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**

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DE ENGENHARIA CIVIL

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Autoridade Nacional de Segurança Rodoviária

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**R&D** TRANSPORTATION

REPORT 21/**2021 – DT/NPTS**

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

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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.

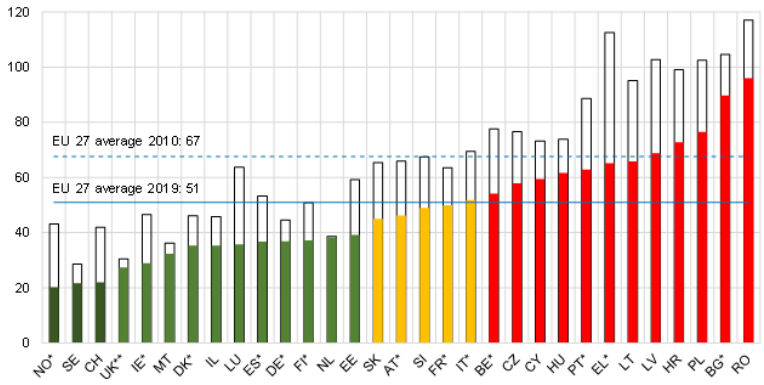


**Figure 1 – Mortality (road deaths per million inhabitants) in 2019. Source; ETSC, 2020b**

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).

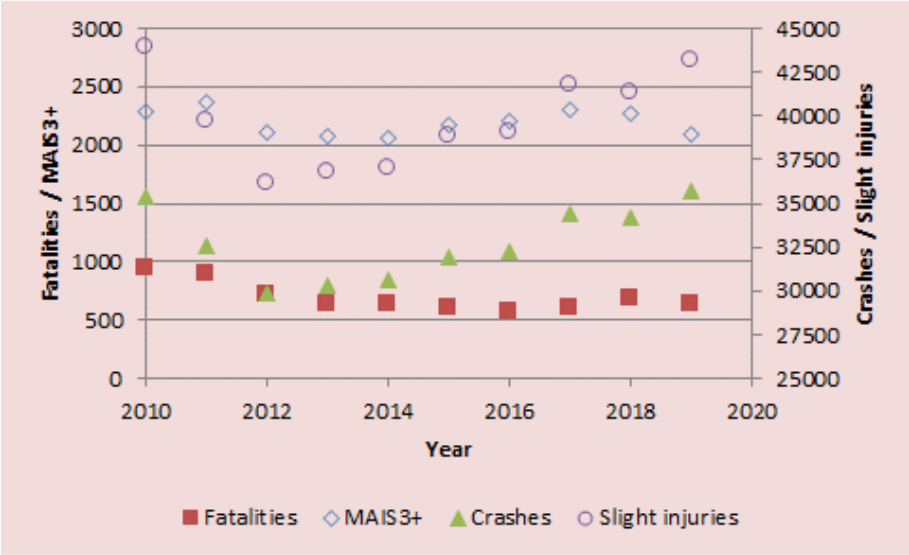


**Figure 2 – Developments in the annual number of injury crashes and casualties (2010 2019)**

**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).

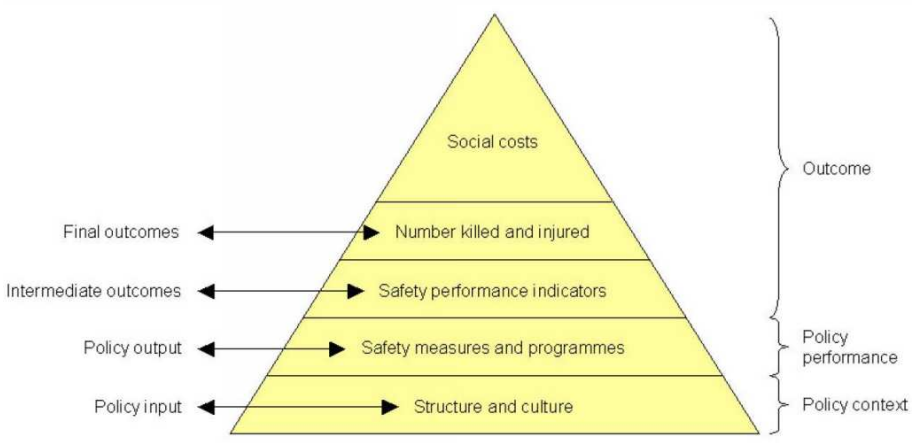


**Figure 3 – The *SUNflower* project approach to the hierarchy of road safety**

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).

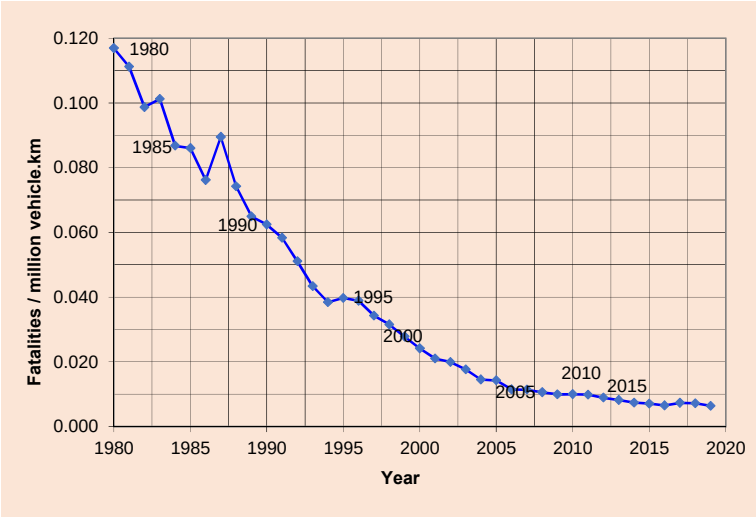



**Figure 2.1 – Developments in the mortality rate (1980 2019)**

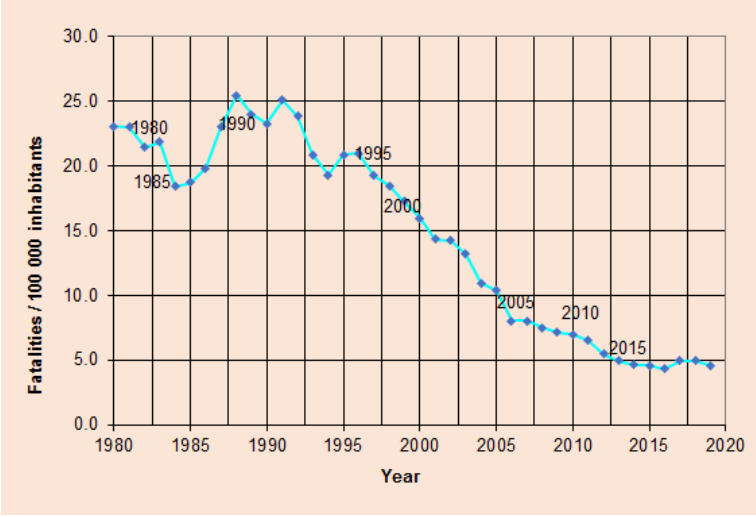



**Figure 2.2 – Developments in the fatality rate (1980 2019)**


**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.

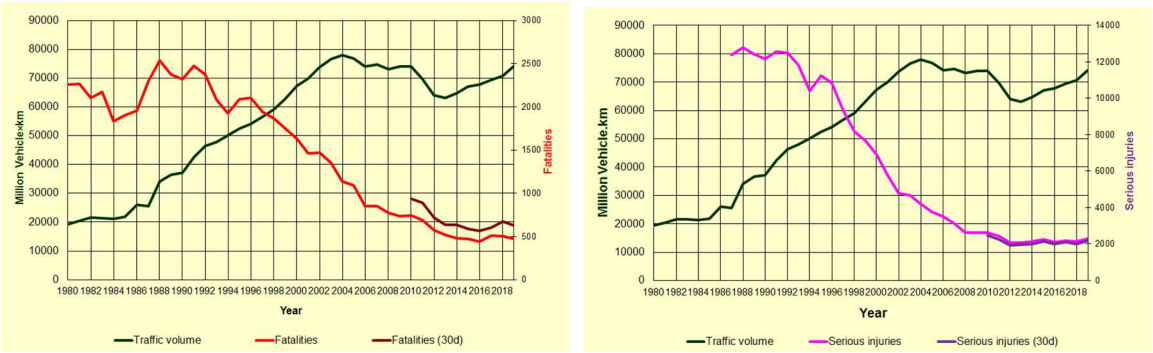



**Figure 2.4 – Developments in annual traffic volumes and the annual numbers of fatalities and serious injuries (1980-2019)**

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.

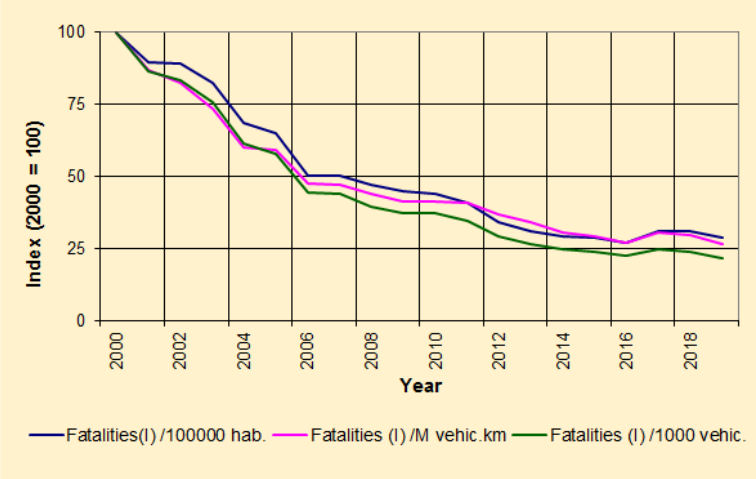



**Figure 2.5 – Developments in the fatality (on-site) rates, per 100 000 inhabitants, million travelled kilometres and 1000 vehicles (2000-2019)**

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.

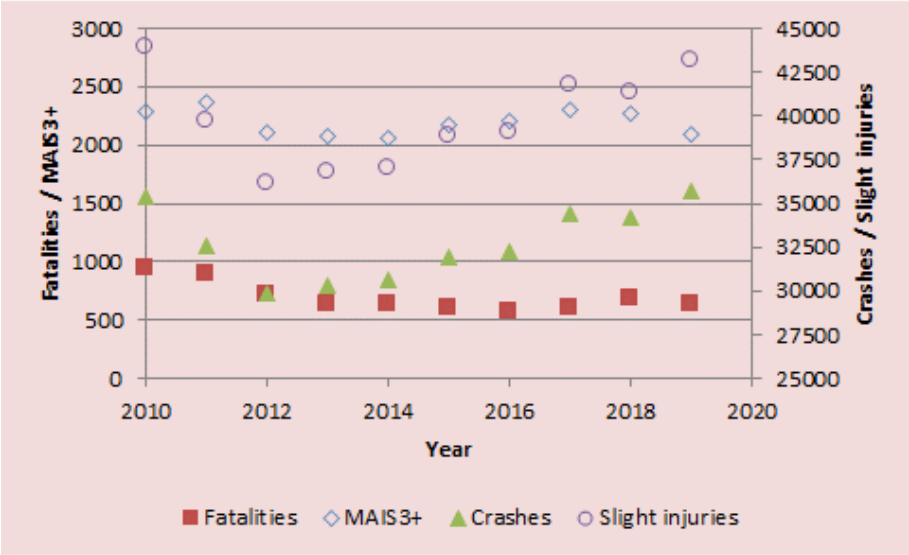



**Figure 2.6 – Development in the annual number of injury crashes and casualties (2010-2019)**

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).

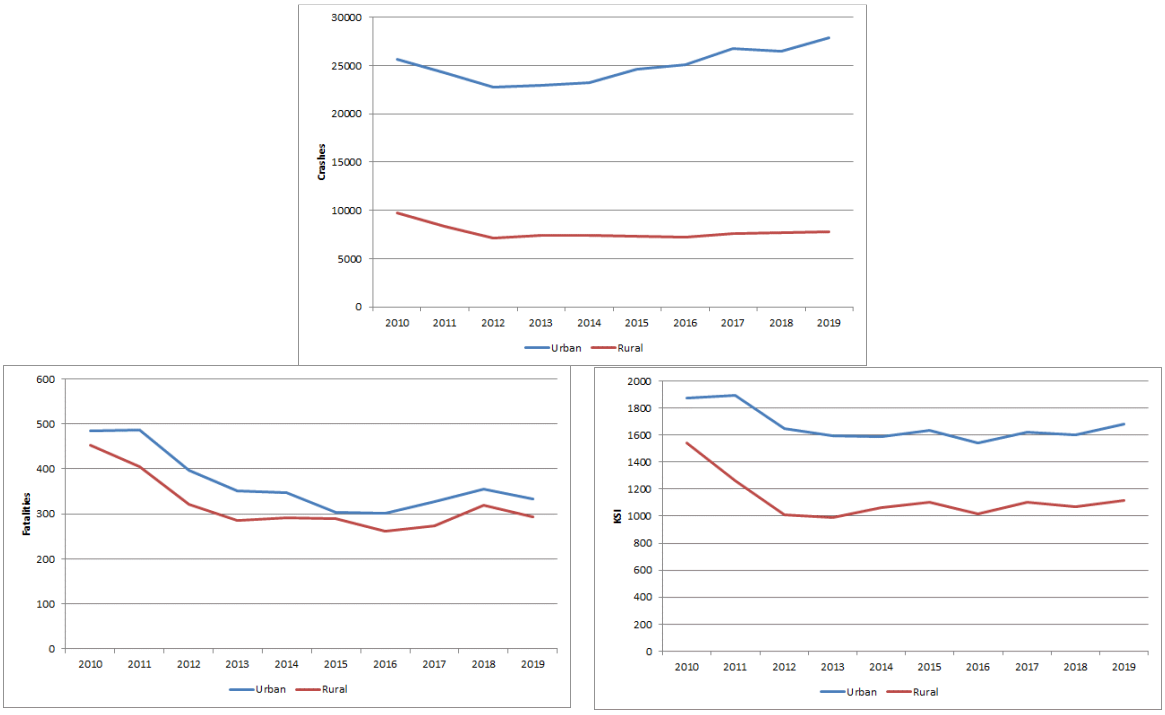



**Figure 2.7 – Development in the annual number of crashes, fatalities and KSI by type of area (2010-2019)**

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%).

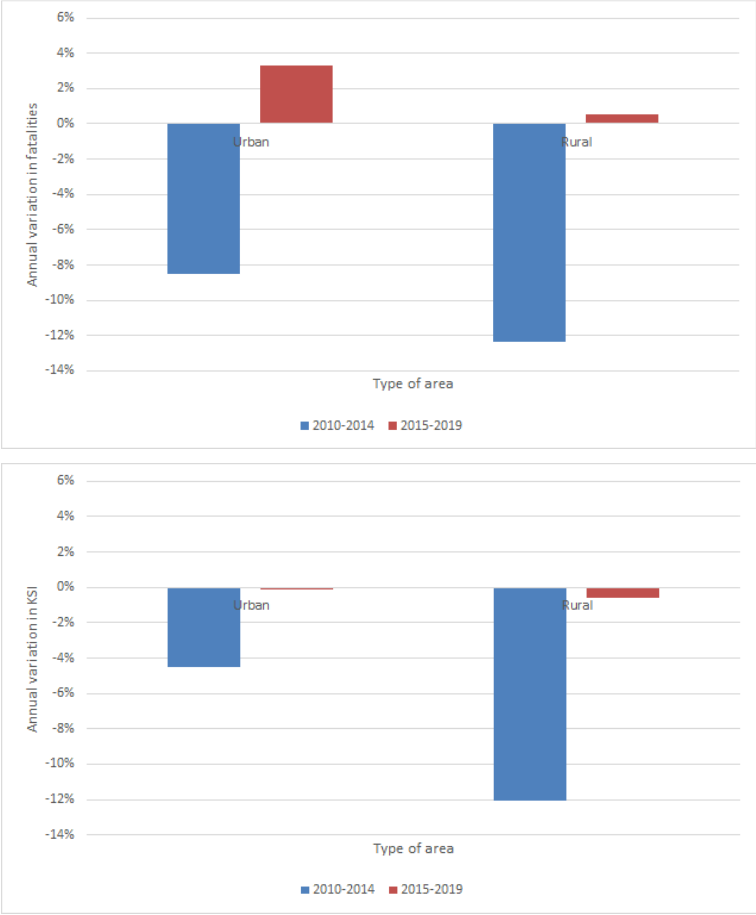


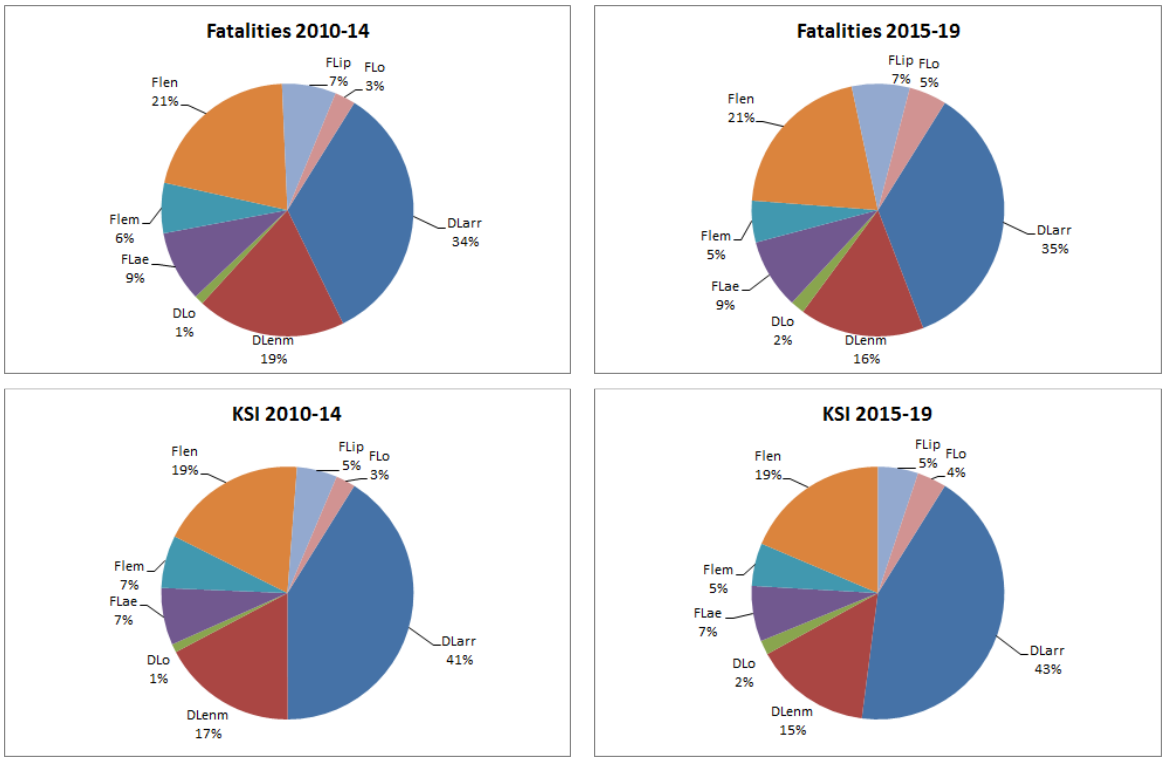

**Figure 2.8 – Annual variation in the number of fatalities and KSI per type of area (2010-14, 2015-2019)**

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 – 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

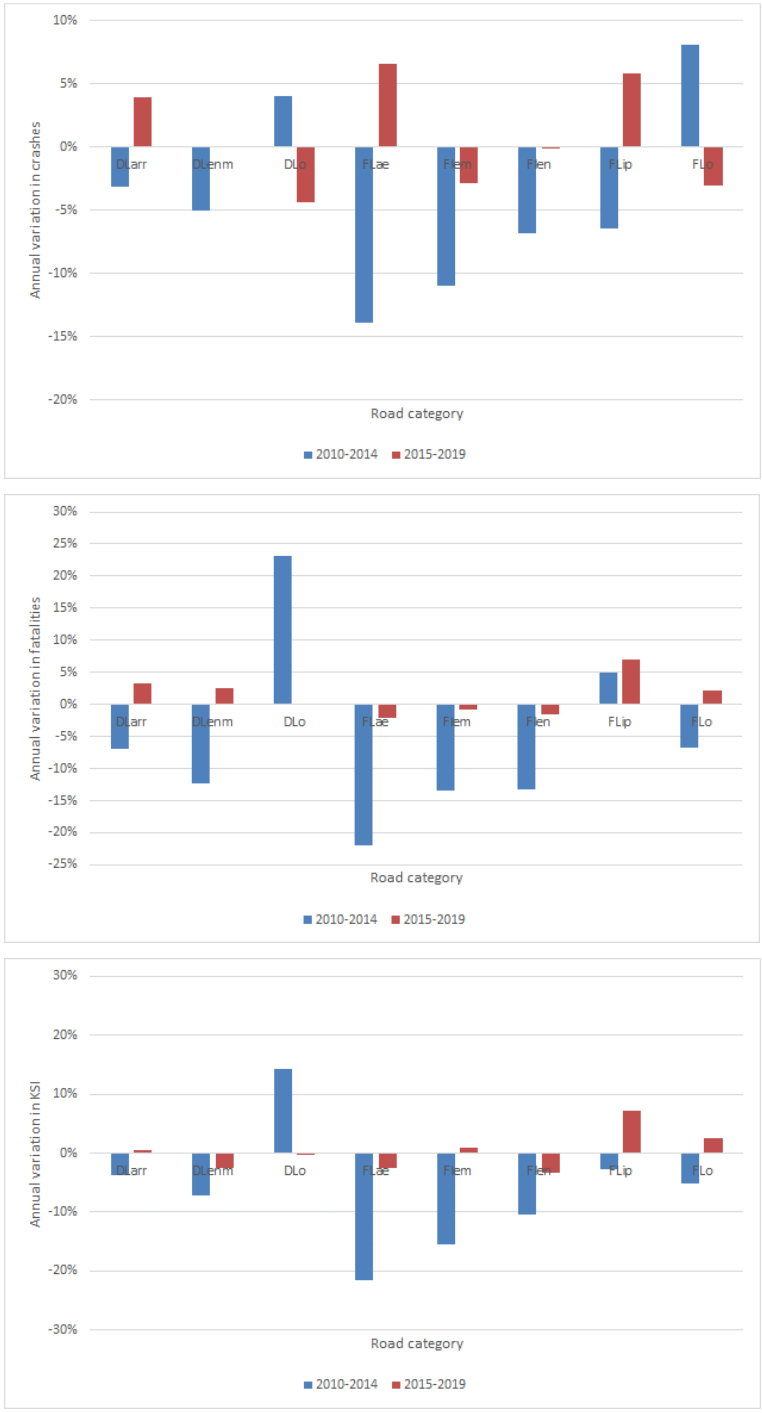



**Figure 2.10 – Annual variation in the number of crashes, fatalities and KSI by road category (2010-2014 and 2015-2019)**

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.

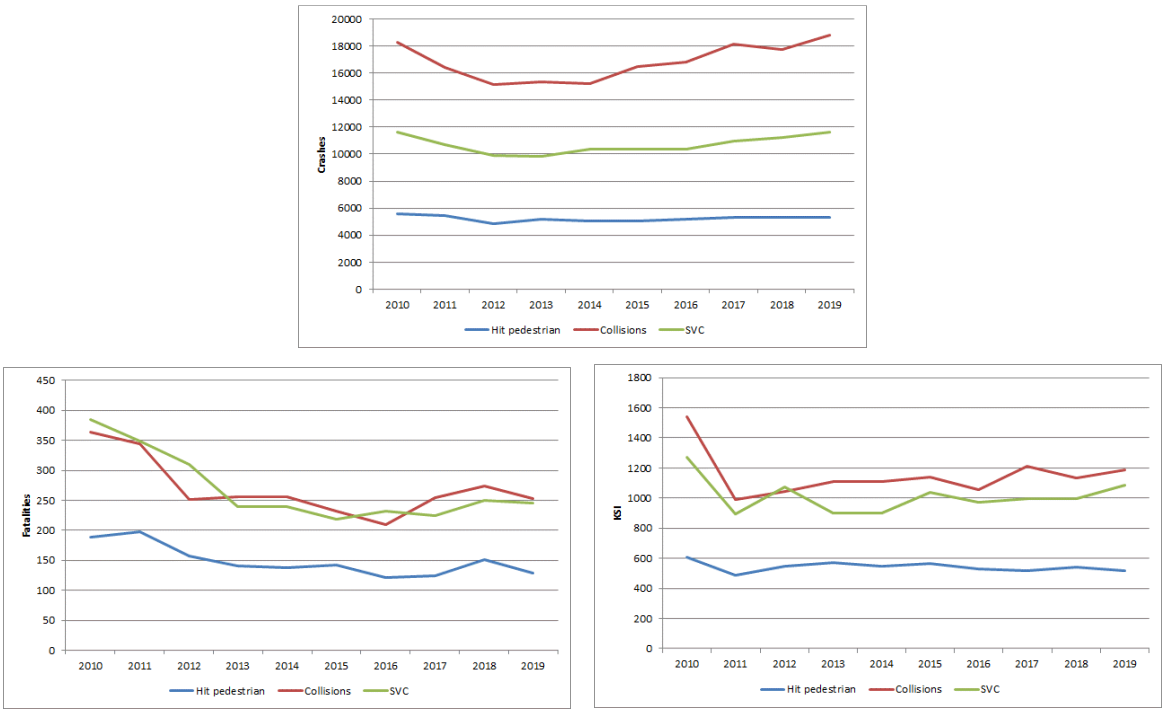



**Figure 2.11 – Development in the annual number of crashes, fatalities and KSI by crash type (2010-2019)**

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.

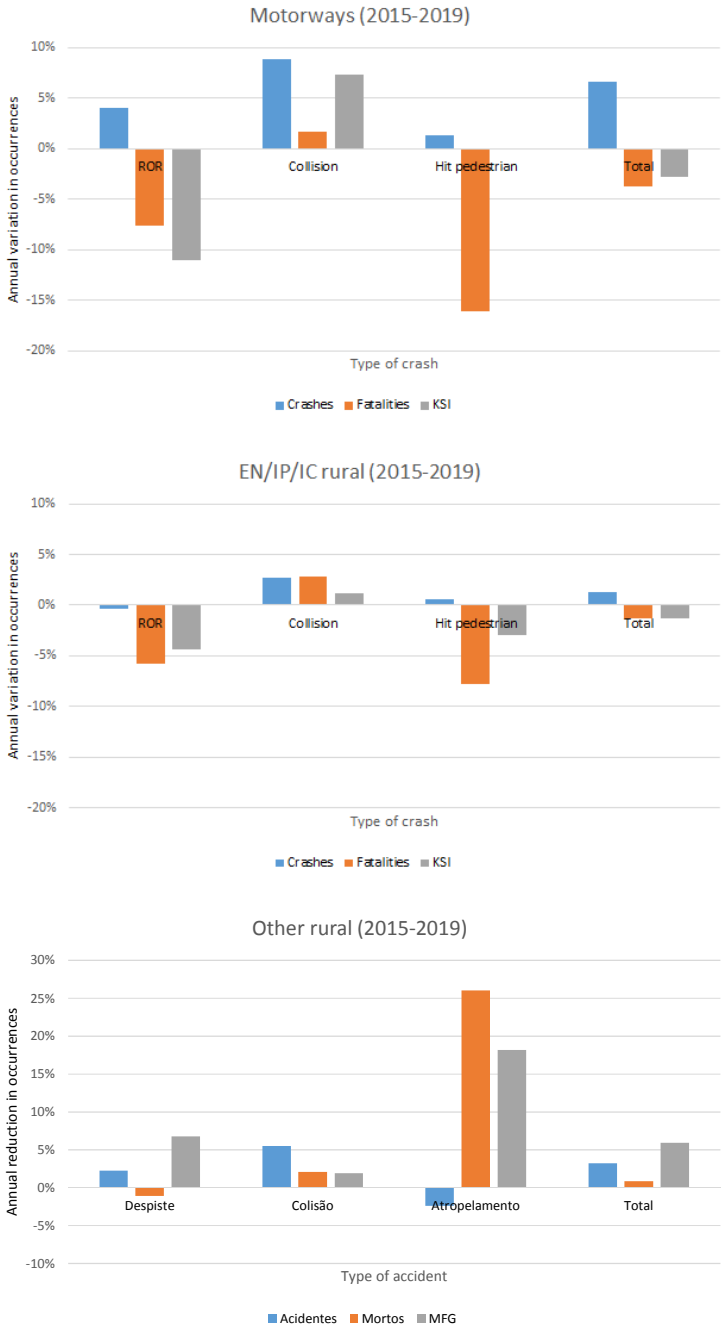



**Figure 2.13 – Average yearly variation in the annual number of crashes, fatalities and KSI by crash type and rural road category (2015-2019)**

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.

