalities and KSI by road user group and sex (2010-2014 and 2015-2019)

2.2.5 Distribution by age group

During the period 2010-2014 reductions in the number of fatalities and KSI were registered for all age groups, except for fatalities for those aged 60-64 years; higher reductions rates were obtained for children under 14 years and in the age groups 25-34. In the period 2015-2019 the number of fatalities in the age groups 20-50 registered a poor performance, at best with low yearly reduction rates, and increasing numbers in the age group 20-24 and in those over 64 years old.

Figure 2.28 shows the average yearly annual variation in the number of casualties per 100 000 inhabitants by age group in the periods 2010-2014 and 2015-2019. Even though the developments were favourable in the period 2010 to 2019, with an average yearly reduction in the number of casualties per 100 000 inhabitants (-5.8% fatalities, and -3.3% KSI), the period 2015-2019 was unfavourable, with an

average yearly growth of +2.1% in the number of killed per 100 000 inhabitants and a stabilization (-0.2%) in the number of KSI per 100 000 inhabitants.

Figure 2.28 – Average yearly annual variation in the number of fatalities and KSI per 100 000 inhabitants by road user age group (2010-2014 and 2015-2019)

Children and teenagers (0-19 years) showed a consistent decrease in fatalities and KSI per 100000 inhabitants, in both periods. Regarding the fatality rate, the performance of age groups 20-24 (+15.6%), 30-34 (+5.9), 65-69 (+6.9%) and over 75 years old (+4.5%) was particularly unfavourable; concerning KSI rates, the worst performing groups were the 25-29 years old (+4.3%), 35-39 (+3.7%), 40-44 (+4.1%) and 70-75 (+5.8%).

In the following paragraphs these figures are disaggregated by driver category: car drivers, bicyclists, moped and motorcycle drivers, and drivers of other vehicles, including HGV and buses. Pedestrian developments by age group were examined in section 2.2.4.

The distributions of car driver mortality rates per age group show local maxima at ages 20-24 and 60-64; between these age groups, there is a U shaped distribution with a plateau from 35 to 59 years. KSI rates have a maximum in age group 20-24 and a plateau starting at age group 40-44 (Figure 2.29).

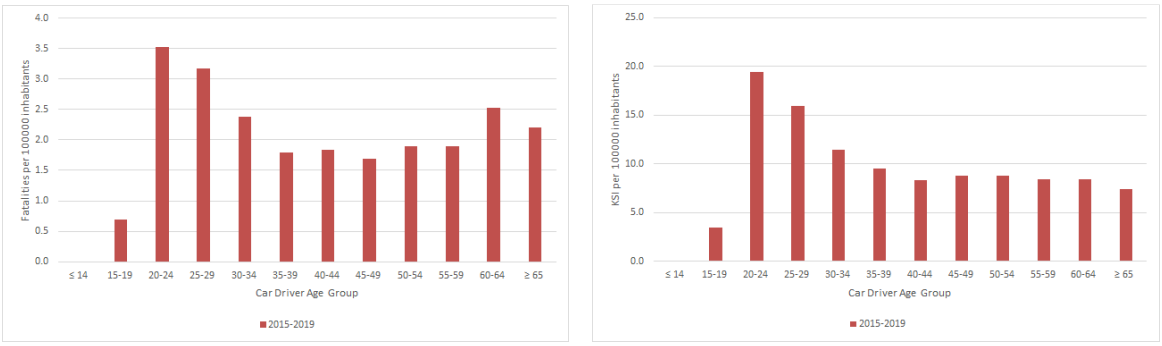


Figure 2.29 – Car driver casualty rates by age group (2015-2019)

Overall, developments in mortality rates were favourable in the period 2015-2019, except for age groups 30-39. Big reductions in mortality and KSI rates were registered for the age group 15-19 (Figure 2.30).

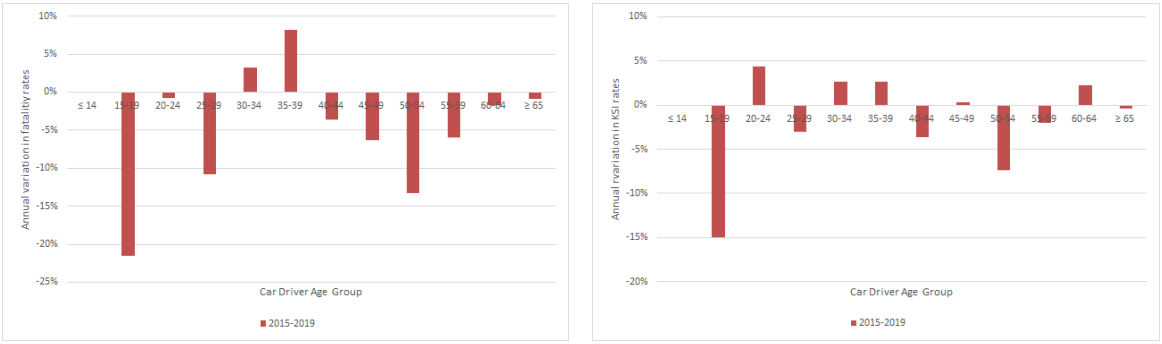


Figure 2.30 – Average yearly annual variations in car driver mortality and KSI rates by age group (2015-2019)

According to a study of PRP, most bicyclist casualties occur in urban areas: 63% of the fatalities, and 76% of the serious injuries. Collisions accounted for 80% of the bicyclist fatalities and 74% of the serious injuries; single vehicle crashes accounted for 20% of the fatalities and 25% of the serious injuries (PRP, 2021b).

Figure 2.31 shows the distributions of bicyclist mortality and KSI rates per age group. No fixed trend is visible in the distribution of mortality rates, which has a maximum at the age group 60-64. The small numbers involved may explain the configuration. KSI rates have a clear maximum in the age group 15-19 and then an inverted U shape configuration with maxima in the age groups between 45 and 59 years.

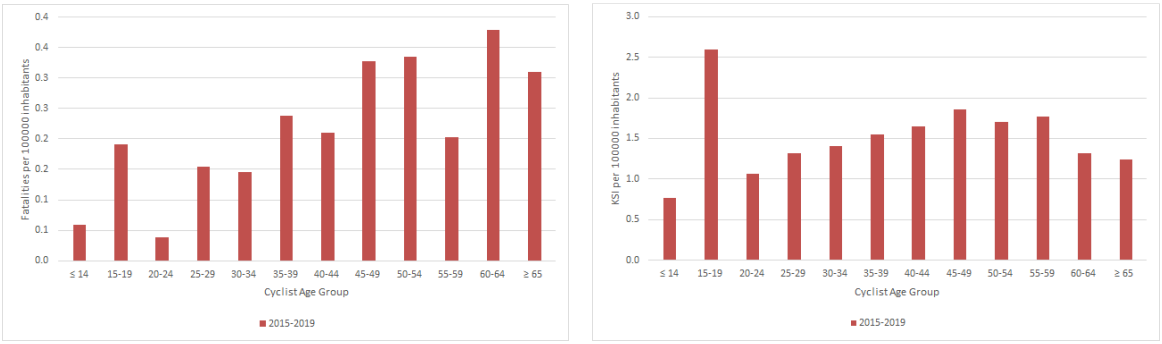


Figure 2.31 – Average yearly annual variations in cyclist casualty rates by age group (2015-2019)

Overall, estimable mortality developments in the period 2015-2019 were favourable, except for the age group 40-44, with a sharp increase; generally, KSI rates diminished as well, except for age groups 30-34 and 55-64 (Figure 2.32).

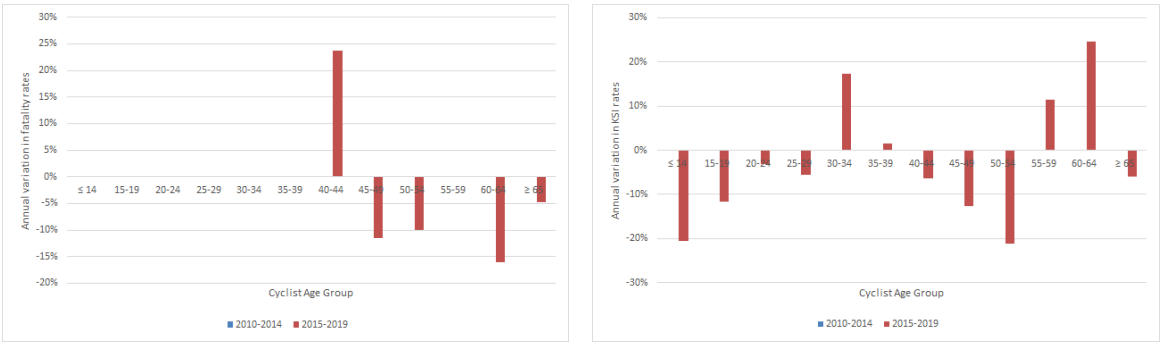


Figure 2.32 – Developments in cyclists mortality and KSI rates by age group (2015-2019)

Data collected by PRP in a study on PTW (mopeds and motorcycles) safety, indicates that the number of PTW increased more than 33% between 2010 and 2019. This development was not equitable: the moped fleet diminished yearly by 7% (from 283 374 to 264 005); whilst on average the number of motorcycles increased annually by 86%, from 213 301 to 396 934 (PRPa). Moped serious injuries and fatalities are on average 26% of the corresponding PTW casualties.

The distributions of PTW mortality and KSI rates per age group show an inverted U shape, with maxima values in age group 35-39 (mortality rate) and 25-29, for the KSI rate (Figure 2.33).

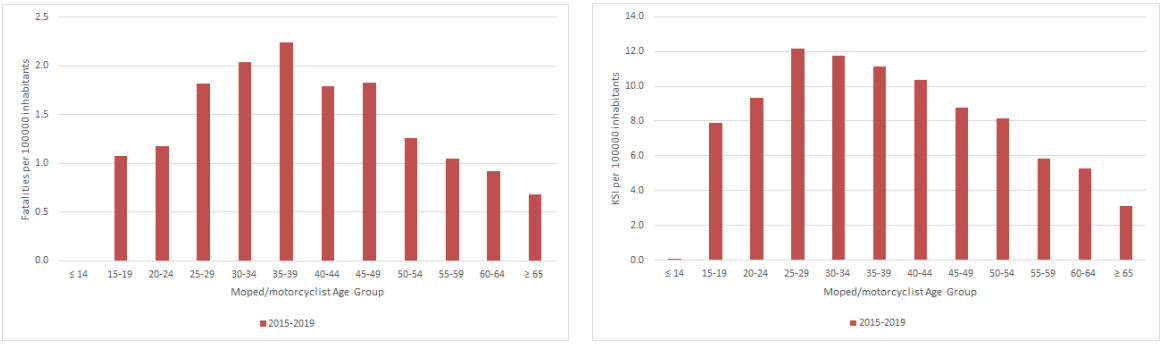


Figure 2.33 – PTW driver casualty rates by age group (2015-2019)

During the period 2015-2019, developments in the mortality rate were especially unfavourable for the age groups 15-24 and 30-34 years old, with marked increases; age group 60-64 showed more than 20% yearly decrease in the mortality rate (Figure 2.34). In the same period, KSI rates increased in the majority of the age groups.

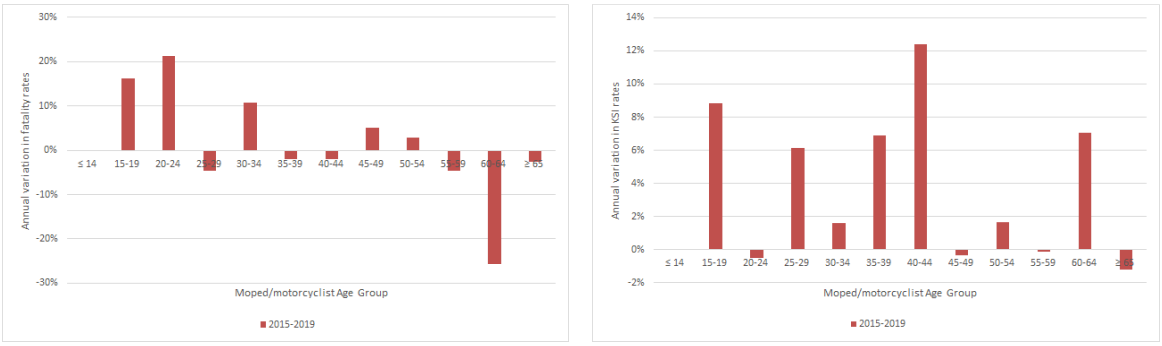


Figure 2.34 – Average yearly annual variations in PTW driver mortality and KSI rates by age group (2015-2019)

Nevertheless, the PRP study shows that the number of fatalities per 100 000 vehicles diminished from 2010 to 2019, both for motorcyclists and moped riders. From a mobility perspective there was a reduction in PTW riders risk; under the public health approach, the PTW safety problem gained dimension. European Commission (EC, 2017) data indicates that Portugal performs badly in relation to PTW safety: in 2017 the mortality rate was 14.8 fatalities per million inhabitants, comparing with 9.9 from EU 25 (no Bulgarian, Austrian, and Slovakian data).

2.2.6 Special issues

2.2.6.1 Drink and drug & driving

Results from alcohol tests carried out by police forces in the period 2010-2019 are presented in Figure 2.35, as reported by ANSR (2020b): the values of Tinfrç/TT refer to the prevalence of offenders; those of Tcrime/Inf refer to the percentage of BAC≥1.20 g/l in violations.

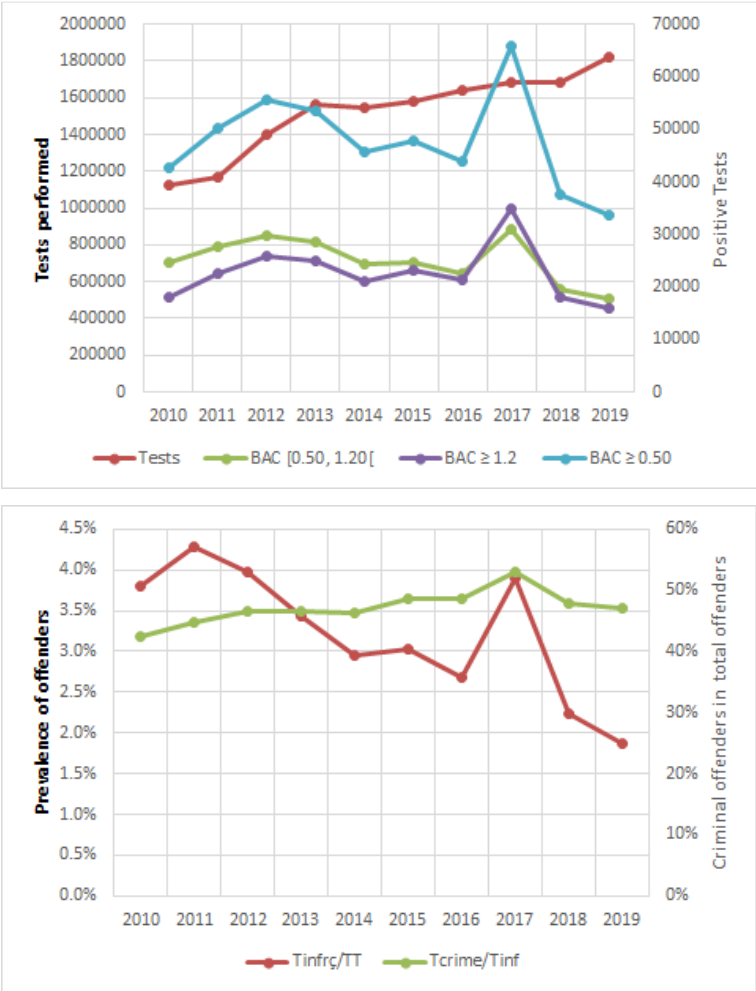


Figure 2.35 – Annual number of alcohol tests performed and violations detected (2010-2019)

Overall, there was a monotonous increase in the number of tests performed in each year, especially in 2012 and 2013; in the period 2010-2014 the number of tests increased at an average 10.7%, and only 3.3% in the period 2015-2019. The number of violations detected annually showed wide fluctuations, 2017 being a year with a very high number of administrative and criminal violations detected[8]. Except

[8] According to the Portuguese Highway Code, a Blood Alcohol Content (BAC) between 0.50 and 1.19 g/l corresponds to an administrative violation; BAC of 1.20 g/l or more corresponds to criminal violation.

for 2017, since 2011 the percentage of violations in tests decreased almost monotonously, from 4.3% to less than 2% in 2019. However, the percentage of violations classified as criminal offenses increased, from 40% in 2010 to 47% in 2019.

The results from observations made in 2008 within the EU DRUID project (Houwing *et al.*, 2011) and in 2013 by PRP (2021c) are presented in Table 2.5. In both studies the number of observations (3912 cases in 2008 and 5392 in 2013) are representative of the driver population. They indicate that alcohol prevalence in Portuguese drivers had increased, especially for the low levels of violation. The prevalence of violations increased by 48%, from 1.22% to 1.80%.

Table 2.5 – Distribution of alcohol in Portuguese drivers by level of violation (2008 and 2013)

Offense level	BAC (g/l)	2008	2013
-	0.0-0.09	95.07%	89.56%
-	0.1-0.49	3.71%	8.64%
Serious	0.5-0.79	0.44%	0.80%
Very serious	0.8-1.19	0.47%	0.67%
Crime	≥ 1.20	0.31%	0.33%
	Total with alcohol	4.93%	10.44%

Figure 2.36 presents the developments in the percentage of pedestrian and driver fatalities with BAC above the driver legal limit (administrative and criminal limits) in the period 2010-2019 (ANSR, 2020b). In that period, the percentage of violations diminished, both for drivers and pedestrians, with an average yearly rate of 1.8%. However, developments in the period 2015-2019 were mostly unfavourable, with an average annual increase in the percentage of drivers with TAS above 0.5 g/l (+2.4%, yearly) and 1.2 g/l (+6.1% yearly), as well as pedestrians[9] above 0.5 g/l (+5.2%); the percentage of pedestrians with more than 1.2 g/l diminished with a yearly rate of -1.1%.

According to the last data on alcohol prevalence (2013), there is a high percentage (18%) violators with BAC ≥ 1.20 g/l; these high levels of offense are also found police tests (more than 40% of the violators). In fatalities, driver violators with BAC ≥ 1.20 g/l are more than 70% of those above the legal limit. Thus, heavy drink driving is a serious problem, and does not seem to be improving.

[9] There are no quantitative legal limits for pedestrians

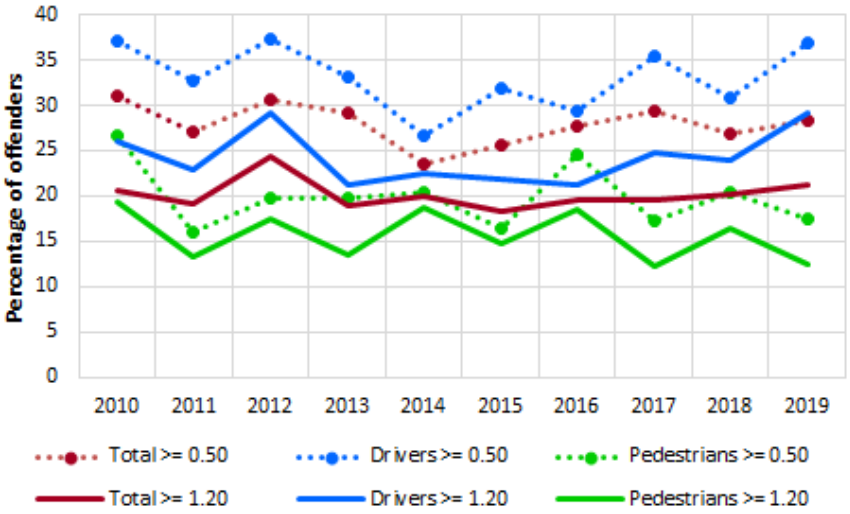


Figure 2.36 – Developments in the percentage of fatalities with BAC above the legal limit (2010-2019)

Figure 2.37 presents the developments in the percentage of road crash fatalities tested positive for substances in 2010-2019 (ANSR, 2020b). In that period, the percentage of violations increased, both for drivers (+10.5%, yearly) and the total number of victims (+8.5%).

The percentage of positive tests for cannabinoids increased significantly (+21.5%, yearly) in the period 2010-2019; during the same period, the percentage of positive tests for cocaine has diminished (-4.6%).

Results from the DRUID project observations, showed that in 2008 the prevalence of cannabinoids (THC) was 1.38% and cocaine was 0.03% (Houwing *et al.*, 2011). Comparing the prevalence levels for 2008 with the percentage of killed drivers with cannabinoids (3.1%) and cocaine (1.9%) in 2010 provides an idea of the influence of these substances on fatality risk in Portugal. The comparison of the percentages in Figure 2.36 with those of Figure 2.38 shows that in Portugal drinking and driving is a far more important problem that drugs and driving. This is in line with the conclusions from the project DRUID).

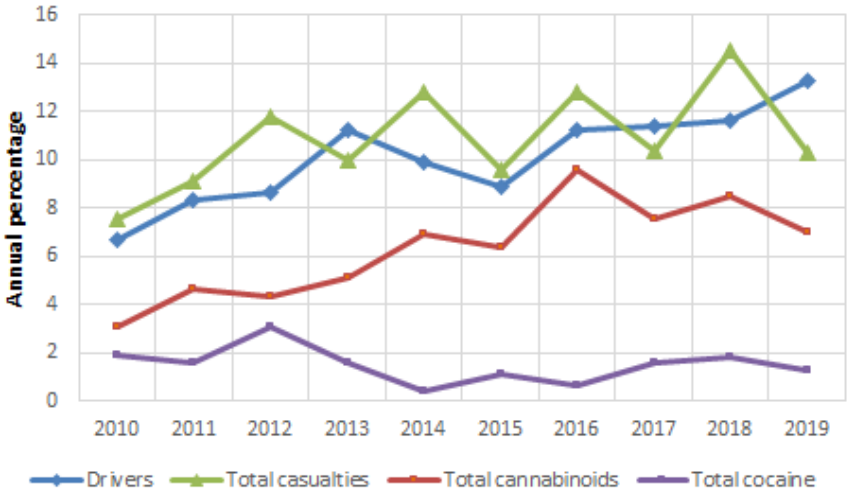


Figure 2.37 – Developments in the percentage of fatalities tested positive for substances (2010-2019)

The developments in the percentages of those who tested positive for substances or for alcohol above the legal limit among the persons involved in crashes and the drivers tested by the police are presented in Figure 2.38 for the period 2010-2019. Overall, the percentage of tests above the legal limit for alcohol remained stable throughout the period (with a slight decrease in the period 2015-2019). The percentage of positive tests for substances showed a marked escalation (+17.4% for drivers and +16.8% for all persons). In 2019, over one third of the persons tested positive for substances also tested above the legal limit for alcohol.

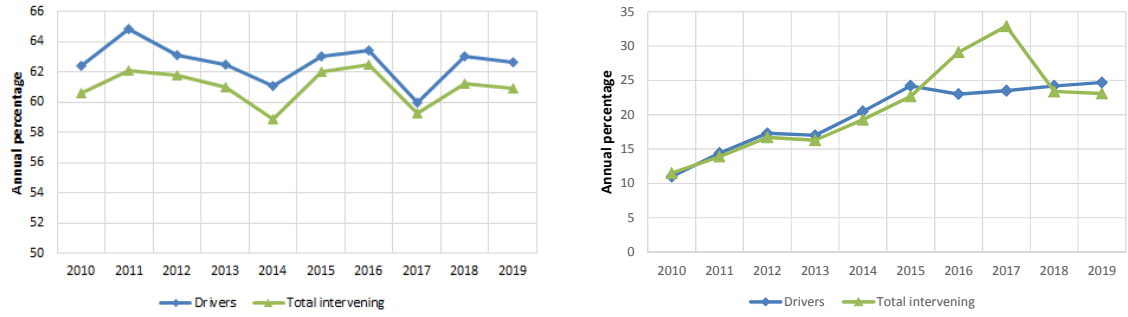


Figure 2.38 – Percentage of persons involved in crashes and drivers tested with TAS above the legal limit or positive for substances (2010-2019)

Therefore, drink and drug driving remains a serious road safety problem in Portugal, despite an increase in the number of alcohol tests being performed by the police forces. Overall, less than 4.5% of drivers tested by the police had BAC above the 0.5 g/l legal limit and this percentage shows a decreasing trend, since 2010. Developments show that the percentage of fatal drivers above 0.5 g/l remained high (37% in 2019), showing a U-shaped trend during the decade 2010-2019. The same can be said on the percentage of driver fatalities above 1.2 g/l, which in 2019 amounted to 29% (i.e. 80% of those above the legal limit). Observations on the prevalence of alcohol on drivers showed an increase in violations, from 1.22% in 2008 to 1.80% in 2013. The percentages of fatal pedestrians with high values of BAC are

also high. The percentage of fatalities who tested positive for substances increased since 2010, especially as regards cannabis.

2.2.6.2 Enforcement activity by the police forces

Figure 2.39 shows the developments in police enforcement activity during the period 2015-2019 (left graph) and in violations detected (right graph), according to the annual reports of internal security (SIS, 2016, 2017, 2018 e 2019). Overall, the number of drivers checked by the police forces shows a reduction (yearly rate of -5.6%); nevertheless, the number of alcohol tests carried out yearly increased by 3.3%, as mentioned in section 2.2.6.1.

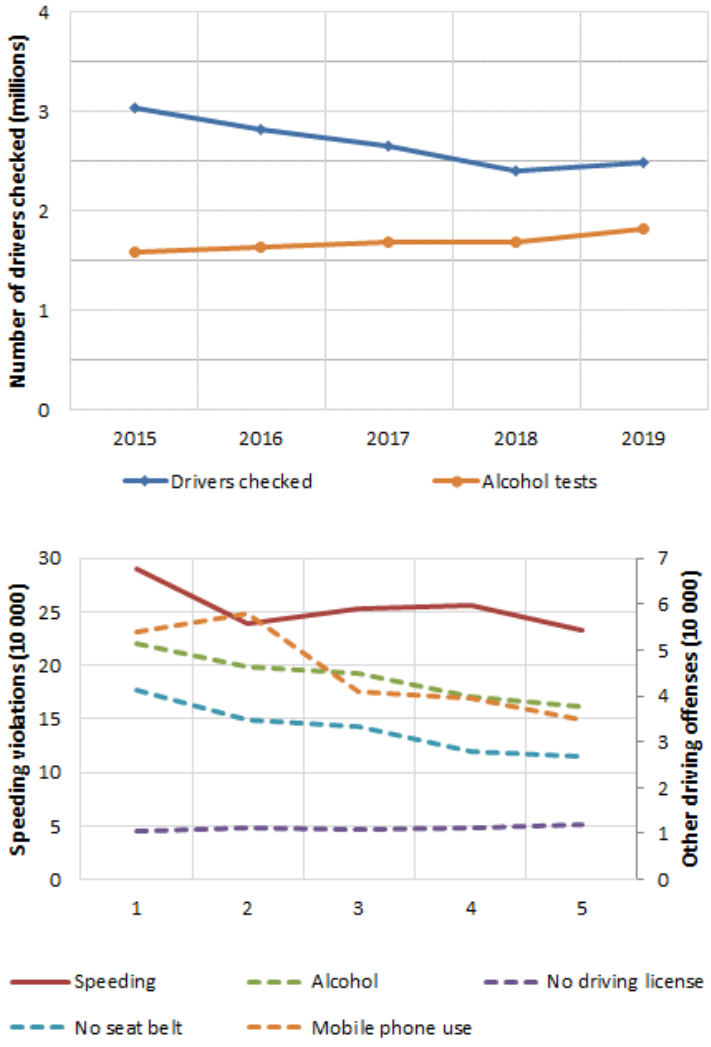


Figure 2.39 – Developments in the police enforcement activity (left) and registered violations (right), in 2015-2019

In the referenced period, the number of detected violations due to no driving licence increased with an average yearly rate of +2.8%. The number of speeding tickets issued decreased at a rate of -3.8%; the numbers of alcohol (-6.9%), seat belt (-9.8%) and mobile phone use (-8.8%) related offence declarations

showed reductions, as well. The number of other types of detected offenses (totalling almost 700 000, in 2019) also showed a significant reduction (-7.4%).

Data provided by ANSR shows that with the implementation of automatic speed violation detection at preselected sites (SINCRO), the number of speeding tickets issued increased by more than 150% (406 475 vs. 217 779 in 2018, and 349 975 vs. 225 804 in 2019).

Overall, 0.45% of the vehicles controlled with SINCRO were issued a speeding ticket, in comparison to the 2.3% of vehicles controlled by police radars.

Figure 2.40 shows the developments in the effectiveness of the enforcement procedures in the period 2015-2019. On average, the number of registered violations increased by +6.5% yearly, the number of issued fines by +7.7% and the number of paid fines by +2.3%. The number of expired fines reduced at an average yearly rate of -29.5%; most of this reduction was achieved in 2016.

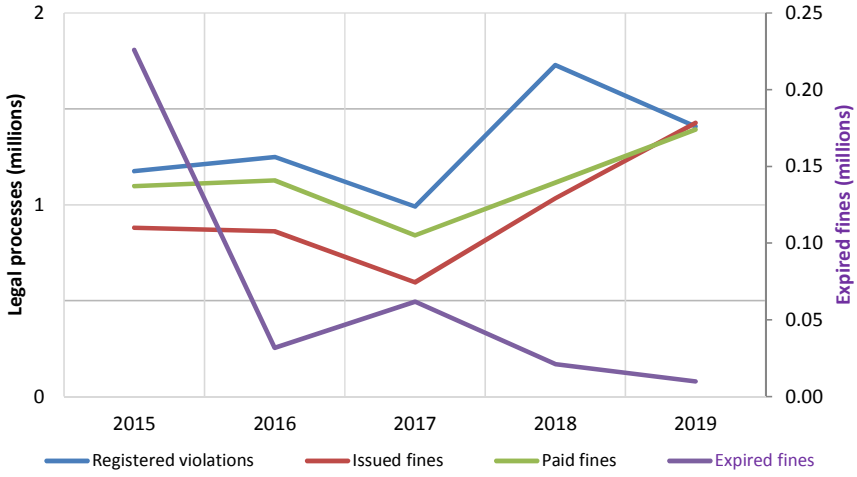


Figure 2.40 – Developments in the enforcement procedures (2015-2019)

2.2.6.3 Campaigns

According to the annual reports of internal security (SIS, 2016, 2017, 2018 e 2019), in the last five years (2015-2019) 24 generic and 20 thematic campaigns were performed. The latter type of campaigns were directed to pedestrian safety and drink & drive issues (2015), to publicise the new penalty point system (2016), drink & drive and mobile phone distraction (2018), and speeding, drink & drive, as well as pedestrian and two wheeled vehicle safety (2019).

In view of the unbalanced distribution of casualties among males and female drivers (see section 2.2.4), even generic campaigns need to be addressing especially the former group, rather than drivers in general.

In the reports, no mention is made to evaluation studies on the campaigns carried out or to their results, despite one such analysis having been performed.

2.2.6.4 Seat belts

In its contribution to the preparation of VisãoZero 2023, *Prevenção Rodoviária Portuguesa* refers to results from a road user behaviour observation campaign made in 2013 on safety belt use by car occupants, which may be considered high in the front seats: 96.4% of drivers (7615 observations) and 95.7% of front seat passengers (2587 observations) had their seat belts fastened (these values are similar to those from the measurements made in 2008).

The fastening of seat belt rates by rear seat passengers are considerably lower, particularly in urban areas. Observations made in 2013 resulted in 72.5% for the adults (502 persons) and 91.0% for children (288 cases) in the country as a whole. An observational study carried out in the city of Lisbon in 2017 confirmed the very low use of the rear seat belts - 28.7% in private cars (634 observations) and 20.4% in taxi (574 observations).

Seat belt use in coaches and buses is also very low: 16.3% of 657 men observed, 24.3% of 902 women and 54.2% of 59 children.

