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EUROPEAN
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Brussels, 24.4.2025
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Roadworthiness package

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

on the revision of the Directives of the Roadworthiness package

Accompanying the documents

Proposal for a Directive of the European Parliament and of the Council amending Directive 2014/45/EU on periodic roadworthiness tests for motor vehicles and their trailers, and amending Directive 2014/47/EU on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Union

Proposal for a Directive of the European Parliament and of the Council on the registration documents for vehicles and vehicle registration data recorded in national vehicle registers, and repealing Council Directive 1999/37/EC

{COM(2025) 179 final} - {SEC(2025) 119 final} - {SWD(2025) 97 final} - {SWD(2025) 98 final} - {SWD(2025) 99 final}

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Glossary

Term or acronym	Meaning or definition
ADAS	Advanced Driver Assistance Systems refer to systems that support the driver in their primary driving task. These systems can inform or warn the driver, but also take over (part of) vehicle control.
CARE	CARE is a Community database on road crashes resulting in death or injury (no statistics on damage-only crashes).
CITA	International Motor Vehicle Inspection Committee, worldwide association of authorities and authorised companies active in the field of vehicle compliance
CO	Carbon monoxide: colourless odourless very toxic gas that is formed as a product of the incomplete combustion of carbon or a carbon compound. The greatest sources of CO to outdoor air are vehicles or machinery that burn fossil fuels.
CoC	Certificate of Conformity: a statement by a vehicle manufacturer that the vehicle conforms to EU type-approval requirements.
DPF	Diesel Particle Filter, a component designed to remove diesel particulate matter or soot from the exhaust gas of a diesel engine.
EEA	European Environment Agency
ELV	End-of-Life Vehicles
EReg	Association of European Vehicle and Driver Registration Authorities
EUCARIS	European car and driving licence information system
EV	Electric vehicle, including battery electric, hybrid electric, and fuel cell electric vehicles
GSR	General Safety Regulation (EU) 2019/2144: type-approval requirements to ensure the general safety of vehicles and the protection of vulnerable road users

HDV	Heavy-duty vehicle, vehicles above 3.5t maximum permissible laden mass, including trucks and buses/coaches
HGV	Heavy goods vehicle, truck
LDV	Light-duty vehicle (i.e., up to 3.5t maximum mass), including cars and vans (light commercial vehicles, LCVs)
NO_2, NO_x	Nitrogen dioxide, nitrogen oxides, including NO and NO_2
NH_3	Ammonia, NH3 contributes to acid deposition and eutrophication, which in turn, can lead to potential changes occurring in soil and water quality.
OBD	A vehicle system that can generate on-board diagnostics. It collects information from the network of sensors inside the vehicle, which the OBD can use to regulate car systems or alert the user to problems. A technician can plug into the OBD port to collect vehicle data and diagnose problems. Recent models can communicate diagnostic information over the air.
OBM	On-Board Monitoring means a system on board a vehicle that is capable of detecting and communicating either emission exceedances or when a vehicle is in zero emission mode, via the OBD port and over the air.
Plume chasing	A new emission testing method used to detect high-emitting vehicles. Also called mobile remote sensing where a chasing vehicle follows the target vehicle, typically a truck.
$PM_{(2.5)}$	Particulate matter (with a diameter smaller than 2.5 micrometres (<2,5 µm)): the emission limits for mass of particulate matter are regulated by type-approval legislation for light (Euro 5 and Euro 6) as well as heavy-duty vehicles (Euro VI)
PN	Particle number, another measure of air pollution, the emission limits for PN were introduced in the type-approval regulations from Euro 5b light vehicles (first registered from 1 January 2013) and from Euro VI HDVs (first registered from 1 January 2014)
PTI (Directive)	Periodic technical inspection (Directive 2014/45/EU on periodic roadworthiness tests for motor vehicles and their trailers)

PTI centre	A PTI station, an authorised workshop or larger inspection centre with one or more PTI lanes
PTI lane	Test lanes along which the vehicle advances during the various stages of PTI
Remote sensing	A method that measures the various components of exhaust emissions of vehicles that pass by the remote sensing device using a light beam and detectors
RSI (Directive)	Roadside inspection (Directive 2014/47/EU on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Union)
RWP	Roadworthiness package: Directive 2014/45/EU, Directive 2014/46/EU amending Directive 1999/37/EC, and Directive 2014/47/EU
SCR	Selective Catalytic Reduction is a technology that reduces nitrogen oxides (NOx) from exhaust gases of diesel engines. It converts NOx into nitrogen and water vapour and improves fuel economy and the performance of diesel engines.
SDG (Regulation)	Single Digital Gateway (Regulation (EU) 2018/1724) establishing a single digital gateway to facilitate online access to information, administrative procedures, and assistance services that citizens and businesses may need in another EU country
UN SDG	United Nations Sustainable Development Goals
VRD (Directive)	Vehicle registration documents (Directive 1999/37/EC, as amended by Directive 2014/46/EU)

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

This Impact Assessment accompanies legislative proposals for the revision of three Directives, collectively called the Roadworthiness Package (hereinafter the "RWP"):

- Directive 2014/45/EU on periodic roadworthiness tests for motor vehicles and their trailers (hereinafter the "Periodic Technical Inspection" or "PTI" Directive)[1];
- Council Directive 1999/37/EC on the registration documents for vehicles as amended by Directive 2014/46/EU (hereinafter the "Vehicle Registration Documents" or "VRD" Directive)[2];
- Directive 2014/47/EU on the technical roadside inspection of the roadworthiness of commercial vehicles (hereinafter the "Technical Roadside Inspection" or "RSI" Directive)[3].

Road transport plays a vital role in connecting businesses and consumers across the EU, facilitating trade, and supporting economic growth and employment. It facilitates mobility of people and supports many industries, such as manufacturing, construction and retail, by providing the means for the transport of goods. It also plays a critical role in emergency response. In 2021, road freight transport represented 54.3% (1,863 billion tonne-kilometres) of all the goods transported within the EU and was responsible for 87% (4,174 billion passenger-kilometres) of the total passenger transport activity[4]. The road transport sector employs more than 5 million people in the EU, of which 3.3 million work in freight and 1.8 million in passenger transport. At the same time, it is a source of certain negative impacts that are addressed by various EU and national transport policies, among which the Roadworthiness Package is a key building block.

Safe vehicles are part of the so-called "Safe System approach", as presented in the EU Road Safety Policy Framework 2021-2030 – Next steps towards "Vision Zero" ([5]). In this road safety strategy, the Commission proposed new interim targets of reducing the number of road deaths by 50% between 2020 and 2030 as well as reducing the number of serious injuries by 50% over the same period. The UN Global Plan for the Decade of Action ([6]) released in October 2021, also applying the "Safe System approach", promotes the same reduction targets already in place at EU level.

The Safe System approach considers death and serious injury in road collisions as being largely preventable, while acknowledging that collisions will continue to occur. It takes as a point of departure the fact that people make mistakes and aims to ensure that such mistakes do not cause fatalities or serious injuries by acting on five pillars: safe roads and roadsides, safe speeds, safe road users, safe vehicles, and fast and effective post-crash care, which all contribute to reducing the impact of crashes. The Roadworthiness Package focuses on the safe vehicle part of this system.

In its Sustainable and Smart Mobility Strategy ([7]) of 2020, the Commission reiterated the target of zero fatalities in all modes of transport by 2050 and announced the revision of the roadworthiness legislative framework, to ensure the lifetime compliance of vehicles with emission and safety standards, under Flagship 1 "Boosting the uptake of zero-emission vehicles, renewable & low-carbon fuels and related infrastructure". In October 2021, the European Parliament adopted a resolution on the EU Road Safety Policy Framework 2021-2030 ([8]), calling on the Commission to consider, among

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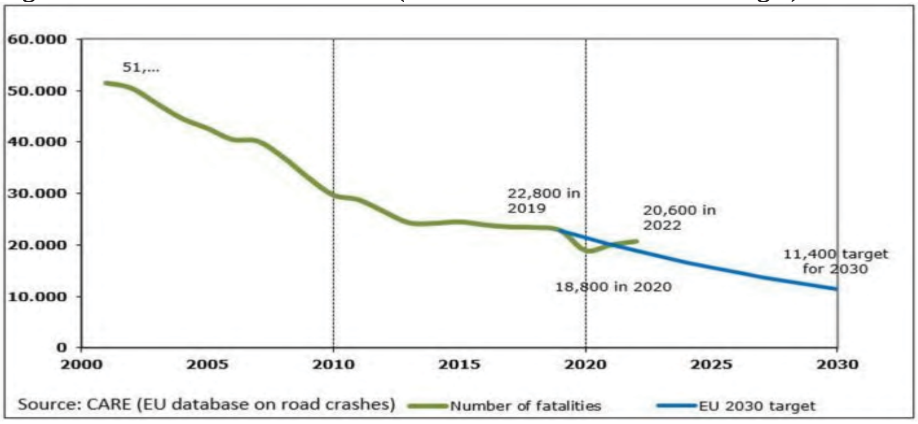
[1] https://eur-lex.europa.eu/eli/dir/2014/45/oj
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01999L0037-20220324
[3] https://eur-lex.europa.eu/eli/dir/2014/47/oj
[4] Statistical pocketbook 2023 (europa.eu)
([5]) SWD(2019) 283 final
([6]) Decade of Action - United Nations Sustainable Development
([7]) COM(2020) 789 final
([8]) P9_TA(2021)0407 https://www.europarl.europa.eu/doceo/document/TA-9-2021-0407_EN.pdf

others, tightening the roadworthiness test regime and to adapt it to the technical progress in vehicle safety features.

Road crashes[9] represent one of the most significant negative impacts of road transport. The external cost of crashes represents almost EUR 250 billion per year, i.e., roughly 2% of GDP[10]. There were around 20,600 fatal crashes in the EU in 2022, a 3% increase on 2021 as traffic levels recovered after the pandemic. This represents however 2,200 fewer fatalities (-10%) compared with the pre-pandemic year 2019 (see Figure 1). The EU and UN target is to halve the number of road deaths by 2030[11]. The main causes of road crashes are speeding, alcohol/drugs, distracted driving, and various driver errors (such as errors of interpretation or fatigue). Other causes include the inadequate state or design of infrastructure (slippery surface, insufficient markings, poor maintenance), and vehicle defects. In the EU, thanks to gradually improving vehicle technology through EU type-approval rules and a well-developed system of technical inspections to ascertain vehicle safety over the entire lifetime, the share of vehicle defects among the causes of road crashes is now limited to just a few percent[12]. However, this also means that avoidable crashes caused by vehicle defects are still taking place. The Safe System approach requires acting on all these fronts, recognising that the parts of the entire system – including users, vehicles, infrastructure and emergency response – work together as an entity[13].

Figure 1: Road fatalities in the EU (2001-2022 and the EU 2030 target)



Air pollutant emissions from road transport have been decreasing ever since the introduction of the first Euro emission standard over 30 years ago. Although subsequent emission standards gradually reduced the limits and extended the scope of air pollutants measured, real-life emissions were significantly above the type-approval limits until recently (i.e. when RDE limits were introduced)[14]. Recent remote sensing

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9 In this document we use the term 'road crash' and not 'road accident'. The word *accident* implies that a car crash happened through the fault of nobody. On the other hand, the word *crash* indicates that someone caused the car wreck to happen, or that someone is at fault. The reality is that it is very rare for a car crash to be just an accident, while many studies point out the fact that most causes of the accidents are attributable to human error.
10 COM(2020) 789 final, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0331. 1.87% based on CE Delft et al. (2020), Handbook on the external costs of transport – Version 2019 – 1.1, Publications Office, https://data.europa.eu/doi/10.2832/51388
11 https://transport.ec.europa.eu/news-events/news/road-safety-eu-fatalities-below-pre-pandemic-levels-progress-remains-too-slow-2023-02-21_en
12 See Section 2.1.1.
13 European Commission (2020), Directorate-General for Mobility and Transport, Next steps towards 'Vision Zero' – EU road safety policy framework 2021-2030, Publications Office, 2020, https://data.europa.eu/doi/10.2832/391271
14 Real-driving emission (RDE) limits were introduced following the "diesel-gate" scandal: https://single-market-economy.ec.europa.eu/sectors/automotive-industry/environmental-protection/emissions-automotive-sector_en

campaigns indicate that even some of the newest vehicles exceed legal emission limits[15]. According to the European Environment Agency (EEA), despite some improvement, air pollution remains the largest environmental health risk in Europe. Exposure to fine particulate matter (PM) and nitrogen dioxide (NO_2) levels caused just under 300,000 premature deaths in 2020. Road transport is the principal source of nitrogen oxides, responsible for 35.5% of emissions in 2022, and accounts for a significant share of PM emissions (8.1% of the $PM_{2.5}$ and 9.5% of the PM_{10} emissions)[16]. In 2022, the Commission proposed[17] to revise the Ambient Air Quality Directives[18] which aims to put the EU on a path to achieve zero pollution for air at the latest by 2050 and sets interim 2030 ambient air quality standards aligned more closely with the updated air quality guidelines issued by the World Health Organization (WHO)[19] for key air pollutants, requiring enhanced measures to reduce emissions at source.

For *noise emissions*, EEA indicates that road transport plays the most significant role[20], with 70% of the EU population living in urban areas and 25% of the population living outside urban areas being exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dB(A) during daytime[21,22]. While a large part of this can be attributed to the volume of traffic and a few other factors, noise emission levels of individual vehicles play a key role, too. The permissible sound level of various road vehicles is regulated by UNECE and EU type-approval legislation[23]. However, here again, regulatory limits are not necessarily respected in real life[24].

Legal context

To address the safety- and nuisance-related defects of vehicles, roadworthiness testing has been in place in Europe for decades and subject to gradual harmonisation in the Union, with the first set of common rules adopted in 1976[25] and last revised in 2014 as part of the RWP. Consecutive revisions gradually extended the scope of vehicles to be tested, as well as the scope of harmonised rules, including requirements on roadside inspections and vehicle registration documents to improve enforcement. They further specified and updated the required test methods, procedures and related documents to reflect technological progress[26].

Today, the **PTI Directive** requires that Member States carry out periodic technical inspections (PTI) on most of the vehicles registered in their territory. This covers cars (M1), vans (N1), lorries (N2-N3), buses (M2-M3), as well as heavy trailers (O3-O4) and high-speed tractors (T with design speed over 40 km/h). It also covers heavy motorcycles, including tricycles and quadricycles (L3e, L4e, L5e and L7e), equipped with a combustion engine above 125 cm^3, with certain possibilities for exemptions. The Directive sets out

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[15] https://cares-project.eu/cares-open-letters/
[16] National air pollutant emissions data viewer 2005-2022 | European Environment Agency's home page, EEA (2024), Air Pollution in Europe; 2024 reporting status, https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2024
[17] COM/2022/542 final
[18] Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air; Directive 2008/50/EC on ambient air quality and cleaner air for Europe.
[19] WHO (2021) WHO Global Air Quality Guidelines.
[20] https://www.eea.europa.eu/en/topics/in-depth/noise
[21] During night-time, 49% of the EU population living in urban areas and 17% of the population living outside urban areas are exposed to road traffic noise with an equivalent sound pressure level exceeding 50 dB(A).
[22] Noise — European Environment Agency (europa.eu)
[23] https://environment.ec.europa.eu/topics/noise/noise-pollution-main-sources_en
[24] The UK and France have experimented with roadside trials to monitor excessive vehicle noise: Décret n° 2022-1; https://www.gov.uk/government/publications/roadside-vehicle-noise-measurement-study-enforcement-and-technology
[25] Council Directive 77/143/EEC of 29 December 1976 on the approximation of the laws of the Member States relating to roadworthiness tests for motor vehicles and their trailers, *OJ L 47, 18.2.1977, p. 47–51*
[26] The evolution of the PTI legislation is illustrated in Annex 6.

the minimum content[27] and frequency of testing for each vehicle category, except for motorcycles, where Member States have a larger room for manoeuvre. Any deficiency found on a vehicle must be categorised as minor, major or dangerous, with the latter two leading to the suspension of the vehicle's authorisation to be used in road traffic. The Directive also sets out minimum requirements as regards the independence of testing centres and training of inspectors, testing equipment, and the content of the roadworthiness (PTI) certificate. The validity of that certificate, as well as any other proof of test, must be recognised by Member States for the purposes of free circulation and re-registration of a vehicle already registered in another Member State.

The **RSI Directive** complements the PTI Directive by requiring Member States to carry out roadside inspections (RSI) on heavy commercial vehicles, i.e., buses, lorries, and their trailers (above 3.5t), with a target of 5% of the fleet each year. Those inspections must include an initial roadside inspection and, if deemed necessary by the inspector, a more detailed technical roadside inspection. The scope of those detailed inspections are the items tested at PTI and it may also include the inspection of cargo securing. When a major or dangerous deficiency is found during a RSI, the Member State where the inspection took place must notify the Member State of registration, in order to enforce the repair of the vehicle that has been suspended from traffic.

Vehicle registration itself is a national competence. The **VRD Directive** specifies that Member States must issue registration certificates for vehicles that are subject to registration under their national legislation. It requires that those certificates be issued in either paper or smart card format. The certificates must contain a minimum set of mandatory data elements, may contain certain optional data elements, and must be recognised among Member States for the purpose of re-registration. The Directive requires certain vehicle data to be registered electronically, including the suspension from traffic following a failed PTI, and the cancellation of registration where a vehicle has been treated as an end-of-life vehicle in accordance with Directive 2000/53/EC[28].

The most recent act adopted by the Commission in the area of roadworthiness testing is a recommendation on particle number (PN) measurement at the periodic technical inspection of diesel vehicles[29]. Although non-binding, the recommendation aims at harmonising the methods of such measurements and the corresponding pass/fail limit instead of the introduction of various methods at national and regional level. Similar Commission recommendations on the assessment of defects during roadworthiness testing have served as basis for the minimum requirements concerning the contents and recommended methods of testing under the current PTI Directive[30].

Political context

Although the PTI and RSI Directives were marginally amended through delegated acts[31], to align them with updated vehicle categories in type-approval legislation[32] and introduce the testing of eCall[33] at PTI, the main rules remained the same since 2014. Due to rapid technological progress, some of these rules are however

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[27] (0) Identification of the vehicle; (1) Braking equipment; (2) Steering; (3) Visibility; (4) Lighting equipment and parts of the electrical system; (5) Axles, wheels, tyres, suspension; (6) Chassis and chassis attachments; (7) Other equipment; (8) Nuisance; (9) Supplementary tests for passenger-carrying vehicles of categories M2 and M3.
[28] https://eur-lex.europa.eu/eli/dir/2000/53/oj
[29] https://eur-lex.europa.eu/eli/reco/2023/688/oj
[30] https://eur-lex.europa.eu/eli/reco/2010/378/oj
[31] https://eur-lex.europa.eu/eli/dir_del/2021/1717/oj and https://eur-lex.europa.eu/eli/dir_del/2021/1716/oj
[32] Regulation (EU) No 168/2013; Regulation (EU) No 167/2013; Regulation (EU) No 2018/858
[33] https://eur-lex.europa.eu/eli/reg/2015/758/oj

already outdated. For this reason, the Sustainable and Smart Mobility Strategy[34] called for adjustments to the roadworthiness legislative framework to ensure lifetime compliance of vehicles with emission and safety standards, thereby contributing to the EU Road Safety policy framework 2021 - 2030[35] and supporting the European Green Deal's objectives.

Roadworthiness inspections of vehicles are fundamental to road safety and to ensure the environmental performance of vehicles during their lifetime. As a result of stricter safety and emission legislation, vehicles in the EU have become technically ever more complex. To keep pace with this trend, certain adaptations to how vehicles are inspected are necessary. In addition, enhanced and more effective EU-wide exchange of roadworthiness-relevant vehicle data would help better enforcement of the rules, improving the functioning of the internal market and protecting citizens from fraudulent malpractices, such as odometer tampering[36].

During the last five years, the European Parliament published a number of related reports and studies, including a resolution on the implementation of the Roadworthiness package in general[37] and on the specific issue of odometer fraud[38]. In these documents, the Parliament pointed at the insufficient decrease in road fatalities and a massive divergence between Member States, highlighting the importance of independent inspections in the wake of emission scandal, the issue of odometer tampering, especially cross-border, as well as the need for further harmonisation of test methods and updates required by the introduction of advanced driver assistance systems and automated driving features. The Parliament called on the Commission to consider tightening the test regime by introducing the obligation of additional checks after reaching a specified mileage for cars used as a taxi or ambulance and for vans, ending the exemption of motorcycles from PTI and introducing mandatory testing of powered two- and three-wheelers with an engine below 125 cm^3 and light trailers. In the resolution on the specific issue of odometer fraud, the Parliament drew the attention to the economic and legal significance of odometer fraud in the EU and requested the Commission to submit a proposal for a legislative framework to prevent odometer fraud.

Synergies with other EU policy instruments

Roadworthiness testing relies on the technical specifications of the vehicles that are harmonised at EU level and beyond (UNECE[39]). Vehicle registration remains a national competence, although it relies on the Certificate of Conformity also defined in type-approval legislation[40]. The most recent and relevant safety- and emissions-related type-approval regulations are the **General Safety Regulation** (GSR)[41] and the **Euro**

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[34] COM(2020) 789 final
[35] http://eur-lex.europa.eu/resource.html?uri=cellar%3A0e8b694e-59b5-11e8-ab41-01aa75ed71a1.0003.02/DOC_2&format=PDF
[36] An odometer is an instrument measuring the distance travelled by a vehicle. Odometer fraud or tampering is the disconnection, resetting or alteration of a vehicle's odometer with the intention to change the number of kilometres indicated. Both digital and analogue odometers can be tampered with and changed. Many newer vehicles have digital control units or computers that may allow for the odometer to be replaced or re-programmed using fraudulent software.
[37] European Parliament resolution of 27 April 2021 on the implementation report on the road safety aspects of the Roadworthiness Package (2019/2205(INI)), https://www.europarl.europa.eu/doceo/document/TA-9-2021-0122_EN.pdf and https://www.europarl.europa.eu/RegData/etudes/STUD/2020/654175/EPRS_STU(2020)654175_EN.pdf
[38] European Parliament resolution of 31 May 2018 with recommendations to the Commission on odometer manipulation in motor vehicles: revision of the EU legal framework: https://www.europarl.europa.eu/doceo/document/TA-8-2018-0235_EN.html, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf and https://www.europarl.europa.eu/RegData/etudes/STUD/2017/602012/IPOL_STU(2017)602012_EN.pdf
[39] World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe
[40] https://eur-lex.europa.eu/eli/reg/2018/858/oj
[41] https://eur-lex.europa.eu/eli/reg/2019/2144/oj

7 Regulation (EU) 2024/1257[42]. The GSR requires that, from July 2022, new types of motor vehicles are equipped with advanced driver assistant systems aimed at reducing the number of fatalities and serious injuries; these will also be used in automated vehicles. At the time of preparing this impact assessment, it was expected that the co-legislators would adopt the **Euro 7 standards** replacing existing emission rules for cars and vans (Euro 6) and lorries and buses (Euro VI), thus ensuring that new vehicles are cleaner in real driving conditions and that they remain clean for longer than required by the existing (durability) rules. However, the actual gains in emissions reduction are likely to be significantly reduced due to the final text adopted by Council and by the European Parliament. In line with the Council position, the new rules keep the Euro 6 standard for cars and vans as regards exhaust emissions[43,44]. This means that the expected baseline emission reductions will not materialise, thus increasing the potential impact of roadworthiness testing in general, and this initiative in particular.

The focus of the RWP is different from the market surveillance legislation mentioned above. Whereas market surveillance provisions aim to ensure that vehicles continue to meet their type-approval requirements when placed on the market and for a limited period thereafter, and so are effectively focusing on the responsibilities of the manufacturer, the RWP focuses on ensuring that minimum standards are maintained by owners throughout the lifetime of the vehicle. Also, while market surveillance requires testing a limited number of vehicles per model, PTI applies to almost all registered vehicles. Thus, the RWP complements the market surveillance legislation in ensuring road safety and the environmental performance of vehicles during their lifetime. Applying the best available test methods will also help Member States reach the stricter air quality standards (limit values for the protection of human health) set by the revised **Ambient Air Quality Directive**[45], notably as regards fine particulate matter and nitrogen oxides.

The Commission is also currently working on an initiative on fair and non-discriminatory **access to in-vehicle data**[46], which is crucial for technical inspection centres to be able to carry out their daily tasks. That initiative will include provisions on access to functions and resources, essential for the provision of data-dependent services in the automotive sector. It will standardise the relevant datasets and ensure effective non-discriminatory and secure access for aftermarket and mobility services. A range of automotive service providers, including vehicle repair and inspection companies and authorities have called for an ambitious Commission proposal, to ensure a level-playing field and unhindered access to the relevant in-vehicle data[47]. The revision of the PTI Directive could complement the access to in-vehicle data proposal, through specific provisions facilitating access to the data necessary for technical inspections. More details on synergies with other EU policy instruments are provided in Annex 16.

Evaluation of the Roadworthiness Package

The Commission conducted an evaluation of the RWP 'back-to-back' with this impact assessment. The evaluation concluded that the RWP was partially successful in achieving its objectives, contributing to increased road safety, and helping reducing air pollutant emissions from road transport. Defective vehicles may still not always be detected, as some categories of vehicles are not subject to PTI or RSI in some Member States, or the frequency or scope of the testing is not adapted to their higher safety and environmental risk. The identified weaknesses in the current RWP require the Directives to be adapted, to

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[42] Regulation - 2024/1257 - EN - EUR-Lex
[43] https://www.consilium.europa.eu/en/press/press-releases/2023/09/25/euro-7-council-adopts-position-on-emissions-from-cars-vans-buses-and-trucks/
[44] https://eur-lex.europa.eu/eli/reg/2024/1257/oj
[45] Directive (EU) 2024/2881 of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe (recast)
[46] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13180-Access-to-vehicle-data-functions-and-resources_en
[47] See e.g. open letter from CITA: https://citainsp.org/wp-content/uploads/2023/03/L2023-006-Data-Act.pdf

address not only current needs but also future challenges. The links between the main conclusions of the ex-post evaluation and the impact assessment are summarised in Annex 11. The evaluation of the RWP is annexed to this impact assessment report (Annex 17).

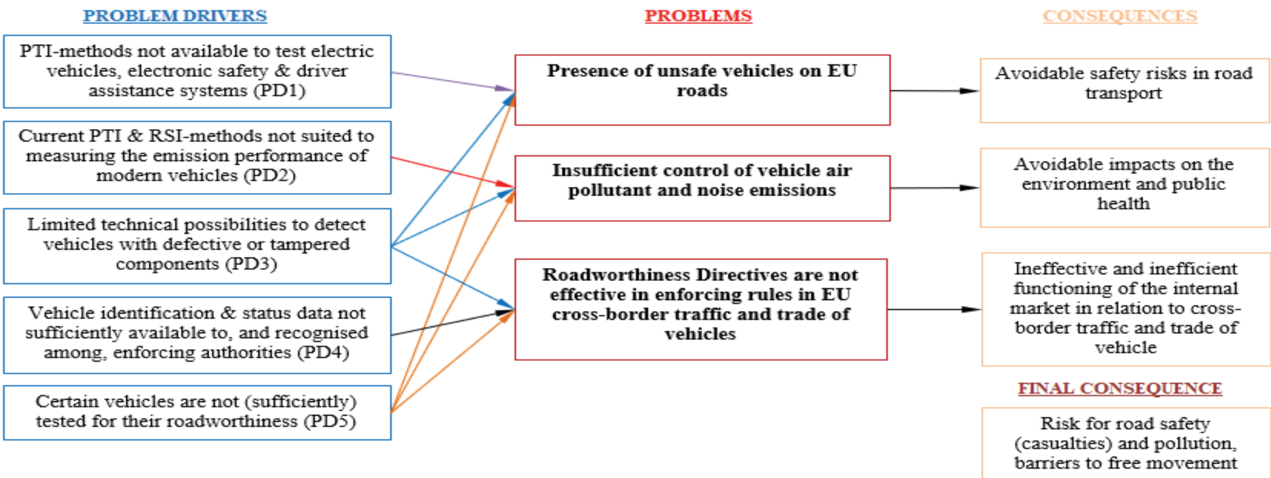
Sustainable Development Goals

The initiative contributes to Sustainable Development Goal (SDG) 3 (Ensure healthy lives and promote well-being for all at all ages), including targets 3.6 (halving the number of deaths and injuries from road traffic accidents) and 3.9 (substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination).

2. PROBLEM DEFINITION

The problems, underlying problem drivers and consequences that are relevant for the revision of the Roadworthiness Package are presented in Figure 2. The evidence underlying the problems and their drivers is based on the best available evidence, including multiple studies involving scientific research, as well as thorough consultation with experts.

Figure *2: Problem tree*



2.1. What is/are the problems?

2.1.1. Presence of unsafe vehicles on EU roads

Although EU roads are the safest in the world and road safety has improved significantly over the last decades, casualties of road crashes continue to represent high costs to society. Despite the improvement in vehicle technology, including active safety and intelligent driver assistance systems in new vehicles, unsafe vehicles still contribute to crashes, either as the main cause or as a contributing factor. A part of unsafe vehicles is identified at PTI or RSI (i.e., vehicles with major or dangerous deficiencies). Others may not be detected either because PTI cannot detect them or because they are not subject to testing. These include vehicles with safety-related tampering and vehicles with incorrectly secured cargo.

Comparable PTI data on vehicles with major and dangerous deficiencies are only available for ten Member States.

Table *1* shows the share of those vehicles by vehicle type and Member State, as well as the median by vehicle type. There is great variability between the PTI results of Member States for each vehicle type, which points to the need to interpret these data with care. A high share of vehicles with major and dangerous defects may also reflect variation in the stringency with which testing is applied in a particular country and not necessarily that vehicles are less roadworthy in that country. What is however clear is that the share of unsafe vehicles is significant in all Member States and for all vehicle types where such data is available.

Table 1: Share of vehicles with major and dangerous defects in the vehicle fleet, by vehicle type - averages over 2018-2022

	M1 (passenger cars)	N1 (vans; <3.5 tonnes)	N2 (small lorries;3.5-12 tonnes)	N3 (large lorries ;>12 tonnes)	M2 (buses/coaches <5 tonnes)	M3 (buses/coaches >5 tonnes)	O1 (trailers <0.75 tonnes)	O2(trailers 0.75-3.5 tonnes)	O3 (trailers 3.5-12 tonnes)	O4 (trailers >12 tonnes)	L3-L7 (motorcycles)
AT	11%	8%	11%		11%	10%	3%	4%	8%	10%	5%
DE	21%	25%	26%	26%	16%	16%	14%	14%	14%	14%	8%
DK		19%	15%	15%	16%	16%	8%	8%	20%	20%	
ES	18%	24%	30%	30%	26%	26%	26%	26%	26%	26%	18%
FR	20%	24%	15%	15%	14%	15%			16%	13%	
HR	22%	28%	33%	22%	35%	25%	14%	11%	13%	16%	10%
LT	48%	50%	52%	43%	55%	48%	24%	24%	34%	34%	35%
LV	38%	44%	55%	44%	29%	22%	12%	22%	44%	42%	17%
SE	25%										
SK	12%	17%	23%	18%	22%	23%	4.70%		31%	21%	8%
Median	**20.7%**	**24.3%**	**25.5%**	**23.6%**	**22.0%**	**22.0%**	**12.9%**	**13.7%**	**20.0%**	**20.0%**	**10.0%**

Source: Ricardo et al. (2023), Impact assessment support study

While not even a well-developed roadworthiness testing system can detect every defective vehicle through PTI or RSI, not all defective vehicles will cause a crash either. Various studies[48] indicate that their share as a contributing factor of the cause of crashes is between 3 and 19%, depending on the scope and methodology of the study; for motorcycles, it is 5% to 12% of crashes[49]. Since PTI has been in place in Europe for a long time, there are very few recent studies covering EU Member States[50]. There are similar studies from other parts of the world[51], the most relevant of them being a recent US study[52] that looked at the difference in crash rates between states with and without PTI. It shows that states with a safety inspection, even if only a very simple one for light vehicles, have 5.5% fewer fatalities on average.