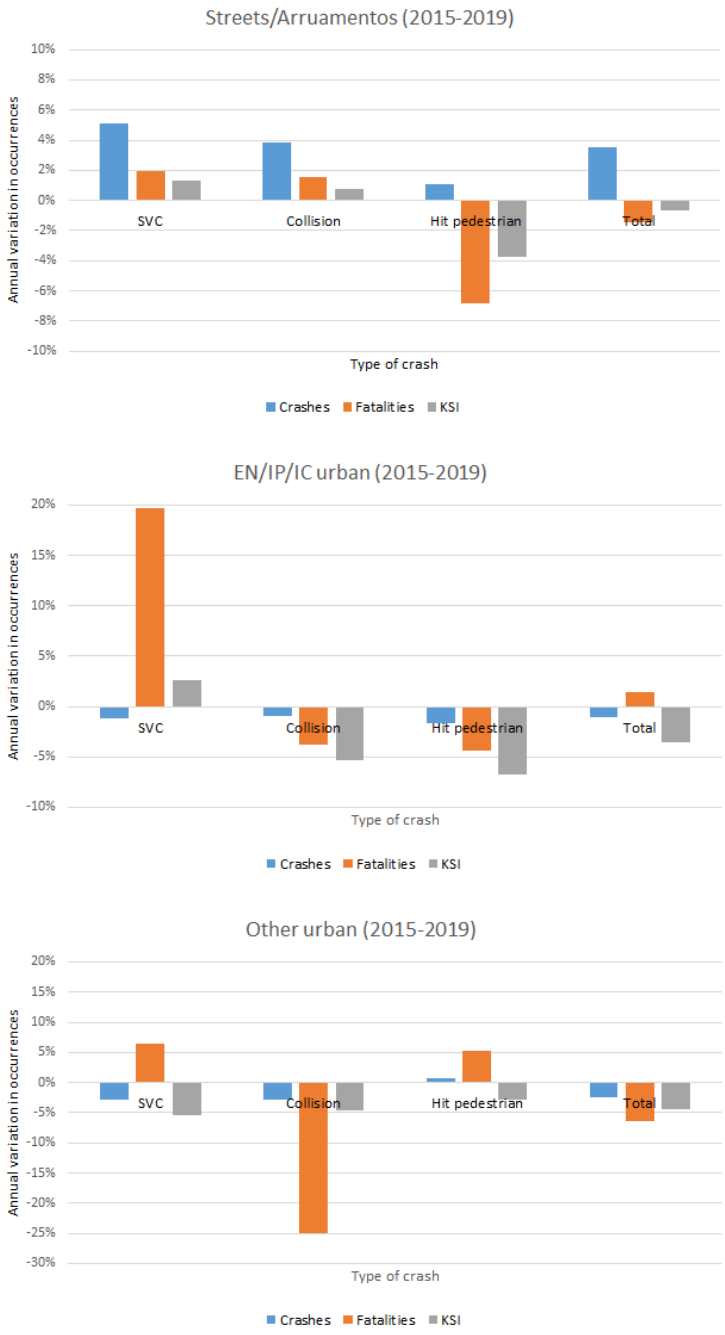



**Figure 2.14 – Average yearly variation in the annual number of crashes, fatalities and KSI by crash type and urban road category (2015-2019)**

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.

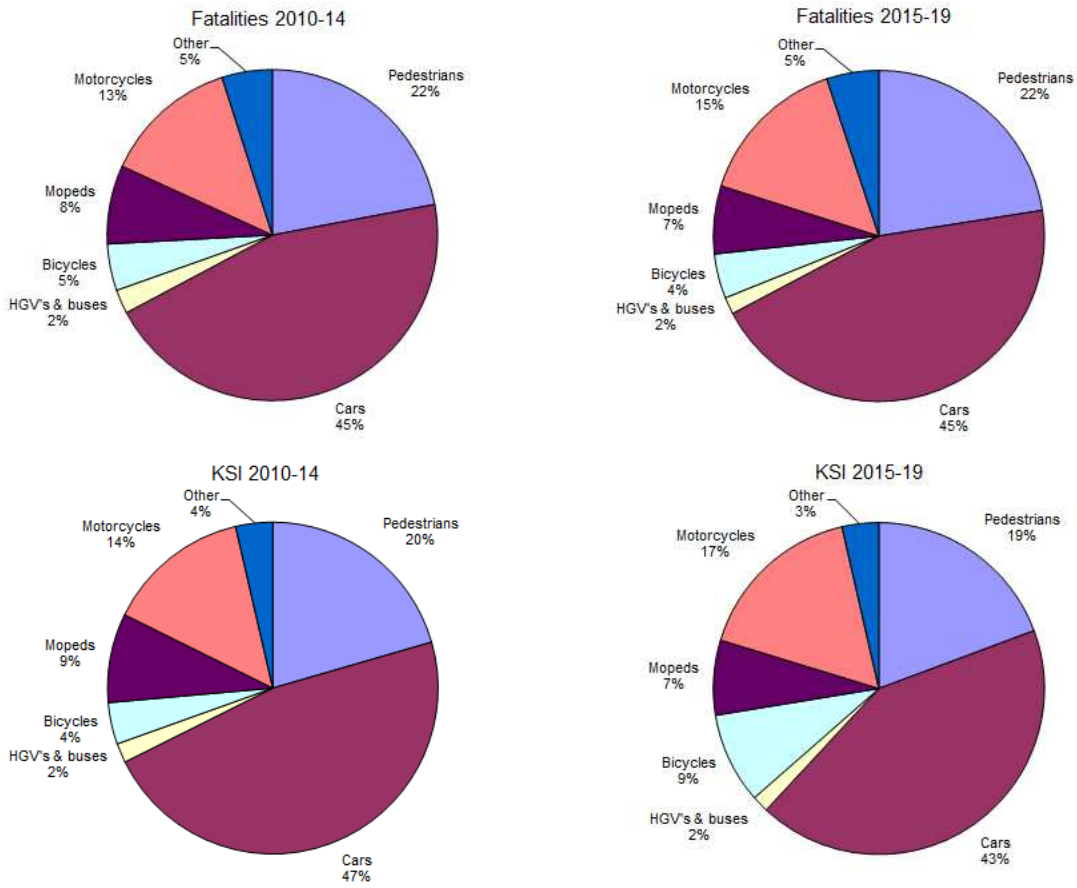



**Figure 2.15 – Distribution of the number of fatalities and KSI by vehicle category (2010-2014 and 2015-2019)**

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.

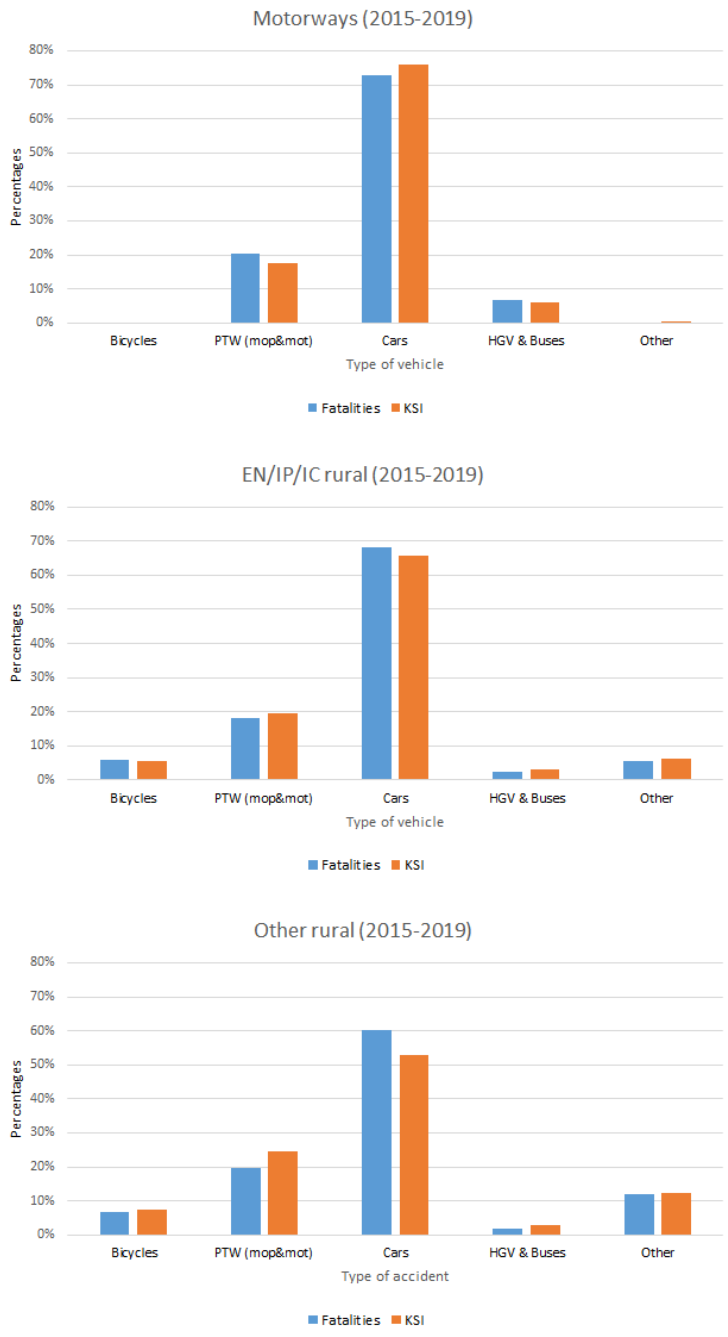



**Figure 2.17 – Distribution of driver casualties per vehicle type and main rural road category (2015-2019)**

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%).

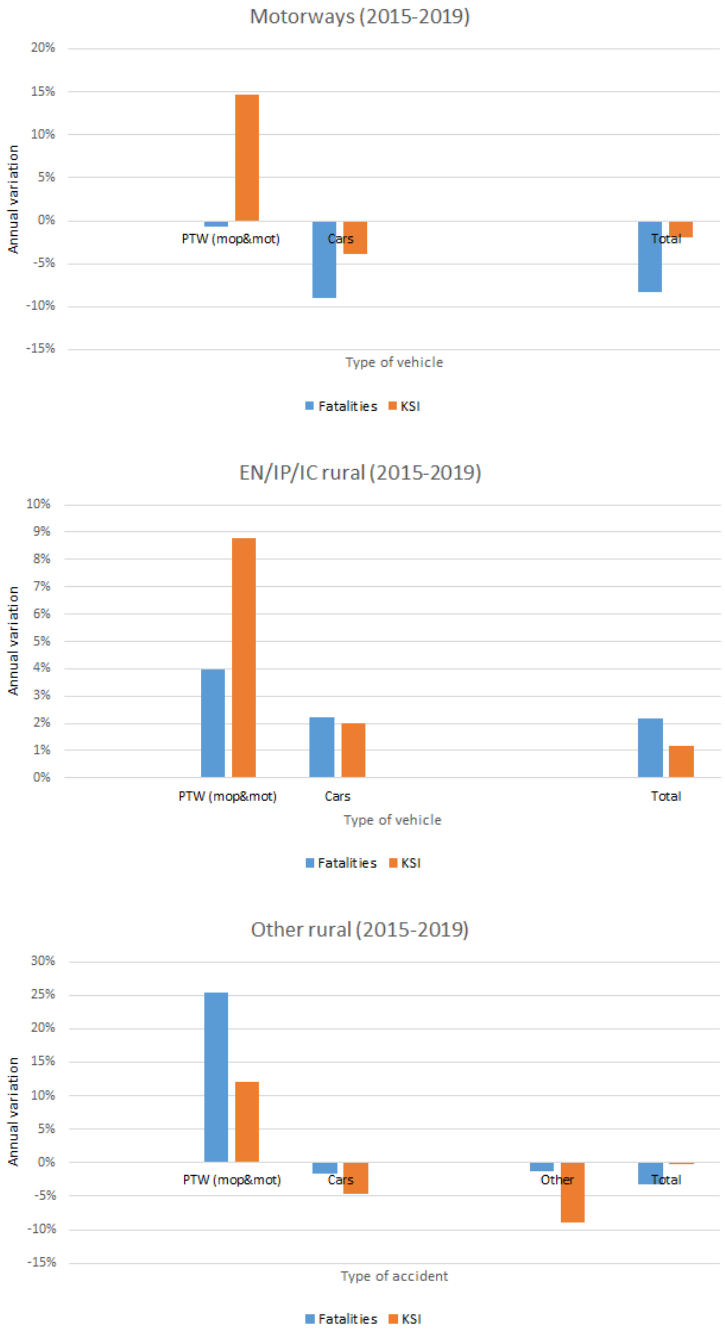



**Figure 2.18 – Average yearly variation in the annual number of driver casualties by rural road category and type of vehicle (2015-2019)**

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).

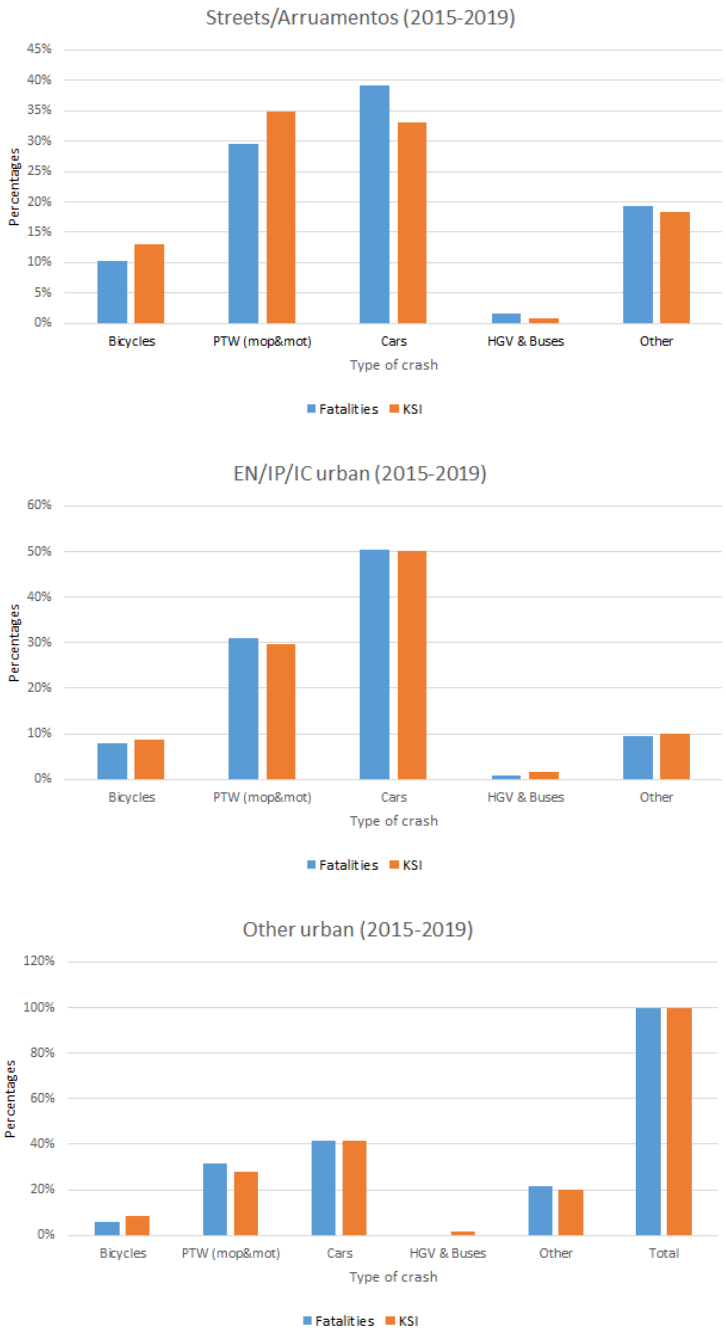



**Figure 2.19 – Distribution of driver casualties per vehicle type and main urban road category (2015-2019)**

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.

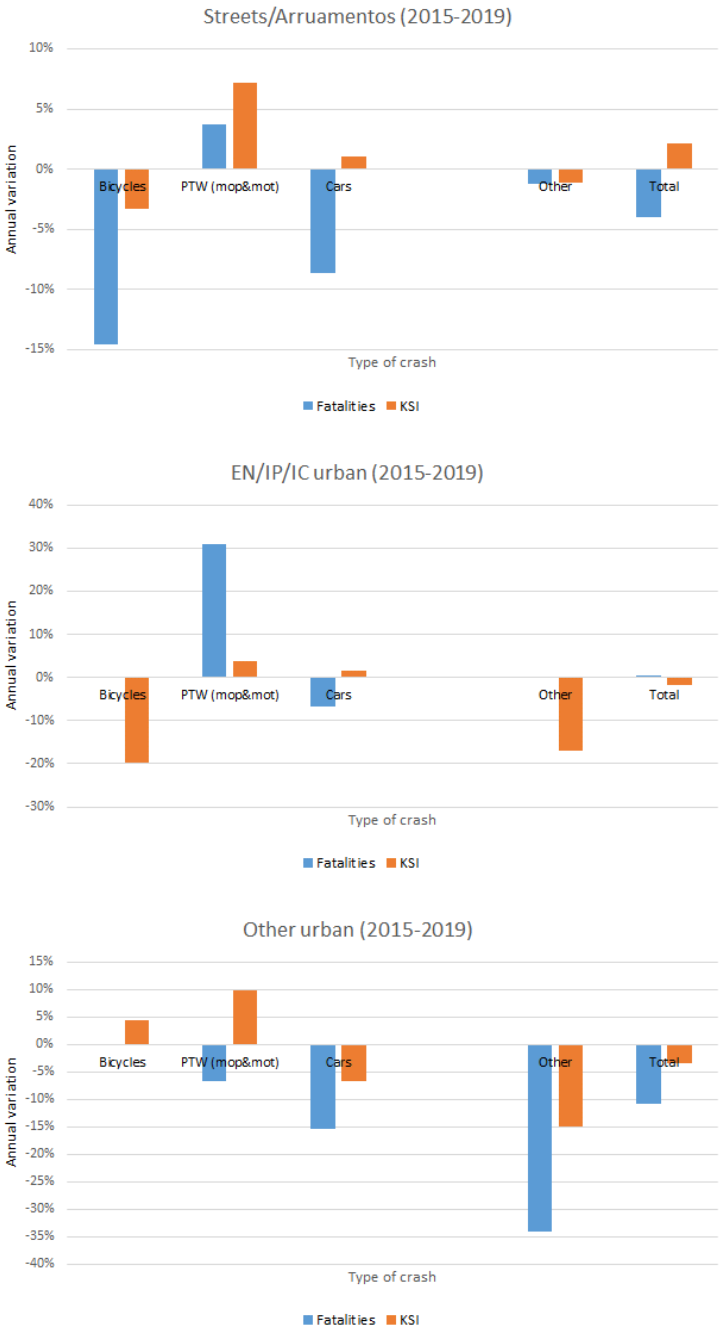



**Figure 2.20 – Average yearly variation in the annual number of occurrences by urban road category and type of vehicle (2015-2019)**

### 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).

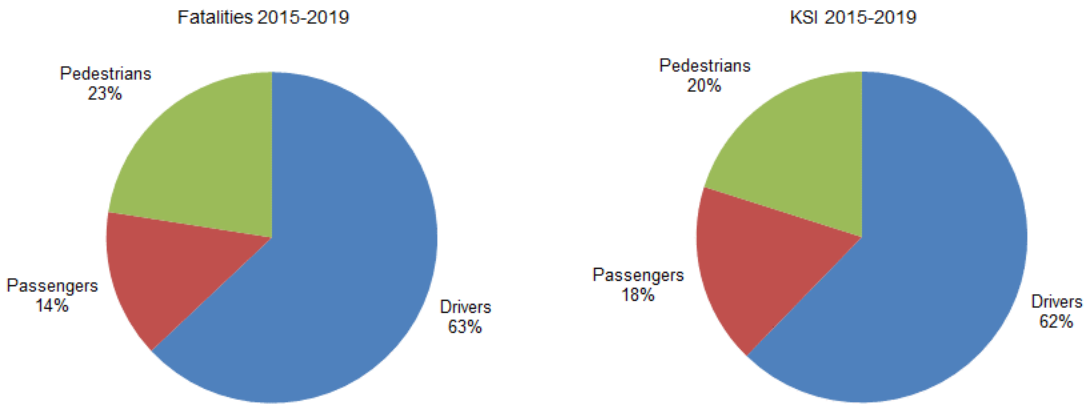



**Figure 2.21 – Distribution of the number of fatalities and KSI by road user group (2015-2019)**

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).

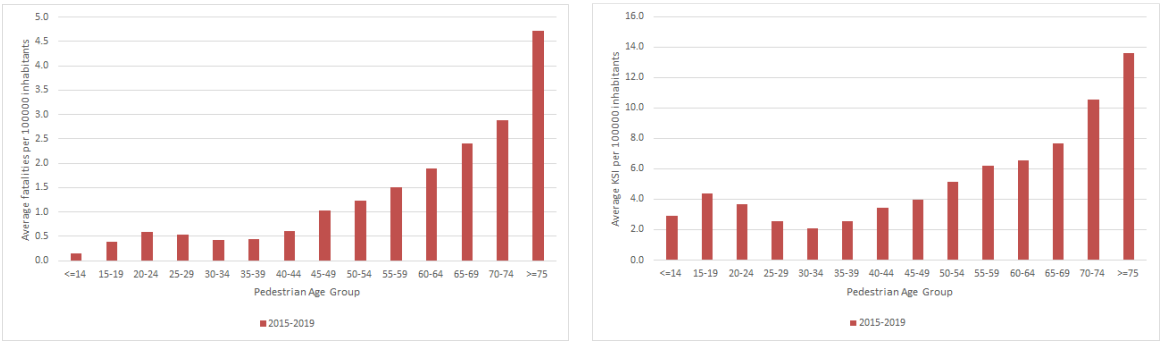



**Figure 2.22 – Pedestrian casualty rates by age group (2015-2019)**

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).

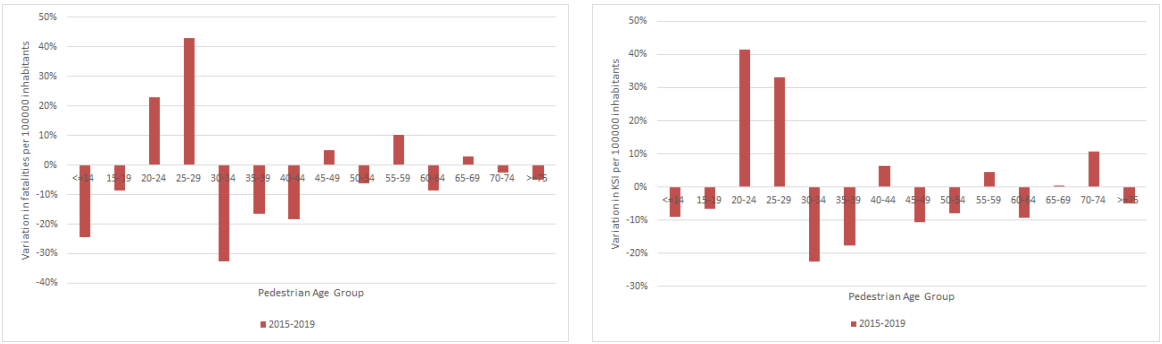



**Figure 2.23 – Developments in pedestrian mortality and KSI rates by age group (2015-2019)**

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%.

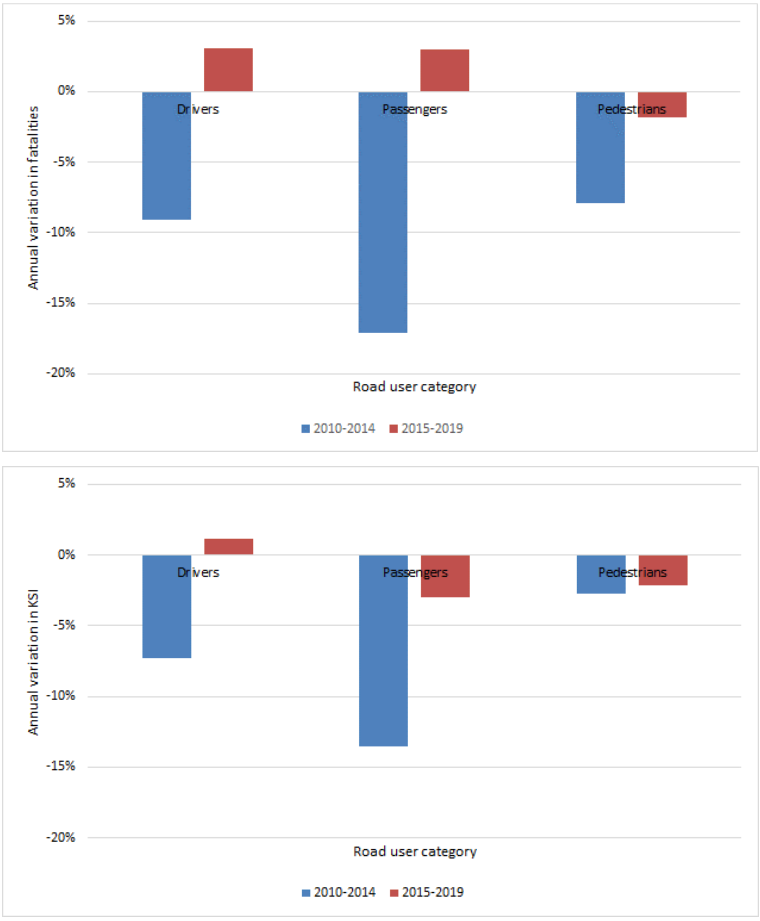



**Figure 2.24 – Average yearly annual variation in the number of fatalities and KSI by road user group (2010-2014 and 2015-2019)**

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.

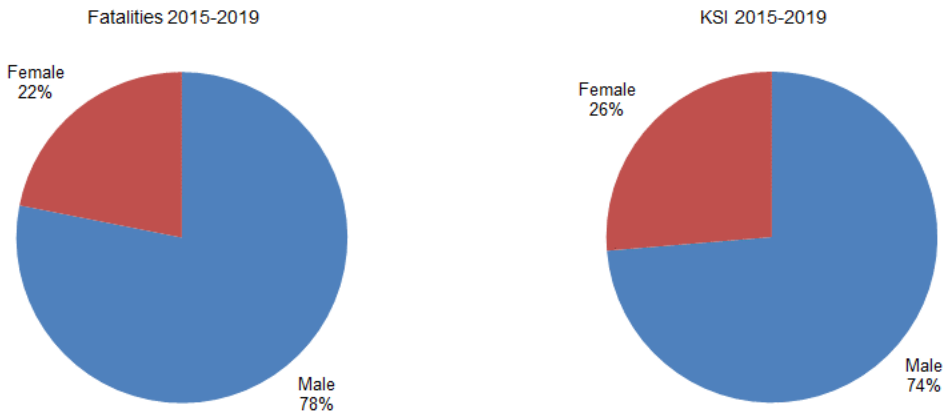
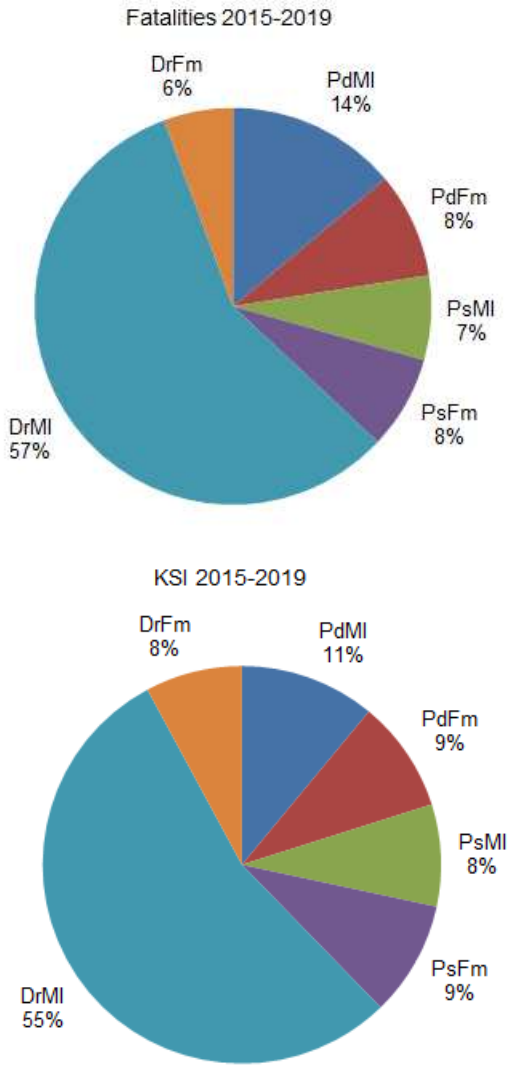



**Figure 2.25 – Distribution of the number of fatalities and KSI by road user sex (2015-2019)**

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.