2.2.6.5 Child restraint systems

Prevenção Rodoviária Portuguesa mentions results from its 2013 observations on child restraint systems use, which showed differences in wearing rates, depending on children age.

All children under 2 years of age were observed with proper child restraint systems (CRS). For ages 2 to 5 years the percentage of CRS use were 97%. Above that age, the rates were 94.7% at 6, 92.7% at 7 and 90.5% at 8. From the age of 9, a significant number of children start wearing seat belts instead of CRS: 81.4% had CRS and 18.6% were with seat belts (100% had some form of restraint systems). Of these, half did so legally, as the children were over 135 cm tall.

Of children aged 10, 46.3% had CRS and 49.6% seat belt; 4.1% without any restraint equipment (95.9% use of a restraint system). Of the children with only a belt, they were 31.4% in regular use (less than 135 cm high). In summary, only 77.7% were in correct use.

Regarding children aged 11: 32.3% had SRC, 57.0% a seat belt, and 10.7% had no restraint system (89.3% with restraint system). Of the children with only a belt, they were in a regular situation 55.8%% (more than 135 cm high). In summary, only 88.1% were correctly using this type of safety devices.

2.2.6.6 Use of protective helmets

According to the Portuguese Highway Code motorcycle and moped riders must wear a type approved helmet. No such obligation exists for riders of bicycles or equivalent vehicles (e.g., e-bikes and e-scooters, motor assisted up to 25 km/h).

In its contribution, *Prevenção Rodoviária Portuguesa* refered to results from observations on the use of helmets PTW riders (PRP, 2021a):

- motorbike drivers: 99.3% out of 856 observed
- moped drivers: 94.4% out of 448 observed.

For passengers, there was 100% use (out of 95 observed) for motorbikes and 92.3% (out of 52 observed) for mopeds.

Concerning helmet use by cyclists, the following results were obtained in observations made in the city of Lisbon point to the following data (PRP, 2021b):

- private city bicycles in urban transport: 55% helmet use;
- *Gira* and *Ubernet* shared bikes: 2% helmet use;
- road touring bicycle: 99% helmet use.

Observations from this study included bicyclist behaviour at signalized intersections: 57% were observed in violation of the red light (PRP, 2021b).

2.2.6.7 Distraction by mobile phone use

According to the Portuguese Highway Code drivers' hand-held use of mobile phones is forbidden; drivers are permitted to use hands-free mobile phones.

Observations on the use of mobile phones while driving were made by *Prevenção Rodoviária Portugesa* in the city of Lisboa, in March and April 2017, a total of 5638 drivers being observed: 3378 in moving vehicles and 2260 in vehicles stopped at traffic lights.

Regarding the moving vehicles drivers, 7.7% were involved in some activity related to mobile phone use: 1.8% talking with the mobile phone in their hand, 3.3% talking with hands free device (speakerphone or headphones), and 2.7% handling the mobile phone.

The percentage of mobile phone use was higher when drivers were standing at traffic lights. In this case, 13.7% were distracted talking to the mobile phone in hand (1.9%), speaking loudly/electrically (5.2%) or handling the mobile phone (7.3%).

Differences in using rates by gender and age were observed, as well. The results also hint that the prevalence of mobile phone use is much higher for drivers travelling alone than for those travelling with passengers, both when standing at traffic lights and when the vehicle is in motion. Drivers with child passengers had lower mobile phone use rates than those without passengers or with adult passengers.

2.2.6.8 Speed

Current information of speed compliance on Portuguese roads is not available. Planned systematic measurements were made in 2000, 2002, 2004 and 2008, on a sample of 60 road sections selected as representative of four interurban road categories and four urban street categories. In these measurements, roads in urban areas were categorized in four levels, Level 2 corresponding to streets with a distributor function, where pedestrian crossings are controlled by signals (see Figure 2.41). Also, the sites for speed measurement on roads through small villages were selected locations where the prevailing road environment was indeed urban.

Figure 2.41 – Example of Level 2 urban roads

Table 2.6 contains selected statistics on the speed distributions in motorways, fully access controlled single carriageway interurban roads, through roads and Level 2 urban streets, obtained in 2004 by LNEC (Cardoso e Andrade, 2005) and in 2008 by *Prevenção Rodoviária Portuguesa*[10].

Table 2.6 – Statistics on speed distributions in selected interurban roads and urban streets (2004 and 2008)

	Interurban				Urban			
	Motorways		Single carriageway with access control		Through road		Level 2 street	
	2004	2008	2004	2008	2004	2008*	2004	2008
Speed limit (km/h)	120		90		50		50	
Average (km/h)	121	118	97	92	62	54	58	56
V85 (km/h)	146	136	113	109	70	64	71	68
Above speed limit	54%	45%	65%	28%	83%	56%	70%	66%
+10 km/h	37%	-	44%	-	58%	-	47%	
+30 km/h	12%	4%	13%	2%	9%	9%	9%	12%
Number observations	196977	23689	129342	11150	159208	12865	360403	37734

* Measurements made at sites with interurban road environment were not considered

In 2004 average speeds were generally higher than the speed limit and the percentage of drivers speeding by more than 30 km/h (serious violation, with fine and driving licence suspension) was also high, being more than 12% on interurban roads and 9% inside urban areas. Speeds measured in 2008 on interurban roads were generally lower than in 2004, and the percentage of serious offenders were much lower than in the previous campaigns; it is unclear if changes in measuring procedures (in 2004

[10] https://observatorio.prp.pt/dados-recolhidos/observacoes/velocidade-2/

measurements were made with inconspicuous mats installed on the pavement and in 2008 they were made with roadside radars) had influenced these differences. Measured speeds in urban roads were also lower in 2008 than in 2004; however, the percentages of serious offenders did not diminish from 2004 to 2008.

Table 2.7 presents selected statistics on the speed distributions measured in 2020, on two motorway sections and three single carriageway interurban roads with full access control, made on working hours. The number of measured vehicles is quite small, even though sufficient to be significant as regards the measured values of the average speed.

Table 2.7 – Example statistics on speed distributions measured in 2020 on selected interurban roads and motorways

	Interurban roads		
	Motorway		Single carriageway with access control
	A12, km 8.9	A1, km 52.8	EN 1, km 51.4 EN 119, km 17 EN 10, km 99
	2020		2020
Speed limit (km/h)	120		90
Average (km/h)	113	134	83
V85 (km/h)	135	152	97
Above speed limit	38%	84%	31%
+10 km/h	21%	69%	12%
+30 km/h	2%	20%	3%
Number observations	1666	1206	1961

Measurements on the two motorways show high differences, the values depending on which site is analysed. Measurements on the three single carriageway roads were relatively consistent, and suggest that average speeds may be lower in 2020 than in previous measurements and that the percentage of high speed violators may have decreased considerably (as compared to 2004 only).

It can be concluded that resuming speed measurements is needed, to ascertain what is the current dimension of speeding problem, and on which road categories it is more dangerous.

2.3 International comparisons

In the scope of this analysis a comparison with other countries was performed, in order to frame the road safety status of Portugal in the context of other European countries. Comparison countries include Spain (neighbouring country), Czech Republic, Hungary, Lithuania, The Netherlands Switzerland and

Norway. The latter three countries were selected as examples of countries with small populations and good starting performance indicators; Switzerland and Norway also showing excellent road safety improvements in the period 2010-2019. The Czech Republic, Hungary and Lithuania were selected as small countries with major road safety indicators, like fatalities per inhabitants, similar to the Portuguese ones.

2.3.1 Fatalities

One of the most common road safety indicators is the number of fatalities per inhabitant. Figure 2.42 presents the development of road fatalities per 100 000 inhabitants between 2010 and 2019 for the eight selected countries. There are two groups that do not intersect. Portugal is in the upper group, with the Czech Republic, Hungary and Lithuania. All countries present a downgrade trend, although for some countries, like Norway and Switzerland, this reduction was greater, with 9.9% and 6.4% yearly, respectively. Portugal registered a reduction of 6.1% yearly in this period.

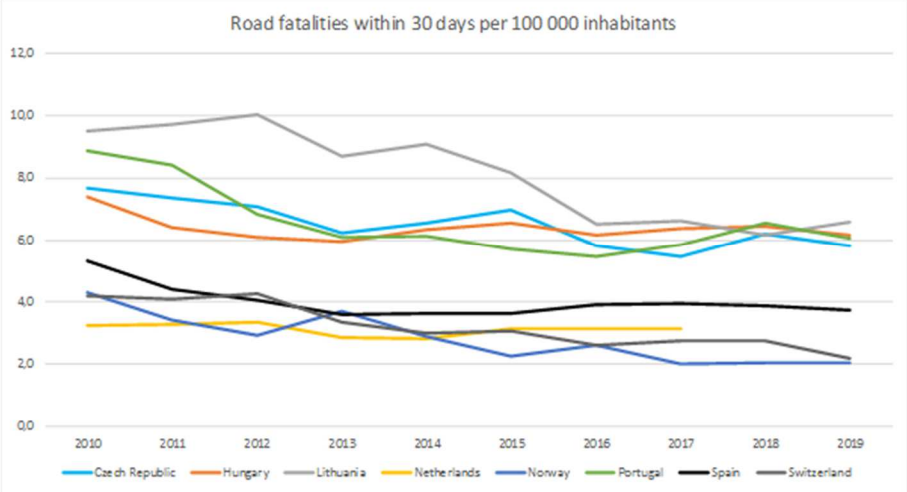
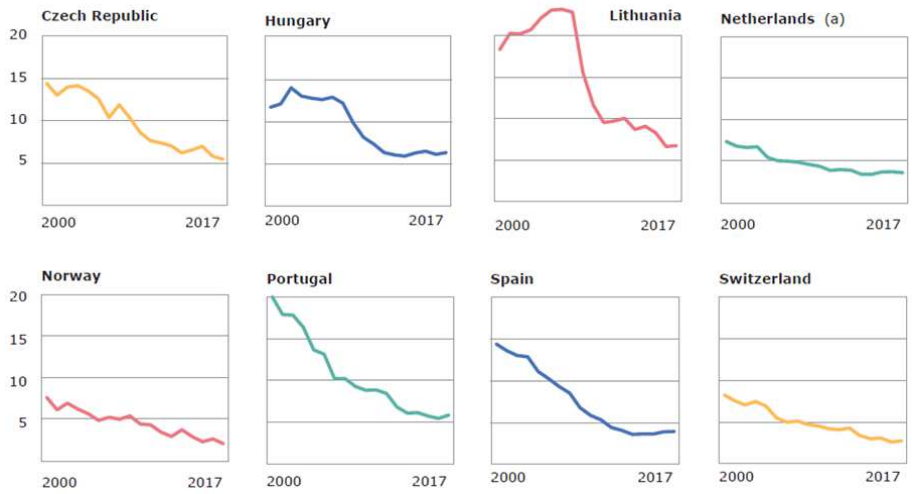


Figure 2.42 – Developments in road fatalities per 100 000 inhabitants between 2010 and 2019 (Source: IRTAD)

A closer look at the same information but at a different scale (Figure 2.43) shows that, although in this century country developments were generally downward, in the most recent period developments they show marked differences. It is worth highlighting that the Dutch fatality data corresponds to the actual number of road crash fatalities, due to the use of capture-recapture methods to correct for underreporting of police registration.



a) Real data (actual numbers instead of reported numbers by the police).

Figure 2.43 – Developments in road fatalities per 100 000 inhabitants between 2000 and 2017 (Source: IRTAD, 2020)

As mentioned in section 2.2, in 2015-2019 Portugal had an average yearly increase of +2.1% in the number of fatalities; of the selected comparison countries, only Spain registered a positive variation (+1.8%) in the number of fatalities as well. The other countries recorded reductions in the number of fatalities: the Czech Republic, -5.7%; Hungary, -1.3%; Lithuania, -7.6%; Norway, -2.8%; and Switzerland, -6.7%.

Figure 2.44 presents the development in yearly road fatalities per billion of kilometres travelled by all vehicles (VKT) between 2010 and 2018. A downgrade trend is also observable for most countries with a plateau-like stabilization in the most recent years. Nevertheless, a clear distinction for Czech Republic and Portugal is shown; these countries present the highest values within this period, and small increases since 2016.

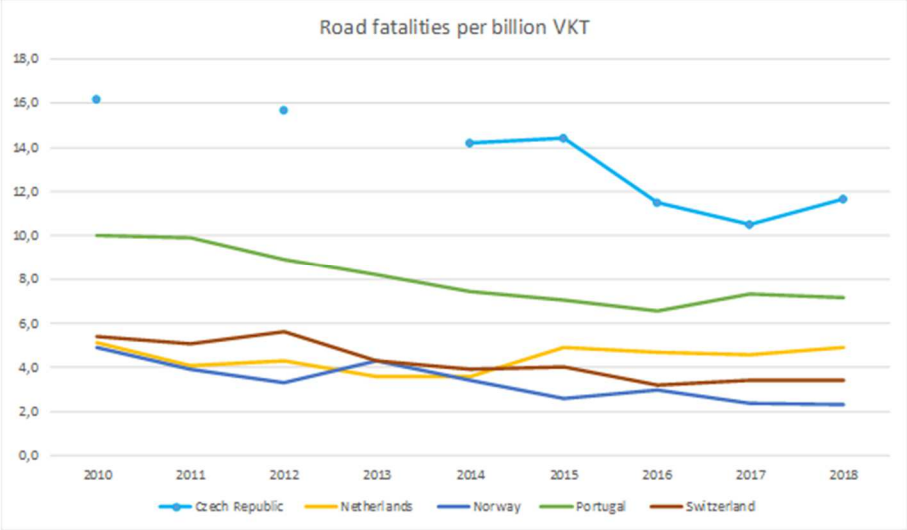


Figure 2.44 – Developments in road fatalities per billion vehicle.km between 2010 and 2018 (Source: IRTAD and LNEC)

Figure 2.45 presents the development in yearly road fatalities per 10 000 registered motorized vehicles between 2010 and 2018. Portugal is situated at an intermediate level, together Czech Republic and slightly lower than Hungary and Lithuania. Best performing countries in this indicator are Norway, Switzerland, The Netherlands and Spain; their values are constant since 2015.

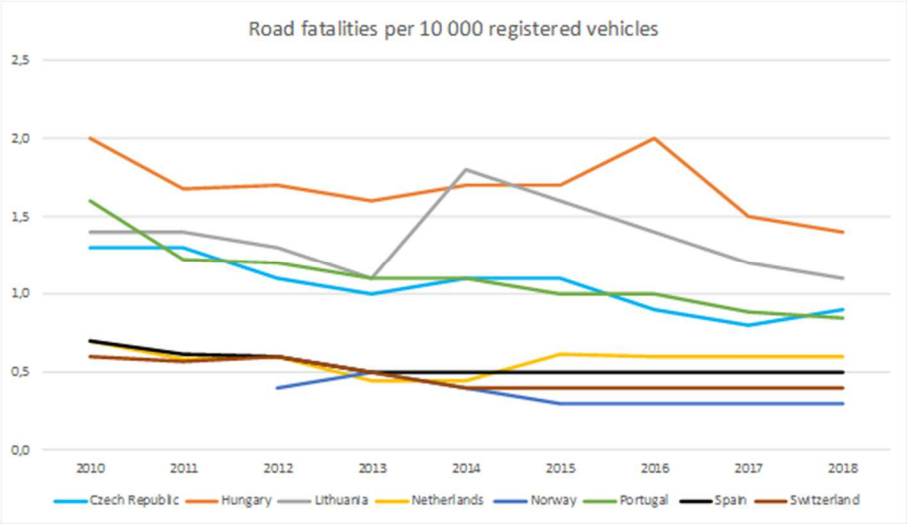


Figure 2.45 – Developments in road fatalities per 10 000 registered vehicles between 2010 and 2018 (Source: IRTAD)

Figure 2.46 presents the average proportion of road fatalities by road type, in the period 2015 and 2017. Portugal stands out from the remaining countries, due to a high percentage of road fatalities that occurred in urban roads: 53% - fifteen percent points above the EU27 average (38%). On the contrary, there is a low proportion of rural non-motorway road fatalities, by comparison with the other countries.

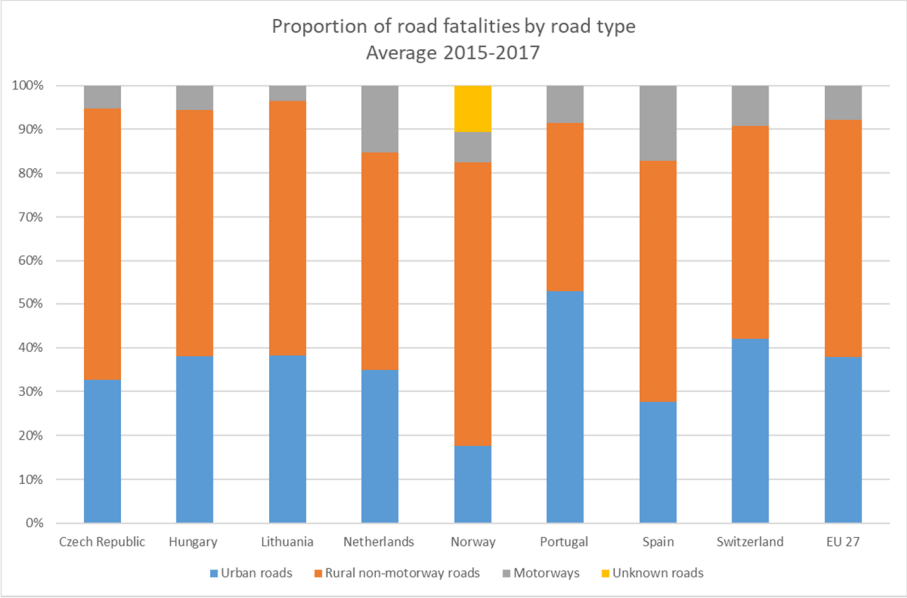


Figure 2.46 – Average proportion of road fatalities by road type, between 2015 and 2017 (Source: ETSC, 2019c)

Figure 2.47 presents the average number of children fatalities per million child population (0-14 years old) between 2014 and 2016. The higher value is clearly presented by Lithuania, with 18.9 fatalities per 100 000 inhabitants, and the lowest is presented by Norway, with 3.2 fatalities per 100 000 inhabitants. Portugal is below the European average (8.2 fatalities per 100 000 inhabitants), with 6.8 fatalities per 100 000 inhabitants.

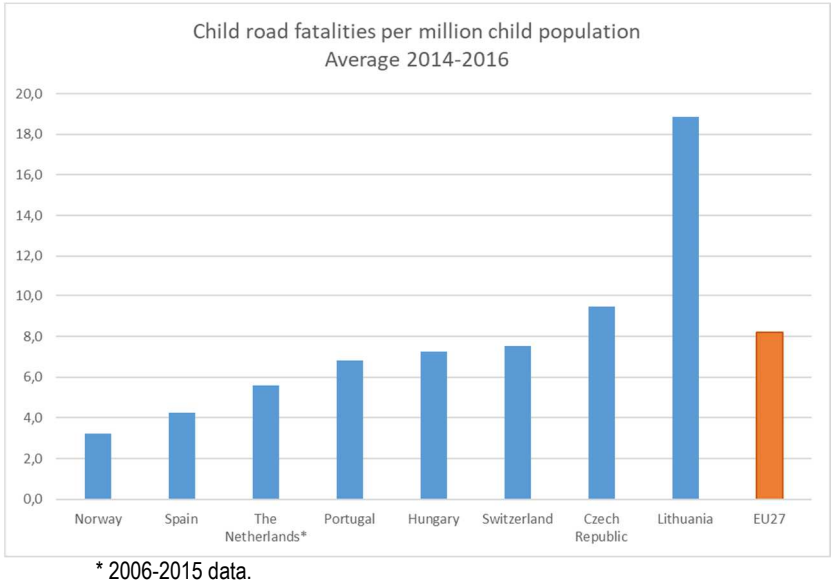


Figure 2.47 – Average number of children fatalities per million child population (0-14 years old) – 2014 to 2016 (Source: ETSC, 2018)

According to the ETSC report, in most countries the annual numbers of fatalities are low, with high relative random variation. However, Spain shows a decreasing trend and no 2016 data in the ETSC report was provided for The Netherlands (which has a spike increase from 2013 to 2014).

Figure 2.48 contains a comparison between the mortality rate (fatalities per 100 000 inhabitants) per age group for 2017, as reported in the IRTAD 2019 report. The mortality rate for those in the age group 75 years or more is considerably higher than the average in Hungary and Portugal.

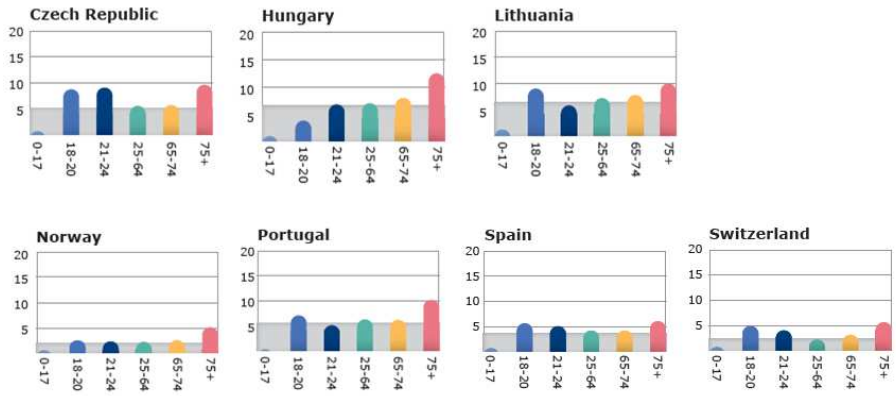


Figure 2.48 – Mortality rate by age group in 2017 (ITF, 2019)

Figure 2.49 presents the average proportion of pedestrian fatalities occurred in collisions with different types of vehicles between 2015 and 2017. Portugal presents the highest percentage of pedestrian fatalities involving collisions with vans (less than 3.5 ton). Most of these vehicles are used for professional travel or logistic operations.

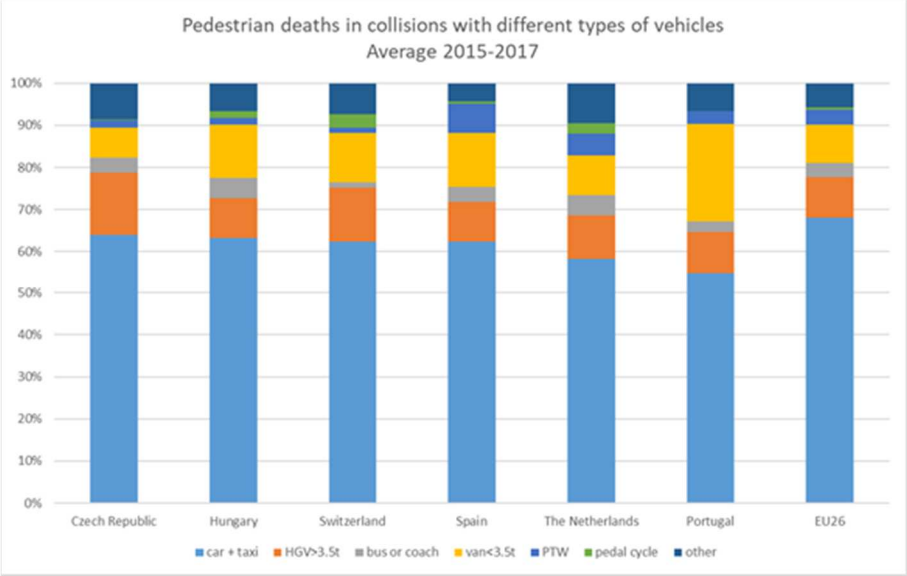
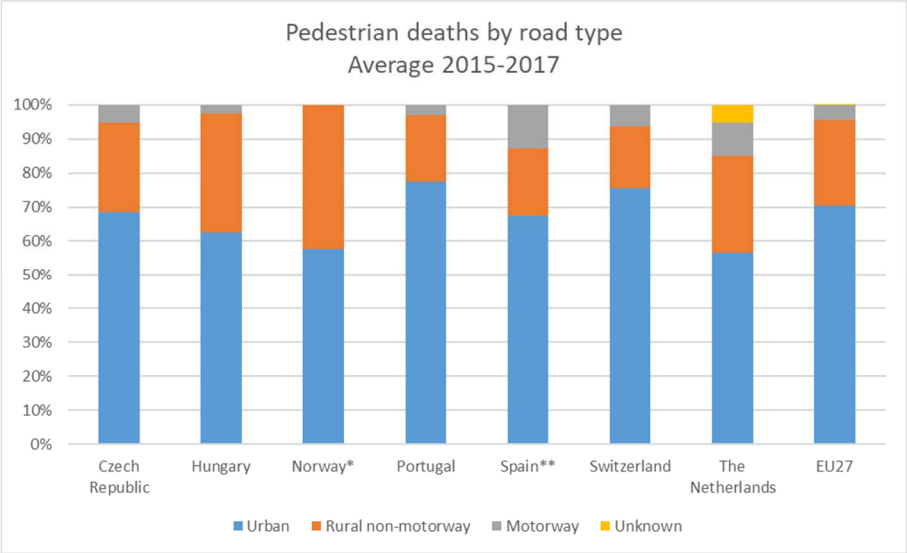


Figure 2.49 – Average proportion of pedestrian fatalities that occurred in collisions against different types of vehicles – 2015 to 2017 (Source: ETSC, 2020)

According to the ACEA-Report Vehicles in use Europe, in 2018 vans represented 17.8% of its reported Portuguese fleet. Similar percentages are reported for Spain (15.8%) and Norway (15.3%). The percentages for other countries are: Czech Republic, 8.7%; Hungary, 10.6%; Switzerland, 7.5%; The Netherlands, 10.0%, and the average for EU was 10.7%. There is no linear relation between the percentage of vans in the fleet and the proportion of pedestrian fatalities in collisions with vans.

Figure 2.50 shows the average proportion of pedestrian fatalities by road category between 2015 and 2017. Portugal presents the highest percentage of pedestrian fatalities that occurred in urban areas. This is consistent with Figure 2.46, in which Portugal presented the highest percentage of road fatalities that occurred in urban roads, and highlights that crashes in urban setting are indeed affecting especially pedestrians – the road user category most prevalent in urban areas.

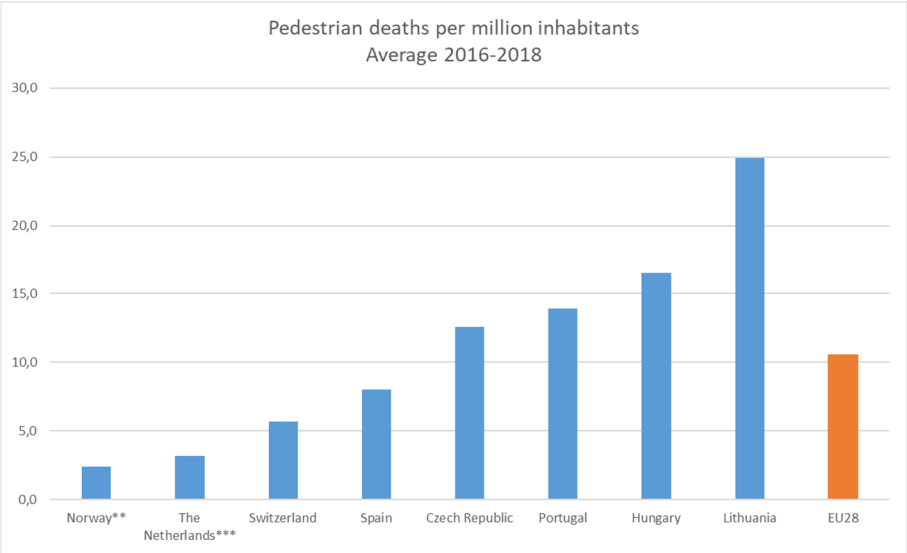
It is also worth noting that the percentage of pedestrian fatalities in Swiss urban areas was similar to what was registered in Portugal.



*Norway - 2016-2017 data.
**Spain - motorways and *autovias* data are presented together.

Figure 2.50 – Average proportion of pedestrian fatalities by road category between 2015 and 2017 (Source: ETSC, 2020)

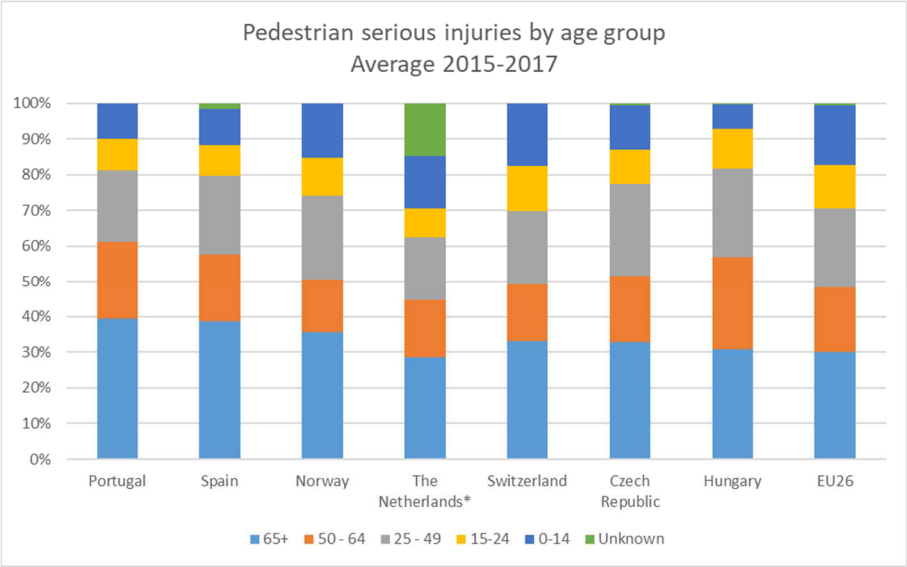
Figure 2.51 shows the average number of pedestrian deaths per million inhabitants between 2016 and 2018. Lithuania presents the highest indicator, with 24.9 pedestrian deaths per million inhabitants, followed by Hungary, Portugal and Czech Republic (16.6, 13.9 and 12.6 pedestrian deaths per million inhabitants, respectively), all above the European average (10.5 pedestrian deaths per million inhabitants). Unlike what was shown in the previous figure (Figure 2.50) the pedestrian mortality rate in Switzerland is considerably lower than in Portugal.



**Spain and Norway - 2010-2017 data.
***Netherlands - Statistics Netherlands data.

Figure 2.51 – Pedestrian deaths per million inhabitants (2016-2018 average) (Source: ETSC, 2020)

Figure 2.52 presents the average percentage of seriously injured pedestrian by age group in the period 2015 to 2017. Portugal and Spain present the same percentage of seriously injured pedestrian older than 65 years old (39%). Concerning the age group between 50 and 64 years old, Portugal presents the second highest percentage – 22% (the highest being presented by Hungary, with 26%). National definitions vary with each country and are not harmonized.

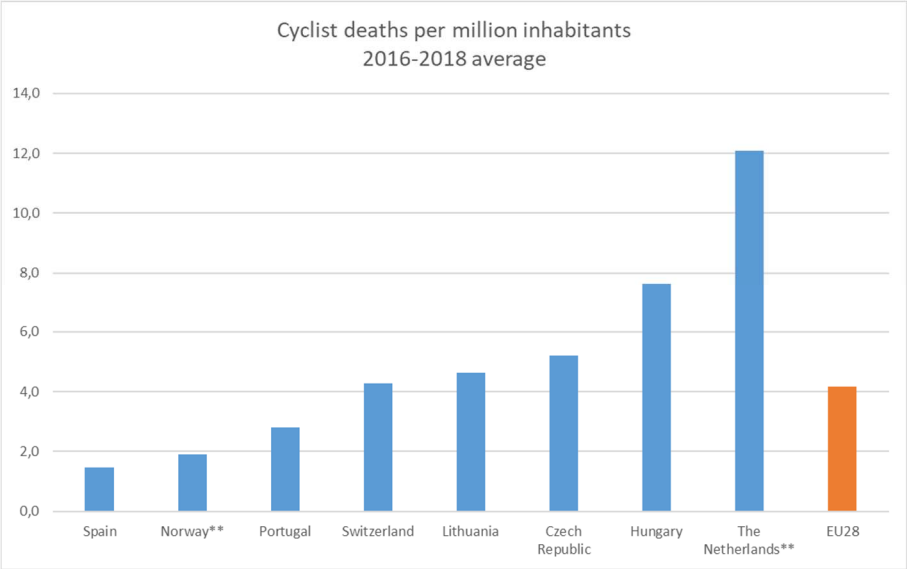


*NL - serious injury data based on the national definition. Data provided by SWOV.