Naturally, older vehicles are prone to more frequent breakdowns, and studies have shown that older vehicles with defects contribute more to the causes of crashes[53]. The situation is not expected to improve by itself as the contribution of older vehicles is becoming an increasing concern with the gradual ageing of the vehicle fleet[54]. Since cars are responsible for by far the largest share of fatalities (see collision matrix[55] in **Figure 3** below), and even if technical defects only represent a relatively small share among the causes of accidents, early detection of those defects can make a significant difference, especially in terms of road safety.

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[48] Martín-delosReyes L.M. et al. (2021), Effect of Periodic Vehicle Inspection on Road Crashes and Injuries: A Systematic Review, https://doi.org/10.3390/ijerph18126476

[49] Ricardo et al. (2023), Impact assessment support study on the directives of the roadworthiness package, Contract no. MOVE/C2/SER/2022-583/SI2.895928, under FWC no. MOVE/2022/OP/0001

[50] Hudec J. and Šarkan B. (2022), Effect of periodic technical inspections of vehicles on traffic accidents in the Slovak Republic.

[51] Schulz W.H. and Scheler S. (2019), Reducing the Death Toll of Road Accidents in Costa Rica through the Introduction of Roadworthiness Inspections by the Government, available at SSRN: https://ssrn.com/abstract=3420341; Schulz W.H. and Scheler S. (2020), Getting Ready for Europe: An Empirical Assessment for the Introduction of Periodical Technical Inspections of Road Vehicles in Turkey, available at SSRN: https://ssrn.com/abstract=3523602

[52] https://ascelibrary.org/doi/10.1061/JTEPBS.TEENG-7320

[53] https://komunikacie.uniza.sk/artkey/csl-202203-0017_effect-of-periodic-technical-inspections-of-vehicles-on-traffic-accidents-in-the-slovak-republic.php

[54] For the most recent report on the vehicle fleet, see e.g.: https://www.acea.auto/publication/report-vehicles-in-use-europe-2023/

[55] https://transport.ec.europa.eu/background/road-safety-statistics-2022-more-detail_en

Figure 3: Road traffic fatalities in the EU by road user and (other) 'main vehicle' involved in the crash

ROAD TRAFFIC FATALITIES IN THE EU IN 2021
by road user and (other) 'main vehicle' involved in the crash

FATALITIES — IN A COLLISION WITH…	PEDESTRIAN	BICYCLE	MOPED	MOTORBIKE	CAR	LORRY (<3.5T)	HEAVY GOODS VEHICLE (>3.5T)	BUS OR COACH	OTHER VEHICLE/ UNKNOWN	NO OTHER VEHICLE INVOLVED	TOTAL
PEDESTRIANS		29	16	115	2 328	416	391	97	162		3 554
CYCLISTS	7	45	6	26	838	183	199	30	77	426	1 837
MOPED RIDERS	0	1	7	6	232	42	27	5	20	175	515
MOTORCYCLISTS	10	8	8	91	1 386	231	207	13	85	1 197	3 236
CAR OCCUPANTS	18	6	4	21	2 504	625	1 392	115	298	3 900	8 883
LORRY (<3.5T) OCCUPANTS	1	0	1	0	124	62	250	10	32	262	742
HEAVY GOODS VEHICLE (>3.5T) OCCUPANTS	1	1	0	0	40	11	192	2	13	153	413
BUS OR COACH OCCUPANTS	3	0	0	0	6	7	12	4	14	74	120
OTHER/UNKNOWN	2	3	2	4	169	34	52	4	27	300	597
TOTAL	42	93	44	263	7 627	1 611	2 722	280	728	6 487	19 897

Source: CARE database

Since there is an element of uncertainty in the actual contribution of vehicle defects to road crashes, a sensitivity analysis was justified.[56] The shares used in this impact assessment (4% for cars, vans, HDVs and 6% for motorcycles) are relatively conservative, e.g., compared to the range based on the literature review presented above. This approach was used to avoid overestimating the benefits.

Secondly, there is an issue related to *safety-related tampering*, which includes the manipulation of engine performance, torque, maximum speed and improved acceleration, representing an obvious safety risk. According to experts, the chip-tuning of electric vehicles is as easy as in the case of those equipped with internal combustion engines, with the added risk of an overheated battery, which can cause fire e.g., in the case of faster charging or faster discharging (higher performance). According to others, while the share of tampered cars in the entire fleet remains relatively low, their share is higher among those involved in crashes. Due to the nature of the problem, available data on it is rather limited. The European Transport Safety Council, among other stakeholders, has highlighted the issue of safety-related tampering, notably in the case of powered two- and three-wheelers[57]. A survey carried out for the Austrian Ministry of Climate Protection, based on police inspections, found that roughly every second moped was manipulated (tuned) in Austria[58].

In addition, *incorrectly stowed or secured cargo* can slide, roll, tip over and fall off a vehicle, potentially causing it to overturn and lead to crashes with other vehicles[59]. To address this problem, the 2014 revision of the RSI Directive introduced detailed provisions on the inspection of cargo securing, including its principles, applicable standards, and the assessment of specific deficiencies (as an optional measure). This was complemented by best practice guidelines[60] prepared by a Commission expert group to provide practical advice to anyone involved in loading/unloading and securing cargo, as well as to enforcers. The guidelines and the corresponding provision of the Directive are non-binding, however. In spite of existing

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[56] Cf. section 6.2.1 and further details in section 6 of Annex 4.
[57] https://etsc.eu/wp-content/uploads/2020-09-ETSC-Briefing-on-Roadworthiness-Package-Implementation-Reports_update16Oct.pdf
[58] https://www.bmk.gv.at/themen/verkehr/strasse/verkehrssicherheit/vsf/forschungsarbeiten/82_tune-it.html
[59] See e.g., Königsberger Ladungssicherungskreis: https://www.klsk.de/en/
[60] https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/safe-vehicles/cargo-securing-and-abnormal-loads_en

rules, according to a major operation of Roadpol in Italy in 2019, 22% of the 40,500 inspected heavy goods vehicles (HGVs) did not comply with cargo securing requirements[61].

The problem of unsafe vehicles affects not only the owners/users of the defective or tampered vehicles, but also other road users, especially vulnerable ones. Such example of vulnerable road users are motorcyclists and while several factors play a role in motorcycle crashes, such as motorcycles' and other vehicles' design (motorcyclists are often overlooked in traffic) and road environment shortcomings (poor road surfaces, poor road alignment, obstacles, limited line of sight), motorcycle design elements such as tyres, brakes, frame, suspensions are nonetheless very relevant for the safety of motorcyclists, and regular control of their technical condition is considered important for their road safety[62].

Society as a whole is affected by the external cost of crashes through human and medical costs, production losses, the cost of police, emergency services, congestion, etc.[63]

More systematic and targeted testing of vehicles, using improved and updated test methods, could reduce the number of such avoidable crashes. 54 out of the 65 stakeholders who replied to the targeted survey agreed with the problem identified, while only 6 disagreed and 5 were neutral. In the OPC, 78% of respondents (123 out of 158) agreed that the issue of vehicles circulating on the roads with defects or tampered components needs to be addressed.

2.1.2. Insufficient control of vehicle air pollutant and noise emissions[64]

Air pollution remains an important cause of poor health in Europe and contributes in particular to respiratory and cardiovascular diseases.[65]

Road transport has significantly reduced its pollutant emissions since 1990, with the exception of compounds NH_3 and N_2O. Their recent increase is mainly due to new catalytic systems for the reduction of NO_x in diesel engines and the use of enriched fuel mixtures to control NO_x at high load in petrol engines. While a significant reduction can be seen for both PM_{10} and $PM_{2.5}$, the non-exhaust fraction of these emissions (i.e. from brake and tyre wear or road abrasion) is increasing[66].

The development of sophisticated emission control technologies has allowed to gradually reduce air pollutant emissions from road vehicles well (orders of magnitude) below pre-Euro standard levels. However, overall emissions from road transport are still too high – they alone are responsible for

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[61] https://etsc.eu/wp-content/uploads/PIN-FLASH39_FINAL.pdf

[62] ERSO Road Safety Thematic Report – Motorcycles, 2023, https://road-safety.transport.ec.europa.eu/european-road-safety-observatory

[63] CE Delft et al. (2020), Handbook on the external costs of transport – Version 2019 – 1.1, Publications Office, https://data.europa.eu/doi/10.2832/51388

[64] The problem analysis focuses on NOx and PM as the main air pollutants from road transport with the highest impact on environment and health. Other pollutants have not been considered although it is plausible that targeting these two pollutants will also affect other air pollutants (e.g. CO, HC, SO2).

[65] In 2021 in the EU-27, 253,000 deaths were attributable to exposure to $PM_{2.5}$ concentrations above WHO's guideline level of 5 µg/m³ (micrograms per cubic metre of air), 52,000 deaths were attributable to exposure to NO_2 concentrations above WHO's guideline level of 10 µg/m³ and 22,000 deaths were attributable to short-term exposure to O_3 concentrations above 70 µg/m³, EEA, Europe's Air Quality Status, 2023, Europe's air quality status 2023 — European Environment Agency.

[66] EEA, Emissions of air pollutants from transport, October 2024 Emissions of air pollutants from transport in Europe | European Environment Agency's home page

approximately 40.6% of the total NO_x and 10.5% of $PM_{2.5}$ emitted in Europe[67], and this has serious implications on human health, the natural environment, and affects the lives of millions, especially in urban areas. Various studies have shown that real-world NOx emissions of modern vehicles were above type-approval limits[68]. Such exceedances can in some instances (due to tampering, for example) be as high as older Euro Standards or even pre-Euro NOx emission levels[69]. Other studies have shown that in the absence of the appropriate emission reducing technology (selective catalytic reduction (SCR) and diesel particulate filter (DPF)) on Euro VI HDVs, vehicles can emit up to a factor of 100 more NOx, CO, and PM than the legal requirements[70].

The findings of the RWP evaluation show that some of the tests used in PTI are no longer sufficiently sensitive to detect emission failures and the current testing procedures are not fit to meet the EU policy goals as regards air pollution. Modern vehicle engines and exhaust gas systems have critical detection criteria that are not covered by the currently prescribed test methods, and current PTI tools are not able to measure PN and NOx. Considering these shortcomings, the current RWP's contribution to reducing the number of vehicles in circulation with high emissions has become less relevant. The measurement of nitrogen oxide emissions or PM/PN values for new cars are still not covered by the current RWP and there are currently no EU provisions for testing vehicles for NOx manipulation/defect or manipulation/defect of diesel particulate filters. The share of vehicles found with defective emission control equipment or exhaust emissions above the limits specified in the PTI and RSI Directives ranges from around 1-3% to up to 45% depending on the Member State and the way checks are conducted. Targeted inspections identify higher shares of over-emitting vehicles. Periodic testing has demonstrated that older vehicles can be much more polluting than newer ones, as the effectiveness of emissions reduction systems declines with age. Since some of the defective vehicles emit multiple times over the regulatory limit, even a relatively limited share of such vehicles can be responsible for a large part of overall road transport emissions. This has been demonstrated by various studies[71].

In addition, there is evidence[72] that the emission control equipment of a non-negligible number of modern vehicles are tampered with, either to avoid immediate replacement of filters or the cost of consumables, such as diesel exhaust fluid (DEF)[73] required for the proper functioning of SCR[74]. Various tampering techniques have been developed to alter on-board diagnostic information and to avoid that the vehicle automatically switches to low-power (or limp) mode, e.g., after it has run out of DEF for a long time. This is consistent with the observation that a small number of "high emitters" are generally responsible for a disproportionate fraction of the overall emissions (e.g., a TNO study[75] indicates that 6% of vehicles

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[67] EEA (2023), Air Pollution in Europe; 2023 reporting status, https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2023

[68] see e.g., TNO report on NOx emissions of eighteen diesel light commercial vehicles: http://resolver.tudelft.nl/uuid:21191e19-2dc7-4468-8559-1075ed6279f7

[69] Giechaskiel, F. et al. (2022), Effect of tampering on on-road and off-road diesel vehicle emissions.

[70] Ricardo et al. (2023), Impact assessment support study on the directives of the roadworthiness package, Contract no. MOVE/C2/SER/2022-583/SI2.895928, under FWC no. MOVE/2022/OP/0001Ricardo et al. (2023), Impact assessment support study

[71] Such as TNO (2022), http://resolver.tudelft.nl/uuid:b5d127c3-303c-4013-b1ac-c9ac01f66e2d and CARES (2023), https://cares-project.eu/emission-factors-lez-impact/

[72] Notably from roadside checks reported by inspectors of national authorities, including with the use of plume chasing technology: https://citainsp.org/wp-content/uploads/2021/11/5-CITA-17-11-2021-for-upload.pdf

[73] Diesel exhaust fluid (DEF), also known as AUS 32 (aqueous urea solution 32%) and marketed as AdBlue.

[74] A basic illustration of the main components of an exhaust aftertreatment system is available at: https://www.autoserviceworld.com/understanding-diesel-exhaust-aftertreatment-systems/

[75] TNO report on NOx emissions of eighteen diesel light commercial vehicles: http://resolver.tudelft.nl/uuid:21191e19-2dc7-4468-8559-1075ed6279f7

defective emission control systems caused 36% of road transport NOx emissions). A recent study involving remote sensing technology screening a large number of vehicles in Flanders, Belgium showed similar results for particle emissions due to DPF failures[76].

As regards the impacts of the problems on pollutant emissions, the links between cause and effect are more straightforward than in the case of road safety. Even though in the absence of accurate emission testing available on a wide scale, the share of high-emitting vehicles and their contribution to total emissions can only be estimated, the available studies applying portable emission measurement systems (PEMS), recent remote sensing campaigns and the first results of newly introduced particle number (PN) testing in three Member States provide a high level of confidence as regards the scale of the problem, and the calculations of the impacts.[77]

As outlined in section 1, road transport is by far the largest source of noise pollution in Europe and is the second most harmful environmental stressor after air pollution[78]. Modified or defective exhaust systems can also contribute to noise pollution. The threshold of noise above which it is considered a nuisance can vary. In the OPC, 91 out of 149 respondents expressed the view that it is very important to address the problem of noise-related tampering/non-compliance in vehicles and 13 had no opinion. Most respondents to the survey and interviews conducted as part of the evaluation believed that technological and market developments had had a low impact on reducing the number of vehicles with tampered or defective noise control systems (46 of 75 respondents; 15 did not know or did not respond). Representatives of the automobile as well as motorcycle manufacturers (ACEA and ACEM) agree that illegal modifications leading to single-event noise peaks need to be addressed through consistent control[79].

While these vehicles are supposed to be repaired or taken out of circulation, there are still many vehicles with defective or tampered emission control systems that go undetected and continue to cause avoidable damage. Noise tampering mainly affects powered two-wheelers, which are not subject to roadworthiness testing in every Member State. The problem of air pollution and noise generated by vehicles mainly affects people living in the vicinity of major roads, in particular in urban areas, and especially the most vulnerable. Lower income groups tend to be exposed to higher levels of air pollution, while older people, children, adolescents, and those with pre-existing health conditions are more susceptible to negative effects of air pollution[80]. 56 out of the 67 stakeholders who replied to the targeted survey agreed with the problem identified, while only 4 disagreed and 7 were neutral.

2.1.3. Roadworthiness Directives are not effective in enforcing rules in EU cross-border traffic and trade of vehicles

One of the objectives of the RWP was to facilitate free movement for EU citizens and ensure the smooth functioning of the internal market[81]. This is reflected in different elements of the RWP, including the mutual recognition of roadworthiness certificates among EU Member States (as part of the PTI Directive), in combination with the provisions of the VRD Directive aiming to ensure the authenticity, accuracy, and mutual recognition of vehicle registration documents across EU Member States. Brought together, these

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[76] Hooftman N., Ligterink N., Bhoraskar A., (2020), Analysis of the 2019 Flemish remote sensing campaign. Commissioned by the Flemish Government - Flanders Environment Agency - Team Air quality policy.
[77] see e.g. DIAS (2022), D6.5 Impact assessment and guidelines for future anti-tampering regulations, or TNO (2022), Approaches for detecting high NOx emissions of aged petrol cars during the periodic technical inspection. R10659v2
[78] https://www.eea.europa.eu/publications/managing-exposure-to-noise-in-europe/noise-in-europe-updated-population-exposure
[79] https://www.acea.auto/files/ACEA-position-paper-Vehicle-noise-setting-appropriate-limits.pdf and https://acem.eu/images/publiq/2021/ACEM_Position_Paper_Sound_Emissions_2021.pdf
[80] https://www.eea.europa.eu/en/topics/in-depth/air-pollution
[81] Cf. recitals 1 and 3 of the Directive 1999/37/EC (VRD) and recital 24 of Directive 2014/45/EU (PTI)

should facilitate the enforcement of the rules, efficient cross-border transport, and prevention of fraudulent practices, eventually contributing to better road safety and less polluting vehicles on the roads.

According to the findings of the evaluation, communication between authorities across national borders improved following the adoption of the RWP. The PTI and RSI Directives established contact points through which information can be more swiftly exchanged between Member States. However, the evaluation also highlighted that Member States still report difficulties in effectively enforcing road safety measures in EU cross-border traffic and vehicle trade. These have their origin in: (a) Member States registering different sets of vehicle data, and (b) difficulties for competent authorities in accessing vehicle register data and other safety-relevant information of vehicles, notably when these are registered in another Member State. These difficulties make the re-registration of vehicles less efficient and more cumbersome for citizens[82]. Related to cross-border trade of vehicles, the evaluation of the RWP found some incoherencies between the VRD Directive and Regulation (EU) 2018/858 on type-approval requirements[83]: in some cases, in the VRD Directive, definitions of the vehicle registration data and terminology do not correspond to those in the type-approval legislation. This leads to confusion and potential errors in recording vehicle information at the time of re-registration. Furthermore, difficulties in the cross-border exchange of information between Member States' authorities can also negatively impact the fight against the widespread malpractice of odometer tampering which, by itself, can negatively affect road safety and the environment (due to poorer maintenance). It is also directly affecting consumers given that mileage is an important determinant of used vehicles' market value.

Odometer tampering rates were estimated at 20 to 40% for cars imported in EU15 countries and 30 to 80% in EU12, according to a study commissioned by the European Parliament[84], while other studies indicate the share of tampered vehicles to be between 5 and 12% of used cars in national sales and much more, between 30 and 50%, of cross-border sales[85]. According to the support study of the European Parliament's 2018 resolution on odometer manipulation in motor vehicles in the EU, the total economic costs of odometer fraud in second-hand cars traded cross-border in the EU could be estimated at around EUR 8.77 billion per year[86]. This was found mainly due to the lack of effective cooperation between Member States' authorities and an insufficient exchange of information on mileage readings of odometers in vehicles traded across the Member States' borders. More recent estimates provided by CarVertical[87], based on analysis of vehicle history reports, suggest overall lower odometer fraud rates for most of the countries reported that those in the European Parliament study. Drawing on CarVertical and other assumptions, the impact assessment support study[88] shows however that fraud rates are still estimated to be significant (i.e., 2.2 to 10% of used cars in national sales and 4.4 to 25.7% of cross-border sales)[89].

Even though odometer manipulation is a punishable offence under the PTI Directive, the fact that odometer readings are recorded only at PTI does not prevent fraud since most cars and vans are not tested before they are four years old and, in most Member States, only every two years thereafter. Furthermore, the evaluation

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[82] As illustrated by various complaints and SOLVIT requests received by the Commission.
[83] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0858
[84] TRT (2017), Research for TRAN Committee (European Parliament) - Odometer tampering: measures to prevent it.
[85] https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[86] https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[87] Overall mileage fraud analysis is available at: https://www.carvertical.com/blog/research-what-countries-have-the-highest-percentage-of-cars-with-a-fake-mileage, and in the CarVertical Market transparency index: https://www.carvertical.com/transparency-index. Specific analysis of the share of odometer tampering for national and imported second hand vehicles is available at: https://www.carvertical.com/blog/research-local-or-imported-cars-have-more-mileage-rollbacks.
[88] Ricardo et al. (2023), Impact assessment support study on the directives of the roadworthiness package, Contract no. MOVE/C2/SER/2022-583/SI2.895928, under FWC no. MOVE/2022/OP/0001
[89] See Annex 4 (section 2) for more detailed explanations on the estimations, and an overview by Member State.

of the RWP also reported that regarding the obligation to introduce effective and dissuasive penalties when an odometer is found to have been manipulated, the national measures appear in many cases rather generic, not specifically aimed at odometer fraud. 39 out of the 60 stakeholders who replied to the targeted survey agreed with the problem identified, while only 5 disagreed and 16 were neutral.

2.2. What are the problem drivers?

2.2.1. PTI-methods not available to test electric vehicles, electronic safety & driver assistance systems (PD1)

This problem driver links to problem 1 (*Presence of unsafe vehicles on EU roads*). The existing rules on roadworthiness testing were designed more than 10 years ago, with the Commission's proposal made in 2012. At the time, the share and expected development of the electric vehicle (EV) market was significantly lower than today[90], which explains why there are no EV-specific requirements in the PTI Directive. The same applies to electronic safety and driver assistance systems.

The General Safety Regulation[91] requires that, from 6 July 2022, new vehicle types are equipped with certain advanced driver assistance systems (ADAS), including intelligent speed assistance, reversing detection with camera or sensors, attention warning in case of driver drowsiness or distraction, event data recorders, an emergency stop signal (in all road vehicles), as well as lane keeping systems and automated braking in cars and vans. These features will be mandatory on all vehicles registered from 7 July 2024 onwards. Thanks to the requirements of the GSR, new car and van models sold since July 2022 and every new vehicle sold from July 2024 will be due for PTI between 2026 and 2028. Trucks and buses featuring technologies helping to recognise blind spots, warnings to prevent collisions with pedestrians or cyclists and tyre pressure monitoring systems will have to undergo their first roadworthiness tests even earlier (usually one year after the first registration).

The RWP evaluation found that systems introduced by the revision of the GSR increases the relevance of vehicle roadworthiness testing to verifying the operation of these mandated electronic systems. These systems may malfunction, require software updates to ensure intended performance, and they could be the target of tampering. In terms of keeping up of the RWP with the technological and scientific progress, most of the stakeholders interviewed in the context of the evaluation considered that it is essential to update the directives to include the functioning of ADAS and advanced lighting, which have been fitted in cars for around a decade but are not tested by standard PTIs. Similarly, the survey respondents, especially ministries, road safety authorities and PTI bodies, considered that the current RWP directives and their objectives follow technological advancement only to a limited extent. The technology used in vehicles has surpassed what the current directives cover and new rules for inspection of new safety systems, such as ADAS, are needed. Although both EVs and ADAS bring about significant benefits by reducing emissions and improving road safety, they also come with new risks to be mitigated. In the case of EVs, including plug-in hybrids, the high voltage systems can be a source of such risks, which, if damaged, can overheat and cause fire. While a few Member States have introduced national requirements (e.g., FR, NL) in relation to the inspection of EVs, these are not generally applied in the EU. For ADAS, it is the possible malfunctioning of the systems themselves that may create safety hazards. However, none of these are currently tested during periodic technical inspections.

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[90] While there were only about 200,000 EVs, including PHEVs, in Europe in 2014 (and much fewer in 2012 when the proposal was made), in 2022, there were 7.8 million EVs on European roads, https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-light-duty-vehicles

[91] https://eur-lex.europa.eu/eli/reg/2019/2144/oj

Next to the research and development efforts needed to define the appropriate test methods, an important barrier to their application is the difficulty for inspection centres to access the necessary in-vehicle data. Although the Commission Implementing Regulation (EU) 2019/621 requires that manufacturers make certain vehicle data available to facilitate PTI tests, it does not apply to the data related to items/components that are not part of the current minimum requirements on items to be tested. According to the findings of the evaluation, there is data incoherence between the RWP and relevant type-approval legislation due to divergence of safety-relevant vehicle data. The interview respondents considered there was a common problem with the RWP regarding the limited direct access to in-vehicle data and functions for authorised inspection service providers. For example, even two models of the same manufacturer can require different file formats, which makes the use of reference data very difficult and time-consuming. 74% of the OPC responses (116 out of 156) were in favour of the need to address this problem driver; a similar percentage of support was expressed by industry representatives during the targeted survey (58 out of 76 responses).

2.2.2. *Current PTI & RSI-methods not suited to measuring the emission performance of modern vehicles (PD2)*

This problem driver affects problem 2 (*Insufficient control of vehicle air pollutant and noise emissions*). The existing Directives require exhaust gas emission testing of diesel vehicles using opacity measurement, or, in the case of Euro 5/V and Euro 6/VI vehicles, by reading the vehicle's on-board diagnostic (OBD) system. While exhaust gas opacity testing may detect a defective emission control system without a particle filter in an older vehicle (pre-Euro 5/V) and has thus been considered sufficient to test the compliance of those vehicles, multiple laboratory tests[92] have proved that it cannot detect a malfunctioning or even tampered diesel particle filter (DPF). DPFs were introduced to comply with significantly stricter limits than before Euro 5/V and the emissions without a DPF could be about an order of magnitude (or two) higher[93]. Even in a Euro 4 vehicle equipped with a defective DPF, the exhaust's opacity may be lower than the instruments' resolution. Studies have also shown that even when high smoke emissions are measured, in most cases the OBD does not indicate any failure.

Furthermore, while the newly developed method of particle number (PN) counting[94] has demonstrated high levels of particle emissions in vehicles with defective DPFs, e.g., close to 10% of Euro 5 and 6 vehicles tested in Belgium in 2022, the OBD showed malfunctioning in only 0.72% of the cases[95]. This illustrates the extent to which the current emission test requirements of the PTI and RSI Directives are obsolete and inadequate concerning modern diesel vehicles. Concerns about the ineffectiveness of smoke opacity tests were also expressed by stakeholders surveyed during the evaluation. The applicability of PN measurement has not yet been sufficiently tested for vehicles equipped with positive ignition engines, but relevant research is ongoing. To address the issue of high NOx emissions, various methods have been studied to measure them[96]. However, while NOx emission limits are set by type-approval, and RDE (Real Driving Emissions)

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[92] Such as those carried out by the Commission's Joint Research Centre: Comparisons of Laboratory and On-Road Type-Approval Cycles with Idling Emissions. Implications for Periodical Technical Inspection (PTI) Sensors, https://doi.org/10.3390/s20205790 and Evaluation of Measurement Procedures for Solid Particle Number (SPN) Measurements during the Periodic Technical Inspection (PTI) of Vehicles, https://doi.org/10.3390/ijerph19137602.

[93] See e.g., https://environnement.brussels/media/1883/download?inline

[94] Already applied by Belgium, the Netherlands, Germany as well as Switzerland, and referred to in the Commission's recommendation on particle number measurement, https://eur-lex.europa.eu/eli/reco/2023/688/oj.

[95] Figures reported by GOCA Vlaanderen for July 2022-April 2023: 12.4% of Euro 5 and 2.8% of Euro 6 vehicles failed with the current 1.000.000 1/cm^3 limit; 16.8% and 4.8%, respectively, would have failed the recommended limit of 250.000 1/cm^3.

[96] E.g., Fernández (2022), Suitability Assessment of NOx Emissions Measurements with PTI Equipment, https://doi.org/10.3390/vehicles4040050; CITA (2022), Monitoring of NOx emissions as part of the PTI – CITA International Motor Vehicle Inspection Committee (citainsp.org); Franzetti et al. (2023), Assessment of a NOx Measurement Procedure for Periodic Technical Inspection (PTI) of Light-Duty Diesel Vehicles, https://doi.org/10.3390/en16145520.

tests have significantly tightened the requirements on new vehicles, the monitoring of NOx emissions from road vehicles is currently not part of PTI.

2.2.3. *Limited technical possibilities to detect vehicles with defective or tampered components (PD3)*

This problem driver is linked to all three problems. Firstly, together with PD1 (*PTI-methods not available to test electric vehicles, electronic safety & driver assistance systems*), it is one of the reasons why there are still, and will continue to be, **unsafe vehicles on the roads**. While new vehicle technology may require new ways of testing (PD1), there are vehicles on the roads today with defects that carry a potential safety risk and that PTI cannot detect, notably due to the limited vehicle data available to testing centres (or repair shops). For example, where a windscreen of a vehicle equipped with cameras is replaced, precise calibration requires not only the manufacturer's specifications, but also the vehicle's relevant data history (which for some vehicles can provide details of the last time the vehicle underwent a recalibration). Such information is currently not available to PTI.

Similarly, unauthorised modifications to the vehicle's engine management system to increase its power may not be detected without access to the relevant in-vehicle data[97]. Such tampering is relatively easy, and devices are widely available, for internal combustion engines as well as for electric vehicles (a simple web search would deliver multiple results). The situation is similar in the case of motorcycles[98]. The ongoing electrification of powered two-wheelers, especially mopeds, has apparently led to an increase in the same kind of tampering of those vehicles, with multiple tutorials available online. Since manipulation is so easy in the case of these vehicles, it is difficult to detect it even where such vehicles are subject to periodic testing as the modifications can also be easily reversed. These vehicles represent an increased safety risk, in particular in urban areas.

Secondly, tampering with emission control systems is equally easy with various solutions offered online[99], even explaining why it is "good" for the user to disable the selective catalytic reduction (SCR) system, which requires diesel exhaust fluid (DEF, or AdBlue). While DEF is a necessary consumable for the SCR to significantly reduce the amount of NOx emissions, since running out of DEF may cause the vehicle not to start, it is a convenient (and often significantly cheaper) solution to deactivate the entire system. It can be especially viable in the case of commercial vehicles, where entire fleets may be tampered to decrease repair and maintenance costs[100]. Together with PD2 (*Current PTI & RSI-methods not suited to measuring the emission performance of modern vehicles*), this contributes to the **insufficient control of vehicle air pollutant and noise emissions**. Noise-related tampering, i.e., removing the exhaust silencer (or dB killer) of a motorcycle is similarly easy with abundant instructions available online. According to ACEM and some experts in vehicle testing, PTI is not sufficiently effective when it comes to such tampering.

Thirdly, tampering with odometers is also a lucrative business and detecting it has been a challenge across the EU, which negatively affects the effectiveness of the RWP in **enforcing rules in EU cross-border traffic and trade of vehicles**. Recording odometer readings at PTI may have somewhat improved the traceability of odometer history, or helped detect fraud (likely too late, when the vehicle is due for PTI with

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[97] Before a recent fatal crash in Budapest, the maximum power of the vehicle causing the crash was increased from 612 to 690hp without it being noticed at PTI.
[98] See e.g. https://buy-tuning-files.com/chiptuning/why-modify-your-motorcyles-rev-limiter-and-how-to-do-it/
[99] See e.g., https://117speed.co.uk/adblue-removal-everything-you-need-to-know/; https://www.canbusemulator.com/en/
[100] See e.g., a case uncovered in Spain: https://www.guardiacivil.es/es/prensa/noticias/6944.html and https://www.europol.europa.eu/media-press/newsroom/news/haulier-in-spain-caught-cheating-emission-regulations-designed-to-prevent-air-pollution

its new owner). However, with PTI being a pre-announced inspection, it is not difficult to readjust the mileage of the vehicle just before or after. Thus, in the absence of a better way to trace odometer history, mileage tampering remains largely possible in most Member States, and especially across borders[101].

2.2.4. *Vehicle identification & status data not sufficiently available to, and recognised among, enforcing authorities (PD4)*

This problem driver links to problem 3 (*Roadworthiness Directives are not effective in enforcing rules in EU cross-border traffic and trade of vehicles*). In addition to the issues mentioned under PD3, the inefficient exchange of information among Member States further contributes to limiting the effectiveness of the Directives. While most stakeholders consider that the RWP has contributed to facilitating communication among Member States, they agree that vehicle identification and status data are still not sufficiently available to enforcing authorities. As mentioned in Section 2.1.3, there are sometimes significant differences in the data elements recorded in national vehicle registers, largely due to the high number of optional data elements, including those that are not even specified in the VRD Directive. Table 2 summarises the diversity in the registration of various data elements. 224 data elements are stored by only some of the Member States (i.e., not by all, and not by any of them).