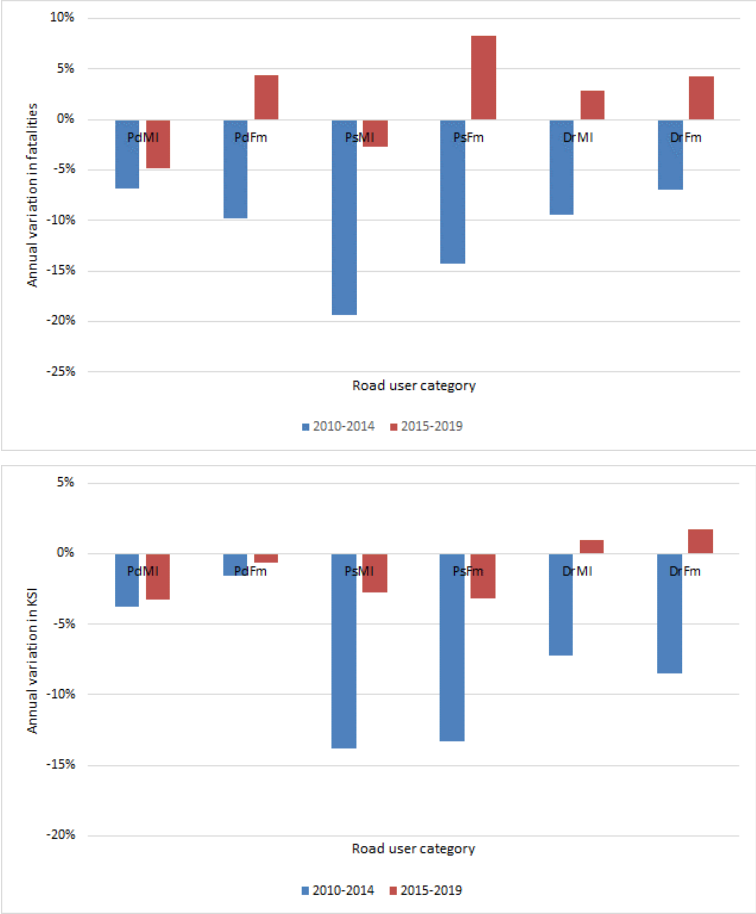



**Figure 2.27 – Average yearly annual variation in the number of fatalities and KSI by road user group and sex (2010-2014 and 2015-2019)**

## 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).

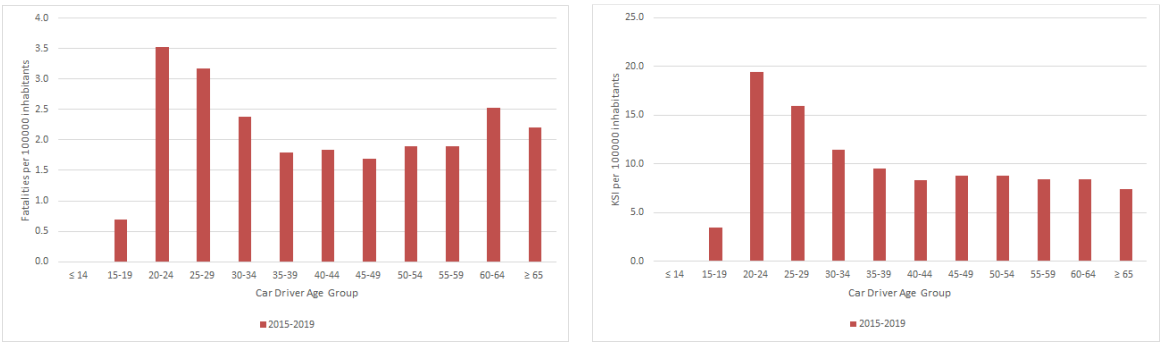



**Figure 2.29 – Car driver casualty rates by age group (2015-2019)**

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).

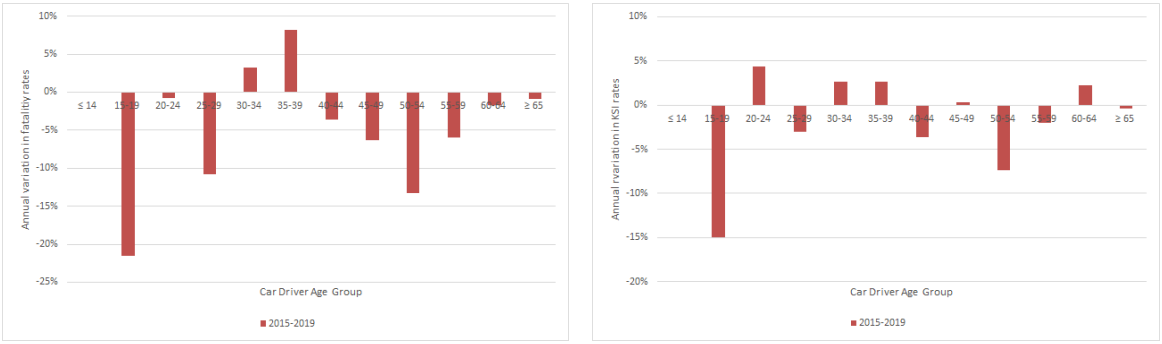



**Figure 2.30 – Average yearly annual variations in car driver mortality and KSI rates by age group (2015-2019)**

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.

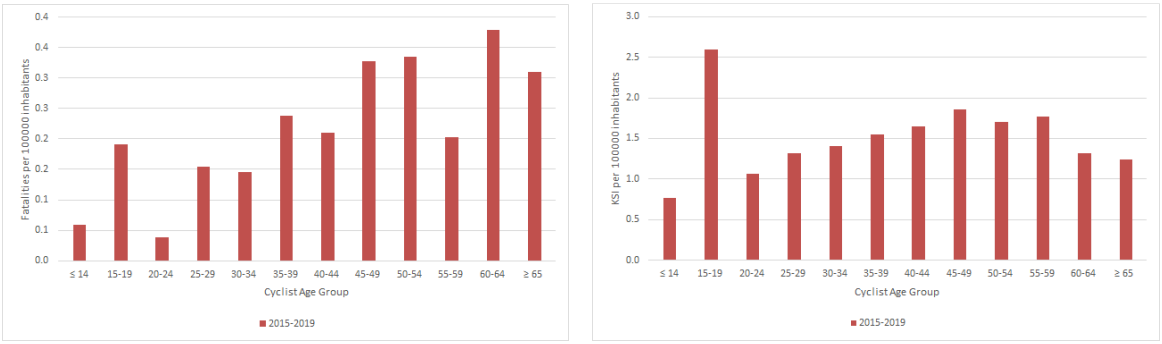



**Figure 2.31 – Average yearly annual variations in cyclist casualty rates by age group (2015-2019)**

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).

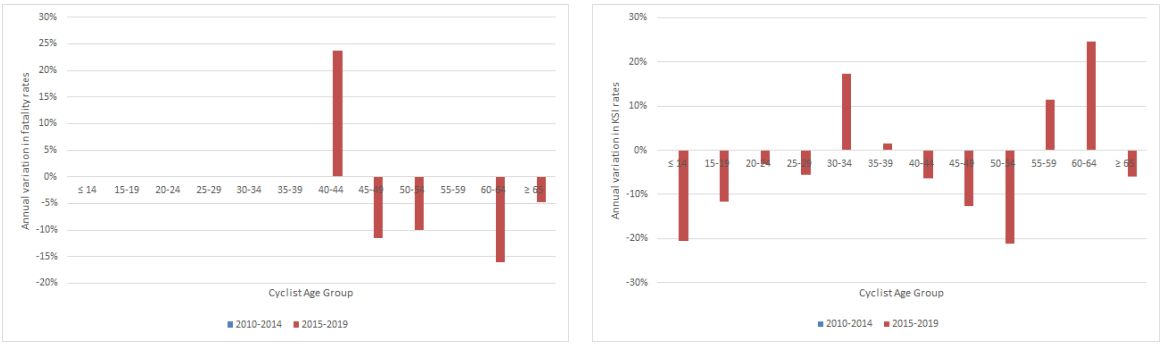



**Figure 2.32 – Developments in cyclists mortality and KSI rates by age group (2015-2019)**

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).

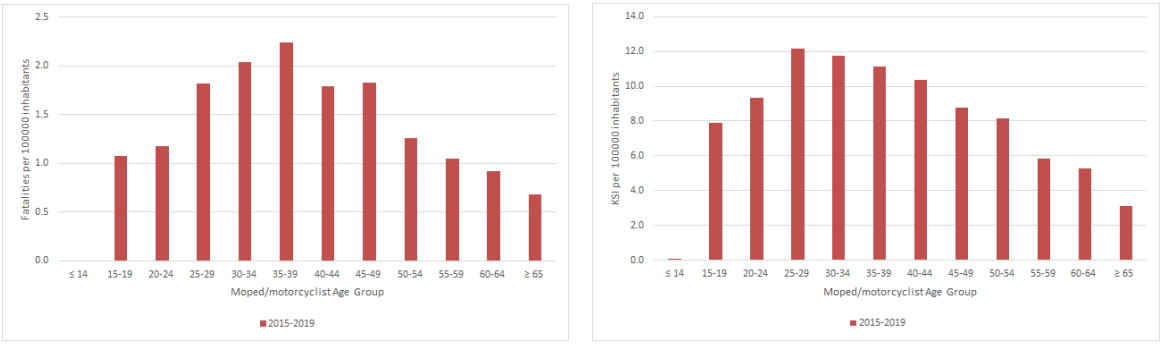



**Figure 2.33 – PTW driver casualty rates by age group (2015-2019)**

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.

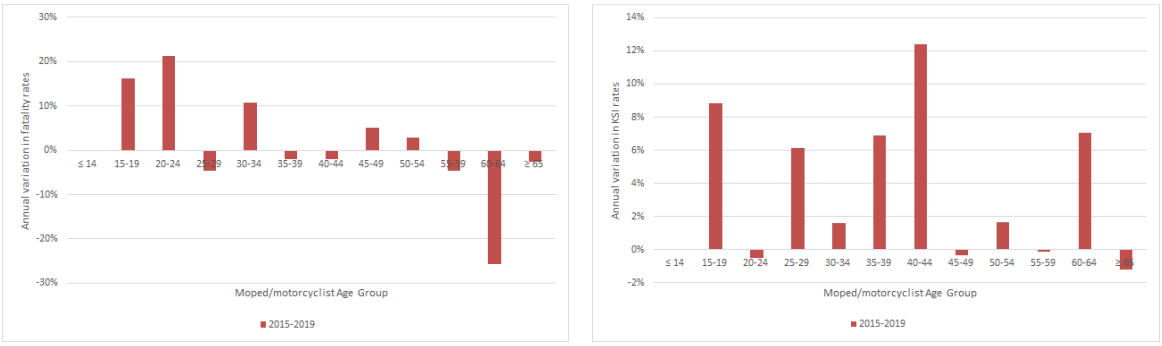



**Figure 2.34 – Average yearly annual variations in PTW driver mortality and KSI rates by age group (2015-2019)**

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.

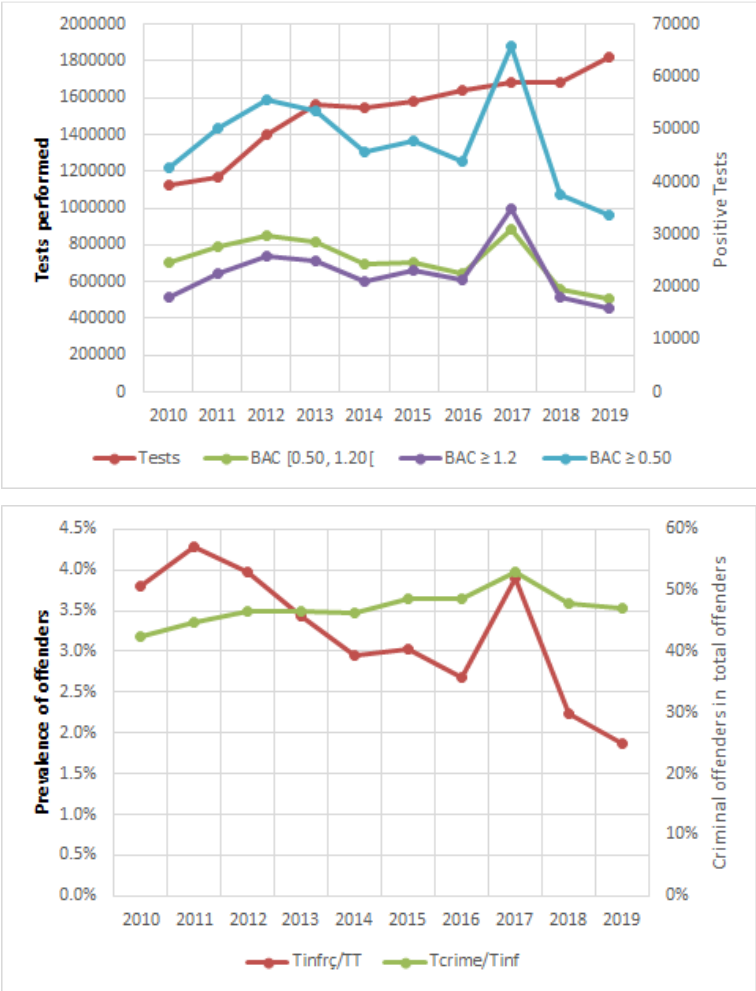



**Figure 2.35 – Annual number of alcohol tests performed and violations detected (2010-2019)**

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

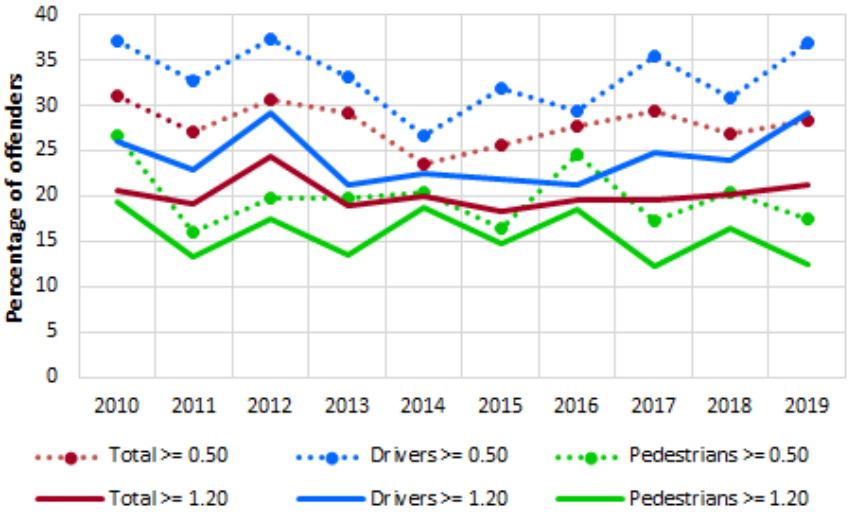



**Figure 2.36 – Developments in the percentage of fatalities with BAC above the legal limit (2010-2019)**

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).

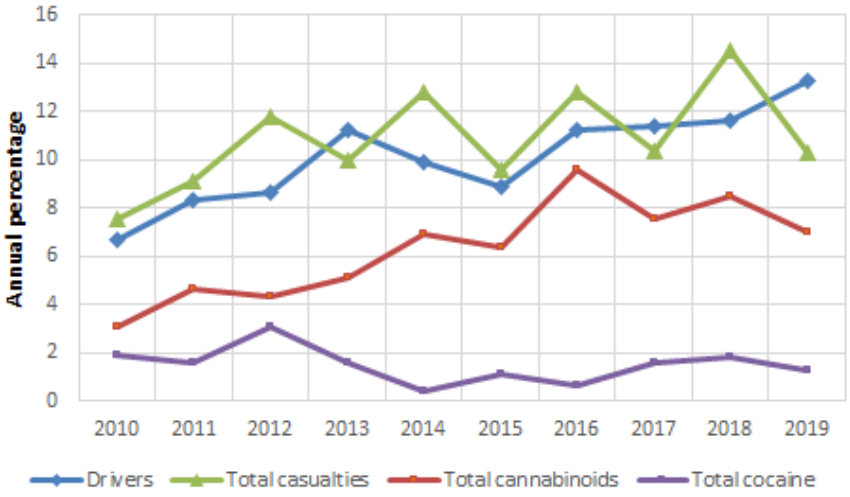



**Figure 2.37 – Developments in the percentage of fatalities tested positive for substances (2010-2019)**

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.

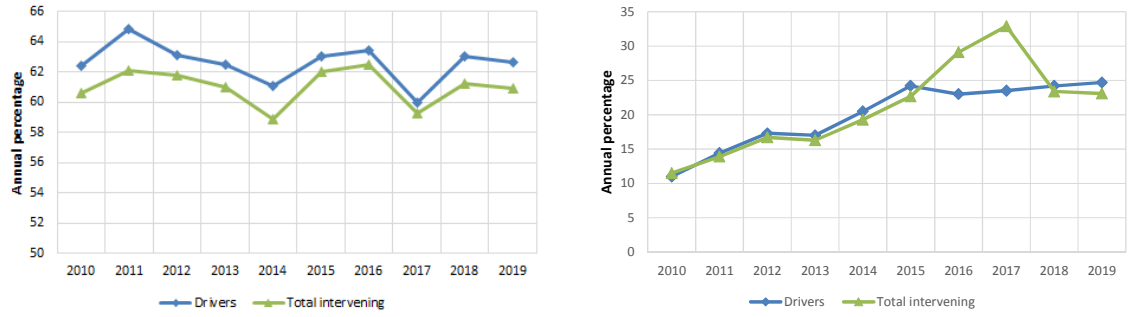



**Figure 2.38 – Percentage of persons involved in crashes and drivers tested with TAS above the legal limit or positive for substances (2010-2019)**

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.

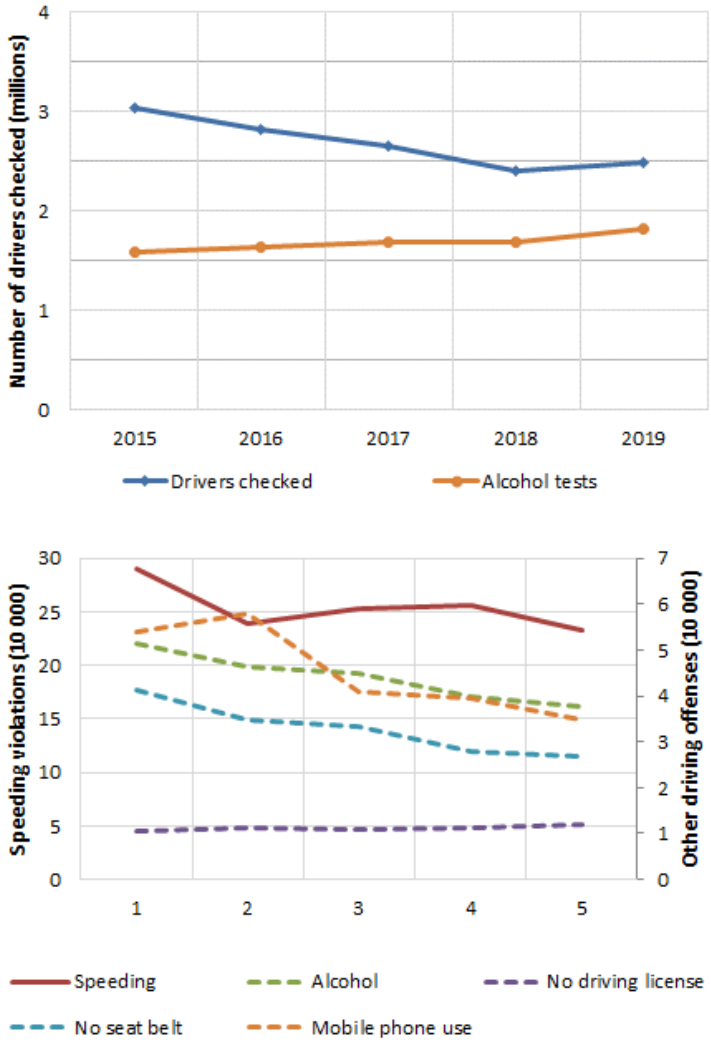



**Figure 2.39 – Developments in the police enforcement activity (left) and registered violations (right), in 2015-2019**

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.

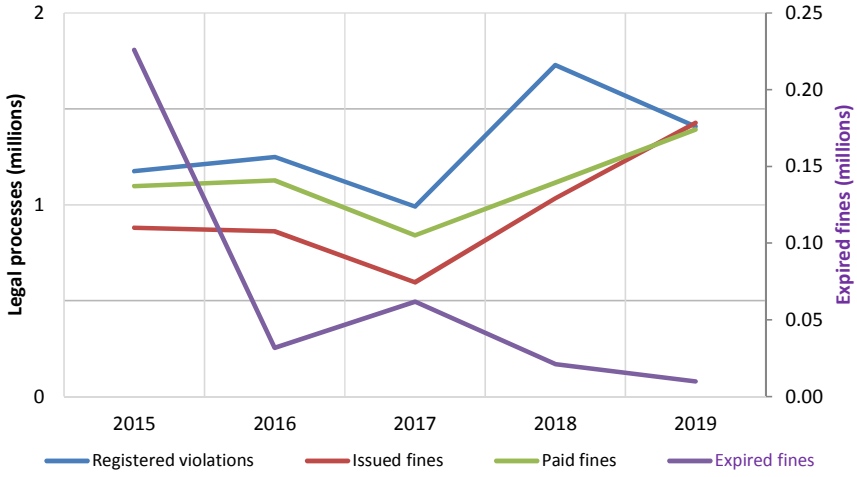



**Figure 2.40 – Developments in the enforcement procedures (2015-2019)**

### *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<br>EN 119, km 17<br>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.

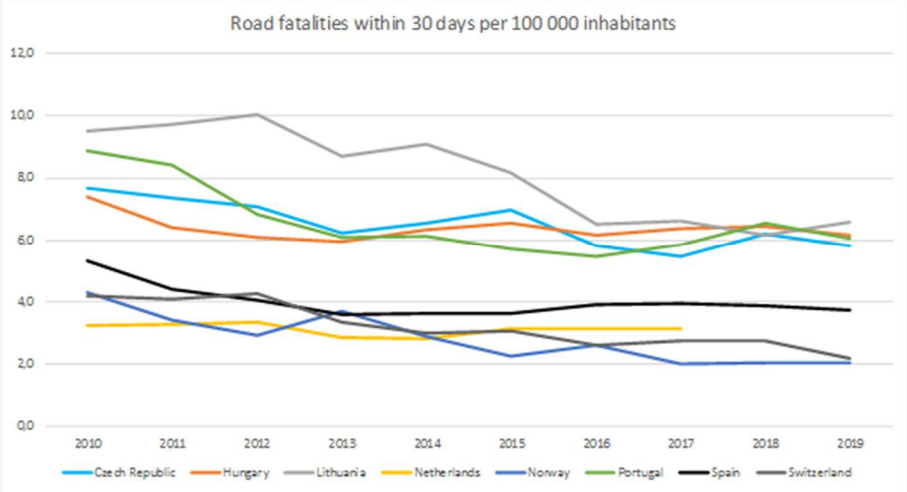
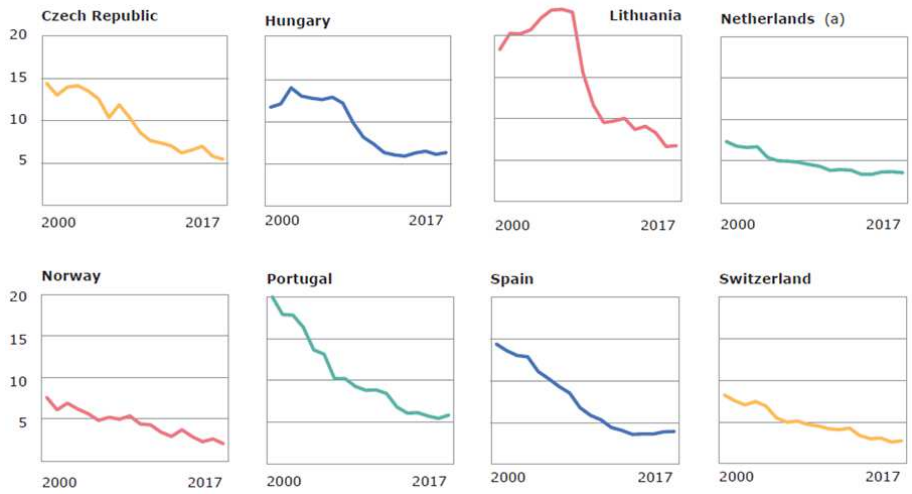



**Figure 2.42 – Developments in road fatalities per 100 000 inhabitants between 2010 and 2019 (Source: IRTAD)**

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.

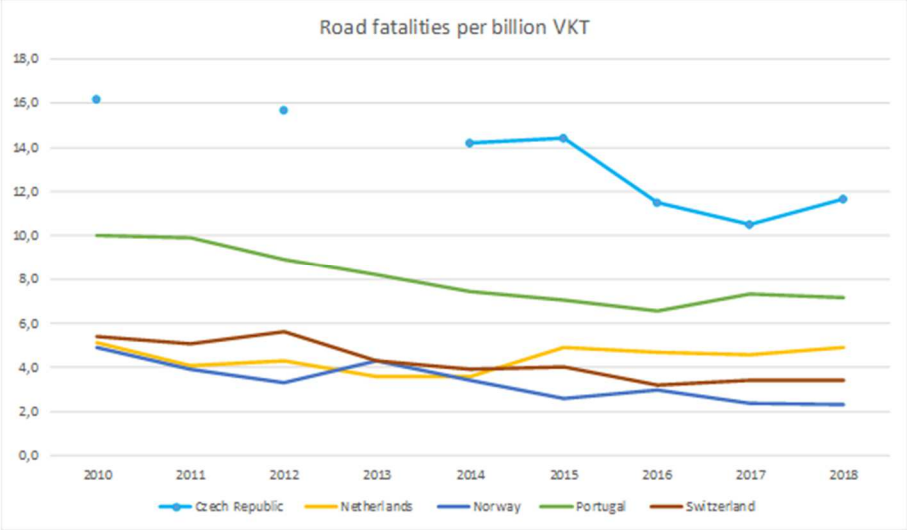



**Figure 2.44 – Developments in road fatalities per billion vehicle.km between 2010 and 2018 (Source: IRTAD and LNEC)**

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.

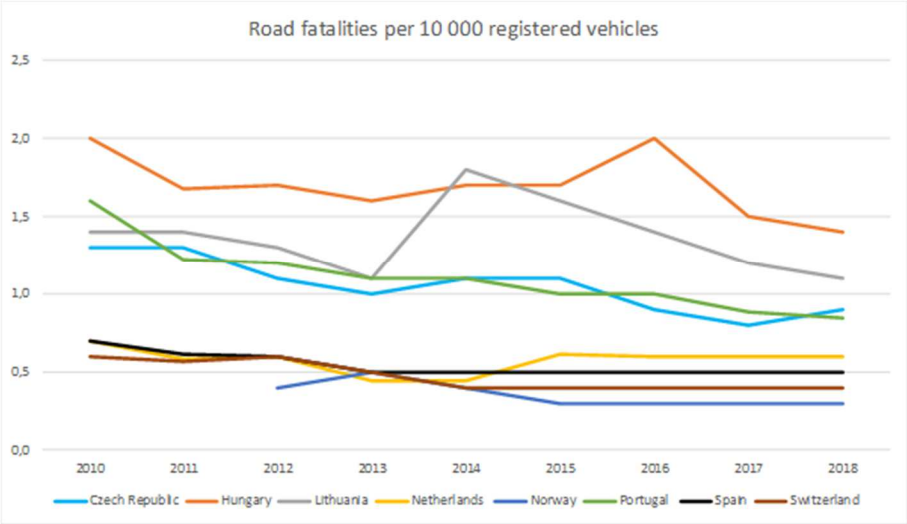



**Figure 2.45 – Developments in road fatalities per 10 000 registered vehicles between 2010 and 2018 (Source: IRTAD)**

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.

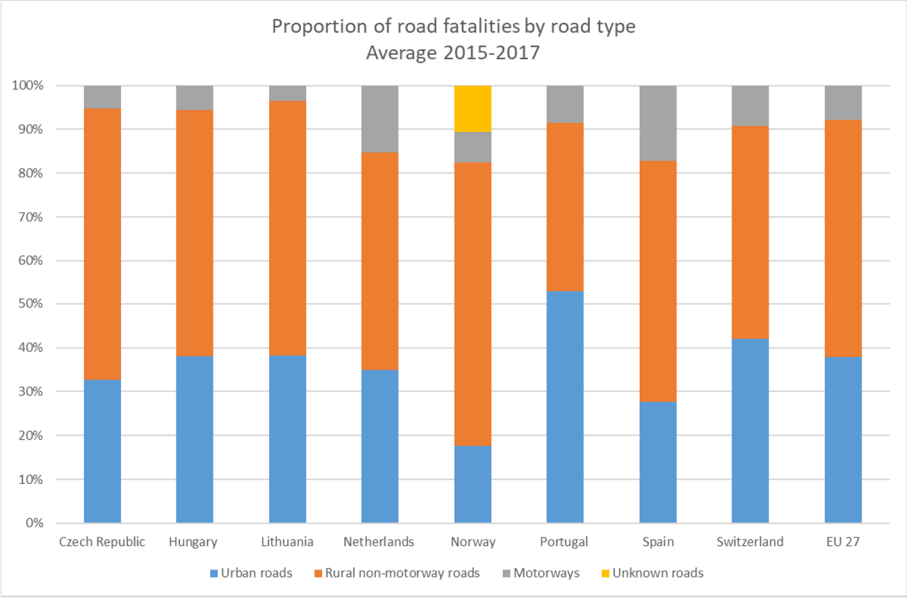



**Figure 2.46 – Average proportion of road fatalities by road type, between 2015 and 2017 (Source: ETSC, 2019c)**

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.

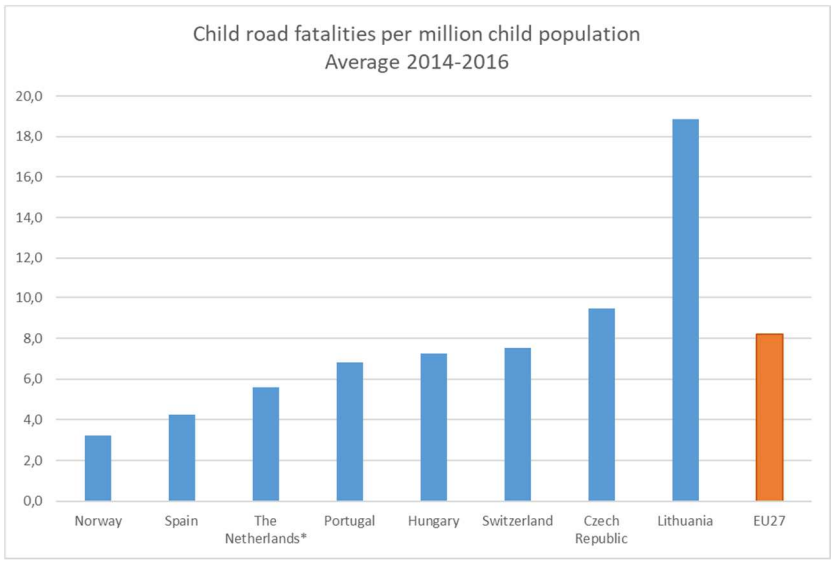



**Figure 2.47 – Average number of children fatalities per million child population (0-14 years old) – 2014 to 2016 (Source: ETSC, 2018)**

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.