Figure 2.52 – Proportion of pedestrian seriously injured by age group (average 2015-2017) based on national definitions of a serious injury (Source: ETSC, 2020)

Figure 2.53 presents the average annual reported cyclist deaths per million inhabitants (of 2018) between 2016 and 2018. Within the eight selected countries, The Netherlands clearly stands out with the highest number of cyclist deaths per million inhabitants (12.1), which is related to the high cyclists' traffic volume. The EU presents a significantly lower value (4.2 cyclist deaths per million inhabitants) and Portugal has an even lower indicator: 2.8 cyclist deaths per million inhabitants.

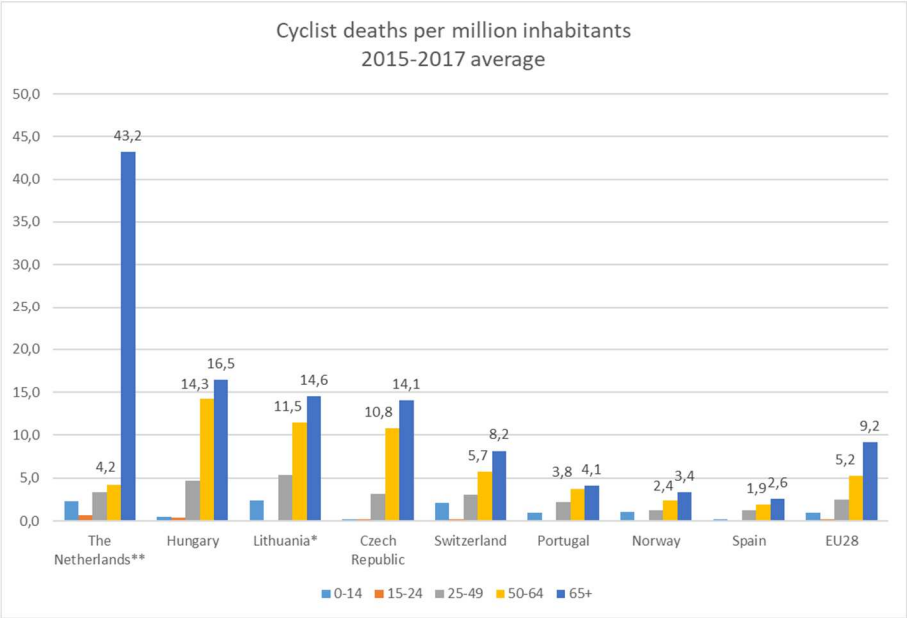
Lack of available exposure data hampers the full use of these data, given the differences in traffic volumes among countries. Given the current implementation of policies fostering the increase of cycling modal share in urban transport, predictions on the impact of these policies on road safety need to be supported by knowledge on the actual and expected levels of bicyclist risk. The main outcome from this graph is that, as with other types of vehicle, increased bicyclist traffic volume is accompanied by higher numbers of fatalities and injuries, meaning that evidence based preventive actions towards lowering actual risk must be included in those policies.



**Spain and Norway - 2010-2017 data.
***The Netherlands - Statistics Netherlands data.

Figure 2.53 – Average annual reported cyclist deaths (2016-2018 average) per million inhabitants in 2018 (Source: ETSC, 2020)

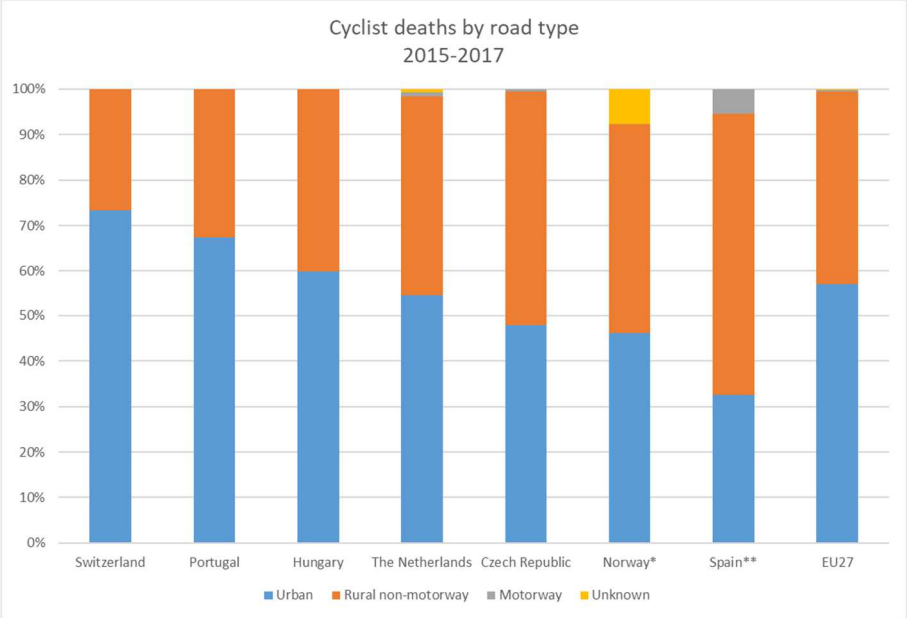
Figure 2.54 shows the average number of cyclist deaths per million inhabitants (from 2017 estimations) disaggregated by age group, between 2015 and 2017. Again it is The Netherlands that presents the highest value: 43.2 cyclist deaths per million inhabitants, but only for the oldest age group (above 65 years old). Within the age group between 50 and 64 years old, Hungary presents the highest value: 14.3 cyclist deaths per million inhabitants, but Lithuania and Czech Republic present close values. Portuguese values are rather low in comparison with the remaining countries.



*Lithuania - 2015 data.
**The Netherlands - Statistics Netherlands data for the following age groups: 0-14, 15-20, 21-30, 31-50, 51-60, 60+.

Figure 2.54 – Cyclist deaths by age group (2015-2017 average) per million inhabitants in 2017 (Source: ETSC, 2020)

Figure 2.55 presents the average proportion of cyclist deaths by road category between 2015 and 2017. Portugal is the second country with the highest percentage of cyclist deaths in urban areas (67%), only surpassed by Switzerland, with 73%. This is a pattern similar to the one for pedestrian fatalities – a very high percentage (see Figure 2.50) of occurrences in urban areas. The EU average remains at 57%.



*Norway - 2016-2017 data
**Spain - motorways and *autovias* data are presented together

Figure 2.55 – Proportion of cyclist deaths by road type (average 2015-2017) (Source: ETSC, 2020)

2.3.2 Serious injuries

Figure 2.57 shows the developments in the number of serious injuries, according to the original national definitions (continuous lines) and the harmonized EU definition (broken lines), using MAIS 3+ as the limiting injury classification. Except for Portugal, the harmonized definition generates a lower number of seriously injured victims than the corresponding original national definition; in the case of The Netherlands the ratio between the harmonized and the original definitions is smaller than 1/3 (MAIS2+ is the Dutch national definition of serious injury.

On average, in the period 2010-2014, only The Netherlands experienced an increase in the number of MAIS+3 serious injuries (+1.2% annually); Spain (-5.7%), Switzerland (-2.4%) and Portugal (-6.8%) had decreased the number of MAIS+3 serious injuries. As observed before, in the period 2015-2019 Portugal presented an almost constant trend (-0.9%), similar to the one in Switzerland (-0.9%).

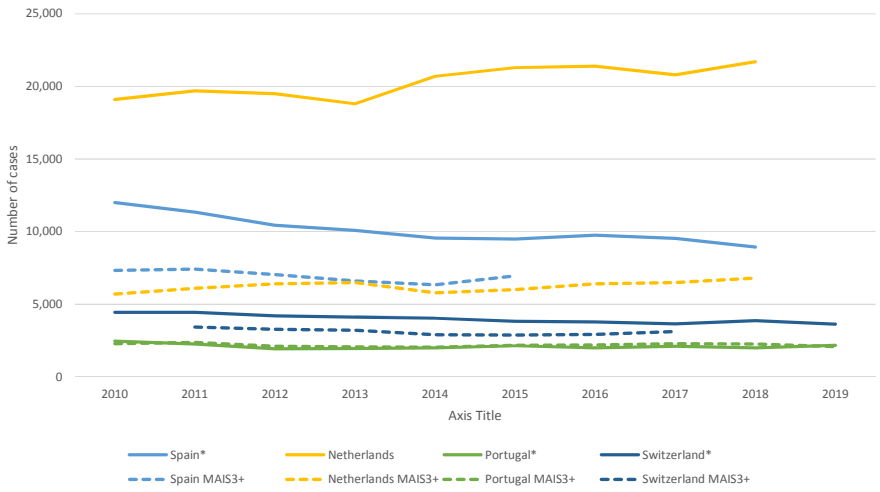


Figure 2.56 – Developments in the number of serious injuries (2010-2019) (Source: ETSC, 2020)

2.3.3 Speeding

In this section a comparison is made between measured traffic speeding indicators. Available data does not allow presenting this analysis for the same years and for all the selected countries. However, with the existing data it is still possible to support some behavioural differences between countries, as regards compliance with the speed limits.

The general speed limits per road category in the analysed countries are presented in Table 2.8. Overall, there is agreement on the speed limit in urban areas; speed limits on rural roads are 80 km/h or 90 km/h. Speed limits on motorways seem to depend on geometric or traffic characteristics, as several countries mention more than one value.

As mentioned by ETSC (2019a), several cities across Europe are introducing or extending 30 km/h zones, especially around schools and in residential and shopping areas with many pedestrians and cyclists.

Table 2.8 – Speed limits (km/h) by road category in the eight selected countries (ETSC, 2019a)

Country	Urban	Rural	Motorway
Czech Republic	50	90	130 / 110
Hungary	50	90	130 / 110
Lithuania	50	90	130 / 110
Netherlands	50 / 30	80	130 / 120 / 100
Norway	50	70 / 80	100 / 110
Portugal	50	90	120 / 100
Spain	50	90 / 100	120
Switzerland	50	80	120

The ETSC (2019a) report recognizes that, even in urban areas, speed compliance on both 50 km/h and 30 km/h roads is still a challenge. Figure 2.57 presents the proportion of cars, taxis and vans driving above the speed limit in urban streets (50 km/h). It is possible to see that, from the three countries with available data, Portugal is the one where speeding in urban areas is most prevalent.

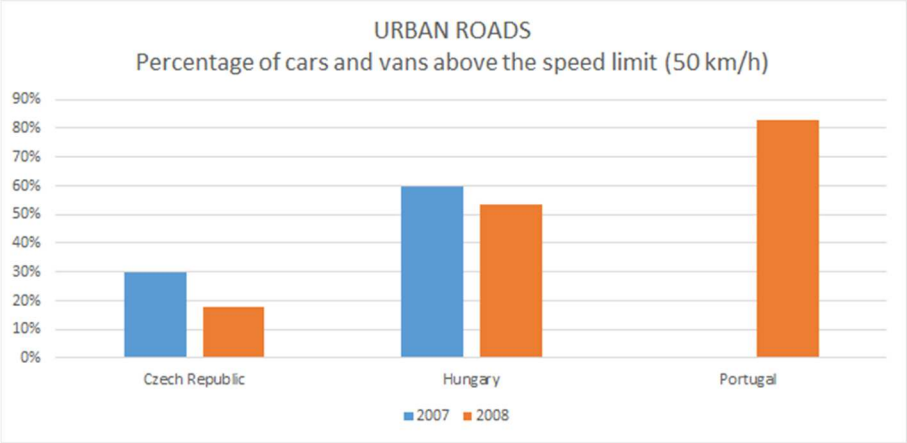


Figure 2.57 – Proportion of cars, taxis and vans traveling above the speed limit in urban roads (Source: ETSC, 2019b, PRP, 2008)

In what concerns rural areas, Figure 2.58 shows that the percentage of cars and vans traveling at speeds higher than the speed limit on rural non-motorway roads is higher in Portugal and Spain. Differences between the analysed countries are small, the percentage of speeding vehicles varying between 35% in Czech Republic and 45% in Spain.

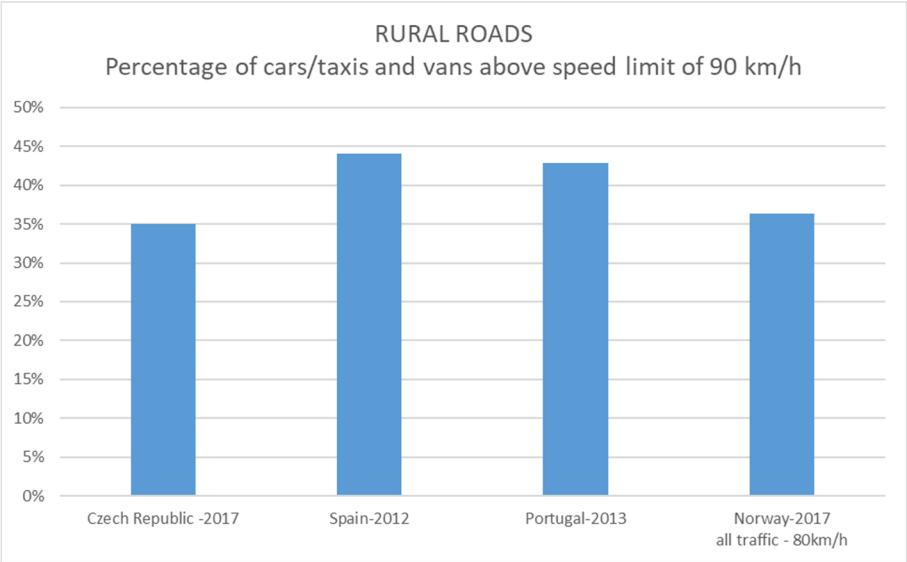
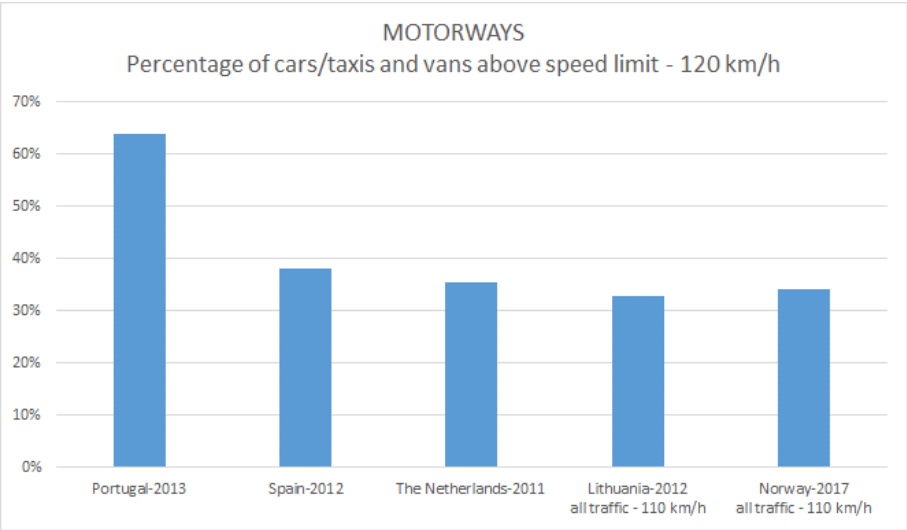


Figure 2.58 – Proportion of observed speeding cars and vans on rural non-motorway roads, under free flow traffic conditions (Source: ETSC, 2019b, PRP)

Figure 2.59 presents the proportion of cars and vans that were measured travelling on motorways at speeds above the speed limit. Although the generalized adopted speed limit is 120 km/h, Lithuania and Norway presented their speeding measurements associated to a speed limit of 110 km/h. Portugal stands out negatively from the other countries, with rather higher percentages of speeding cars (64%), whilst in the other countries this percentage is around 35%.



Portugal – all vehicles

Figure 2.59 – Proportion of cars and vans travelling at speeds higher than the speed limit on motorways, under free flow traffic conditions (Source: ETSC, 2019b, PRP)

Previous international comparisons between Portugal and the UK and The Netherlands, carried out with existing speed data from 2001, showed that speeds in urban streets were higher in Portugal. Updating

the speed distribution measurements, and the corresponding safety performance indicators on Portuguese roads is needed, in order to be able to monitor developments in this area (prevalence of speeding). Although the comparative Portuguese data shown is old, when matched with the international data available, there is no evidence that speeding prevalence changed significantly (see section 2.2). Speed management is required in this domain, and a Safe System approach to this will provide a good foundation for implementing safe and credible speed limits.

2.3.4 Drinking and driving

In what concerns the problem of drinking and driving, countries have adopted different measures to minimize it. Setting-up legal maximum values for Blood Alcohol Concentration (BAC) levels and enforcing their compliance is one of these measures. Table 2.9 presents a summary of the adopted criteria in the selected countries. Only the Czech Republic and Hungary adopted the zero level of tolerance against alcohol presence in drivers. Intermediate levels were adopted by Norway and Lithuania (0.2 g/l and 0.4 g/l respectively). The remaining countries – Portugal included – adopted the 0.5 g/l as a general level. Differentiated BAC levels were adopted by all countries except the Czech Republic, Hungary and Norway.

Table 2.9 – Maximum Blood Alcohol Concentration (BAC) levels in the eight selected countries (ETSC, 2019a)

Country	General BAC level (g/l)	Differentiated BAC level (g/l)
Czech Republic	0,0	-
Hungary	0,0	-
Lithuania	0,4	0.0 for novice, professional, moped and motorcycle drivers
Netherlands	0.5 (including cyclists)	0.2 for novice drivers (first five years)
Norway	0,2	-
Portugal	0,5	0.2 for novice (first three years) and professional drivers (since 1 January 2014)
Spain	0,5	0.3 for novice and professional drivers
Switzerland	0,5	0.0 for novice (first three years) and professional drivers

Figure 2.60 presents the developments in the percentage of alcohol-related fatalities, as reported by ETSC (2019a). Only Portugal, the Czech Republic and Switzerland are using the SafetyNet definition of alcohol related road deaths: any death occurring as a result of road crash in which any active participant was found with blood alcohol level above the legal limit. Furthermore, in Portugal, all road crash fatalities are autopsied. In Hungary only car drivers are considered, and these are tested only if assumed to be responsible for the crash; in Spain, pedestrian are not considered; in Latvia and Norway, only collisions are considered; and in The Netherlands the police does not provide alcohol-related data since 2011.

Portugal, stands high in the graph, with a percentage above 25%, except for a small decrease in 2014. Despite this constant trend, in the ESRA surveys (PRP, 2017 and PRP, 2020), the perceived likelihood

of the police checks for drink-driving in Portugal in 2018 (26% considered highly probable to be tested on the road for alcohol at least once a year) is higher than the obtained value in the 2015 survey (23%); on the other hand, 22% of drivers said they had been tested for alcohol in the last year, a percentage lower than the 25% found in 2015.

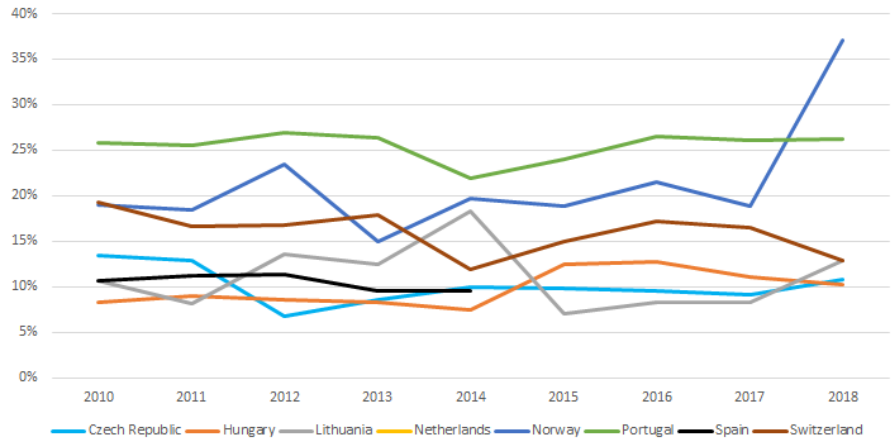


Figure 2.60 – Developments in the percentage of road deaths attributed to alcohol in one of the intervening active parties (Source: ETSCa, 2019)

2.4 Main conclusions

Analysis of collected data allowed to detect some relevant safety aspects, for further consideration, in the following activities of Stage 2.

Urban areas are of particular concern as regards road safety in Portugal. Overall, in the period 2010-2019, 54% of the fatalities and 60% of killed and serious injured casualties (KSI) occurred in urban areas. Furthermore, the situation deteriorated in the period 2015-2019, as the number of fatalities inside urban areas increased annually by +3.3%, whilst by +0.5% outside those areas. The percentage of fatalities in urban areas in Portugal (54%) is especially high, when compared with other European countries – where it barely reached 40%.

In the period 2015-2019, the majority of fatalities occurred on urban streets (35%), interurban National Road Network roads (21%), National Road Network roads through villages (19%), motorways (9%) and on interurban trunk roads (IP's and IC's – 7%). In that five year period 2015-2019 the number of fatalities increased on streets (+3.4%), through roads (+2.6%) and IP's (+7%), while diminishing on motorways (-2.2%).

During that period, run-off-road//single vehicle crashes (accounting for 35% of street fatalities and 28% of through road fatalities) increased in all urban road categories. The increase in this type of crash hints at either inappropriate speed issues or increasing numbers of crashed unprotected vehicle occupants as possible contributing factors (or both).

In the ten year period 2010-2019, the majority of pedestrian fatalities occurred in urban areas: 80% of the pedestrians killed and 92% of those seriously injured.

On streets and through roads, PTW occupants represented 30% of the fatalities in 2015-2019; their number increased in these last five years. Except for motorways, there was an increase in the number of PTW occupant fatalities on interurban roads (19% of fatalities in these roads). Data suggests that part of this increase may be explained by an increase in the number of motorcycles, which dates back to 2010.

Overall, in 2015-2019 car occupants (45%), pedestrians (22%), moped riders (8%) and motorcyclists (15%) accounted for the majority of fatalities (cyclists accounted for 4%, and occupants of other vehicles for 7%). The distribution of KSI by vehicle category was similar, except for bicyclists whose percentage was 9%, higher than in the previous five year period (2010-2015), when it was 4%, only.

The number of pedestrian fatalities has diminished along the period 2015-2019 in all interurban road categories (9% of the fatalities) and on streets and through roads. Nevertheless, the pedestrian mortality rate in Portugal (13.9 fatalities per million habitants) is higher than the EU average (10.4), being especially high for pedestrians aged 65 or more: 35.1 fatalities per million inhabitants in Portugal vs. 25.1 - the average EU 28 (data for 2016-2018). Comparing with other European countries, the percentage of pedestrians hit by vans is much higher in Portugal; the same happens to the percentage of seriously injured pedestrians aged 65 or more.

The number of bicyclist fatalities (representing 10% on streets and through roads) diminished in 2015-2019.

Overall, in 2015-2019 there was an increase in the mortality rate (fatalities per corresponding 100 000 inhabitants) in age groups 20-24 years (+15%), 30-34 (+5.9%) and over 65 years (+4.5%). This can be partially explained by an increase in the number of motorcyclists.

Drink and drug driving is still a serious road safety problem in Portugal, The former is especially serious, taking in consideration the percentage of driver and pedestrian fatalities with illegal BAC values and those with BAC above 1.20 g/l..

In 2015-2019, less than 4.5% of drivers tested by the police had BAC above the 0.5 g/l legal limit; since 2010, the trend showed a continuous descent. According to INE, in the period 2010-2018 higher percentages of offenders were detected on moped riders (10.7%) and bicyclists (5.4%), and lower on bus and HGV drivers (0.9%).

Nevertheless, observations on the prevalence of alcohol on drivers showed higher percentages of violators in 2013 (1.80%) than in 2008 (1.22%), and the percentage of criminal offenders (above 1.20 g/l) was stable, at 0.3%. Both observation campaigns were designed to provide results representative of the national situation.

Despite the low values of both the prevalence and the percentage of detected offenders, 28% of the crash fatalities had a BAC above 0.5 g/l: 33% for drivers (of which over 70% with 1.20 g/l or more) and 21% for pedestrians, on average for 2015-2019. Developments show that the percentage of drivers killed in crashes who had BAC above 0.5 g/l increased in the period 2015-2019, the same happened as regards the percentage of fatal drivers above 1.2 g/l. Overall the percentage of crashes involving alcohol is similar in urban and interurban roads.

Developments in the percentage of fatalities testing positive for substances show and increasing trend, since 2010, especially as regards cannabis.

In the period 2015-2019 there was a reduction in the number of police checks and a corresponding reduction in the number of detected violations, except for the number of no driving licence detections. Concerning the other stages of enforcement, the numbers of both issued and paid fines increased.

Automatic speed camera enforcement (SINCRO) started in 2017, with a small number of devices (77 sites by 2020), but its enlargement is under way. It is expected that this system will offset (at least partially) the effects of lower numbers of standard police checks.

Speeding is a serious problem, as shown by international comparisons on the number of drivers running at speeds higher than the legal limit, on motorways, interurban roads and especially on urban streets. Statistics on speed distributions on interurban roads and urban streets from 2004 and 2008 show a sizeable percentage of car drivers speeding by more than 30 km/h (20 km/h on urban streets), which corresponds to a high excess danger of fatality and severe injury, as reported by research. Recent spot speed measurements do not allow to assume that the problem has been significantly reduced since the most recent observations.

3 | Implementation of PENSE 2020

3.1 Summary description

In the National Strategic Road Safety Plan - PENSE 2020, five strategic objectives were defined, in line with the UN's Plan for the Decade of Action: to improve road safety management, make users safer, make infrastructures safer, promote greater vehicle safety, and improve assistance and support to victims. These strategic objectives have been developed into 13 operational objectives comprising 107 measures (See Annex I).

The objective of improving road safety management (Strategic Objective 1) was developed into three operational objectives:

1. Improve the system for collecting, processing, and making available road safety information
2. Improve legislation, supervision, and sanctioning
3. Improve the system of allocation of financial resources for road safety

Four operational objectives were defined to make users safer (Strategic Objective 2):

4. Promote education and training for the development of a Road Safety Culture in articulation with the framework in which Citizenship Education is developed
5. Develop specific programs to promote safe behaviour
6. Improve the protection of vulnerable users
7. Improve the efficiency of communication campaigns

Strategic Objective 3 (safer infrastructure) was established into two operational objectives:

8. Promote the improvement of the National Road Network
9. Promote the improvement of the Municipal Road Network

Two operational objectives were defined to promote safer vehicles (Strategic Objective 4):

10. Promote the maximization of the safety of the new vehicles park
11. Promote the maximization of the security of the used vehicle park

Finally, Strategic Objective 5 (Improve assistance and support to victims) was developed into two operational objectives:

12. Promote the optimization of the aid, treatment, and rehabilitation of victims of road crashes;
13. Establish a program and a network of support points for victims of road crashes.

These 13 operational objectives were enabled through 34 actions containing 107 operational measures.

For each measure, a "Definition, development and monitoring sheet" was prepared, which was intended for guiding the execution and monitoring of PENSE 2020. These sheets, prepared by ANSR, include an operationalization section of the measures, a section on their development, and a final section for indicators (FPCEUP, 2019a).

According to the information provided by ANSR in a spreadsheet (ANSR, 2020), the analysis of the execution of the proposed 107 measures revealed that by October 2020:

- 38 measures had been achieved,
- 55 measures were still to be concluded, of which 15 (14%) had execution rates below 50%;
- Six measures had been cancelled;
- Eight measures had no information on their execution since no "Definition, development and monitoring sheet" on these measures were available to the Scientific Monitoring Council.

No attempts were made to estimate the impact of implementing PENSE2020 on the number of crashes and injuries.

The official targets were set at 41 fatalities per million inhabitants (a 56% reduction from the 2010 value) and 178 serious injuries (MAIS3+) per million inhabitants, a 22% decrease from the 2010 value. In 2019 the following values were registered per million inhabitants: 64 fatalities and 213 serious injuries (MAIS3+), at the risk of not meeting the road safety targets for 2020.

3.2 Reported outputs

As part of the Scientific Monitoring Council's mission, annual evaluation reports of the measures have been made by various entities. Analysed reports refer to the period from July 2017 to June of 2019, the remaining 18 months period of PENSE2020 being covered by forthcoming reports. The assessment of compliance with the measures took into account a set of parameters, previously discussed and agreed upon among the representatives of all higher education institutions involved in the Scientific Monitoring Council (FPCEUP, 2019a). However, it should be noted that the reports produced have no common structure and that some reports are very detailed while others only have a rough analysis.

The parameters defined for the evaluation of each measurement were the following (FPCEUP, 2019a):

- Degree of suitability of the intervention methodology and technical options selected;
- Adequacy of the objectives/results indicated and indicators/criteria for evaluating the impact;
- Clarity, detail and relevance of the work plan and Milestones defined;
- Technical-scientific quality of the work already developed;
- Results/Milestones and Impacts already materialized;
- Degree of accomplishment of the work plan / degree of conditioning of the development of PENSE2020.

The following subsections provide a brief description of four entities' annual evaluation reports (University of Coimbra, Mechanical Engineering Institute, Faculty of Psychology and Education Science, and *Instituto Direito e Segurança*).

3.2.1 University of Coimbra (UC)

The annual evaluation reports delivered by the University of Coimbra focused on the assessment of compliance with the sectoral action programs of 26 measures of PENSE 2020 (A1.1 to A2.10 and A19.78 to A25.93) (UC, 2018). These reports point out difficulties in the evaluation, particularly due to the absence of a description of the approach methodologies used and performance indicators that would allow the impact and degree of effectiveness of the measures to be assessed and quantified. It is also worth mentioning the concern with the delays in measures 20.80, 22.84, and 24.89 that may have a cascading effect on several other measures that need to be concluded in advance (UC, 2019). Of these three measures, the first has already been implemented, the second has practically been completed (95%), and the third has been cancelled. In these reports, the need for pilot intervention stretches is also reinforced, which should enhance the identification and design of solutions and the implementation of corrective measures, and an additional effort to disseminate the results obtained and tools and methodologies developed.

3.2.2 Institute of Mechanical Engineering (idMEC)

The annual evaluation reports developed by the Mechanical Engineering Institute (*idMEC – Instituto de Engenharia Mecânica*) of the *Instituto Superior Técnico* (IST) focused on seven measures (A6.22, A6.23, A26.94 to A29.98). These reports point out problems in implementing these measures, which resulted in the unfeasibility of their execution by 2020 (IDMEC, 2019a, IDMEC, 2019b). Of the seven measures analysed, three were cancelled (A6.23, A26.95, and A29.98). Measure A26.94 has been completed, measures A27.96, A28.97 have not been completed, and no information is available regarding measure A6.22. The authors note that there are no outputs in the overwhelming majority of measures.

3.2.3 Faculty of Psychology and Education Science (FPCEUP)

The annual evaluation reports developed by the Faculty of Psychology and Education Science of the University of Porto (FPCEUP) concern 54 measures of PENSE2020 (FPCEUP, 2019a). These reports highlight the small number of measure accounts revealing the monitoring indicators, namely performance, budget, and production.

On the other hand, the positive evaluation of the methodological suitability and respective technical options in 43 of the measures (86%) is highlighted. However, in several cases, it is mentioned that the description of the methodologies and technical options adopted is scarce, and there is no supporting documentation for such options. Likewise, the assessment of the technical-scientific quality of the work developed was globally positive (FPCEUP, 2019b). In any case, it is noted that the assessment was almost always indirect since the Monitoring Sheets were not accompanied by documentary evidence to substantiate the work developed. According to the authors, to adequately evaluate the effectiveness of the measures, their products must be stated concretely and, as far as possible, their results and impacts measurably formulated. Also, the technical-scientific overlap between some measures is mentioned, highlighting the need for adjustments.