Table 2: Summary of the registration of various data elements

Number of data elements M1	Percentage of the MS that stores the item
11	11 data elements were stored by all of the MS (100%)
23	23 data elements were stored by a clear majority of the MS (80% – 99 %)
135	135 data items were stored by a substantial number of MS (30% – 79 %)
66	66 data elements were stored by a minority of the MS (1% – 29 %)
38	38 data elements were stored by none of the MS (0%)

Source: EReg/EUCARIS[102]

In addition to the regulatory framework provided by the VRD Directive, EReg, the Association of European Vehicle and Driver Registration Authorities, has worked on the voluntary harmonisation of registration procedures and data quality, including on the scope of data that should be stored in vehicle registers to facilitate cross-border trade (re-registrations) and issued various reports on the topic[103].

Although the VRD Directive requires Member States to assist one another in the implementation of the Directive, it merely allows exchange of information and only hints at the possibility that this could be done electronically. This has led to a situation where several Member States use EUCARIS[104] for the exchange of vehicle registration data, mileage data, PTI data or roadside inspection (RSI) reports. However, while many Member States use EUCARIS for various services, not all of them use it systematically for the relevant exchange of data. The lack of clear rules as regards the exchange of vehicle related information among Member States therefore further complicates smooth communication between authorities.

To implement requirements of the RSI Directive to notify the Member State of registration of any major or

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[101] While Belgium and the Netherlands have introduced dedicated systems with databases keeping much more frequent odometer readings than what PTI can offer, and thus significantly reducing odometer fraud in both countries and between them, such systems do not exist elsewhere and detecting odometer fraud, especially in imported vehicles, is less likely.

[102] https://www.ereg-association.eu/media/2742/final-report-topic-group-xxi-proposal-on-the-registration-of-vehicle-data.pdf

[103] https://www.ereg-association.eu/topic-groups/topic-group-xxi/

[104] EUCARIS (European Car and Driving Licence Information System) is a system developed by and for governmental authorities to help fighting car theft and registration fraud. It enables the sharing of vehicle and driving licence information between EU and non-EU countries: https://www.eucaris.net/

dangerous deficiencies found at RSI, since June 2020, the notifications must be sent using the RSI system[105], built on the functionalities of the European Register of Road Transport Undertakings (ERRU). ERRU and RSI messaging system, as well as several other road transport-related applications are hosted by the Commission and use a central hub (MOVEHUB) to interconnect national registers. While certain EU legislation requires the use of EUCARIS[106], and others, including the RSI Directive, refer to the MOVEHUB for data exchange, there is no legal requirement to use such systems to facilitate the re-registration of vehicles and the implementation of the PTI and VRD Directives. The inability to effectively exchange a real-time data on the vehicle (de)registration status, including the information on cases when a vehicle is temporary de-registered or its ownership has changed, contribute to the problem of a low traceability of vehicles across the EU. Such administrative and regulatory failures hinder the uncovering of illegal activities such as the illegal trade or illegal dismantling of vehicles, leading to the problem known as "missing vehicles"[107].

Certain optional data registered in one Member State are not recognised by another EU country for re-registration. The reason is that the second Member State registers a different set of data. This may concern data related to the owner, the mass, the category, or the exhaust emissions of the vehicle. Moreover, even though there is significant level of harmonisation in roadworthiness testing, there are very few cases where the Member State of registration recognises the validity of a PTI certificate issued in another Member State (one example is the Netherlands accepting PTI conducted in certain PTI centres in Spain). Such lack of recognition of registration data and PTI reports lead to inefficiencies in administrative processes and cause avoidable administrative burden for vehicle owners.

Stakeholders consulted during the evaluation emphasised in their interviews that digital data exchange and harmonisation of vehicle documents is needed for streamlining the vehicle re-registration process since standardising the content and format of vehicle files would facilitate the digital transfer of registration information between national databases and reduce the administrative burden and costs associated with the process. The interviewees stressed the need for a legal framework to support this exchange of data and digital services for efficient re-registration process. 67% of the OPC responses (100 out of 149) were in favour of the need to address this problem driver; a similar percentage of support was expressed by industry representatives during the targeted survey (47 out of 72 responses).

2.2.5. *Certain vehicles are not (sufficiently) tested for their roadworthiness (PD5)*

Problem driver 5 relates to the fact that certain vehicle categories are not covered by or not necessarily tested under the PTI/RSI Directives and, as a result, PTI/RSI is only required for such vehicles in a few Member States. Furthermore, frequency or scope of testing of certain vehicles is not adapted to the higher safety and environmental risk associated with them (very frequent use or vehicle age). This directly affects the first two problems, i.e., the presence of unsafe vehicles on EU roads and insufficient control of air pollutant and noise emissions. Indirectly, it also has an influence on the third problem, in that testing light vehicles annually from the date of their first registration (as is the case for HDVs), and at the roadside, could also increase the effectiveness of the directives, notably in preventing odometer fraud.

In 2014, the scope of the PTI Directive was extended to faster tractors (design speed >40km/h) and larger

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[105] Commission Implementing Regulation (EU) 2017/2205 on detailed rules concerning the procedures for the notification of commercial vehicles with major or dangerous deficiencies identified during a technical roadside inspection: https://eur-lex.europa.eu/eli/reg_impl/2017/2205/oj

[106] Such as https://eur-lex.europa.eu/eli/reg_impl/2021/133/oj and the Commission proposal on the revision of Directive 2015/413 on facilitating cross-border exchange of information on road-safety-related traffic offences.

[107] This problem and its drivers are discussed in the Impact Assessment Report accompanying the proposal for an ELV Regulation (SWD (2023)256 final) mentioned in section 1.

two- and three-wheel vehicles and quadricycles (equipped with internal combustion engines >125cm^3), effective from January 2022. However, the Directive allows for exempting motorcycles, tricycles and heavy quadricycles (L3e, L4e, L5e and L7e) from PTI "*where the Member State has put in place effective alternative road safety measures*" and on condition that the Commission is notified. At the end of 2023, eight Member States[108] made use of this possibility. France introduced PTI for powered two- and three-wheelers and quadricycles in April 2024. As such, the scale of the problem is expected to reduce significantly, especially thanks to the introduction of PTI in France.

Agriculture and forestry tractors may also be exempted. Since they are not covered by the PTI Directive, mopeds are only subject to periodic roadworthiness testing in some Member States (e.g., Austria, Croatia, Spain). Although not in the scope of the PTI Directive, more than half of the EU Member States (16) have provisions for mandatory PTI for light trailers (3 Member States have provided this only for the larger O2-category, i.e., with maximum mass above 750 kg and up to 3500 kg), while others exempt them under certain characteristics or conditions of operation[109].

With regards to the RSI Directive, the requirements on technical roadside inspections currently only apply to commercial vehicles of more than 3.5 tonnes, while vehicles below this weight and their trailers are exempted from inspections in most Member States.

Finally, and most importantly, only 16 Member States apply more frequent (yearly) roadworthiness tests to older cars (>10 years)[110], that is, eleven, including the Member States with the largest fleets[111], do not, which represent an increased safety and environmental risk. Since the car and van fleets of these Member States represent roughly half of the EU fleet, and the vehicles older than 10 years among them are about half of that, annual testing of vehicles older than 10 years would affect around 25% of the EU light duty vehicle fleet.[112]

2.2.6. Interlinkages between the problem drivers

Some of the problem drivers are interlinked with each other. This is the case in particular with PD3 *(Limited possibilities to detect vehicles with defective or tampered components)*, which is influencing or influenced by all the other problem drivers. EVs and ADAS represent new technologies and test methods for such systems are very recent or just being developed and are not widely used yet (PD1). The lack of legal requirement to test such systems during PTI and RSI for their potential defects may also present a safety risk. PD3 is also linked to PD2 *(Current PTI & RSI-methods not suited to measuring the emission performance of modern vehicles)* in a similar way as to PD1. Emission control systems have also evolved considerably and developing adequate test methods to verify their functioning in a PTI-environment (i.e., requiring a quick, simple, and cheap method) has taken some time, which partly explains why the current PTI and RSI emission test requirements are outdated. While for the purpose of detecting tampered vehicles, RSI has the advantage of the drivers not knowing that they would be tested, it has the limitation that it is only organised in campaigns and can therefore only screen a small subset of the vehicle fleet. PD3 is linked to PD4 *(Vehicle identification & status data not sufficiently available to, and recognised among, enforcing authorities)* in that in most Member States it is currently not possible to verify whether the odometer reading of a vehicle is correct or not. Finally, it is linked to PD5 *(Certain vehicles are not (sufficiently) tested for their roadworthiness)* since it is not possible to detect defective or tampered vehicles that are not tested.

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[108] BE (testing is only required before selling or after a crash), DK (requiring roadside checks instead), FI, FR, IE, MT, NL, PT (PTI only above 250 cm^3). FR introduced PTI for powered two- and three-wheelers and quadricycles in 2024.
[109] DK, EL, FI, FR, NL, IE, PT exempt all light trailers, while PL, SK, BE and ES exempt O1.
[110] Cf. section 2 of Annex 6.
[111] Those eleven are DE, FR, IT, CY, CZ, DK, EL, HU, LT, MT, and SK.
[112] Sections 4.1.9, 4.2.10 and 5 of Annex 4.

2.3. How likely is the problem to persist?

Problem 1 - Presence of unsafe vehicles on EU roads. While technological development is likely to further improve vehicle safety, the uptake of new technologies in the EU vehicle fleet would take some time, and some of the new features may also bring about new risks. Similarly, while tampering may be made more difficult by technical solutions, it is unlikely that it would disappear without enabling vehicle testing to detect illegal modifications, notably of the engine management software e.g., through securing better access to in-vehicle data. Thus, in the absence of EU level intervention, the problem is likely to persist. Member States may take unilateral measures (e.g., introducing PTI for specific vehicle categories, specific methods for the testing of EVs or ADAS). However, these measures cannot replace the coordinating and harmonising effect of the three Directives, with the risk of possible distortions of the internal market and only partially addressing the problem.

Problem 2 - Insufficient control of vehicle air pollutant and noise emissions. The problem of insufficient control of vehicle air pollutant emissions would persist as long as vehicles equipped with internal combustion engines (ICE) are on the roads. Although with stricter emission standards and gradual electrification the number of vehicles generating tailpipe emissions will decrease, they will still be circulating in the EU decades from now. While the proposed Euro 7 standard should address tampering and durability more effectively than its predecessors, vehicle aging and defects are unlikely to be completely overcome and vehicle inspection will continue to be key. Without updating the current emission test requirements at EU level however, Member States may not introduce the most effective and efficient test methods already available based on Commission recommendations. Similarly, while more Member States may start experimenting with roadside noise testing e.g., as mentioned in section 1, it is unlikely that the problem of noise vehicles would reduce significantly without a more systematic and coordinated approach.

Problem 3 - Roadworthiness Directives are not effective in enforcing rules in EU cross-border traffic and trade of vehicles. Without EU level intervention, certain Member States may take unilateral or bilateral measures, such as systematic recording (and possibly exchanging) of odometer readings, or develop agreements to recognise each other's roadworthiness certificates. However, the systemic problem of insufficient and inefficient exchange of roadworthiness-related vehicle data would remain, hindering effective implementation and enforcement of existing rules.

Foresight tools. The analysis incorporates throughout all its dimensions relevant *foresight tools*. It does so to anticipate trends and issues that may affect the initiative and build a robust, future-proof evidence base for its likely impact. The megatrend "Accelerating technological change and hyperconnectivity" will have a significant impact on the road transport sector and is relevant for the problems related to the presence of unsafe vehicles on EU roads and the insufficient control of vehicle air pollutant and noise emissions. However, as explained above, technological change on its own would not be able to address these problems, or at least not for decades from now. The 2022 Strategic Foresight Report[113] points to the potential of digitalisation and artificial intelligence to boost the emergence of more efficient mobility solutions, with a new generation of digital technologies enabling a major shift towards more sustainable mobility for passengers as well as heavy-duty freight transport. This trend will have an impact on all three problems mentioned above. For example, while digital solutions play a crucial role in innovative safety features and highly sophisticated emission control systems, the trend has also led to new tampering techniques in both areas. The trend will also play a key role in addressing the third problem, however, in itself, it will not be sufficient to resolve regulatory failures. The megatrend "climate change and environmental degradation"[114] is directly related to the insufficient control of vehicle emissions, identified as one of the main issues to be

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[113] https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2022-strategic-foresight-report_en
[114] https://knowledge4policy.ec.europa.eu/foresight/tool/megatrends-hub_en

addressed in line with the air quality legislation referred to in section 1. The same foresight report identified "enabling a greener transport sector with digital technologies" as one of the areas where the twinning of the green and digital transitions is expected to have a major effect. As regards the expected transformation of the vehicle fleet over the next decade, certain automakers (e.g., Volvo) plan to sell only EVs as of 2030. Those cars will also be connected and featuring the ADAS required by the General Safety Regulation.

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

The legal basis giving the EU the right to act is Article 91 of the Treaty on the Functioning of the European Union (TFEU. In particular, Article 91(1)(c) provides that the Union has competence in the field of transport to lay down measures to improve transport safety.

3.2. Subsidiarity: Necessity of EU action

In the absence of the EU level intervention, Member States would continue to carry out periodic and roadside inspections, but it is very unlikely that test methods and the scope of inspections required by the EU acquis (e.g. testing brakes, suspension and emissions reduction equipment, etc.) would be applied in a harmonised or coordinated manner. Different and piecemeal solutions would be applied, which would lead to even larger differences in the safety and environmental performance of vehicles than today, with the risk of distorting the internal market, and creating further barriers to free movement. The initiative therefore addresses safety and environmental protection needs with "Union relevance".

Road transport, especially freight, is an international sector, with vehicle approval regulated at the EU and international (UNECE) level. Therefore, it has by nature a strong cross-border dimension. According to the evaluation and the various targeted stakeholder consultations carried out as part of the revision process, the RWP has been considered to have contributed to road safety and environmental protection in the EU and has even had positive spill-over effects in neighbouring countries.

The identified problems apply across the entire Union and have the same underlying causes. At the same time, there is widespread agreement among national authorities and industry experts that the current Directives are no longer aligned with the latest regulatory and technological developments in vehicle safety and emission control. In the absence of EU action, EU Member States may implement national solutions and will work in an uncoordinated and non-harmonised way. This could undermine the harmonised safety and emission standards.

3.3. Subsidiarity: Added value of EU action

As road transport and the automotive industry are international sectors, it is much more efficient and effective to address the issues at the EU level than at the level of Member States. While national practices differ historically, a certain minimum level of harmonisation in vehicle testing and commonly agreed solutions to exchange vehicle data between Member States is more effective than multiple uncoordinated national solutions. With common rules applied to testing modern vehicle technologies (EVs, ADAS, and the most recent emission control equipment), Member States will realise economies of scale and testing equipment manufacturers can operate on a more homogenous market. The functioning of the internal market would also be improved by vehicles being subject to similar tests under similar conditions, and transport operators facing similar costs. Coordinating the conditions of access and exchange of vehicle data at the EU level will not only be more efficient than bilateral agreements and negotiations with individual manufacturers, but also level the playing field among Member States and put them, collectively, in a stronger position vis-à-vis the automotive industry.

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

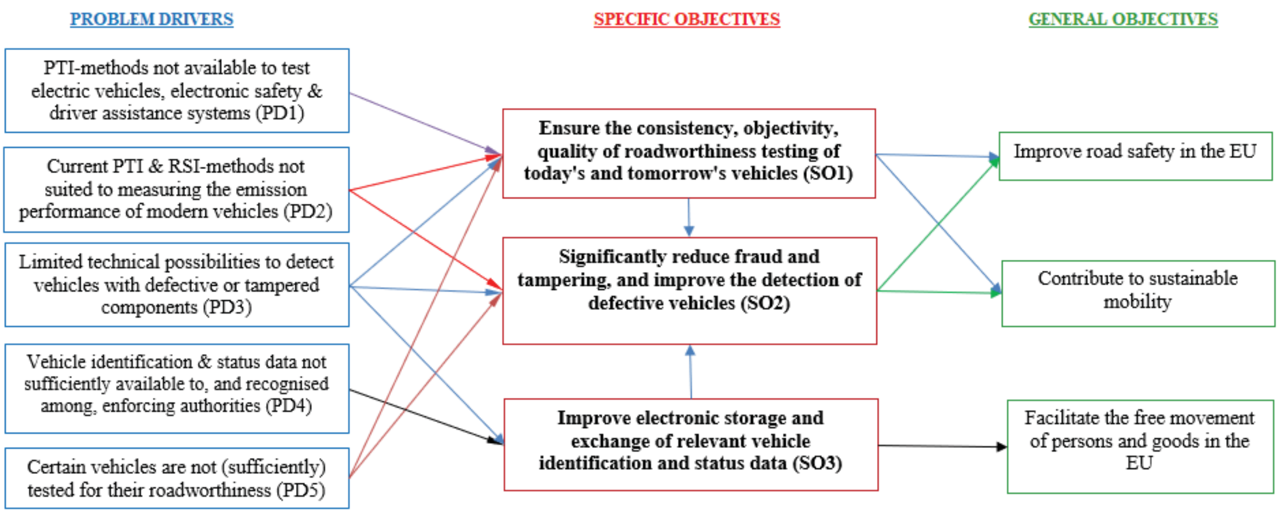
4.1. General objectives

To address the problems identified in section 2 and in line with the overall logic of the Roadworthiness Package on the one hand, and with the Commission's strategic priorities on the other hand ('Vision Zero' road safety policy framework, the European Green Deal, the Sustainable and Smart Mobility Strategy, the Zero Pollution Action Plan) and Treaty principles, the general objectives of this revision are to: (i) improve road safety in the EU; (ii) contribute to sustainable mobility; and (iii) facilitate the free movement of persons and goods in the EU. Stakeholders were consulted on these objectives as part of public as well as targeted consultations, including through the Roadworthiness Committee and the Expert Group representing Member States and industry experts, and a large majority of them agreed with the identified general and specific objectives (see Annex 2). Improving road safety in the EU and contributing to sustainable mobility are in line with UN Sustainable Development Goal (SDG) 3 (Ensure healthy lives and promote well-being for all at all ages), including targets 3.6 (halving the number of deaths and injuries from road traffic accidents) and 3.9 (by 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination), notably through specific objectives 1 and 2 mentioned below.

4.2. Specific objectives

The specific objectives of the initiative are designed to address the problems and problem drivers described above (Figure 4). As each of the specific objectives address two or three problem drivers, they complement each other to help achieve the general objectives. Both SO1 and SO3 contribute to SO2, while there are no trade-offs between them.

Figure 4: Correspondence between problem drivers and the objectives



SO1: Ensure the adequacy, consistency, objectivity, and quality of roadworthiness testing of today's and tomorrow's vehicles. This objective aims to address the challenges presented by the need to test the latest and emerging vehicle technologies in a coherent manner. More specifically, the testing of EVs and ADAS must be ensured before most of the new vehicles equipped with such systems are due for their first PTI (PD1)[115]. To correct for the inability of existing emission tests to identify high-emitting vehicles (PD2),

[115] While many electric vehicles are already on the roads, many more new vehicles equipped with ADAS will be due for PTI in 2026.

newly developed test methods need to be incorporated in the minimum requirements. Similarly, measures need to be taken to improve the detection rate of defective or tampered, thus polluting, excessively noisy and potentially dangerous vehicles (PD3). Some of those vehicles are not tested today, or not frequently enough to detect those deficiencies (PD5). The majority of stakeholders participating in the targeted consultation (64 out of 67) agreed with this specific objective. Adapting testing to today's and tomorrow's vehicles (SO1) will also help achieve SO2.

SO2: Significantly reduce fraud and tampering, and improve the detection of defective vehicles. This objective aims to significantly reduce tampering and improve the detection of vehicles with deficiencies, to allow for the detection of defective/tampered safety and emission (i.e., air pollution and noise emission) control systems, as well as of odometer fraud, by improving the suitability of emission testing (PD2), providing for better tools to detect safety-related modifications, notably of vehicle software (PD3), and by more and targeted inspections (PD5). Most stakeholders participating in the targeted consultation (60 out of 66) agreed with this specific objective.

SO3: Improve electronic storage and exchange of relevant vehicle identification and status data. This objective aims at improving electronic storage and exchange of specific vehicle data, therefore addressing the problem of insufficient availability of such data and mutual recognition by enforcing authorities (registration, PTI, RSI) (PD4). More accurate status data (such as mileage) and efficient exchange of information among Member States will also help identify vehicles with tampered odometer (PD3). As such, SO3 also complements SO2. The majority of stakeholders participating in the targeted consultation (54 out of 61) agreed with this specific objective.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1. What is the baseline from which options are assessed?

The EU Reference scenario 2020 is the starting point for the impact assessment of this initiative. The REF2020 takes into account the impacts of the COVID-19 pandemic that had a significant impact on the transport sector. More detailed information about the preparation process, assumptions, and results are included in the Reference scenario publication[116]. Building on REF2020, the baseline has been designed to include the initiatives of the ‘Fit for 55’ package proposed by the Commission on 14 July 2021[117] and the initiatives of the RePowerEU package proposed by the Commission on 18 May 2022[118]. The baseline scenario factors in the revision of the HDV CO_2 standards Regulation[119] and the new Euro 7 standards[120], the proposed end-of-life vehicles (ELV) Regulation[121] and the forthcoming initiative on fair and non-discriminatory access to in-vehicle data[122], as well as other initiatives part of the Road Safety package[123]

[116] EU Reference Scenario 2020 (europa.eu)
[117] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
[118] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
[119] Regulation (EU) 2024/1610
[120] COM(2022) 586 final
[121] The proposed ELV Regulation calls for data related to the reasons of deregistering vehicles to be recorded in the national vehicle registers. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0451
[122] According to current plans, the proposal on access to in-vehicle data would provide for non-discriminatory access to such data in a harmonised, machine-readable format. This will be key for vehicle inspection too, without, however, specifying the means of data access, which will continue to allow manufacturers to set their own (often cumbersome) rules.
[123] Proposal for a Directive amending the Driving Licence Directive, proposal for a Directive amending the Cross-Border Enforcement Directive and proposal for a Directive on the Union-wide effect of certain driving disqualifications.

and the Greening Freight package[124].

The baseline scenario assumes no further EU level intervention beyond the current Roadworthiness Package (i.e., the PTI and the RSI Directives as amended by the delegated Regulations to align with the evolution of type-approval legislation[125] and to introduce the testing of eCall at PTI[126], and the VRD Directive as last amended by the revision of the Eurovignette Directive[127]). As some of the provisions of the RWP allowed for a very long transition period[128], certain Member States are still notifying transposition measures to the Commission. The baseline scenario assumes full transposition of the current Roadworthiness Package. In addition, the baseline reflects the introduction of PN measurement by three Member States[129].

The baseline also incorporates *foresight megatrends* and developments captured in the 2022 Strategic Foresight Report[130], as explained in section 2.3. Among others, it captures the trend of increasing demand for transport as population and living standards grow, as well as the links between the digital and green transition, and the accelerating technological change and hyperconnectivity. In particular, the projected transport activity draws on the long-term population projections from Eurostat and GDP growth from the *Ageing Report 2021*[131] by the Directorate General for Economic and Financial Affairs.

In the baseline scenario, EU transport activity is projected to grow post-2020, following the recovery from the COVID-19 pandemic. Road transport would maintain its dominant role within the EU by 2050. Road passenger transport activity (expressed in passenger-kilometres)[132] is projected to grow by 10% between 2015 and 2030 (27% for 2015-2050), while road freight transport activity (expressed in tonne-kilometres)[133] by 27% during 2015-2030 (52% for 2015-2050). Rail transport activity is projected to grow significantly faster than for road, driven in particular by the completion of the TEN-T core network by 2030 and of the comprehensive network by 2050, supported by the CEF, Cohesion Fund and ERDF funding, but also by measures of the ‘Fit for 55’ package[134] and the Greening Freight package. Passenger rail activity is projected to go up by 37% by 2030 relative to 2015 (86% for 2015-2050). Freight rail traffic would increase by 50% by 2030 relative to 2015 (107% for 2015-2050).

The share of zero-emission vehicles in the light duty vehicle fleet (passenger cars and light commercial vehicles) is projected at 15% in 2030, going up to 95% in 2050 in the baseline scenario, while for heavy duty vehicle fleet (buses and coaches, and heavy goods vehicles) at 6% in 2030 and 72% in 2050. These developments are driven by the CO_2 standards Regulations, supported by the Alternative Fuels Infrastructure Regulation. The current limitations of the emission testing methods applied under the PTI and RSI Directives are expected to persist in the baseline scenario, with the shares of high-emitting vehicles[135] in the Euro 5/V and Euro 6/VI fleet remaining largely the same. On the other hand, the share of high-emitting vehicles in the Euro 7 fleet is expected to be lower than for Euro 5/V and Euro 6/VI. The uptake

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124 Green Deal: Greening freight for more economic gain with less environmental impact (europa.eu)
125 https://eur-lex.europa.eu/eli/dir_del/2021/1717/oj and https://eur-lex.europa.eu/eli/dir_del/2021/1716/oj
126 https://eur-lex.europa.eu/eli/reg/2015/758/oj
127 Directive (EU) 2022/362 amending Directives 1999/62/EC, 1999/37/EC and (EU) 2019/520, as regards the charging of vehicles for the use of certain infrastructures, https://eur-lex.europa.eu/eli/dir/2022/362/oj
128 For example, PTI for motorcycles (with a possibility for exemptions) since January 2022; the deadline to equip all test centres with all the required equipment was 20 May 2023 (five years after the date of application).
129 Belgium, Germany and the Netherlands.
130 COM(2022) 289 final.
131 The 2021 Ageing Report. Economic and Budgetary Projections for the EU Member States (2019-2070) (europa.eu)
132 Covering passenger cars, buses and coaches, and power-two wheelers.
133 Covering heavy goods vehicles and light commercial vehicles.
134 These measures increase to some extent the competitiveness of rail relative to road and air transport.
135 High emitters are vehicles with defective emission or noise control systems or vehicles with tampered emissions/noise control systems.

of zero-emission vehicles, the penetration of Euro 7 vehicles in the fleet and the related introduction of on-board emissions monitoring systems[136], combined, are expected to result in significant reductions of air pollution emissions from road transport in the baseline scenario. NOx emissions are projected to reduce by 52% in 2030 relative to 2015 (98% reduction for 2015-2050), while particulate matter (PM2.5) emissions would decrease by 43% in 2030 relative to 2015 (98% reduction for 2015-2050). CO_2 emissions from road transport are projected to decrease by 32% by 2030 relative to 2015, and be close to zero by 2050, thanks to the large-scale uptake of zero-emission vehicles and some use of renewable and low-emission fuels.

In the baseline scenario, the number of fatalities is projected to decrease by 24% by 2030 relative to 2015 and by 31% by 2050 relative to 2015[137]. The number of serious and slight injuries is projected to decrease by 19% between 2015 and 2030 and by 26% for 2015-2050. This is despite the increase in traffic over time. Relative to 2019, the number of fatalities would decrease by 15% by 2030 and 23% by 2050, and the number of serious injuries by 10% by 2030 and 18% by 2050. Thus, the targets of the EU Road Safety Policy Framework 2021-2030 – Next steps towards "Vision Zero", of reducing the number of road deaths and the number of serious injuries by 50% between 2019 and 2030, would not be met. In addition, this is still far from the goal of the Sustainable and Smart Mobility Strategy of a close to zero death toll for all modes of transport in the EU by 2050. The external costs of noise emissions are projected to increase by 7% by 2030 relative to 2015 and to remain relatively stable post-2030. The uptake of zero-emission vehicles compensates to some extent the increase in noise due to the higher traffic[138].

In the baseline scenario, the number of periodic technical inspections (PTI) for cars, vans, buses, trucks and motorcycles is projected to increase from 151.5 million in 2015 to 168.9 million in 2030 and 192.3 million in 2050[139]. For O1 and O2 vehicles the number of inspections is projected at 7.9 million in 2030 and 8.7 million in 2050. Most of the technologies required for more advanced testing included in the policy measures are available and part of the baseline; however certain test methods need to be developed. More detailed explanations are provided in Annex 4 (section 8).

The number of national second-hand vehicle sales with mileage fraud at EU level is projected at 1.71 million in 2030 and 1.90 million in 2050, and that of cross border vehicle sales with mileage fraud at 3.35 million in 2030 and 3.64 million in 2050. The national and cross-border odometer fraud is estimated to lead to damages for European consumers estimated at EUR 10.7 billion in 2030 and EUR 11.7 billion in 2050[140]. Expressed as present value over 2026-2050 this amounts to EUR 194.6 billion. More details on the baseline scenario are provided in Annex 4 (section 2).

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[136] Considering the expected effects of the Euro 7 based on the Commission's proposal, the currently dominant Euro 5/V and 6/VI vehicles should be gradually replaced by new ones complying with the Euro 7 standard. This would result in reduced levels of tampering and lower emissions, in particular for heavy-duty vehicles. A limitation to mention here is that the baseline reflects the Commission proposal. Following the changes agreed by the co-legislators, the baseline likely overestimates the reduction in the air pollution emissions over time and thus slightly underestimates the contribution of this initiative to the air pollution emissions reduction. This is particularly relevant in the short to medium term. In the medium to long term this is less relevant due to the expected large-scale penetration of the zero-emission vehicles in the fleet.

[137] Projections refer to injuries in accidents in which a car, a van, a bus or a truck, or a motorcycle is involved.

[138] It should however be noted that the reduction in noise due to zero-emission vehicles is only linked to the powertrain. The noise from tyres still remains.

[139] They are derived based on the 'testing frequency' and the average number of PTIs in the statistical life of a vehicle.

[140] The average cost of mileage fraud, due to higher purchase price and maintenance costs incurred, is estimated at EUR 2,119 per vehicle in 2022 prices drawing on a Belgian Car-Pass study (https://www.car-pass.be/files/article_files/file/7/crm%2520study%2520final%2520report.pdf). More explanations are provided in section 2 of Annex 4.

5.2. Description of the policy options

As a first step, a comprehensive list of possible policy measures was established after extensive consultations with stakeholders, expert meetings, and independent research in the context of the impact assessment support study and the Commission's own analysis. This list was subsequently screened based on the likely effectiveness, efficiency and proportionality of the proposed measures in relation to the given objectives, as well as their legal, political and technical feasibility.

Discarded policy measures and policy options

The possibility to adopt further recommendations or a communication from the Commission was discarded at early stage as non-regulatory measures could not be sufficiently effective in addressing the problems identified and would have limited effect on harmonisation. Most stakeholders, including public authorities participating in the open public consultation, agree that a legislative review of the RWP would be more effective (see Annex 2). Out of the more than 40 policy measures discussed at five meetings with the Expert Group on Roadworthiness and vehicle registration documents (RWEG), 13 measures have been discarded. A more detailed list with all discarded measures can be found in Annex 8.

Retained policy measures and policy options

A list of 26 policy measures has been retained. Table 3 presents an overview of the policy measures included in the policy options and their links with the specific objectives. A detailed description of the policy measures is provided in Annex 7.

The policy options offer choices with focus on different aspects such as means of testing (e.g., PTI vs roadside inspections, tailpipe testing only vs its combination with remote sensing) or different levels of harmonisation in the exchange of vehicle data, the scope and methods of testing and the mutual recognition of PTI certificates.

Four policy options have been identified (PO1a, PO1b, PO2 and PO3), and each of the four policy options includes a set of policy measures that are common for all options, as well as additional measures that are included in one or more options. The common set of policy measures (from PMC1 to PMC9) are considered as the minimum necessary to correct the shortcomings of the existing RWP Directives and to adapt to technological and regulatory developments over the last ten years, and are supported by most stakeholders. Beyond the common measures, PO1a and PO1b differ in their focus, while compared to them PO2 and PO3 represent an increasing level of ambition and harmonisation. This reflects the preferences of various stakeholder groups and genuine options for more or less convergence in the areas covered by the three Directives.