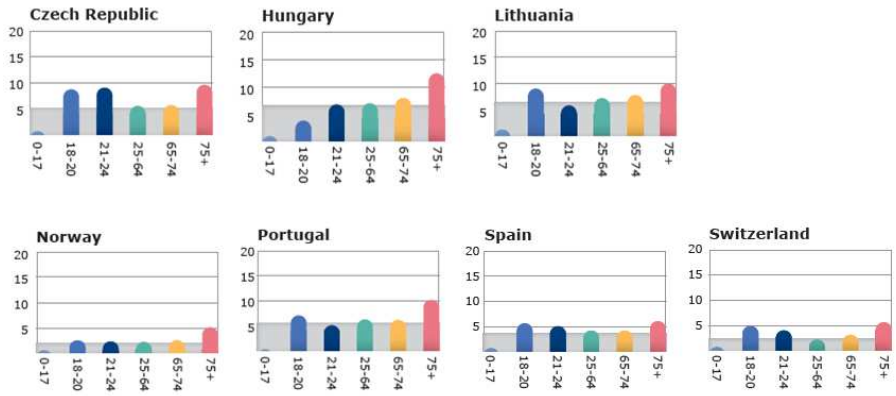



**Figure 2.48 – Mortality rate by age group in 2017 (ITF, 2019)**

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.

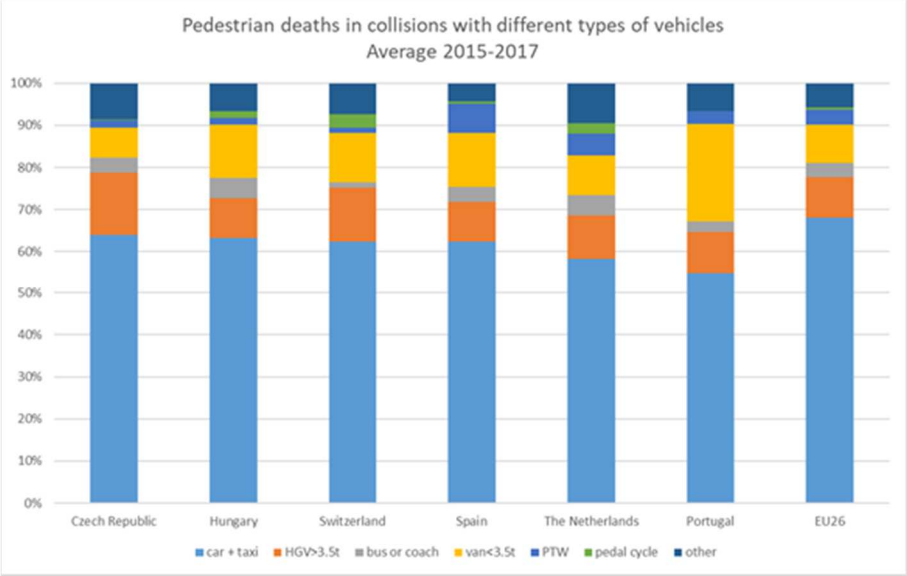
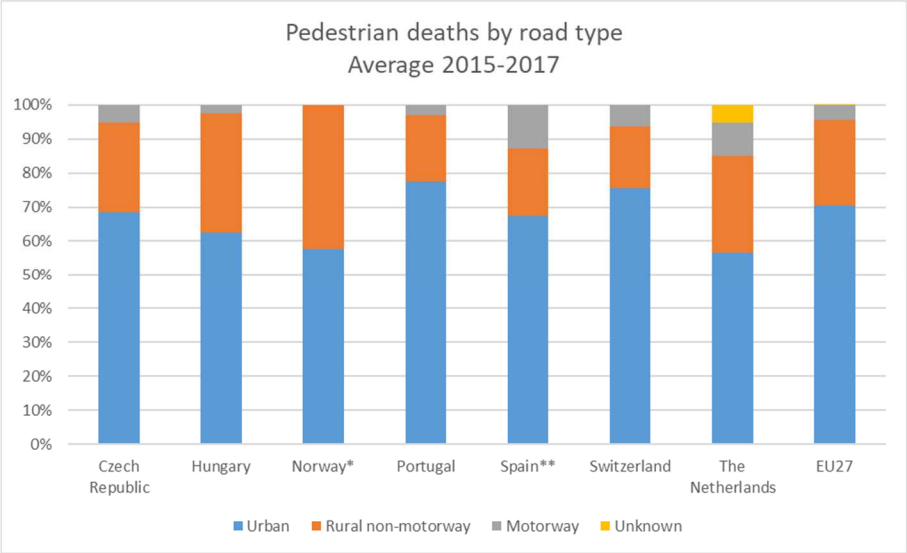



**Figure 2.49 – Average proportion of pedestrian fatalities that occurred in collisions against different types of vehicles – 2015 to 2017 (Source: ETSC, 2020)**

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.

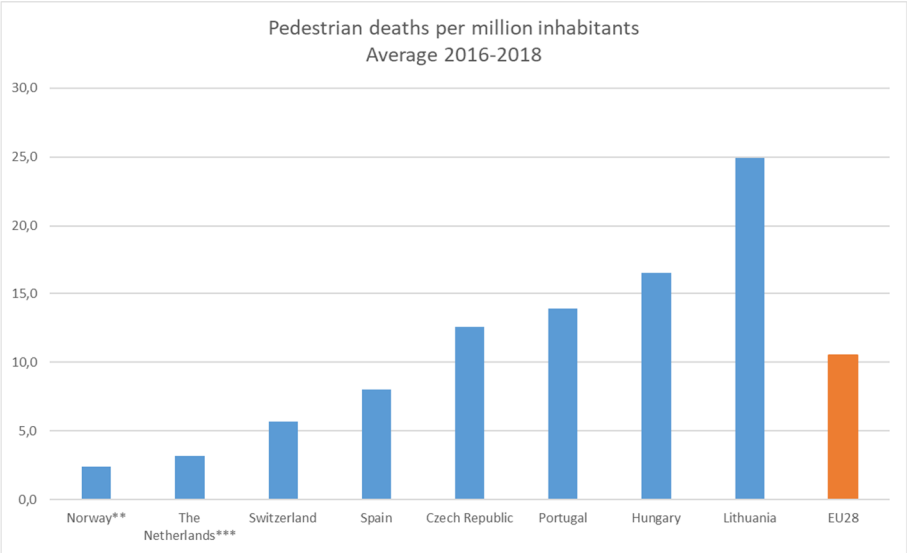
It is also worth noting that the percentage of pedestrian fatalities in Swiss urban areas was similar to what was registered in Portugal.




*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)**

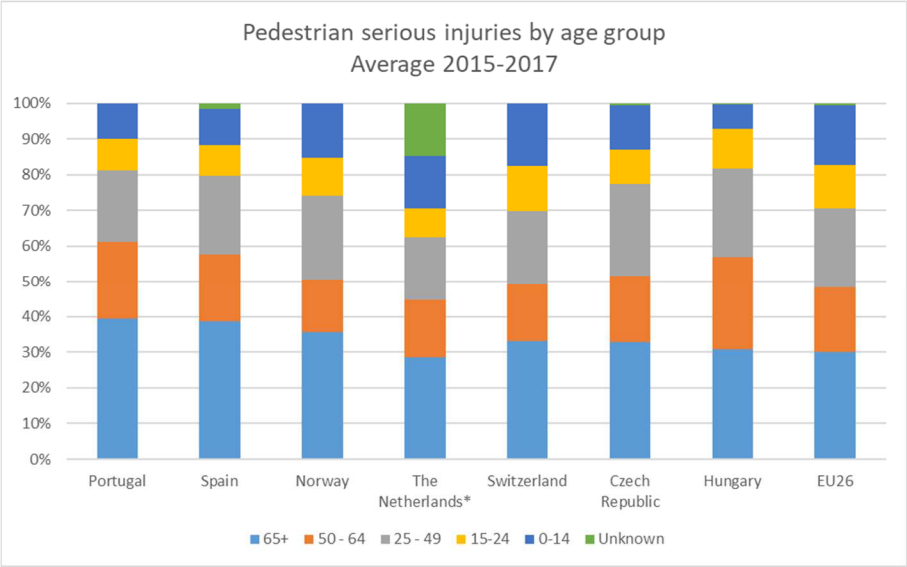
Figure 2.51 shows the average number of pedestrian deaths per million inhabitants between 2016 and 2018. Lithuania presents the highest indicator, with 24.9 pedestrian deaths per million inhabitants, followed by Hungary, Portugal and Czech Republic (16.6, 13.9 and 12.6 pedestrian deaths per million inhabitants, 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.

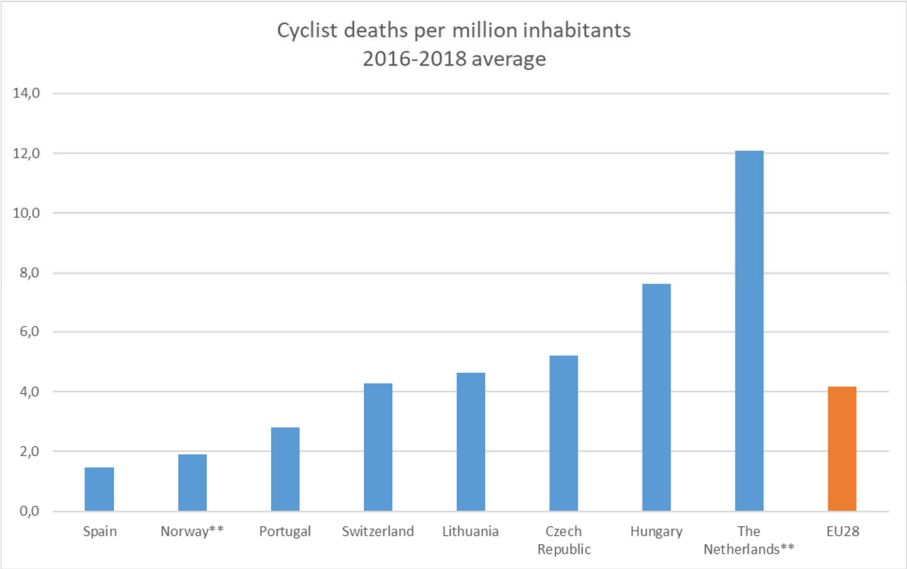



*NL - serious injury data based on the national definition. Data provided by SWOV.

**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.

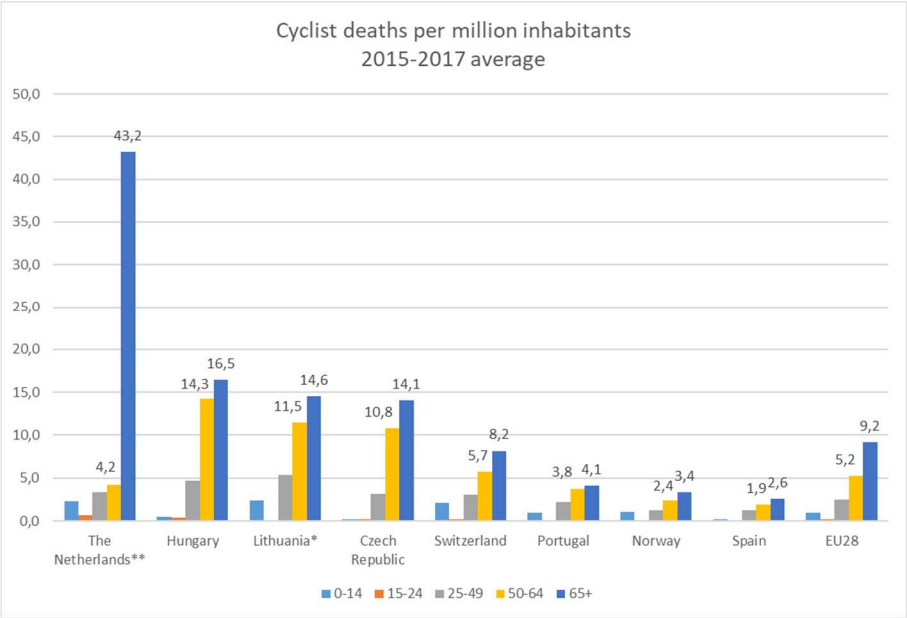
Lack of available exposure data hampers the full use of these data, given the differences in traffic volumes among countries. Given the current implementation of policies fostering the increase of cycling modal share in urban transport, predictions on the impact of these policies on road safety need 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)**

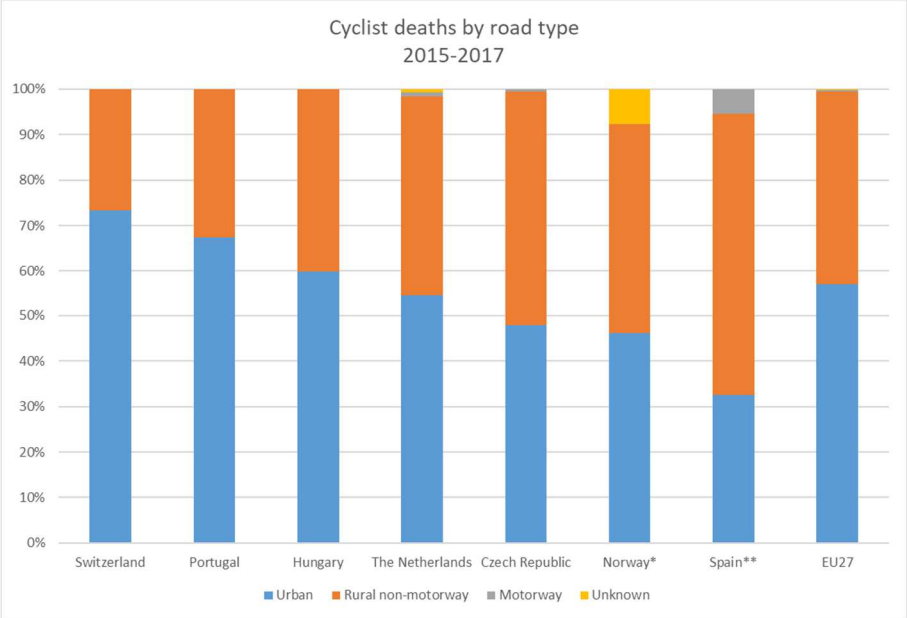
Figure 2.54 shows the average number of cyclist deaths per million inhabitants (from 2017 estimations) disaggregated by age group, between 2015 and 2017. Again it is The Netherlands that presents the highest value: 43.2 cyclist deaths per million inhabitants, but only for the oldest age group (above 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%).

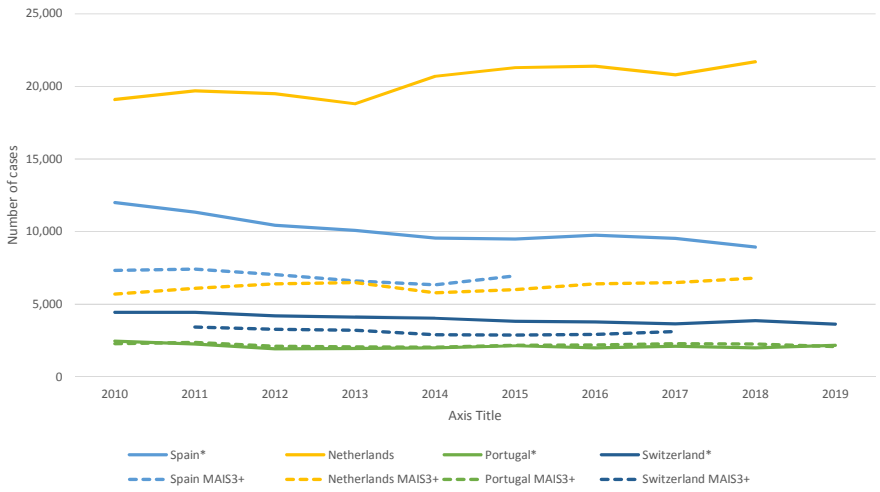



**Figure 2.56 – Developments in the number of serious injuries (2010-2019) (Source: ETSC, 2020)**

### 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.

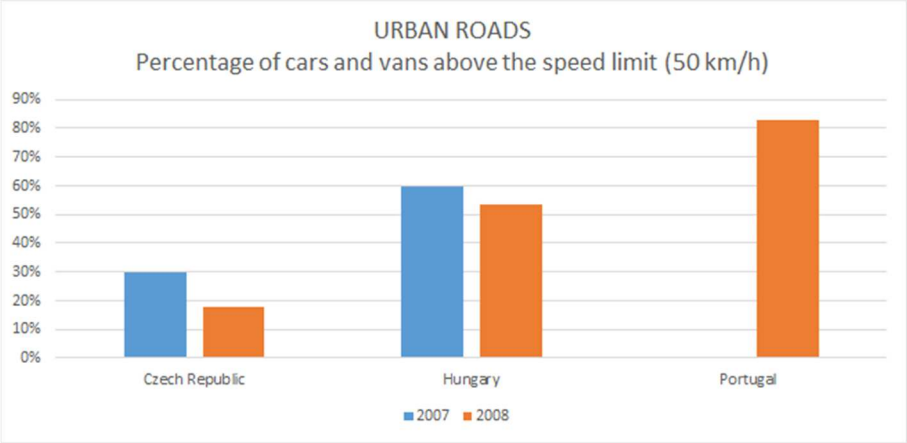



**Figure 2.57 – Proportion of cars, taxis and vans traveling above the speed limit in urban roads (Source: ETSC, 2019b, PRP, 2008)**

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.

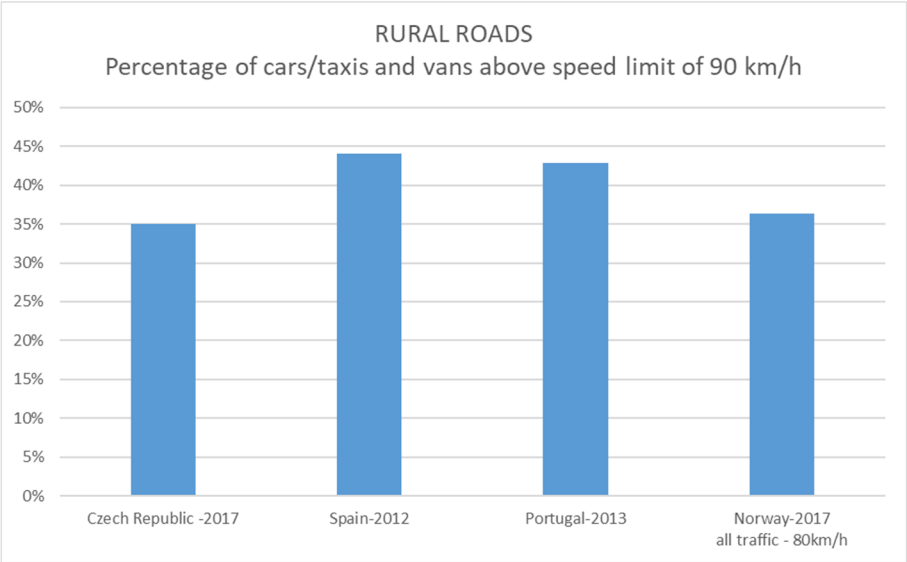
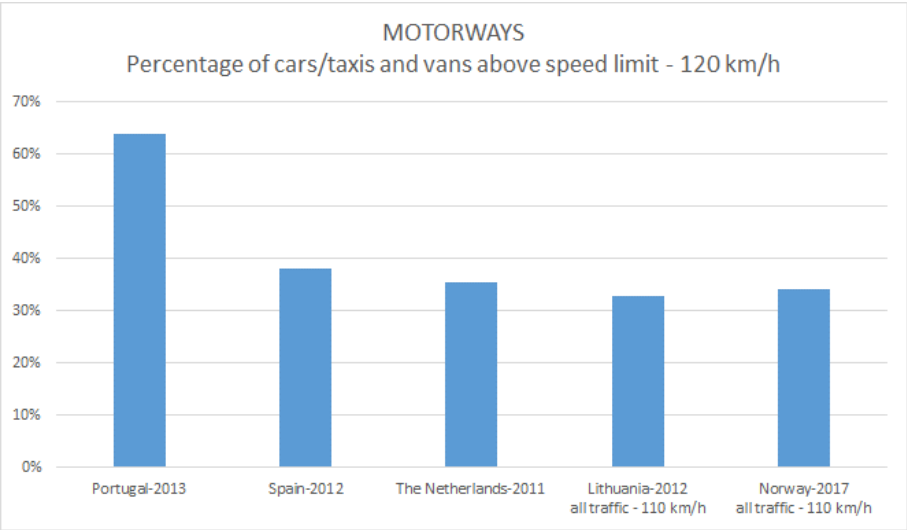



**Figure 2.58 – Proportion of observed speeding cars and vans on rural non-motorway roads, under free flow traffic conditions (Source: ETSC, 2019b, PRP)**

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.

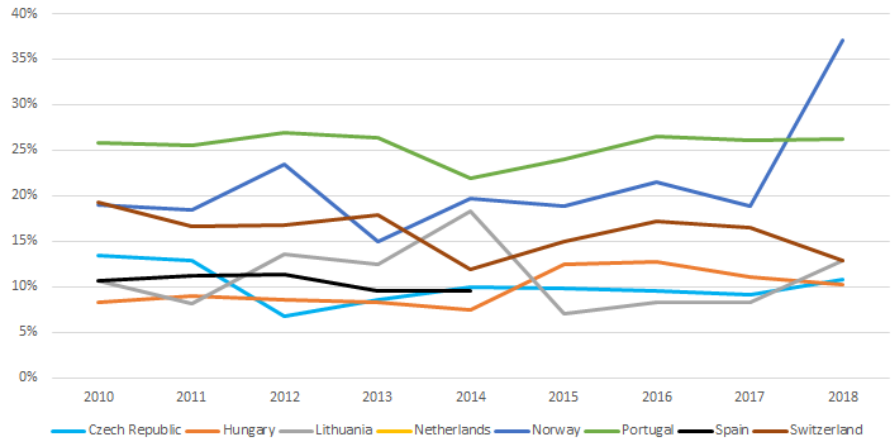



**Figure 2.60 – Developments in the percentage of road deaths attributed to alcohol in one of the intervening active parties (Source: ETSCa, 2019)**

## 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.

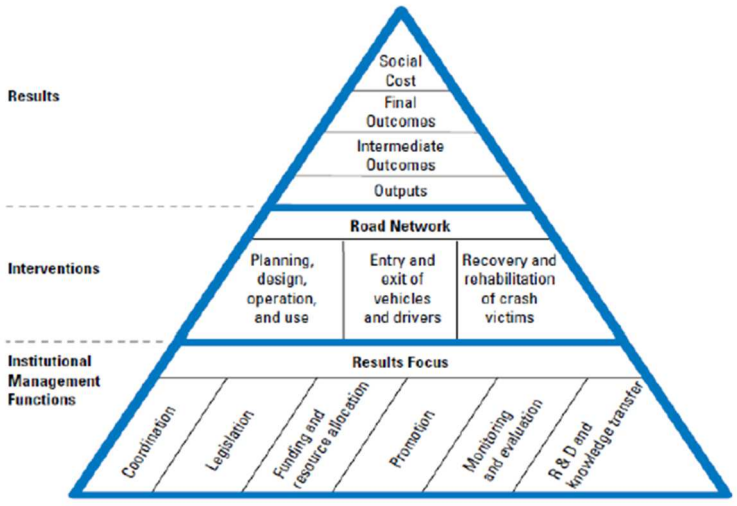



**Figure 4.1 – The road safety management system (Bliss & Breen, 2009)**

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.

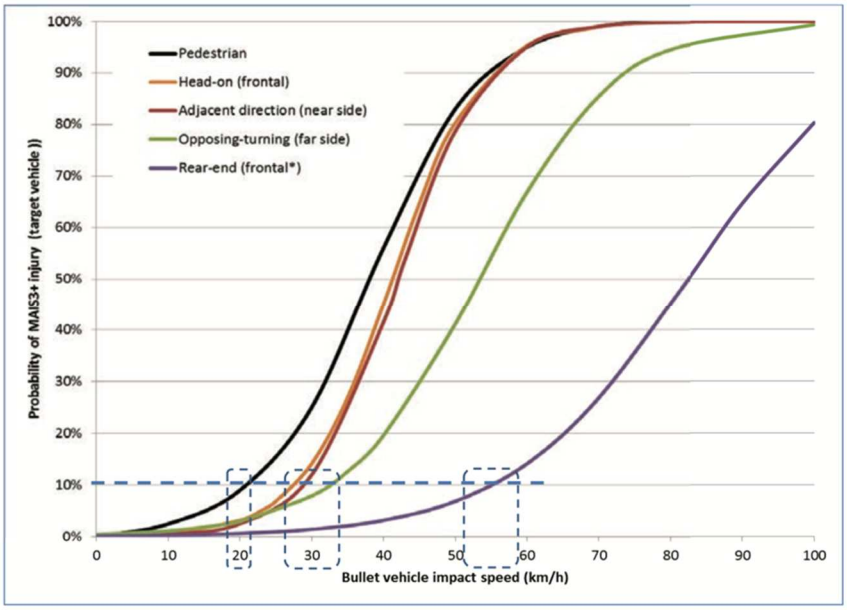



**Figure 4.3 – Safe speed: influence of impact speed, road user and type of impact on the probability of MAIS3+ injury (Jurewicz *et al.*, 2016)**

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.

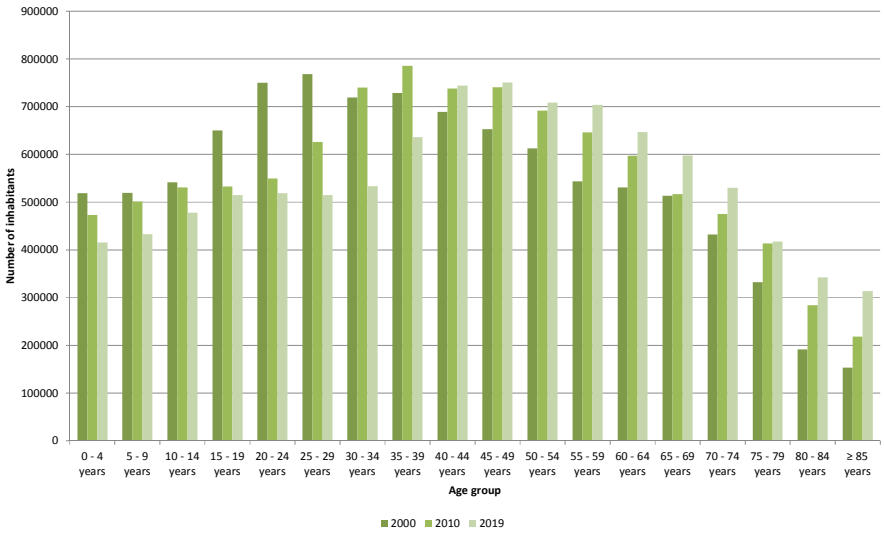



**Figure 5.1 – Developments in the Portuguese population between 2000 and 2019, by age group (INE)**

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* |

[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.

| | | | | |
|---|---|---|---|---|
| 10 | *aplicacao* | *velocidade* | *prova* | *regulamentacao* |

**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* |

To provide a better understanding of the LDA's latent topics, Figure 6.1 presents some examples of the topic-specific words probabilities ($\beta$) 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 ($\beta$) 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.

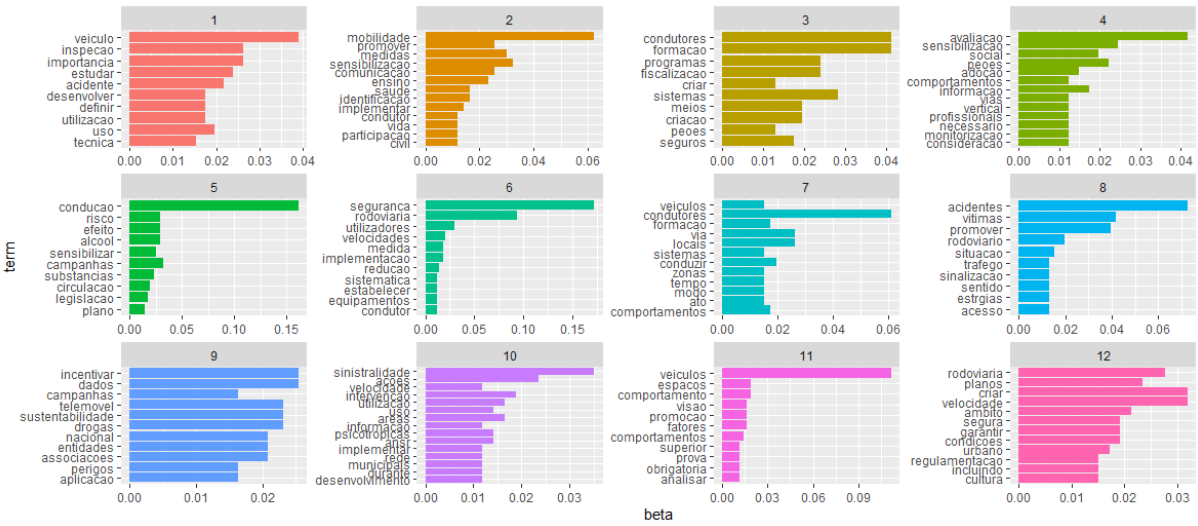



**Figure 6.1 – Topic-specific word probabilities for the public and private entities' record set.**

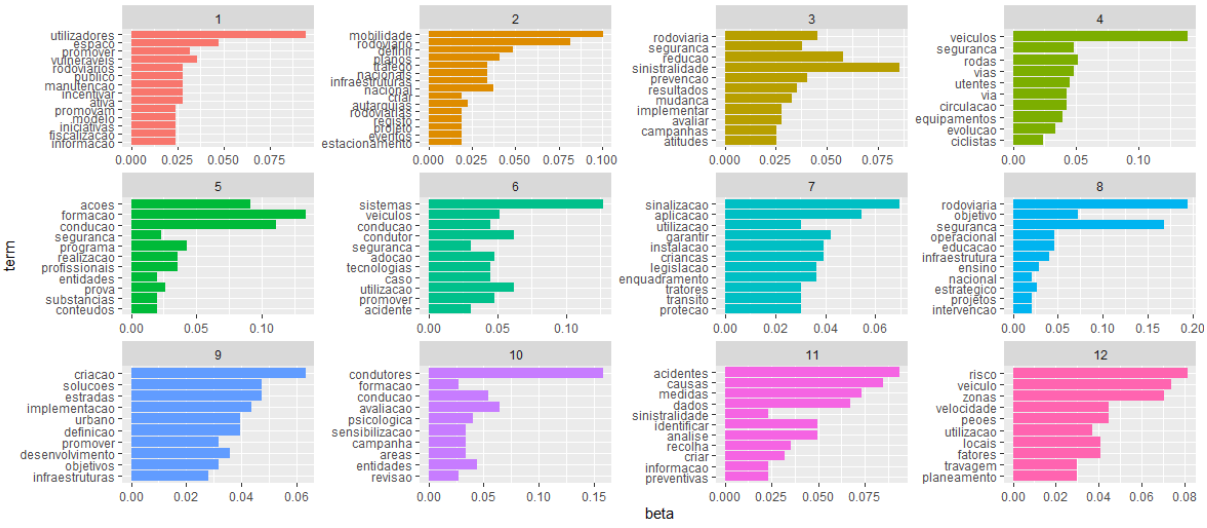



**Figure 6.2 – Topic-specific word probabilities for Non-Executive Council of Experts' record set.**

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

Lisboa, LNEC, December 2020

APPROVED

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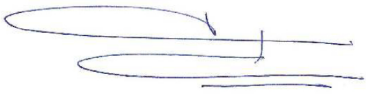

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# References

AARTS, L.; NES, N. V.; WEGMAN, F. C. M.; SCHAGEN, I. N. L. G. V.; LOUWERSE, R., 2009 – **Safe Speeds and Credible Speed Limits (SaCredSpeed): New Vision for Decision Making on Speed Management.** Paper presented at the 88th Annual Meeting of the Transportation Research Board TRB, Washington DC, USA.