Regarding the work plans and their timing, the activities were considered relevant to achieve the measures' objectives. However, the authors reinforced the need to schedule activities in greater detail. Also, to better monitor the measures, it would be convenient to specify monitoring indicators and more detailed scheduling of activities, whenever possible, with milestones (FPCEUP, 2019b).

The second report (FPCEUP, 2019b) also points out that the products resulting from implementing the set of measures under consideration are below what can be expected. Finally, within the constraints of the work plans, the interdependence between seven of the measures of Strategic Objective 2 and the measures of Action 18 of Operational Objective 7, which were postponed, is highlighted.

3.2.4 Instituto Direito e Segurança (IDeS)

The *Instituto Direito e Segurança (IDeS)* assessed compliance with measures A3.11 to A5.21 and A30.99 to A34.107, for a total of 20 measures in the 2020 PENSE action plan (IDeS, 2018). The IDeS highlights the lack of Plan Performance Indicators, which prevent the effective monitoring, at all times, of deviations in the execution of actions and their timing, and assessing the responsibility of the entities to which they were entrusted (IDeS, 2020). Difficulties for the monitoring mission of PENSE 2020 arise from the absence of a model for collecting information from the entities involved in the implementation of the measures'. In the second report, and concerning the 20 measures analysed, it is noted that the results achieved were insufficient, given the significant degree of non-fulfilment of the planned actions (IDeS, 2020). In this document, the overall analysis of the results achieved shows a 40% of execution, highlighting performance vulnerabilities, despite the lack of a rational and measurable metric to quantify them. The delay in developing the planned actions has increased the pressure on the plan's last period, anticipating the impossibility of realizing some of these measures. Finally, the IDeS considered that the mission assigned to the Scientific Monitoring Council proved innocuous, given the little attention given to the reports it produces by the entities involved in PENSE 2020 (IDeS, 2020).

3.3 Main identified constraints

Based on the yearly evaluation reports and on the information provided by ANSR in a spreadsheet (ANSR, 2020), several constraints were identified.

Partial implementation of activities and their measures were often mentioned (e.g., measures A1.1, A5.20, and A17.73). Some constraints were linked to the total lack of information (e.g., measures A3.11, A7.25, and A9.34). Also, several other measures were difficult to evaluate due to the absence of a methodological description (measure A1.2), or information about the realization of the measure (e.g., A.5.20 and A8.28), or a list of milestones (A.7.24, A.7.25, and A.7.26) and performance indicators (e.g., A.16.69 and A16.70).

Some measures take precedence over others, and others overlap. For example, in the first case, measures A1.04 and A1.05 are partially dependent on measures A01.13 and A01.03, respectively. In the latter case, measure A13.54 overlaps with A13.55, or A.14.60 and A14.61 with A4.15.

In some cases, financial resources were also a constraint, as in measures A8.28 and A8.30, and several measures were delayed (e.g., A.8.30, A.10.35, and A11.44).

Annex I includes a list of all measures and a brief summary of comments on each measure, including the identified major constraints.

Difficulties in the evaluation process were mentioned by the Scientific Council, due to incomplete information about the realization of some measures and unclear specification of milestones, as well as incomplete follow-up on recommendations provided by the Scientific Council.

The PENSE2020 plan comprised 107 safety interventions, the responsibility of their execution being distributed by 19 institutions from eight different Ministries. Furthermore, the actual implementation of the interventions involved more than 36 entities, both public and NGO's.

The analysis of the reports of the Scientific Monitoring Council of PENSE2020 allowed to identify some institutional constraints to the implementation of the measures in the road safety plan, namely as relates to insufficient timely and predictable provision of financial resources, as well as scarce allocation of dedicated human resources by some public institutions.

Overall, full commitment to action implementation by responsible entities is not evident, and a description of accountability procedures is absent.

Evidence of the active participation of municipalities in the realization of PENSE2020 is scant. By 2019, only 16 municipal road safety plans had been approved developed, and 22 municipalities had some other form of organizing their road safety related activity. This suggests that deficient vertical coordination with municipalities was an unsolved issue. Nevertheless, no explicit reference to these issues was found in the evaluation reports.

Problems in the execution of some interventions were aggravated by a cascading effect, as the delayed start or late accomplishment of some actions had an impact on related ensuing actions. The described scope of accomplishment of some actions stated as completed does not allow to ascertain their full effectiveness.

Involvement of the public sector and NGO's in the development of PENSE2020 was promoted by ANSR; the private sector, however, was not called for in the same manner, and their reported participation in the plan was scant. Nevertheless, several companies included in their own road safety supporting activity some collaboration in PENSE2020 actions, occasionally in a visible way.

Overall, it may be stated that PENSE2020 had the main characteristic of every comprehensive road safety strategy: a large set of interventions, closely aligned and frequently intertwined, to be implemented by many and diverse entities. That was the nature of PENSE2020, and this will remain in the coming strategy. Orchestrating the execution of such an endeavour requires the close alignment of the acting institutions and a great coordination between the involved Ministries, which entails political engagement at the highest level and accountability at the operational level.

4 | Safe System perspective on the Portuguese road safety situation

4.1 Institutional management level

As mentioned in section 1.2, road safety policy implementation involves great cooperation and interaction between the stakeholders, requiring good institutional management to be effective and efficient. Although there is a general recommendation for the formal establishment of a Lead Agency responsible for this institutional management, this does not mean that the corresponding main functions (see Figure 4.1) may not be shared across departments at a central government level, in the absence of such an agency. Conversely, an established agency with limited capacity in a number of functions – namely a sustainable and predictable budget – may still require strengthening.

According to Bliss & Breen (2009), six primary institutional management functions are provided in a robust institutional setting for road safety management, as described in Figure 4.1. These are related to coordination, legislation, funding and resource allocation, promotion, monitoring and evaluation, as well as research, innovation and knowledge dissemination.

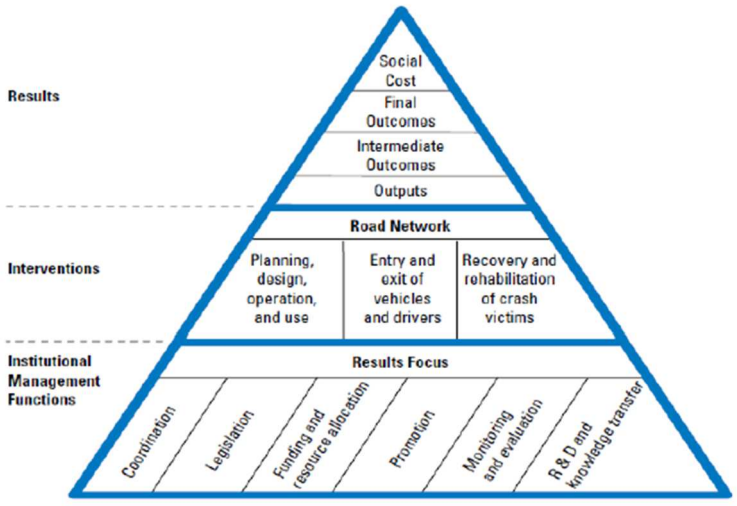


Figure 4.1 – The road safety management system (Bliss & Breen, 2009)

In an ideal situation, the Lead Agency's strategic orientation is such that all interventions are linked to results, and that analyses performed reveal targets and result in a performance-driven management framework for implementing interventions and attaining their intermediate and final outcomes. This results-focused approach is revealed by a public set of quantifiable targets for each intervention and a measurable expression of where the country wants to be, how it plans to get there and how it intends to

monitor and evaluate getting there. The strategic orientation is performance-driven, and goals and targets are monitored to assess the actual performance.

The coordination function reflects how the country organises and manages its safety interventions and efforts aimed at remedying road safety problems across the government and other organisations. Usually, this means horizontal coordination between central government departments and vertical coordination – i.e. cooperation with local and regional authorities. Coordination also means fostering partnerships with NGOs and business at the central, regional and local levels and nurturing close relations with parliament at all levels, to facilitate approval of the policy and legislative proposals.

The legislation relates to the legal framework in which the organisations and institutions responsible for road safety must function. Effective legislation defines the responsibility, accountability, intervention, and associated institutional management functions needed to achieve the desired result. Good practice in legislation depends on regularly reviewing the legislative framework's scope, developing and updating legislation required for the road safety strategy, consolidating legislation, and securing legislative resources for road safety (Bliss & Breen, 2009).

Stable (at least predictable) funding and resource allocation are essential for supporting the organisation’s operational budget for road safety management and the associated interventions needed to achieve the intended results in a sustainable manner. Predictability is needed for an efficient allocation of resources, based on a rational evaluation framework, relying on quantitative assessment of costs and benefits concerning the intended objectives, and on clear procedures to guide the allocation of resources across the safety programmes.

Promotion relates to the process of communicating with the public on road safety issues. It is a main task of government and society to emphasize the shared social responsibility to develop, implement and support road safety improvement initiatives and interventions that aim at meeting stated targets.

The monitoring and evaluation function corresponds to the continuous and systematic measurement of road safety performance outputs and indicators in order to assess and evaluate the efficacy of introduced measures and interventions and the progress towards the stated targets. To successfully accomplish the tasks in this function, proper data systems need to be established and maintained, to set and monitor progress towards final and intermediate outcomes and output targets. Furthermore, a transparent review of the road safety strategy implementation needs to be ensured, in terms of results, interventions, and institutional management functions; and make the necessary adjustments to interventions and institutional outputs needed to achieve the desired results. The summary presented in section 3.2 shows that the road safety strategy implementation was duly reviewed but that the selected procedures to incorporate recommendations and make adjustments were not ideally effective.

Research, development & innovation, and technology transfer are an integral component of any road safety management system. It is related to the development of new knowledge on the phenomenon, the timely identification of changes in the system, the development of new techniques and methods, the application of new knowledge and the transfer and application of knowledge to continually improve the efficiency and effectiveness of the system in order to keep meeting the desired results.

In practice, results-focused encompasses five activities, according to Howard *et al.* (2010):

- Assessing current road safety performance through high level strategic review;
- Adopting a far reaching road safety goal for the longer term;
- Analysing what can be achieved in the shorter term;
- Setting targets by mutual consent across the road safety partnership, and;
- Establishing mechanisms to ensure stakeholder accountability for results.

Since the laying out and implementation of the National Road Safety Plan (*Plano Nacional de Prevenção Rodoviária* - PNPR) in 2003, Portugal has been focused on systems-wide interventions, targeted results, and institutional leadership. Road safety performance has been regularly assessed through high level strategic review; targets have been set by mutual consent (attending to the interests of all sectors involved in road safety, including transport, health, finance, environment, and education), and (although in an imperfect way) short term achievable safety objectives have been agreed for Portugal. However, to be fully operative, these objectives demand setting targets based on problem analysis, future long term trends, scenarios, computer modelling, analysis of effectiveness of measures and issues such as public acceptability of system-wide implementation (Howard *et al.*, 2010). Furthermore, although ANSR has promoted the involvement of public agencies and NGO's in the development of previous safety strategies, the private sector was not summoned in the same manner, and its participation in it was scant.

It controversial whether far reaching long term road safety goals have been set for Portugal until now. Also, recent experience shows that mechanisms have yet to be developed and implemented to ensure stakeholder accountability for results (see section 3.2, on the PENSE2020 evaluation results). Despite some specific goals and targets having been set, the measures in place to monitor compliance to these were ineffective. There is no evidence of the existence of clear indications on the consequences if these goals and targets were not met.

In order for strategic road safety plans and interventions to succeed, there needs to be a formalised process to involve relevant stakeholders with precise delegated tasks, responsibilities and goals, and road safety should be integrated into the work procedures and processes of agencies and departments active in the road transport sector. Thus, at the government level organisations and government departments should be committed to specific road safety targets and assigned specific responsibility or accountability for their accomplishment. The intended development of biennial action plans for the implementation of *VisãoZero 2030* may contribute to achieve this approach.

As mentioned in section 2.1, existing data allows for a detailed picture of crash and injury frequencies and associated factors. Furthermore, due to a specific PENSE2020 action, foreseeable developments on the availability of numbers of MAIS3+ severe injuries, provided by medical sources, open up the possibility of exploiting corresponding indicators for monitoring safety changes. However, full exploitation of these data for properly supporting road safety management is hampered by the absence of detailed comprehensive and systematic data on fundamental exposure features, as well as on key safety performance indicators, as previously highlighted in section 2.1. Thus, improving the available

data is an actual topic for action to lay the ground for elaborating safety problem statements fully supported by evidence.

Furthermore, since current mobility policies, at the national and local levels, foster the increase of the share of active (walking and cycling) and soft modes (e.g., e-bikes) and encourage the use of micromobility (e.g., e-scooters) in cities, the enhancement of current crash data collection procedures is needed, in order to start collecting data on single vulnerable road users crashes and casualties. As mentioned by Methorst *et al.* (2016), this may involve widening the scope of the definition of road crash to consider all travel on the public space (roads, streets and footpaths), independently of the involvement of a vehicle. However, this certainly will involve close cooperation of ANSR with relevant city municipalities, providing guidance and support.

As evidenced in Figure 4.2, besides outputs, intermediate and final outcomes, safety results are expressed by social costs. To be operative, these need to be accurate and representative of the crash and injury phenomenon. Current cost estimates (Donário & Santos, 2012) are based on successive financial updates of an original study published in 1991 (PRP, 1991), in which the human capital method was applied to detailed data from a sample of crashes that occurred in 1987. More complete economic evaluations of the value of statistical life in road safety are currently available (e.g., willingness-to-pay, mentioned in Alfaro *et al.*, 1994, and by Wijnen *et al.*, 2017). In the beginning of this century Macedo *et al.* (2000) acknowledged that changes in road infrastructure, vehicle fleet, advances in trauma care, as well as other features of the traffic system and society, were believed to have modified the basic characteristics of road crash injuries and property loss, limiting the usefulness of ordinary financial updates of the existing cost values. They reasoned that a new full crash cost study was needed to provide values attuned to the existing characteristics of the phenomenon. Recent and on-going modal shifts and the important number of crashes and victims in urban areas bring an accrued weight to the pertinence of the said study. Furthermore, besides their use in road safety management, accident costs are the basis for the evaluation of road safety externalities in transport investment assessments (EC, 2019).

Figure 4.2 – The SUNflower project approach to the hierarchy of road safety (Wegman *et al.*, 2008)

Research, development & innovation (RD&I) and knowledge transfer correspond to the systematic and continuous creation, codification, transfer, and application of knowledge that contributes to the improved efficiency and effectiveness of the road safety management system to achieve the desired focus on results (Bliss & Breen, 2009). This function is important, as it provides the means to support developing, designing and guiding the application of evidence-based interventions aimed at reducing road deaths and injuries, given the changes in the traffic system and the growing mobility and exposure to risk.

RD&I involves developing capacity for multi-disciplinary research, creating a national road safety research strategy and an annual programme, and securing sustainable funding sources for road safety research. Adequate knowledge transfer depends on establishing good practice guidelines, training, and professional exchange, and setting up demonstration projects.

There is no evidence of a national road safety research strategy in Portugal, nor is there a dedicated road safety research programme supported by specific funding. However, some actions of PENSE2020 included research studies, which were carried out by academia or research institutes, mainly to respond to specific issues requiring investigation. As mentioned in section 3.2, some central research actions did register marginal realization, only. Nevertheless, further road safety research activity was developed under EU RD&I programmes (namely Horizon 2020), and national (through *Fundação para a Ciência e a Tecnologia* - FCT) funding programmes or through public research institutes own resources. However, these activities are limited in their scope and, in the case of EU funding, are integrated into international needs rather than responding to national research questions. It is also rare to have scientific studies carried out to assess the effects of specific programmes and interventions.

Within PENSE2020, several guidelines on urban street and space design were developed (e.g., A25.2, on the design of urban streets), along with other relevant documents also fostered by ANSR (e.g., guidelines for 30 km/h zones). However, knowledge dissemination and training sessions for these and other already existing technical documents were scant. Road safety related knowledge dissemination by other interested stakeholders reached only a small part of potential trainees (e.g., municipal urbanists and traffic engineers, teachers, judges, and public prosecutors).

Besides professional knowledge dissemination, it is important to communicate with the public on road safety issues. Embracing the Safe System methodology and its four principles will demand a major change in the way institutions and society approach safety, from a reactive culture to a proactive or even generative culture. As will be mentioned in section 6.1, some contributions gathered with the open initial survey evidenced unfamiliarity with the Safe System concept and misconceptions about its underlying principles and how these can be reliably applied in practice. Promotion, through education and campaigns, is important to raise awareness on this issues and to correct misunderstandings in this domain. Successful interventions in this area depend on the monitoring and systematic evaluation of these activities; this is seldom practiced in Portugal, despite the existence of an European produced set of recommendations for the appropriate design and evaluation of road safety campaigns in all EU.

4.2 Interventions level

4.2.1 Safe System

In this section a basic evaluation is made on how the four Safe System principles (ITF, 2008 and ITF, 2016) are adhered to in the conceptualization, planning, design, construction, operation, maintenance and use of the Portuguese road transport system. This evaluation is made for three of the five Safe System intervention elements proposed in the World Bank report (Bliss & Breen, 2009): safer roads, safe speeds, and safe road users. The remainder two pillars were not included in this evaluation, as the status concerning the vehicles depends principally on decisions taken at the international level (although buying decisions can be influenced by national policies, to some extent), and trauma care is essentially in the domain of the medical sciences and depends heavily on health policies.

In a Safe System approach, it is recognized that people make mistakes that may result in road crashes, but at the same time, it is envisioned that no one ought to be killed or seriously injured in those crashes. Hence, there is a need to prevent the occurrence of errors.

It is also acknowledged that the human body has a limited biomechanical ability to tolerate crash forces before harm occurs. This capability varies with the intensity, direction, and duration of those forces. Hence, there is a need to prevent that excessive forces may impinge on road users due to road crashes. These forces are related to the kinetic energy that has to be dissipated, the available distance for dissipation, and the road user's protective gear. The kinetic energy to be dissipated in a crash is defined by multiplying the mass of a colliding body and by the impact speed (to the power of two).

It is recognized that, although road users have a responsibility to be self-conscious when driving and act with care and within traffic laws, there is a shared responsibility with other road users, with those who design, build and manage roads and vehicles and with those who provide post-crash care to prevent crashes resulting in serious injury or death.

Finally, it is likewise stated that all elements of the system must be strengthened in combination to increase their effects and to ensure that road users are still protected if one part happens to fail.

4.2.2 Safe Roads and Roadsides

As mentioned previously, roads in Mainland Portugal are organized in several connected road networks: the National Road Network, totalling 14313 km, and the 298 municipal road networks (streets and interurban roads) totalling over 80000 km. The NRN includes the Main Network (2338 km of Main Itineraries), the Complimentary Network (1894 km of Complimentary Itineraries and 5291 km of National Roads), and the Regional Roads (4791 km). Motorways (totalling 3121.9 km) are part of the NRN. Roads belonging to the TERN – the Trans European Road Network – are all part of the NRN, totalling 2661.9 km, of which 2083 km are motorways. Road lengths data refers to 2019, according to official values provided by IMT and published by the Statistics Institute of Portugal (*Instituto Nacional de Estatística – INE*).

A Safe System approach to the road environment provides roads that incorporate the concepts of self-explaining roads and forgiving roadsides. Accordingly, roads and streets are designed and constructed in such a manner that the risk of crashes is minimized (i.e., the design of the road will not be directly attributable to a crash), and where they do occur, the severity of the crash will be minimized. Furthermore, the road networks must be systematically and logically classified according to their function, and road designs must comply with design and safety standards. Safe System standards for roads typically have features such as adequate clear zones, no roadside hazards, breakaway constructions, safe barriers, no conflicts between opposing traffic, slow and fast traffic physically separated in time or space, and vulnerable road users are separated from motorized traffic in medium to high speed roads.

Portugal has a comprehensive set of design and maintenance standards for interurban roads of the National Road Network that is applied on a voluntary basis by some municipalities in their own interurban road networks. The standards date back to the early 1990s; nevertheless, they include some consideration to human factors. Although some aspects have been reviewed under a Safe System like approach (e.g., concerning a functional hierarchy, geometric consistency, roadside characteristics, the selection of road restraint systems, and the roundabout design), the revised geometric design standard is still pending approval. The update of other documents (e.g., intersection and interchanges) has not started yet.

No national guidelines exist for the design of streets. However, as referenced by Macedo and Cardoso (2001) guidelines for the design of streets (Oliveira e Mateus, 1970; and Campos, 1993) and pedestrian crossings (Gonçalves and Oliveira, 1974) were available in Portuguese since the early 1970s. Despite this, the normal practice is for each municipality to decide on the requirements to meet in their own jurisdiction, resulting in the adoption of foreign recommendations or the loose adaptation of the interurban design standards. Within PENSE 2020, a new set of design standards for urban roads and streets was prepared, and it is hoped that, following its upcoming public consultation and approval, it will be the basis for future design and redesign of safer municipal road networks. Due consideration was made to the Safe System principles in the preparation of these new standards.

Maintenance requirements are included in the concession contracts of the NRN (which include penalties and bonuses for safety performance), setting up acceptance and intervention criteria for several aspects. However, requirements are not equal for all concession contracts (of the same road category), and in some cases, the minimum values for safety relevant issues (e.g., skidding resistance and macrotexture) are too low.

The Directive 2008/96/EC on road infrastructure safety management has been adopted in Portugal, through a set of legal documents. However, applying its proactive and reactive instruments is only required on TERN roads – differently from what happened with the Directive 2004/54/CE on tunnels, which is applied to all tunnels, even those of the municipal networks. This means that, urban roads and streets design are generally not subject to road safety audits, although the existing manual has checklists fitting most of those environments. The preparation of complimentary checklists is recognised, for full coverage. The pending application of Directive 2019/1936/EC, amending Directive 2008/96/EC,

is an opportunity for improvement in this area, as the new document extends the scope to main roads and mandates attention to vulnerable road users.

Furthermore, as mentioned by Cardoso and Roque (2019), despite the preparation by LNEC of several technical manuals – for road safety audits (Cardoso e Bairrão, 2006), road safety inspections (Cardoso, 2010b), road safety impact assessment (Cardoso, 2012) and high risk location, and the availability of a syllabus for road safety auditor training (e.g., Matena *et al.*, 2007), it is still not possible to obtain in Portugal the corresponding professional permits, due to the absence of enabling legislation. This means that the quality of road safety audits varies considerably, depending on the individual performing the analysis. In a number of cases, designs are still only checked for compliance with design standards, road safety not being a specific issue on those occasions. In feasibility studies, road safety is mostly addressed in economic evaluations, but not at a more technical level (e.g., by checking the layout design against specific road safety design criteria).

The current status is deficient, on the application not only of existing recommendations concerning geometric design consistency of single carriageway interurban roads but also of the instruments for setting appropriate speed limits and for signing dangerous curves. However, crashes on curves are still an issue on those roads. The same can be said about the application of recommendations concerning safe roadsides (Roque e Cardoso, 2010a) and the selection and installation of road restraint systems (Roque e Cardoso, 2010b), as experienced in a recent training course on road safety inspections for a motorway concessionaire who started a special program for roadside safety improvement. Although legislation already considers the roadside needs of high risk road user groups, consideration of heavy goods vehicles and buses is still too weak. Run-off-road crashes are a high percentage of the occurrences on interurban roads, as seen in section 2.2.2.

One final important issue relates to aligning speed limits with Safe System design principles. In view of the existing road network environment, it is scarce the level of success reached with disseminating the existing manual for setting and signing speed limits on the Portuguese road network, which was prepared for both the interurban and the urban road environments.

4.2.3 Safe Speeds

Safe speed are critical in a Safe System approach: impact speeds should be lower than a certain level in order to prevent serious injuries in a crash. These are typically operationalised by means of either the impact speed where the chance of death or serious injury (MAIS3+) is less than 10% or the point on fatality risk curves where this changes from shallow to steep. Speed limits are an important support tool to reach safe speeds. Speed limits have to be credible for the given road conditions to be accepted by road users. The road environment and a prevailing speed limit should be aligned to each other. Speed limits are also applied to protect vulnerable road users where conflicts with them are possible (Figure 4.3.

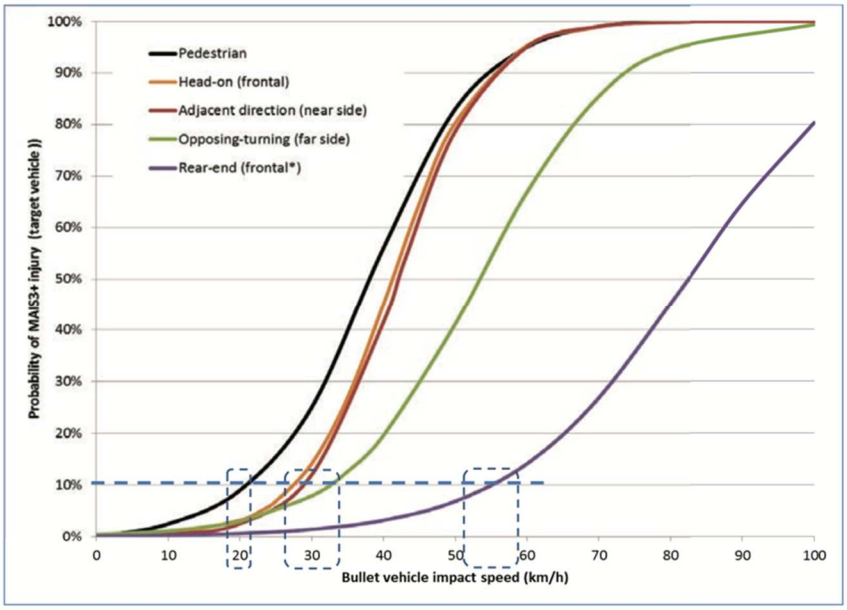


Figure 4.3 – Safe speed: influence of impact speed, road user and type of impact on the probability of MAIS3+ injury (Jurewicz *et al.*, 2016)

Safety, mobility, environmental considerations and quality of life are usually taken into account for determining the appropriate speed for a road link (OECD, 2008). To facilitate compliance, the user should perceive speed limits as a logical result of the prevailing road environment and conditions. Research and practice have demonstrated that the road environment layout can be modelled in such a way as to nudge compliance by drivers, even for low speed limits. Practical application of this reasoning led to the development of concepts such as safe and credible speed limits (Aarts *et al.*, 2009) and the Swedish Vision Zero method for setting speed limits (Vadeby and Forsman, 2017).

Speed limits compliance and efficiency is best obtained through a speed management approach. In this manner, the speed limit setting is made according to those methods and is accompanied by an infrastructure environment layout properly adapted to road categorization (self-explaining) and supported by safety campaigns and effective law enforcement and adjudication of offences.

A manual for setting speed limits on Portuguese roads was prepared, following the mentioned main concepts, and adapted to interurban roads and urban streets, including the definition of a Mainland road hierarchy (Cardoso, 2010a). With the publication of this manual, several training courses were carried out throughout the country. There is, however, scarce evidence that the procedures recommended in the manual are being applied by national road network operators or the municipalities. Also, the PENSE2020 action (A23.88) intended to disseminate these recommendations did not foster new dates for the training courses.

As mentioned in section 2.2.6.2, there are enforcement plans, which include specific actions towards speeding. However, as mentioned in sections 2.1 and 2.2.6.8, there is no speed monitoring programme in Portugal, providing the basis for efficient allocation of priorities in this matters.

Finally, due to the damage potential of public transport (both to occupants and third parties) and heavy goods vehicles, it is good practice to limit these vehicles' maximum speeds, preferably via speed limiters in the vehicles themselves. However, in some Portuguese urban cities buses are not even required to be equipped with tachographs.

4.2.4 Safe Road User

Human behaviour may be influenced by several environmental factors, such as technology, group affiliation, productivity requirements, time pressure, legislation, the risk of being monitored, the consequences of being detected in violation, as well as the social and organisational context.

Under a Safe System approach, road users are expected to have the knowledge, capability, capacity, and willingness to correctly use the road transport system (ITF, 2016).

This entails that all active road users (and not only the motorized vehicle drivers) are properly informed on traffic, their vehicles' functioning limits under general road environment and traffic conditions, and how to use the passive safety devices at their disposal. It also demands that road drivers are conscious and able to take full advantage of their physical and cognitive capacities and that they are nudged to follow established rules through enforcement and technology.

In fact, research has shown that campaigns may be used to empower passive road users (e.g. informal bus or taxi passengers) and nudge them to actively influence their motorist's driving behaviour through social pressure from passengers (Cardoso *et al.*, 2018). This was obtained by road safety communication campaigns drawing on behavioural-change theories invoking social responsibility and reversing social norms (i.e. "*no passenger comment on unsafe driving allowed*") of informal buses and taxis. In this way, the scope of the Safe System approach includes all road users.

According to ITF (2018), in a Safe System people using the road transport system are supported to comply with road rules, acknowledging their capabilities and limitations, so they can fulfil their part of the shared responsibility agreement that exists between the users and the system designers. Part of this help steams from the functional design of road infrastructure and corresponding speed limits, as mentioned in previous sections. Another part entails compliance with seat belt or helmet use, no speeding, no drink-driving or driving under the influence of other drugs, and operative enforcement compliance programmes aligned with effective road safety communication campaigns.

As mentioned in section 3.2 with measure A4.15, the Scientific Monitoring Council concluded that PENSE2020 reached the objective of fostering the preparation and implementation of pluriannual enforcement action plans to efficiently allocate PSP and GNR resources to enforce critical safety related traffic regulations.

Data referenced in section 2.2.6.4 show that car occupants' compliance with seat belt use is lower in rear seats than in front seats, but even here, there is scope for improvement, especially in urban areas. Seat belt use by coach occupants is low, as demonstrated in some highly documented headline crashes. By international comparison, Portuguese children's unsafety is not high; however, there is scope for improving compliance with proper child restraint use even in this domain. Helmet use by motorcycle

occupants is almost 100%, and above 90% by moped occupants. On the opposite side, helmet use by bicyclists is not mandatory, the same happens for users of e-bikes, e-scooters and other vehicles with an auxiliary motor functioning at speeds up to 25 km/h – which is not fitting to a Safe System approach. Not surprisingly, helmet use for these road users is low; interestingly, helmet use by riders of private bicycles seems to be much higher than for those resorting to shared vehicles (see section 2.2.6.6).

Driving under the influence of alcohol or drugs is not compatible with Safe System operation. In this regard, Portugal needs to make considerable improvements. Despite an increase in testing and an overall decrease in the number of detected violations, the period 2015-2019 corresponds to an increase in the percentage of fatally injured drivers and pedestrians above the legal limit for alcohol, the same happening to those tested above 1.2 g/l. Positive testing for drugs and driving shows a similar trend, especially for cannabinoids. This situation is not compatible with a Safe System

Inappropriate speeds are a major contributing factor to crash and injury frequency and severity; in a Safe System operation, overall compliance with speed limits is high, and very high speed violations would be rare. Past observational data provides an unfavourable picture as regards speed limit compliance in Portugal: statistics for the speed distributions obtained in 2004 and 2008 show that less than half the drivers comply with the speed limit and that a high percentage of drivers exceed the speed limit by more than 30 km/h (20 km/h in urban roads), a serious violation mandating a reduction in the number of penalty points. These numbers are especially serious in urban roads, both in through roads and in streets in city centres. In this respect, installation of the automatic spot speed control system (SINCRO) has been slow. No results assessments were publicly available, the same happening with public disclosure of the reasons for selecting the installation sites, although a rational method was developed by LNEC (Cardoso, 2009) for this purpose, based on the empirical Bayes method for detecting hazardous road locations followed by a site inspection and traffic operation observation.