Table 3: Policy measures and policy options

PM#	Policy Measure	Specific objective	PO1a	PO1b	PO2	PO3
Measures common to all policy options						
	New PTI and RSI tests					
PMC1	Adapt PTI to electric and hybrid vehicles (safety, environmental performance, standardised data), including training of inspectors	SO1	X	X	X	X
PMC2	Update PTI and RSI due to new requirements in the General Safety Regulation and checking emission reduction systems (new test items, including checks of software status/integrity), by reading on-board diagnostics	SO1	X	X	X	X

PM#	Policy Measure	Specific objective	PO1a	PO1b	PO2	PO3
PMC3	Mandatory PN testing of LDVs and HDVs equipped with particle filter, at PTI, and of HDVs at technical roadside inspections of commercial vehicles	SO1, SO2	X	X	X	X
PMC4	Mandatory NOx testing of LDV and HDV at PTI, and HDVs at roadside inspections	SO1, SO2	X	X	X	X
	Frequency of testing					
PMC5	Mandatory roadworthiness testing following significant modifications of the vehicle (e.g. change of class, propulsion system)	SO2	X	X	X	X
	Facilitating exchange of PTI and registration data					
PMC6	Require roadworthiness certificate in electronic format only	SO3	X	X	X	X
PMC7	Provide electronic access to relevant data, including on PTI reports stored in national databases, to the registration authorities of other Member States using a common interface	SO3	X	X	X	X
PMC8	Harmonisation and regular update of the technical data in the vehicle registration documents (of currently optional content)	SO3	X	X	X	X
	Tackling odometer tampering					
PMC9	Member States to record odometer readings in a national database and make the records available to other MSs in the case of re-registration	SO2, SO3	X	X	X	X
Measures not included in all policy options						
	Scope of vehicles subject to PTI/RSI					
PM1	RSI for heavy/powerful motorcycles (L category > 125cm3) as an alternative measure, in Member States where they are not subject to PTI (i.e., using the available opt-out)	SO2	X		X	
PM2	Mandatory PTI for motorcycles above 125cm3 (remove opt-out)	SO2		X		
PM3	Extend PTI to all motorcycles (incl. from 50cm3 = all L3e, L4e), plus tricycles (L5e) and heavy quadricycles (L7e)	SO2				X
PM4	Mandatory PTI for light trailers (O1 and O2 categories)	SO2				X
	Frequency of testing					
PM5	Annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2- frequency	SO2		X	X	X
PM6	Mandatory yearly testing for vehicles that are 10-year-old or older	SO2		X	X	X
	Recognition of PTIs conducted in another Member State					
PM7	PTI certificate issued in any EU MS is recognised by the MS of registration + further harmonisation of test methods	SO1, SO3				X
PM8	PTI certificate issued in any EU MS is recognised by the MS of registration for a period of up to 6 months (for passenger cars only), on the condition that the next PTI is conducted in the MS of registration	SO3		X	X	
PM9	PTI in another EU MS recognised by MS of registration based on bilateral agreement (voluntary recognition)	SO3	X			
	Improve current PTI tests and procedures					
PM10	More advanced testing of noise for motorcycles	SO2		X	X	X

PM#	Policy Measure	Specific objective	PO1a	PO1b	PO2	PO3
PM11	Data governance: further define the procedures and the means of access to vehicle technical information by testing centres free of charge	SO1, SO3			X	X
	RSI methods					
PM12	NOx, PM, and noise measurement by remote sensing in RSI of all vehicles (with option for simplified PTI if vehicle passed recent RSI)	SO1, SO2		X	X	X
PM13	Mandatory inspection of cargo securing	SO1, SO2		X	X	X
	Scope of vehicles subject to RSI					
PM14	Extend the scope of application of roadside inspections to light commercial (N1) vehicles	SO2			X	X
PM15	Extend the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3)	SO2				X
	Registration certificate and registered data					
PM16	Introduce issuing the registration certificates in digital format to gradually replace current paper (and smart card) documents	SO3	X		X	X
PM17	Add new data to the vehicle register – minimum mandatory set (including among others: country of 1st registration, registration status, PTI status, changes due to transformation)	SO3	X		X	X

Adapting PTI to EVs (PMC1) and including new test items through the ePTI (PMC2, including the testing of software integrity of safety- and emission-relevant systems) will help align the PTI rules with technological and regulatory developments and hence contribute to SO1 *(Ensure the adequacy, consistency, objectivity, and quality of roadworthiness testing of today's and tomorrow's vehicles)*. Similarly, new emission test methods for both particles and NOx (PMC3 and PMC4) are necessary to adapt to more recent emission control technologies (contributing to SO1) and to capture high emitting vehicles, including tampered ones (contributing to SO2). PMC5 will also contribute to SO2 *(Significantly reduce fraud and tampering, and improve the detection of defective vehicles)* by requiring that vehicles undergo a roadworthiness test following any significant modification involving e.g., the change of the propulsion system or the emission class. PMC6, PMC7 and PMC8 contribute to SO3 *(Improve electronic storage and facilitating exchange of relevant vehicle identification and status data)* through digitalisation of the roadworthiness certificate, linking national vehicle registers and extending the set of harmonised vehicle data in those registers. PMC9 introduces a requirement for Member States to record odometer readings in national databases and make those records available to other Member States in the case of re-registration. Garages (including car manufacturers), tyre and other repair services, in addition to PTI bodies would have to provide such readings for cars and vans following every visit. PMC9 contributes to SO2 and SO3.

Reasoning behind the packaging of options

PO1a and **PO1b** are designed rather conservatively as regards the scope of vehicles to be tested and are limited to the measures that are indispensable to address each of the problem drivers and to meet all specific objectives, while each of these two options has a specific focus: PO1a focuses primarily on enhancing the exchange of vehicle data and enhancing digitisation. PO1b on the other hand focuses more on improving the testing of vehicles and introducing additional and more ambitious measures regarding emission testing and recognition of PTI.

PO2 is designed to provide a more integrated approach. It builds on the measures already included in PO1a and PO1b and adds more ambition with additional measures such as the extension of roadside inspections to vans. It also improves access to relevant technical and registration data through specific measures, such as better access to vehicle data necessary for testing notably modern electronic safety systems.

PO3 builds on PO2 and takes its integrated approach, but compared to PO2 it further extends the scope of vehicles and items to be tested. It further extends the scope of PTIs to cover light trailers and motorcycles with smaller engine size, combined with mandatory roadside inspection for motorcycles. It also provides a wider recognition of PTI inspections taking place in other Member States. Overall, it represents the most ambitious option.

Policy option 1a (PO1a)

This policy option aims primarily at more efficient use of vehicle (registration and status) data, further focusing on addressing SO3. In addition to the common measures, PO1a would require adding certain new data elements to national vehicle registers, notably related to the registration and roadworthiness status of the vehicle, thus facilitating the implementation and enforcement of the RWP as well as that of the ELV legislation (PM17). Issuing registration certificates in digital format (PM16) will further enhance the efficiency of data exchange. Furthermore, PO1a would allow Member States to sign bilateral agreements to enable the cross-border recognition of PTIs and thus facilitate the free movement of people and goods (PM9). PM9, PM16 and PM17 contribute to addressing SO3.

Beyond the common measures, PO1a applies a relatively light touch approach to addressing SO2. To reduce the number of tampered and defective motorcycles due to their lack of testing, it would require those Member State which exempt these vehicles from PTI to apply as alternative measure, testing a share of them at the roadside (PM1). Most stakeholders, including Member States authorities and especially EReg/EUCARIS support this policy option, while the PTI sector (CITA and others) and motorcycle manufacturers (ACEM) would prefer stricter PTI and RSI requirements.

Policy option 1b (PO1b)

Beyond the common measures, PO1b further focuses on addressing SO2 through more effective technical inspections. The most important measure in this respect is the use of remote sensing technology[141] (PM12), which allows targeted and thus much more effective and efficient emission testing at the roadside. Remote sensing, using laser technology (LiDAR) to detect critical pollutants, has been demonstrated to be an effective method to screen very large numbers of vehicles at relatively low cost[142]. This measure will allow monitoring the emissions of virtually the entire vehicle fleet, including older vehicles, depending on the scale of its implementation. Remote sensing using microphones is able to single out unusually noisy vehicles even in dense traffic[143]. This allows the identification of potentially high-emitting vehicles that can be either inspected at a subsequent roadside check immediately after being identified or invited to a roadworthiness centre for an emission test.

In addition, to address specific groups of vehicles that are more prone to tampering or defects than the average, PO1b introduces specific measures: it would remove the possibility to exempt motorcycles from PTI (PM2) and require yearly emission testing of light commercial vehicles (PM5). Furthermore, it would

[141] https://cares-project.eu/about/
[142] See e.g., https://publications.tno.nl/publication/34638150/2gBdxC/hooftman-2020-analysis.pdf and https://nemo-cities.eu/remote-sensing/
[143] https://nemo-cities.eu/remote-sensing-device-for-noise/

introduce mandatory annual PTIs for vehicles older than 10 years (PM6), an improved noise test for motorcycles based on type-approval requirements (PM10) and make the inspection of cargo securing mandatory (PM13). As such, all these measures go further in addressing SO2 (beyond the common measures included in all options). PO1b would further facilitate the free movement of people, and further address SO3, by requiring that the Member State of registration recognises the PTI certificate issued by another Member State for a period of up to six months, provided that the next PTI is conducted in the Member State of registration (PM8). This policy option enjoys the support of the PTI industry (CITA, FSD and others) as well as automobile manufacturers (ACEA), testing equipment (EGEA) and motorcycle manufacturers (ACEM), while certain Member States and motorcycle users find it too demanding. Stricter cargo securing requirements are strongly supported by the logistics industry (in particular by EUMOS).

Policy option 2 (PO2)

PO2 combines most of the measures of PO1a and PO1b. As regards the testing of motorcycles, PO2 includes a measure of PO1a (PM1), while for the recognition of PTIs conducted in another Member State, it uses PM8 (temporary recognition), like in PO1b. To further improve the consistency and quality of testing of modern vehicles (SO1) and the availability of relevant technical data to testing centres (SO3), it includes an additional measure on data governance (PM11), aiming to define the procedures and the means of access to vehicle technical information (including in-vehicle data). The measure would complement an existing Implementing Regulation[144] and build on the upcoming proposal on access to in-vehicle data[145].

To further reduce the number of tampered and defective vehicles and contribute towards SO2, in addition to the measures of PO1b and PO1a, it would also introduce roadside inspections for light commercial vehicles (PM14). RSI complements PTI and is arguably better suited to detect and reduce fraud thanks to the vehicle users having no prior notice of roadside tests, in comparison to pre-planned periodical technical inspections, where pre- and post-tempering of vehicles cannot be excluded. In addition to being a combination of PO1a and PO1b, PM11 on data governance makes this policy option more favoured by the PTI industry (CITA, FSD and others) as well as FIA, testing equipment (EGEA) and motorcycle manufacturers (ACEM). It is supported also by some Member States, notably those that rely on thousands of smaller roadworthiness testing centres. On the other hand, the issue of access to vehicle data is considered less important by automobile manufacturers. Stricter cargo securing requirements included in this option are strongly supported by the logistics industry (EUMOS).

Policy option 3 (PO3)

PO3 goes further on harmonising the scope and methods of roadworthiness testing and the mutual recognition of PTI certificates. As such, it aims to further address SO2, as well as SO1 and contributes to facilitating the free movement of people and goods more comprehensively than the other options also further addresses SO3. To the measures of PO2, PO3 adds further extension of scope of PTI to cover all motorcycles without exception (PM3) and light trailers (PM4), and it extends RSI to motorcycles (PM15). All these measures further contribute to addressing SO2. PO3 is the only option to include PM7, a requirement that PTI certificates issued in any other EU Member States are recognised by the Member State of registration without limitations, further addressing SO1 and SO3. This necessitates further harmonisation of test methods where the PTI Directive currently offers various options. It would thus mean less room for manoeuvre for Member States, and fewer choices for inspection centres. This being the most ambitious

[144] https://eur-lex.europa.eu/eli/reg_impl/2019/621/oj
[145] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13180-Access-to-vehicle-data-functions-and-resources_en

option, it is mainly supported by the PTI sector, including equipment manufacturers as well as by ACEM and a few Member States that apply stricter requirements than the current RWP Directives.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

This section summarises the main expected economic, social and environmental impacts of each policy option (PO)[146]. The proposed measures are assumed to be implemented from 2026 onwards, so the assessment has been undertaken for the 2026-2050 period and refers to EU27. Costs and benefits are expressed as present value over the 2026-2050 period, using a 3% discount rate, in constant prices of the year 2022. Further details on the methodological approach are provided in Annex 4. The evidence underlying the assessment of impacts is based on the best available evidence, including multiple studies involving scientific research, as well as thorough consultation with experts.

6.1. Economic impacts

This section focuses on the economic impacts of the policy options on national public authorities, businesses and citizens. It also provides an assessment of impacts on competitiveness, on innovation and technological developments, on small and medium enterprises (SMEs), on the functioning of the internal market and competition, and looks at territorial impacts and digital by default. The assessment of economic impacts draws on multiple data sources, including the targeted stakeholders' consultation (interviews and survey) and OPC, and findings from desk research in the context of the impact assessment support study. The costs and benefits of each policy measure by stakeholder group are described in detail in Annex 4 (sections 3 and 4), including the assumptions used to estimate them. In addition, the cost-benefit analysis for some key policy measures is provided in Annex 4 (section 6).

6.1.1. Impacts on national public authorities

All policy options are expected to result in adjustment and administrative costs for national public authorities, while PO1b and PO3 would also lead to additional enforcement costs. At the same time, all policy options are expected to result in significant administrative costs savings for the national authorities (see Table 4 to Table 6). The costs and costs savings by policy option are discussed below, while the detailed calculations by policy measure are provided in Annex 4 (section 3).

Adjustment costs. All policy options include adjustment costs related to three common measures (PMC2, PMC3 and PMC4). They cover one-off adjustment costs (see Table 6) for: the acquisition of on-board diagnostic (OBD) scanning tools for RSI and the training of inspectors to use the OBD tools[147] (PMC2), estimated at EUR 0.2 million in 2026 relative to the baseline; the purchase of PN measurement devices for RIS and the training of inspectors to use them[148] (PMC3), estimated at EUR 0.7 million in 2026; and, the acquisition of NOx measurement devices for RIS and the training of inspectors[149] (PMC4), amounting to EUR 2 million. In addition, recurrent adjustment costs (i.e., maintenance and calibration costs) for the PN and NOx measurement devices are assumed at 5% of the capital costs, based on stakeholders' feedback, and are estimated at EUR 32,750 per year from 2026 onwards in PMC3 and at EUR 98,250 per year in

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[146] The analysis in this section is based on Ricardo et al. (2024), Impact assessment support study on the directives of the roadworthiness package, Contract no. MOVE/C2/SER/2022-583/SI2.895928, under FWC no. MOVE/2022/OP/0001, and on the analysis of stakeholders' feedback.
[147] The costs are estimated at EUR 1,000 per tool. One tool is required per RSI unit, and the number of RSI units total 131 at EU level. Two hours of training are assumed for each of the 393 RSI inspectors across EU27.
[148] One PN measurement device is needed per RSI unit, at a cost of EUR 5,000 each. 131 RSI units would need to purchase PN testing equipment. An additional half-day of training related to the use of PN measurement devices is assumed for the estimated 393 RSI inspectors across the EU in 2026.
[149] One NOx measurement device is assumed per RSI unit, at a cost of EUR 15,000 each. 131 RSI units would need to purchase the equipment. An additional half-day of training is assumed for the 393 RSI inspectors.

PMC4 (see Table 5). Expressed as present value over 2026-2050, the total one-off and recurrent adjustment costs are estimated at EUR 0.2 million for PMC2, EUR 1.3 million for PMC3 and EUR 3.8 million for PMC4 (see Table 4). Thus, the adjustment costs due to the common set of measures (PMC2, PMC3 and PMC4) are estimated at around EUR 5.2 million, of which EUR 2.9 million one-off costs. In addition to the common measures, the most significant one-off adjustment costs in **PO1a** are due to PM9, concerning the recognition of PTIs conducted in another Member State than that of registration based on bilateral agreements. National authorities are expected to incur expenses for establishing bilateral agreements and implementing procedures to facilitate inspections in another Member State. Assuming each Member State establishes three bilateral agreements, the total costs for 41 such agreements have been estimated at around EUR 1.4 million in 2026 (EUR 53,550 per Member State). In addition, PM1 will require that those Member States[150] that do not have a PTI requirement for motorcycles to introduce roadside inspections for motorcycles over 125cm3 as an alternative, leading to the need of purchasing additional equipment to support these inspections (one-off adjustment costs) and of maintaining it (recurrent adjustment costs). The one-off adjustment costs due to PM1 are estimated at EUR 0.1 million in 2026 and the recurrent adjustment costs at EUR 12,000 per year from 2026 onwards[151] (see Table 5 and Table 6). The total one-off and recurrent adjustment costs for national public authorities due to PO1a are thus estimated at **EUR 7 million** (see Table 4), expressed as present value over 2026-2050, of which EUR 4.4 million one-off costs.

In **PO1b**, in addition to the costs of the common measures (PMC2, PMC3 and PMC4), the most significant additional adjustment costs for authorities arise due to the introduction of remote sensing, and the option to use plume chasing to measure NOx emissions from trucks, as well as the installation of noise cameras (PM12). PM12 involves one-off costs for the purchase of the necessary equipment, the setting up of the corresponding IT infrastructure and related training of inspectors, as well as recurrent costs for the maintenance of the equipment and data management, and labour costs for the inspectors performing the plume chasing[152]. The one-off adjustment costs due to PM12 amount to EUR 23.6 million in 2026, and the recurrent adjustment costs to EUR 9.4 million per year (see Table 5 and Table 6). Total adjustment costs due to this measure are thus estimated at EUR 192.9 million, expressed as present value over 2026-2050 relative to the baseline. In addition, PM13 is expected to lead to one-off adjustment costs for national public authorities for training on cargo securing in the 14 Member States[153] that currently do not require minimum training of inspectors (EUR 26,916 in 2026), and recurrent adjustment costs for the retraining of inspectors on a biennial basis (EUR 26,916 per year every second year after 2026)[154]. Total adjustment costs for PO1b are thus estimated at **EUR 198.3 million** (see Table 4), expressed as present value over the 2026-2050 period relative to the baseline, of which EUR 26.5 million one-off costs.

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[150] These are: BE, FI, IE, NL, MT and PT. FR will introduce PTI for powered two- and three-wheelers and quadricycles in 2024. DK does not have mandatory PTI but since 1 January 2022 it has introduced roadside inspections. In the case of PT, current requirements cover only motorcycles over 250cc.

[151] For a 5% share of the motorcycles fleet one extra RSI unit per Member State is expected to be sufficient. The capital costs are estimated at EUR 20,000 per unit and maintenance costs are assumed at around 10% of the capital costs.

[152] For *remote sensing*, 250 devices would be needed in EU27 to be able to analyse at least 30% of the road fleet. The capital cost of a remote sensing equipment is estimated at EUR 85,000. Maintenance and calibration costs are around 5% of the capital costs, and the cost for the processing and data management EUR 24,000 per year per device. In addition, one day of training for the use of NOx and PM remote sensing equipment is assumed for the 393 RSI inspectors. For *plume chasing*, the capital costs are estimated at EUR 32,500 per equipment. On average, two vehicles are assumed per Member State, for 26 Member States (DK has already implemented the system). The maintenance and calibration costs are around 5% of the capital cost. Labour costs are estimated assuming one inspector per plume chasing vehicle and four days per week of plume chasing. Two days of training on plume chasing are assumed for the 52 inspectors. For *acoustic cameras*, the capital costs are estimated at EUR 2,000 per device, and the maintenance cost at 5% of the capital cost. A half-day training would be needed for 393 RSI inspectors, for using the acoustic cameras.

[153] BE, DK, DE, EE, FR, IE, LV, LU, BG, FI, IT, NL, PL and PT.

[154] Training for cargo securing is assumed to take 3 hours, with 264 roadside inspectors requiring training.

PO2 includes the adjustment costs related to the common measures (PMC2, PMC3, PMC4), the costs related to PM1 as in PO1a, and the costs related to PM12 and PM13 as in PO1b. To this, PO2 adds one-off costs for additional roadside equipment and training of inspectors due to the introduction of roadside inspections for light commercial vehicles (PM14)[155], estimated at EUR 3.1 million in 2026, and recurrent costs for the maintenance of equipment, estimated at EUR 0.3 million per year[156] (see Table 5 and Table 6). Expressed as present value over 2026-2050, the total costs of PM14 are estimated at EUR 8.6 million. Total adjustment costs for PO2 are thus estimated at **EUR 207.2 million**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 29.7 million one-off costs.

PO3 includes the adjustment costs related to the common measures (PMC2, PMC3, PMC4) and the costs related to PM12, PM13 and PM14 as in PO2. Moreover, it adds one-off adjustment costs for the purchase of additional mobile inspection units due to the introduction of roadside checks for motorcycles (PM15)[157], estimated at EUR 0.4 million in 2026, and recurrent costs for the maintenance of the inspection units (EUR 40,000 per year from 2026 onwards)[158]. Expressed as present value over 2026-2050, the total costs of PM15 are estimated at EUR 1.1 million. Thus, the total adjustment costs for authorities for PO3 are estimated at **EUR 208 million**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 30 million one-off costs.

Administrative costs. All policy options include administrative costs for public authorities related to four common measures (PMC6, PMC7, PMC8 and PMC9). The digitalisation of the roadworthiness certificate (PMC6) is expected to lead to one-off administrative costs for the development of the software for electronic certificates, estimated at EUR 17.8 million in 2026[159], and recurrent administrative costs for the maintenance and update of the system (EUR 0.9 million per year from 2026 onwards)[160]. The interconnection of national vehicle registers (PMC7) would result in one-off administrative costs for developing the common interfaces for accessing the data, estimated at EUR 8.1 million in 2026 (EUR 300,000 per Member State), and recurrent administrative costs for providing access to the relevant data (EUR 0.4 million per year from 2026 onwards). Further harmonisation and regular update of technical data in the registration documents (PMC8) is expected to lead to one-off administrative costs for redesigning and setting up the new template for the registration documents, estimated at EUR 0.7 million in 2026 and recurrent administrative costs for the regular update of the vehicle registration documents with new items that may be found relevant in the future (EUR 0.5 million per year from 2026 onwards). The most significant administrative costs in all policy options arise from PMC9, under which authorities (except Belgium and the Netherlands that have already implemented the system) will need to develop a system for the recording of odometer readings of vehicles at garages and other repair stations. Based on the information provided by

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155 Few Member States (ES, HU, SE, SK and FI) already conduct roadside inspections for light commercial vehicles. This measure is thus relevant for 22 MS.

156 The extra inspections will be delivered by an estimated total of 182 inspectors in around 61 roadside inspection units. These units will need to be equipped with relevant equipment. The one-off cost of the roadside equipment is around EUR 50,000, and the maintenance cost is estimated at 10% of the capital cost. One-day training per inspector is assumed.

157 Few Member States (SE, SI, AT, FI, DK, HU, RO) already perform such inspections and are thus part of the baseline.

158 On the basis of the additional number of inspections to be conducted it is estimated that a total of 32 inspectors will be needed for the 20 Member States. With an average of 3 inspectors per unit, each Member State will need a minimum of one additional set of roadside equipment for testing of motorcycles. The one-off cost per equipment is estimated at EUR 20,000, and the recurrent maintenance cost at 10% of the initial cost. In addition, a one-day training is assumed per inspector in 2026 for the 32 inspectors.

159 Assuming one-off costs of EUR 500,000 per IT system for each of the 15 Member States with smaller volumes of inspections (BG, CY, EE, FI, HR, HU, IE, LT, LV, LU, MT, SI, SK, DK and CZ), EUR 750,000 per IT system for each of the 7 Member States with medium volumes of inspections (AT, BE, EL, NL, PT, RO and SE) and EUR 1,000,000 per IT system for each of the 5 Member States with higher volumes of inspections (DE, FR, IT, PL and ES). More details are provided in Annex 4 (section 3).

160 Assumed at 5% of the capital costs.

CAR-Pass[161], the one-off cost per database that will be collecting the odometer readings at Member State level is estimated at around EUR 1 million. Furthermore, the annual cost of operating the system was estimated at around EUR 0.42 per vehicle (in 2022 prices)[162]. In total, one-off administrative costs for authorities are estimated at around EUR 25 million in 2026, and recurrent costs at EUR 111.4 million in 2030 and EUR 125.6 million in 2050 relative to the baseline[163]. Expressed as present value over 2026-2050, the total one-off and recurrent administrative costs are estimated at EUR 33.7 million for PMC6, EUR 15.4 million for PMC7, EUR 9.4 million for PMC8 and EUR 2.12 billion for PMC9 (see Table 4). Thus, the administrative costs due to the common set of measures (PMC6, PMC7, PMC8 and PMC9) are estimated at around EUR 2.18 billion, expressed as present value over 2026-2050, of which EUR 51.6 million one-off costs.

In **PO1a**, beyond the costs of the common measures (PMC6, PMC7, PMC8 and PMC9), additional administrative costs are expected from the introduction of RSI for motorcycles not covered by PTI in six Member States (PM1), from the digitalisation of the registration certificates (PM16), and from adding new data elements to the vehicle registers (PM17). The recurrent administrative costs (i.e., labour costs for the additional inspections) due to PM1 are estimated at EUR 0.5 million in 2030 and EUR 0.6 million in 2050 relative to the baseline[164]. For PM16, the one-off costs for the adaptation of the IT system are estimated at EUR 12.8 million in 2026, while the recurrent costs for maintenance are estimated at EUR 1.3 million per year[165]. The one-off costs for harmonising the dataset in PM17 are estimated at EUR 0.5 million in 2026 and the recurrent costs for continuous data updates and broader maintenance of the dataset at EUR 0.4 million per year. Expressed as present value over 2026-2050, total administrative costs are estimated at EUR 9.1 million for PM1, EUR 35.8 million for PM16 and EUR 8.4 million for PM17. Altogether, the administrative costs for authorities under PO1a amount to **EUR 2.23 billion** expressed as present value over 2026-2050 relative to the baseline.

On top of the common measures, **PO1b** includes only one measure that generates administrative costs for authorities, namely the mandatory inspection of cargo securing (PM13). The recurrent administrative costs relate to labour costs for the additional cargo securing inspections and are estimated at EUR 0.5 million in 2030 and EUR 0.6 million in 2050 relative to the baseline[166] (EUR 9.8 million expressed as present value over 2026-2050). The total administrative costs for authorities under PO1b are thus estimated at **EUR 2.19 billion**, expressed as present value over 2026-2050.

PO2 includes the administrative costs related to the common measures, the costs related to PM1, PM16 and PM17 as in PO1a, and the costs related to PM13 as in PO1b. In addition, it includes administrative costs related to two other measures (PM11 and PM14). In the case of PM11 (adaptations related to data governance ensuring access to vehicle data for PTI centres), total one-off costs for the adaptation of the IT system are estimated at EUR 13 million in 2026[167], and recurrent administrative costs at EUR 1.3 million

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[161] https://www.car-pass.be/en/
[162] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[163] The number of cars and vans relevant for PMC9 are projected at 262.4 million in 2030 and 295.8 million in 2050.
[164] The average cost per inspection is estimated at EUR 5.7 and the number of roadside inspections for motorcycles in PM1 at 82,566 in 2030 and 104,321 in 2050 for the 6 Member States concerned (BE, FI, IE, NL, MT and PT).
[165] The one-off costs for the adaptation of the IT system are estimated at EUR 300,000 to EUR 1,000,000 per MS, depending on the volume of new registrations, and costs for maintenance at 10% of the capital costs.
[166] A cargo securing inspection takes on average 20 minutes. Cargo securing inspections are expected to cover 5% of the N2/N3 fleet in the Member States affected by the measure (EE, FR, IE, LV and LU).
[167] Inputs from stakeholders (NL and SI authorities) suggest one-off costs for the adaptation of IT systems in the range of EUR 300,000 to EUR 1,000,000 per country, depending on the volume of PTI inspections per country.

per year[168]. This is equivalent to total one-off and recurrent costs of EUR 36.3 million, expressed as present value over 2026-2050. In addition, the roadside testing of vans (PM14) will also generate recurrent administrative costs (i.e., labour costs for the additional inspections), estimated at EUR 5.6 million in 2030 and EUR 6.7 million in 2050[169] relative to the baseline (EUR 107.5 million, expressed as present value over 2026-2050). All in all, the one-off and recurrent administrative costs for authorities under PO2 are expected to amount to **EUR 2.39 billion,** expressed as present value over 2026-2050.

PO3 includes the administrative costs related to the common measures and the costs related to the additional measures under PO2 (except for PM1). In addition, the introduction of RSI for motorcycles (PM15) is expected to lead to recurrent administrative costs (i.e., labour costs for the additional inspections), estimated at EUR 1 million in 2030 and EUR 1.3 million in 2050[170] (EUR 19.5 million expressed as present value over 2026-2050). Thus, the total one-off and recurrent administrative costs for authorities due to PO3 would be close to **EUR 2.40 billion,** expressed as present value over 2026-2050 relative to the baseline.

Enforcement costs. No enforcement costs for national authorities are expected in PO1a and PO2. In **PO1b** recurrent enforcement costs are due to the introduction of mandatory PTI for motorcycles above 125cm3 (PM2) that will imply some extra costs for the authorities that are responsible for monitoring the operation of the system, for evaluating the quality and impartiality of the additional tests. Recurrent enforcement costs in PO1b are estimated at EUR 1.7 million in 2030 and EUR 2.1 million in 2050[171] (see Table 5), or **EUR 32.9 million** expressed as present value over 2026-2050 relative to the baseline. Similarly, in **PO3**, the extended scope of PTI to all motorcycles (PM3) is expected to result in monitoring costs of EUR 2 million in 2030 and EUR 2.5 million in 2050 (EUR 38.1 million expressed as present value over 2026-2050) and the mandatory PTI for light trailers (PM4) will lead to monitoring costs of EUR 2.1 million in 2030 and EUR 2.3 million in 2050[172] (EUR 39.2 million expressed as present value over 2026-2050). Total recurrent enforcement costs for PO3 are thus estimated at **EUR 77.4 million**, expressed as present value over 2026-2050 (see Table 4).

Administrative cost savings. Recurrent cost savings for national administrations arise from the common measures PMC6 (roadworthiness certificate in electronic format) and PMC7 (the interlinking of national vehicle registers) in all policy options, as well as from PM16 (issuing digital registration certificates) included in PO1a, PO2 and PO3. The savings are expected to be significant in all options, and especially under **PO1a, PO2 and PO3**, reaching **EUR 5.23 billion**, expressed as present value over 2026-2050 (see Table 4). In **PO1b** they are estimated to be lower, at **EUR 3.80 billion**. The largest potential savings are expected from PMC6, due to issuing the roadworthiness certificates in electronic format only, estimated at EUR 167.3 million in 2030 and EUR 190.6 million in 2050 (EUR 3.16 billion expressed as present value over 2026-2050)[173]. Cost savings related to PMC7, due to the time saved for the re-registration of a vehicle in another Member State, are estimated at EUR 35.8 million per year from 2026 onwards (EUR 641.8 million expressed as present value over 2026-2050)[174]. In addition, PM16 will bring further recurrent

[168] Recurrent administrative costs for maintenance are estimated at around 10% of the capital costs.
[169] The additional number of inspections due to the measures is estimated at 497,627 in 2030 and 588,721 in 2050. The cost per inspection is estimated at EUR 11.3.
[170] For the 20 Member States concerned (excluding SE, SI, AT, FI, DK, HU, RO that already perform such inspections) the number of additional inspections is estimated at 176,228 in 2030 and 227,291 in 2050 relative to the baseline. The cost per inspection is estimated at EUR 5.7.
[171] An average monitoring cost of EUR 2.25 per PTI for motorcycles.
[172] An average monitoring cost of EUR 1.5 per PTI for light trailers.
[173] The cost of a paper roadworthiness (RW) certificate is estimated at 1 EUR per certificate. The number of RW certificates issued in paper format in the baseline is estimated at 167.3 million in 2030 and 190.6 million in 2050.
[174] PMC7 is expected to lead to time savings of around 15 minutes per re-registration of a vehicle in another Member State because of less need of reaching out to other National Contact Points by phone/mail.

administrative costs savings for national public authorities, by avoiding the costs of printing, distribution and handling of paper/plastic registration certificates, estimated at EUR 79.3 million in 2030 and EUR 86.3 million in 2050 (EUR 1.43 billion expressed as present value over 2026-2050)[175].