ACHERMANN STÜRMER, Y.; MEESMANN, U.; BERBATOVCI, H., 2019 – **Driving under the influence of alcohol and drugs**. ESRA2 Thematic report Nr. 5. ESRA project (E-Survey of Road users' Attitudes). Bern, Switzerland: Swiss Council for Accident Prevention. [https://www.esranet.eu/storage/minisites/esra2018thematicreportno5drivingunderinfluence.pdf].

ALFARO, J-L; FABRE, M.; CHAPUIS, M. eds., 1994 – **Cost 313: Socio-economic cost of road accidents. Final report of the action**. European Commission, Brussels.

ANSR, 2020a – **Monitorização PENSE 2020** – Out 20. (ficheiro Excel).

ANSR, 2020b. – **Condução sob a influência de álcool**. Autoridade Nacional de Segurança Rodoviária, Cabanas.

ANSR, 2020c – **Reference Document Vision Zero 2030.** Autoridade Nacional de Segurança Rodoviária, Cabanas.

ARUN, R.; SURESH, V.; VENI MADHAVAN, C.E.; NARASIMHA MURTHY, M.N., 2010 – **On Finding the Natural Number of Topics With Latent Dirichlet Allocation: Some Observations**. Springer, Berlin, Heidelberg, 391-402.

AZEVEDO, C.L., 2008 – **Estimação de volumes anuais de tráfego rodoviário. Um modelo para Portugal.** Dissertação para obtenção do grau de Mestre em Transportes do Instituto Superior Técnico da Universidade Técnica de Lisboa e LNEC.

BLEI, D.M.; NG, A.Y.; JORDAN, M.I., 2003 – **Latent Dirichlet Allocation**. The Journal of Machine Learning Research, 3, 993-1022.

BLISS, T.; BREEN, J., 2009 – **Country Guidelines for the Conduct of Road Safety Management Capacity Reviews and the Specification of Lead Agency Reforms, Investment Strategies and Safe System Projects.** Global Road Safety Facility, World Bank, Washington, D.C.

BOS, N.M.; BIJLEVELD, F.D.; DECAE, R.J.; AARTS, L.T., 2019 – **Ernstig verkeersgewonden 2019 [Serious road injuries 2019]**. R-2020-28. SWOV, Den Haag.

CAMPOS, V., 1993 – **Normas técnicas para projecto de urbanização.** Lisboa, LNEC.

CARDOSO, J.L., 1998 – **Definição e detecção de zonas de acumulação de acidentes na rede rodoviária nacional. (1º Relatório).** LNEC - Procº 093/19/13004. Relatório 119/98 – DVC/NTSR.

CARDOSO, J.L., 2005 – **The use of international data on fuel sales and vehicle fleet for the estimation of yearly national traffic volumes.** Accident Analysis & Prevention, Vol 37, pp 207–215. DOI: 10.1016/j.aap.2003.12.005, EID: 2-s2.0-10444261878.

CARDOSO, J.L., 2009 – **Requisitos para instalação de sistemas fixos de fiscalização automática do cumprimento dos limites de velocidade.** LNEC - Proc. 0703/1/16976. Relatório 19/09 – NPTS/DT.

CARDOSO, J.L., 2010b – **Inspecções de segurança rodoviária. Manual Técnico.** InIR, NPTS-LNEC, Lisboa.

CARDOSO, J.L., 2010a – **Recomendações para Definição e Sinalização de Limites de Velocidade.** Prevenção Rodoviária Nacional, Lisboa. ISBN 978-972-98080-4-3.

CARDOSO, J.L., 2012 – **Avaliação do impacte sobre a segurança rodoviária - Recomendações para aplicação na Rede Rodoviária Nacional.** InIR, NPTS-LNEC, Lisboa.

CARDOSO, J.L., 2020 – **Deteção de zonas de acumulação de acidentes na rede rodoviária nacional. Período de 2013 a 2017.** LNEC - Proc. 0703/123/21409. Relatório 338/2019 – DT/NPTS.

CARDOSO, J.L.; ALMEIDA ROQUE, C., 2016 – **Auditorias e inspecções de segurança rodoviária. Aspectos práticos decorrentes da legislação recente e por estabelecer**. 8º Congresso Rodoviário Português, Lisboa.

CARDOSO, J.L.; ANDRADE, P.S., 2005 – **Velocidades praticadas pelos condutores nas estradas portuguesas. Ano de 2004.** LNEC - Proc. 0703/1/13773. Relatório 395/05 – DT/NPTS. (Vol I, Vol II).

CARDOSO, J.L.; BAIRRÃO, 2006. – **Auditoria de segurança rodoviária. Manual de aplicação ao projecto de estradas da rede rodoviária nacional.** ISBN-13 978-972-49-2085-6, LNEC, 2006.

CARDOSO, J.L.; GOMES, S.V., 2019 – **Mobilidade sustentável. A vertente do sistema seguro como elemento a integrar para abordagem holística dos problemas dos utentes vulneráveis.** 9º Congresso Rodoviário Português, Lisboa.

CARDOSO, J.L.; META, E.; QUIGLEY, C.; WELSH, R.; TALBOT, R., 2018 – **Analysis of good practice.** Deliverable D7.1 of the H2020 project SaferAfrica-Innovating dialogue and problems appraisal for a safer Africa, Lisboa.

DONÁRIO, A.,A.; SANTOS, R.B., 2012 – **Custo económico e social dos acidentes de viação em Portugal.** Universidade Autónoma, documento 1-2012-CARS, Lisboa. ISBN 978-989-8191-35-9.

EC, 2017 – **Traffic Safety Basic Facts on Motorcycles and Mopeds.** European Commission, Directorate General for Transport, Brussels. [https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/statistics/dacota/bfs2017_motomoped.pdf]

EC, 2019 – **Handbook on the external costs of transport**. European Commission, Directorate-General for Mobility and Transport. Brussels.

ERTRAC, 2019 – **Connected Automated Driving Roadmap**. European Road Transport Research Advisory Council, Brussels.

ETSC, 2018 – **Reducing child deaths on European roads. PIN Flash Report 34**. European Transport Safety Council, Brussels.

ETSC, 2019a – **Progress in reducing drink-driving and other alcohol-related road deaths in Europe**. European Transport Safety Council, Brussels.

ETSC, 2019b – **Reducing speeding in Europe. PIN Flash Report 36.** European Transport Safety Council, Brussels.

ETSC, 2019c – **Safer roads, safer cities: how to improve urban road safety in the EU. PIN Flash Report 37.** European Transport Safety Council, Brussels.

ETSC, 2020a – **How safe is walking and cycling in Europe? PIN Flash Report 38.** European Transport Safety Council, Brussels.

ETSC, 2020b – **Ranking EU progress on road safety. 14th Road Safety Performance Index Report.** European Transport Safety Council, Brussels.

FEINERER, I.; HORNIK, K.; MEYER, D., 2008 – **Text mining infrastructure in R**. J. Stat. Softw., 25 (5), 1-54.

FERSI, 2018 – **Safety through automation? Ensuring that automated and connected driving contribute to a safer transportation system.** Position paper. Forum of European Road Safety Research Institutes, Brussels.

FPCEUP, 2019a – **1º Relatório de Acompanhamento das medidas do Objetivo Estratégico 2 (utilizadores mais seguros) do PENSE-2020** (Plano Estratégico Nacional de Segurança Rodoviária 2016-2020). Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto (FPCEUP).

FPCEUP, 2019b – **2º Relatório de Acompanhamento das medidas do Objetivo Estratégico 2 (utilizadores mais seguros) do PENSE-2020** (Plano Estratégico Nacional de Segurança Rodoviária 2016-2020). Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto (FPCEUP).

GONÇALVES, J.A.A.; OLIVEIRA, R.G., 1974 – **Passagens de peões**. DGV, Lisboa.

GRIFFITHS, T.L.; STEYVERS, M., 2004 – **Finding scientific topics.** Proc. Natl. Acad. Sci., 101 (2004), pp. 5228-5235.

GRUN, B.; HORNIK, K., 2011 – **Topic models: an R package for fitting topic models.** J. Stat. Softw., 40 (13), pp. 1-30.

HOUWING, S.; HAGENZIEKER, M.; MATHIJSSEN, R.; BERNHOFT, I.M.; HELS, T.; JANSTRUP, K.; VAN DER LINDEN, T.; LEGRAND, S.-A.; VERSTRAETE, A.; DIAS, M.; FONSECA, S.; SIMÕES, S., 2011 – **Prevalence of alcohol and other psychoactive substances in drivers in general traffic. Part II: Country reports.** Deliverable D2.2.3 of DRUID-Driving under the Influence of Drugs, Alcohol and Medicines. BASt.

HOWARD, E.; BREEN, J.; BLISS, T.; CORBEN, B., 2010 – **Road safety management capacity review – Western Australia (Final report)**. Government of Western Australia, Perth.

IDeS, 2018 – **Análise e Avaliação do Cumprimento das Medidas A3.11 a A5.21 e A30.99 a A34.107 do Plano de Ação do PENSE 2020. Relatório Anual Ano 2018.** Instituto Direito e Segurança (IDeS).

IDeS, 2020 – **Análise e Avaliação do Cumprimento das Medidas A3.11 a A5.21 e A30.99 a A34.107 do Plano de Ação do PENSE 2020. 2º Relatório Anual Ano 2019**. Instituto Direito e Segurança (IDeS).

IDMEC, 2019a – **Relatório de Avaliação Anual do ano 2018 PENSE 2020 Medidas A6.22, A6.23, A26.94 a A29.98**. Instituto de Engenharia Mecânica (IDMEC) do Instituto Superior Técnico (IST).

IDMEC, 2019b – **Relatório de Avaliação Anual do ano 2019 PENSE 2020 Medidas A6.22, A6.23, A26.94 a A29.98.** Instituto de Engenharia Mecânica (IDMEC) do Instituto Superior Técnico (IST).

ITF, 2008 – **Towards Zero: Ambitious Road Safety Targets and the Safe System approach.** OECD Publishing, Paris.

ITF/OECD, 2011 – **Reporting on serious road traffic casualties. Combining and using different data sources to improve understanding of non-fatal road traffic crashes**. ITF/IRTAD, Paris.

ITF, 2016 – **Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System,** OECD Publishing, Paris. http://dx.doi.org/10.1787/9789282108055-en.

ITF, 2019 – **IRTAD Road Safety Annual Report 2019.** OECD Publishing, Paris.

JARRETT, D.; CARDOSO, J.L.; MACEDO, A.L.; WRIGHT, C.C., 1994 – **Models for comparison of road accident rates in Portugal and the U.K., at the local authority level**. Memória 781, LNEC, Lisboa. ISBN 972-49-1604-9.

JUREWICZ, C.; SOBHANI, A.; WOOLLEY, J.; DUTSCHKE, J.; CORBEN, B., 2016 – **Exploration of vehicle impact speed - injury severity relationships for application in safer road design.** Transportation Research Procedia 14, 424-425.

MACEDO, A.L.; CARDOSO, J.L., 2001 – **Elementos para apoio à intervenção em meio urbano indisponibilidade ou sub-aproveitamento?** 1º Encontro nacional "Segurança rodoviária em meio urbano". Prevenção Rodoviária Portuguesa, Lisboa.

MACEDO, A.L.; CARDOSO, J.L.; ARSÉNIO, E.; DIONÍSIO, A.; FIGUEIREDO, A., 2000 – **Participação do LNEC nos estudos sobre imputação dos encargos pela utilização das infraestruturas. 2º Relatório.** LNEC - Procº 093/01/13563. Relatório 59/00 – DVC/NTSR.

MATENA, S.; WEBER, R.; HUBER, C.; HRUBY, Z.; POKORNY, P.; GAITANIDOU, E.; VANEERDEWEGH, P.; STRNAD, B.; CARDOSO, J.L.; SCHERMERS, G.; ELVIK, R., 2007 – **Road Safety Audit – Best Practice Guidelines. Qualification for Auditors and Programming.** Ripcord-Iserest Report D4.2. BASt.

METHORST, R.; EENINK, R.; CARDOSO, J.L.; MACHATA, K.; MALASEK, J., 2016 – **Single Unprotected Road User crashes: Europe we have a problem!**, Transportation Research Procedia, Volume 14, pages 2297-3305, 2016, https://doi.org/10.1016/j.trpro.2016.05.246.

OECD, 2008 – **Speed management.** Organization for Economic Co-operation and Development, Paris, France.

OLIVEIRA, R.G.; MATEUS, A.M., 1970 – **Técnicas de engenharia de trânsito.** Gabinete de Estudos e Planeamento de Transportes Terrestres/Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 1991 – **Avaliação dos custos socio-económicos dos acidentes rodoviários.** Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2017 – **ESRA 2015 Portugal. Álcool & Drogas. Comportamentos auto-declarados, atitudes e perceção de risco.** Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2020 – **ESRA 2015 Portugal. Álcool & Drogas. Comportamentos auto-declarados, opiniões e atitudes**. Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2021a – **Veículos de 2 rodas a motor (motociclos e ciclomotores). Sinistralidade, comportamentos e atitudes.** Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2021b – **Ciclistas. Sinistralidade, comportamentos e atitudes**. Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2021c – **Condução sob o efeito de álcool em Portugal.** Prevenção Rodoviária Portuguesa, Lisboa.

PRP, 2021d – **Peões. Sinistralidade, comportamentos e atitudes.** Prevenção Rodoviária Portuguesa, Lisboa.

REURINGS, M.; JANSSEN, T.; EENINK, R.; ELVIK, R.; CARDOSO, J.L.; STEFAN, C., 2006 – **Accident Prediction Models and Road Safety Impact Assessment: a state-of-the-art.** Ripcord-Iserest. Deliverable, Leidschendam, 2006.

RIBEIRO, C., 2012 – **Modelação de dados espaço-temporais em segurança rodoviária.** Dissertação para Doutoramento em Estatística e Investigação Operacional. Especialidade em Probabilidades e Estatística. Universidade de Lisboa.

RIBEIRO, C.; TURKMAN, A.; CARDOSO, J.L., 2011 – **Bayesian hierarchical models for road accidents in small area using INLA.** 5th Workshop on Statistics, Mathematics and Computation: Methods and Applications, Faro.

ROQUE, C.; CARDOSO, J.L.; CONNELL, T.; SCHERMERS, G.; WEBER, R., 2019 – **Topic analysis of Road safety inspections using latent dirichlet allocation: a case study of roadside safety in Irish main roads**. Accid. Anal. Prev. 131, 336-349.

ROQUE, C.; CARDOSO, J.L., 2010a – **Critérios de segurança para a área adjacente à faixa de rodagem.** InIR, NPTS-LNEC, Lisboa.

ROQUE, C.; CARDOSO, J.L., 2010b – **Sistemas de retenção rodoviários de veículos. Recomendações para selecção e colocação.** InIR, NPTS-LNEC, Lisboa.

RUPPRECHT CONSULT (editor), 2019 – **Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition**. European Commission, Brussels.

SANTIAGO, C. R.; ROQUE, C.; LAVINHA, P.; NUNES, C., 2019 – **Investigação em segurança rodoviária em Portugal: a utilização de bases de dados hospitalares e sua ligação a outras bases.** 9º Congresso Rodoviário Português, Lisboa.

SIS, 2015 – **Relatório anual de segurança interna. Ano de 2015**, Sistema de Segurança Interna.

SIS, 2016 – **Relatório anual de segurança interna. Ano de 2016**, Sistema de Segurança Interna.

SIS, 2017 – **Relatório anual de segurança interna. Ano de 2017**, Sistema de Segurança Interna.

SIS, 2018 – **Relatório anual de segurança interna. Ano de 2018**, Sistema de Segurança Interna.

SIS, 2019 – **Relatório anual de segurança interna. Ano de 2019**, Sistema de Segurança Interna.

UC, 2018 – **Avaliação do cumprimento dos programas de ação setoriais do PENSE 2020 para o período jun 2017- jun 2018.** Faculdade de Ciências e Tecnologia da Universidade de Coimbra (UC).

UC, 2019 – **Avaliação do cumprimento dos programas de ação setoriais do PENSE 2020 para o período jun 2017- jun 2019**. Faculdade de Ciências e Tecnologia da Universidade de Coimbra (UC).

VADEBY, A.; FORSMAN, Å., 2017 – **Traffic safety effects of new speed limits in Sweden.** Accident; analysis and prevention. Vol. 114, pp 34-39.

WANG, W.; FENG, Y.; DAI, W.; 2018 – **Topic analysis of online reviews for two competitive products using latent Dirichlet allocation**. Electron. Commer. Res. Appl., 29, 142-156.

WATSON, A.; WATSON, B.; VALLMUUR, K. 2015 – **Estimating under-reporting of road crash injuries to police using multiple linked data collections.** Accident Analysis and Prevention, 83, 18--25.

WEFERING, F.; RUPPRECHT, S.; BÜHRMANN, S.; BÖHLER-BAEDEKER, S.; RUPPRECHT CONSULT – Forschung und Beratung GmbH, 2013 – **Guidelines. Developing and Implementing a Sustainable Urban Mobility Plan. 1st Edition.** European Commission, Brussels.

WEGMAN, F.; COMMANDEUR, J.; DOVEH, E.; EKSLER, V.; GITELMAN, V.; HAKKERT, S.; LYNAM, D.; OPPE, S., 2008 – **SUNflowerNext: Towards a composite road safety performance index.** SWOV, Leidschendam.

WHO, 2011 – **Global Plan for the Decade of Action for Road Safety 2011-2020.** World Health Organization, Geneva, Switzerland.

WIJNEN, W.; WEIJERMARS, W.; VANDEN BERGHE, W.; SCHOETERS, A.; BAUER, R.; CARNIS, L.; ELVIK, R.; THEOFILATOS, A.; FILTNESS, A.; REED, S.; PEREZ, C.; AND MARTENSEN, H., 2017 – **Crash cost estimates for European countries**, Deliverable 3.2 of the H2020 project SafetyCube.