Road safety communication campaigns were performed with some regularity, but the percentage of general campaigns (overall less effective) is high in relation to thematic and focused ones. Furthermore, despite a PENSE2020 dedicated measure (A18.76), existing good practice in this area, as laid out in the EU R&D project *CAST-Campaigns and Awareness-raising Strategies in Traffic Safety*, is not being used, which prevents the realization of a learning process in this domain.

As mentioned earlier, enforcement of traffic law is part of a Safe System. Adequate planning of the detection stage (as possible with the enforcement plans) is important for an efficient allocation of resources, and automation of this stage (e.g., SINCRO) is critical for proper human resource management. For this activity to be effective, the ensuing stages of penalty assignment (at-fault driver identification) and ticket collection are of equal importance, especially for obtaining high levels of specific deterrence. In this respect, considerable improvements were obtained on the collection of fines. However, the number of expired administrative processes is still far from zero, which does not help to obtain a high level of specific deterrence.

The observed reduction in enforcement activity (section 2.2.6.2) is not a favourable development, as regards general deterrence levels. Nevertheless, results from the ESRA2 (PRP, 2020) show that similar percentages of Portuguese (22.5%) and European countries (21.8%) respondents stated having been

tested for alcohol in the previous 12 months. Nevertheless, the results on the perception of risk of being tested show a marked difference: 26.5% for Portuguese respondents, vs. the remainder European respondents (18.0%). Despite a general reduction in enforcement activity, the increase in the number of alcohol tests performed by the police (see section 2.2.6.2) may have contributed to this heightened perception.

5 | Emerging challenges and external factors

The Portuguese population is aging over time. Figure 5.1 shows developments in the number of inhabitants in Portugal between 2000 and 2019, based on census (2000 and 2010) and population estimates by INE, the Statistics Institute of Portugal. Comparing the mentioned periods, it is possible to identify an aging trend, as the higher number of inhabitants in 2000 was concentrated in the 20 to 29 years old age group, but this has shifted in time: in 2010 this peak moved to the 35-39 age group; and to the 40-49 age group in 2019. The percentage of population aged 75 years or more increased from 7% in 2000 to 11% in 2019 (9% in 2010). This group of road users is especially relevant for road safety, as they combine physical frailty with great variability in mobility and cognitive capacities and are more exposed as a vulnerable road user than others.

This trend is also quite visible for the older age groups: 80-84 and ≥85 years old, where a heightened increase is evident. A noticeable difference is also shown in the age groups between 15 and 30 years old, where between 2000 and 2019 a serious reduction in the number of inhabitants occurred.

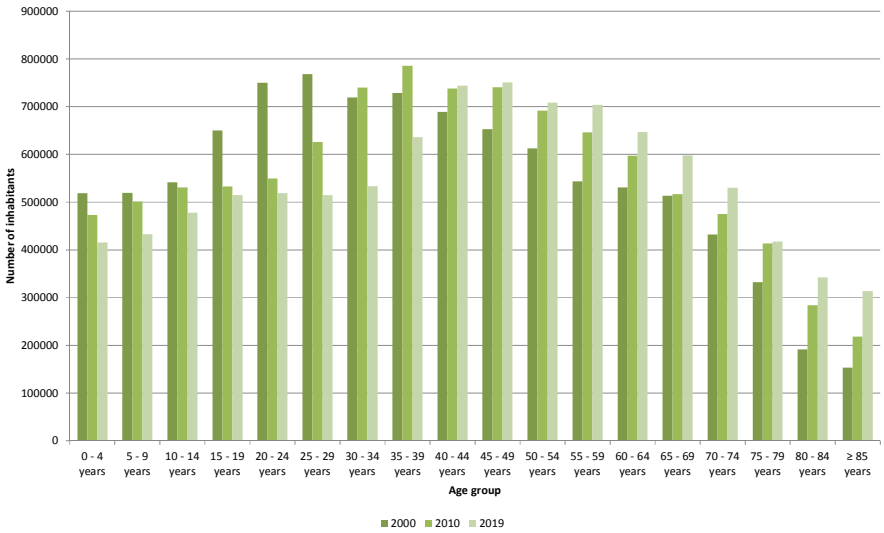


Figure 5.1 – Developments in the Portuguese population between 2000 and 2019, by age group (INE)

At this stage, it is uncertain what will be the effect of the Covid19 pandemic on future developments in the population age distribution, given the excess number of fatalities due to both Covid19 (especially for older age groups) and other diseases (across all ages). Assuming that population trends will be only slightly delayed, human factor requirements embedded in road infrastructure and in vehicles will need to be updated. Design criteria parameters are decided upon selected statistics of relevant human perceptual and cognitive characteristic (e.g., reaction times) distributions. The expected changes in age

distributions of candidate drivers will impact corresponding distributions of human performance, which should be reflected in the safety related road and vehicle design parameters.

Policies addressing climate change and sustainable development are putting forward new approaches to mobility, especially in urban areas.

Specific policy documents were prepared, for example, laying out the National Strategy for Active Cycling Mobility 2020-2030[11], with the goal of promoting individual travel in active modes as a safe, accessible, and attractive experience for all. Major targets for bicycles include reaching the following:

- 7,5% modal share of cycling trips on the mainland territory;
- 10% modal share of cycling trips in cities;
- a 20% mode share for bicycle and pedestrian travel in the mainland area;
- a 10 000 km total length of cycle lanes by 2030;
- a 50% reduction in pedestrian and cyclists road crashes.

Specific objectives for walking are still being prepared, and both the preparation and the implementation of the walking and cycling strategies are an opportunity to address the road safety problems of these road users and foster their safety.

Sustainable Urban Mobility Plans (SUMPs) are currently developed in Portugal at the municipal level, aiming at the achievement of mobility related objectives, such as improved air quality, better accessibility and mobility, safer roads, reduced traffic noise, greater energy efficiency and, in general, an enhanced quality of life, especially in cities and urban areas.

Guidelines for the preparation of these plans were developed at the national level, based on EU guidance, and aimed at supporting the elaboration and implementation of Municipal Mobility and Transport Plans, alerting to the need for an integrated territorial approach to land use, accessibility, and mobility. In the first version of this guiding document (Wefering *et al.*, 2013), road safety was only briefly mentioned as a possible criterion to be considered. SUMPs which were prepared following this guidance seldom attempted to articulate a discussion of road safety issues and the safety consequences of available options and decisions, as referred by Cardoso and Gomes (2019). In this domain, progress has been made in the current second version of the EU guidelines (Rupprecht, 2019), introducing an explicit mention to road safety diagnosis as imperative to the elaboration of adequate Sustainable Urban Mobility Plans. On the one hand, this is beneficial to evidence-based contributions to road safety interventions by municipalities; but, on the other hand, it brings a new set of challenges and requests regarding crash and casualty data availability, as well as integration and harmonization of municipal interventions. Furthermore, new safety and exposure data on walking and cycling need to be collected, the former at a national level with Local Administrative Unit disaggregation and the latter at the municipal level, but preferably in a harmonized way at the Intermunicipal Community level, as a minimum.

[11] Resolution of the Council of Ministers n.º 131/2019, of August, the 2nd , approving the *Estratégia Nacional para a Mobilidade Ativa Ciclável 2020-2030*

With the prominence of sustainable mobility and new ways to provide the last mile in city travel, micromobility has been gaining modal share in short journeys. Micromobility solutions refer to vehicles that are comparable to bicycles in terms of where they can travel: i.e. on bike lanes and road carriageways. Micromobility vehicles include e-bikes and e-scooters, which are limited to a maximum speed of 25 km/h under assisted mode, according to the Portuguese Highway Code. These vehicles are becoming ubiquitous in several main Portuguese cities, either shared or in private use. Speed, visibility and user protection (own and third party) are issues to be considered in developing Safe System aligned regulations concerning these vehicles' use. As with standard cycling, enforcing traffic rules specific for these users raises unique problems that need to be addressed adequately, as well.

Over the recent few years, there has been significant technical progress regarding sensors, communication technology and artificial intelligence-related algorithms enabling increasing levels of road vehicle automation and traffic system elements' cooperation (both vehicle to vehicle and vehicle with infrastructure). It is commonly claimed that automated driving has the potential to improve road safety. Nevertheless, uncertainties concerning several fundamental factors conditional for such a development still exist (FERSI, 2018). One of those relates to how pre-existing vehicles and current road infrastructure characteristics (namely road markings) should mix and co-exist with vehicles capable of varying levels of automated driving and the impact on safety of different market share levels penetration of these vehicles. Another problem to be solved relates to the interaction between connected and automated vehicles (CAV) and vulnerable road users. In this domain, the Forum of European Road Safety Institutes (FERSI) categorized into four main groups of questions the issues to be addressed for a successful consideration of road safety (FERSI, 2018):

- How can CAV and ITS improve road safety, what conditions should be met, and which actions ought to be taken for that purpose?
- Which road safety issues will likely not be solved by CAV and ITS? In particular, are there groups of road users that could benefit from CAV and ITS, but are unlikely to do so unless special action is taken?
- What road safety issues may be caused by CAV and ITS, and which actions can be taken to avoid these?
- How should testing, certification, and validation methods be adapted?

Cooperative and automated driving will be an issue requiring increasing attention as the implementation of VisãoZero2030 will progress in time. National involvement in developments concerning harmonization of Operational Design Domain (ODD) and Infrastructure Support levels for Automated Driving (ISAD) specifications will be required, as well as in the preparation of a new traffic regulations framework. In its connected automated driving roadmap (ERTRAC, 2019), the European Road Transport Research Advisory Council (ERTRAC), projects that by 2030 Level 4 (high driving automation) will be available as a system prototype demonstration in operational environment (TRL 7), for passenger cars (e.g., highway autopilot including Highway Convoy), freight vehicles (e.g., Highway Pilot Platooning) and urban mobility vehicles (e.g., automated buses on dedicated roads).

6 | Results from preliminary external consultation

6.1 Contributions from public and private entities and from the Non-Executive Council of Experts

In the first phase of the RSS 2020-2030 ("VisãoZero2030"), in which the guidelines of the new strategy were defined, ANSR opened a period to collect written contributions from experts and stakeholders. Over 100 written contributions (some containing several documents) were received, with numerous proposals for objectives, at the strategic and operational levels and actions encompassing national and local areas.

The contributions from the 26 members of the Non-Executive Council of Experts can be clustered in three broad groups:

1. Infrastructure and Innovation;
2. Emergency, Education, Vehicles, Dissemination, among others;
3. Urbanism and Soft Transport Modes.

In the first group, the contributions covered both types of objectives (strategic and operational), stressing the need to address the following issues:

- Unsatisfactory protection of the vulnerable road users (VRU) in traffic system;
- The regulation, design, and management of road networks, including the review and update of the existing set of guidelines and standards (e.g., regarding VRU) for infrastructure design or the maintenance and repair of the existing network;
- Inconsistency in speed limit policy in the municipal and national networks;
- Poor road safety quality check of new roads design and redesign of existing and incomplete implementation of road safety audits and road safety inspections;
- Absence of a clear policy towards the coming integration of autonomous vehicles in the traffic system, approach to address national needs in this area;
- Slow implementation of innovative driving support systems (e.g., those based on road and driver monitoring), including Advanced Driver Assistance Systems (ADAS), Intelligent Speed Assistance (ISA), and alcohol interlocks;
- Absence of regular collection of road safety related performance indicators.

In the second group several issues were highlighted, including some of the matters mentioned in the first group. Also, the absence of multidisciplinary teams to investigate fatal and serious road crashes, resulting a low level of knowledge on the Portuguese crash phenomenon, and preventing identifying their causes. Heavy goods vehicles overweight was also mentioned having road safety implications. It was also mentioned the slow marked penetration of vehicles equipped with ADAS or that reached the highest EuroNCAP levels, as well as obstacles to the desired renewal of agricultural tractors and farm implement fleet. Driver training and updating was mentioned as still relying too much on knowledge on

Highway Code regulations, not enlarging sufficiently the safety awareness and the timely identification of risk factors by candidate drivers, as well as not improving adequately the proper use of new vehicle driving support technologies. A concern was expressed on school education, due to the nonexistence of pedagogical resources available for ages over 12 years old, to support teachers and students in their activities related to road safety and sustainable mobility. Road safety communication was also mentioned as a problematic area, as campaigns are still not drawing on behavior-change theories and their effects are not being routinely evaluated yet. Concerning Crash prevention and injury protection of powered two-wheeled riders was also mentioned as an area requiring improvements. Work related crashes were also mentioned.

In the third group several of the previous problems were also highlighted, e.g., the poor collection and analysis of road crash related data, the lack of detailed investigation on the causes and consequences of crashes, or deficient speed management in cities. Perceived lack of effectiveness in detecting and deterring infringements to the Highway Code was also mentioned. The experts also referred to the absence of legislation supporting city councils actions in road safety and to the small number of organizations (public and private) implementing road safety management systems (e.g. ISO 39001, which was translated to Portuguese in PENSE2020. Finally, the experts also expressed concern related to the age of the vehicle fleet and the absence of advanced driver assistance systems in the majority of the vehicles, even those able to support retrofitting in this domain

Overall, the contributions revealed a widespread awareness on the meaning of Vision Zero and support to its ultimate goal and the Safe System concept. However, the contributions also exposed some unfamiliarity with the Safe System concept and flawed notions about its underlying principles and how these can be reliably applied in practice. This is especially evident in relation to speed management and the risk of severe head injury for low speed unprotected road users.

A summary list of the most relevant problems and proposals is presented in Annex 2.

6.2 Topic analysis of the proposals from the public and private entities and the Non-Executive Council of Experts using Latent Dirichlet Allocation

As previously mentioned, over 100 documents were received, with several proposals for objectives, at the strategic and operational levels, as well as actions encompassing national and local areas.

The proposals for road safety for intervention encompassed the five pillars of the Safe System: Road Safety Management, Safer Users, Safer Infrastructure, Safer Vehicles, and Post-crash care. Overall, most contributions did not convey new basic data on the current status and recent developments on road safety in Portugal, except for those mentioned in section 2.2.

As mentioned earlier, the written contributions were collected in an open survey, their content being non-harmonized and in some cases containing additional documents. The large number of safety and non-safety issues described in the problem-statements and proposals, and their non-harmonized

description yield a large-scale dataset, were believed to be suited for supporting the automatic identification of patterns of co-occurring contributions, through topic analysis. In this context, the aim is to identify co-occurrence patterns of attributes related to the issues (problems) and proposals, as described by the public and private entities as well as the members of the Non-Executive Council of Experts.

A data-driven approach was adopted to identify many-to-many associations among a broad group of issues and proposals collected from experts and stakeholders. Considering the technical requirements of text analysis, *Latent Dirichlet Allocation* (LDA) (Blei *et al.*, 2003) was applied. This is a method for fitting a topic[12] model, in order to analyse the topics of the issues and proposals, which were divided into two groups: public and private entities, and the Non-Executive Council of Experts. A description of the methodology applied is detailed in Annex 3.

Table 6.1 and Table 6.2 show the 24 extracted latent topics for the problems and solutions record sets. Each topic contains all words in the corpus[13], albeit with different probabilities. The top 10 terms for each record set are also listed in these tables.

Table 6.1 – Extracted Latent Topics with keywords (public and private entities record set)

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6	Topic 7	Topic 8
1	*veiculo*	*mobilidade*	*formacao*	*avaliacao*	*conducao*	*seguranca*	*condutores*	*acidentes*
2	*importancia*	*sensibilizacao*	*condutores*	*sensibilizacao*	*campanhas*	*rodoviaria*	*via*	*vitimas*
3	*inspecao*	*medidas*	*sistemas*	*peoes*	*alcool*	*utilizadores*	*locais*	*promover*
4	*estudar*	*comunicacao*	*fiscalizacao*	*social*	*risco*	*velocidades*	*conduzir*	*rodoviario*
5	*acidente*	*promover*	*programas*	*informacao*	*efeito*	*medida*	*comportamentos*	*situacao*
6	*uso*	*ensino*	*meios*	*adocao*	*sensibilizar*	*implementacao*	*formacao*	*sinalizacao*
7	*definir*	*saude*	*criacao*	*necessario*	*substancias*	*reducao*	*tempo*	*sentido*
8	*utilizacao*	*identificacao*	*seguros*	*vias*	*circulacao*	*condutor*	*veiculos*	*trafego*
9	*desenvolver*	*implementar*	*peoes*	*comportamentos*	*legislacao*	*equipamentos*	*zonas*	*acesso*
10	*tecnica*	*condutor*	*criar*	*vertical*	*plano*	*sistematica*	*modo*	*estrgias*

	Topic 9	Topic 10	Topic 11	Topic 12
1	*dados*	*sinistralidade*	*veiculos*	*velocidade*
2	*incentivar*	*acoes*	*comportamento*	*criar*
3	*telemovel*	*intervencao*	*espacos*	*rodoviaria*
4	*sustentabilidade*	*utilizacao*	*promocao*	*planos*
5	*drogas*	*areas*	*visao*	*ambito*
6	*nacional*	*psicotropicas*	*fatores*	*segura*
7	*entidades*	*ansr*	*comportamentos*	*condicoes*
8	*associacoes*	*uso*	*superior*	*garantir*
9	*campanhas*	*informacao*	*obrigatoria*	*urbano*
10	*aplicacao*	*velocidade*	*prova*	*regulamentacao*

[12] Blei *et al.* (2003) refer to the latent multinomial variables in the LDA model as topics, so as to exploit text-oriented intuitions, but make no epistemological claims regarding these latent variables beyond their utility in representing probability distributions on sets of words.

[13] A 'corpus' is a collection of documents, which is a sequence of words, as explained in Annex III.

Table 6.2 – Extracted Latent Topics with keywords (Non-Executive Council of Experts record set)

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6	Topic 7	Topic 8
1	*utilizadores*	*mobilidade*	*sinistralidade*	*veiculos*	*formacao*	*sistemas*	*sinalizacao*	*rodoviaria*
2	*espaco*	*rodoviario*	*reducao*	*rodas*	*conducao*	*utilizacao*	*aplicacao*	*seguranca*
3	*vulneraveis*	*definir*	*rodoviaria*	*seguranca*	*acoes*	*condutor*	*garantir*	*objetivo*
4	*promover*	*planos*	*prevencao*	*vias*	*programa*	*veiculos*	*instalacao*	*operacional*
5	*ativa*	*nacional*	*seguranca*	*utentes*	*realizacao*	*adocao*	*criancas*	*educacao*
6	*publico*	*nacionais*	*resultados*	*circulacao*	*profissionais*	*promover*	*enquadramento*	*infraestrutura*
7	*rodoviarios*	*trafego*	*mudanca*	*via*	*prova*	*caso*	*legislacao*	*ensino*
8	*manutencao*	*infraestruturas*	*avaliar*	*equipamentos*	*seguranca*	*conducao*	*utilizacao*	*estrategico*
9	*incentivar*	*autarquias*	*implementar*	*evolucao*	*entidades*	*tecnologias*	*transito*	*intervencao*
10	*fiscalizacao*	*projeto*	*campanhas*	*ciclistas*	*substancias*	*seguranca*	*protecao*	*nacional*

	Topic 9	Topic 10	Topic 11	Topic 12
1	*criacao*	*condutores*	*acidentes*	*risco*
2	*estradas*	*avaliacao*	*causas*	*veiculo*
3	*solucoes*	*conducao*	*medidas*	*zonas*
4	*implementacao*	*entidades*	*dados*	*peoes*
5	*definicao*	*psicologica*	*analise*	*velocidade*
6	*urbano*	*areas*	*identificar*	*fatores*
7	*desenvolvimento*	*campanha*	*recolha*	*locais*
8	*objetivos*	*sensibilizacao*	*criar*	*utilizacao*
9	*promover*	*revisao*	*informacao*	*planeamento*
10	*infraestruturas*	*formacao*	*sinistralidade*	*travagem*

Correspondence between the keywords identified in the analysis, the corresponding Portuguese written words and their English translation are presented in Table III.1 (Annex III).

To provide a better understanding of the LDA's latent topics, Figure 6.1 presents some examples of the topic-specific words probabilities (β) for the 24 topics of the public and private entities' record set. For instance, the word "*condutores*" has a 6% probability of being generated from Topic 7, whereas "*locais*" has 3% probability of being generated from the same topic. Figure 6.2 presents the topic-specific words probabilities (β) for the 24 topics of the Non-Executive Council of Experts record set. Here we can see that the word "*veiculos*" has a 17% probability of being generated from Topic 4, whereas "*ciclistas*" has a 2% probability of being generated from the same topic.

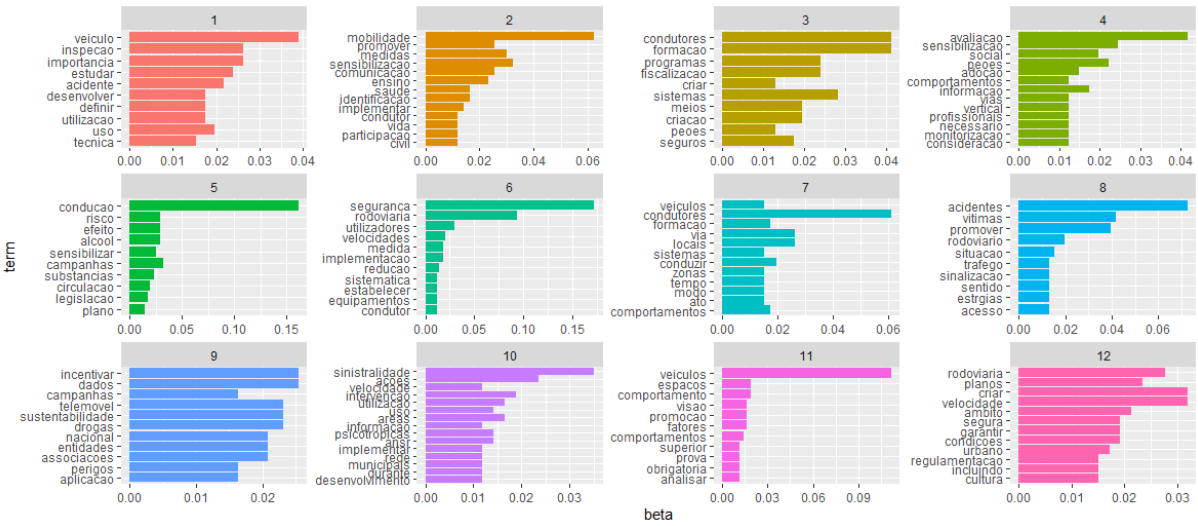


Figure 6.1 – Topic-specific word probabilities for the public and private entities' record set.

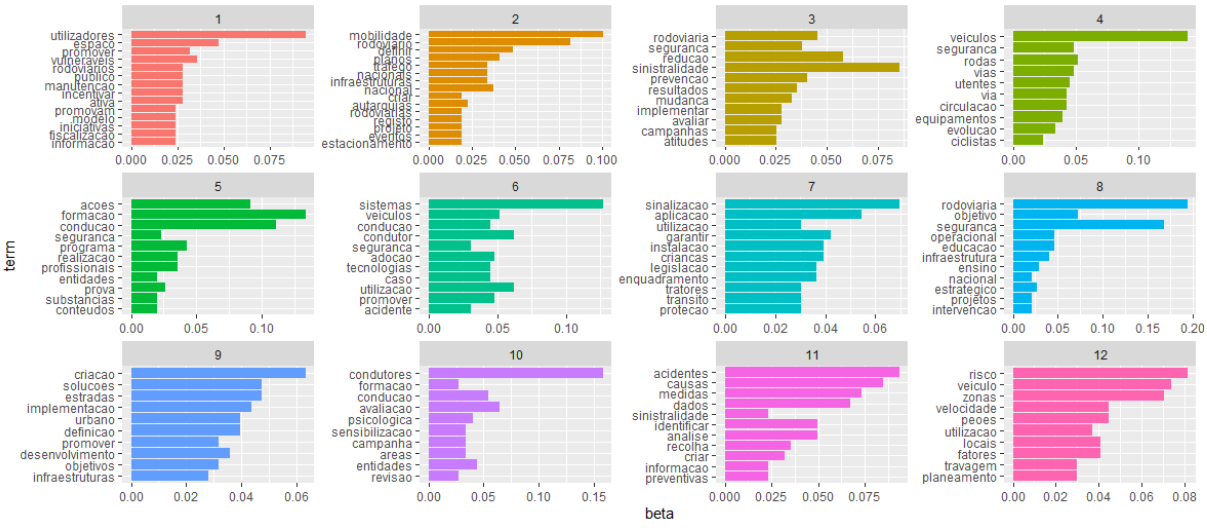


Figure 6.2 – Topic-specific word probabilities for Non-Executive Council of Experts' record set.

As demonstrated by Table 6.1 and Table 6.2, the extracted 12 topics obtained from each record set match typical road safety issues reasonably well, suggesting that the contributions have successfully covered most of the relevant road safety aspects. No unsuspected issues were detected in these topics. However, there is a clear distinction between the two record sets. In the case of the public and private entities' record set, the topics are not disjointed (they overlap), and it is not possible to find main components that have a clear focus (see Table 6.1 and Figure 6.1). On the other hand, there are several topics in Table 6.2 and Figure 6.2 focused on well-known road safety problems, namely:

- Unsafe conditions for vulnerable road users;
- The small consideration to road safety in sustainable mobility plans;
- Difficulties in the implementation and evaluation of road safety campaigns;
- Contributory factors in crashes with powered two-wheelers and bicyclists;

- Immaturity, lack of experience, impairment, and lifestyles associated with younger drivers and the frailty and vulnerability of older drivers, and the need for professional training;
- The unfitting application of signs and road markings;
- Speeding and the absence of effective speed management;
- Potential conflicts in the integration of road safety in urban design;
- The absence of comprehensive investigation of the causes of crashes;
- Unfamiliarity with new road safety challenges introduced by ITS and ADAS devices and the pace of their market penetration, and uncertainty on how these devices will impact on driver distraction and inadvertent behavioural change.

These results also show the need to promote a more focused and organised survey at a later stage of the study. Survey questions will be fittingly more focused and the design will provide for a more controlled type of responses, for example, restricting the number of characters or words in the responses and providing the desired structure for them.

Results from this data driven analysis are aligned with those from the more traditional approach described in section 6.1

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APPROVED

The Director of the Transportation Department

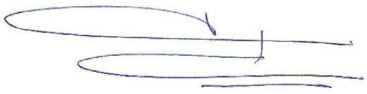
António Lemonde de Macedo

AUTHORS

João Lourenço Cardoso
Senior Researcher with Habilitation
Head of the Planning, Traffic and Safety Unit

Sandra Vieira Gomes
Assistant Researcher

Carlos Roque
Assistant Researcher



Fred Wegman
Professor

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ANNEXES

ANNEX I
Summary of PENSE 2020 measures (October 2020)

List of PENSE2020 actions and measures

Strategic Objective	Operational Objective	Ref.	Measure description
1. Improve road safety management	1. Improving the system for collecting, processing and making available road safety information	**A1.1.**	To implement the geocoding system and manage in an integrated way the crash data collected by the police forces
		A1.2.	To implement the new definition of serious injury (MAIS ≥ 3) to casualties registered in the ANSR Accident Database
		A1.3.	To investigate the implementation of a "National Trauma Register
		A1.4.	Establish the system of public notices on the occurrence of Traffic Accidents
		A1.5.	To optimize the process of registering and processing information on road accidents at the Emergency Patient Advisory Centres (CODU) of the Emergency Services Institute (INEM).
		A1.6.	To provide the police forces with access to the Death Certificate Information System (SICO)
		A2.7.	To establish the collection and dissemination of information on the road transport system
		A2.8.	To survey representative samples on attitudes and behaviour of road transport system users, taking into account the gender dimension
		A2.9.	To update the study on social and economic costs of road crashes
		A2.10.	To foster in-depth multidisciplinary investigation of road crash causes
	2. Improving legislation, enforcement and sanctions	**A3.11.**	To review the Highway Code and complementary legislation
		A3.12.	To analyse the legislation applicable to driving under the influence of psychotropic substances and propose appropriate amendments
		A3.13.	To update the system of compulsory civil liability insurance established by Decree-Law No 291/2007 of 21 August 2007
		A3.14.	To analyse the possibility of regulating the detection of mobile phone use by drivers involved in accidents (the “Evan’s Law” in the USA)
		A4.15.	To establish, implement and monitor the National Enforcement Plan in accordance with the principles contained in Recommendation 2004/345/EC, defining multi-annual priorities
		A4.16.	To establish and expand the National Automatic Speed Control Network (SINCRO)
		A5.17.	To establish the annual evaluation of the "Penalty Point System" driving licence system
		A5.18.	To improve the liaison and sharing of information between all entities on drivers and vehicles
		A5.19.	To speed up the administrative offence procedures, in particular by allowing mobile radars access to the SINCRO system
		A5.20.	Digitize the administrative procedures by the police in the areas of competence of the IMT and ACT and simplify the administrative prosecution procedures
		A5.21.	To raise awareness of judicial authorities on their role in promoting road safety
	3. Improving the system for allocating financial resources for road safety	**A6.22.**	To establish an accounting system of public investment in road safety and carry out systematic cost-benefit analyses on the main investments in this area
		A6.23.	To launch the Multiannual Road Safety and Prevention Tender
2. Safer road users	4. Promote education and training for the development of a Road Safety Culture in liaison with the framework of the implementation of the National Strategy for Citizenship Education	**A7.24.**	To disseminate and encourage the use of Road Education textbooks for Pre-School, Elementary and Secondary Education and Adult Education/Promoting Road Education Practices
		A7.25.	To deliver resources and tools to promote Road Education in Pre-School, Elementary and Secondary Education and Adult Education
		A7.26.	To establish the pilot project "Network of School Road Learning Clubs” (RECAR).
	5. Develop specific programmes to promote safe behaviour	**A8.27.**	To establish legislative procedures impacting the obligations of municipalities regarding the Road Transport System and road sign installation and maintenance
		A8.28.	To update the "Guide for the elaboration of Municipal Road Safety Plans" with the enclosure of a practical application guide

Strategic Objective	Operational Objective	Ref.	Measure description
		A8.29.	To encourage the elaboration of Municipal Road Safety Plans and their implementation
		A8.30.	To prepare and disseminate among local authorities a manual of good practice guide for children and adolescents safe mobility in and around schools
		A8.31.	Collaborate in the identification of critical points where problems in the urban/municipal road networks operation occur and encourage their intervention
		A8.32.	To encourage and raise awareness among municipalities on measures eliminating barriers for users of reduced mobility and on programmes properly integrating bicycle with pedestrian and road networks
		A9.33.	To translate the ISO/DIS 39001 - Road Safety Management Systems Standard (for public and private organisations) and encourage its application
		A9.34.	To promote the adoption of road safety policies at the workplace
		A10.35.	Carry out a prevalence study and risk estimation of driving under the influence of psychoactive substances, in particular alcohol and psychotropic substances, taking into account the gender dimension
		A10.36.	Conducting national campaigns against driving under the influence of psychoactive substances (alcohol and psychotropic substances), segmented according to the main risk groups, taking into account in particular the gender dimension, with the use of disposable devices
		A10.37.	Promote the implementation of programmes targeting the problems of the consumption of psychoactive substances, in particular alcohol, psychotropic substances and medicines, in the framework of health policy, including the gender dimension
		A10.38.	To study the introduction of alcohol-locks
		A10.39	To execute inspection actions in accordance with the National Inspection Plan
		A11.40	To establish the mandatory collection, in the crash investigations carried out by the police forces, of information regarding "distracted driving" and "fatigue", as contributing factors to the occurrence of the accident
		A11.41	To create incentives and promote the purchase of vehicles with "deviating trajectory warning" and "frontal collision hazard warning", preferably with automatic brake actuation
		A11.42.	To assess the feasibility of gathering evidence on the use of mobile phones by drivers and pedestrians involved in accidents with victims in investigations under the responsibility of the safety forces
		A11.43.	To develop and implement awareness actions on "distracted driving" aimed at all users, motorised and non-motorised, and on "fatigue", segmented according to the main risk groups
		A11.44.	To prepare and implement a plan for the execution of rumble strips as lane departure warnings
		A11.45	Increasing enforcement of driving and rest times
		A11.46	To carry out systematic driving enforcement actions using the mobile phone and other devices illegally
		A12.47.	Analyse the causes of road crashes involving agricultural tractors
		A12.48.	To study the feasibility of mandating compulsory inspection of agricultural tractors, using mobile inspection centres
		A12.49.	To promote legislative changes in the legal driving licence, mandating compulsory safety training for all drivers who do not hold a driving licence for agricultural tractors
		A12.50.	Promote legislative change in the context of the proper use of roll-over and restraint systems
		A12.51.	Develop and implement awareness-raising campaigns segmented according to specific target audiences
		A12.52.	To increase the selective inspection of agricultural tractors with particular incidence on safety belts, safety harnesses and passenger transport
		A13.53.	To promote the investigation of the causes of accidents with vehicles of the police, the INEM, the fire brigade, the Portuguese Red Cross and companies with a licence to transport patients
		A13.54.	To promote awareness actions/defensive driving training for emergency vehicle drivers related to the operations of INEM, the fire brigade, the Portuguese Red Cross and companies with permits to transport patients
		A13.55.	Assess the feasibility of establishing a certification process for drivers of emergency vehicles and non-emergency patient transport vehicles, including companies licenced for patients transport
		A13.56	Prepare a programme for "Promotion of Road Safety of Fire Bodies".
	6. Improve vulnerable road users protection	**A14.57.**	To promote a national campaign aimed at pedestrians and drivers focusing on the main causes of pedestrians being hit-and-special emphasis on vulnerable users
		A14.58.	To promote the correct and appropriate use of infrastructure and equipment for pedestrians to cross the roads and to carry out specific enforcement actions