Net benefits. All policy options are expected to lead to net benefits for national public authorities. Net benefits, expressed as present value over 2026-2050 relative to the baseline, are estimated to be the highest in PO1a (EUR 2.99 billion), followed by PO2 (EUR 2.63 billion), PO3 (EUR 2.54 billion) and PO1b (EUR 1.38 billion).

Table 4: Recurrent and one-off costs, and costs savings for national public authorities in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Adjustment costs	**7.0**	**198.3**	**207.2**	**208.0**
PMC2	0.2	0.2	0.2	0.2
PMC3	1.3	1.3	1.3	1.3
PMC4	3.8	3.8	3.8	3.8
PM1	0.3		0.3	
PM9	1.4			
PM12		192.9	192.9	192.9
PM13		0.3	0.3	0.3
PM14			8.6	8.6
PM15				1.1
Administrative costs	**2,233.8**	**2,190.4**	**2,387.5**	**2,397.9**
PMC6	33.7	33.7	33.7	33.7
PMC7	15.4	15.4	15.4	15.4
PMC8	9.4	9.4	9.4	9.4
PMC9	2,122.1	2,122.1	2,122.1	2,122.1
PM1	9.1		9.1	
PM11			36.3	36.3
PM13		9.8	9.8	9.8
PM14			107.5	107.5
PM15				19.5
PM16	35.8		35.8	35.8
PM17	8.4		8.4	8.4
Enforcement costs	0.0	32.9	0.0	77.4
PM2		32.9		
PM3				38.1
PM4				39.2
Administrative costs savings	**5,226.3**	**3,796.8**	**5,226.3**	**5,226.3**
PMC6	3,155.0	3,155.0	3,155.0	3,155.0
PMC7	641.8	641.8	641.8	641.8
PM16	1,429.5		1,429.5	1,429.5
Net benefits	**2,985.5**	**1,375.2**	**2,631.6**	**2,543.1**

Source: Ricardo et al. (2024), Impact assessment support study

175 The costs savings due to PM16 are limited to the time spent for preparing and printing the documents and the costs of delivering the documents. It is assumed that around 2 minutes of work per document could be saved, at an average cost per hour for technicians and associate professionals (ISCO level 3) of EUR 34, plus EUR 2 per document for paper and mail cost.

Table 5: Recurrent and one-off costs, and costs savings for national public authorities in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**4.6**	**0.1**	**0.1**	**36.1**	**9.6**	**9.6**	**39.6**	**9.9**	**9.9**	**39.9**	**9.9**	**9.9**
PMC2	0.2			0.2			0.2			0.2		
PMC3	0.7	0.03	0.03	0.7	0.03	0.03	0.7	0.03	0.03	0.7	0.03	0.03
PMC4	2.1	0.1	0.1	2.1	0.1	0.1	2.1	0.1	0.1	2.1	0.1	0.1
PM1	0.1	0.01	0.01				0.1	0.01	0.01			
PM9	1.4											
PM12				33.0	9.4	9.4	33.0	9.4	9.4	33.0	9.4	9.4
PM13				0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
PM14							3.4	0.3	0.3	3.4	0.3	0.3
PM15										0.45	0.04	0.04
Administrative costs	176.9	115.3	129.7	161.9	113.7	128.0	197.1	122.8	138.3	197.6	123.3	139.0
PMC6	18.6	0.9	0.9	18.6	0.9	0.9	18.6	0.9	0.9	18.6	0.9	0.9
PMC7	8.5	0.4	0.4	8.5	0.4	0.4	8.5	0.4	0.4	8.5	0.4	0.4
PMC8	1.2	0.5	0.5	1.2	0.5	0.5	1.2	0.5	0.5	1.2	0.5	0.5
PMC9	133.1	111.4	125.6	133.1	111.4	125.6	133.1	111.4	125.6	133.1	111.4	125.6
PM1	0.5	0.5	0.6				0.5	0.5	0.6			
PM11							14.3	1.3	1.3	14.3	1.3	1.3
PM13				0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6
PM14							5.4	5.6	6.7	5.4	5.6	6.7
PM15										1.0	1.0	1.3
PM16	14.1	1.3	1.3				14.1	1.3	1.3	14.1	1.3	1.3
PM17	0.9	0.4	0.4				0.9	0.4	0.4	0.9	0.4	0.4
Enforcement costs	**0.0**	**0.0**	**0.0**	**1.6**	**1.7**	**2.1**	**0.0**	**0.0**	**0.0**	**3.9**	**4.0**	**4.8**
PM2				1.6	1.7	2.1						
PM3										1.9	2.0	2.5
PM4										2.0	2.1	2.3
Administrative costs savings	**272.7**	**282.3**	**312.7**	**197.3**	**203.0**	**226.4**	**272.7**	**282.3**	**312.7**	**272.7**	**282.3**	**312.7**
PMC6	161.5	167.3	190.6	161.5	167.3	190.6	161.5	167.3	190.6	161.5	167.3	190.6
PMC7	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
PM16	75.4	79.3	86.3				75.4	79.3	86.3	75.4	79.3	86.3
Net benefits	**91.2**	**166.8**	**182.9**	**-2.4**	**78.1**	**86.7**	**35.9**	**149.6**	**164.5**	**31.2**	**145.0**	**159.0**

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 6: One-off costs for national public authorities in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**4.4**	**0.0**	**0.0**	**26.5**	**0.0**	**0.0**	**29.7**	**0.0**	**0.0**	**30.0**	**0.0**	**0.0**
PMC2	0.2			0.2			0.2			0.2		
PMC3	0.7			0.7			0.7			0.7		
PMC4	2.0			2.0			2.0			2.0		
PM1	0.1						0.1					
PM9	1.4											
PM12				23.6			23.6			23.6		
PM13				0.03			0.03			0.03		

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM14							3.1			3.1		
PM15										0.4		
Administrative costs	**64.9**	**0.0**	**0.0**	**51.6**	**0.0**	**0.0**	**77.9**	**0.0**	**0.0**	**77.9**	**0.0**	**0.0**
PMC6	17.8			17.8			17.8			17.8		
PMC7	8.1			8.1			8.1			8.1		
PMC8	0.7			0.7			0.7			0.7		
PMC9	25.0			25.0			25.0			25.0		
PM11							13.0			13.0		
PM16	12.8						12.8			12.8		
PM17	0.5						0.5			0.5		
Net costs	**69.3**	**0.0**	**0.0**	**78.1**	**0.0**	**0.0**	**107.6**	**0.0**	**0.0**	**107.9**	**0.0**	**0.0**

Source: Ricardo et al. (2024), Impact assessment support study

6.1.2. *Impacts on businesses*

This section describes the impacts on affected businesses, primarily PTI stations, but also garage equipment manufacturers, garages, motor vehicle dealers, various repair workshops, vehicle manufacturers and other businesses (i.e., vehicle owners). The costs, costs savings and other benefits by policy option are discussed below, while the detailed calculations by policy measure are provided in Annex 4 (section 3).

6.1.2.1. Impacts on PTI centres

The vast majority of periodic technical inspections are conducted by businesses. In some Member States periodic technical inspections can be performed by the central licencing authority in the country and/or public inspection centres (i.e., governmental owned vehicle inspection centres), in addition (e.g. EL, ES, HU, LV, RO) or instead (e.g. LU) of private inspection centres. On the other hand, in AT and NL, they are performed by thousands of commercial garages. Annex 6 provides more details on this point. Given the diversity at Member State level and the fact that in most Member States PTIs are mostly performed by private inspection centres (e.g., in RO, less than 5% of the tests are performed by public authorities), the PTI centres were classified under businesses for the purpose of this impact assessment. The precise share of periodic technical inspections carried out by private entities is not available.

All policy options result in adjustment costs for PTI centres, while PO2 and PO3 also lead to administrative costs. On the other hand, all policy options are expected to generate benefits for PTI centres due to the increased number of inspections, and PO2 and PO3 will also lead to administrative costs savings (see Table 7 to Table 10).

Depending on the Member State, the additional costs for the PTI centres due to the additional requirements per PTI may be passed through to vehicle owners (i.e. citizens and businesses). This will depend on how PTI charges are set by the Member State: where prices are not regulated, it is likely that PTI centres will seek to recover investment costs, possibly on a relatively short term. On the other hand, in Member States that regulate the level of PTI charges, the evolution of those charges will depend on the public contract agreed with the PTI service provider, potentially subject to renegotiation, or on the price-setting policy of the authority that is itself responsible for PTI. In these cases, costs may either be borne by the service provider/authority or be recovered over a longer period. Considering the complexity of the process, and the uncertainty related to the degree of pass-through of the costs as well as the time horizon for passing-through the costs, in this impact assessment it has been assumed that the additional costs for the PTI centres are partly borne by them (i.e. for those measures that would increase the cost per PTI). On the other hand, the higher costs due to the increased number of inspections (i.e. due to the extended scope) are fully passed through to the vehicle owners, and represent benefits for the PTI centres.

Adjustment costs. In **PO1a**, adjustment costs for PTI centres are only due to common measures included in all options, namely PMC1, PMC2, PMC3, and PMC4. They cover one-off adjustment costs (see Table 10) for: the acquisition of tools adapted to the PTI of electric and hybrid vehicles and training of inspectors[176] (PMC1), estimated at EUR 119.8 million in 2026 and EUR 24.4 million in 2030; the software update for reading on-board diagnostics and training of inspectors[177] (PMC2), estimated at EUR 96.1 million in 2026; the purchase of devices for the PN counting and training of inspectors[178] (PMC3), estimated at EUR 372.7 million in 2026; and, the acquisition of NOx measurement equipment and training of inspectors (PMC4)[179], estimated at EUR 1.48 billion in 2026. In addition, recurrent adjustment costs (i.e., maintenance and calibration costs) for the PN and NOx measurement equipment are assumed at 5% of the capital costs, based on stakeholders' feedback, and are estimated at EUR 18.1 million per year from 2026 onwards in PMC3 and at EUR 73.3 million per year in PMC4 (see Table 9). Expressed as present value over 2026-2050, the total one-off and recurrent adjustment costs are estimated at EUR 143.6 million for PMC1, EUR 96.1 million for PMC2, EUR 697.1 million for PMC3 and EUR 2.80 billion for PMC4 (see Table 7). Thus, PO1a results in total one-off and recurrent adjustment costs of around **EUR 3.73 billion**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 2.09 billion one-off costs. The largest share of total adjustment costs in PO1a is due to PMC4 (75% of the costs), followed by PMC3 (19%).

In **PO1b**, in addition to the costs entailed by the common measures (same as under PO1a), the mandatory PTI for motorcycles above 125cm3 (PM2), the annual emission testing for light commercial vehicles (PM5), the mandatory yearly testing of vehicles that are 10-year-old or older (PM6), the more advanced testing of noise for motorcycles (PM10), and the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission tests in a PTI centre (PM12) will also lead to one-off and recurrent adjustment costs. For PM2, the one-off adjustment costs are driven by the additional PTI lanes needed to deliver the inspections and the training of inspectors in the seven Member States where PTI is currently not in place for motorcycles above 125cm3[180] and are estimated at EUR 3.3 million in 2026 and up to EUR 40,000 per year post-2026 (see Table 10)[181], while the recurrent costs (i.e., maintenance costs for the PTI lanes and labour costs for the additional inspections)[182] are estimated at EUR 8.9 million in 2030 and EUR 11.1 million in 2050 relative to the

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[176] One stakeholder (FSD – the German PTI agency) provided a cost estimate of EUR 500 per tool for measuring insulation resistance and equipotential bonding. One such tool per PTI centre would need to be acquired in 2026 by the 48,880 PTI centres in the EU, with a second one added in 2030. A three-day training per PTI inspector would be needed for the 128,536 inspectors across EU.

[177] The cost for the software update is estimated at EUR 500 per PTI tool and 128,536 PTI tools in the EU would need to be updated. A one-day training per inspector would be needed.

[178] For the 36,173 PTI centres in the EU affected by this measure (excluding BE, DE and NL, which have already introduced such testing and are thus part of the baseline), two PN measurement devices per PTI inspection centre would be needed. The price per PN measurement equipment is estimated at EUR 5,000. An additional half day of training related to the use of PN-testing for 88,776 inspectors (excluding BE, DE and NL) is assumed to take place in 2026.

[179] The cost per NOx measurement equipment is estimated at EUR 15,000 and each of the 48,880 PTI centres in the EU is assumed to be equipped with two devices. An additional half day training related to the use of NOx testing is assumed to take place for the 128,536 inspectors across EU.

[180] BE, FI, IE, NL, MT, PT and DK.

[181] The additional number of inspections in the 7 MS is estimated at 751,660 in 2030 and 941,911 in 2050. 204 additional PTI lanes would be needed in total over 2026-2050 relative to the baseline. The cost per PTI lane is estimated at EUR 20,000. A two-day training for the additional inspectors is assumed.

[182] Recurrent maintenance costs for the PTI lanes are assumed at 10% of the capital costs (i.e. EUR 2,000 per lane). The labour costs per inspection are estimated at EUR 11.3.

baseline. For PM5, the one-off adjustment costs are due to the additional PN and NOx measurement equipment needed for the annual emission testing of light commercial vehicles and training of inspectors in all Member States, and are estimated at EUR 20.1 million. At the same time, the recurrent costs associated with PM5 cover the maintenance costs for the equipment and the labour costs for the additional PN and NOx testing, and they are estimated at EUR 49.2 million in 2030 and EUR 4.9 million in 2050 relative to the baseline[183]. For PM6, 11 Member States that do not require annual PTI testing of cars and vans after 10 years of their registration would be affected[184]. The additional number of PTIs for cars due to PM6 is estimated at 42.1 million in 2030 and 47.5 million in 2050 and for vans at 4.5 million in 2030 and 5.2 million in 2050. Thus, this measure would require a very significant increase in the number of PTI lanes and trained inspectors over time, with one-off adjustment costs estimated at EUR 1.01 billion in 2026, EUR 4.9 million in 2030 and EUR 1.7 million in 2050[185] (see Table 10). It would also lead to significantly higher maintenance costs for the PTI lanes and labour costs for performing the inspections, with total recurrent costs estimated at EUR 886 million in 2030 and EUR 995.7 million in 2050 relative to the baseline. PM10 would result in one-off adjustment costs for the acquisition of noise measurement devices and training of inspectors in the 23 Member States that currently do not measure L-vehicles noise emissions at PTI[186], estimated at EUR 4.7 million (see Table 10)[187], and in recurrent costs (i.e., maintenance costs for the devices and labour costs for the additional testing time)[188] of EUR 61.8 million in 2030 and EUR 73.7 million in 2050 relative to the baseline. For PM12, the additional number of emission tests for internal combustion engine vehicles (i.e. for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission test in a PTI centre) is estimated at 2.4 million in 2030 and 174,609 in 2050 relative to the baseline[189]. PM12 is expected to lead to additional labour costs for performing the tests, estimated at EUR 8 million in 2030 and EUR 0.6 million in 2050 relative to the baseline[190]. Expressed as present value over 2026-2050, the costs of PM2 are estimated at EUR 175.7 million, those of PM5 at EUR 647.7 million, the costs of PM6 at EUR 17.68 billion, those of PM10 at EUR 1.17 billion and the costs of PM12 at EUR 99 million. Thus, PO1b results in total one-off and recurrent adjustment costs of around **EUR 23.51 billion**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 3.22 billion one-off costs (see Table 7 and Table 8). The largest share of the total adjustment costs in PO1b is by far due to PM6 (75% of the costs), followed by PMC4 (12% of the costs), PM10 (5% of the costs) and PMC3 (3% of the costs). The common measures, together, represent only 16% of the costs.

Total one-off and recurrent adjustment costs of **PO2** are very similar to those of PO1b, without however including the costs due to PM2. They are estimated at **EUR 23.33 billion**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 3.22 billion one-off costs (see Table 7 and Table 8). The most significant policy measures in terms of costs in PO2 are similar to those in PO1b.

[183] The recurrent costs decrease over time due to the decreasing number of internal combustion light commercial vehicles that require PN and NOx testing.
[184] CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT and SK.
[185] Based on an interview with TUV Rheinland, the cost of a new PTI lane is assumed at EUR 50,000. Each new lane for cars in 2026 will also require one set of PN and NOx testing equipment. Additional PN testing and NOx testing equipment is assumed only for cars as the costs for such equipment related to vans is already reflected in PM5.
[186] Few MSs (DE, ES, HR and SK) are already measuring L-vehicles noise emissions at PTI.
[187] The cost for purchasing a noise measurement device is estimated at EUR 800 per device, and 2 devices are assumed to be needed for each PTI centre with a test track. A half a day of training is assumed per inspector.
[188] Recurrent adjustment costs for the maintenance and calibration of devices are assumed at 5% of the capital cost. The additional noise testing is estimated to take around 15 minutes per PTI.
[189] The decrease in the number of emission tests is driven by the increase in the number of zero-emission vehicles over time in the baseline.
[190] Due to the small share of the fleet affected it is assessed that no additional emission testing equipment will be needed and that the available PTI lanes will be able to serve the additional demand.

PO3 includes the same adjustment costs as in PO2, but leads to additional one-off and recurrent adjustment costs for extending the PTI to all motorcycles (PM3), for making PTI mandatory for light trailers (PM4) and for further harmonisation of test methods (PM7). For PM3, the one-off adjustment costs for extending the PTI to motorcycles from 50cm3 in the eight Member States where such requirement is currently not in place[191] are estimated at EUR 3.8 million in 2026 and up to EUR 60,000 per year post-2026[192], while the recurrent adjustment costs at EUR 10.2 million in 2030 and EUR 13 million in 2050 relative to the baseline[193]. For PM4[194], the one-off costs for the additional PTI lanes and the training of inspectors are estimated at EUR 1 million in 2026 and up to EUR 20,000 per year post-2026[195], and the recurrent costs (i.e., for the maintenance of the PTI lanes and the labour costs for the additional inspections) at EUR 11.9 million in 2030 and EUR 13.4 million in 2050. In PM7, PTI centres in the Member States with lower-stringency roadworthiness systems will need to acquire new equipment to enhance their capacity, including an advanced brake testing device and a suspension tester. One-off costs for equipment and training due to PM7 are estimated at EUR 367 million in 2026 and EUR 122.2 million in 2030[196], and recurrent costs for maintenance at EUR 48 million in 2030 and in 2050. Thus, PO3 results in total one-off and recurrent adjustment costs of **EUR 25.06 billion**, expressed as present value over 2026-2050 relative to the baseline, of which EUR 3.71 billion one-off costs (see Table 7 and Table 8). The largest share of the total adjustment costs in PO3 is by far due to PM6 (71% of the costs), followed by PMC4 (11% of the costs), and PM7 and PM10 (5% of the costs each). The common measures, together, represent only 15% of the costs in PO3.

Garage equipment manufacturers will benefit from the measures that require the acquisition of new or more testing equipment by PTI centres[197].

Administrative costs. No administrative costs are expected for PTI centres under PO1a and PO1b. In **PO2** and **PO3**, administrative costs would result from the data governance (PM11), related to the need of the PTI centres to adapt their IT systems. The one-off administrative costs for the adaptation of the IT systems is estimated at EUR 1,000 per centre. Total one-off administrative costs would therefore amount to EUR 48.9 million in 2026 for the 48,880 PTI centres across the EU (see Table 10). In addition, recurrent administrative costs for the maintenance of the IT systems are estimated at 10% of the capital costs, or EUR 100 per PTI centre. Total recurrent administrative costs are thus estimated at EUR 4.9 million per year from 2026 onwards (see Table 9). Overall, PO2 and PO3 are estimated to result in total one-off and recurrent administrative costs of **EUR 136.5 million**, expressed as present value over 2026-2050 (see Table 7).

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[191] BE, FI, IE, NL, MT, PT, DK and CY (in CY motorcycles above 125cm3 are already covered).

[192] As in PM2, the one-off adjustment costs cover the additional PTI lanes needed to deliver the inspections and the training of inspectors. The cost per PTI lane is the same as in PM2. This is also the case of the time required for the training of inspectors.

[193] The recurrent adjustment costs, as in PM2, cover the maintenance costs for the PTI lanes and labour costs for the additional inspections. More details are available in Annex 4 (section 3).

[194] Eleven MS would be affected by PM4: 7 MS where there is currently no requirement for PTI for either O1 or O2 (DK, EL, FI, FR, NL, IE, PT) and 4 MS where there is currently only a requirement for PTI for O2 (PL, SK, BE and ES).

[195] The cost of an additional PTI lane for trailers is estimated at EUR 10,000 per lane.

[196] For HDV brake testing using extrapolation methods, an average one-off cost of EUR 2,500 is assumed per PTI centre. The purchase cost of a suspension tester for light vehicles is around EUR 10,000. Considering the 11 Member States with lower-stringency roadworthiness systems, 29,922 of the 48,880 PTI centres would have to invest into advanced brake testing equipment and 28,322 into suspension testers. An average of 4 hours of training is assumed per inspector.

[197] Among the common measures and thus in PO1a, the most important in this respect are those related to the new emission tests (PMC3 and PMC4). In PO1b, PO2 and PO3, these businesses would also benefit from additional demand for testing equipment generated mainly by annual emission testing of vans (PM5), the noise testing of motorcycles (PM10), and especially due to the annual PTI for cars and vans above 10 years of age (PM6). The benefits from mandatory PTI for heavy motorcycles (PM2 in PO1b) would be limited since only a few Member States would be affected. PO3 would bring additional benefits to garage equipment manufacturers through testing all motorcycles and trailers (PM3 and PM4). Furthermore, PM7 would increase the need for more advanced testing equipment.

Administrative costs savings. The data governance (PM11), included in **PO2** and **PO3**, is also expected to lead to administrative costs savings for the PTI centres. The access to relevant technical information would bring some limited time savings for PTI centres for performing the PTIs[198], with recurrent administrative costs savings estimated at EUR 87.1 million in 2030 and EUR 99.3 million in 2050 (see Table 9). This is equivalent to **EUR 1.64 billion**, expressed as present value over 2026-2050 relative to the baseline (see Table 7). No administrative costs savings are expected for PO1a and PO1b.

Benefits from additional periodic technical inspections. PTI centres will benefit from the extension of the scope of PTI and more frequent testing of certain vehicle categories[199]. In **PO1a**, the benefits stemming from the mandatory roadworthiness testing following significant modifications of the vehicle (PMC5) are estimated at EUR 45.5 million in 2030 and EUR 52.3 million in 2050, relative to the baseline (**EUR 860.5 million** expressed as present value over 2026-2050). **PO1b** includes the same benefits as PO1a, due to the common measure (PMC5), and adds additional benefits for the PTI centres due to the mandatory PTI for motorcycles above 125cm3 (PM2), the annual emission testing of light commercial vehicles (PM5), the mandatory yearly testing of vehicles that are 10-year-old or older (PM6) and the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission tests in a PTI centre (PM12). Of these measures, the highest benefits are estimated for PM6 (1.94 billion in 2030 and EUR 2.19 billion in 2050; EUR 36.54 billion expressed as present value over 2026-2050), followed by PM5 (EUR 115 million in 2030 and EUR 9.4 million in 2050; EUR 1.46 billion expressed as present value over 2026-2050), PM2 (EUR 15.1 million in 2030 and EUR 19 million in 2050; EUR 294.1 million expressed as present value over 2026-2050) and PM12 (EUR 19.7 million in 2030 and EUR 1.6 million in 2050; EUR 247.2 million expressed as present value over 2026-2050). Thus, PO1b results in total benefits of 2.14 billion in 2030 and EUR 2.27 billion in 2050, relative to the baseline (**EUR 39.39 billion** expressed as present value over 2026-2050). In **PO2** the total benefits are slightly lower than in PO1b as it includes the same measures except for the mandatory PTI for motorcycles above 125cm3 (PM2). They are estimated in total at EUR 2.12 billion in 2030 and EUR 2.26 billion in 2050. Expressed as present value over 2026-2050, the benefits for PTI centres due to PO2 amount to **EUR 39.10 billion**. The highest benefits would be realised under **PO3**, which in addition to the measures of PO2, adds the extension of PTI to all motorcycles (PM3) and the mandatory PTI for light trailers (PM4). They are estimated at EUR 2.17 billion in 2030 and EUR 2.31 billion in 2050, relative to the baseline (**EUR 39.97 billion** expressed as present value over 2026-2050). PM6 generates around 93% of the total benefits for PTI centres in PO1b and PO2 and 91% of the total benefits in PO3.

Net costs/benefits for PTI centres. PO1a results in net costs for the PTI centres estimated at EUR 2.87 billion, expressed as present value over 2026-2050 relative to the baseline. On the other hand, PO1b, PO2 and PO3 result in net benefits for the PTI centres, mainly driven by the measure on the yearly testing of older vehicles. The highest net benefits are estimated for PO2 (EUR 17.27 billion, expressed as present value over 2026-2050 relative to the baseline), followed by PO3 (EUR 16.41 billion) and PO1b (EUR 15.89 billion).

Table 7: Recurrent and one-off costs, costs savings and benefits for PTI centres in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	**3,734.1**	**23,507.9**	**23,332.2**	**25,061.7**

[198] Time savings of 3 minutes are assumed per PTI. This represents 10% of the average of 30 minutes per PTI for a car. Not all PTI centres are expected to benefit of this measure, as access to relevant information is often already available. It is expected that only 30% of PTIs would benefit of PM11.

[199] The benefits (i.e. revenues) for the PTI centres are derived based on the number of additional inspections performed relative to the baseline, depending on the policy measure, and the PTI charges per vehicle category. More details are provided in Annex 4 (section 3).

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
PMC1	143.6	143.6	143.6	143.6
PMC2	96.1	96.1	96.1	96.1
PMC3	697.1	697.1	697.1	697.1
PMC4	2,797.3	2,797.3	2,797.3	2,797.3
PM2		175.7		
PM3				203.9
PM4				225.4
PM5		647.7	647.7	647.7
PM6		17,680.8	17,680.8	17,680.8
PM7				1,300.2
PM10		1,170.6	1,170.6	1,170.6
PM12		99.0	99.0	99.0
Administrative costs	**0.0**	**0.0**	**136.5**	**136.5**
PM11			136.5	136.5
Administrative costs savings	0.0	0.0	1,643.4	1,643.4
PM11			1,643.4	1,643.4
Benefits	**860.5**	**39,394.2**	**39,100.1**	**39,968.0**
PMC5	860.5	860.5	860.5	860.5
PM2		294.1		
PM3				341.3
PM4				526.6
PM5		1,454.8	1,454.8	1,454.8
PM6		36,537.6	36,537.6	36,537.6
PM12		247.2	247.2	247.2
Net benefits	**-2,873.6**	**15,886.2**	**17,274.7**	**16,413.2**

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 8: One-off costs for PTI centres in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	**2,094.7**	**3,221.3**	**3,217.4**	**3,708.7**
PMC1	143.6	143.6	143.6	143.6
PMC2	96.1	96.1	96.1	96.1
PMC3	372.7	372.7	372.7	372.7
PMC4	1,482.3	1,482.3	1,482.3	1,482.3
PM2		3.9		
PM3				4.5
PM4				1.1
PM5		20.1	20.1	20.1
PM6		1,097.9	1,097.9	1,097.9
PM7				485.6
PM10		4.7	4.7	4.7
Administrative costs	**0.0**	**0.0**	**48.9**	**48.9**
PM11			48.9	48.9
Net costs	**2,094.7**	**3,221.3**	**3,266.3**	**3,757.6**

Source: Ricardo et al. (2024), Impact assessment support study

Table 9: Recurrent and one-off costs, costs savings and benefits for PTI centres in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	2,162	115.8	91.4	4,186	1,130	1,177	4,175	1,121	1,166	4,603	1,313	1,241
PMC1	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0
PMC2	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0
PMC3	390.8	18.1	18.1	390.8	18.1	18.1	390.8	18.1	18.1	390.8	18.1	18.1
PMC4	1,556	73.3	73.3	1,556	73.3	73.3	1,556	73.3	73.3	1,556	73.3	73.3
PM2				11.9	8.9	11.1						
PM3										13.7	10.2	13.0
PM4										12.3	11.9	13.4
PM5				69.6	49.2	4.9	69.6	49.2	4.9	69.6	49.2	4.9
PM6				1,870	886.0	995.7	1,870	886.0	995.7	1,870	886.0	995.7
PM7										402.8	170.2	48.0
PM10				63.6	61.8	73.7	63.6	61.8	73.7	63.6	61.8	73.7
PM12				8.6	8.0	0.6	8.6	8.0	0.6	8.6	8.0	0.6
Admin costs	0.0	0.0	0.0	0.0	0.0	0.0	53.8	4.9	4.9	53.8	4.9	4.9
PM11							53.8	4.9	4.9	53.8	4.9	4.9
Admin costs savings	0.0	0.0	0.0	0.0	0.0	0.0	84.1	87.1	99.3	84.1	87.1	99.3
PM11							84.1	87.1	99.3	84.1	87.1	99.3
Benefits	44.1	45.5	52.3	2,086	2,135	2,275	2,071	2,120	2,256	2,115	2,166	2,309
PMC5	44.1	45.5	52.3	44.1	45.5	52.3	44.1	45.5	52.3	44.1	45.5	52.3
PM2				14.8	15.1	19.0						
PM3										17.0	17.5	22.1
PM4										26.6	28.0	31.5
PM5				115.8	115.0	9.4	115.8	115.0	9.4	115.8	115.0	9.4
PM6				1,890	1,940	2,192	1,890	1,940	2,192	1,890	1,940	2,192
PM12				21.4	19.7	1.6	21.4	19.7	1.6	21.4	19.7	1.6
Net benefits	-2,118	-70.3	-39.1	-2,100	1,006	1,097	-2,073	1,082	1,184	-2,458	934.7	1,163

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 10: One-off costs for PTI centres in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**2,071**	**24.4**	**0.0**	**3,111**	**29.4**	**1.7**	**3,107**	**29.3**	**1.7**	**3,479**	**151.6**	**1.7**
PMC1	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0
PMC2	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0
PMC3	372.7	0.0	0.0	372.7	0.0	0.0	372.7	0.0	0.0	372.7	0.0	0.0
PMC4	1,482	0.0	0.0	1,482	0.0	0.0	1,482	0.0	0.0	1,482	0.0	0.0
PM2				3.3	0.02	0.04						
PM3										3.8	0.02	0.06
PM4										1.0	0.02	0.00
PM5				20.1	0.0	0.0	20.1	0.0	0.0	20.1	0.0	0.0
PM6				1,012	4.9	1.7	1,012	4.9	1.7	1,012	4.9	1.7
PM7										367.0	122.2	0.0
PM10				4.7	0.0	0.0	4.7	0.0	0.0	4.7	0.0	0.0
Administrative costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**48.9**	**0.0**	**0.0**	**48.9**	**0.0**	**0.0**

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM11							48.9	0.0	0.0	48.9	0.0	0.0
Net costs	**2,071**	**24.4**	**0.0**	**3,111**	**29.4**	**1.7**	**3,156**	**29.3**	**1.7**	**3,528**	**151.6**	**1.7**

Source: Ricardo et al. (2024), Impact assessment support study

Net costs/benefits per PTI centre. Looking at the costs and benefits per PTI centre (see Table 11), expressed as present value over 2026-2050, reveals that the highest total costs per PTI centre are expected in PO3 (EUR 516 thousand), followed by PO1b (EUR 481 thousand), PO2 (EUR 480 thousand) and PO1a (EUR 76 thousand). The highest benefits (including costs savings) are however also projected for PO3 (EUR 851 thousand), followed by PO2 (EUR 834 thousand), PO1b (EUR 806 thousand) and PO1a (EUR 18 thousand). The highest net benefits are however estimated for PO2 at EUR 353 thousand, followed by PO3 at EUR 336 thousand and PO1b at EUR 325 thousand, while PO1a results in net costs of around EUR 59 thousand. Net benefits in PO2 represent around 6.3% of the turnover per PTI centre, in PO3 around 6% of the turnover, in PO1b around 5.8% of the turnover per PTI centre, while the net costs in PO1a around 1.1% of the turnover.