# 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%<br>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%<br>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%<br>PSP 93.8%<br>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%<br>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%<br>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<br>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 | Face à recente publicação dos documentos "Zonas Residenciais e de Coexistência" e "Zonas 30", importa, em estreita colaboração de autarquias, definir um programa de execução integrante de um conjunto de estudos piloto, que permita, em tempo útil, testar a aplicação dos conceitos, e avaliar em termos quantitativos, o nível de eficácia associado a cada medida/ação implementada. Esses resultados deverão alimentar a atualização/revisão desses documentos de base e do quadro legar vigente | | x | | x | | | x | | | | | | | |
| 2 | definição de objetivos e ações especificas dirigidas a velocípedes no meio urbano, nomeadamente regras de conceção de redes cicláveis. | | x | | x | | | | x | | | | | | |
| 3 | revisão, reformulação, aprovação formal e a publicação de disposições normativas/recomendativas para regulamentação e apoio à conceção de soluções padronizadas aplicadas ao atravessamento de localidades, por estradas nacionais ou regionais | x | x | | | | | | | | | | | | |
| 4 | Aposta na implementação sistemática de soluções de organização funcional hierarquizada das redes municipais urbanas e rurais | x | x | | | | | | | | | | | | |
| 5 | Revisão do enquadramento local das Auditorias de Segurança Rodoviária (ASR), tornando este instrumento de base obrigatória, quer na rede rural quer na urbana estruturante. | | x | | | | | | | | | | | | |
| 6 | Integrar as novas tendências, como o crescente fenómeno de distração devido ao uso dos telemóveis durante a condução e de headphones por parte dos peões. | | | x | | | | | | | | | | | |
| 7 | Antever os impactos potenciais decorrentes dos avanços tecnológicos no domínio da automação dos veículos e da sua conectividade com a infraestrutura e meio envolvente, tirando partido do potencial para a melhoria da segurança rodoviária | | | | | x | | | | | x | | | | |
| 8 | Definir e implementar o quadro referencial que permita às diferentes entidades responsáveis pela gestão da infraestrutura rodoviária municipal e nacional responder aos desafios, oportunidades e riscos, associados à progressiva e crescente integração no âmbito rodoviário de veículos cada vez possuidores de maiores níveis de autonomia e dispensa de condutor | x | x | | | x | | | | | | | | | |
| 9 | Medidas de apoio às frotas que implementassem estratégias de apoio à condução, em particular sistemas de Apoio baseados na monitorização da estrada e do condutor. | x | | | | x | | | | | | | | | |
| 10 | Os documentos legais a rever são o Código da Estrada (CE - Lei n.º 72/2013, de 3 de setembro) e o Regulamento de Sinalização do Trânsito (RST - republicado na Declaração de Retificação n.º 60-A2019, de 20 de dezembro 2019) | x | x | | | | | | | | | | | | |
| 11 | Rever e atualizar o conjunto de documentos normativos existentes: A Norma de Sinalização Vertical (NSV, da JAE) adicionando-lhe os novos sinais verticais e toda a marcação rodoviária em moldes similares, tornando-a na Norma de Sinalização do Trânsito. Todas as Disposições Normativas de sinalização do trânsito do InIR (DN-InIR, do atual IMT) face às alterações ao CE e ao RST, convertendo-as no Manual de Sinalização do Trânsito. A Norma de Sinalização Turística (NST). | x | x | | | | | | | | | | | | |
| 12 | À semelhança do Manual on Uniform Control Devices (U.S. Department of Transportation, Federal Highway Administration) e de outros manuais, será mais prático ter um único volume, designado "Manual de Sinalização do Trânsito", que incorpore toda a necessária atualização daqueles textos face à alteração do RST | x | x | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Criação de quadro para a segurança da infraestrutura, compreendendo nomeadamente o uso de tecnologias de monitorização de infraestruturas, qualidade do piso, etc., tirando partido de sistemas colaborativos, tendencialmente em tempo real, tendo em vista a segurança de circulação; | x | x | | | | | | | | | | x | | x |
| 14 | Criação de condições para a aceleração e massificação de soluções de conectividade total, incluindo V2I e C-ITS, tirando partido da disponibilidade das tecnologias associadas ao 5G; | | | | | | | | | | x | | | | |
| 15 | Promoção de ferramentas de integração e disponibilização de informação de estado, condições da via, fluxos, etc., a operadores de serviços e ao utilizador. | x | | x | | | | | | | | | | | |
| 16 | Agilização de processos de homologação de novas tipologias de veículos (leves) para novos serviços urbanos e respetivos sistemas de segurança passiva e ativa (ADAS, sistemas colaborativos baseados em C-ITS, etc.); | | | | | x | | | | | x | | | | |
| 17 | Criação de condições para a introdução de soluções de condução autónoma em zonas urbanas e zonas extraurbanas; | | | | | | | | | | x | | | | |
| 18 | Familiarização e preparação das forças de segurança e socorro para a assistência a veículos elétricos /eletrificados. | x | | | | | x | | | | | | | | |
| 19 | Criação de quadro de referência para massificação de sistemas C-ITS e infraestrutura inteligente, incluindo sinalética inteligente; | x | | | | | | | | | x | | | | |
| 20 | Integração de informação com peões. | | | x | | | | x | | | x | | | | |
| 21 | Aceleração de mecanismos de interoperabilidade entre sistemas e tecnologias relacionados com segurança passiva e ativa; | | | | | | | | | | x | | | | |
| 22 | Valorização de ambientes de teste de novas tecnologias, nomeadamente no âmbito do enquadramento já existente para as Zonas Livres Tecnológicas; | | | | | | | | | | x | | | | |
| 23 | Definição de enquadramento para a segurança de dados, tecnologias e serviços (cibersegurança). | x | | | | | | | | | x | | | | |
| 24 | criar mecanismos que permitam uma mais profunda, ativa, participação ex-ante de (e não meramente validatória por) key players – que, assim, poderão tornar-se parte verdadeiramente integrante da própria especificação de objetivos e modalidades de intervenção a consignar no Plano Estratégico. Essa, a lógica que subjaz às considerações que seguem. | x | | | | | | | | | | | | | |
| 25 | lançar uma Política de Segurança Rodoviária disruptiva relativamente aos pretéritos Planos Estratégicos. É disso que trata o presente position paper. Mas, esclareça-se desde já: não em conflito; pelo contrário, assumindo como fundação os resultados alcançados via execução desses mesmos Planos Estratégicos. | x | | | | | | | | | | | | | |
| 26 | necessidade de evoluir para uma reformulação triangular, isto é, integrada, dos fatores críticos para análise e intervenção em Segurança Rodoviária: humano, tecnologia e fiscalização. | x | | | | | | | | | | | | | |
| 27 | os comportamentos individuais não podem, no presente contexto, ser arquetipamente «modelados» sem a aplicação conjugada de fiscalização, esta tecnologicamente suportada; se bem que se tenda a ver a 'tecnologia' como uma aglomerado de técnicas disjuntas, de facto os desenvolvimentos tecnológicos, ainda que tendo de satisfazer exigências sectorialmente distintas, revelam-se normalmente de aplicação multifacetada (multipurpose); a conceção das próprias modalidades de fiscalização é indissociável do nível educacional do público a que se aplicam, pelo que tem de evoluir em sintonia, quer com a 'resiliência' dos | x | | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | respetivos alvos de atuação, quer com o próprio progresso técnico. | | | | | | | | | | | | | | |
| 28 | «ter vergonha» de certos comportamentos pessoais. Para a concretização da (alternativa) via ética, dois ingredientes podem ser singularizados como indispensáveis: o directo, repetido, envolvimento da mais alta magistratura da Nação – uma via de que o Presidente Jorge Sampaio foi percursor; um vasto debate nacional, intensamente mediático, com fulcro na «revelação/ denúncia» de práticas que, por norma, o condutor auto alternativo evita auto-analisar – o que requer campanha profissional de comunicação; aliás opção muito ajustada ao actual modo pandémico de soul-searching. | | | x | | | | | | | | | | | |
| 29 | Sensorização das infraestruturas e dos seus equipamentos, por forma a permitir a mobilidade conectada; | | x | | | | | | | | x | | | | |
| 30 | Preparação das infraestruturas físicas ao nível da sua manutenção, para possibilitar a mobilidade autónoma; | | x | | | | | | | | x | | | | |
| 31 | Preparar normativo técnico de referência aos projetos de construção e reabilitação de vias, para vias que permitam mobilidade autónoma; | x | x | | | | | | | | | | | | |
| 32 | Rever a legislação nacional por forma a permitir mobilidade conectada e autónoma; | x | x | | | | | | | | | | | | |
| 33 | Diagnóstico nacional das zonas de maior risco de sinistralidade rodoviária; | | x | | | | | | | | | | | x | |
| 34 | Obrigatoriedade legal de realização de inspeções de segurança rodoviária aos locais com maior risco; | | x | | | | | | | | | | | | |
| 35 | Construir um plano nacional para implementar medidas que eliminem zonas de acumulação de acidentes e implemente medidas de acalmia de tráfego, que através de medidas de baixo custo tenham elevados impactos na diminuição da sinistralidade; | x | x | | | | | | | | | | | | |
| 36 | Ao nível dos projetos de novas vias ou de reabilitação, deverá existir obrigatoriedade legal para elaboração de auditorias de segurança rodoviária; | | x | | | | | | | | | | | | |
| 37 | Criação de um simulador nacional de segurança rodoviária, que permita através de realidade virtual e aumentada, simular a experiência de condução que os novos projetos irão prever nas infraestruturas a construir ou reabilitar; | | | x | | | | | | | | | | | |
| 38 | Diagnóstico nacional das zonas de maior risco de eventos extremos originados pelas alterações climáticas, e que possam criar locais de sinistralidade rodoviária; | | x | | | | | | | | | | | | |
| 39 | Avaliação da resiliência das infraestruturas aos eventos extremos das alterações climáticas; | | x | | | | | | | | | | | | |
| 40 | Preparação da resistência física das infraestruturas para os eventos extremos; | | x | | | | | | | | | | | | |
| 41 | Implementação de infraestruturas tecnológicas que durante os eventos extremos permitem comunicar diretamente com os utilizadores das infraestruturas físicas; | | x | | | | | | | | x | | | | |
| 42 | Planos de recuperação do nível de serviço das infraestruturas, após os eventos extremos, e que reduzam o mais rapidamente possível o risco de sinistralidade. | x | x | | | | | | | | | | | | |
| 43 | Planos Municipais de Segurança Rodoviária, com mapeamento do risco de sinistralidade nas redes municipais rodoviárias, mas também de mobilidade suave e pedonal, com realização de auditorias e inspeções de segurança rodoviária, e subsequentes planos municipais de eliminação de zonas de acumulação de acidentes e implementação de zonas de acalmia de tráfego; Planos para introdução da mobilidade conectada e autónoma; Planos para resiliência das infraestruturas às alterações climáticas; | x | x | | | | | | | | x | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | As Auditorias de Segurança Rodoviária deveriam alargar o seu campo de atuação às infraestruturas rodoviárias onde se verifica a maior incidência de acidentes, como as Estradas Nacionais e as vias de caráter municipal mais importantes (rurais e urbanas). | | x | | | | | | | | | | | | |
| 45 | Deveriam ser generalizadas as Inspeções de Segurança Rodoviária | | x | | | | | | | | | | | | |
| 46 | poderá ser criado um indicador associado à "percentagem de distância percorrida em estradas com uma classificação de segurança superior a um limiar acordado", como previsto pela Comissão Europeia, mas a definição concreta do limiar aceitável em termos nacionais reveste-se da maior importância, justificando profunda ponderação. | x | | | | | | | | | | | | | |
| 47 | uma eventual maior autonomia dos veículos poderá tornar irrelevante a sobriedade do "condutor" ou a sua distração, pois o mesmo deixará de ter influência na condução, de acordo com os objetivos que se pretendem atingir com tal autonomia, que deverá verificar uma significativa evolução na década em causa. essa autonomia implicará uma exigência muito superior à atual no que se refere à qualidade da infraestrutura, o que também justificará uma incidência mais exigente das Inspeções já referidas, para garantir a compatibilidade esperada. | | x | | | | | | | | | | | | |
| 48 | Emanar orientações no sentido de dispor, até 2030, de um modelo digital completo dos eixos rodoviários com maior procura e daqueles com maior incidência de pontos negros; | | x | | | | | | | | | | | | |
| 49 | Dotar, até 2030, todos os eixos rodoviários com maior procura e aqueles com maior incidência de pontos negros da sensorização que permita a contagem e classificação de utilizadores da via, incluindo de VRUs; | | x | | | | | | | | | | | | |
| 50 | Impor, até 2025, que todas as intervenções na rodovia sejam acompanhadas por simulações como parte dos seus projetos, delas resultando sempre um mínimo de três cenários onde indicadores de segurança sejam ponderados face aos demais critérios de projeto na escolha da intervenção a realizar; | | x | | | | | | | | | | | | |
| 51 | Prosseguir, com os vários stakeholders, a adoção das soluções de Mobilidade Conectada, a concluir até 2025, visando dotar todos os eixos rodoviários com maior procura e aqueles com maior incidência de pontos negros da infraestrutura de comunicação V2I/I2V10 que permita a implementação dos casos de uso definidos pela plataforma C-ROADS; | | x | | | | | | | | x | | | | |
| 52 | Aplicar em todos os pontos negros da rede viária, até 2030, nomeadamente àqueles que correspondem a interseções/pontos de conflito viário, soluções de deteção automática de infrações; | | x | | | | | | | | x | | | | |
| 53 | Elaborar, até 2022, um modelo de planos de conservação obrigatórios e aplicados a todos os eixos rodoviários com maior procura e aqueles com maior incidência de pontos negros, em que sejam incorporadas, tanto quanto possível, práticas de manutenção baseada na condição. Este modelo deverá ser obrigatório e impedir que a contratação dos serviços de conservação se limite ao preço – e logo à redução, na prática, dos serviços de manutenção efetivamente prestados. | | x | | | | | | | | | | | | |
| 54 | Podem – e devem – ser efetuados os cálculos associados a qualquer investimento em tecnologia para a rodovia, projetando o investimento no tempo e, naturalmente, internalizando todos os benefícios decorrentes desse investimento, incluindo os de acréscimo de segurança. Do lado dos custos terão de estar os investimentos e os custos de operação; do lado dos proveitos, terão de constar eventuais suportes a | x | x | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| | receita mas também os benefícios ambientais e sobretudo, os de segurança. Só com uma análise ampla se poderão tirar conclusões quanto à proteção do investimento, conclusões estas que devem estar sempre presentes quando um investimento é levado a decisão. Mas mais ainda quando negligenciar estes aspetos pode levar a sistemas intrinsecamente menos seguros. | | | | | | | | | | | | | | |
| 55 | Publicação, e sequente implementação, da Portaria referente aos Auditores de Segurança Rodoviária, nomeadamente à certificação de entidades formadoras, à certificação/ reconhecimento de cursos e outras ações de formação em segurança rodoviária e à certificação e registo dos referidos profissionais, cujo projeto de diploma foi efetuado no âmbito da Medida A22.84 do PENSE 2020; | x | x | | | | | | | | | | | | |
| 56 | A monitorização dos resultados da Medida A11.44 - Definir e implementar um plano de execução de guias sonoras para aviso de saída da faixa de rodagem, cujas obras ainda decorriam em finais do ano de 2020; | | | | | | | | | | | | x | | |
| 57 | A transposição e implementação da Diretiva (UE) 2019/1936 do Parlamento e do Conselho, de 23/10/2019, relativa à Gestão da Segurança da Infraestrutura Rodoviária (potenciando e incentivando a realização de procedimentos de gestão da segurança rodoviária tanto nas estradas da Rede Transeuropeia (já obrigatórias) como em outras estradas da Rede Rodoviária Nacional, designadamente as autoestradas que não integram a Rede Transeuropeia). Esta transposição deverá levar à alteração do Decreto-lei n.º 138/2010, de 28 de dezembro, do Decreto-lei n.º 123/2014, de 11 de agosto (que estabelece as regras aplicáveis à realização de Inspeções de Segurança Rodoviária) e, eventualmente, do Decreto-lei n.º 122/2014 (que estabelece as regras aplicáveis à realização de Auditorias de Segurança Rodoviária), de 11 de agosto, e da Lei n.º 49/2014, de 11 de agosto (que estabelece o regime de acesso e de exercício da profissão de auditor de segurança rodoviária, de emissão dos respetivos títulos profissionais e de acesso e exercício da atividade de formação profissional dos auditores). | x | | | | | | | | | | | | | |
| 58 | A revisão ou substituição dos seguintes documentos e metodologias (no âmbito ou fora da transposição da Diretiva acima referida) (ver justificações no Anexo I): Inspeções de Segurança Rodoviária - Manual de aplicação, Área Adjacente à Faixa de Rodagem – Manual sobre aspetos de segurança, Manual de Auditorias de Segurança Rodoviária, Determinação de Zonas de Acumulação de Acidentes, Avaliação dos custos sociais dos acidentes rodoviários com vítimas | x | x | | | | | | | | | | | | |
| 59 | A promoção da capacitação da infraestrutura rodoviária em matéria de C-ITS (Cooperative Intelligent Transport Systems), no sentido de assegurar que os veículos, a breve prazo, possam comunicar com a infraestrutura, e vice-versa, uma vez que se espera que os serviços C-ITS, em especial os de dia 1 e 1,5, mas também os futuros (dia 2), irão produzir impactos positivos na segurança rodoviária. | | x | | | | | | | | x | | | | |
| 60 | A implementação da regulamentação para permissão de testes de veículos conectados e autónomos, uma vez que se espera que a condução autónoma e conectada produzirá benefícios em termos de segurança rodoviária, e aqui com o especial foco na seleção dos troços das infraestruturas considerados adequados, e sua evolução progressiva, na medida da evolução da regulamentação europeia e nacional. | 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 |
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| 61 | A promoção da evolução do sistema eCall (já implementado em Portugal) com a integração nos centros de controlo de tráfego dos gestores das infraestruturas rodoviárias, de forma a uma melhor e mais rápida prestação de serviços de emergência / sinalização e disseminação da informação, potenciando também a comunicação da infraestrutura com o veículo. | x | | | | x | x | | | | | | | | |
| 62 | Desenvolver instrumentos e medidas de proteção dos utilizadores vulneráveis promovendo deslocações seguras e confortáveis, a pé, de bicicleta e/ou através de outros meios de micromobilidade; | | | x | | | | x | x | | | | | | |
| 63 | Avaliar a introdução de medidas legislativas relativas à responsabilidade civil e criminal de acidentes envolvendo utilizadores vulneráveis, com foco nos utilizadores de bicicleta; | x | | | | | | x | x | | | | x | | |
| 64 | Sensibilizar a adoção de comportamentos seguros por parte de todos os utilizadores, na partilha do espaço rodoviário, com especial foco nos peões, utilizadores de bicicleta e outros meios de micromobilidade. | | | x | | | | x | x | | | | | | |
| 65 | Estudar a implementação de Planos de Segurança Rodoviária desenvolvidos pelos atores do sistema de mobilidade e transporte (exs. empresas de transporte rodoviário, gestores de centros coordenadores de transportes, empresas de mobilidade partilhada, etc.). | x | x | | | | | | | | | | | | |
| 66 | Promover a harmonização da legislação na área dos transportes e a sua aplicação pelas forças de segurança; | x | | | | | | | | | | | | | |
| 67 | Reforçar o registo eletrónico nacional das empresas de transporte rodoviário licenciadas pelo IMT, com ligação à plataforma ERRU da CE e às autoridades competentes nacionais, por forma a potenciar o sancionamento efetivo de entidades reiteradamente incumpridoras de normativos vigentes; | x | | | | | | | | | | | x | | |
| 68 | Reforçar a fiscalização nas áreas dos transportes e promover o reforço da capacitação das entidades fiscalizadoras na área do transporte em segurança. | x | | | | | | | | | | | x | | |
| 69 | Revisão (concertada) e atualização de todo o enquadramento legal dos transportes, em alinhamento com o novo Pacote da Mobilidade e outros regulamentos comunitários, por forma a potenciar harmonização de entendimentos e aplicação uniforme dos dispositivos legais por todas as entidades fiscalizadoras; | x | | | | | | | | | | | | | |
| 70 | Revisão (concertada) de diplomas estritamente nacionais que possam contribuir para o reforço da segurança rodoviária, por forma a acompanhar a forte dinâmica do sector da mobilidade. | x | | | | | | | | | | | | | |
| 71 | Promover o reforço do acompanhamento na formação e avaliação de novos condutores nas áreas com relevância para a segurança rodoviária; | | | x | | | | | | | | | x | | |
| 72 | Promover o reforço do acompanhamento na formação e avaliação dos profissionais do ensino da condução e dos motoristas profissionais nas áreas com relevância para a segurança rodoviária; | | | x | | | | | | | | | x | | |
| 73 | Incrementar e promover a atualização de conhecimentos para os condutores; | | | x | | | | | | | | | | | |
| 74 | Reforçar as competências para a manutenção da condução segura nos condutores seniores; | | | x | | | | | | | | | x | | |
| 75 | Reforçar a qualidade da avaliação física, mental e psicológica dos condutores. | | | x | | | | | | | | | x | | |
| 76 | Acompanhar e sensibilizar as escolas de condução para a necessidade de reforçar os conteúdos programáticos sobre segurança rodoviária, em particular quanto aos Módulos Comuns de Segurança Rodoviária e aos Módulos Complementares Teórico Prático e para a utilização de técnicas e métodos de ensino-aprendizagem que proporcionem aos | | | x | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| | candidatos a condutor uma maior tomada de consciência das exigências da tarefa da condução (ex. condução comentada, coaching) que apelem ao aumento da capacidade de atenção e deteção de perigos na condução e à consciencialização e responsabilidade pelas decisões de condução; | | | | | | | | | | | | | | |
| 77 | Incrementar o aumento de questões sobre segurança rodoviária na prova teórica de candidatos a condutor e na prova teórica de acesso à profissão de instrutor de condução e dos motoristas profissionais; | | | x | | | | | | | | | | | |
| 78 | Desenvolver o projeto de monitorização dos exames de condução e aumentar o enfoque das atitudes e do comportamento do condutor na prova prática; | | | x | | | | | | | | | | | |
| 79 | Acompanhar e sensibilizar as entidades formadoras dos profissionais do ensino da condução e dos motoristas profissionais para a necessidade de reforçar na formação a transmissão dos conteúdos programáticos sobre segurança rodoviária; | | | x | | | | | | | | | | | |
| 80 | Desenvolver uma ferramenta informática para a disponibilização de conteúdos de formação e informação específica para condutores, para efeitos de ação de atualização (voluntária); | | | x | | | | | | | | | | | |
| 81 | Aumentar a intervenção e a capacidade de respostas do IMT ao nível da avaliação psicológica dos condutores; | x | | x | | | | | | | | | x | | |
| 82 | Promover referenciais de suporte à avaliação física, mental e psicológica dos condutores. | | | x | | | | | | | | | x | | |
| 83 | Promover a melhoria da rede rodoviária nacional; | | x | | | | | | | | | | | | |
| 84 | Incentivar a capacitação tecnológica da infraestrutura rodoviária; | | x | | | | | | | | | | | | |
| 85 | Preparar a infraestrutura para os veículos autónomos e conectados; | | x | | | | | | | | | | | | |
| 86 | Promover uma melhor integração da gestão da infraestrutura com a assistência e o apoio às vítimas. | | x | | | | | | | | | | | | |
| 87 | Promover as condições de segurança das vias rodoviárias através de auditorias aos projetos e inspeções às vias, através de: | | x | | | | | | | | | | | | |
| 88 | a efetiva implementação, no âmbito do IMT, da Portaria (a publicar) referente à certificação de entidades formadoras, à certificação/ reconhecimento de cursos e outras ações de formação em segurança rodoviária, e à certificação e registo dos Auditores de Segurança Rodoviária; | | x | | | | | | | | | | | | |
| 89 | a transposição e implementação da Diretiva (UE) 2019/1936 do Parlamento e do Conselho, de 23/10/2019, relativa à Gestão da Segurança da Infraestrutura Rodoviária, potenciando e incentivando a realização de procedimentos de gestão da segurança rodoviária tanto nas estradas da Rede Transeuropeia (já obrigatórias) como em outras estradas da Rede Rodoviária Nacional. | x | x | | | | | | | | | | | | |
| 90 | Promover a capacitação da infraestrutura em matéria de C-ITS, seja através de recursos próprios, seja recorrendo a programas europeus de financiamento dinamizados pelos parceiros públicos, no sentido de assegurar que os veículos - não do futuro longínquo, mas a breve prazo - consigam comunicar com a infraestrutura e vice-versa, uma vez que os serviços C-ITS, em especial os de dia 1 e 1,5, mas também os futuros (dia 2), irão produzir certamente impactos positivos na segurança rodoviária. | | x | | | | | | | | x | | | | |
| 91 | Implementar a regulamentação para permissão de testes de veículos conectados e autónomos, uma vez que a condução autónoma e conectada irá produzir benefícios em termos de sinistralidade rodoviária, e aqui com o especial foco na seleção dos troços das infraestruturas considerados adequados, e sua | | x | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| | evolução progressiva, na medida da evolução da regulamentação europeia e nacional. | | | | | | | | | | | | | | |
| 92 | Promover a possível evolução do sistema eCall já implementado em Portugal, com a integração nos centros de controle de tráfego dos gestores das infraestruturas rodoviárias, de forma a uma melhor e mais rápida prestação de serviços de emergência/sinalização e disseminação da informação, potenciando também a comunicação da infraestrutura com o veículo. | | x | | | | | | | | x | | | | |
| 93 | Implementar a inspeção técnica de motociclos, triciclos e quadriciclos com cilindrada superior a 125 cm3, através dos CITVs; | | | | | x | | | | | | | x | | |
| 94 | Implementar a inspeção periódica obrigatória para os tratores agrícolas e seus reboques; | | | | | x | | | | | | | x | | |
| 95 | Incentivar à instalação de cintos de segurança de 3 pontos nos lugares sentados dos autocarros das categorias II e III; | | | | | x | | | | | | x | | | |
| 96 | Regulamentar as condições de aprovação e de circulação de dispositivos de mobilidade, que não se enquadram na regulamentação europeia da área dos veículos rodoviários. | | | | | x | | | | | | | | | |
| 97 | Campanha de sensibilização face aos riscos associados à condução distraída ("A MELHOR SEGURANÇA É O NOSSO CÉREBRO. NÃO O DISTRAIA.") | | | x | | | | | | | | | | | |
| 98 | Campanha de sensibilização para os condutores em geral face à potencial redução das capacidades (físicas, mentais e psicológicas) para conduzir em segurança, nomeadamente decorrentes dos efeitos associados à pandemia provocada pela COVID19. | | | x | | | | | | | | | | | |
| 99 | Campanhas de comunicação e sensibilização para grupos de risco específicos, nomeadamente jovens, idosos, condutores de motociclos, em razão do nº de acidentes existentes nestes grupos / Relançamento de campanha. | | | x | | | | | | | | | | | |
| 100 | Campanha de sensibilização dos riscos associados ao excesso de velocidade/velocidade excessiva / Relançamento de campanha. | | | x | x | | | | | | | | | | |
| 101 | Campanha de sensibilização dos riscos associados à condução sob o efeito de bebidas alcoólicas e substâncias psicotrópicas / Relançamento de campanha. | | | x | | | | | | | | | | | |
| 102 | Campanhas de sensibilização dirigidas aos condutores de veículos de duas rodas / | | | x | | | | | | | | | | | |
| 103 | Realização de um concurso televisivo à semelhança do que acontece em Espanha, no programa produzido pela TVE denominado "Arranca en Verde" https://www.rtve.es/rtve/20180226/1-estrena-arranca-verde-concurso-sobre- seguridad-vial-presentado-sara-escudero/1684728.shtml - concurso semanal interativo, no qual se colocam questões relacionadas com a segurança rodoviária a um convidado (figura pública), com a participação simultânea e ativa do telespectador, com o objetivo de divulgar de forma lúdica regras de trânsito e sensibilizar para a prevenção rodoviária. | | | x | | | | | | | | | | | |
| 104 | Campanhas de sensibilização periódicas e regulares, nos meios de comunicação social, em parceria com a ANSR, relativamente à utilização correta quer dos veículos quer de acessórios: velocidade, disposição da carga, refletorização, pneus, instalação de cadeirinhas | | | x | x | | | | | | | | | | |
| 105 | Projeto "Embaixadores de Segurança Rodoviária" que, de forma voluntária e empenhada, se envolvam em ações que ajudem a reduzir o número de mortes e feridos graves nas estradas (ex. ações in loco junto dos pares para dissuasão da condução sob o efeito de álcool e/ou drogas). | | | x | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| 106 | Angariar jovens recém-condutores por ser uma faixa etária facilitadora para a identificação com os pares e pela recetividade que os jovens têm para se envolver neste tipo de projetos. | | | x | | | | | | | | | | | |
| 107 | Programas de formação por pares, sensibilizando para as consequências de comportamentos inadequados, nomeadamente decorrente de fatores como a idade e o género, motivações da própria idade e do grupo de pares, estilo de vida, hábitos de consumo de álcool e drogas, velocidade e o uso do telemóvel ou similares. (Ex. "Close To", com o objetivo de reduzir os riscos típicos da faixa etária 17 – 24 anos e a reincidência e, simultaneamente, a prevenção de riscos para outros jovens e futuros condutores). | | | x | | | | | | | | | | | |
| 108 | Acompanhar a condução dos condutores no pós habilitação (follow up), mediante a realização de fóruns/debates que permitam abrir espaço à partilha de experiências, nomeadamente dificuldades na condução e acidentes durantes os primeiros 2/3 anos, identificando fatores de risco comuns e decisões de condução mais seguras para todos. Envolver, nomeadamente, os Embaixadores de Segurança Rodoviária e os recém-encartados. | | | x | | | | | | | | | | | |
| 109 | Desenvolver/incrementar a interoperabilidade de dados, nomeadamente no que toca ao ciclo do condutor, no sentido de as várias entidades intervenientes nesse ciclo interagirem de forma eficaz e eficiente na troca de informação | | | x | | | | | | | | | | | |
| 110 | O controlo generalizado da velocidade, através de uma cobertura muito alargada da rede rodoviária nacional por radares, permitindo estabelecer uma cultura de respeito pelos limites de velocidade; | | | | x | | | | | | | | | | |
| 111 | Um controlo muito alargado dos pesos nos veículos pesados de mercadorias, com reflexo não só na segurança rodoviária como no estado de conservação da infraestrutura. | | x | | | x | | | | | | | | | |
| 112 | colaborar no desenvolvimento de uma estratégia de comunicação, desde a seleção priorizada dos temas a abordar (Excesso de velocidade, fadiga, álcool, utilização de telemóveis, drogas, ...), à segmentação dos grupos alvo identificando as suas motivações e as suas vulnerabilidades, desenvolvendo o/s briefing/s para seleção de agências de publicidade e de media. | | | x | | | | | | | | | | | |
| 113 | Identificar cada grupo-alvo, ou seja, grupos de pessoas que compartilham algumas características-chave. | | | x | | | | | | | | | | | |
| 114 | Identificar motivações e crenças, que possam ser a génese das abordagens passíveis para gerar a mudança comportamental | | | x | | | | | | | | | | | |
| 115 | Desenvolvimento de um briefing detalhado sobre os objetivos, o grupo-alvo, a estratégia central e os racionais de suporte, que permitam às agências criativas o desenvolvimento de campanhas | | | x | | | | | | | | | | | |
| 116 | Pré-teste da campanha desenvolvida: 1. Atenção; 2. Impacto; 3. Afinidade; 4. Alteração de comportamento; | | | x | | | | | | | | | | | |
| 117 | Desenvolvimento de um briefing detalhado sobre os objetivos, o grupo-alvo, a estratégia central e os racionais de suporte, que permitam às agências de meios a seleção dos meios considerados mais efetivos para que se atinja a cobertura e a frequência desejada | | | x | | | | | | | | | | | |
| 118 | Acompanhamento da produção das peças publicitárias | | | x | | | | | | | | | x | | |
| 119 | Recurso a estudos quantitativos para avaliação da eficácia da campanha junto do grupo alvo | | | x | | | | | | | | | x | x | |
| 120 | Estatísticas de segurança rodoviária para avaliação do real impacto da alteração de comportamentos | | | x | | | | | | | | | | x | |
| 121 | A legislação deve implementar sistemas motivadores em detrimento de sistemas dissuasores bastante | x | | | | | | | | | | | | | |

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| | banalizados e com provas dadas das suas limitações em termos de prevenção da sinistralidade rodoviária. | | | | | | | | | | | | | | |
| 122 | Estudar e prevenir as causas que levam o condutor a infringir a lei, ao invés do reforço de medidas que apenas banalizam e agravam ainda mais a punição, é um passo importante rumo à prevenção e à mudança da mentalidade que se procura. | | | | | | | | | | | | | x | |
| 123 | A análise de dados é uma etapa importante em qualquer processo decisório, a obtenção de mais e melhores dados é por isso uma prioridade a qualquer sistema de gestão, contudo, para que tais informações representem um contributo efetivo para o reforço das metas traçadas, é essencial garantir uma análise de dados certeira capaz de dar respostas assertivas. Isso significa elaborar pesquisas com o foco voltado para a solução do problema e não apenas para o problema em si. | | | | | | | | | | | | | x | |
| 124 | É crucial termos acesso às causas dos sinistros, há que desenvolver ferramentas desenhadas especialmente para essa finalidade. Para facilitar o acesso à leitura e interpretação dos dados, é importante que esses dados estejam padronizados de acordo com determinados critérios, para que sejam relevantes e possam garantir tomadas de decisão assertivas na prevenção da sinistralidade rodoviária. Isso inclui segmentar e agrupar toda a informação disponível de todas as entidades intervenientes. | | | | | | | | | | | | | x | |
| 125 | As seguradoras do ramo automóvel têm um papel crucial na resolução dos sinistros e no tratamento dos dados relativos aos mesmos sendo também as primeiras a beneficiar com a redução da sinistralidade rodoviária. Estes agentes podem dar um contributo importante ao partilharem informação que identifique as causas dos sinistros e que enriqueça as análises estatísticas usadas para definir estratégias e desenvolver ações eficazes à prevenção da sinistralidade rodoviária e consequente redução do número de vítimas na estrada. | | | x | | | | | | | | | | x | |
| 126 | O foco deve estar no estudo das causas da sinistralidade e as medidas preventivas devem centrar-se ao nível dos principais ingredientes causais. A não divulgação das causas concretas dos sinistros abre espaço a todo o tipo de especulações e implementação de medidas desajustadas. A construção, o direcionamento e a conclusão da análise dos ingredientes causais dos sinistros, devem ser obtidas e partilhadas com todas as entidades intervenientes. | | | | | | | | | | | | | x | |
| 127 | Nos relatórios de sinistralidade de 2020 da ANSR deixaram constar dados importantes que nos permitem avaliar a evolução dos sinistros em veículos de 2 rodas a motor, nomeadamente o número total de mortes, feridos graves e feridos leves desta categoria de utentes. É importante voltar a divulgar estes dados porque sem eles não nos é possível avaliar com exatidão a evolução e o resultado da implementação de medidas preventivas no combate à sinistralidade de veículos de 2 rodas a motor. | | | | | | | | | x | | | | | |
| 128 | Instrutores profissionais de condução de moto, devem prestar provas práticas de vasta experiência com moto e não maioritariamente conhecimento teórico pouco relevante à prática da condução de veículos de 2 rodas. | | | x | | | | | | x | | | | | |
| 129 | Ainda no âmbito do ensino prático da condução, acreditamos que seria benéfico destinar parte das receitas obtidas através das infrações de trânsito, para o financiamento de projetos que visem lecionar cursos de condução defensiva acessíveis a todos e ações de formação adaptadas às necessidades que visão mitigar as principais causas dos sinistros e infrações. | x | | x | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| 130 | A sã convivência rodoviária onde todos se respeitem é essencial em termos de segurança, principalmente quando existem utentes que circulam em veículos que se caracterizam pela sua fragilidade. Campanhas de prevenção rodoviária, onde se promova e motive esse bom convívio e respeito entre todos os utentes, são uma prioridade. | | x | | | | | | | | | | | | |
| 131 | Noções básicas de prevenção rodoviária devem ser dadas desde o ensino primário em tenras idades (6 anos), com especial incidência nos comportamentos enquanto peões; | | x | | | | | x | | | | | | | |
| 132 | A redução de IVA nos equipamentos de segurança obrigatórios e recomendados aos utentes de veículos de 2 rodas a motor seria uma mais valia para a prevenção de sequelas graves em caso de sinistro ou até a morte. | x | | | | | | | | x | | | | | |
| 133 | É de evitar a utilização de materiais tratados com cimento nas camadas do pavimento de qualquer superfície uma vez que estes dão lugar ao aparecimento de fissuras de retração, de endurecimento ou térmica, destas camadas à superfície do pavimento, com os consequentes problemas de segurança, incomodidade para o utente e danos nas viaturas, a que se soma a entrada de água no pavimento e deterioração da camada de desgaste. É igualmente de evitar o uso de materiais escorregadios para cobrir fissuras nos pavimentos. Embora nos veículos de quatro rodas não seja tão evidente, num veículo de duas rodas é um fator de grande instabilidade podendo mesmo levar à sua perda do controlo. | | x | | | | | | | x | | | | | |
| 134 | Para combater este ingrediente causal de sinistralidade existem algumas estradas que, na sua camada de desgaste, ou seja, na camada que contacta diretamente o tráfego, empregam misturas betuminosas drenantes ou misturas descontínuas que são projetadas por forma a conferir um número importante de vazios nas mesmas, eliminando ou diminuindo alguma das frações de agregado. | | x | | | | | | | x | | | | | |
| 135 | Para que possamos eliminar este problema, é necessário garantir que a marcação e sinalização horizontal das estradas é feita exclusivamente com a aplicação de tintas fluorescentes e com característica antiderrapante de elevada aderência e resistência mecânica. | | x | | | | | | | x | | | | | |
| 136 | A instalação de lombas de desaceleração em plena curva (figura 3) e/ou zona de travagem é um erro grave de planeamento que revela total desprezo pelos fatores que mais influenciam a capacidade de travagem de qualquer veículo movido sobre rodas. A colocação das lombas precisamente onde o contacto dos pneus da viatura com o piso é mais critico, constitui motivo de perda da estabilidade de qualquer veículo movido sobre rodas. Se queremos que as lombas contribuam para reduzir ao máximo a distância de travagem, mantendo a estabilidade e controlo direcional do veículo, é necessário remove-las dos locais de travagem e das curvas. É primordial que sejam consideradas áreas destinadas à travagem de superfície antiderrapante e que as lombas sejam deslocadas para as zonas que antecedem essas áreas. | | x | | | | | | | x | | | | | |
| 137 | A falta de aderência das juntas de dilatação de pontes e viadutos (figura 4) são outro problema que leva à perda de aderência dos pneus com o piso. Muitos são os casos de sinistro em veículos de duas rodas a motor, provocados pela ausência de sinalização destas juntas e pela sua falta de aderência aos pneus, em especial quando se encontram em zonas de curva ou travagem. | | x | | | | | | | x | | | | | |