Strategic Objective	Operational Objective	Ref.	Measure description
		A14.59.	To develop and implement road safety education programmes with an emphasis on pedestrian safety, at all levels of non-university education
		A14.60.	To execute driving enforcement towards drink and drug driving, speeding and distractions with mobile phone use at pedestrian crash sites
		A14.61.	Prioritize enforcement of sidewalk parking, or near pedestrian crossings
		A14.62.	To prepare and disseminate technical provisions to support the design of low speed areas
		A14.63.	To detect and evaluate high pedestrian risk sites and implement interventions on the infrastructure, including traffic calming, road lighting and installation of traffic signals.
		A14.64.	To develop and approve stricter rules for the licensing of roadworks, in order to ensure pedestrian accessibility
		A14.65.	Setting up targets by municipal councils for the reduction of pedestrian fatalities and serious injuries in their municipal road safety plans
		A15.66.	Carry out a study on the characteristics of accidents involving bicyclists
		A15.67.	To develop campaigns aimed at bicycle users warning on risky behaviour, including non-use of protective equipment, and aimed at car drivers focusing on interaction with biker users, taking into account the gender dimension
		A15.68.	To ensure that users of bicycles comply with the rules by means of enforcement aimed at high-risk behaviour, such as failure to observe traffic lights and failure to use lighting
		A16.69.	To establish conditions for positive discrimination in the purchase of safer two-wheel motor vehicles, particularly in terms of active safety
		A16.70.	Study the enlargement of the number of mandatory safety equipment
		A16.71.	To execute enforcement actions according to the National Inspection Plan
		A16.72.	To execute awareness campaigns targeting 2 PTW road users
		A17.73.	To study the feasibility of implementing mandatory updating of Highway Code legislation knowledge for Group I drivers (motorbike and car drivers)
		A17.74.	To foster awareness education targeting elderly drivers, delivered by health professionals. To raise awareness of age-related problems, diseases, medication and their potential effects on driving, taking into account the gender dimension
	Improving the effectiveness of communication campaigns	**A17.75.**	To deliver awareness campaigns aimed at older drivers
		A18.76.	To develop a guideline to define metrics and evaluation methods for campaigns
		A18.77.	To establish an innovative and integrated communication strategy for the period 2017-2020 that constitutes a new paradigm, embodied in a profound transformation, using the various channels available and with differentiated messages for the various target audiences, including gender dimension
3. Safer roads	8. Promoting the improvement of the National Road Network	**A19.78.**	To develop and evaluate a pilot project for the classification of a National Road
		A19.79.	To prepare and implement an evaluation and classification program for the National Road Network (RRN)
		A20.80.	To detect, using the LNEC's procedure high accident risk sites, in order to prioritize interventions in the National Road Network TIPRRN)
		A20.81.	To implement, monitor and evaluate an intervention program for detected TIPRRN
		A21.82.	To identify priority through road locations for intervention (National Road Network and municipal networks)
		A21.83.	To prepare and implement road safety intervention projects (National Road Network and municipal networks)
		A22.84.	To create the necessary legislative conditions for carrying out road safety audits of road design schemes
		A22.85.	To execute road safety audits and road safety inspections, both on mandatory trans-European network routes and on the national network, as indicated by IMT
		A22.86.	To foster the establishment of liaison channels between the police forces and road operators, aiming at the creation of a network for monitoring the problems detected in the infrastructure
		A23.87.	To prepare and disseminate a manual on the Safe Transport System, for road infrastructure managers
		A23.88.	Disseminate the manual "Recommendations for setting and signing maximum speed limits", applicable to all road sections, both inside and outside urban areas
	9. Promoting the improvement of the	**A24.89.**	Study the conditions for application of the EuroRAP methodology in the assessment of municipal roads
		A24.90.	Prepare and implement the program of evaluation and classification of municipal roads

Strategic Objective	Operational Objective	Ref.	Measure description
	municipal road networks	**A24.91.**	Identify, according EuroRAP results, high accident rate sections for implementation of priority interventions in the municipal road networks (TIPRRRA)
		A25.92.	To prepare a design standard for urban streets
		A25.93.	Identify a broad set of documentation techniques, in particular good practices and technical provisions manuals, applicable in urban areas and to promote the updating and republication of those in the areas of IMT's remit
4. Safer vehicles	10. Promote the maximisation of the safety of the new vehicle fleet	**A26.94.**	To establish positive discrimination in the purchase of safer new vehicles
		A26.95.	To analyse the preparation of legislation on the inclusion of EuroNCAP classification in advertising messages for new vehicles
	11. Promote the maximization of the safety of the used vehicle fleet	**A27.96.**	Prepare a study to establish the safety classification for the used vehicle fleet and promote its use
		A28.97.	To assess the system of Mandatory Periodic Inspection of vehicles, including its legal regime, and define and implement measures to improve the performance of the system (inspections and their control)
		A29.98.	To foster the retrofitting of existing vehicles with E-call devices
5. Improved post-crash care	12. Promote the optimisation of assistance, treatment and rehabilitation of victims of road accidents	**A30.99.**	To prepare first aid teaching textbooks and material, and promote the training of the school population in first aid and basic life support
		A30.100.	To improving the knowledge of novice drivers on basic first aid notions, by strengthening the content of training and assessment programs.
		A31.101.	To update and make available, in digital format, the Safety Data Sheets Manual and promote training actions for its use by the Fire Brigade officers
		A32.102.	To prepare a program for upgrading the emergency service system
		A32.103.	Implementing and disseminating the new 112 emergency assistance system
		A33.104.	To setup a uniform kit for signing crash sites, and prepare a procurement template for its acquisition and distribution by relevant police forces and fire brigades
	13. Establish a programme and a support network for road accident victims and their carers	**A34.105.**	Establish a Working Group to draw up the Programme
		A34.106.	To prepare and approve the Programme and the necessary network and resources
		A34.107.	Starting up and monitoring the network

Status of execution of PENSE 2020 measures by October 2020.

Strategic Objective	Operational Objective	Action. Measure	Current situation	Monitoring Entity[1]	Assessment of execution status[2]	Notes
1	1	A1.1.	50.0%	UC	Np/2/2	Lack of uniformity of objectives
		A1.2.	60.0%	UC	Np/2/2	Methodological document is missing
		A1.3.	60.0%	UC	Np/2/3	Undefined registration process
		A1.4.	40.0%	UC	Np/2/2	Partially dependent on measure A01.13
		A1.5.	100.0%	UC	Np/3/2	Partially dependent on measure A01.03
		A1.6.	100.0%	UC	Np/3/3	System to be operationalized (September 2020?)
		A2.7.	85.0%	UC	Np/3/3	There is a lack of systematization and processing of the data collected. Specific platform is missing.
		A2.8.	100.0%	UC	Np/1/1	Mention to the SARTRE questionnaire, which was replaced by ESRA. Mention of delays but ESRA is in progress and already has 2 editions.
		A2.9.	50.0%	UC	Np/1/1	To be done. According to the LNEC report, a simple financial update of the 1980 study should not be done; a new study from scratch is needed.
		A2.10.	40.0%	UC	Np/1/1	To be done
	2	A3.11.	100.0%	IDS	Np	No evaluation for lack of information
		A3.12.	100.0%	IDS	Np	Survey of legislation; lack of good practice survey
		A3.13.	40.0%	IDS	4/Np/3	Missing the proposal to amend Decreto Lei n.º 291/2007, of August 21
		A3.14.	100.0%	IDS	4/Np/4	The question of the measure was not answered (verification of signs in crashes) but a more general one (driving inspection). Overlapped with A11.42
		A4.15.	100.0%	IDS	4/Np/4	Delayed delivery of 2019 plan (June)
		A4.16.	80.0%	IDS	Np	Network duplication for 100 sites delayed
		A5.17.	66.0%	IDS	4/Np/2	What are the objects of the evaluation to be performed? There seem to be 2 sides but data for only one of them
		A5.18.	35.0%	IDS	Np	Missing protocols and legislation
		A5.19.	100.0%	IDS	Np/Np/4	Operationalized objectives
		A5.20.	IMT 40.0% ICT 30%	IDS	Np	Lack of information about the accomplishment of the process phases
		A5.21.	100.0%	IDS	Np/Np/2	Only one training course for 60 magistrates (out of a total of 3800).
	3	A6.22.	?	idMEC		No file
		A6.23.	Cancellled	idMEC	2/1/3	Unrealized contests
2	4	A7.24.	100.0%	FPCEUP	Np/4/5	Operationalized objectives (300 trainers involved)
		A7.25.	75.0%	FPCEUP	Np	No evaluation for lack of information
		A7.26.	100.0%	FPCEUP	4/4/4	Operationalized objectives. Meeting with 3000 participants
	5	A8.27.	100.0%	FPCEUP	5/5/3	Operationalized objectives. There is no reference to consequences. Decreto-lei n.º100/2018. Lack of executive power of the responsible entity

Strategic Objective	Operational Objective	Action. Measure	Current situation	Monitoring Entity[1]	Assessment of execution status[2]	Notes
		A8.28.	**25.0%**	FPCEUP	Np/Np/1	Lack of information about the realization of the measure. Delay due to Human Resources and Financial Resources constraints
		A8.29.	**70.0%**	FPCEUP	4/4/3	6 Protocols ; two types of constraints identified but not described
		A8.30.	**75.0%**	FPCEUP	Np/Np/1	Lack of information about the realization of the measure. Delay due to Human Resources and Financial Resources constraints
		A8.31.	**10.0%**	FPCEUP	4/2/Np	Analyzed 116 locations. Lack of information on procedures adopted
		A8.32.	**80.0%**	FPCEUP	3/3/3	Carried out a survey on good practices. Low response rate
		A9.33.	**100.0%**	FPCEUP	Np/4/4	Translated standard; There is no reference to the scope of dissemination
		A9.34.	**?**	FPCEUP	Np	No evaluation for lack of information
		A10.35.	**100.0%**	FPCEUP	3/Np/3	In execution, with delay
		A10.36.	**100.0%**	FPCEUP	5/3/3	Impact evaluation dependent on A18.
		A10.37.		FPCEUP	5/5/4	In execution. Formed teams
		A10.38.	**100.0%**	FPCEUP	4/4/4	Study conducted. There is no reference to consequences.
		A10.39.	**GNR 85% PSP 93.8%**	FPCEUP	5/3/3	Overlapped with A4.15? Enforcement actions in place; committed re-equipment and training (GNR); no problem (PSP)
		A11.40.	**GNR 97% PSP 93.8%**	FPCEUP	Np/4/5	Data collected (GNR, PSP). There is no reference to the analysis of collected data and its results
		A11.41.	**?**	FPCEUP	Np	No evaluation for lack of information
		A11.42.	**100.0%**	FPCEUP	Np	Same objective as A3.14
		A11.43.	**100.0%**	FPCEUP	5/3/3	Executed, despite minor financial resources constraints. Impact evaluation dependent on A18 (which is delayed/cancelled)
		A11.44.	**50.0%**	FPCEUP	5/4/3	In execution; delayed
		A11.45.	**GNR 80% PSP 93.8% ACT 45%**	FPCEUP	3/2/Np	Overlapped with A4.15? Review of unrealized legislation (ACT). Reinforcement of inspection but dependent on A5.20 (GNR). In execution (PSP)
		A11.46.	**GNR 100% PSP 93.8%**	FPCEUP	2/Np/4	Overlapped with A4.15? Activities 2 and 4 not realized (GNR, PSP)
		A12.47.	**100.0%**	FPCEUP	5/5/5	Reports performed
		A12.48.	**90.0%**	FPCEUP	Np	No evaluation for lack of information
		A12.49.	**100.0%**	FPCEUP	5/4/5	Decreto-lei n.º 151/2017 published
		A12.50.	**100.0%**	FPCEUP	4/4/4	Legislation prepared. There is no reference to publication
		A12.51.	**100.0%**	FPCEUP	4/4/4	Disclosure actions carried out
		A12.52.	**GNR 60% PSP 93.8%**	FPCEUP	Np/Np/2	Lack of legislation; undone campaigns (GNR). Ongoing inspection (PSP); Overlapped with A4.15?
		A13.53.	**80.0%**	FPCEUP	5/4/4	in progress for INEM; impossible for other entities
		A13.54.	**88.0%**	FPCEUP	Np/4/4	Overlap with A13.55
		A13.55.	**85.0%**	FPCEUP	Np/3/3	The certification system is not completed, due to duly identified constraints.

Strategic Objective	Operational Objective	Action. Measure	Current situation	Monitoring Entity[1]	Assessment of execution status[2]	Notes
		A13.56	70.0%	FPCEUP		2018 work plan not realized. No funding in 2020
	6	A14.57.	100.0%	FPCEUP	Np	Postponed
		A14.58.	50.0%	FPCEUP	Np	Postponed
		A14.59.	100.0%	FPCEUP	3/3/3	Good practice meeting not held, without description of reasons
		A14.60.	GNR 100% PSP 93.8%	FPCEUP	5/4/5	Performed (GNR, PSP). Overlapped with A4.15? There is no reference to evaluation of results
		A14.61.	GNR 100% PSP 93.8%	FPCEUP	Np/3/3	Performed (GNR, PSP). Overlapped with A4.15? There is no reference to evaluation of results
		A14.62.	100.0%	FPCEUP	5/4/4	Manuals published
		A14.63.	IP 50.0% Municip. ?	FPCEUP	5/3/3	In progress. There is no reference to evaluation of results
		A14.64.	?	FPCEUP	Np	No evaluation for lack of information
		A14.65.	?	FPCEUP	Np	No evaluation for lack of information
		A15.66.	100.0%	FPCEUP	Np/Np/4	In progress. There is no reference to published reports
		A15.67.	50.0%	FPCEUP	Np	Postponed
		A15.68.	GNR 100% PSP 93.8%	FPCEUP	4/4/4	Performed (GNR, PSP). Overlapped with A4.15? evaluation of results?
		A16.69.	100.0%	FPCEUP	Np/Np/5	Performed. There is no reference to evaluation of results
		A16.70.	100.0%	FPCEUP	Np/Np/4	Performed. There is no reference to evaluation of results legislation elaborated
		A16.71.	GNR 100% PSP 93.8%	FPCEUP	5/4/5	Performed (GNR, PSP). Overlapped with A4.15? There is no reference to evaluation of results
		A16.72.	100.0%	FPCEUP	5/4/4	Performed. There is no reference to evaluation of results
		A17.73.	50.0%	FPCEUP	4/3/3	In progress. There is no reference to published survey reports
		A17.74.	85.0%	FPCEUP	3(4/4	In progress. There is no reference to the 2 workshops held
		A17.75.	50.0%	FPCEUP	4/Np/1	In progress. There is no reference to published reports
	7	A18.76.	40.0%	FPCEUP	Np	Postponed (Why? There is a good practice manual of the European CAST project in which PRP participated)
		A18.77.	75.0%	FPCEUP	Np	Postponed
3	8	A19.78.	100.0%	UC	Np/5/3	Pilot study conducted
		A19.79.	100.0%	UC	Np/3/5	A study applied to all roads in the country was conducted. There is no reference the dissemination of the results
		A20.80.	100.0%	UC	Np/3/5	Performed for RRN
		A20.81.	15.0%	UC	Np/Np/5	Not carried out
		A21.82.	IP 40.0% Municip. ?	UC	Np/Np/2	(IP, Mun) Not realized. Depends on A20.80 and A21.83
		A21.83.	IP 10.0% Municip. ?	UC	Np/Np/1	(IP, Mun) Not realized. Depends on A20.80
		A22.84.	95.0%	UC	Np/4/4	Not carried out
		A22.85.	55.0%	UC	Np/3/5	Not carried out. Depends on A22.84

Strategic Objective	Operational Objective	Action. Measure	Current situation	Monitoring Entity[1]	Assessment of execution status[2]	Notes
		A22.86.	**GNR 70% PSP 93.8%**	UC	Np/2/4	(GNR, PSP) Lack of clarification of what was done
		A23.87.	**50.0%**	UC	Np/Np/3	Unpublished manual
		A23.88.	**100.0%**	UC	Np/3/3	Manual released. Absence of training actions
	9	**A24.89.**	**Cancellled**	UC	Np/1/1	Cancelled. Impracticable. Nevertheless, EuroRAP is only not applicable in urban zones
		A24.90.	**Cancellled**	UC	Np/Np/1	Cancelled. Impracticable. Nevertheless, EuroRAP is only not applicable in urban zones
		A24.91.	**Cancellled**	UC	Np/Np/Np	Cancelled. Impracticable. Nevertheless, EuroRAP is only not applicable in urban zones
		A25.92.	**85.0%**	UC	Np/2/2	Unpublished manual (but is already in the 2nd revision phase)
		A25.93.	**100.0%**	UC	Np/2/2	List published
4	**10**	**A26.94.**	**100.0%**	idMEC	3/Np/Np	Non acceptance of change in fiscal law
	11	**A26.95.**	**Cancellled**	idMEC	-	Non acceptance of the measure by IMT
		A27.96.	**40.0%**	idMEC	3/3/Np	Not carried out
		A28.97.	**90.0%**	idMEC	3/Np/Np	Carried out?
		A29.98.	**Cancellled**	idMEC	4/4/4	Technical report but lack of implementation
5	**12**	**A30.99.**	**92.0%**	IDS	4/Np/3	Data from the sheet goes beyond the purpose of the measure (recommendation for IMT is within the scope of measure A30.100). Training in 21 pilot schools (2500 students)
		A30.100.	**90.0%**	IDS	Np	Not carried out
		A31.101.	**100.0%**	IDS	Np	Lack of funds
		A32.102.	**100.0%**	IDS	4/Np/1	There is no reference to the definition of the program. Mention only to acquisition of equipment
		A32.103.	**100.0%**	IDS	4/Np/4	It is not clear if the implementation was carried out according to any plan No evidence of implementation of the dissemination campaign.
		A33.104	**GNR 90% PSP 90% ANEPC100% INEM 100%**	IDS	Np	The standardization of a single kit for GNR, PSP and ANpC is not recommended
		A34.105.	**0.0%**	IDS	-	No file
		A34.106.	**0.0%**	IDS	-	No file
	13	**A34.107.**	**0.0%**	IDS	-	No file

Notes:

1 – UC – Faculdade de Ciências e Tecnologia da Universidade de Coimbra; IDS – Instituto Direito e Segurança; IdMEC - Instituto de Engenharia Mecânica do Instituto Superior Técnico da Universidade de Lisboa; FPCEUP – Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto

2 – Technical quality / accomplished milestones / accomplishment of the workplan. (NP-not possible to evaluate)

ANNEX II
Summary of contributions received

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
1	In light of the recent publication of the documents documentos "Zonas Residenciais e de Coexistência" and "Zonas 30", it is important, in close cooperation with municipalities, to define an implementation programme that includes a set of pilot studies, which will allow, in due time, to test the application of the concepts, and to assess, in quantitative terms, the level of effectiveness associated to each implemented measure/action. These results should feed into the updating/revision of these base documents and the existing legal framework		x		x			x							
2	Definition of objectives and specific actions aimed at cyclists in the urban environment, including rules for designing cycling networks.		x		x				x						
3	Reviewing, reformulating, formally approving and publishing normative/recommendations provisions for regulating and supporting the design of standardized solutions applied to through roads of urban areas, by national or regional roads.	x	x												
4	Commitment to the systematic implementation of solutions for the hierarchical functional organization of urban and rural municipal networks	x	x												
5	Review of the local framework for Road Safety Audits (RSA), making this instrument compulsory in both the rural and structuring urban networks.		x												
6	Integrate new trends, such as the growing phenomenon of distraction due to the use of mobile phones while driving and headphones by pedestrians.			x											
7	Anticipate the potential impacts of technological advances in vehicle automation and connectivity with the infrastructure and the environment, exploiting the potential for improved road safety.					x					x				
8	Define and implement the referential framework that allows the different entities responsible for the management of the municipal and national road infrastructure to respond to the challenges, opportunities and risks associated with the progressive and growing integration of vehicles with higher levels of autonomy and driver exemption into the road environment	x	x			x									
9	Support measures for fleets implementing driving support strategies, in particular support systems based on road and driver monitoring.	x				x									
10	The legal documents to be reviewed are the Highway Code (CE - Lei n.º 72/2013, de 3 de setembro) and the Regulamento de Sinalização do Trânsito (RST - Declaração de Retificação n.º 60-A2019, de 20 de dezembro 2019)	x	x												
11	Review and update the existing set of normative documents: The Norma de Sinalização Vertical (NSV, from JAE) adding to it the new vertical signs and all road markings in similar ways, making it the Traffic Signalization Standard. All the Normative Provisions of traffic signs of InIR (DN-InIR, of the current IMT) in view of the amendments to the EC and the RST, converting it into the Traffic Signs Manual. The Tourist Signs Standard (NST).	x	x												
12	As with the Manual on Uniform Control Devices (U.S. Department of Transportation, Federal Highway Administration) and other manuals, it would be more practical to have a single volume, called the "Traffic Signal Manual", which incorporates all the necessary updates of those texts in light of the amendment of the RST	x	x												
13	Creating a framework for infrastructure safety, including the use of technologies for monitoring infrastructure, road surface quality, etc., taking advantage of collaborative systems, tending towards real-time traffic safety.	x	x										x		x

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
14	Creating conditions for the acceleration and massification of total connectivity solutions, including V2I and C-ITS, taking advantage of the availability of 5G associated technologies.										x				
15	Promotion of tools for the integration and availability of status information, track conditions, flows, etc., for service operators and users.	x		x											
16	Streamlining homologation processes for new types of (light) vehicles for new urban services and their passive and active safety systems (ADAS, collaborative systems based on C-ITS, etc.);					x					x				
17	Creating conditions for the introduction of autonomous driving solutions in urban and extra-urban areas;										x				
18	Familiarization and preparation of security and rescue forces for electric/electrified vehicle assistance.	x					x								
19	Creation of reference framework for massification of C-ITS systems and smart infrastructure, including smart signage;	x									x				
20	Integration of information with pedestrians.			x				x			x				
21	Acceleration of interoperability mechanisms between passive and active safety related systems and technologies;										x				
22	Enhancing new technology test environments, namely within the existing framework for Technology Free Zones;										x				
23	Definition of framework for security of data, technologies and services (cybersecurity).	x									x				
24	Create mechanisms that enable a deeper, more active, ex-ante participation of (and not merely validation by) key players - who, thus, may become a truly integral part of the very specification of objectives and intervention modalities to be enshrined in the Strategic Plan. This is the logic that underlies the following considerations.	x													
25	Launching a Road Safety Policy which is disruptive in relation to previous Strategic Plans. This is what the present position paper is about. But, let it be made clear: not in conflict; on the contrary, assuming as foundation the results achieved through the execution of those same Strategic Plans.	x													
26	Need to evolve towards a triangular reformulation, i.e. integrated, of the critical factors for analysis and intervention in Road Safety: human, technology and monitoring.	x													
27	Individual behaviours cannot, in the present context, be archetypally "modelled" without the conjugated application of surveillance, this one technologically supported; although one tends to see 'technology' as a cluster of disjointed techniques, in fact technological developments, even if having to meet sectorial distinct demands, reveal themselves normally of multifaceted application (multipurpose); The design of the enforcement modalities themselves is inseparable from the educational level of the public to which they are applied, and therefore has to evolve in line with both the 'resilience' of the respective targets of action and the technical progress itself.	x													
28	"Be ashamed" of certain personal behaviours. To materialise the (alternative) ethical path, two ingredients may be singled out as indispensable: the direct, repeated involvement of the Nation's highest magistrature - a path for which President Jorge Sampaio was a precursor; a vast national debate, intensely mediated, based on the "revelation/ denouncement" of practices which, as a rule, the alternative self-driver avoids self-analysing - which requires a professional communication campaign; in fact, an option very appropriate to the current pandemic mode of soul-searching.			x											

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
29	Sensing of infrastructures and their equipment to enable connected mobility;		x								x				
30	Preparation of the physical infrastructure in terms of its maintenance, to enable autonomous mobility;		x								x				
31	Prepare technical reference standards for road construction and rehabilitation projects, for roads that allow autonomous mobility;	x	x												
32	Review national legislation to enable connected and autonomous mobility;	x	x												
33	National diagnosis of the areas with the highest risk of road accidents;		x											x	
34	Legal obligation to carry out road safety inspections of the places with the highest risk;		x												
35	Build a national plan to implement measures that eliminate high risk zones and implement traffic calming measures that, through low-cost measures, have a high impact on the reduction of accidents;	x	x												
36	At the level of new road or rehabilitation projects, there should be a legal obligation to perform road safety audits;		x												
37	Creation of a national road safety simulator that enables, through virtual and augmented reality, the simulated driving experience that new projects will provide in the infrastructures to be built or rehabilitated;			x											
38	National diagnosis of the areas at greatest risk of extreme events caused by climate change, and which may create road accidents;		x												
39	Assessing the resilience of infrastructure to extreme climate change events;		x												
40	Preparing the physical resilience of infrastructure for extreme events;		x												
41	Implementation of technological infrastructures that during extreme events allow direct communication with the users of the physical infrastructures;		x								x				
42	Plans to restore the level of service of infrastructures after extreme events and to reduce the risk of accidents as quickly as possible.	x	x												
43	Municipal Road Safety Plans, with mapping of the accident risk in municipal road networks, but also of soft and pedestrian mobility, with road safety audits and inspections, and subsequent municipal plans for the elimination of high risk zones and implementation of traffic calming zones; Plans for the introduction of connected and autonomous mobility; Plans for infrastructure resilience to climate change;	x	x								x				
44	Road Safety Audits should extend their scope of action to road infrastructures where there is a higher incidence of accidents, such as National Roads and the most important municipal roads (rural and urban).		x												
45	Road Safety Inspections should be generalised		x												
46	An indicator linked to the "percentage of distance travelled on roads with a safety rating above an agreed threshold" could be created, as envisaged by the European Commission, but the concrete definition of the nationally acceptable threshold is of the utmost importance and justifies thorough consideration.	x													
47	An eventual greater autonomy of the vehicles may make the sobriety of the "driver" or his distraction irrelevant, since he will no longer have any influence on driving, in accordance with the objectives to be achieved with such autonomy, which should see a significant evolution in the decade in question. Such autonomy will imply a much higher demand than today with regard to infrastructure quality, which will also justify a more demanding incidence of the aforementioned Inspections, to ensure the expected compatibility.		x												

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
48	Issue guidelines to have a complete digital model by 2030 of the roads with the highest demand and those with the highest incidence of high risk zones;		x												
49	Provide, until 2030, all roads with the highest demand and those with the highest incidence of high risk zones with sensors enabling road users, including VRUs, to be counted and classified;		x												
50	By 2025, impose that all road interventions be accompanied by simulations as part of their projects, always resulting in a minimum of three scenarios where safety indicators are weighed against other project criteria in the choice of the intervention to be carried out;		x												
51	Pursue, with the various stakeholders, the adoption of Connected Mobility solutions, to be completed by 2025, aimed at equipping all roads with the highest demand and those with the highest incidence of high risk zones with the V2I/I2V10 communication infrastructure that enables the implementation of use cases defined by the C-ROADS platform;		x								x				
52	Apply solutions for automatic detection of infractions in all high risk zones on the road network by 2030, namely those corresponding to intersections/road conflict points;		x								x				
53	Develop, until 2022, a model of mandatory conservation plans applied to all roads with greater demand and those with higher incidence of high risk zones, in which maintenance practices based on condition are incorporated as much as possible. This model should be mandatory and prevent the contracting of conservation services from being limited to price - and therefore to a reduction, in practice, of the maintenance services effectively provided.		x												
54	The calculations associated with any investment in road technology can - and should - be made, projecting the investment over time and, naturally, internalizing all the benefits arising from that investment, including those of increased safety. On the cost side, there must be investment and operating costs; on the income side, possible revenue support must be included, as well as environmental benefits and, above all, safety benefits. Only with a broad analysis can conclusions be drawn regarding the protection of the investment, conclusions that should always be present when an investment is taken to decision. But even more so when neglecting these aspects can lead to systems that are intrinsically less safe.	x	x												
55	Publication and subsequent implementation of the Decree on Road Safety Auditors, namely the certification of training entities, certification / recognition of courses and other training actions in road safety and certification and registration of these professionals, whose draft diploma was made under Measure A22.84 of PENSE 2020;	x	x												
56	The monitoring of the results of Measure A11.44 - Define and implement an execution plan for rumble stips for warning of leaving the carriageway, whose works were still in progress at the end of 2020;												x		

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
57	The transposition and implementation of Directive (EU) 2019/1936 of the Parliament and of the Council of 23/10/2019 on Road Infrastructure Safety Management (enhancing and encouraging the implementation of road safety management procedures both on Trans-European Network roads (already mandatory) and on other roads in the National Road Network, namely motorways that are not part of the Trans-European Network). This transposition should lead to the amendment of Decree-Law no. 138/2010, of 28 December, Decree-Law no. 123/2014, of 11 August (which establishes the rules applicable to the carrying out of Road Safety Inspections) and, possibly, Decree-Law no.No. 122/2014 (establishing the rules applicable to the conduct of Road Safety Audits), of 11 August, and Law No. 49/2014, of 11 August (establishing the regime for access to and the exercise of the profession of road safety auditor, for the issue of the respective professional titles and for access to and the exercise of the professional training activity of auditors).	x													
58	The revision or replacement of the following documents and methodologies (within or outside the scope of the transposition of the above-mentioned Directive) (see justifications in Annex I): Road Safety Inspections - Manual of application, Roadside - Manual on safety aspects, Manual of Road Safety Audits, Determination of High risk zones, Assessment of the social costs of road injury accidents	x	x												
59	Promoting the capacitation of road infrastructure in C-ITS (Cooperative Intelligent Transport Systems) to ensure that vehicles will soon be able to communicate with the infrastructure, and vice versa, as C-ITS services, especially those of day 1 and 1.5, but also those to come (day 2), are expected to have positive impacts on road safety.		x								x				
60	The implementation of the regulation for permitting tests of connected and autonomous vehicles, as it is expected that autonomous and connected driving will produce benefits in terms of road safety, and here with a particular focus on the selection of the sections of infrastructure deemed suitable, and their progressive evolution, as European and national regulations evolve.	x	x			x					x				
61	Promoting the evolution of the eCall system (already implemented in Portugal) with integration in the traffic control centres of the road infrastructure managers, so as to improve and speed up the provision of emergency / signalling services and dissemination of information, also enhancing the communication of the infrastructure with the vehicle.	x				x	x								
62	To develop tools and measures to protect vulnerable users by promoting safe and comfortable travel by walking, cycling and/or other means of micro-mobility;			x				x	x						
63	Assess the introduction of legislative measures regarding civil and criminal liability for accidents involving vulnerable users, with a focus on bicycle users;	x						x	x				x		
64	To raise awareness of the adoption of safe behaviour by all users when sharing road space, with a special focus on pedestrians, cyclists and other means of micro-mobility.			x				x	x						
65	To study the implementation of Road Safety Plans developed by the actors of the mobility and transport system (e.g. road transport companies, transport coordination centre managers, shared mobility companies, etc.).	x	x												
66	Promote the harmonisation of legislation in the field of transport and its application by the security forces;	x													