Table 11: Recurrent and one-off costs, costs savings and benefits per PTI centre in the policy options, expressed as present value over 2026-2050 relative to the baseline, in thousand EUR (2022 prices) and share of the turnover

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	76.4	480.9	477.3	512.7
Administrative costs	0.0	0.0	2.8	2.8
Administrative costs savings	0.0	0.0	33.6	33.6
Benefits from additional periodic technical inspections	17.6	805.9	799.9	817.7
Net benefits	-58.8	325.0	353.4	335.8
Share of turnover (%)				
Adjustment costs	1.4%	8.6%	8.6%	9.2%
Administrative costs	0.0%	0.0%	0.1%	0.1%
Administrative costs savings	0.0%	0.0%	0.6%	0.6%
Benefits from additional periodic technical inspections	0.3%	14.5%	14.4%	14.7%
Net benefits	-1.1%	5.8%	6.3%	6.0%

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

6.1.2.2. Garages, motor vehicle dealers, tyre and repair stations, etc.

Administrative costs. In **all policy options**, the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory (PMC9), is expected to generate one-off and recurrent administrative costs for vehicle repair shops (including tyre, windscreen service, etc.), motor vehicle dealers and other garages. One-off costs for software updates, to allow them to transfer their data to the central national database, are estimated at EUR 229 per company (in 2022 prices)[200]. These costs are relevant for 651,351 companies (470,765 repair shops and garages and 180,586 motor vehicle dealers)[201], excluding those in Belgium and the Netherlands, which implemented the measure already and are part of the baseline. Total one-off administrative costs are thus estimated at EUR 149.2 million in 2026.

[200] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[201] Eurostat, Structural business statistics, Enterprise statistics by size class and NACE Rev.2 activity.

In addition, recurrent administrative costs (i.e., for the maintenance of the software and the time spent for recording the odometer readings) are estimated at EUR 19.4 million in 2030 and 14.9 million in 2050 relative to the baseline[202]. Thus, total one-off and recurrent administrative costs would amount to **EUR 460 million** (EUR 706 per company), expressed as present value over 2026-2050. For the purpose of the *'one in one out approach'*, the average annual recurrent administrative costs over 2026-2035 are estimated at EUR 19.5 million per year[203]. Considering the 651,351 companies relevant for PMC9, the average annual cost per company is estimated at EUR 29.9. In addition, as explained above, the one-off administrative costs are estimated at EUR 149.2 million in 2026.

6.1.2.3. Vehicle manufacturers

Administrative costs. In **PO2** and **PO3**, automobile manufacturers will face administrative costs related to the setting up of a governance framework for providing access to in-vehicle data necessary to carry out PTI and RSI to inspection centres and competent authorities (PM11). According to one manufacturer, the adjustments to their IT systems to ensure access to the relevant data are estimated at EUR 1 million. For the 20 manufacturers, the total one-off administrative costs are estimated at EUR 20 million in 2026. Recurrent administrative costs (i.e., maintenance costs) are estimated at 10% of the capital costs or EUR 100,000 per vehicle manufacturer. Total recurrent costs would amount to EUR 2 million per year from 2026 onwards. Expressed as present value over 2026-2050, one-off and recurrent administrative costs are estimated at **EUR 55.9 million** relative to the baseline (EUR 2.8 million per vehicle manufacturer). No administrative costs are expected for vehicle manufacturers in PO1a and PO1b.

6.1.2.4. Other businesses (vehicle owners)

In all policy options, transport operators and various other businesses that own vehicles will face some administrative costs linked to additional inspections. In all policy options they will benefit due to the reduction in odometer fraud, while in PO1b, PO2 and PO3 they will also enjoy additional cost savings.

Administrative costs. In **PO1a**, the recurrent administrative costs are linked to one common measure (PMC5), which requires that vehicles undergo a roadworthiness test following any significant modification that could affect safety or the environmental performance of the vehicle. The number of vehicles affected by the measure is projected at 0.66 million in 2030 and 0.75 million in 2050 in 20 Member States[204], and the recurrent costs are estimated at EUR 27.8 million in 2030 and EUR 31.6 million in 2050 relative to the baseline[205] (see Table 13). Expressed as present value over 2026-2050, total administrative costs for PO1a amount to EUR **524.2 million** (see Table 12). Some common measures, like those related to the introduction of mandatory PN and NOx testing (PMC3 and PMC4), may lead to a higher charge per PTI for vehicle owners (businesses and citizens), as PTI centres may pass the additional costs of investment in equipment for these tests to their customers. Due to the very diverse organisation of PTI in Member States[206], including different organisational and contractual setups between the competent authorities and PTI centres (which may themselves be run by public authorities or agencies as well as by authorised private companies, large or small), it is not possible to estimate the extent of such cost pass-through. Whether or not it will happen

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[202] The recurrent costs are decreasing over time due to the projected uptake of connected vehicles. No manual encoding is needed for the connected vehicles.
[203] This is calculated as a simple average over 2026-2035, non-discounted.
[204] Around 0.6% of the vehicle fleet is assumed to undergo significant modifications, based on data for ES and DE. PTI following modification is already a requirement in HR, FI, AT, NL, DE, SE and ES, and thus part of the baseline. 60% of the cars registrations and 100% of vans, lorries and buses registrations are undertaken by businesses.
[205] The charge per PTI is used to calculate the costs. For businesses, for the categories of vehicles relevant for them, the average charge per PTI at EU level is estimated at EUR 42.1 per vehicle.
[206] Cf. Annex 6, section 2 and 3.

and when will depend on the specific situation in each Member State, e.g., on the timespan of existing agreements, service contracts, if they can be renegotiated or not, etc.[207]. On the other hand, it should be noted that the higher costs due to the increased number of inspections (i.e. due to the extended scope) are fully passed through to the vehicle owners and reflected in the costs calculations.

In **PO1b**, in addition to PMC5, the annual emission testing for light commercial vehicles (PM5), the yearly testing of vehicles that are 10-year-old or older (PM6), the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission tests in a PTI centre (PM12), and the regular inspection of cargo securing (PM13) will lead to recurrent administrative costs for businesses. For PM5, affecting all Member States, the additional number of emission testing for internal combustion light commercial vehicles is estimated at 14.2 million in 2030 and 1.2 million in 2050 relative to the baseline[208], and the recurrent costs at EUR 115 million in 2030 and EUR 9.4 million in 2050 (EUR 1.46 billion expressed as present value over 2026-2050). For PM6, eleven Member States only require an inspection every two years for cars and vans after 10 years of their registration[209]. Thus, the measure is expected to result in a doubling of the number of inspections for vehicles over 10 years old in these Member States, with costs for businesses (vehicles owners) estimated at EUR 1.24 billion in 2030 and EUR 1.40 billion in 2050 (EUR 23.3 billion expressed as present value over 2026-2050). For PM12, business that own cars, vans and heavy duty vehicles will incur extra costs for emissions testing if the vehicles are identified as high emitters via the use of remote sensing or plume chasing and are sent for PTI due to the 0.5% limit in the capacity for roadside inspections. The recurrent administrative costs are estimated at EUR 14 million in 2030 and EUR 1.2 million in 2050 (EUR 175 million expressed as present value over 2026-2050)[210]. For PM13[211], the extra costs for the additional time for cooperating on the cargo securing inspections would amount to EUR 0.44 million in 2030 and EUR 0.55 million in 2050[212] (EUR 8.5 million expressed as present value over 2026-2050). Thus, total administrative costs for PO1b are estimated at **EUR 25.46 billion**, expressed as present value over 2026-2050. Costs related to PM6 would represent 92% of the total costs of PO1b.

PO2 includes the same costs as in PO1b, and additional recurrent administrative costs related to the extension of the scope of application of roadside inspections to light commercial vehicles (PM14). The extra costs for the additional time for cooperating on roadside inspections in PM14[213] would amount to EUR 10.9 million in 2030 and EUR 12.9 million in 2050[214] (EUR 208 million, expressed as present value over 2026-2050). Total recurrent administrative costs for PO2 are therefore estimated at **EUR 25.67 billion**, expressed as present value over 2026-2050 relative to the baseline. The largest share of the costs in PO2 would be due to PM6 (91% of the costs).

[207] For example, in Ireland, the changes introduced by the 2014 RWP have not resulted in any increase in PTI charges. Any price increase would require government decision based on a detailed business case. However, the PTI operator can still claim indexation through the reduction of a levy that it pays to the competent authority after each test, while keeping the charge per PTI unchanged.
[208] The decrease in the number of emission testing is driven by the decrease in the number of internal combustion light commercial vehicles over time. This is due to the Regulation on CO_2 standards for LDVs that is included in the baseline.
[209] CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT and SK.
[210] The cost of an emission test is estimated at 20% of the PTI charge per vehicle. Around 60% of cars and 100% of vans and heavy duty vehicles are owned by businesses.
[211] Owners of heavy-duty vehicles would be affected by the measure to be introduced by 5 MS (EE, FR, IE, LV and LU).
[212] They are calculated considering an average hourly labour cost of EUR 21.9 for drivers (ISCO 8 - Plant and machine operators and assemblers), the average time per inspection of 20 minutes, and the additional number of roadside inspections (44,813 in 2030 and 55,526 in 2050).
[213] 22 MS will be affected by the measure (except ES, HU, SE, SK and FI, that already conduct such inspections).
[214] They are calculated considering an average hourly labour cost of EUR 21.9 for drivers (ISCO 8 - Plant and machine operators and assemblers), the average time per inspection of 20 minutes, and the additional number of roadside inspections (497,627 in 2030 and 588,721 in 2050).

PO3 includes the same costs as in PO2, and in addition it reflects costs related to the mandatory PTI for light trailers (PM4). Businesses (vehicle owners) would be affected by PM4 when introduced in eleven Member States[215], with recurrent administrative costs estimated at EUR 20.4 million in 2030 and EUR 23.1 million in 2050 (EUR 385.1 million, expressed as present value over the 2026-2050 period). Total recurrent administrative costs for PO3 are thus estimated at **EUR 26.05 billion**, expressed as present value over 2026-2050. Costs related to PM6 represent 89% of the total costs of PO3 and PM5 6% of the costs.

Administrative costs savings. Administrative costs savings are expected to arise in **PO1b, PO2 and PO3** from the possibility to avoid emission testing at PTI in case the vehicle passed a roadside inspection or was found to be in line with the applicable emission limits during a screening by remote sensing (PM12). The number of PTI tests avoided by businesses due to PM12 is estimated at 11.9 million in 2030 and EUR 1 million in 2050[216]. The savings (see Table 12 and Table 13) would amount to EUR 102.6 million in 2030 and EUR 10.1 million in 2050 (**EUR 1.29 billion** expressed as present value over 2026-2050).

Benefits due to avoided odometer fraud. In all policy options, the requirement for mandatory recording and reporting to a national central database of vehicle mileage, whenever a vehicle undergoes repair/ maintenance or in the case of tyre changes/replacement (PMC9)[217] offers very significant benefits to businesses in relation to the reduction of odometer fraud, which currently affects around 4.8% of vehicles in national second-hand sales and 11.3% in cross-border sales. The benefits to businesses due to the avoided odometer fraud reduction are estimated at EUR 6.35 billion in 2030 and EUR 6.99 billion in 2050[218]. Expressed as present value over 2026-2050 the benefits amount to EUR 118.34 billion, relative to the baseline. It should however be acknowledged that there is uncertainty regarding the economic damage caused by odometer fraud and the number of cars affected. For this reason, sensitivity analysis has been performed and is reported in section 7.5 and Annex 4 (section 7).

Net benefits/costs for businesses (vehicle owners). All policy options are expected to result in significant net benefits for businesses (vehicle owners), mainly due to the avoided odometer fraud. The highest net benefits are estimated for PO1a (EUR 117.82 billion), followed by PO1b (EUR 94.17 billion), PO2 (EUR 93.96 billion) and PO3 (EUR 93.58 billion) (see Table 12).

Table 12: Recurrent costs, costs savings and benefits for other businesses (vehicle owners) in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	**524.2**	**25,458.4**	**25,666.4**	**26,051.5**
PMC5	524.2	524.2	524.2	524.2
PM4				385.1
PM5		1,454.8	1,454.8	1,454.8
PM6		23,295.9	23,295.9	23,295.9
PM12		175.0	175.0	175.0
PM13		8.5	8.5	8.5
PM14			208.0	208.0

[215] 7 Member States where there is currently no requirement for PTI for either O1 or O2 (DK, EL, FI, FR, NL, IE, PT) and 4 Member States where there is currently only a requirement for PTI for O2 (PL, SK, BE and ES).
[216] The reason for the decreasing number of PTI tests avoided over time is the increasing share of zero-emission vehicles in the baseline scenario.
[217] PMC9 is relevant for all Member States, except Belgium and the Netherlands that have already introduced such requirement.
[218] The average cost of mileage fraud, due to higher purchase price and maintenance costs incurred, is estimated at EUR 2,119 per vehicle in 2022 prices drawing on a Belgian Car-Pass study (https://www.car-pass.be/files/article_files/file/7/crm%2520study%2520final%2520report.pdf). More explanations are provided in section 2 of Annex 4.

	Difference to the baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Administrative costs savings	**0.0**	**1,287.3**	**1,287.3**	**1,287.3**
PM12		1,287.3	1,287.3	1,287.3
Benefits	**118,340.5**	**118,340.5**	**118,340.5**	**118,340.5**
PMC9	118,340.5	118,340.5	118,340.5	118,340.5
Net benefits	**117,816.3**	**94,169.4**	**93,961.3**	**93,576.3**

Source: Ricardo et al. (2024), Impact assessment support study

Table 13: Recurrent costs, costs savings and benefits for other businesses (vehicle owners) in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**27.0**	**27.8**	**31.6**	**1,362**	**1,394**	**1,443**	**1,372**	**1,405**	**1,456**	**1,392**	**1,425**	**1,479**
PMC5	27.0	27.8	31.6	27.0	27.8	31.6	27.0	27.8	31.6	27.0	27.8	31.6
PM4										19.3	20.4	23.1
PM5				115.8	115.0	9.4	115.8	115.0	9.4	115.8	115.0	9.4
PM6				1,204	1,237	1,400	1,204	1,237	1,400	1,204	1,237	1,400
PM12				14.8	14.0	1.2	14.8	14.0	1.2	14.8	14.0	1.2
PM13				0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.5
PM14							10.5	10.9	12.9	10.5	10.9	12.9
Administrative costs savings	**0.0**	**0.0**	**0.0**	**109.4**	**102.6**	**10.1**	**109.4**	**102.6**	**10.1**	**109.4**	**102.6**	**10.1**
PM12				109.4	102.6	10.1	109.4	102.6	10.1	109.4	102.6	10.1
Benefits	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**
PMC9	6,043	6,353	6,991	6,043	6,353	6,991	6,043	6,353	6,991	6,043	6,353	6,991
Net benefits	**6,016**	**6,325**	**6,959**	**4,791**	**5,062**	**5,558**	**4,780**	**5,051**	**5,545**	**4,761**	**5,030**	**5,522**

Source: Ricardo et al. (2024), Impact assessment support study

6.1.3. Impacts on citizens (vehicle owners)

Vehicle owners can be businesses or citizens. This section discusses only impacts on citizens[219]. The impacts on businesses as vehicle owners are discussed in section 6.1.2.4. In all policy options citizens are expected to be faced with administrative costs, but also with adjustment costs savings and benefits due to avoided odometer fraud. In addition, PO1b, PO2 and PO3 would result in administrative costs savings (see Table 14 and Table 15).

Administrative costs for citizens. In **PO1a**, the recurrent administrative costs for citizens are linked to one common measure which extends the PTI to cover vehicles with significant modifications (PMC5), and to the introduction of roadside inspections for motorcycles over 125cm3 as an alternative to PTI (PM1). For PMC5, the number of vehicles affected is estimated at 0.45 million in 2030 and 0.53 million in 2050 in 20 Member States[220], and the recurrent administrative costs (based on the number of vehicles affected and the cost per PTI) at EUR 17.7 million in 2030 and EUR 20.6 million in 2050 (EUR 336.3 million, expressed as present value over 2026-2050). For PM1, the extra costs for the time spent for cooperating on roadside

[219] Around 40% of cars are owned by citizens (see e.g., https://www.transportenvironment.org/challenges/cars/company-cars/ and https://cleantechnica.com/2022/12/08/european-company-car-market-goes-green/). For motorcycles, it is assumed that 100% are owned by citizens, in lack of more detailed information.
[220] Around 0.6% of the vehicle fleet is assumed to undergo significant modifications, based on data for ES and DE. PTI following modification is already a requirement in HR, FI, AT, NL, DE, SE and ES, and thus part of the baseline.

inspections with the public authorities are estimated at EUR 0.4 million in 2030 and EUR 0.5 million in 2050[221] (EUR 7.9 million, expressed as present value over 2026-2050). Total administrative costs in PO1a are thus estimated at **EUR 344.2 million**, expressed as present value over 2026-2050. As explained in section 6.1.2.4, some common measures, like those related to the introduction of mandatory PN and NOx testing (PMC3 and PMC4), may lead to a higher charge per PTI for vehicle owners (businesses and citizens), as PTI centres may pass the additional costs of investment in equipment for these tests to their customers. However, as explained in section 6.1.2.4, it is not possible to estimate the extent of such cost pass-through. On the other hand, it should be noted that the higher costs due to the increased number of inspections (i.e. due to the extended scope) are fully passed through to the vehicle owners and reflected in the costs calculations.

In the case of **PO1b**, in addition to the costs of the common measure (PMC5), there will be some additional administrative costs for the owners of motorcycles in a few Member States[222] as a result of the mandatory PTI for motorcycles above 125cm3 (PM2), as well as additional costs due to the mandatory yearly testing of vehicles older than 10 years (PM6) and due to the additional emission tests for vehicles that are found as high emitters during remote sensing and are sent for emission tests in a PTI centre (PM12). The related administrative costs for citizens due to PM2 are estimated at EUR 15.1 million in 2030 and EUR 19 million in 2050 (EUR 294.1 million, expressed as present value over 2026-2050). PM6 generates administrative costs estimated at EUR 703.4 million in 2030 and EUR 792.3 million in 2050[223] (EUR 13.24 billion expressed as present value over 2026-2050). For PM12, citizens that own cars will incur extra costs for emissions testing if the vehicles are identified as high emitters via the use of remote sensing and are sent for PTI due to the 0.5% limit in the capacity for roadside inspections. The recurrent administrative costs are estimated at EUR 5.8 million in 2030 and EUR 0.3 million in 2050 (EUR 72.2 million expressed as present value over 2026-2050)[224]. Thus, total administrative costs for citizens under PO1b for the period 2026-2050 are estimated at **EUR 13.94 billion** relative to the baseline.

In **PO2**, the recurrent administrative costs for citizens are driven by the costs of the common measure (PMC5), the introduction of roadside inspections for motorcycles over 125cm3 as an alternative to PTI (PM1), the mandatory yearly testing of vehicles older than 10 years (PM6) and the additional emission tests for vehicles that are found as high emitters during remote sensing and are sent for emission tests in a PTI centre (PM12). The total administrative costs for citizens under PO2 for the period 2026-2050 are estimated at **EUR 13.66 billion** relative to the baseline.

The highest impact on administrative costs for citizens is expected in **PO3**, where additional costs relative to PO2 are due to mandatory extension of PTI to all motorcycles (PM3), mandatory PTI for light trailers (PM4), and the extension of the scope of application of roadside inspections to 2- and 3-wheeled vehicles (PM15). PM6 generates by far the highest administrative costs in PO3, estimated at EUR 703.4 million in 2030 and EUR 792.3 million in 2050 (EUR 13.24 billion expressed as present value over 2026-2050). For PM3, the recurrent administrative costs are estimated at EUR 17.5 million in 2030 and EUR 22.1 million in 2050[225] (EUR 341.3 million over the period 2026-2050), while in PM4 at EUR 7.6 million in 2030 and EUR 8.4 million in 2050 (EUR 141.5 million, expressed as present value over 2026-2050). Finally, the

[221] The additional number of roadside inspections is estimated at 82,566 in 2030 and 104,321 in 2050 in the MS affected (BE, FI, IE, NL, MT and PT). The average time required for a roadside inspection is estimated at 10 minutes and the average hourly labour cost at EUR 29.5.
[222] BE, FI, IE, NL, MT, PT and DK.
[223] 11 MS (CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT and SK) only require an inspection every two years for cars and vans after 10 years of their registration. Thus, the measure is expected to result in a doubling of the number of inspections for vehicles over 10 years old in these Member States. More details are provided in Annex 4 (section 3).
[224] The cost of an emission test is estimated at 20% of the PTI charge per vehicle.
[225] The additional number of inspections in the 8 MS affected (BE, FI, IE, NL, MT, PT, DK, CY) is estimated at 869,017 in 2030 and 1,097,479 in 2050. In Cyprus motorcycles above 125cm3 are already covered.

extension of the scope of application of roadside inspections to 2- and 3-wheeled vehicles is expected to result in some costs due to the time spent for cooperating on inspections, estimated at EUR 0.9 million in 2030 and EUR 1.1 million in 2050 (EUR 16.9 million for the period 2026-2050). The total administrative costs for citizens due to PO3 would amount to **EUR 14.15 billion**, expressed as present value over 2026-2050 relative to the baseline (see Table 14).

Other costs for citizens. The measures aimed at increasing the effectiveness of the PTI and RSI, along with new testing requirements regarding safety, air pollutant emissions and noise, will lead to an increased number of vehicle owners experiencing repair costs to ensure that their vehicles can pass the PTI inspection and remain in use. This may mean costs to replace breaks, axles, suspensions systems, lamps, or other defective components, such as a defective emission control system. It is difficult to estimate these costs as this may vary significantly in each case and for each vehicle type. Such costs are also expected to be higher as vehicles get older. Due to the number of uncertainties, it was not possible to develop an estimate of such costs. It should however be noted that these costs are not considered regulatory costs linked to this initiative.

Adjustment costs savings for citizens. Adjustment cost savings for citizens are expected to come from the measures related to the recognition of PTI certificates in other Member States, as a result of avoided travel costs back to the country of vehicle registration for a PTI. The highest costs savings are expected in **PO3**, which includes the obligation for PTI certificate issued in any Member State to be recognised by the Member State of registration (PM7). They are estimated at EUR 228.2 million in 2030 and EUR 254.8 million in 2050, relative to the baseline. Expressed as present value over 2026-2050, the cost savings for PO3 amount to **EUR 4.29 billion** relative to the baseline. In **PO1b** and **PO2** the cost savings are driven by the recognition of the PTI certificate issued by a Member State other than Member State of registration of up to six months (PM8) and are estimated at EUR 114.1 million in 2030 and EUR 127.4 million in 2050. Expressed as present value over 2026-2050, they are estimated at **EUR 2.14 billion** relative to the baseline. **PO1a** shows the lowest costs savings for citizens (vehicle owners) among the options, linked to the recognition of PTI certificates on the basis of bilateral agreements (PM9). The savings are estimated at EUR 49 million in 2030 and in 2050 (**EUR 878.2 million** relative to the baseline, expressed as present value over 2026-2050).

Administrative costs savings for citizens. Under **PO1b**, **PO2** and **PO3**, citizens will benefit from administrative cost savings related to the option for Member States not to require emission testing at PTI after the vehicle has successfully passed a screening by remote sensing (PM12), i.e., it has been found to emit below the emission limits applicable to it. The corresponding savings amount to EUR 48.8 million in 2030 and are expected to drop to around EUR 2.8 million by 2050 (**EUR 591.9 million** expressed as present value over the 2026-2050 period). No administrative costs savings are expected in PO1a.

Benefits due to avoided odometer fraud. In **all policy options**, the obligation for Member States to record odometer readings in a national database, as well as to make them available to other Member States in the case of a re-registration of a vehicle (PMC9), is expected to help reduce odometer fraud in the Member States where such a system is not currently in place[226] (i.e., both in domestic sales of used vehicles and in cross-border sales, where odometer tampering has been found to be more common). The corresponding benefits for citizens are estimated at EUR 3.55 billion in 2030 and EUR 3.86 billion in 2050. Expressed as present value over 2026-2050, they are estimated at around **EUR 65.67 billion** relative to the baseline. As explained in section 6.1.2.4, it should be acknowledged that there is uncertainty regarding the economic damage caused by odometer fraud and the number of cars affected. For this reason, sensitivity analysis has been performed and is reported in section 7.5 and Annex 4 (section 7).

[226] Only BE and NL have introduced such requirement.

Net benefits for citizens. All policy options are expected to result in net benefits for citizens (vehicle owners). Expressed as present value over 2026-2050 relative to the baseline (see Table 14), they are estimated to be the highest in PO1a (EUR 66.20 billion), followed by PO3 (EUR 56.40 billion), PO2 (EUR 54.75 billion) and PO1b (EUR 54.46 million).

Table 14: Recurrent costs, costs savings and benefits for citizens (vehicle owners) in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Adjustment costs	**344.2**	**13,944.3**	**13,658.1**	**14,150.0**
PMC5	336.3	336.3	336.3	336.3
PM1	7.9		7.9	
PM2		294.1		
PM3				341.3
PM4				141.5
PM6		13,241.7	13,241.7	13,241.7
PM12		72.2	72.2	72.2
PM15				16.9
Adjustment costs savings	**878.2**	**2,144.6**	**2,144.6**	**4,289.3**
PM7				4,289.3
PM8		2,144.6	2,144.6	
PM9	878.2			
Administrative costs savings	**0.0**	**591.9**	**591.9**	**591.9**
PM12		591.9	591.9	591.9
Benefits	**65,666.9**	**65,666.9**	**65,666.9**	**65,666.9**
PMC9	65,666.9	65,666.9	65,666.9	65,666.9
Net benefits	**66,200.9**	**54,459.0**	**54,745.2**	**56,398.0**

Source: Ricardo et al. (2024), Impact assessment support study

Table 15: Recurrent costs, costs savings and benefits for citizens (vehicle owners) in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			**PO1b**			**PO2**			**PO3**		
	2026	**2030**	**2050**	**2026**	**2030**	**2050**	**2026**	**2030**	**2050**	**2026**	**2030**	**2050**
Administrative costs	**17.5**	**18.1**	**21.1**	**724.9**	**742.0**	**832.3**	**710.6**	**727.3**	**813.8**	**735.3**	**752.8**	**844.9**
PMC5	17.1	17.7	20.6	17.1	17.7	20.6	17.1	17.7	20.6	17.1	17.7	20.6
PM1	0.4	0.4	0.5				0.4	0.4	0.5			
PM2				14.8	15.1	19.0						
PM3										17.0	17.5	22.1
PM4										7.3	7.6	8.4
PM6				686.5	703.4	792.3	686.5	703.4	792.3	686.5	703.4	792.3
PM12				6.5	5.8	0.3	6.5	5.8	0.3	6.5	5.8	0.3
PM15										0.8	0.9	1.1
Adjustment costs savings	**49.0**	**49.0**	**49.0**	**110.7**	**114.1**	**127.4**	**110.7**	**114.1**	**127.4**	**221.5**	**228.2**	**254.8**
PM7										221.5	228.2	254.8
PM8				110.7	114.1	127.4	110.7	114.1	127.4			
PM9	49.0	49.0	49.0									
Administrative costs savings	**0.0**	**0.0**	**0.0**	**53.4**	**48.8**	**2.8**	**53.4**	**48.8**	**2.8**	**53.4**	**48.8**	**2.8**
PM12				53.4	48.8	2.8	53.4	48.8	2.8	53.4	48.8	2.8
Benefits	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**
PMC9	3,381	3,554	3,857	3,381	3,554	3,857	3,381	3,554	3,857	3,381	3,554	3,857
Net benefits	**3,412**	**3,585**	**3,885**	**2,820**	**2,975**	**3,155**	**2,834**	**2,990**	**3,173**	**2,920**	**3,078**	**3,269**

Source: Ricardo et al. (2024), Impact assessment support study

6.1.4. Impacts on competitiveness

The stakeholders that participated in the survey were requested to assess the impact of each measure on the cost and price competitiveness of sectors affected, with a score of 1 representing a very negative impact and a score of 7 representing a very positive impact. According to the consulted stakeholders, a somewhat positive impact on the cost and price competitiveness of affected sectors would be expected from the introduction of new PTI/RSI test requirements (average 3.89). A similarly positive impact on the cost and price competitiveness of sectors affected is expected by the stakeholders that participated in the survey from measures widening the scope of vehicles to be tested, and increased frequency of testing for certain vehicle categories. Finally, recognising PTIs conducted in Member States other than the Member State of registration would be expected by the stakeholders to achieve almost no impact (average 3.12).

As explained in section 6.1.2.1, the biggest share of the additional adjustment costs for ***PTI centres*** compared to the baseline is related to measures requiring the upgrade of equipment and facilities (PMC3 and PMC4), included in all policy options, the annual emission testing for light commercial vehicles (PM5), the mandatory yearly testing of vehicles that are 10-year-old or older (PM6) and the requirement for more advanced emission and noise testing (PM10) in PO1b, PO2 and PO3, and the required investment in new equipment, including an advanced brake testing device and a suspension tester (PM7) under PO3. To a lesser extent, the extension of the scope of the vehicles covered (PM3 and PM4) also leads to additional adjustment costs under PO3. All policy options, and in particular PO1b, PO2 and PO3 will also result in greater revenue sources for testing centres, thanks to more vehicles having to undergo PTI. Overall, as explained in section 6.1.2.1, PO2 results in net benefits of EUR 353 thousand per PTI centre expressed as present value over 2026-2050 relative to the baseline, followed by PO3 with EUR 336 thousand and PO1b with net benefits of EUR 325 thousand per PTI centre, while PO1a results in net costs of around EUR 59 thousand per PTI centre. Net benefits in PO2 represent around 6.3% of the turnover per PTI centre, in PO3 around 6% of the turnover, in PO1b around 5.8% of the turnover per PTI centre, while the net costs in PO1a around 1.1% of the turnover. Even though the analysis shows that PO1a may result in net direct costs for PTI centres, these costs may be passed through to vehicle owners (citizens and businesses) through higher PTI charges or compensated by the competent public authorities (see discussion on cost pass-through under administrative costs for other businesses - section 6.1.2.4, and for citizens - section 6.1.3). It can thus be concluded that PO1a is not expected to have a significant negative impact, while PO1b, PO2 and PO3 are expected to have very positive impact on the competitiveness of PTI operators.

Garages and other repair workshops will be affected by the requirement to record odometer readings of every vehicle they service (PMC9). As described in section 6.1.2.2, total one-off and recurrent administrative costs would amount to EUR 706 per company, expressed as present value over 2026-2050, which is not expected to have any significant impact on their competitiveness. Some of them, as well as vehicle manufacturers and dealers already record odometer readings for the purpose of keeping a maintenance schedule.