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| | A eliminação destes pontos negros deve passar pela sinalização horizontal (à semelhança do que se faz com algumas lombas) e pelo uso de materiais antiderrapantes nas juntas. | | | | | | | | | | | | | | |
| 138 | Existe uma falha grave na identificação e listagem dos locais de risco onde é exigida a aplicação das guardas de segurança aos rails desprotegidos. Para tal importa saber a quem cabe a responsabilidade, nomeadamente: levantamento dos pontos negros relativos a esta problemática; da listagem dos dispositivos de proteção nas guardas de segurança já aplicadas nas vias de comunicação rodoviária, até à presente data; Da programação prevista para a colocação das restantes proteções nas guardas de segurança; Na aplicação das sanções referidas no artigo 6.º da Lei n.º 33/2004 pelo incumprimento da mesma. | | x | | | | | | | x | | | | | |
| 139 | A delimitação do espaço urbano de modo a evitar o uso indevido de espaços que não estão autorizados a veículos, tem motivado as autarquias de todo o País a instalar de forma intensiva balizadores verticais metálicos. Independentemente da sua justificação na gestão de espaços urbanos, o uso de dispositivos nas vias não pode descartar o fator segurança de algumas categorias de utentes dessas vias. Os utilizadores de veículos de duas rodas (com ou sem motor) são por natureza os mais expostos a equipamentos rodoviários, cujas características podem tornar-se contraproducentes e até bastante perigosas em caso de acidente. Independentemente do seu perfil este tipo de equipamentos tornam as vias urbanas especialmente inseguras para ciclistas e motociclistas. | | x | | | | | | | x | | | | | |
| 140 | A instalação de equipamentos nas vias públicas não pode representar uma ameaça que coloque em risco a vida dos utentes. Existem balizadores fabricados em derivados do plástico que, pela sua flexibilidade previne danos físicos e retoma a sua forma original após choque. | | x | | | x | | | | x | | | | | |
| 141 | É crucial considerar as consequências negativas que a instalação de dispositivos representa a toda a classe de utentes das vias. A prioridade deve centrar-se na segurança dos utentes e a prevenção urge a remoção destes balizadores metálicos, de cuja perigosidade as fotos são bem ilustrativas. | | x | | | x | | | x | x | | | | | |
| 142 | Uma medida a curto prazo e com efeitos imediatos na redução do risco acrescido, que a circulação por estradas mais movimentadas e menos seguras representa, é a criação de uma classe de portagens justa para motos que incentive mais motociclistas a optar por circular em estradas menos movimentadas e mais seguras. | x | x | | | | | | x | | | | | | |
| 143 | Considerando o peso, o volume e o desgaste que o motociclo provoca na estrada, é injusto a forma como os motociclistas são portajados. Assim, respeitando os critérios existentes de definição das classes de portagens, é de toda a justiça a criação da Classe 5 (MOTOS) de valor inferior a 50% do valor da Classe 1 (automóveis ligeiros). | x | | | | | | | x | | | | | | |
| 144 | Capacitar as organizações e os profissionais-chave envolvidos na avaliação e gestão do risco rodoviário | x | | | | | | | | | | | x | | |
| 145 | Elaborar um programa de formação e promover/apoiar a realização de ações de formação para técnicos das autarquias com responsabilidade na mobilidade e planeamento e gestão de tráfego | x | | | | | | | | | | | | | |
| 146 | Criar um sistema rápido, eficaz e fiável de recolha, tratamento e consulta de informação relevante | | | | | | | | | | | | x | x | |
| 147 | Criar uma plataforma on-line dinâmica que possibilite a consulta de informação estatística sobre acidentes | | | | | | | | | | | | x | x | |

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| | rodoviários (com a possibilidade de diferentes desagregações e cruzamento de variáveis, por exemplo, por idade, modo de transporte e contexto geográfico) | | | | | | | | | | | | | | |
| 148 | Desenvolver estudos de conveniência associados a diferentes fatores de risco (ex: uso do telemóvel, utilização de sistemas de retenção, consumo de álcool, velocidade) e sobre os impactos ambientais diretos e indiretos do uso excessivo de veículos automóveis (incluindo aqueles associados à poluição ambiental e a estilos de vida sedentários) | | | | | | | | | | | | | x | |
| 149 | Criar um grupo multidisciplinar para a investigação dos acidentes rodoviário | | | | | | | | | | | | x | x | |
| 150 | Garantir a adequação, atualização e aplicação da legislação relevante | x | | | | | | | | | | | | | |
| 151 | Rever e atualizar a legislação do Transporte Coletivo de Crianças | x | | | | | | | | | | x | | | |
| 152 | Introduzir na legislação: a obrigatoriedade da utilização de Sistemas de Retenção para Crianças nos táxis (pelo menos em alguns trajetos); a obrigatoriedade da utilização de capacetes por crianças e adolescentes quando andam de bicicleta; a proibição da utilização do banco elevatório antes do 125 cm; a responsabilidade do condutor em termos do ónus da prova em situações de colisão envolvendo crianças e adolescentes (peões ou ciclistas) | | | x | | | | x | x | | | | | | |
| 153 | Criar um "grupo de trabalho" responsável pela análise e discussão da aplicação da legislação existente, de forma a garantir a interpretação e aplicação homogênea da mesma (exemplo: Lei do Transporte Coletivo de Crianças, Artigo 55º do Código da Estrada). Este deve poder emitir pareceres ou documentos interpretativos com carácter vinculativo | x | | | | | | | | | | | x | | |
| 154 | Promover e incentivar iniciativas que promovam a mobilidade ativa como modo predominante nas deslocações diárias | | | x | | | | x | x | | | | | | |
| 155 | Apoiar iniciativas já em curso que promovam a mobilidade ativa (ex: projeto Sigapé/APSI; iniciativa Ciclo Expresso do Oriente) | | | x | | | | x | x | | | | | | |
| 156 | Elaborar e disseminar junto das autarquias um Programa/Plano Nacional para a promoção da utilização de modos de deslocação suaves | x | | | | | | x | x | | | | | | |
| 157 | Criar uma rede de autarquias (à semelhança da Rede Portuguesa de Cidades Saudáveis ou Cidades Amigas das Crianças) aderentes a este programa | x | | | | | | x | x | | | | | | |
| 158 | OP. Promover e incentivar iniciativas que promovam a ocupação definitiva e/ou temporária do espaço público | | | | | | | x | x | | | | | | |
| 159 | Apoiar iniciativas já em curso que promovam a ocupação do espaço público (ex: playstreets – ver projeto Brincapé/APSI; parklets – ver iniciativa Bicicultura) | | | | | | | x | x | | | | | | |
| 160 | Criar uma rede urbana de transportes públicos acessível, inclusiva e multimodal | | | | | | | | | | | x | | | |
| 161 | Criar uma rede pedonal contínua, segura, conveniente e inclusiva junto de estabelecimentos educativos | | | x | | | | x | | | | | | | |
| 162 | Conceber e disseminar junto das autarquias um Manual de Boas Práticas para a promoção de uma mobilidade segura das crianças e adolescentes junto dos estabelecimentos educativos | x | | | | | | x | | | | | | | |
| 163 | Avaliar o risco rodoviário junto dos estabelecimentos educativos | | | | | | | | | | | | x | | |
| 164 | Promover a criação de zonas 20 e 30 junto de estabelecimentos educativos e zonas residenciais | | | | x | | | x | | | | | | | |
| 165 | Definir uma zona crítica mínima em torno dos estabelecimentos educativos livre da circulação de veículos motorizados ou com grandes restrições à sua velocidade (através de medidas de acalmia de tráfego) e estacionamento | | | | x | | | x | | | | | | | |

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| 166 | Promover a educação das crianças e dos jovens para a cidadania rodoviária | | | x | | | | | | | | | | | |
| 167 | Promover a utilização dos Recursos Educativos Digitais sobre Educação Rodoviária, da ANSR, Júnior Seguro | | | x | | | | | | | | | | | |
| 168 | Apoiar iniciativas de educação das crianças e jovens já em curso (ex: promovidas pela APSI, A-CAM, Estrada Viva, Gare, Mubi) | | | x | | | | | | | | | | | |
| 169 | Elaborar um programa de formação para professores e educadores de infância e promover/apoiar a realização de ações de formação para estes profissionais | | | x | | | | | | | | | | | |
| 170 | Elaborar um programa de formação para estudantes do ensino superior a frequentar cursos com acesso a profissões na área da mobilidade e planeamento e gestão de tráfego (engenharia, arquitetura) e promover/apoiar a realização destas ações de formação | | | x | | | | | | | | | | | x |
| 171 | Incentivar a participação dos jovens na definição e implementação de medidas para a redução do risco rodoviário | | | x | | | | | | | | | | | |
| 172 | Criar em Portugal uma iniciativa semelhante ou em articulação com Youth for Road Safety | | | x | | | | | | | | | | | |
| 173 | Incentivar a participação da sociedade civil na definição de medidas para a resolução do risco rodoviário | | | x | | | | | | | | | | | |
| 174 | Promover a utilização correta e sistemática do cinto de segurança e sistemas de retenção pelas crianças e jovens | | | x | | | | | | | | | | | |
| 175 | Elaborar um programa de formação para agentes de autoridade e instrutores de condução e promover/apoiar a realização de ações de formação para estes profissionais | | | | | | | | | | | | | | x |
| 176 | Introduzir na inspeção automóvel a verificação da correta instalação dos Sistemas de Retenção para Crianças (SRC) | | | x | | x | | | | | | | | | |
| 177 | Elaborar um programa de formação para inspetores de automóvel para a verificação da correta instalação dos SRCs e apoiar/promover estas ações de formação | | | x | | x | | | | | | | | | |
| 178 | Criar um sistema integrado de apoio às vítimas de acidente rodoviário | x | | | | | | | | | | | x | | |
| | Criar uma rede integrada de prestação de apoio psicológico, social e jurídico às vítimas de acidentes rodoviários e aos seus familiares, que inclua a criação de linhas telefónicas específicas, o apoio social local, advogados especializados na defesa da pessoa traumatizada, apoio terapêutico à pessoa traumatizada e família, e apoio na área da reabilitação e reinserção social | x | | | | | | | | | | | | | |
| 180 | Definir protocolos de atuação no atendimento pré-hospitalar e hospitalar à criança e adolescente com trauma rodoviário, particularmente, traumatismos cranioencefálicos e vertebro- medulares | | | | | | x | | | | | | | | |
| 181 | Capacitar a população para a prestação de primeiros socorros | | | | | | x | | | | | | | | |
| 182 | Integrar a formação em primeiros socorros nos conteúdos programáticos obrigatórios da formação para obtenção da carta de condução | | | | | | x | | | | | | | | |
| 183 | Criar referenciais de educação para todos os níveis de ensino para conteúdos relacionados com os primeiros socorros | | | | | | x | | | | | | | | |
| 184 | Promover e apoiar a realização de ações de formação na área dos primeiros socorros para a população em geral | | | | | | x | | | | | | | | |
| 185 | Objetivo Estratégico- Promover a educação e a formação para o desenvolvimento de uma Cultura de Segurança Rodoviária em articulação com o quadro em que se desenvolve a Estratégia Nacional de Educação para a Cidadania. | | | x | | | | | | | | | | | |

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| 186 | Objetivo Operacional 1- Criar um banco de recursos didático-pedagógicos dirigidos aos alunos a frequentar os diversos ciclos e níveis de educação e ensino; | | | x | | | | | | | | | | | x |
| 187 | Objetivo Operacional 2- Incentivar a criação de redes de escolas que desenvolvam projetos de educação para a segurança rodoviária; | x | | x | | | | | | | | | | | |
| 188 | Objetivo Operacional 3 – Fomentar espaços e modalidades diversas de formação em Segurança Rodoviária. " | | | x | | | | | | | | | | | |
| 189 | Conhecer e divulgar estatísticas de Acidentes Rodoviários ocorridos em contexto laboral ou de trajeto casa-trabalho, de forma a permitir a criação de indicadores para acompanhamento e gestão; | | | | | | | | | | | | x | x | |
| 190 | Conhecer e divulgar as características, causas e circunstâncias que estão na origem destes acidentes (em contexto laboral ou de trajeto casa-trabalho) e as suas consequências como ferramenta de apoio à criação de campanhas/políticas públicas que permitam utilizadores/Infraestrutura e/ou veículos mais seguros. | | | | | | | | | | | | x | x | |
| 191 | Conhecer e divulgar a localização temporal (hora, dia, mês) e geográfica (concelho) em que predominantemente sucedem mais acidentes para poder adequar a resposta à procura pelos serviços de assistência imediata; | | | | | | | | | | | | x | x | |
| 192 | Conhecer e divulgar as consequências dos acidentes para poder adequar a resposta às necessidades das vítimas. | | | | | | | | | | | | x | x | |
| 194 | Objetivo operacional: aprofundar a educação rodoviária nos curricula escolares e de formação/certificação de condutores | | | x | | | | | | | | | | | x |
| 195 | Objetivo operacional: criar equipas-piloto de avaliação das causas profundas da sinistralidade rodoviária com vítimas mortais e em acidentes com feridos graves em "pontos negros". | | | | | | | | | | | | x | x | |
| 196 | Objetivo operacional: revitalizar e avaliar programas e campanhas de prevenção da sinistralidade e sensibilização para a segurança rodoviária. | | | | | | | | | | | | x | | |
| 197 | Objetivo operacional: promover a investigação da sinistralidade rodoviária por fatores humanos em território nacional. | | | | | | | | | | | | | x | |
| 198 | Objetivo operacional: criar incentivos para a aquisição de veículos com tecnologia de assistência à condução, prevenção e proteção em caso de acidente. | | | | | x | | | | | | | | | |
| 199 | Objetivo operacional: instituir entidades acreditadas para a avaliação médica e psicológica de condutores. | x | | x | | | | | | | | | | | |
| 200 | Objetivo operacional: incorporar técnicas de mudança de atitudes e comportamentos nas ações de formação de segurança rodoviária. | | | x | | | | | | | | | | | x |
| 201 | Objetivo operacional: prosseguir as ações de fiscalização, especialmente focadas nas zonas de maior risco. | | x | | | | | | | | | | | | |
| 203 | Deveríamos analisar outras estratégias: A Espanha é um bom exxemplo | x | | | | | | | | | | | | | |
| 204 | Problemas específicos que precisam de ser abordados: peões, veículos de transporte de mercadorias (conduzidos por profissionais), motociclos e ciclomotores (o anterior PENSE2020 não era suficientemente focado neles), bicicletas (um problema crescente). Os tractores agrícolas continuam a ser um problema em Portugal | | | | | x | | x | | | | | | | |
| 205 | A sinalização e a marcação rodoviária são problemas. Para reduzir o número de mortos é importante a velocidade de circulação. O llimite de velocidade de 30 km/h deve ser implementado o mais rapidamente possível. | | | | | | | | | | | | | | |

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| 206 | A fiscalização é muito importante para alterar o comportamento dos condutores, nomeadamente limites de velocidade e álcool | | | | | | | | | | | | | | |
| 207 | Equipas multidisciplinares para analisar acidentes. São necessários mais dados envolvendo as causas dos acidentes | | | | | | | | | | | | | | |
| 208 | Como ações de formação habilitantes, os condutores devem frequentar a ação de formação "Conduzir e operar com o trator em segurança (COTS), de 35 horas, prevista na alínea d), do art.º 2.º, do Despacho 3232/2017, de 18-02, ou a Unidade de Formação de Curta Duração (UFCD) 9596, do Catálogo Nacional de Qualificações, de 50 horas; As ações de formação devem ser ministradas por entidades previamente certificadas como entidades formadoras, sendo as ações de formação homologadas e os formandos avaliados, conforme disposto no art.º 5.º, do referido Despacho 3232/2017, de 18-02. em Portugal cerca de metade dos tratores em circulação na estrada não dispõem de qualquer estrutura de proteção – arco de segurança, quadro de segurança ou cabina – nem sistemas de retenção, por não serem obrigatórios. Mais, dificilmente estes tratores serão substituídos ou serão alvo de legislação que torne obrigatória a instalação dessas estruturas que protejam o condutar em casos de reviramento; | | | | | | | | | | | | | | |
| 209 | Inovação tecnológica: o elevado número de tratores antigos merece uma atenção especial devendo ser fomentado um programa de renovação e reequipamento das explorações agrícolas para a modernização do parque de tratores a nível nacional, designadamente com estímulos positivos que fomentem o abate de tratores antigos, sem estruturas de proteção, em troca de tratores novos e mais seguros. O Estado, através do ministério da agricultura, e as organizações de produtores, através do Sistema de Aconselhamento Agrícola e Florestal, tem aqui um papel importante com a informação técnica, formação e aconselhamento dos produtores agrícolas e florestais. Deve desempenhar um papel central na apresentação das melhores opções, podendo contribuir para uma maior rentabilidade e eficácia de utilização, uma amortização mais rápida e substituição mais regular, de forma a acompanhar a evolução da segurança e da técnica, podendo contribuir para a redução do número de tratores em utilização/circulação no nosso País; | | | | | | | | | | | | | | |
| 210 | promovidas alterações legislativas que fomentem a instalação obrigatória de estruturas de proteção e de sistemas de retenção em todos os tratores, bem como da inspeção dos mesmos de forma a garantir a verificação, a manutenção e a instalação e funcionamento da sinalização, nomeadamente a luminosa (pirilampo). Os veículos agrícolas, à semelhança do enquadramento legal do arquipélago dos Açores, devem ter enquadramento legislativo para tornar obrigatória a inspeção periódica, por forma a garantir a regular manutenção do trator, as verificações do funcionamento da sinalização, o estado de conservação das estruturas de proteção, dos pneus, dos travões (dois), dos aceleradores (dois), das embraiagens e dos órgãos de trabalho (sistema de levantamento hidráulico, tomada de força, barra de puxo e tomadas de pressão hidráulica). Nessa inspeção deveriam ser avaliadas as estruturas que permitem o equilíbrio da máquina, designadamente pela distribuição de massas (água nas rodas, pesos frontais, pesos nas rodas, entre outros; | | | | | | | | | | | | | | |

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| 211 | legislação necessita ser revista, designadamente a respeitante à presença e utilização/funcionamento da sinalização de marcha lenta (vulgo pirilampo rotativo) cujo enquadramento legal deve tornar obrigatória a instalação e utilização sempre que o veículo agrícola circula na estrada (previstas coimas para ambas as situações – presença e utilização). Atendendo a que o legislador previu sancionamento para a não utilização da sinalização luminosa na via pública e omitiu o sancionamento para a não instalação, muitos dos utilizadores retiram a sinalização; | | | | | | | | | | | | | | |
| 212 | O planeamento da fiscalização deverá, entre outros, refletir o conhecimento da sinistralidade e deverá incidir sobre a habilitação legal, a utilização das estruturas de proteção em posição ativa e a utilização do cinto de segurança (se presentes na máquina), sobre a ligação dos dois travões na estrada para evitar o risco de reviramento e sobre o transporte de passageiros no veículo agrícola, em especial no estribo e guarda lamas. O transporte de passageiros (trabalhadores agrícolas) encontra-se regulamentado no Decreto-Lei n.º 221/2004, de 18-11. Atendendo ao elevado número de veículos agrícolas sem estruturas de proteção e sistemas de retenção, devem estes condutores, geralmente de idade muito avançada, ser sensibilizados para os riscos da condução desses tratores; | | | | | | | | | | | | | | |
| 213 | Introdução de benefícios fiscais para quem opte por adquirir veículos equipados com determinados sistemas de segurança ativa e passiva, ou que atinjam os níveis mais elevados do Programa Europeu de Avaliação de Novos Veículos (Euro NCAP). | | | | | | | | | | | | | | |
| 214 | Introduzir sistemas limitadores de velocidade nos veículos, tendo como referência os valores permitidos para a circulação em cada país. | | | | | | | | | | | | | | |
| 215 | Assegurar a formação e atualização dos condutores, garantindo que se encontram aptos a utilizar veículos equipados com as novas tecnologias de apoio à condução, à medida que forem surgindo no mercado. | | | | | | | | | | | | | | |
| 216 | Incutir nos condutores o hábito de ler o manual de instruções do veículo, como forma de garantir que conhece as funcionalidades e limitações dos sistemas. | | | | | | | | | | | | | | |
| 217 | Impor a obrigatoriedade de, no ato da entrega do veículo, o vendedor efetuar uma apresentação/demonstração prática dos sistemas que equipam o veículo | | | | | | | | | | | | | | |
| 218 | Os veículos utilizados em sistemas desta natureza devem estar munidos de um documento que descreva, de forma sucinta, os dispositivos de segurança que equipam o veículo, permitindo ao condutor adaptar a sua condução. | | | | | | | | | | | | | | |
| 219 | Classificar a segurança das estradas (ou troços) de 1 a 5 estrelas. Desta forma, o condutor pode optar por utilizar aquela que lhe oferece maior segurança. | | | | | | | | | | | | | | |
| 220 | Melhorar o desempenho da marcação horizontal e da sinalização vertical rodoviárias, incluindo a sua colocação, visibilidade e retro-refletividade | | | | | | | | | | | | | | |
| 221 | Reduzir a velocidade média praticada nas nossas estradas, nomeadamente naquelas que atravessam localidades; | | | | | | | | | | | | | | |
| 222 | Implementar regras de planeamento urbano para a construção de novas áreas residenciais (bairros), que obriguem à criação de vias paralelas de acesso e impeçam a entrada/saída diretamente da habitação para a via de circulação. | | | | | | | | | | | | | | |
| 223 | Garantir que os condutores respeitam o limite legal permitido para a condução sob o efeito destas substâncias; | | | | | | | | | | | | | | |

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| 224 | Cria condições para que todos os estabelecimentos autorizados a vender bebidas alcoólicas disponibilizem gratuitamente aos seus clientes equipamentos que permitam medir a taxa de alcoolemia no sangue | | | | | | | | | | | | | | |
| 225 | Desincentivar a utilização de aparelhos móveis durante a condução. | | | | | | | | | | | | | | |
| 226 | Garantir que todos os ocupantes dos veículos de quatro rodas utilizam adequadamente os cintos de segurança, nomeadamente nos bancos traseiros; | | | | | | | | | | | | | | |
| 227 | Garantir que todos os condutores e passageiros de veículos de duas rodas a motor utilizam capacete homologado, devidamente ajustado e apertado; | | | | | | | | | | | | | | |
| 228 | Garantir que nenhuma criança com menos de 135 cm de altura e menos de 12 anos de idade circula sem sistema de retenção adequado; | | | | | | | | | | | | | | |
| 229 | Incentivar os ciclistas a utilizar capacete, nomeadamente quando circulam fora das ciclovias. | | | | | | | | | | | | | | |
| 230 | Investir em campanhas que incentivem os utentes de trotinetes e de bicicletas a respeitar as normas rodoviárias e promovam a partilha pacífica do espaço rodoviário e a salvaguarda da segurança dos restantes utentes. | | | | | | | | | | | | | | |
| 231 | Conclusão do processo de regulamentação do Regime Jurídico do Ensino da Condução, publicando-se a legislação em falta desde 2014, para que seja possível a sua plena implementação; | | | | | | | | | | | | | | |
| 232 | Publicação da portaria que regulamenta a formação de instrutores e diretores de escolas de condução, adaptando-as à legislação em vigor; | | | | | | | | | | | | | | |
| 233 | Criação de norma que permita aos condutores que, por opção, realizaram prova prática em veículo de caixa automática remover a restrição 78 (caixa automática) da sua carta de condução, mediante a realização formação e exame em veículo de caixa manual; | | | | | | | | | | | | | | |
| 234 | Criação de regulamentação que garanta que a condução de veículos agrícolas na via pública depende de formação prévia em escola de condução e aprovação em exame de condução específico, extinguindo-se a possibilidade de conduzir este tipo de veículos por "equivalência"; | | | | | | | | | | | | | | |
| 235 | Introdução dos Sistemas Avançados de Apoio ao Condutor (ADAS) nos conteúdos programáticos da formação de condutores, para que os novos condutores conheçam as funcionalidades e limitações das tecnologias que equipam os veículos atualmente em circulação; | | | | | | | | | | | | | | |
| 236 | Implementação da monitorização da prova prática do exame de condução, introduzindo-se um sistema que permita o registo automático da duração e percurso realizados, das faltas cometidas pelo candidato e do local onde ocorreram, com recurso a equipamentos tipo "tablet" próprios para o efeito; | | | | | | | | | | | | | | |
| 237 | Atualização do modelo do relatório da prova prática, adaptando-o à legislação em vigor e com preenchimento no dispositivo indicado na alínea anterior; | | | | | | | | | | | | | | |
| 238 | Implementação de medidas que permitam evitar/minimizar a fraude nas provas de exame, nomeadamente, Instalação de equipamentos que inibam a comunicação com o exterior (Câmaras, telemóveis, "smartwatch", etc); Criação de procedimentos que impeçam o acesso de "duplos" às provas | | | | | | | | | | | | | | |
| 239 | A realização de provas teóricas com recurso a tradutores (contratados pelos próprios formandos) levanta fortes suspeitas quanto à seriedade do sistema. Deve ser eliminada a realização da prova com tradutores, criando-se a possibilidade de responder à | | | | | | | | | | | | | | |

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| | prova noutras línguas no próprio computador do teste, à semelhança do que se verifica nos restantes países da Europa. | | | | | | | | | | | | | | |
| 240 | Conclusão do manual de procedimentos das provas de exame (em preparação desde 2015), a fim de promover uniformidade dos critérios de avaliação | | | | | | | | | | | | | | |
| 241 | As categorias AM, A1, A2, A e BE podem ser obtidas em regime de autopropositura. Estes candidatos treinam sozinhos na via pública, sem qualquer apoio ou orientação especializada. Para além do evidente risco para a segurança (sua e dos outros), cada vez que o fazem comentem uma contraordenação muito grave. Por esse motivo, a obtenção destas categorias deve depender sempre de formação e acompanhamento a exame por escola de condução; | | | | | | | | | | | | | | |
| 242 | A condução de veículos de duas rodas a motor deve passar a carecer de formação específica e aprovação em exame de condução, extinguindo-se a possibilidade de conduzir veículos das categorias AM e A1 pelo simples facto de se estar habilitado para conduzir veículos da categoria B; | | | | | | | | | | | | | | |
| 243 | extinguir-se a possibilidade de acesso direto à categoria A, impondo-se um regime de acesso gradual e sequencial (A1, A2, A), que permita ao condutor adquirir experiência em motociclos menos potentes, contribuindo-se para a redução da mortalidade neste tipo de veículos | | | | | | | | | | | | | | |
| 244 | Os condutores devem passar a frequentar uma ação de formação que permita atualizar periodicamente os seus conhecimentos sobre regras de trânsito, sinalização rodoviária, novas tecnologias e outros aspetos fundamentais à condução. | | | | | | | | | | | | | | |
| 245 | Constituir equipas multidisciplinares para investigar acidentes de viação graves, identificar as suas causas e preconizar e aplicar medidas preventivas concretas, para a melhoria contínua da segurança do sistema rodoviário. | | | | | | | | | | | | | | |
| 246 | Definição de protocolos de cooperação, com as entidades relacionadas com as diferentes áreas disciplinares e sectoriais. | | | | | | | | | | | | | | |
| 247 | Definição dos modelos de análise científica e técnica aplicável e formação de especialistas. | | | | | | | | | | | | | | |
| 248 | Construção de uma plataforma informática de compilação e de análise de dados. | | | | | | | | | | | | | | |
| 249 | Análise de dados compilados e preconização de medidas preventivas. | | | | | | | | | | | | | | |
| 250 | Aplicação de medidas preventivas e avaliação de resultados. | | | | | | | | | | | | | | |
| 251 | No caso das substâncias estupefacientes ou psicotrópicas ilícitas será importante avaliar o impacto da introdução do controlo aleatório da fiscalização, da utilização de amostra de saliva nas análises toxicológicas de rastreio e confirmação e da utilização das concentrações limite e exame comportamental no enquadramento jurídico dos casos positivos. | | | | | | | | | | | | | | |
| 252 | No caso dos medicamentos, cuja utilização terapêutica pode ser compatível com a condução, será importante definir quais os fármacos, intervalos de concentração terapêutica e enquadramento clínico a considerar no contexto da fiscalização. Este estudo deverá ser elaborado por especialistas na área da saúde (medicina, psicologia, farmácia) relativamente aos potenciais efeitos dos fármacos com impacto do desempenho da condução, e na área operacional (GNR, PSP, INMLCF) relativamente à capacidade de deteção das substâncias definidas. | | | | | | | | | | | | | | |