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
67	Strengthen the national electronic register of road transport companies licensed by IMT, with connection to the ERRU platform from EC and the competent national authorities, in order to enhance the effective sanctioning of entities that repeatedly fail to comply with the regulations in force;	x											x		
68	Strengthen surveillance in the transport areas and promote capacity building of surveillance entities in the area of safe transport.	x											x		
69	A (concerted) review and update of the entire legal framework for transport, in alignment with the new Mobility Package and other community regulations, in order to foster harmonisation of understanding and uniform application of the legal provisions by all supervisory bodies;	x													
70	(Concerted) revision of strictly national legislation that can contribute to the improvement of road safety, in order to keep up with the strong dynamics of the mobility sector.	x													
71	Promote the reinforcement of monitoring in the training and assessment of new drivers in areas with relevance to road safety;			x									x		
72	To promote the strengthening of monitoring in the training and assessment of driving instruction professionals and professional drivers in areas with relevance to road safety;			x									x		
73	Increasing and promoting knowledge updating for drivers;			x											
74	Strengthen skills for maintaining safe driving in senior drivers;			x									x		
75	Strengthen the quality of physical, mental and psychological assessment of drivers.			x									x		
76	To accompany and sensitise driving schools to the need to reinforce the syllabus on road safety, in particular as regards the Common Modules on Road Safety and the Supplementary Theoretical and Practical Modules, and to the use of teaching-learning techniques and methods that provide driver candidates with a greater awareness of the demands of the driving task (e.g. commented driving, coaching), that appeal to the increase of the capacity of attention and detection of dangers in driving, and to the awareness and responsibility for driving decisions;			x											
77	Increasing the number of road safety questions in the theory test for drivers candidates, for driving instructor and professional drivers;			x											
78	Develop the driving test monitoring project and increase the focus on driver attitudes and behaviour in the practical test;			x											
79	To accompany and raise the awareness of training entities for driving instruction professionals and professional drivers on the need to reinforce in their training the transmission of programmatic content on road safety;			x											
80	To develop an IT tool to provide specific training and information content for drivers, for the purpose of (voluntary) refresher courses;			x											
81	To increase IMT's intervention and response capacity in terms of psychological evaluation of drivers;	x		x									x		
82	Promote references to support the physical, mental and psychological assessment of drivers.			x									x		
83	Promote the improvement of the national road network;		x												
84	Encourage technological capacity building in road infrastructure;		x												
85	Preparing the infrastructure for autonomous and connected vehicles;		x												
86	Promoting better integration of infrastructure management with victim assistance and support.		x												

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
87	Promote the safety conditions of roadways by auditing projects and inspecting roads, through:		x												
88	The effective implementation, within IMT's scope of action, of the decree (to be published) regarding the certification of training entities, the certification/recognition of courses and other road safety training actions, and the certification and registration of Road Safety Auditors;		x												
89	the transposition and implementation of Directive (EU) 2019/1936 of the Parliament and of the Council of 23/10/2019 on Road Infrastructure Safety Management, enhancing and encouraging the implementation of road safety management procedures both on Trans-European Network roads (already mandatory) and on other roads in the National Road Network.	x	x												
90	Promote C-ITS infrastructure capacity building, either through its own resources or through European funding programmes promoted by public partners, to ensure that vehicles - not in the distant future, but in the near future - are able to communicate with the infrastructure and vice-versa, since C-ITS services, especially those of day 1 and 1.5, but also those of the future (day 2), will certainly have positive impacts on road safety.		x								x				
91	Implement the regulation for permission to test connected and autonomous vehicles, since autonomous and connected driving will produce benefits in terms of road safety, and here with a special focus on the selection of the sections of infrastructure considered suitable, and their progressive evolution, as European and national regulations evolve.		x												
92	Promote the possible evolution of the eCall system already implemented in Portugal, with integration in the traffic control centres of the road infrastructure managers, in order to provide better and faster emergency/signalling services and information dissemination, also enhancing the communication of the infrastructure with the vehicle.		x								x				
93	Implement technical inspection of motorbikes, tricycles and quadricycles with an engine capacity greater than 125 cm3, through CITVs;					x							x		
94	Implement mandatory periodic inspection for agricultural tractors and their trailers;					x							x		
95	To encourage the installation of 3-point safety belts in seats of buses from categories II and III;					x						x			
96	To regulate the conditions of approval and circulation of mobility devices, which are not covered by European regulations in the area of road vehicles.					x									
97	Awareness campaign on the risks associated with distracted driving ("THE BEST SAFETY IS OUR BRAIN. DON'T DISTRACT IT.")			x											
98	Awareness campaign for drivers in general regarding the potential reduction in capacity (physical, mental and psychological) to drive safely, in particular from the effects associated with the pandemic caused by COVID19.			x											
99	Communication and awareness campaigns for specific risk groups, namely young people, the elderly, motorbike drivers, due to the number of accidents in these groups / Campaign re-launching.			x											
100	Campaign to raise awareness of the risks associated with speeding/over-speeding / Relaunch campaign.			x	x										
101	Campaign to raise awareness of the risks associated with driving under the influence of alcohol and psychotropic substances / Relaunching the campaign.			x											
102	Awareness-raising campaigns targeting the drivers of two-wheeled vehicles /			x											

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
103	Holding a television competition similar to what happens in Spain, in the programme produced by TVE called "Arranca en Verde" https://www.rtve.es/rtve/20180226/1-estrena-arranca-verde-concurso-sobre- seguridad-vial-presentado-sara-escudero/1684728.shtml - a weekly interactive competition, in which a guest (public figure) is asked questions related to road safety, with the simultaneous and active participation of the viewer, with the aim of playfully disseminating traffic rules and raising awareness of road prevention.			x											
104	Periodic and regular awareness-raising campaigns in the media, in partnership with ANSR, regarding the correct use of vehicles and accessories: speed, loading, reflectors, tyres, fitting child seats			x	x										
105	Project "Road Safety Ambassadors" who, in a voluntary and committed way, get involved in actions that help reduce the number of deaths and serious injuries on the roads (e.g. on-site actions with peers to dissuade driving under the influence of alcohol and/or drugs).			x											
106	Reach out to young new drivers as this is a facilitating age group for identifying with peers and because of the receptiveness that young people have for getting involved in this type of project.			x											
107	Peer education programmes, raising awareness of the consequences of inappropriate behaviour, namely arising from factors such as age and gender, age and peer group motivations, lifestyle, alcohol and drug habits, speed and the use of mobile phones or similar (e.g. "Close To", with the aim of reducing the typical risks of the 17 - 24 age group and recidivism, and at the same time preventing risks for other young people and future drivers).			x											
108	To follow up on drivers' driving after qualification (follow-up), through forums/discussions that allow for sharing of experiences, namely difficulties in driving and accidents during the first 2/3 years, identifying common risk factors and safer driving decisions for all. Involving, namely, Road Safety Ambassadors and recent graduates.			x											
109	Develop/increase data interoperability, namely with regard to the driver's cycle, so that the various entities intervening in this cycle may interact effectively and efficiently in the exchange of information			x											
110	Generalised speed control, through a very extensive coverage of the national road network by radars, making it possible to establish a culture of respect for speed limits;				x										
111	Very extensive control of the weights of heavy goods vehicles, with repercussions not only on road safety but also on the conservation state of the infrastructure.		x			x									
112	Collaborate in the development of a communication strategy, from the prioritised selection of the themes to be addressed (speeding, fatigue, alcohol, mobile phone use, drugs, ...), to the segmentation of the target groups by identifying their motivations and their vulnerabilities, developing the brief/s for the selection of advertising and media agencies.			x											
113	Identify each target group, i.e. groups of people who share some key characteristics.			x											
114	To identify motivations and beliefs, which may be the genesis of approaches to generate behavioural change			x											
115	Development of a detailed brief on the objectives, target group, core strategy and supporting rationales, enabling creative agencies to develop campaigns			x											
116	Pre-test of the developed campaign: 1. attention; 2. impact; 3. affinity; 4. behavioural change;			x											

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
117	Development of a detailed briefing on the objectives, target group, core strategy and supporting rationales, allowing media agencies to select the media considered most effective to achieve the desired coverage and frequency			x											
118	Supervision of the production of advertising pieces			x									x		
119	Use of quantitative studies to assess the effectiveness of the campaign on the target group			x									x	x	
120	Road safety statistics to assess the real impact of changing behaviour			x										x	
121	The legislation should implement motivational systems rather than dissuasive systems which are quite commonplace and have proven their limitations in terms of preventing road accidents.	x													
122	Studying and preventing the causes that lead drivers to break the law, instead of strengthening measures that only trivialise and further aggravate punishment, is an important step towards prevention and the change of mentality that is being sought.													x	
123	Data analysis is an important step in any decision-making process, obtaining more and better data is therefore a priority for any management system, however, so that such information represents an effective contribution to the reinforcement of the goals outlined, it is essential to ensure a precise data analysis capable of providing assertive answers. This means developing research focused on the solution to the problem and not just on the problem itself.													x	
124	It is crucial that we have access to the causes of accidents, and tools specially designed for that purpose must be developed. To facilitate the access to the reading and interpretation of data, it is important that such data be standardized according to certain criteria, so that they are relevant and can ensure assertive decision-making in the prevention of road accidents. This includes segmenting and grouping all available information from all intervening entities.													x	
125	Car insurance companies play a crucial role in the settlement of claims and in the processing of claims data and are also the first to benefit from the reduction of road fatalities. These agents can make an important contribution by sharing information that identifies the causes of accidents and enriches statistical analyses used to define strategies and develop effective actions to prevent road accidents and consequently reduce the number of victims on the road.			x										x	
126	The focus should be on the study of the causes of accidents and preventive measures should be centred at the level of the main causal ingredients. The non-disclosure of the concrete causes of claims opens room for all kinds of speculation and implementation of inappropriate measures. The construction, direction and conclusion of the analysis of the causal ingredients of accidents should be obtained and shared with all stakeholders.													x	
127	ANSR's accident reports of 2020 no longer contain important data that allow us to assess the evolution of accidents in two-wheeled motor vehicles, namely the total number of deaths, serious injuries and light injuries of this category of users. It is important to re-disclose this data because without it we cannot accurately assess the evolution and outcome of the implementation of preventive measures to combat accidents involving two-wheeled motor vehicles.									x					
128	Professional motorbike driving instructors, should provide practical evidence of extensive motorbike experience and not mostly theoretical knowledge of little relevance to the practice of driving 2-wheeled vehicles.			x						x					

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
129	Still within the scope of the practical teaching of driving, we believe that it would be beneficial to allocate part of the revenue obtained through traffic infractions to finance projects aimed at teaching defensive driving courses accessible to all and training actions adapted to the needs that aim to mitigate the main causes of accidents and infractions.	x		x											
130	Healthy road coexistence where everyone respects each other is essential in terms of safety, especially when there are users circulating in vehicles that are characterised by their fragility. Road safety campaigns to promote and encourage this good coexistence and respect among all users are a priority.		x												
131	Basic road safety knowledge should be taught from primary school age (6 years old), with a special focus on pedestrian behaviour;		x					x							
132	VAT reduction on mandatory and recommended safety equipment for users of two-wheeled motor vehicles would be an added value to prevent serious consequences in case of accidents or even death.	x								x					
133	The use of cement-treated materials in the pavement layers of any surface should be avoided as these give rise to shrinkage, hardening or thermal cracking of these layers on the pavement surface, with the consequent problems of safety, inconvenience for the user and damage to vehicles, as well as the entry of water into the pavement and deterioration of the wear layer. The use of slippery materials to cover cracks in pavements should also be avoided. Although in four-wheeled vehicles it is not so evident, in a two-wheeled vehicle it is a factor of great instability that may even lead to loss of control.		x							x					
134	To combat this causal ingredient of accidents, there are some roads which, in their wear layer, i.e. the layer that comes into direct contact with traffic, employ asphalt drainage mixtures or discontinuous mixtures that are designed in such a way as to confer an important number of voids in them, eliminating or reducing some of the aggregate fractions.		x							x					
135	In order to eliminate this problem, it is necessary to ensure that the road markings signs is done exclusively with fluorescent paints and with an anti-slip characteristic with high adherence and mechanical resistance.		x							x					
136	The installation of deceleration humps in the middle of a curve (Figure 3) and/or braking zone is a serious planning error that shows total disregard for the factors that most influence the braking ability of any wheeled vehicle. Placing the humps precisely where the contact of the car tyres with the road surface is most critical is a reason for the loss of stability of any wheeled vehicle. If humps are to help reduce braking distance as much as possible while maintaining stability and directional control of the vehicle, they must be removed from braking places and curves. It is paramount that non-slip surface braking areas are considered and that the humps are moved to the areas prior to these areas.		x							x					
137	The lack of adherence of expansion joints in bridges and viaducts (figure 4) is another problem that leads to loss of adherence of tyres to the ground. There are many cases of accidents in two-wheeled motor vehicles caused by the lack of signalling of these joints and their lack of adherence to the tyres, especially when they are placed in curves or braking areas. These high risk zones should be eliminated by means of horizontal signalling (similar to what is done with some speed humps) and by the use of non-slip materials in the joints.		x							x					

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
138	There is a serious failure in the identification and listing of risk locations where the application of safety barriers to unprotected rails is required. To this end, it is important to know who is responsible, namely: the identification of high risk zones related to this problem; the list of protection devices on the safety rails already applied on the roads, to date; the planned schedule for placing the remaining protections on the safety rails; the application of the sanctions referred to in article 6 of Law 33/2004 for non-compliance with the same.		x							x					
139	The delimitation of urban space in order to avoid the misuse of spaces which are not authorized for vehicles, has motivated municipalities throughout all the country to install in an intensive way vertical metallic beacons. Regardless of its justification in the management of urban spaces, the use of devices on roads cannot disregard the safety factor for some categories of users of these roads. Users of two-wheeled vehicles (with or without motor) are by nature the most exposed to road equipment, whose characteristics may become counterproductive and even quite dangerous in the event of an accident. Whatever their profile, this type of equipment makes urban roads particularly unsafe for cyclists and motorcyclists.		x							x					
140	The installation of equipment on public roads must not pose a threat that endangers the lives of road users. There are beacons made of plastic derivatives which, due to their flexibility, prevent physical damage and return to their original shape after a shock.		x			x				x					
141	It is crucial to consider the negative consequences that the installation of these devices represents to all road users. Priority must be given to the safety of road users, and prevention urges the removal of these metal beacons, the dangerous nature of which is well illustrated in the photos.		x			x			x	x					
142	A short-term measure with immediate effect in reducing the increased risk posed by travelling on busier and less safe roads is the creation of a fair motorbike toll class to encourage more motorcyclists to choose to travel on less busy and safer roads.	x	x						x						
143	Considering the weight, volume and wear and tear the motorbike causes on the road, the way motorcyclists are charged is unfair. Thus, respecting the existing criteria for defining toll classes, it is only fair to create a Class 5 (MOTORCYCLES) worth less than 50% of the value of Class 1 (light cars).	x							x						
144	Build the capacity of organisations and key professionals involved in road risk assessment and management	x											x		
145	Elaborate a training programme and promote/support the realisation of training actions for municipal technicians with responsibility for mobility and traffic planning and management	x													
146	Create a rapid, effective and reliable system for collecting, processing and consulting relevant information												x	x	
147	Create a dynamic online platform that makes it possible to consult statistical information on road accidents (with the possibility of different disaggregation and crossing of variables, for example, by age, mode of transport and geographical context)												x	x	
148	To develop convenience studies associated with different risk factors (e.g. mobile phone use, use of restraint systems, alcohol consumption, speed) and on the direct and indirect environmental impacts of excessive car use (including those associated with environmental pollution and sedentary lifestyles)													x	

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
149	Setting up a multidisciplinary group for investigating road accidents												x	x	
150	Ensure the adequacy, updating and enforcement of relevant legislation	x													
151	Review and update legislation on the Collective Transport of Children	x										x			
152	Introduce in legislation: the mandatory use of Child Restraint Systems in taxis (at least on some routes); the mandatory use of helmets by children and adolescents when cycling; the prohibition of the use of booster seats before 125 cm; the responsibility of the driver in terms of the burden of proof in collision situations involving children and adolescents (pedestrians or cyclists)			x				x	x						
153	Create a "working group" responsible for analysing and discussing the application of existing legislation in order to guarantee its homogeneous interpretation and application (example: Law of Public Transport of Children, Article 55 of the Highway Code). This group should be able to issue binding opinions or interpretative documents	x											x		
154	Promote and encourage initiatives that promote active mobility as the predominant mode of daily travel			x				x	x						
155	Support initiatives already underway that promote active mobility (e.g., Sigapé/APSI project; Ciclo Expresso do Oriente initiative)			x				x	x						
156	Elaborate and disseminate to municipalities a National Programme/Plan for the promotion of the use of soft modes of transport	x						x	x						
157	Create a network of municipalities (similar to the Portuguese Healthy Cities Network or Child-Friendly Cities) adherent to this programme	x						x	x						
158	OP. Promote and encourage initiatives that promote the definitive and/or temporary occupation of public space							x	x						
159	Support initiatives already underway that promote the occupation of public space (e.g., playstreets - see the Brincapé/APSI project; parklets - see the Bicicultura initiative)							x	x						
160	Creating an accessible, inclusive, and multimodal urban public transport network											x			
161	Create a continuous, safe, convenient, and inclusive pedestrian network around educational establishments			x				x							
162	Design and disseminate to local authorities a Manual of Good Practices for the promotion of safe mobility of children and adolescents in educational establishments	x						x							
163	Road risk assessment in educational establishments												x		
164	Promote the creation of zones 20 and 30 near educational establishments and residential areas				x			x							
165	Define a minimum critical zone around educational establishments free of motor vehicle circulation or with significant restrictions on their speed (through traffic calming measures) and parking				x			x							
166	Promote road citizenship education for children and young people			x											
167	Promote the use of ANSR's Digital Educational Resources on Road Safety, "Júnior Seguro"			x											
168	Support children and youth education initiatives already underway (e.g., promoted by APSI, A-CAM, Estrada Viva, Gare, Mubi)			x											
169	Elaborate a training programme for teachers and early childhood educators and promote/support the realisation of training actions for these professionals			x											
170	Elaborate a training programme for higher education students attending courses with access to professions in the area of mobility and traffic planning and management (engineering, architecture) and promote/support the realisation of these training actions			x											x
171	Encourage the participation of young people in defining and implementing road risk reduction measures			x											

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
172	Create in Portugal a similar initiative or articulation with Youth for Road Safety			x											
173	Encourage the participation of civil society in defining measures to tackle road risk			x											
174	Promote the correct and systematic use of seatbelts and restraint systems by children and young people			x											
175	To draw up a training programme for law enforcement officers and driving instructors and promote/support the holding of training sessions for these professionals														x
176	Introduce in the vehicle inspection the verification of the correct installation of Child Restraint Systems (CRS)			x		x									
177	Draw up a training programme for vehicle inspectors to verify the correct installation of CRSs and support/promote these training actions			x		x									
178	Creating an integrated support system for victims of road accidents	x											x		
	Create an integrated network to provide psychological, social, and legal support to the victims of road accidents and their families, including the creation of specific telephone lines, local social support, lawyers specialised in defending the traumatised person, therapeutic support for the traumatised person and their family, and support in the area of rehabilitation and social reinsertion	x													
180	Define protocols for pre-hospital and hospital care of children and adolescents with road trauma, particularly cranioencephalic and vertebro-medullary trauma						x								
181	Training the population to provide first aid						x								
182	Integrate first aid training into the mandatory syllabus of the training for obtaining a driving licence						x								
183	Create education benchmarks for all levels of education for first aid related content						x								
184	Promote and support training courses on first aid for the general population						x								
185	Strategic - To promote education and training for the development of a Road Safety Culture in articulation with the framework in which the National Strategy for Education for Citizenship is developed.			x											
186	Operational Objective 1- Create a bank of didactic and pedagogical resources aimed at students attending the various cycles and levels of education and teaching;			x											x
187	Operational Objective 2- Encourage the creation of networks of schools that develop road safety education projects;	x		x											
188	Operational Objective 3 - Foster spaces and diverse modalities of training in Road Safety. "			x											
189	To know and disseminate statistics on Road Accidents occurring in the context of work or home-work commuting, to allow the creation of indicators for monitoring and management;												x	x	
190	To know and disseminate the characteristics, causes, and circumstances at the origin of these accidents (in the context of work or home-work commuting) and their consequences as a tool to support the creation of public campaigns/policies that enable safer users/infrastructure and/or vehicles.												x	x	
191	Know and disclose the time (hour, day, month) and geographical (municipality) location where most accidents occur to adjust the response to the demand for immediate assistance services;												x	x	
192	Knowing and publicising the consequences of accidents to be able to tailor the response to victims' needs.												x	x	
194	Operational objective: deepen road safety education in school curricula and driver training/certification			x											x

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
195	Operational objective: Set up pilot teams to assess the root causes of road fatalities and serious injuries in "black spots".												x	x	
196	Operational objective: revitalise and evaluate programmes and campaigns to prevent accidents and raise road safety awareness.												x		
197	Operational objective: to promote the investigation of road accidents caused by human factors on national territory.													x	
198	Operational objective: create incentives for the purchase of vehicles with driving assistance, prevention and protection technology in an accident.					x									
199	Operational objective: to establish accredited bodies for the medical and psychological assessment of drivers.	x		x											
200	Operational objective: incorporate techniques to change attitudes and behaviours in road safety training actions.			x											x
201	Operational objective: continue surveillance actions, mainly focused on the areas of most significant risk.		x												
203	We should look at other strategies: Spain is a good example	x													
204	Specific problems that need to be addressed: pedestrians, goods transport vehicles (driven by professionals), motorbikes and mopeds (the previous PENSE2020 was not sufficiently focused on them), bicycles (a growing problem). Agricultural tractors are still a problem in Portugal					x		x							
205	Road signs and road markings are problems. Traffic speed is important to reduce the number of fatalities,. The 30 km/h speed limit should be implemented as soon as possible.														
206	Enforcement is essential to change driver behaviour, such as speed limits and alcohol														
207	Multidisciplinary teams to analyse accidents. More data involving the causes of accidents is needed														
208	As qualifying training actions, drivers should attend the training action "Driving and operating the tractor safely (COTS), of 35 hours, provided in paragraph d) of Article 2, of Order 3232/2017, of 18-02, or the Short Duration Training Unit (UFCD) 9596, of the National Qualifications Catalogue, of 50 hours; The training actions should be taught by entities previously certified as training entities, being the training actions approved and the trainees evaluated, as provided in art.In Portugal, about half of the tractors in circulation on the road have no protective structure - safety arch, safety frame, or cab - or restraint systems because they are not mandatory. Moreover, these tractors are unlikely to be replaced or be subject to legislation that makes it mandatory to install these structures that protect the driver in cases of overturning;														
209	Technological innovation: the high number of old tractors deserves special attention, and a programme of renewal and re-equipment of agricultural holdings should be encouraged for the modernisation of tractors at a national level, namely with positive incentives that encourage the scrapping of old tractors, without protective structures, in exchange for new and safer tractors. Through the Ministry of Agriculture, the State and producer organizations, through the Agricultural and Forestry Advisory System, have an important role here with technical information, training, and advice for agricultural and forestry producers. It should play a central role in presenting the best options, which may contribute to greater profitability and efficiency of use, faster amortization, and more regular replacement, to accompany the evolution of safety and technology, and may contribute to reducing the number of tractors in use/circulation in our Country;														

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210	legislative amendments to encourage the mandatory installation of protective structures and restraint systems on all tractors and their inspection to ensure the verification, maintenance, installation, and operation of signs, namely light-signalling devices (rotating beacons). The agricultural vehicles, similarly to the legal framework of the Azores archipelago, should have the legislative framework to make compulsory the periodic inspection, to ensure the regular maintenance of the tractor, the verifications of the functioning of the signaling, the state of conservation of the protective structures, tyres, brakes (two), accelerators (two), clutches and working organs (hydraulic lifting system, power take-off, pull bar and hydraulic pressure taps). During this inspection, the structures which enable the machine to be balanced should be assessed, namely by the distribution of masses (water on wheels, front weights, wheel weights, etc.);														
211	legislation needs to be revised, particularly concerning the presence and use/functioning of slow-moving signs (known as rotating beacons), the legal framework of which should make installation and use obligatory whenever the farm vehicle is on the road (fines are provided for both situations - presence and use). Many users remove the signalling, as the legislator has provided penalties for failure to use the light signalling on public roads but omitted to penalise failure to install it.														
212	The planning of the inspection should, among other things, reflect the knowledge of the accident rate and should focus on legal qualification, the use of protective structures in the active position and the use of seat belts (if present on the machine), on the connection of the two brakes on the road to avoid the risk of overturning and on the transport of passengers in the agricultural vehicle, especially in the stirrup and mudguards. The transport of passengers (agricultural workers) is regulated by Decree-Law 221/2004, of 18-11. Given the high number of agricultural vehicles without protective structures and restraint systems, these drivers, who are generally very elderly, should be made aware of the risks of driving these tractors;														
213	To introduce tax benefits for those who choose to purchase vehicles equipped with active and passive safety systems or reach the highest levels of the European New Car Assessment Programme (Euro NCAP).														
214	To introduce speed limitation systems in vehicles, with reference to the values allowed for circulation in each country.														
215	Ensure that drivers are trained and up-to-date, ensuring that they are able to use vehicles equipped with new technologies to support driving, as and when they appear on the market.														
216	Instil in drivers the habit of reading the vehicle's instruction manual to ensure that they know the functionalities and limitations of the systems.														
217	make it compulsory for the vendor to give a practical presentation/demonstration of the vehicle's systems at the time of delivery of the vehicle														
218	Vehicles used in such systems should be provided with a document that briefly describes the safety devices fitted to the vehicle and enables the driver to adapt their driving behaviour.														
219	Rate the safety of roads (or stretches of road) from 1 to 5 stars. In this way, the driver can choose to use the safest road.														

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220	Improving the performance of road markings and vertical road signs, including their placement, visibility, and retro-reflectivity														
221	Reduce the average speed on our roads, particularly those through villages;														
222	Implement urban planning rules for the construction of new residential areas (neighbourhoods), which require the creation of parallel access roads and prevent direct entry/exit from housing onto the road.														
223	Ensure that drivers respect the legal limit for driving under the influence of these substances;														
224	Creates conditions for all establishments authorised to sell alcoholic beverages to provide their customers with free equipment to measure the blood alcohol level														
225	Discourage the use of mobile devices while driving.														
226	Ensure that all occupants of four-wheeled vehicles are wearing seatbelts properly, particularly in the rear seats;														
227	Ensure that all drivers and passengers of two-wheeled motor vehicles wear an approved helmet that is properly fitted and fastened;														
228	Ensure that no child under 135 cm in height and under 12 years of age is travelling without a suitable restraint system;														
229	Encourage cyclists to wear helmets, particularly when riding outside cycle paths.														
230	Invest in campaigns that encourage users of scooters and bicycles to respect road rules and promote the peaceful sharing of road space and safeguard the safety of other road users.														
231	Completion of the regulation process of the Legal Regime for Driving Education, publishing the legislation missing since 2014, so that its full implementation is possible;														
232	Publication of the ordinance that regulates the training of driving school instructors and directors, adapting them to the legislation in force;														
233	Creating a rule to allow drivers who, by choice, have taken a practical test in an automatic gearbox vehicle to remove restriction 78 (automatic gearbox) from their driving licence by taking the training and test in a manual gearbox vehicle;														
234	Creation of regulations guaranteeing that driving agricultural vehicles on public roads depends on prior training in a driving school and passing a specific driving test, thus extinguishing the possibility of driving this type of vehicle by "equivalence";														
235	Introduction of Advanced Driver Support Systems (ADAS) in the syllabus of driver training, so that new drivers are aware of the functionalities and limitations of the technologies equipping the vehicles currently in circulation;														
236	Implementing the monitoring of the practical driving test, introducing a system that allows the automatic recording of the duration and route taken, the faults committed by the candidate and the place where they occurred, using tablet-type equipment for this purpose;														
237	Updating of the practical test report model, adapting it to the legislation in force, and filling in the device indicated in the previous sub-paragraph;														
238	Implementation of measures to prevent/minimise examination fraud, namely: Installation of equipment that inhibits communication with the outside (cameras, mobile phones, smartwatches, etc.); Creation of procedures to prevent the access of another person to the examination papers														