Other businesses (vehicle owners) may face somewhat higher costs as a result of the additional PTI costs and more frequent roadside inspections in all policy options (in particular in PO1b, PO2 and PO3), but the estimated extra costs in the case of HGVs are limited; they are more significant for passenger cars. At the same time, a more effective enforcement of the roadworthiness framework will ensure fair competition, reducing the opportunities for gaining price advantage on the basis of lower vehicle standards, and avoidance of the required maintenance costs of vehicles.

6.1.5. *Impacts on innovation and technological development*

Positive impacts on innovation are expected from requiring more stringent and advanced test methods that also need to be adjusted to the general requirement for a PTI to be quick, simple and affordable. Although new tests, such as PN- and NOx-measurement, ePTI or advanced brake and noise tests are based on existing technologies, there is still a certain degree of development and adaptation necessary to ensure their widespread application. The consulted stakeholders expect a positive impact on the innovative capacity of the sectors affected from measures related to new PTI/RSI test requirements, improved access and exchange of information and the digitalisation of vehicle documents. Furthermore, increased demand for new test methods and equipment can be expected to generate further development of relevant technologies by developers of measurement equipment, a viewpoint supported by the representatives of the sector in their contribution to the stakeholder consultation. Together with that, relevant training of inspectors to the new test methods will enhance the availability of technical skills and expertise that can have a broader positive impact. As such, most of the common measures are expected to have some positive impact on innovation (PMC1 on the testing of electric vehicles, PMC2 using ePTI, PMC3 and PMC4 on new emission tests, PMC6 on digital PTI certificates, and PMC7 on more efficient exchange of vehicle data).

While in the case of PO1a the digitalisation of the registration certificates (PM16) may require further innovation, PO1b would introduce remote sensing and plume chasing (PM12) to monitor air pollutants and noise emitted by vehicles. Remote sensing also relies on existing technologies but requires adaptations to scale them up to cover the desired share of the vehicle fleet. Deploying these technologies at a larger scale than today would also necessitate process innovation. PO2 and PO3 combine the benefits of both measures.

6.1.6. *Impacts on small and medium enterprises (SMEs)*

Periodic technical inspections are in many Member States performed by smaller independent garages. Moreover, roadside inspections under the RSI Directive have been specifically targeted at commercial vehicle fleets, which are predominantly operated by SMEs. Garages, motor vehicle dealers, tyre and repair workshops, etc., almost entirely SMEs, will be affected by the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory. Therefore, the initiative is considered relevant for SMEs, and the SME test has been performed. More detailed explanations on the impacts on SMEs and SME test (including the four SME steps) are provided in Annex 10.

As explained in section 2.2.3, various forms of tampering affect the safety and environmental performance of vehicles. Next to odometer fraud, tampering may relate to disconnecting or altering the emission and noise reduction systems or modifying the performance of the vehicle. As regards possible impacts on the SME tuning sector, this initiative is not intended to cover legitimate tuning that is authorised and documented/registered by the competent authorities. It only refers to illegal activity where modifications are not authorised and documented/registered by the competent authorities. The possible impacts on the SME tuning sector have thus not been considered.

6.1.7. *Impact on the functioning of the internal market and competition*

The existing divergence between vehicle registration documents and the information included and quality of the data stored in the vehicle registers creates challenges in coordinating enforcement actions by Member States. Furthermore, the non-recognition of roadworthiness certificates among EU Member State creates additional trade barriers for cross-border operation or sale of vehicles, hindering the efficient functioning of the internal market, business operations and the freedom of movement of people within the EU. All policy options are expected to have a positive impact on the functioning of the internal market.

The combination of the measures related to improving the availability and exchange of vehicle-related information, making the roadworthiness certificate available in electronic format, the specific measure on odometer fraud, harmonising testing methods, the frequency of testing, requirements for the improvement of the PTI and the scope of testing, can have a positive impact on the functioning of the internal market and on competition. Qualitative assessment shows that PO2 and especially PO3 are expected to have the highest positive impact on the internal market and competition. PO2 incorporates additional measures aimed at extending roadside inspections to light commercial vehicles, and facilitating access to vehicle data necessary for thorough testing by PTI centres. This comprehensive approach is expected to have a stronger impact than PO1a and PO1b due. PO3 has a stronger positive impact due to PM7, which requires that a PTI certificate issued in any Member State is recognised by the Member State of registration, as well as further harmonisation of test methods. In addition, PO3 introduces mandatory PTI for all motorcycles and light trailers, which are not currently tested by all Member States. The inclusion of L-category vehicles in the scope of RSI (PM15) is expected to reduce the number of tampered vehicles. PO3 applies more ambitious measures regarding the standardisation of tests methods than provisions already included in the other policy options. As such, PO3 is expected to deliver the most significant positive impact on the internal market and competition. A more detailed discussion is presented in Annex 13.

6.1.8. Territorial impacts

There is no inherent bias (positive or negative) of the proposed options towards specific regions or territories of the European Union, and no specific differences among the different policy options. The underlying measures are expected to be applied in a more harmonised way in terms of the test procedures to be followed in comparison to the baseline scenario. There may be a limited number of specific issues that arise for authorities and vehicles owners in different regions of the European Union. These may relate to the implications of different climatic conditions when performing relevant tests (e.g., warm engine NOx test in Nordic countries) or the long distances needed to reach a PTI centre, and the extra costs that would arise for citizens and businesses in less dense and/or remote regions from widening the scope of vehicles subject to PTI and/or increasing the frequency of testing. Furthermore, there are different profiles of level of ownership, frequency of use, and size of motorcycles across the EU (e.g., motorcycles in most Southern European countries are smaller and are used more often for daily commute, in comparison to Northern European countries where motorcycles are more often used for leisure). In that respect, PO3 (including an extended scope to motorcycles of more than 50cc) could have a greater impact. However, PTI for smaller size motorcycles is already mandatory in some Southern European countries including in Italy, Spain, and Greece. It would be left open to Member States – in the implementation of the specific measures – to adapt the testing procedures to reflect the specific climatic conditions or to support the operation of mobile PTI units to minimise the time and cost for citizens in remote areas.

6.1.9. Digital by default

All policy options will have a positive impact on the application of the ‘digital by default’ principle. The mandatory electronic format of roadworthiness certificates (PMC6) should have a positive impact on administrative costs for authorities and contribute to digital transformation in the EU. PMC7 will, for the process of re-registration, save time and costs for authorities and citizens by moving away from information and data exchange via e-mail etc. which is less efficient in accessing relevant vehicle data. The impact would be even higher in PO1a, PO2 and PO3 relative to PO1b, as those options also include the issuing of vehicle registration certificates in electronic format (PM16), combined with an extension of the information to be included in the certificates (PM17). A digital registration certificate should help reduce time and costs by making access and exchange of the relevant information easier, faster. The introduction of digital registration certificates will be a further step towards the alignment of the RWP legal framework with Regulation (EU) 2018/1724 on the Single Digital Gateway, which requires that Member States ensure that vehicle registration procedures are delivered in a fully digital way when a citizen moves from one Member State to another. In all cases the expectation is that while roadworthiness and registration certificates will be issued in electronic format, there will still be a possibility for vehicle owners to obtain (or print) the relevant documents with the introduction of a QR code. This should help to minimise accessibility issues arising for specific parts of the population.

6.1.10. Reporting obligations

In should be noted that the current reporting requirements under the three Directives is minimal. Therefore, there is no scope for further reducing the reporting requirements.

6.2. Social impacts

6.2.1. Impacts on road safety

Given that the general objective of the initiative is to improve road safety in the EU, several measures to achieve this objective were included in the policy options. Direct impact on road safety is expected due to the more effective identification of vehicles with major and dangerous defects in the fleet, which should lead to the reduction of road crashes caused by technical defects and, as a result, to reduced fatalities and injuries (serious and light). Policy options also include other measures contributing to road safety, which relate to better implementation and enforcement of the roadworthiness legislation (such as the exchange of data among Member States' authorities).

Several assumptions were used to establish the impacts on road safety. They are explained in detail, by policy measure, in Annex 4 (section 4.1). These inputs[227] were subsequently used in the PRIMES-TREMOVE model to derive the impacts on the number of lives saved and injuries avoided. The impacts on road safety assessed are only linked to the measures considered in this impact assessment. More detailed explanations on the impacts by policy option and policy measure are provided in Annex 4 (section 5.1).

It should be noted that an important element in this assessment relates to the contribution of vehicle technical defects to road crashes[228]. For this assessment, a conservative approach was taken assuming a 4% contribution of technical defects to road crashes in the case of light-duty vehicles, heavy-duty vehicles and trailers and 6% in the case of motorcycles. Considering the uncertainty, a sensitivity analysis has been performed and is included in section 7.5 and Annex 4 (section 7).

All policy options are expected to result in lives saved and injuries avoided relative to the baseline scenario. Table 16 provides the reduction in the number of fatalities and injuries relative to the baseline in 2030 and 2050, as well as the cumulative number of lives saved, and injuries avoided relative to the baseline over the 2026-2050 horizon. Cumulatively, over the period 2026-2050, PO3 is expected to result in 7,013 lives saved, followed by PO2 (6,912 lives saved), PO1b (6,847 lives saved) and PO1a (4,661 lives saved). The numbers of severe and slight injuries avoided follow a similar pattern with PO3 having the highest impact, followed by PO2, PO1b, and PO1a. More explanations on the impacts by policy option and policy measure are provided in Annex 4 (section 5.1).

Table 16: Expected reduction in the number of fatalities and injuries in the POs relative to the baseline, in 2030 and 2050, and cumulative reduction over the period 2026-2050

		Fatalities	Serious injuries	Slight injuries
PO1a	**2030**	195	1,768	9,929
	2050	173	1,587	9,011
	Cumulative over 2026-2050	**4,661**	**42,272**	**239,803**
	% reduction	**1.1%**	**1.2%**	**1.3%**

[227] See more details in Annex 4 (section 4.1) on the inputs by measure and their aggregation into policy options.
[228] As explained in section 2.1.1, various studies indicate that their share as a contributing factor of the cause of crashes is between 3 and 19%, depending on the scope and methodology of the study; for motorcycles, it is 5% to 12% of crashes.

		Fatalities	Serious injuries	Slight injuries
PO1b	**2030**	287	2,711	15,099
	2050	253	2,420	13,658
	Cumulative over 2026-2050	**6,847**	**64,640**	**364,155**
	% reduction	**1.6%**	**1.8%**	**1.9%**
PO2	**2030**	289	2,721	15,162
	2050	255	2,429	13,712
	Cumulative over 2026-2050	**6,912**	**64,885**	**365,665**
	% reduction	**1.6%**	**1.8%**	**1.9%**
PO3	**2030**	293	2,753	15,274
	2050	259	2,460	13,826
	Cumulative over 2026-2050	**7,013**	**65,686**	**368,498**
	% reduction	**1.6%**	**1.8%**	**2.0%**

Source: Ricardo et al. (2024), Impact assessment support study

Table 17 provides the reduction in the external costs of accidents relative to the baseline, expressed as present value over the 2026-2050 period. The 2019 Handbook on the external costs of transport[229] was used to monetise the costs[230]. As a result of the positive impacts on lives saved and injuries avoided presented above, PO3 shows the highest impact in terms of reduction in the external costs of accidents relative to the baseline (expressed as present value over the 2026-2050 period), estimated at EUR 75.2 billion. It is followed by PO2 with EUR 74.2 billion, PO1b with EUR 73.9 billion, and PO1a with EUR 48.1 billion.

Table 17: Reduction in the external costs of accidents in the POs relative to the baseline, expressed as present value over the 2026-2050 horizon, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Fatalities	11,677	17,498	17,633	17,902
Serious injuries	21,348	33,235	33,299	33,821
Slight injuries	15,053	23,196	23,251	23,521
Total	**48,079**	**73,929**	**74,183**	**75,244**

Source: Ricardo et al. (2024), Impact assessment support study

6.2.2. *Impact on employment*

Measures involving an extension of vehicle scope or increase in testing frequency for particular vehicle categories will lead to additional inspections and the need for additional inspectors to perform them. The impact on the number of full-time RSI and PTI inspectors employed, relative to the baseline, has been estimated on the basis of the additional number of inspections required in each policy option[231]. The impacts on the number of full-time RSI and PTI inspectors in 2026, 2030, and 2050, relative to the baseline, are provided in Table 18 and Table 19, respectively. It should be noted that RSI inspectors are employed by and generate costs for national public authorities (discussed in section 6.1.1), while PTI inspectors by PTI centres (included under businesses and discussed in section 6.1.2.1).

Apart from the indirect positive impact on garage equipment manufacturers, related to the need for new testing equipment (in particular under PMC3 and PMC4), no direct impacts on employment are expected from the common set of measures. **PO1a** is expected to increase the number of full-time *RSI inspectors* by

[229] https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1

[230] Based on the Handbook, the external cost of a fatality in 2022 prices is estimated at around EUR 3.5 million, that of a serious injury at around EUR 0.5 million and that of a slight injury at around EUR 0.04 million. These values are multiplied by the number of fatalities, serious and slight injuries, respectively, to monetise the external costs of accidents in the context of this impact assessment.

[231] The number of inspections per inspector is dependent on the assumed time taken to perform the required procedure and the location of the test (either at PTI centres or at the roadside).

16 in 2030 and 20 in 2050 relative to the baseline. The impact on employment for PO1a is solely driven by PM1, which requires additional RSI inspectors to perform inspections of motorcycles over 125cc for those Member States where there is no PTI currently in place. No direct impact on employment for PTI centres is expected under this policy option.

PO1b is expected to increase the number of full-time *PTI inspectors* by 18,923 in 2030 and 20,322 in 2050, relative to the baseline. The increase in employment is mainly a result of PM2 and PM5 (PTI for motorcycles and annual emission testing for vans), PM6 (the mandatory yearly testing of vehicles that are 10-year-old or older), PM10 (noise testing of motorcycles at PTI) and PM12 (for the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission test in a PTI centre). Of these, PM6 is expected to have by far the largest impact as it involves more frequent testing of around a quarter of the EU car and van fleet. No direct impact on employment for *RSI inspectors* is expected under this policy option.

For **PO2** the increase in the number of full-time *PTI inspectors* is slightly lower than in PO1b (18,752 in 2030 and 20,107 in 2050, relative to the baseline). This is driven by the annual emission testing of vans (PM5), the mandatory yearly testing of vehicles that are 10-year-old or older (PM6), by the noise testing of motorcycles at PTI (PM10) and by the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission test in a PTI centre (PM12). Unlike PO1b, PO2 does not include the effect of PM2. PO2 is also expected to increase the number of full-time *RSI inspectors* by 204 in 2030 and 243 in 2050, relative to the baseline. The impact of PO2 on the number of full-time *RSI inspectors* is mostly due to PM14, which requires to extend roadside inspections to 2% of the fleet of vans. PM1 also requires additional inspectors relative to the baseline, to inspect motorcycles over 125cc for those Member States where there is no PTI currently in place.

PO3 measures are expected to lead to 19,047 additional full-time *PTI inspectors* in 2030 and 20,357 in 2050, relative to the baseline. Similarly to PO2, PO3 includes the impacts of PM5, PM6, PM10 and PM12. In addition, PM3 and PM4 also require additional inspectors from 2026 in PO3. PO3 is also expected to lead to an increase in the full-time *RSI inspectors* of 248 in 2030 and 283 in 2050, relative to the baseline. The increase in RSI employment for PO3, relative to the baseline, is due to the extension of the RSI scope to cover vans (PM14) and L-category vehicles (PM15).

Table 18: Increase in the number of full-time RSI inspectors by policy option, relative to the baseline, in 2026, 2030 and 2050

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
2026	15	-	197	242
2030	16	-	204	248
2050	20	-	243	283

Source: Ricardo et al. (2023), Impact assessment support study

Table 19: Increase in the number of full-time PTI inspectors by policy option, relative to the baseline, in 2026, 2030 and 2050

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
2026	-	18,448	18,281	18,569
2030	-	18,923	18,752	19,047
2050	-	20,322	20,107	20,357

Source: Ricardo et al. (2023), Impact assessment support study

As well as the increase in the number of inspectors employed, there will be benefits from the additional training for the inspectors that will be needed to be able to deliver the new testing methods. The impact on inspectors' skills will be positive for all policy options, with PO3 offering the greatest impact. Furthermore, the need for additional testing equipment for new test procedures and additional inspections will lead to indirect employment benefits for the wider equipment supply chain and distribution network. In particular, the demand for additional and new testing equipment will lead to an increase in production-related jobs within Member States (provided that manufacturing capabilities are available within the EU27). Also, there will be employment benefits related to providing ongoing maintenance for the new testing equipment. In particular, measures concerning new emission testing equipment (PMC3 and PMC4) could increase equipment-related employment.

6.2.3. Impacts on fundamental rights

The policy options were assessed to determine if they have an impact on the fundamental rights and/or equal treatment of EU citizens. The starting point of the assessment of the fundamental rights is the Charter of Fundamental Rights of the European Union[232]. All POs were assessed having regard to the relevant EU instrument and it was concluded that they maintain full respect for human and fundamental rights, and none will have any negative impact thereon. A more detailed analysis is provided in Annex 12.

6.3. Environmental impacts

The analysis of environmental impacts covers the air pollutant emissions, CO_2 emissions, noise emissions and natural resources. One of the general objectives is contributing to sustainable mobility, therefore the environmental benefits are an important justification for the initiative. In the first step, the expected contribution of each measure on the identification and removal of high emitter vehicles (whether due to defective emissions control systems or tampering) from the fleet is defined. It is assumed that high emitters identified will undergo repair (whether this refers to the replacement of malfunctioning filters, sensor or noise reduction system or the necessary modifications of the engine). The reduction of high emitters by policy option relative to the baseline is then used as input in the PRIMES-TREMOVE model to calculate the reduction in air pollutant emissions, and in the external costs of air pollution emissions and noise[233]. The impacts on environmental outcomes assessed are only linked to the measures considered in this impact assessment. More detailed explanations of the inputs used by policy measure are included in section 4.2 of Annex 4. A detailed discussion of the impacts on air pollution and noise emissions by policy option is provided in section 5.2 of Annex 4. A qualitative assessment is provided for the impacts on CO_2 emissions and natural resources.

Impacts on air pollutant emissions. The analysis of the impact on emissions has focused on the two pollutants that are targeted in the proposed measures, NOx and particulate matter (particulates). Other pollutants have not been considered although it is possible that by targeting high emitters for these two pollutants, there will also be benefits related to other air pollutants (e.g. CO, HC, SO2). Table presents the expected impact on the level of emissions in comparison to the baseline for each policy option. PO2 and PO3 are expected to have the highest cumulative impact on air pollutants reduction over 2026-2050 (3,969 kilo-tonnes of NOx in PO2 and 3,970 kilo-tonnes of NOx in PO3, and 199 kilo-tonnes of PM in both PO2 and PO3), representing a decrease of 21% and 18.7% for NOx and PM, respectively, relative to the baseline. PO1b shows somewhat lower levels of emissions reductions (20.8% for NOx and 18.5% for PM). PO1a is expected to bring the least reduction of both air pollutants over the 2026-2050 period (3,176 kilo-tonnes of

[232] https://commission.europa.eu/aid-development-cooperation-fundamental-rights/your-rights-eu/eu-charter-fundamental-rights_en

[233] The 2019 Handbook on the external costs of transport (Source: https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1) has been used to monetise the costs.

NOx, representing a 16.8% reduction relative to the baseline, and 135 kilo-tonnes of PM, representing 12.7% reduction).

Table 20: Impact on air pollutant emissions (kilo tonnes of NOx and PM2.5 avoided relative to the baseline in 2030 and in 2050, and cumulative over 2026-2050; % change in cumulative air pollution emissions relative to the baseline)

	2030	2050	Cumulative over 2026-2050	% change to baseline
NOx (kilo tonnes of NOx avoided)				
PO1a	200.5	12.1	3,176	-16.8%
PO1b	253.1	13.9	3,925	-20.8%
PO2	255.9	14.0	3,969	-21.0%
PO3	255.9	14.0	3,970	-21.0%
PM2.5 (kilo tonnes of PM avoided)				
PO1a	7.8	0.6	135	-12.7%
PO1b	12.0	0.8	196	-18.5%
PO2	12.1	0.8	199	-18.7%
PO3	12.1	0.8	199	-18.7%

Source: Ricardo et al. (2024), Impact assessment support study

The external cost savings due to the reduction of air pollutant emissions (NOx and PM) were calculated using the 2019 Handbook on the external costs of transport[234]. PO2 and PO3 are expected to lead to the highest levels of reduction in external costs, estimated at around EUR 76.1 billion, expressed as present value over the 2026-2050 period. This is slightly higher than in PO1b (EUR 75.2 billion) and much higher than in PO1a (EUR 58.7 billion). Results are presented in Table .

Table 21: Reduction in the external costs of air pollutant emissions relative to the baseline, expressed as present value over 2026-2050, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Reduction in external costs related to NOx emissions	46,966	58,054	58,646	58,659
Reduction in external costs related to PM emissions	11,707	17,193	17,429	17,429
Total reduction in external costs of air pollutant emissions	**58,673**	**75,247**	**76,075**	**76,088**

Source: Ricardo et al. (2024), Impact assessment support study

Impact on noise emissions. The impact on the reduction of high emitters and thereby on noise is expected to be the lowest in PO1a as it does not contain any measure directly targeted at noise (it has a small positive impact through 6, the assumed introduction of roadside checks for motorcycles in six Member States where they are not fully covered by PTI[235]). A higher impact is expected in the case of PO1b and PO2, combining more advanced noise testing in PTI (PM10) and use of remote sensing to support roadside inspections (PM12). For PO2 and PO3, additional positive impacts can also arise from the increase in roadside inspection of vans but the highest impacts in terms of noise reduction are expected in PO3, due to the mandatory RSI for motorcycles (PM15). Table 22 presents the estimated reduction in the external costs of noise for the four policy options, with PO3 providing the largest savings of around EUR 7.8 billion, expressed as present value over 2026-2050 relative to the baseline. PO1b and PO2 are expected to bring similar reductions in the external costs of noise (EUR 7.3 billion over the same period). The reduction under PO1a would be significantly lower (EUR 0.2 billion). As for the costs of accidents and air pollution, the

[234] https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1
[235] BE, FI, IE, MT, NL, PL.

external costs of noise were calculated using the PRIMES-TREMOVE model, based on the 2019 Handbook on the external costs of transport.

Table 22: Reduction in the external costs of noise emissions relative to the baseline, expressed as present value over 2026-2050, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Reduction in external costs related to noise emissions	154	7,323	7,319	7,757

Source: Ricardo et al. (2024), Impact assessment support study

Impact on CO_2 emissions and climate change. CO_2 emissions are not tested as part of the roadworthiness and roadside inspections and the measures included in this analysis are not expected to have a direct impact on the CO_2 emissions of vehicles. Any impact on CO_2 emissions may only be indirect in case there would be reductions in the fuel consumption as a result of PTI inspections. Measure PM5 that introduces more frequent emission testing for vans from year 1, and PM6 on the annual testing of vehicles older than 10 years could potentially have such an impact, but it is expected to remain very limited and has not been quantified. The reduction in particulate matter (soot) is not only expected to improve air quality but probably also have a positive impact on climate change. Since dark particles absorb sunlight, warm the atmosphere and cause faster melting of snow and ice, they have a warming effect on the climate[236]. However, the extent of the net impact taking various indirect effects (including in cloud formation) into account is still uncertain and subject to ongoing research[237]. Although such an impact on climate change has not been quantified, recent calculations indicate that it may be substantial[238].

Impact on natural resources. Some of the measures under consideration are expected to have a direct impact on the use of natural resources. These include the requirement for the PTI certificate to be issued in electronic format only (PMC6, included in all policy options), and issuing the registration certificates in electronic format (PM16, included in PO1a, PO2 and PO3). Both can be expected to bring saving in terms of the use of paper that will be proportionate to the number of PTIs and vehicle registrations. However, their impact may be lower in the short term due to continued provision of paper versions on request. The replacement of paper PTI certificates with digital copies is projected to affect 161.5 million vehicles in 2026, 167.3 million vehicles in 2030 and 190.6 million in 2050. The replacement of paper registration certificates with digital copies is projected to affect 24.1 million new vehicles in 2026, 25.3 million new vehicles in 2030 and 27.6 million in 2050. Hence the savings from electronic PTI certificates are expected to be much greater than for electronic registration certificates.

Regarding the impact on biodiversity, it is considered that the reduction of NOx emissions from road transport may also have positive impact on the health of ecosystems, due to their reduced indirect exposure related to chronic accumulation of nitrogen. This impact, while established in various studies and reviews[239], was however not analysed and quantified for this initiative since it is expected to be indirect and limited.

All policy options are consistent with the environmental objectives of the ***European Green Deal*** (though contributing to these objectives at varying degrees as outlined above) and the ***European Climate Law***[240].

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236 See e.g.https://climate.nasa.gov/explore/ask-nasa-climate/3271/aerosols-small-particles-with-big-climate-effects/

237 See also Bond, T. C., et al. (2013), Bounding the role of black carbon in the climate system: A scientific assessment, J. Geophys. Res. Atmos., 118, 5380–5552, doi:10.1002/jgrd.50171.

238 Mayer, A.C., Mayer, J., Wyser, M. et al. Particulate Filters for Combustion Engines to Mitigate Global Warming. Estimating the Effects of a Highly Efficient but Underutilized Tool. Emiss. Control Sci. Technol. (2024). https://doi.org/10.1007/s40825-023-00236-x

239 Ricardo-AEA Ltd for Natural (2016), Such as the ecological effects of air pollution from road transport: an updated review.

240 Regulation (EU) 2021/1119

All policy options contribute towards Sustainable Development Goals SDG 3. ***No significant harm*** is expected on the environment in any of the policy options.

7. HOW DO THE OPTIONS COMPARE?

7.1. Effectiveness

The assessment of effectiveness looks at the extent to which the policy options meet the general and specific objectives (SO) of the intervention. Table provides the link between policy objectives and assessment criteria.

Table 23: Link between objectives and assessment criteria

Objectives	Assessment criteria
General objectives	
GO1- Improve road safety in the EU	% reduction in the level of fatalities and injuries and associated external costs
GO2 – Contribute to sustainable mobility	% reduction in the level of air pollutant emissions and noise from road transport and associated external costs
GO3 - Facilitate the free movement of persons and goods in the Union	Removal of obstacles to re-registration of vehicles in another MS related to roadworthiness legal framework
	Removal of obstacles related to the roadworthiness testing of vehicles (recognition of certificates issued by other MSs)
Specific objectives	
SO1 – Ensure the adequacy, consistency, objectivity and quality of roadworthiness testing of today's and tomorrow's vehicles	Use of available test methods and procedures to assess the roadworthiness of vehicles, including new internal combustion engine and electric vehicles, and their electronic safety and emission control systems
SO2 – Significantly reduce fraud and tampering, and improve the detection of defective vehicles	Impact (% of reduction) on the number of defective vehicles
	Impact (% reduction) on the number of vehicles with tampered emission/noise control system
	Impact (% reduction) on the number of vehicles with tampered odometer
SO3 - Improve electronic storage and exchange of relevant vehicle identification and status data	Reduction of time/costs associated with the access to relevant vehicle data by inspection centres and enforcement and registration authorities.

All policy options contribute to the **general objective** of **increasing road safety in the EU** through more effective identification of vehicles with major and dangerous defect in the fleet. The most effective policy options are PO3 (7,013 lives saved and 65,686 serious injuries avoided), PO2 (6,912 lives saved and 64,885 serious injuries avoided) and PO1b (6,847 lives saved and 64,640 serious injuries avoided), while for PO1a a smaller positive effect is expected (4,661 lives saved and 42,272 serious injuries avoided). All policy options will also **contribute to sustainable mobility** by reducing air pollutant and noise emissions. This will lead to a reduction of external costs of these emissions, with the most effective options being PO3 (external costs savings from the reduction of air pollutants and noise estimated at EUR 83.8 billion), PO2 (external costs savings estimated at EUR 83.4 billion) and PO1b (external costs savings estimated at EUR 82.6 billion). PO1a, as the least effective, is expected to bring external costs savings of EUR 58.8 billion. All policy options will **facilitate the free movement of persons and goods in the EU** through removal of obstacles to re-registration of vehicles in another Member State, where PO1a, PO2 and PO3 are expected to be similarly effective, while PO1b is expected to be less effective due to the absence of measures on digital vehicle registration certificate and additional data included in the vehicle register. Regarding removing obstacles related to the roadworthiness testing of vehicles, PO3 is expected to be the most effective option due to EU wide recognition of PTI certificates in another Member State extended to all vehicles, followed by PO2 and PO1b (limited EU wide recognition of PTI certificates) and PO1a as the least effective (bilateral agreements on recognition of PTI certificates).

Thanks to the common set of measures, all policy options are effective in reaching **the specific objectives**. The differences in their overall effectiveness are linked to their focus, and thus the inclusion of additional measures aimed at further addressing one or the other specific objective.

As regards **SO1**, all options can be expected to bring significant benefits through introducing test methods for the inspection of electric vehicles, improved emission testing for internal combustion engine vehicles (NOx and PN measurement), and the introduction of testing ADAS and other safety systems required by the General Safety Regulation. PO1b, PO2 and PO3 are expected to perform better than PO1a as they would bring additional positive impacts through the introduction of mandatory cargo securing inspections and new ways of testing, such as plume chasing and remote sensing to monitor pollutant and noise emissions. PO2 and PO3 go even further than PO1b with the data governance measures to define the procedures and means of access to vehicle technical information by PTI centres, that should also contribute to the enhanced quality and consistency of inspections.

In terms of the achievement of **SO2**, all options are expected to lead to a reduction of defective and tampered vehicles through improved detection, thanks to the new ways of testing, as well as to systematically addressing odometer fraud. PO1b, PO2 and PO3 are however expected to be significantly more effective, due to the increase in the scope of vehicles covered (mandatory yearly testing of vehicles over 10 years old). PO1b and PO3 are more effective than PO2 in reducing the negative externalities associated with motorcycles (mandatory PTI versus optional in the other two options).

Roadside inspections are an effective complementary measure when it comes to the identification of tampering of emission and noise control systems, the latter especially for motorcycles, that are much more difficult to capture as part of the PTI since they are very easy to manipulate. Therefore, PO2 and PO3 are expected to be more effective, given that both extend RSI to light commercial vehicles, and in the case of PO3, also to motorcycles. Nevertheless, the differences between PO3 and PO1b and PO2 in terms of the expected level of reduction of defective vehicles and high emitters are relatively small, essentially linked to the more comprehensive approach of PO3, i.e. the inclusion of all motorcycles in both PTI and RSI. PO3 is expected to be the most effective in addressing SO2, closely followed by PO2and PO1b, while PO1a is expected to be significantly less effective.

In relation to **SO3**, all options can be expected to make a positive contribution based on the common measures on the mandatory electronic roadworthiness certificate, access to relevant PTI and registration data for national authorities by using a common interface and the harmonisation and regular update of technical data in vehicle registration documents. PO1a, PO2 and PO3 are expected to bring additional benefits due to the extension of data included in the vehicle register database and the introduction of the vehicle registration document in digital format. Moreover, PO2 and PO3 are expected to be more effective than PO1a and PO1b because of improved data governance and enhanced access to relevant vehicle technical information for PTI centres. Taken together, while there are limited differences among the four policy options in meeting the SO3, PO2 and PO3 appear to be most effective, followed by PO1a, and PO1b being the least effective option.

Overall, option PO3 seems to be the most effective when considering the expected contribution towards the achievement of all general and specific objectives, closely followed by PO2. PO1a is the least effective – especially in relation to specific objectives SO1 and SO2. PO1b is almost as effective as PO2 in terms of SO1 and SO2, but is expected to be less effective in the case of objective SO3. A more detailed assessment of the effectiveness, including quantified impacts per objective can be found in Annex 9.

7.2. Efficiency

Efficiency concerns the 'extent to which objectives can be achieved for a given cost (cost effectiveness)'. The estimates of costs and benefits are summarised in Table .