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| 253 | melhoria da recolha e da análise dos dados de acidentes de viação e a sua monitorização, permitindo o desenvolvimento de novas medidas de segurança rodoviária. | | | | | | | | | | | | | | |
| 254 | analisar e investigar as causas e consequências dos acidentes e as possibilidades de minimização dos mesmos. | | | | | | | | | | | | | | |
| 255 | intensificar o controlo do cumprimento do código da estrada, verificando e dissuadindo as infrações de um modo mais eficiente, onde a adopção generalizada de instrumentos eletrónicos de controlo de tráfego é absolutamente crítica e será porventura das medidas com maior impacto de curto prazo. | | | | | | | | | | | | | | |
| 256 | Campanhas específicas de fiscalização e de informação aos utentes. Nestas realçam-se, nomeadamente, ações de informação e sensibilização dos condutores automóveis, mas também os utilizadores mais jovens, seniores, motociclistas, utilizadores de modos suaves de deslocação e ciclistas. | | | | | | | | | | | | | | |
| 257 | Adoção e criação de normas técnicas para a proteção dos utentes vulneráveis da via pública, elencando-se o "Manual Desenho da Rua" realizado pela CML como uma contribuição nesse sentido. | | | | | | | | | | | | | | |
| 258 | Aumentar a segurança dos ciclistas e de outros utentes vulneráveis das vias rodoviárias, interessa a promoção e o adequado desenho de infraestruturas adequadas e a sua uniformização, não existindo normas nacionais, pelo que o município de Lisboa realizou, de acordo com as boas práticas internacionais, uma tentativa de uniformização das suas propostas neste âmbito. | | | | | | | | | | | | | | |
| 259 | RST não responde às necessidades atuais das cidades, não estando ajustado nem ao modelo de espaço público, com menor dependência de sinalização vertical (que compromete a circulação de peões em particular de mobilidade reduzida), nem ajustado à proteção dos utilizadores vulneráveis no espaço viário (em particular ciclistas). | | | | | | | | | | | | | | |
| 260 | Educação para uma mobilidade consciente e sustentável, que aponte á opção por opções mais racionais do ponto de vista da segurança rodoviária e da proteção do ambiente, bem como a formação dos utentes das vias rodoviárias, incidindo sob dois aspetos: a formação contínua dos condutores profissionais e não profissionais e, também muito relevante, a formação de população não encartada (nomeadamente as crianças e a mais envelhecida/ sénior que vêm a sua mobilidade condicionada com a idade). | | | | | | | | | | | | | | |
| 261 | Ao nível das escolas existir formas de aumentar a autonomia das crianças, quer por via de formação específica, quer por uma revisão profunda das condições de circulação e requisitos das vias na envolvente destes equipamentos. | | | | | | | | | | | | | | |
| 262 | Adoção de medidas que visem a proteção dos utentes vulneráveis da via pública, como sejam os condutores de motociclos e ciclomotores, os ciclistas e os peões, especialmente em meio urbano, como é o caso de Lisboa, e perante o crescimento na utilização diária dos veículos de duas rodas motorizados por efeitos da diretiva europeia, das dificuldades de estacionamento e da facilidade da sua circulação na cidade. | | | | | | | | | | | | | | |
| 263 | Segurança e consequência dos acidentes associados com ciclomotores/ motociclos é relevante, podendo as melhorias neste domínio estar associadas à homologação, aos dispositivos de segurança integrados (p. ex. "airbags"), a eventuais inibidores de desempenho dos veículos e aos equipamentos e vestuário dos condutores (e passageiros). | | | | | | | | | | | | | | |

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| 264 | Promoção de utilização de tecnologias modernas para reforço da segurança rodoviária tem um efeito importante em termos de segurança rodoviária. A adoção generalizada de sistemas de deteção de incidentes, nomeadamente de alerta anticolisão e de sistemas de reconhecimento de peões com travagem automática podem ser fundamentais para reduzir a sinistralidade e o seu efeito em meio urbano, bem como de inibição de velocidades excessivas. A "retromontagem" destes sistemas avançados de assistência ao condutor em veículos recentes do atual parque automóvel será de equacionar. | | | | | | | | | | | | | | |
| 265 | O excesso de velocidade é o fator mais relevante na sinistralidade e seus impactos na saúde humana, importa realçar o benefício incomparável que terá a introdução e obrigatoriedade de equipamentos Intelligent Speed Assistance (ISA) nos veículos, especialmente se forçarem a limitação da velocidade de circulação para os níveis definidos na lei. A mensagem do Estado Português para a Comissão Europeia sobre esta matéria, deve ser particularmente inequívoca e clara, criando formas crescentes de controlo de comportamentos abusivos por via de sistemas V2I. | | | | | | | | | | | | | | |
| 266 | Plano Estratégico de Segurança Rodoviária 2021-2030 – Visão Zero 2030 apontasse à criação de legislação que fosse mais longe do que as diretivas europeias no sentido de forçar à utilização destas soluções, de forma a garantir que os limites de velocidade em espaço urbano são efetivamente respeitados, já que a lei e a sua fiscalização, por si só, se têm revelado insuficientes. | | | | | | | | | | | | | | |
| 267 | Financiamento e apoio à concretização dos objetivos e subsequentes medidas e ações que se venham a propor no âmbito do Plano Estratégico de Segurança Rodoviária 2021-2030 – Visão Zero 2030, nomeadamente aquelas que ficarem na esfera de atuação dos municípios. | | | | | | | | | | | | | | |
| 268 | Polícia Municipal deve ser considerada como uma das entidades relevantes com vista à prossecução dos objetivos, medidas e ações que se venham a definir, dadas as suas responsabilidades igualmente em matéria de regularização, fiscalização do tráfego e do estacionamento rodoviário. | | | | | | | | | | | | | | |
| 269 | Promover uma transição gradual do Código da Estrada para Código da Rua (Code de la Rue na Bélgica e França ou Straatcode na Holanda), onde se destaque a via pública não somente enquanto espaço dedicado à função de tráfego e circulação mas antes um espaço de fruição e convivência, incorporando todos os utilizadores, com especial relevância aos mais vulneráveis, permitindo-lhes que se possam movimentar em segurança, independentemente da sua idade ou capacidade física. | | | | | | | | | | | | | | |
| 270 | Incluir o conceito de Zona 30, enquanto zonas de circulação especialmente condicionadas e destinadas, primeiramente, para peões, onde a velocidade máxima de circulação de veículos está fixada em 30 km/h. Nestas zonas os peões devem poder atravessar a via fora dos locais sinalizados devendo, contudo, certificar-se de que o podem fazer sem risco ou impedimento indevidos, não sendo necessário implementar nas mesmas, passagens para peões formalizadas. | | | | | | | | | | | | | | |
| 271 | Rever o conceito de utilizador vulnerável, definindo-se uma hierarquia em benefício do peão, e efetuando-se a associação direta do conceito aos diversos casos de partilha dos espaços, nomeadamente às zonas de | | | | | | | | | | | | | | |

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| | coexistência e às pistas obrigatórias para peões e velocípedes. | | | | | | | | | | | | | | |
| 272 | Incentivar a elaboração de Planos de Mobilidade Urbana Sustentável (PMUS) que promovam os modos sustentáveis de deslocação, em conformidade com o Guião da Comissão Europeia (SUMP Guidelines) e as estratégias nacionais e europeias existentes em matéria de mobilidade, alterações climáticas e neutralidade carbónica, que possibilitem uma visão holística sobre o território, sem deixar de perder o seu foco essencial na melhoria da qualidade de vida urbana, da saúde pública e da segurança dos cidadãos. | | | | | | | | | | | | | | |
| 273 | Legislar no sentido da obrigatoriedade da elaboração de Planos Municipais de Segurança Rodoviária, com atualização e monitorização regular e considerando sempre a informação de todas as tipologias de acidentes, sejam com vítimas ou sem vítimas, por forma a eliminar a totalidade dos pontos de atrito existentes no espaço público. | | | | | | | | | | | | | | |
| 274 | Incentivar a inclusão, nos instrumentos legais associados ao planeamento do território, da obrigatoriedade de realização de Planos de Mobilidade de Empresas e Grandes Polos Geradores de Deslocações por forma a encontrar soluções que minimizem a utilização do automóvel e as necessidades de estacionamento nestes locais. A uma redução da utilização do automóvel poder-se-á associar, de forma direta, a redução do tráfego nas cidades e vilas com benefícios não somente para a descarbonização, mas também para a redução da sinistralidade rodoviária. | | | | | | | | | | | | | | |
| 275 | Estabelecer o urbanismo de proximidade enquanto elemento fundamental dos instrumentos de planeamento territorial. O urbanismo de proximidade assume- se como um dos pilares centrais no garante da mobilidade sustentável, promovendo um desenho urbano humanizado, menos propenso a fenómenos de sinistralidade rodoviária, desenvolvido em função das pessoas e não do veículo motorizado, devendo, os decisores locais, apostar em medidas que garantam cidades compactas e com usos do solo mistos. | | | | | | | | | | | | | | |
| 276 | A implementação de medidas corretivas deverá incidir sobre a revisão do planeamento urbano vigente, por forma a fomentar a proliferação de comércio e serviços de proximidade e minimizar a necessidade de utilização do transporte individual motorizado, através de um conjunto articulado de ações globais. | | | | | | | | | | | | | | |
| 277 | Promover a revisão do Regulamento de Sinalização do Trânsito (RST), incorporando mais exaustivamente as matérias afetas ao modo ciclável, nomeadamente no que concerne à sinalização vertical e horizontal. Na última revisão do RST perdeu-se a oportunidade de, entre outros: introduzir as bikeboxes e o seu conceito, incentivando, nos casos regulados por sinalização semafórica, que o sinal de verde para o ciclista seja antecipado em relação ao do automobilista; introduzir as caixas protegidas de viragem à esquerda para ciclistas; introduzir a simbologia de partilha de via com o automóvel (sharrow) e as suas consequências para os utilizadores; reduzir a poluição visual em meio urbano, prevendo-se a possibilidade de inserção da sinalização destinada ao ciclista, habitualmente vertical, enquanto marcação horizontal no pavimento, mantendo-se com validade legal; incorporar a simbologia de marcação de sentidos de circulação da bicicleta no pavimento; introduzir ou rever sinalização vertical e as respetivas regras/conceitos (quando aplicável), nomeadamente: o sinal que obriga o ciclista | | | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a desmontar da bicicleta; o sinal de via sem saída exceto para velocípedes e/ou peões; o sinal informativo de início e fim de pista reservada a velocípedes; o sinal informativo de duplo sentido ciclável; o sinal de permissão de circulação de bicicletas em contra-fluxo; a sinalização (e regra) que possibilite, aos velocípedes, a passagem de sinal luminoso vermelho na sua viragem à direita e ao seguir em frente, devendo, contudo, ceder a passagem aos peões e outros veículos em circulação. Prever a sinalização adequada quando não for possível a sua aplicação. | | | | | | | | | | | | | | |
| 278 | Alterar a velocidade máxima de circulação dentro das localidades de 50km/h para 30km/h, com o devido acompanhamento de medidas físicas de acalmia de tráfego, devido ao número elevado de atropelamentos e de acidentes aqui ocorridos, potenciando-se, desta forma, uma redução da sinistralidade e da gravidade dos acidentes, mas também a redução da emissão de gases poluentes e da poluição sonora, e, em oposição, incrementando-se as possibilidades várias de humanização dos territórios. | | | | | | | | | | | | | | |
| 279 | Considerar o agravamento das sanções, eventualmente a criminalização (tal como ocorre com a condução em estado de embriaguez com uma TAS igual ou superior a 1,2 g/l) e o reforço da fiscalização para a circulação em excesso de velocidade na medida em que as estatísticas evidenciam que uma percentagem elevadíssima de acidentes ocorre com bom tempo, em pleno dia, em vias com boas condições de conservação e, naturalmente, em velocidade excessiva. | | | | | | | | | | | | | | |
| 280 | Definir a obrigatoriedade de planos de ação para a manutenção da sinalização vertical e horizontal que permitam reduzir o elevado número de situações anómalas nomeadamente no que concerne à sua colocação, visibilidade e retro- refletividade. | | | | | | | | | | | | | | |
| 281 | Proceder à criação de um manual para apoio ao projeto de vias cicláveis, que defina claramente as regras para a criação e dimensionamento de ciclovias, de atravessamentos cicláveis, de sinalização em rotundas, entroncamentos e cruzamentos (com especial relevância para a uniformização da coloração das vias com especial ênfase para os pontos de conflito entre modos), orientando os projetistas e, simultaneamente, uniformizando as características, (inclusive as de segurança de todos os utilizadores da via pública) das vias cicláveis a nível nacional. | | | | | | | | | | | | | | |
| 282 | Reforçar a importância do rigoroso e eficaz desenho dos atravessamentos pedonais através da criação de um manual específico de apoio ao dimensionamento e localização dos atravessamentos pedonais e demais normas de segurança associadas ao peão no espaço púbico urbano, nomeadamente o seu correto posicionamento na via pública, a utilização de pavimentos podotáteis de acordo com a norma portuguesa em vigor e dimensionamentos de acordo com o Decreto-Lei n.º 163/2006, de 8 de agosto, incentivando também a sua aplicação. | | | | | | | | | | | | | | |
| 283 | Obter e analisar informações baseadas em evidências sobre o comportamento das pessoas no sistema rodoviário: identificar os tipos de erros que os condutores e outros participantes do sistema de trânsito cometem; definir os efeitos de tais erros no sistema rodoviário; definir medidas para prevenir estes erros. | | | | | | | | | | | | | | |
| 284 | Definir os métodos e recursos necessários para aumentar a autoconsciência dos condutores e outros participantes no ambiente rodoviário. | | | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| 285 | Definir os métodos e recursos necessários para fornecer aos utilizadores feedback sobre a segurança do seu comportamento. | | | | | | | | | | | | | | |
| 286 | Investigar e analisar novos comportamentos e formas de interação dos utilizadores com os veículos e os ambientes rodoviários, à luz das novas ferramentas e sistemas tecnológicos inteligentes e automatizados. | | | | | | | | | | | | | | |
| 287 | Fornecer aos restantes stakeholders informações claras, qualitativas e quantitativas, sobre as capacidades, desempenho e limitações cognitivas dos utilizadores em função das condições contextuais atuais (no veículo, na infraestrutura e no contexto de utilização). | | | | | | | | | | | | | | |
| 288 | Incluir conhecimento baseado em evidências relativo aos utilizadores (indicadores de desempenho, interação e segurança) nos processos de implementação, regulamentação e certificação de novas soluções inteligentes e sistemas cooperativos nas infraestruturas rodoviárias e veículos (envolvendo a interação veículo-ambiente-humano, impacto ambiental). | | | | | | | | | | | | | | |
| 289 | Definir procedimentos para trabalhar com o público geral, com o intuito de promover o comportamento responsável e a mudança atitudinal, em colaboração com as entidades reguladoras, movimentos civis e comunitários. | | | | | | | | | | | | | | |
| 290 | Definir procedimentos de educação e treino ao longo da vida para todos os utilizadores envolvidos no sistema rodoviário, e não só no nível de iniciação, com especial incidência na preparação para a transformação tecnológica que o ecossistema rodoviário está a sofrer. | | | | | | | | | | | | | | |
| 291 | Promover a adoção de sistemas de apoio à condução | | | | | | | | | | | | | | |
| 292 | Promover a adoção de sistemas de Ecocondução | | | | | | | | | | | | | | |
| 293 | Promover a adoção de sistemas de informação com vista à manutenção preditiva dos veículos | | | | | | | | | | | | | | |
| 294 | Averiguação das causas de acidentes, potencialmente mais graves (choques frontais e atropelamentos), através da análise de imagens recolhidas por câmaras de vídeo frontais instaladas a bordo dos veículos | | | | | | | | | | | | | | |
| 295 | Promover a travagem automática de emergência, ou de redução automática, sempre que seja detetado um obstáculo na frente do veículo, não sendo possível parar antes do embate, se a velocidade se mantiver (risco iminente de colisão) | | | | | | | | | | | | | | |
| 296 | Sistema de registo de eventos de condução, com registo de imagens frontais, dos últimos segundos, face ao evento gerado (eventos: acelerações bruscas, travagens acentuadas, | | | | | | | | | | | | | | |
| 297 | acelerações laterais, desvio de rota por transposição de traços contínuos, não cumprimento da velocidade máxima definida, ativação do sistema de travagem automática, etc.) | | | | | | | | | | | | | | |
| 298 | Promoção da visão direta e indireta por parte do condutor (sistema de aviso de perigo em "ângulos mortos"), através da instalação de sensores laterais e traseiros, que permitam avisar o condutor de risco de colisão lateral, por manobra, ou mudança de via | | | | | | | | | | | | | | |
| 299 | Adoção de retrovisores exteriores com indicação da existência de perigo em ângulo morto. Sistema de retrovisores baseados em câmaras, com tratamento de imagem, que minimizem o risco de encadeamento em ambiente noturno | | | | | | | | | | | | | | |
| 300 | Instalação de sistemas de aviso, de abandono do posto de condução, sem a viatura se encontrar convenientemente travada (aviso de travão de parque não acionado) | | | | | | | | | | | | | | |
| 301 | Instalação de sistema de emissão de alertas, em veículos elétricos, sempre que a velocidade desce | | | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| | abaixo de um limite pré-definido (e.g. 10 km/h), com vista à minimização de atropelamento, por distração de peão, ou de invisuais. | | | | | | | | | | | | | | |
| 302 | Adoção de sistemas de absorção de energia, em caso de atropelamento, evitando ferimentos graves, ou outras consequências, para os utilizadores vulneráveis | | | | | | | | | | | | | | |
| 303 | Promover a utilização dos dados gerados pelos sistemas de apoio à condução e/ou ecocondução (georreferenciação) para identificar 'pontos negros' ou áreas onde a infraestrutura pode estar a potenciar a ocorrência de acidentes ou incidentes de segurança rodoviária Investigação de acidentes, com incorporação de georreferenciação, para determinação de pontos negros e tipologia de acidente nos mesmos, de forma a tomar decisões mitigadoras | | | | | | | | | | | | | | |
| 304 | Fomento de zonas de velocidade reduzida (e.g. "zonas 30"), em locais densamente povoados e em que o Transporte Público coexista com utilizadores vulneráveis. | | | | | | | | | | | | | | |
| 305 | Promover a utilização dos dados gerados pelos sistemas de apoio à condução e/ou ecocondução para identificar falhas humanas e oportunidades de melhoria do desempenho, que possam ser a base de ações de formação ou outras ações corretivas. | | | | | | | | | | | | | | |
| 306 | Instalação de sistemas de medição automática, "on-board", da fadiga do condutor, aconselhando a paragem do veículo, logo que possível | | | | | | | | | | | | | | |
| 307 | Adoção de sistemas de bloqueio de ignição, por deteção precoce de nível de Álcool no sangue, por parte do condutor. | | | | | | | | | | | | | | |
| 308 | Promover a adoção de Sistemas de Gestão de Segurança Rodoviária, preferencialmente, utilizando o referencial "ISO 39001". | | | | | | | | | | | | | | |
| 309 | Promover a adoção de sistemas de automáticos de fiscalização de regras do código da estrada (e.g. sistemas vídeos para controle de sinais vermelhos, estacionamento ilegal, utilização ilegítima de corredores bus. | | | | | | | | | | | | | | |
| 310 | Promover projetos de I&D colaborativa entre universidades, centros de investigação, empresas e instituições públicas na área do teste e demonstração de novas tecnologias na área da segurança rodoviária. | | | | | | | | | | | | | | |
| 311 | Aprovar a criação de 'Zonas Livres Tecnológicas' (ZLT) para testar soluções inovadoras de promoção da segurança rodoviária. Em particular estas ZLT devem compreender um quadro legislativo que promova e facilite a realização de atividades de investigação, demonstração e teste, em ambiente real, de tecnologias, produtos, serviços, processos e modelos inovadores. | | | | | | | | | | | | | | |
| 312 | Facilitar, através da criação de legislação apropriada, a realização de testes e projetos-piloto de utilização de veículos autónomos. | | | | | | | | | | | | | | |
| 313 | A IP precisa de mudar os seus conhecimentos técnicos para as necessidades de infraestruturas locais. | | | | | | | | | | | | | | |
| 314 | Encorajar as deslocações pedonais e desencorajar a velocidade. | | | | | | | | | | | | | | |
| 315 | Indicadores qualitativos - devem ser recolhidos os quase acidentes - o medo também deve ser recolhido. | | | | | | | | | | | | | | |
| 316 | Indicadores quantitativos - recolher quantos quilómetros são feitos pelo utilizador, ou por modo, para serem utilizados em medidas de risco. | | | | | | | | | | | | | | |
| 317 | Fazer melhores inspecções - criar profissionais para o fazer, os relatórios devem ser públicos. | | | | | | | | | | | | | | |
| 318 | Mais investimento em investigação sobre acidentes. | | | | | | | | | | | | | | |
| 319 | Disponibilidade pública de bases de dados sobre acidentes (em bruto). | | | | | | | | | | | | | | |

| | Comment / suggestion | RS management | Roads | Users | Speeds | Vehicles | Post-crash | Pedestrians | Cyclists | PTW | ITS | Public transport | Monitoring & Evaluation | Research | knowledge transfer |
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| 320 | Indicadores - integrar diferentes externalidades num indicador único de sustentabilidade. | | | | | | | | | | | | | | |
| 321 | Comportamento/tecnologia - instalar dispositivos nos veículos para avisar a VRU à distância e os veículos motorizados. | | | | | | | | | | | | | | |
| 322 | Cultura - os padrões de comportamento podem ser alterados pelas infraestruturas. | | | | | | | | | | | | | | |
| 323 | Considerar uma abordagem diferente para os diferentes tipos de infraestruturas, tendo eles desafios diferentes. | | | | | | | | | | | | | | |
| 324 | Áreas urbanas - mudança de paradigma de aceleração nas áreas urbanas – ideias bloqueiam novas prioridades, atrasando o investimento. As decisões são tomadas isoladas umas das outras - micro decisões. Se não houver mudança, as coisas não mudam. O desenvolvimento de capacidades deve ser uma prioridade. | | | | | | | | | | | | | | |
| 325 | A forma como a estratégia é comunicada às cidades. É um assunto que diz respeito a todos. Tem de ser vendida: multimodal, sustentável, segura. O desemprego terá de utilizar opções de mobilidade. | | | | | | | | | | | | | | |
| 326 | Passos críticos - conhecer as orientações. Quatro prioridades: excesso de velocidade, cruzamentos, estacionamento ilegal, áreas altamente vulneráveis (escolas). | | | | | | | | | | | | | | |
| 327 | As cidades podem: mudar as infraestruturas, mudar a gestão do tráfego, a fiscalização (policia municipal), incluir ISA na frota municipal; comunicações à população; e dados (avaliação de risco como IRAP; acidentes geocodificados). | | | | | | | | | | | | | | |

# 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 6.3 and Figure 6.4 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.

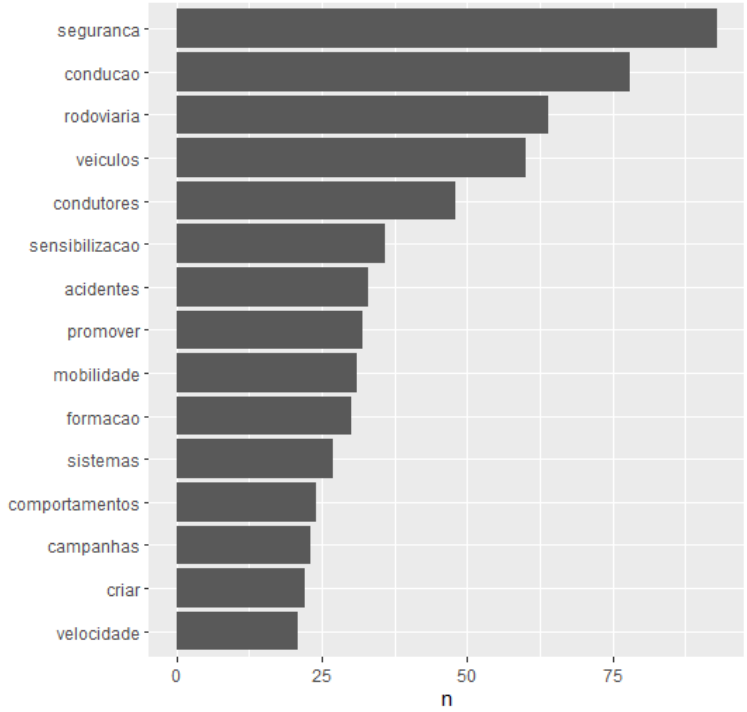


**Figure 6.3 –Number of occurrences of the most frequent words (n>20) in the public and private entities' record set.**

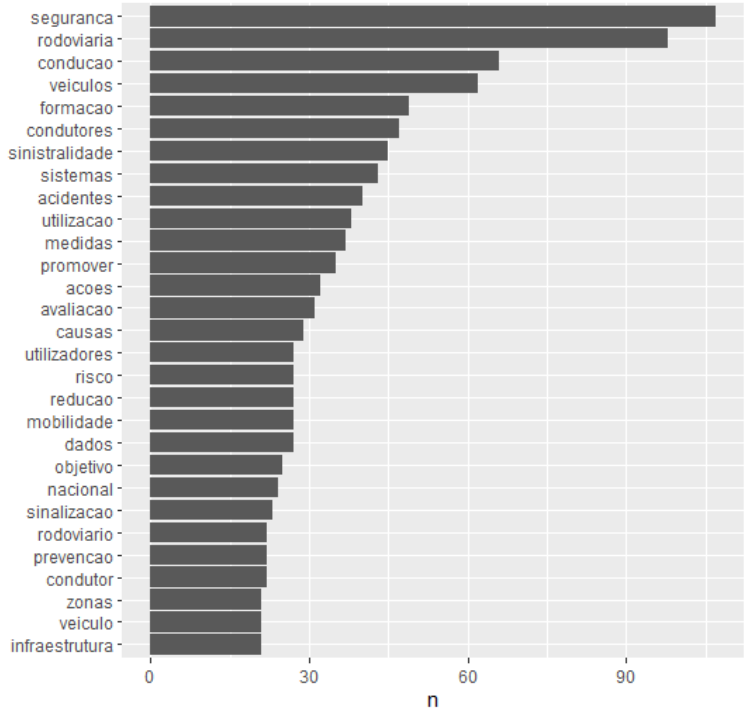


**Figure 6.4 –Number of occurrences of the most frequent words (n>20) in the Non-Executive Council of Experts' record set.**

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 6.5 and Figure 6.6 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 6.5, 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 6.5 also shows the more general character of the contributions, highlighting problems associated with road, vehicle, and the bigram "*rede viaria*".

Figure 6.6 shows that the solutions record sets is particularly focused around *words* such as "*infraestrutura*", "*seguranca*" and "*formacao*". Similar to the previous figure, Figure 6.6 also highlights the broader set of road safety issues (e.g., "*recolha dados*" and "*avaliacao medica*").

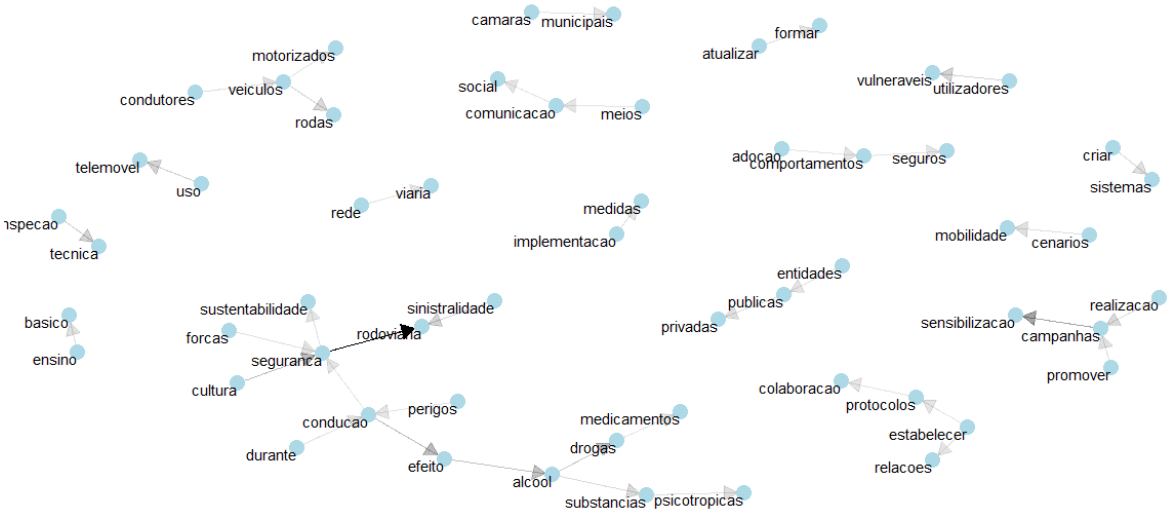


**Figure 6.5 – Directed graph of common bigrams in the public and private entities' record set.**

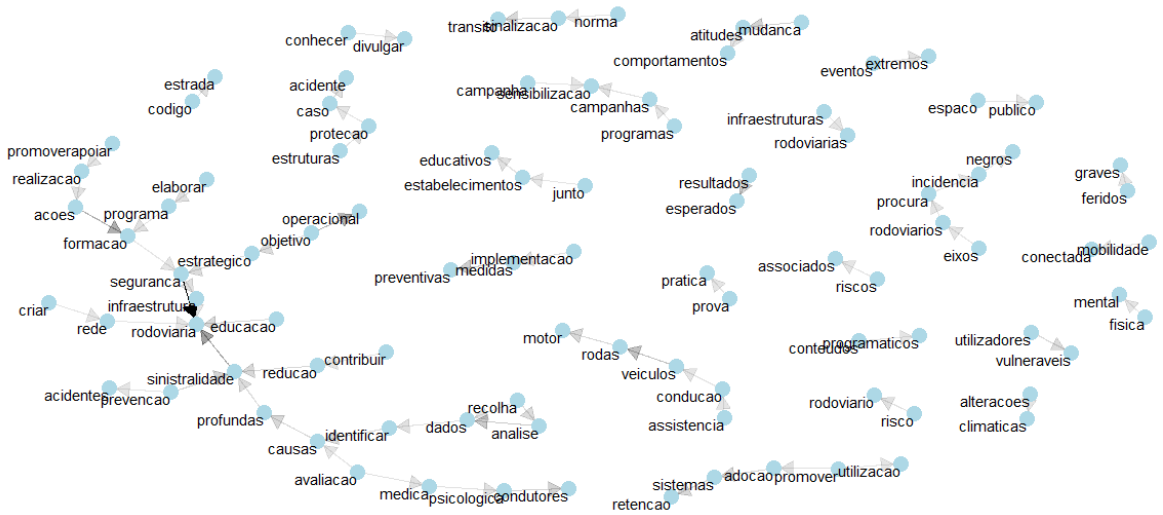


**Figure 6.6 – Directed graph of common bigrams in the in the Non-Executive Council of Experts' record set.**

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.

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