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239	The fact that theoretical tests are carried out using translators (hired by the trainees) raises strong suspicions about the system's seriousness. Therefore, the test with translators should be eliminated, making it possible to answer the test in other languages on the computer, as in other European countries.														
240	Completion of the examination procedures manual (in preparation since 2015) to promote uniformity of assessment criteria														
241	Categories AM, A1, A2, A, and BE can be obtained by self-practice. These candidates train alone on the public highway, without any support or specialised guidance. Apart from the obvious risk to safety (their own and others), they commit a severe offence every time they do so. For this reason, obtaining these categories should always depend on training and accompaniment to the examination by a driving school;														
242	The driving of two-wheeled motor vehicles will now require specific training and a driving test, and the possibility of driving category AM and A1 vehicles simply because one is qualified to drive category B will be removed;														
243	the possibility of direct access to category A should be removed, and a system of gradual and sequential access should be introduced (A1, A2, A), enabling drivers to gain experience on less powerful motorbikes, thus helping to reduce the number of deaths on this type of vehicle														
244	Drivers must now attend training to update their knowledge on traffic rules, road signs and signals, new technologies, and other critical aspects of driving regularly.														
245	Set up multidisciplinary teams to investigate serious road accidents, identify their causes, and recommend and implement concrete preventive measures to continuously improve road system safety.														
246	Define cooperation protocols with entities related to the different disciplinary and sectorial areas.														
247	Define applicable scientific and technical analysis models and training of specialists.														
248	Build a computer platform for data compilation and analysis.														
249	Analyse compiled data and advocacy of preventive measures.														
250	Application of preventive measures and evaluation of results.														
251	In the case of illicit narcotic or psychotropic substances, it will be important to assess the impact of introducing random checks on monitoring, the use of saliva samples in screening and confirmatory toxicological analyses. Also, threshold concentrations and behavioural testing on the legal framework for positive cases.														
252	In the case of medicines, the therapeutic use of which may be compatible with driving, it will be important to define the drugs, therapeutic concentration intervals, and clinical framework to be considered in the context of monitoring. Specialists should carry out this study in the health area (medicine, psychology, pharmacy) regarding the potential effects of the drugs with an impact on driving performance and in the operational area (GNR, PSP, INMLCF) regarding the ability to detect the substances defined.														
253	Improving the collection and analysis of road accident data and its monitoring, enabling the development of new road safety measures.														
254	Analyse and investigate the causes and consequences of accidents and possibilities of minimising them.														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
255	Stepping up enforcement of the Highway Code, verifying and deterring infractions in a more efficient manner, where the widespread adoption of electronic traffic control instruments is critical and will perhaps be among the measures with the most significant short-term impact.														
256	Specific enforcement and user information campaigns. These include, in particular, information and awareness-raising actions for car drivers, but also for young people, senior citizens, motorcyclists, users of soft modes of transport, and cyclists.														
257	Adoption and creation of technical standards for the protection of vulnerable road users, with the "Street Design Manual" produced by CML being a contribution in this sense.														
258	Suitable infrastructures need to be promoted, designed, and standardized to increase the safety of cyclists and other vulnerable road users. There are no national standards, so the municipality of Lisbon has attempted to standardise its proposals in this area in line with international best practices.														
259	RST does not respond to the current needs of cities, being neither adjusted to the model of public space, with less dependence on vertical signs (which compromises the circulation of pedestrians in particular of reduced mobility), nor adjusted to the protection of vulnerable users in the road space (in particular cyclists).														
260	Education for conscious and sustainable mobility, which points to the choice of more rational options from the point of view of road safety and environmental protection, as well as the training of road users, focusing on two aspects: the continuous training of professional and non-professional drivers and, also very relevant, the training of the non-professional population (namely children and the elderly/senior citizens whose mobility is conditioned by age).														
261	At the school level, there are ways to increase the autonomy of children, either through specific training or through a thorough review of the circulation conditions and road requirements in the surroundings of these facilities.														
262	Adoption of measures aimed at protecting vulnerable road users, such as motorbike and moped drivers, cyclists, and pedestrians, especially in an urban environment, as is the case of Lisbon, and given the growth in the daily use of two-wheeled motor vehicles as a result of the European Directive, the difficulties of parking and the ease of their circulation in the city.														
263	Safety and consequence of accidents associated with mopeds/motorcycles are relevant, and improvements in this field could be linked to type approval, integrated safety devices (e.g., airbags), possible vehicle performance inhibitors, and equipment and clothing for drivers (and passengers).														
264	Promoting the use of modern technologies to enhance road safety has an important effect on road safety. The widespread adoption of incident detection systems, notably Collision Warning and Pedestrian Recognition Systems with automatic braking, can be instrumental in reducing accidents and their effect in urban environments and inhibiting excessive speed. Retrofitting these advanced driver assistance systems to newer vehicles in the current car fleet should be considered.														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
265	Speeding is the most relevant factor in accidents and their impact on human health. It is important to highlight the benefit that the introduction and mandatory use of Intelligent Speed Assistance (ISA) equipment in vehicles will have, especially if it forces speed limitation to the levels defined by law. The message from the Portuguese State to the European Commission on this matter should be particularly unmistakable and clear, creating increasing forms of control of abusive behaviour through V2I systems.														
266	Strategic Plan for Road Safety 2021-2030 - Vision Zero 2030 aimed at creating legislation that goes beyond the European directives to force the use of these solutions, to ensure that speed limits in urban areas are effectively respected since the law and its monitoring alone have proved insufficient.														
267	Financing and supporting the implementation of objectives and subsequent measures and actions that may be proposed within the scope of the Strategic Plan for Road Safety 2021-2030 - Vision Zero 2030, namely those that fall within the scope of municipalities' actions.														
268	The Municipal Police must be considered one of the relevant entities to pursue the objectives, measures, and actions that may be defined, given their responsibilities in terms of regularisation, traffic control, and road parking.														
269	Promote a gradual transition from the Highway Code to the Street Code (Code de la Rue in Belgium and France or Straatcode in the Netherlands), where the public highway is highlighted not only as a space dedicated to the function of traffic and circulation but rather as a space for enjoyment and coexistence, incorporating all users, with special relevance to the most vulnerable, allowing them to move safely, regardless of their age or physical ability.														
270	Include the concept of Zone 30, as specially conditioned circulation areas intended primarily for pedestrians, where the maximum speed of vehicles is set at 30 km/h. In these zones, pedestrians should be able to cross the road outside signalized locations but should ensure they can do so without undue risk or hindrance, and there is no need to implement formalized pedestrian crossings in these zones.														
271	Review the concept of vulnerable users, defining a hierarchy in favour of pedestrians, and directly associating the concept with the various cases of sharing spaces, namely coexistence zones and compulsory lanes for pedestrians and cyclists.														
272	Encourage the drafting of Sustainable Urban Mobility Plans (SUMPs) that promote sustainable modes of travel, in accordance with the European Commission's SUMP Guidelines and existing national and European strategies on mobility, climate change, and carbon neutrality, which enable a holistic vision of the territory, without losing their essential focus on improving the quality of urban life, public health, and citizen safety.														
273	Legislate that Municipal Road Safety Plans must be drawn up, regularly updated, and monitored, always taking into account information on all types of accidents, whether with or without victims, to eliminate all existing points of friction in public spaces.														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
274	Encourage the inclusion, in the legal instruments associated with territorial planning, of the obligation to carry out Mobility Plans for Companies and Major Transport Generating Centres in order to find solutions that minimise car use and parking needs in these locations. A reduction in car use may be directly associated with a reduction in traffic in cities and towns with benefits not only for decarbonisation, but also for reducing road accidents.														
275	Establish proximity urbanism as a fundamental element of territorial planning instruments. Proximity urbanism is one of the central pillars in ensuring sustainable mobility, promoting a humanised urban design, less prone to road accidents, developed for people and not for the motor vehicle, and local decision-makers should invest in measures that ensure compact cities with mixed land uses.														
276	The implementation of corrective measures should focus on revising the urban planning in force to encourage the proliferation of local commerce and services and minimise the need to use individual motorised transport through an articulated set of global actions.														
277	Promote the Traffic Signal Regulations (RST) revision, incorporating more exhaustively the matters related to the cycling mode, particularly concerning vertical and horizontal signalling. In the last revision of the RST the opportunity was lost to, among others introduce bikeboxes and their concept, encouraging, in cases regulated by semaphore signaling, that the green signal for the cyclist is anticipated in relation to that of the car driver; introduce protected left-turn boxes for cyclists; introduce the symbology of sharing lane with car (sharrow) and its consequences for users; reduce visual pollution in urban areas, providing for the possibility of inserting signs for cyclists, usually vertical ones, as horizontal markings on the pavement, remaining with legal validity; incorporate the symbolism marking the directions of bicycle traffic on the pavement; introduce or review vertical signs and the respective rules/concepts (when applicable), namely the sign forcing the cyclist to dismount from the bicycle; the no exit lane sign except for cyclists and/or pedestrians; the sign informing of beginning and end of lane reserved for cyclists; the sign informing of double direction cycling; the sign allowing bicycles to circulate in counterflow; the sign (and rule) that makes it possible for cyclists to pass through a red light when turning right and when going straight ahead, but they should give way to pedestrians and other vehicles in circulation. Provide appropriate signage when it is not possible to apply it.														
278	Change the maximum speed of circulation within the localities from 50km/h to 30km/h, with physical measures for traffic calming, due to the high number of pedestrian collisions and accidents that have occurred. Thus enhancing a reduction in the accident rate and severity of accidents, but also reducing the emission of pollutant gases and noise pollution, and, on the other hand, increasing the various possibilities for humanisation of the territories.														
279	Consider increasing penalties, possibly criminalizing them (as is the case with drunken driving with a BAC of 1.2 g/l or more) and strengthening controls on speeding, since statistics show that a high percentage of accidents occur in good weather, in broad daylight, on well maintained roads and, naturally, at excessive speed.														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
280	Define the obligation of action plans to maintain vertical signs and road markings that allow for a reduction in the high number of abnormal situations, namely regarding their placement, visibility, and retro-reflectivity.														
281	Create a manual to support the design of cycle paths, which clearly defines the rules for the creation and dimensioning of cycle lanes, cycle crossings, signalling at roundabouts, junctions and intersections (with special emphasis on the standardisation of road colouring, with special emphasis on conflict points between modes), guiding designers and, at the same time, standardising the characteristics, (including those for the safety of all road users) of cycle paths at national level.														
282	Reinforce the importance of rigorous and effective design of pedestrian crossings through the creation of a specific manual to support the sizing and location of pedestrian crossings and other safety standards associated with pedestrians in urban public space, namely their correct positioning on the public thoroughfare, the use of podotactile paving in accordance with Portuguese standards in force and sizing by Decree-Law 163/2006, of 8 August, also encouraging their application.														
283	To obtain and analyse evidence-based information on people's behaviour in the road system: to identify the types of errors that drivers and other participants in the traffic system make; to define the effects of such errors on the road system; to define measures to prevent these errors.														
284	To define the methods and resources needed to increase the self-awareness of drivers and other participants in the road environment.														
285	Define the methods and resources needed to provide users with feedback on the safety of their behaviour.														
286	Investigating and analysing new behaviours and ways in which users interact with vehicles and road environments in the light of new intelligent and automated technological tools and systems.														
287	To provide other stakeholders with clear qualitative and quantitative information on users' capabilities, performance, and cognitive limitations according to the current contextual conditions (in the vehicle, the infrastructure, and the context of use).														
288	Include evidence-based knowledge concerning users (performance, interaction, and safety indicators) in the implementation, regulation, and certification processes of new intelligent solutions and cooperative systems in road infrastructures and vehicles (involving vehicle-environment-human interaction, environmental impact).														
289	Define procedures for working with the general public to promote responsible behaviour and attitudinal change, in collaboration with regulators, civil and community movements.														
290	Define lifelong education and training procedures for all users involved in the road system, not only at the initiation level but also on preparation for the technological transformation that the road ecosystem is undergoing.														
291	Promote the adoption of driving support systems														
292	Promote the adoption of Ecoconduction systems														
293	Promote the adoption of information systems for predictive maintenance of vehicles														
294	Investigating the causes of potentially more serious accidents (frontal collisions and pedestrian collisions) by analysing images taken by frontal video cameras installed in vehicles														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
295	Apply automatic emergency braking, or automatic reduction, when an obstacle is detected in front of the vehicle, and it is not possible to stop before impact if the speed is maintained (imminent risk of collision)														
296	Driving event recording system, with frontal image recording, of the last few seconds, in relation to the event generated (events: sudden accelerations, heavy braking,														
297	Lateral accelerations, drifting off course when crossing continuous road marks, failure to observe the set maximum speed, activation of the automatic braking system, etc.)														
298	Promotion of direct and indirect vision by the driver (blind spot warning system) through the installation of side and rear sensors to warn the driver of the risk of side collision, manoeuvring or changing lanes														
299	Adoption of exterior mirrors with blind spot hazard warning. Camera-based rear-view mirror system, with image processing, which minimises the risk of glare at night														
300	Installation of warning systems when leaving the driving position without the vehicle being adequately braked (parking brake not applied)														
301	Installation of an alert emission system in electric vehicles, whenever the speed drops below a pre-defined limit (e.g. 10 km/h), to minimise pedestrian distraction or blind people being run over.														
302	Adoption of energy absorption systems, in case of trampling, avoiding serious injuries, or other consequences, to vulnerable users														
303	Promote the use of data generated by the driving and/or eco-driving support systems (geo-referencing) to identify 'black spots' or areas where the infrastructure may enhance accidents or road safety incidents. Investigation of accidents, incorporating geo-referencing, to determine black spots and accident typology to take mitigating decisions.														
304	Encouragement of low-speed zones (e.g., "30 zones") in densely populated areas where public transport coexists with vulnerable road users.														
305	Promote the use of data generated by driving and/or eco-driving support systems to identify human failures and performance improvement opportunities, which can form the basis of training or other corrective actions.														
306	Installation of automatic, on-board systems to measure driver fatigue and advise the driver to stop the vehicle as soon as possible														
307	Adoption of ignition interlock systems, for early detection of the alcohol level in the blood, by the driver.														
308	Promote the adoption of Road Safety Management Systems, preferably using the "ISO 39001" reference.														
309	Promote the adoption of automatic systems for monitoring the rules of the road (e.g., video systems to control red lights, illegal parking, and illegitimate use of bus lanes).														
310	To promote collaborative R&D projects between universities, research centres, companies, and public institutions in testing and demonstrating new technologies in the field of road safety.														
311	Approve the creation of 'Technology Free Zones' for testing innovative solutions for promoting road safety. In particular, these zones should comprise a legislative framework that supports and facilitates the conduct of research, demonstration, and testing activities, in a real environment, of innovative technologies, products, services, processes, and models.														

	Comment/suggestion	RS management	Roads	Users	Speeds	Vehicles	Post-crash	Pedestrians	Cyclists	PTW	ITS	Public transport	Monitoring & Evaluation	Research	knowledge transfer
312	Facilitate, through the creation of appropriate legislation, the carrying out of tests and pilot projects to use autonomous vehicles.														
313	IP needs to shift its technical expertise to local infrastructure needs.														
314	Encourage pedestrian travel and discourage speeding.														
315	Qualitative indicators - near misses should be collected - fear should also be collected.														
316	Quantitative indicators - collect how many kilometres are driven by the user or mode to be used for risk measures.														
317	Make better inspections - create professionals to do this; reports should be public.														
318	More investment in accident investigation.														
319	Public availability of accident databases (raw).														
320	Indicators - integrate different externalities into a single sustainability indicator.														
321	Behaviour/technology - install devices in vehicles to warn VRU from a distance and motor vehicles.														
322	Culture - patterns of behaviour can be changed by infrastructure.														
323	Consider a different approach for different types of infrastructure; they have different challenges.														
324	Urban areas - acceleration paradigm shift in urban areas - ideas block new priorities, delaying investment. Decisions are made in isolation from each other - micro decisions. If there is no change, things don't change. Capacity development must be a priority.														
325	How the strategy is communicated to the cities is a matter that concerns everyone. It has to be sold: multimodal, sustainable, safe. Unemployment will have to use mobility options.														
326	Critical steps - know the guidelines. Four priorities: speeding, junctions, illegal parking, highly vulnerable areas (schools).														
327	Cities can: change infrastructure, change traffic management, enforcement (municipal police), include ISA in the municipal fleet; communications to the population; and data (risk assessment such as IRAP; geocoded accidents).														

ANNEX III
Application of Latent Dirichlet Allocation to the proposals of the public and private entities and the members of the Non-Executive Council of Experts

As mentioned in Section 6.2, this research applies *Latent Dirichlet Allocation* (LDA) (Blei *et al.*, 2003), a method for fitting a topic model, to analyse the topics of the proposals, which were divided into two groups: public and private entities, and the Non-Executive Council of Experts.

In this annex and in Section 6.2, the following terms defined by Blei *et al.* (2003) were used:

- A *word* is the basic unit of discrete data, defined to be an item from a vocabulary;
- A *document* is a sequence of *N words*;
- A *corpus* is a collection of *M documents*.

The LDA algorithm is a three-level hierarchical Bayesian modelling process that groups a set of items into topics defined by words or terms. Each of the terms identified characterizes a topic.

Underlying the “bag-of-words” assumption, LDA represents a document as a mixture of latent topics in which a topic has a multinomial distribution over words. Every document will have its own mixing proportion of topics, and each topic has its own word distribution (Wang *et al.*, 2018).

Based on an unsupervised Bayesian learning algorithm, LDA can capture the latent topics that represent the opinions of the inspection teams from unstructured and large written reports. Each topic can be regarded as a specific feature of the issue or road that inspection team members expressed in their reports.

As previously mentioned, LDA was applied to two datasets, one comprising the proposals of public and private entities (333) and the other the Non-Executive Council of Experts’ proposals (369). In total, 702 proposals were analysed. The analysis was performed on the original Portuguese text versions. In both sets of proposals, the obtained topics aligned well with known co-occurrences.

The method’s ability to generate meaningful topics from both datasets demonstrates its effectiveness in reliably exposing co-occurring attributes.

The statistical open-source tool R was adopted to perform the text mining procedure. Namely, the “tm” (Feinerer *et al.*, 2008) and “topicmodel” packages (Grün and Hornik, 2011) were chosen. The former provides text mining functions, while the latter implements the LDA algorithm.

Contributions from several stakeholders included background information and additional bibliography. Second, the content of the contributions, including the description of the proposals, were tracked, and two record sets – document-term matrices were constructed.

To create a document-term matrix that can be processed via topic modelling, several data organization and pre-processing choices were made. The document-term matrix serves as input to the LDA topic modelling to obtain the most relevant topics (Blei *et al.*, 2003).

Text pre-processing in this study includes word text tokenization, converting words to lower-case, removing punctuation characters and numbers, and removing stop words.

Stemming (reducing inflected words to their base or root form) was not considered in pre-processing since it sometimes combines terms that would best be considered distinct, and variations of the same word will usually end up in the same topic.

Figure III.1 and Figure III.2 show descriptions of the most frequent words appearing in each record set, in decreasing order of occurrence frequency. Each bar represents the number of occurrences of each word in the respective record set.

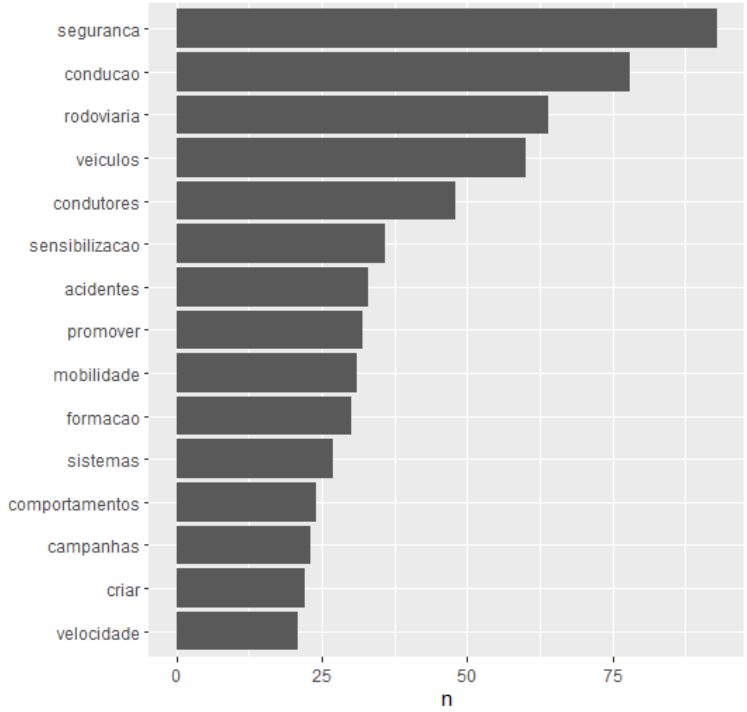

Figure III.1 –Number of occurrences of the most frequent words (n>20) in the public and private entities' record set.

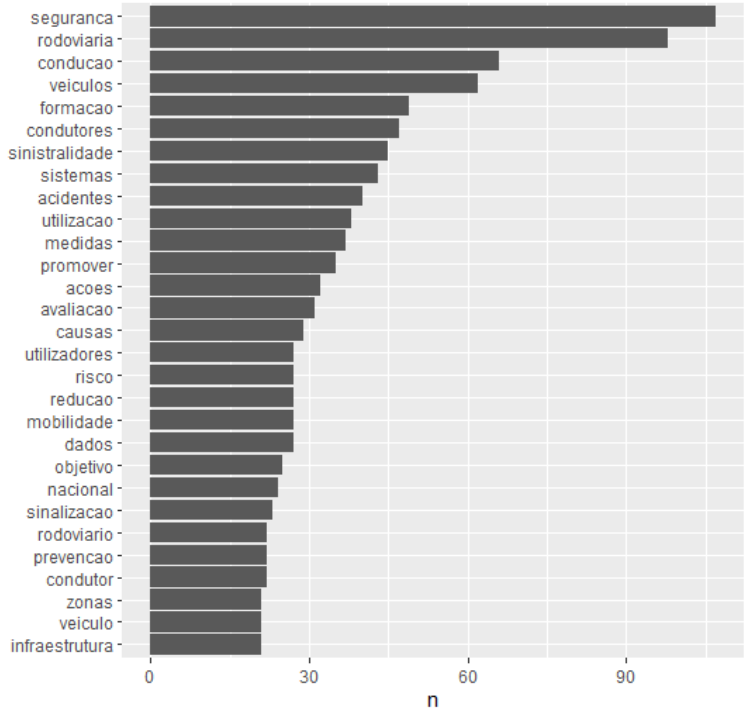

Figure III.2 –Number of occurrences of the most frequent words (n>20) in the Non-Executive Council of Experts' record set.

The relationships between two words were analyzed by counting how often word X is followed by word Y. By automatically extracting and using phrases, especially two-word phrases (hereafter bigrams) it is possible to improve the identification of the proposals described in the multiple contributions.

Figure III.3 and Figure III.4 present a combination of connected nodes for both record sets, where it is possible to visualize some details of the text structure. The relationships here are directional (marked with an arrow).

In Figure III.3, one can see that *words* such as "*rodoviaria*" and "*seguranca*" form common centers of nodes. The *word* "*alcool*" is preceded by "*efeito*" and followed by "*drogas*". We also see pairs and triplets that form common short phrases related to road safety issues ("*uso telemovel*", "*utilizadores vulneraveis*" or "*condutores veiculos motorizados/rodas*"). Figure III.3 also shows the more general character of the contributions, highlighting problems associated with road, vehicle, and the bigram "*rede viaria*".

Figure III.4 shows that the solutions record sets is particularly focused around *words* such as "*infraestrutura*", "*seguranca*" and "*formacao*". Similar to the preceding figure, Figure III.4 also highlights the broader set of road safety issues (e.g., "*recolha dados*" and "*avaliacao medica*").

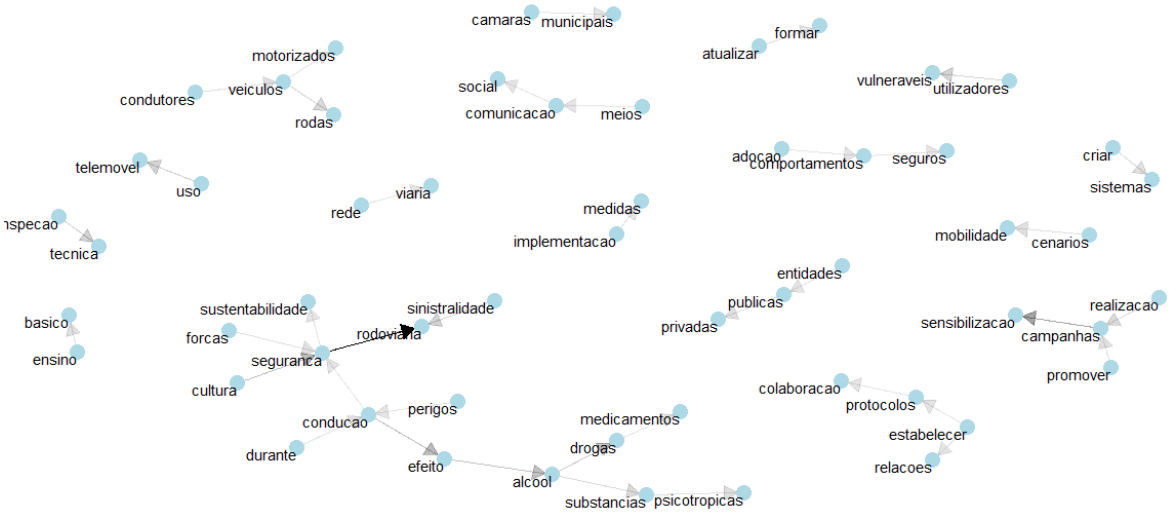

Figure III.3 – Directed graph of common bigrams in the public and private entities' record set.

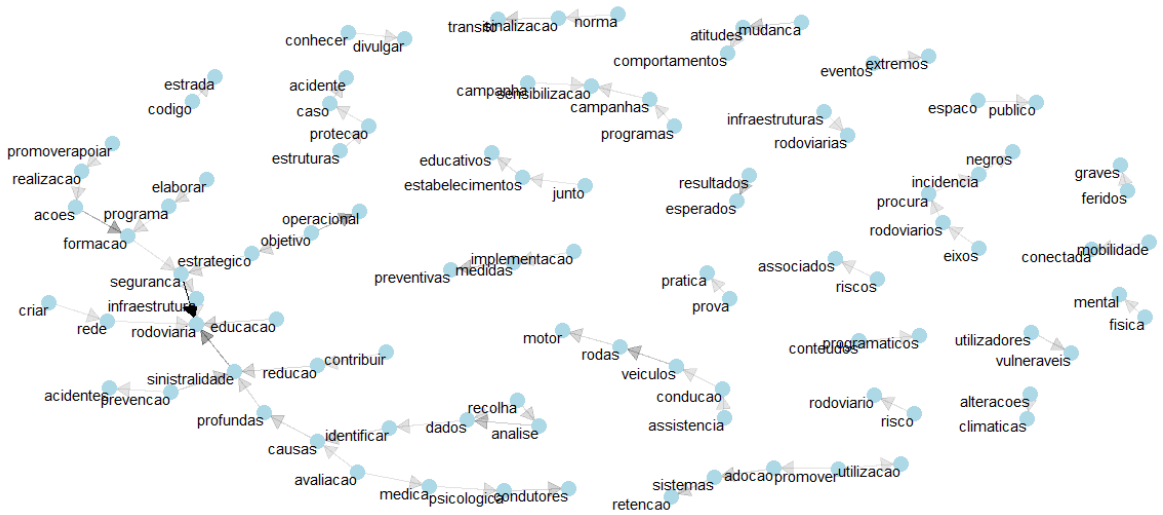

Figure III.4 – Directed graph of common bigrams in the in the Non-Executive Council of Experts' record set.

Topic modelling is a method for unsupervised classification of *documents*, by modelling each document as a mixture of topics and each topic as a mixture of words.

LDA was employed to model proposals' *documents* as though they were generated by sampling from a mixture of *K* topics, where a topic is a multinomial distribution over all words in our vocabulary (Blei *et al.*, 2003). For a detailed description of these models, readers are referred to Roque *et al.* (2019).

While LDA uses Bayesian inference to generatively estimate the posterior model distribution based only on the words shown in the texts, it requires one parameter (*K*: number of latent topics to identify) to begin with its iteration process.

There are various approaches to establish the optimal *K* providing a good range of possible *K* values that are mathematically plausible. The R package "ldatuning" (Nikita, 2016) was used for this purpose, which simultaneously runs two different approaches:

- KL-divergence minimization method of Arun *et al.* (2010),
- and expectation-maximization method of Griffiths and Steyvers (2004).

The LDA implementation was applied to both *corpora*, where each of the resulting topics is a distribution over words. Different numbers of topics, *K*, were considered, ranging from two to 25. Two LDA models are estimated by setting the *K* value equal to 12.

Table III.1 – Extracted keywords/words and corresponding Portuguese and English words

Keyword /word	Portuguese word	English word
acesso	acesso	access
acidente	acidente	accident
acidentes	acidentes	accidents
acoes	ações	actions
adocao	adoção	adoption
alcool	álcool	alcohol
alteracoes	alterações	changes
ambito	âmbito	scope
analisar	analisar	analyse
analise	análise	analysis
ansr	ANSR	ANSR
aplicacao	aplicação	application
areas	áreas	areas
associacoes	associações	associations
atitudes	atitudes	attitudes
ato	ato	act
atualizar	atualizar	update
autarquias	autarquias	municipalities
avaliacao	avaliação	evaluation
avaliar	avaliar	evaluate
basico	básico	basic
camara	câmara	chamber
campanha	campanha	campaign
campanhas	campanhas	campaigns
caso	caso	case
causas	causas	causes
cenarios	cenários	scenarios
ciclistas	ciclistas	cyclists
circulacao	circulação	circulation
civil	civil	civil
climaticas	climáticas	climatic
comportamento	comportamento	behaviour
comportamentos	comportamentos	behaviours
comunicacao	comunicação	communication
condicoes	condições	conditions
conducao	condução	driving
condutor	condutor	driver
condutores	condutores	drivers
conduzir	conduzir	drive
consideracao	consideração	consideration
conteudos	conteúdos	content
criacao	criação	creation
criancas	crianças	children
criar	criar	create
cultura	cultura	culture
dados	dados	data
definicao	definição	definition
definir	definir	define
desenvolver	desenvolver	develop
desenvolvimento	desenvolvimento	development
divulgar	divulgar	disclose
drogas	drogas	drugs
durante	durante	during
educacao	educação	education
efeito	efeito	effect
enquadramento	enquadramento	framework
ensino	ensino	teaching
entidades	entidades	entities
equipamentos	equipamentos	equipment
espaco	espaço	space
espacos	espaços	spaces
estabelecer	estabelecer	establish
estacionamento	estacionamento	parking
estradas	estradas	roads
estrgias	estratégias	strategies
estrategico	estratégico	strategical
estruturas	estruturas	structures
estudar	estudar	study

Keyword /word	Portuguese word	English word
eventos	eventos	events
evolucao	evolução	evolution
extremos	extremos	extreme
fatores	fatores	factors
feridos	feridos	injured
fiscalizacao	fiscalização	inspection
fisicas	físicas	physical
forcas	forças	forces
formacao	formação	training
formar	formar	train
garantir	garantir	ensure
graves	graves	serious
identificacao	identificação	identification
identificar	identificar	identify
implementacao	implementação	implementation
implementar	implementar	implement
importancia	importância	importance
incentivar	incentivar	encourage
incluindo	incluindo	including
informacao	informação	information
infraestrutura	infraestrutura	infrastructure
infraestruturas	infraestruturas	infrastructures
iniciativa	iniciativa	initiative
inspecao	inspeção	inspection
instalacao	instalação	installation
intervencao	intervenção	intervention
junto	junto	near
legislacao	legislação	legislation
locais	locais	sites
medica	médica	medical
medicamentos	medicamentos	medicines
medida	medida	measure
medidas	medidas	measures
meios	meios	means
mental	mental	mental
mobilidade	mobilidade	mobility
modo	modo	mode
monitorizacao	monitorização	monitoring
mudanca	mudança	change
municipais	municipais	municipal
nacional	nacional	national
nacionais	nacionais	national
necessario	necessário	necessary
norma	norma	standard
objetivo	objetivo	goal
objetivos	objetivos	goals
obrigatoria	obrigatória	mandatory
operacional	operacional	operacional
participacao	participação	participation
peoes	peões	pedestrians
planeamento	planeamento	planning
plano	plano	plan
planos	planos	plans
prevencao	prevenção	prevention
preventivas	preventivas	preventive
profissionais	profissionais	professionals
profundas	profundas	profound
programas	programas	programmes
projeto	projeto	project/design
projetos	projetos	projects
promocao	promoção	promotion
promovam	promovam	promote
promover	promover	promote
protecao	proteção	protection
protocolo	protocolo	protocol
prova	prova	proof
psicologica	psicológica	psychological
psicotropicas	psicotrópicas	psychotropic
publicas	públicas	public
publico	público	public
realizacao	realização	execution

Keyword /word	Portuguese word	English word
recolha	recolha	gathering
rede	rede	network
reducao	redução	reduction
regulamentacao	regulamentação	regulation
relacao	relação	relationship
resultados	resultados	results
revisao	revisão	review
risco	risco	risk
rodas	rodas	wheels
rodoviaria	rodoviária	road
rodoviario	rodoviário	road
saude	saúde	health
segura	segura	safe
seguranca	segurança	safety
seguros	seguros	Insurance/safe
sensibilizacao	sensibilização	awareness
sensibilizar	sensibilizar	raise awareness
sentido	sentido	direction
sinalizacao	sinalização	signalling
sinistralidade	sinistralidade	accidents
sistemas	sistemas	systems
sistematica	sistemática	systematic
situacao	situação	situation
social	social	social
solucoes	soluções	solutions
substancias	substâncias	substances
superior	superior	higher
sustentabilidade	sustentabilidade	sustainability
tecnica	técnica	technical
tecnologias	tecnologias	technologies
telemovel	telemóvel	mobile phone
tempo	tempo	time
trafego	tráfego	traffic
transito	trânsito	traffic
tratores	tratores	tractors
travagem	travagem	brake
urbano	urbano	urban
uso	uso	use
utentes	utentes	users
utilizacao	utilização	use
utilizadores	utilizadores	users
veiculo	veículo	vehicle
veiculos	veículos	vehicles
velocidade	velocidade	speed
velocidades	velocidades	speeds
vertical	vertical	vertical
via	via	lane/road
viaria	viária	road
vias	vias	lanes/roads
visao	visão	vision
vitimas	vítimas	victims
vulneraveis	vulneráveis	vulnerable
zonas	zonas	areas

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AV DO BRASIL 101 • 1700-066 LISBOA • PORTUGAL
tel. (+351) 21 844 30 00 • fax (+351) 21 844 30 11
lnec@lnec.pt **www.lnec.pt**