Table 24: Summary of costs and benefits of policy options – present value over 2026-2050 compared to the baseline (in million EUR), in 2022 prices

	Difference to the baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
PTI centres				
Adjustment costs	3,734.1	23,507.9	23,332.2	25,061.7
Administrative costs	0.0	0.0	136.5	136.5
Administrative costs savings	0.0	0.0	1,643.4	1,643.4
Benefits	860.5	39,394.2	39,100.1	39,968.0
Garages, motor vehicle dealers, tyre and repair stations, etc.				
Administrative costs	460.0	460.0	460.0	460.0
OEMs				
Administrative costs	0.0	0.0	55.9	55.9
Other businesses - vehicle owners				
Administrative costs	524.2	25,458.4	25,666.4	26,051.5
Administrative costs savings	0.0	1,287.3	1,287.3	1,287.3
Benefits	118,340.5	118,340.5	118,340.5	118,340.5
Citizens				
Administrative costs	344.2	13,944.3	13,658.1	14,150.0
Adjustment costs savings	878.2	2,144.6	2,144.6	4,289.3
Administrative costs savings	0.0	591.9	591.9	591.9
Benefits	65,666.9	65,666.9	65,666.9	65,666.9
National public authorities				
Adjustment costs	7.0	198.3	207.2	208.0
Administrative costs	2,233.8	2,190.4	2,387.5	2,397.9
Enforcement costs	0.0	32.9	0.0	77.4
Administrative costs savings	5,226.3	3,796.8	5,226.3	5,226.3
External costs savings				
Air pollution	58,673.1	75,246.6	76,074.5	76,087.7
Accidents	48,078.8	73,929.4	74,183.0	75,244.2
Noise	154.2	7,323.4	7,319.4	7,756.7
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits	297,878.5	387,721.5	391,577.8	396,102.1
Net benefits	290,575.2	321,929.2	325,674.0	327,503.2
Benefits to costs ratio	**40.8**	**5.9**	**5.9**	**5.8**

Source: Ricardo et al. (2023), Impact assessment support study

Total costs are projected to be the lowest in PO1a, estimated at EUR 7.3 billion expressed as present value over 2026-2050 relative to the baseline, followed by PO1b (EUR 65.8 billion), PO2 (EUR 65.9 billion) and PO3 (EUR 68.6 billion). Of these, adjustment costs for PTI centres (for equipment, training, and additional inspectors to perform the inspections) represent around 51% of the total costs in PO1a, 36% in PO1b, 35% of the total costs in PO2 and 37% in PO3. Administrative costs for other businesses (i.e., vehicle owners), for additional periodic technical inspections and cooperating on roadside inspections with the public authorities, represent another important element of the total costs (7% of total costs in PO1a, 39% in PO1b and in PO2 and 38% in PO3). This is also the case of administrative costs for citizens (for additional periodic technical inspections and cooperating on roadside inspections with the public authorities), estimated at 5% of the total costs in PO1a and 21% of total costs in PO1b, PO2 and PO3. The large share of administrative costs for other businesses and citizens (i.e., vehicle owners) in PO1b, PO2 and PO3 is related to the mandatory yearly testing for vehicles that are 10-year-old or older (PM6). Finally, administrative costs for national public administrations are expected to represent around 31% of the total costs in PO1a and below 4% in PO1b, PO2 and PO3. In PO1a these relate to the setup of the database with odometer readings and the operation of the system (PMC9). Other costs represent a relatively small share of the total costs in all policy options.

Total benefits are estimated at EUR 297.9 billion in PO1a, EUR 387.7 billion in PO1b, EUR 391.6 billion in PO2 and EUR 396.1 billion in PO3, expressed as present value over 2026-2050 relative to the baseline. Of these, external costs savings related to air pollutant emissions, noise emissions and accidents would represent around 36% in PO1a and 40% in PO1b, in PO2 and in PO3. Benefits for citizens and other businesses (i.e., vehicle owners) due to the avoided odometer fraud would represent 62% of the total benefits in PO1a, 47% in PO1b and in PO2 and 46% in PO3. In addition, the mandatory yearly testing for vehicles that are 10-year-old or older (PM6) would lead to additional benefits for the PTI centres in PO1b, PO2 and PO3 due to the higher number of inspections relative to the baseline. The total benefits for the PTI centres are estimated at around 10% of the total benefits in PO1b, PO2 and PO3. Other costs savings represent a relatively small share of the total benefits in all policy options.

Overall, all policy options result in **net benefits** relative to the baseline. PO3 shows the highest net benefits, estimated at EUR 327.5 billion expressed as present value over 2026-2050, followed by PO2 (EUR 325.7 billion), PO1b (EUR 321.9 billion) and PO1a (EUR 290.6 billion). PO1a shows the highest benefits to costs ratio among the options (40.8), followed by PO1b (5.9), PO2 (5.9) and PO3 (5.8).

Among the measures included in the policy options, it should be noted that the setup of the database with odometer readings and the operation of the system (PMC9, included in all options) is estimated to lead to the highest benefits to costs ratio (69.8). The mandatory yearly testing for older vehicles (PM6, included in PO1b, PO2 and PO3) is estimated to lead to benefits to costs ratio of 1.4, the mandatory PTI for light trailers (PM4, included in PO3) to benefits to costs ratio of 0.7, and the policy measures focusing on motorcycles to benefits to costs ratios of 2.4 to 20.2. More specifically, for motorcycles the policy measures focusing on roadside inspections (PM1, included in PO1a and PO2; and PM15, included in PO3) show much higher benefits to costs ratio (20.2 for PM1 and 18.5 for PM15) than measures extending the PTI (PM2, included in PO1b with benefits to costs ratio of 2.4; and PM3, included in PO3, with benefits to costs ratio of 2.5). This is because of the higher effectiveness of the roadside inspections relative to PTI. More details on the calculation of the benefits to costs ratios for these measures are provided in Annex 4 (section 6).

7.3. Coherence

Internal coherence assesses how various elements of the proposed options are expected to work together to achieve the objectives. Although all four policy options address the identified specific objectives and underlying problem drivers, they do so in different ways, and with a different level of intervention. All policy options ensure internal coherence. Among the four options, PO2 and PO3 are expected to benefit from a broader range of synergies that can contribute to a higher level of achievement of the objectives. This is thanks to their more comprehensive approach compared to PO1a and PO1b. Synergies indicated in relation to PO1a and PO1b are expected to increase in the case of PO2 and PO3, containing more comprehensive sets of measures and even lead to extra synergies, for example due to measures on registration certificates and more harmonised registered data. The differences between PO2 and PO3 are limited. They consist in PO3 proposing almost complete harmonisation in the area of roadworthiness testing: in terms of testing methods, full recognition of PTI certificates, and the full coverage of smaller motorcycles (down to 50 cm^3) and light trailers by PTI, as well as RSI for motorcycles. On the other hand, PO2 addresses the bulk of the issues/inconsistencies.

External coherence focuses on the compliance of the initiative with other EU instruments and relevant EU policies, as well as national policies or international obligations. All identified policy options show strong links to several EU instruments. In terms of external coherence, all policy options are considered consistent with relevant EU strategies and legal instruments and contribute to EU policy priorities. PO1b (focussing on more and better testing), as well as PO2 and PO3 perform best when it comes to coherence with the road safety policies, notably the "Vision Zero" objective. The same is true as regards coherence with the EU's green policies, such as the European Green Deal, the Sustainable and Smart Mobility Strategy, the Zero Pollution Action Plan and the air quality legislation. On the other hand, PO1a, PO2 and PO3 are more coherent with digital policies (e.g. the Single Digital Gateway, Data Act) than PO1b. In relative terms, PO3 and PO2 are expected to be the most coherent with the policy objectives in related EU legislation and strategies, followed by PO1b and PO1a being slightly less coherent. In relation to the well-established national policies in the field, however, stronger interventions, in particular in PO3, are less coherent. This is further explained under section 7.4 below. Detailed comparison of policy options regarding internal and external coherence is provided in Annex 14.

7.4. Subsidiarity and proportionality

Regarding subsidiarity, and as described in sections 3.2 and 3.3, EU action is justified on the basis that Member States alone would not be able to reach the objectives of the initiative, i.e., updating the harmonised rules on roadworthiness testing, including coordinated exchange of vehicle-related data. What differentiates the policy options beyond the common measures necessary to achieve the objectives at a minimum level is their focus (between PO1a and PO1b) and the extent to which they can fulfil the objectives (PO2 and PO3 going beyond the other two). In terms of proportionality, as the level of intervention and associated costs increase from PO1a to PO3, the level of positive impacts also increases, although not proportionally (as shown by the efficiency ratios).

In general, the scope of the options is limited to what can best be achieved at the EU level (in terms of harmonisation of methods and scope of testing, as well as in finding common solutions to ensure efficient sharing and access to the necessary vehicle data). All policy options comply with the principle of subsidiarity and proportionality, with PO3 possibly going somewhat beyond what is necessary to reach the objectives. This may be the case in particular with requiring full recognition of PTI certificates, which may not be compatible with existing structural differences in the way Member States have set up their periodic testing involving, among others, significant differences in pricing, granting concessions and differences in the structural organisation of the PTIs. In addition, it could be argued that the need to introduce PTI for light motorcycles and trailers, which primarily circulate on national territory, may be best assessed by Member States. More detailed analysis on subsidiarity and proportionality is provided in Annex14.

Table 25 provides a summary of the comparison of the options against the baseline scenario in terms of effectiveness, efficiency, coherence, subsidiarity, and proportionality. The following ranking symbols have been used: from '+' (more effective/efficient/coherent/proportionate than the baseline) to '+++' (much more effective/efficient/coherent/proportionate than the baseline).

Table 25: Comparison of options in terms of effectiveness, efficiency, coherence, subsidiarity and proportionality relative to the baseline

Impacts	PO1a	PO1b	PO2	PO3
Effectiveness	+	++	++/+++	+++
Road safety (GO1)				
Reduced fatalities by	4,661	6,847	6,912	7,013
Reduced severe injuries by	42,272	64,640	64,885	65,686
Reduced slight injuries by	239,803	364,155	365,665	368,498

Impacts	PO1a	PO1b	PO2	PO3
External cost savings (billion EUR)	48.1	73.9	74.2	75.2
	(++)	(+++)	(+++)	(+++)
Air pollution and noise (GO2)				
Reduction of NOx emissions (kt)	3,176	3,925	3,969	3,970
Reduction of PM emissions (kt)	135	196	199	199
External cost savings - emissions (billion EUR)	58.7	75.2	76.1	76.1
	(++)	(+++)	(+++)	(+++)
External cost savings - noise (billion EUR)	0.2	7.3	7.3	7.8
	(0/+)	(++)	(++)	(++)
Free movement of persons and goods (GO3)				
Removal of obstacles to re-registration of vehicles in another MS	(++)	(+)	(++)	(++)
Removal of obstacles related to the roadworthiness testing	(+)	(++)	(++)	(+++)
Update of roadworthiness testing (SO1)				
Roadworthiness of vehicles (incl. electric) in terms of their road safety performance	(+)	(+++)	(+++)	(+++)
Roadworthiness of vehicles in terms of their environmental performance	(+)	(+++)	(+++)	(+++)
Reducing tempering, improving detection of defected vehicles (SO2)				
Reduction defective and tampered vehicles in terms of emission control systems	(++)	(+++)	(+++)	(+++)
Reduction of vehicles with tampered emission/noise control system	(0/+)	(+)	(++)	(+++)
Reduction of odometer tampering	(+++)	(+++)	(+++)	(+++)
Benefits due to reduction of odometer tampering (billion EUR)	118.3 (businesses owners) 65.7 (consumers)	118.3 (businesses owners) 65.7 (consumers)	118.3 (businesses owners) 65.7 (consumers)	118.3 (businesses owners) 65.7 (consumers)
Electronic storage and exchange of vehicle identification and status data (SO3)				
Reduction of time/costs related to the access and exchange of relevant vehicle data:	(+++)	(+)	(+++)	(+++)
- Cost savings for authorities (billion EUR)	0.64	0.64	0.64	0.64
- Cost savings for PTI centres (billion EUR)	1.43	0.0	1.43	1.43
Efficiency	+++	++	++	++
Coherence	++	++	+++	++
Subsidiarity and proportionality	++	++	++	+

Source: Ricardo et al. (2024), Impact assessment support study

7.5. Sensitivity analysis

Sensitivity analysis on contribution of technical defects to road crashes and share of high emitting vehicles of air pollution and noise in the fleet. As indicated in section 6.2.1, there is significant uncertainty around the contribution of technical defects to road crashes. The central assumption used is that 4% of road crashes are caused by technical defects in the case of cars, vans, heavy duty vehicles and trailers and 6% in the case of motorcycles. A sensitivity analysis has been performed to understand the implications of lower or higher contribution of technical defects to road crashes. The following cases have been assessed:

- Low case: 3% for motorcycles and 1% for all other categories;

- High case: 9% for motorcycles and 7% for all other vehicle categories.

In addition, considering the uncertainty of the share of high emitting vehicles of air pollution and noise in the fleet, the implications of alternative shares of high and low emitters in the baseline scenario have been assessed. More specifically, compared to the central case the following assumptions have been used:

- Low case: shares of high emitters 25% lower than in the baseline;
- High case: shares of high emitters 25% higher than in the baseline.

Subsequently, the impacts on external costs and the efficiency of the policy options is assessed for the low and high case, including both elements related to safety and emissions.

Table 29 presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the low case, central case and high case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to change in the low case and high case relative to the central case estimates. More details on the sensitivity analysis, including the details on the external costs by type, are provided in Annex 4 (section 7).

Table 26: Summary of costs and benefits of the policy options in the low case, central case and high case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Low case	282,344.8	347,977.0	351,341.5	355,230.4
Central case	297,878.6	387,721.5	391,578.3	396,102.2
High case	317,762.6	428,602.8	432,933.3	438,106.8
Net benefits				
Low case	275,041.5	282,184.7	285,437.6	286,631.5
Central case	290,575.3	321,929.3	325,674.4	327,503.3
High case	310,459.3	362,810.5	367,029.4	369,507.9
Benefits to costs ratio				
Low case	38.7	5.3	5.3	5.2
Central case	40.8	5.9	5.9	5.8
High case	43.5	6.5	6.6	6.4

Source: Ricardo et al. (2024), Impact assessment support study

Sensitivity analysis on odometer fraud. As explained in sections 6.1.2.4 and 6.1.3, it should be acknowledged that there is uncertainty regarding the economic damage caused by odometer fraud and the number of vehicles affected. For this reason, sensitivity analysis has been performed on the economic damage caused by odometer fraud and the number of vehicles affected.

With regard to the economic damage caused by odometer fraud, a central estimate of EUR 2,119 per vehicle has been used and it is explained in more detail in Annex 4 (section 2). The following cases have been assessed:

- Low economic damage case: 20% lower damage costs/costs savings per vehicle (EUR 1,696 per vehicle);

- High economic damage case: 20% higher damage costs/costs savings per vehicle (EUR 2,543 per vehicle).

With regard to the number of vehicles affected, the central assumptions used for the shares of vehicles with tampered odometers are provided in Annex 4 (section 2), Table 37. The following cases have been assessed:

- Fewer vehicles affected case: share of affected vehicles 20% lower than in the central case;
- More vehicles affected case: share of affected vehicles 20% higher than in the central case.

In addition, the ***combined impact of the economic damage caused by odometer fraud and vehicles affected*** has been assessed as follows:

- Low economic damage and vehicles affected case: 20% lower damage costs/costs savings per vehicle (EUR 1,696 per vehicle) and the share of affected vehicles 20% lower than in the central case;
- High economic damage and vehicles affected case: 20% higher damage costs/costs savings per vehicle (EUR 2,543 per vehicle) and the share of affected vehicles 20% higher than in the central case.

Subsequently, the impacts on the benefits due to avoided odometer fraud and the efficiency of the policy options is assessed for the low case and for the high case. In this section, only the combined impact of the sensitivity analysis for economic damage caused by odometer fraud and vehicles affected is presented. The results of the separate sensitivity analysis for the economic damage caused by odometer fraud and for the number of vehicles affected is presented in Annex 4 (section 7).

Table 27 presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the low economic damage and vehicles affected case, central case and high economic damage and vehicles affected case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to significantly change in the low economic damage and vehicles affected case and high economic damage and vehicles affected case relative to the central case estimates. More details on the benefits due to avoided odometer fraud in each case are provided in Annex 4 (section 7).

Table 27: Summary of costs and benefits of the policy options in the low economic damage and vehicles affected case, central case and high economic damage and vehicles affected case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Low economic damage and vehicles affected case	231,635.9	321,478.8	325,335.2	329,859.5
Central case	297,878.5	387,721.5	391,577.8	396,102.1
High economic damage and vehicles affected case	378,841.8	468,684.7	472,541.1	477,065.4
Net benefits				
Low economic damage and vehicles affected case	224,332.5	255,686.6	259,431.3	261,260.6
Central case	290,575.2	321,929.2	325,674.0	327,503.2
High economic damage and vehicles affected case	371,538.5	402,892.5	406,637.2	408,466.5
Benefits to costs ratio				

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Low economic damage and vehicles affected case	31.7	4.9	4.9	4.8
Central case	40.8	5.9	5.9	5.8
High economic damage and vehicles affected case	51.9	7.1	7.2	7.0

Source: Ricardo et al. (2024), Impact assessment support study

8. PREFERRED OPTION

8.1. Identification of the preferred policy options and stakeholder views

Each of the policy options addresses the problems identified, their drivers and the specific objectives, however some options are more effective in achieving the specific and general objectives. As indicated in the previous sections, PO3 is the most effective option, as it performs best or among the best under all assessment criteria (cf. Annex 9), since it aims to fill most regulatory gaps. It is followed very closely by PO2, with PO1b and PO1a being less effective (especially PO1a at least in terms of bringing quantifiable benefits). The fact that PO1a and PO1b perform less well on certain aspects is due to their focus on better exchange of data (PO1a) and on better testing (PO1b), while PO2 and PO3 combine the key measures of the first two options. While PO1b performs very well in relation to the objectives of improving road safety (GO1) and reducing the number of high-emitting vehicles (GO2), PO1a does so in terms of improving free movement (GO3). The advantages of PO2 and PO3 become clear when comparing the options against the specific objectives, where they achieve high scores while PO1a and PO1b are limited by their specific focus. PO1a is the least effective, especially in relation to specific objectives SO1 and SO2.

On the other hand, in terms of efficiency, PO1a performs much better as it generates the lowest costs, while PO1b, PO2 and PO3 are more costly but also bring more benefits. PO1a is the most efficient option, with benefits to costs ratio estimated at 40.8. PO1b, PO2 and PO3 show very similar benefits to costs ratio (5.8 to 5.9). In terms of net benefits that can be quantified, PO1b, PO2 and PO3 perform significantly better than PO1a, while the quantifiable differences among these three options are relatively limited (they are essentially down to the measures extending PTI or RSI to relatively smaller groups of vehicles). In addition, compared to PO1b, PO2 brings cost savings for PTI centres due to improved data governance, as well as increased and more accessible data for authorities and inspection centres in PO2 as compared to PO1b which facilitates re-registration and roadside inspections. The efficiency and the net benefits of PO2 and PO3 would further increase compared to PO1b if the benefits related to achieving the objectives related to free movement (GO3) could be quantified. PO2 appears to strike the best balance between achieving the objectives to a high degree, while performing at better the other options in terms of internal and external coherence (by combining the most important measures of PO1a and PO1b while not having issues with external coherence as PO3), as well as in terms of subsidiarity and proportionality (by including only what is most needed to achieve the objectives).

While all options include the most efficient policy measure (PMC9 addressing odometer fraud), which offer very high benefits compared to limited costs, only PO1b, PO2 and PO3 feature relatively costly measures that introduce new testing requirements. Among them, the mandatory yearly testing of vehicles older than 10 years generate the highest costs, but also the largest benefits, both in terms of road safety and emission reductions. Crucially, this measure also generates a significant number of jobs, especially in Member States where the automotive industry is facing historical challenges. Comparatively, the measures differentiating between PO2 and PO3 are less significant, albeit still relevant. The detailed costs and benefits of those measures are outlined in Annex 4, section 5 and 6.

PO2 addresses all identified issues in a comprehensive manner by adapting roadworthiness testing to new vehicles with a capability of identifying a significant share of high-emitters and various forms of tampering, including odometer fraud with the help of digitalisation and better exchange of vehicle data. What PO2 does not do in comparison to PO3 is mandatory PTI for all motorcycles, trailers, including lighter ones, and the full recognition of PTIs conducted in another Member State with further harmonisation of test methods. While these measures could bring further benefits, they appear to be limited in comparison to the costs and additional administrative efforts required, and thus lower the efficiency of PO3. In relation to the well-established national policies in the field, PO3 also appears to be less coherent than PO2, and regarding the full recognition of PTI certificates, PO3 could be going beyond what is necessary to reach the objectives and it may not be compatible with existing structural differences of PTI testing setup in the Member States.

The analysis above points at PO2 as the preferred policy option, given it is considered effective in reaching the policy objectives, it presents high efficiency and net benefits and it appears to be coherent with the well-established national policies in the field, while including in its set of measures only those which are needed to achieve the objectives.

The preferred option enjoys the support of the PTI industry (CITA, FSD and others) as well as FIA, testing equipment (EGEA) and motorcycle manufacturers (ACEM). It is supported also by some Member States, notably those that rely on thousands of smaller roadworthiness testing centres. Regarding access and exchange of information, various respondents (including CITA, EGEA and EReg), underlined the importance of free and easy access to in-vehicle data to enable the proper inspection of vehicles. Stricter cargo securing requirements included in this option are strongly supported by the logistics industry.

Various industry respondents, including PTI operators, called for the extension of the PTI Directive to cover all road vehicles. While stakeholders belonging to motorcyclists' groups at EU or national level did not support such extension of the PTI to motorcycles in the OPC, in the survey most of the respondents supported mandatory PTI for motorcycles with the objective to reduce tampering and the detection of defected vehicles. Stakeholders also noted that many Member States already required a PTI for motorcycles, as well as for tractors and/or trailers.

All policy options include mandatory testing after significant modification of a vehicle, which was supported by stakeholders in the survey. Regarding the increased frequency of testing, PO2 introduces annual emission testing for vans, and it also contains a requirement for an annual PTI for vehicles over 10 years old, both these measures being supported by a majority of stakeholders in the survey.

Regarding the recognition of PTIs conducted in another Member State, PO3 introduces a full recognition, while PO2 requires the recognition of the PTI from another MS than the MS of registration for a period of up to 6 months. Stakeholder views on this differ to quite some extent: vehicle owners and those not directly involved in PTI inspections tended to be more in favour of the mutual recognition of PTI certificates under certain conditions, although some recognised that the mutual recognition under bilateral agreements would be a good first step. Those more actively involved with inspections were concerned that the difference between the approach taken to PTIs in different Member States meant that mutual recognition would be difficult and potentially lead to adverse effects on safety. Concerns were also raised that mutual recognition without the increased harmonisation of PTIs would lead to "PTI tourism", where drivers had their vehicles tested in countries where it was easier to pass a PTI.

All policy options tackle odometer tampering. New methods for tackling odometer fraud were considered as necessary by 69% (107) respondents in the OPC and adding odometer data to the vehicle register was welcomed by 72% (111) respondents in the OPC. In the consultations, in relation to odometer readings, some stakeholders suggested that it should be mandatory to record odometer data at certain events, such as following accidents and the transfer of ownership, and that potential buyers should have access to all this information. Not all stakeholders were however positive about this measure: some called on odometer system manipulation to be addressed via type-approval legislation, rather than the revision of the PTI Directive (FIA), and others questioned the potential inclusion of new methods to tackle odometer fraud, arguing that inspection organisations did not have the legal means or ways to detect and sanction such fraud (CITA).

Regarding the content of RSI, a majority of respondents (81% and 77% respectively) thought that PN testing for commercial vehicles and NO_x and noise testing for all vehicles using remote sensing would improve the detection of defective vehicles and reduce tampering. In the OPC, a small majority supported extended emission testing (e.g., NO_x and PN), including the use of remote sensing equipment, during RSI. Regarding cargo securing, there was a high level of support for mandatory checks during roadside inspections of commercial vehicles to ensure the safe securing of cargo, expressed in the survey and OPC.

In relation to introducing RSI to light commercial vehicles, around three quarters of respondents thought that the extension of the scope of the RSI to light commercial vehicles would contribute to better detection of defective and tampered vehicles, but some stakeholders also suggested that this could bring additional costs, in terms of lost time, for SMEs operating such vehicles.

Regarding access and exchange of information/data, two-thirds of respondents in OPC supported clarifying the existing rules on access to in-vehicle data. Vehicle and equipment manufacturers/suppliers were less supportive of this provision than others. In response to the open survey and interview questions, various respondents (including CITA, EGEA and EReg), underlined the importance of free and easy access to in-vehicle data to enable the proper inspection of vehicles.

Finally, all policy options include measures aimed at facilitating exchange of PTI and registration data. PO1a, PO2 and PO3 furthermore introduce measures on the digitalisation of registration certificates and new data sets to be included. A large majority of stakeholders supported these measures. National authority respondents highlighted that 17 Member States already used Eucaris for the purpose of data exchange, and that this system worked well. They underlined that data on the vehicle register should be harmonised and available to all organisations that were involved in undertaking PTIs and RSIs for national authorities. EReg called for a larger set of data to be included in the vehicle register and generally supported the digitalisation of the vehicle registration documents and the mutual recognition of these. Various national authorities, and users, underlined the importance of the data in the vehicle register being up to date as soon as relevant changes happen.

More details on stakeholder views are provided in Annex 2.

8.2. REFIT (simplification and improved efficiency)

This initiative is included in the Commission Work Programme 2023[241], item 3 in Annex II: REFIT initiatives, under headline A – A European Green Deal. It contributes to increasing the efficiency of the existing legislation in various ways: by replacing obsolete test methods with stat-of-the art solutions both at periodic as well as at roadside checks by requiring to use the most recent measurement techniques and technology to more effectively detect a large number of high-emitting vehicles; by introducing simple, nevertheless meaningful tests to check the safety and environmental performance of modern vehicles in a

[241] 2023 Commission work programme – key documents (europa.eu)

harmonised way; by interconnecting national databases to help share and access vehicle data that otherwise would be exchanged using more cumbersome procedures. The initiative is expected to significantly reduce fraud related to emission and safety-relevant systems as well as to the stated mileage of used vehicles especially in cross-border sales and would thus lead to significant savings in external costs as well as in avoided damage to consumers.

8.3. Application of the 'one in, one out' approach

PO2 is expected to lead to administrative costs for PTI centres and vehicle manufacturers due to the measure on data governance (PM11), and for garages, motor vehicle dealers, tyre service and repair stations due to the measure on odometer readings (PMC9).

For PTI centres, the one-off administrative costs for the adaptation of their IT systems are estimated at EUR 1,000 per centre. Total one-off administrative costs would amount to EUR 48.9 million in 2026, for the 48,880 PTI centres across the EU. The recurrent administrative costs for the maintenance of the IT systems are estimated at 10% of the capital costs, or EUR 100 per PTI centre. Total recurrent administrative costs are thus estimated at EUR 4.9 million per year from 2026 onwards.

Vehicle manufacturers will also need to adjust their own IT systems to ensure access to the relevant data. The one-off costs are expected to be around EUR 1 million per vehicle manufacturer, with total one-off administrative costs of EUR 20 million in 2026 for the 20 vehicle manufacturers across the EU. Recurrent administrative costs are estimated at 10% of the capital costs or EUR 100,000 per vehicle manufacturer. For the 20 vehicle manufacturers, they amount to EUR 2 million per year from 2026 onwards.

The costs for the garages, motor vehicle dealers, tyre service and repair stations will relate to possible software updates to allow them to transfer their data to the central national database, maintenance costs for the software and the time needed to record the odometer readings. Based on input from Car-Pass and the European Parliament study[242], the costs for software updates are estimated at EUR 229 per garage in 2022 prices[243]. In PMC9 these costs are relevant for 651,351 companies (470,765 repair shops and garages across the EU and 180,586 motor vehicle dealers)[244], excluding those in Belgium and the Netherlands, which implemented the measure already and are part of the baseline. Total one-off administrative costs are thus estimated at EUR 149.2 million in 2026. In addition, for the purpose of the *'one in one out approach'*, the average annual recurrent administrative costs over 2026-2035 are estimated at EUR 19.5 million per year[245] or EUR 29.9 per company.

In total, the additional one-off administrative costs relative to the baseline relevant for the 'one in one out approach' in PO2 are estimated at EUR 218 million in 2026. Expressed as annualised net present value over the relevant period they amount to EUR 25.5 million. In addition, the recurrent administrative costs relative to the baseline amount to EUR 26.4 million per year. Thus, the total additional administrative costs (one-off and recurrent) relevant for the 'one in one out approach' in PO2 are estimated at EUR 51.9 million per year relative to the baseline. Other administrative costs for citizens and businesses (i.e., vehicle owners) in PO2 relate to additional periodic technical inspections and

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[242] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[243] The cost was estimated at EUR 200 per garage in 2018 prices. Using the harmonised index of consumer prices (HICP) from Eurostat, this is equivalent to EUR 229 per garage in 2022 prices.
[244] Eurostat, Structural business statistics, Enterprise statistics by size class and NACE Rev.2 activity.
[245] This is calculated as a simple average over 2026-2035, non-discounted.

cooperating on roadside inspections with the public authorities and are thus not subject to the *'one in one out approach'*.

9. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

The Commission services will monitor the implementation and effectiveness of this initiative through a number of actions and a set of core indicators that will measure progress towards achieving the operational objectives. Five years after the revised legislation will have been applied, the Commission services should carry out an evaluation to verify to what extent the objectives of the initiative have been reached.

Road safety: the Commission regularly monitors key road safety indicators, including the evolution of the number of fatalities, serious and slight injuries per Member State and per vehicle category, age and certain vehicle characteristics. Detailed information on the causes of crashes, notably on vehicle defects is unlikely to become available at large scale soon. In the future, analysis of event data recorders mandated by the General Safety Regulation may provide more detailed insight into the causes of a significant share of crashes. Until then, existing reporting requirements should be updated to better respond to current monitoring needs, as outlined in Annex 15.

Similarly, the evolution of *air and noise pollution* is continuously monitored by the EEA. Part of the reduction expected over the years to come will be related to this initiative through better maintenance of vehicles and reduced tampering with emission control systems. Progress towards the objective of contributing to sustainable mobility can be measured through the evolution of PTI and RSI results, as well as from remote sensing data. As for *facilitating free movement*, indicators of success will be the number of Member States recognising PTIs conducted abroad.

To measure the success of the initiative, the following operational objectives are set: 1) Apply newly available safety and emission testing methods; 2) Interconnect Member States' vehicle registers and odometer databases through a common hub; 3) Digitalise vehicle documents; 4) Reduce the number of defective and tampered vehicles on EU roads. Indicators to monitor progress towards these objectives are defined in Annex 15.

ANNEX 1: PROCEDURAL INFORMATION

1. LEAD DG, DECIDE PLANNING/CWP REFERENCES

The lead DG is Directorate General for Mobility and Transport (MOVE), Unit C2: Road Safety

DECIDE reference number: PLAN/2021/10932

This initiative was referred to in point 16 of the Sustainable and Smart Mobility Strategy. Action 7 in the Action Plan called for improved emission testing in roadworthiness tests. Action 66 called on the Commission to assess the need for a proposal to require efficient exchange of odometer readings across the EU.

This initiative is included in the Commission Work Programme 2023[246], item 3 in Annex II (REFIT initiatives), under headline A – A European Green Deal.

2. ORGANISATION AND TIMING

The impact assessment and the ex-post evaluation of the Roadworthiness Package were performed in a back-to-back manner (i.e., the evaluation and impact assessment have been launched at the same time) in 2021-2023.

The combined evaluation roadmap/inception impact assessment was published on Have your say on 4 October 2021[247]. The ex-post evaluation and the impact assessment on a possible review of the Roadworthiness Package were coordinated by an Inter-Service Steering Group (ISG). The Commission Services participating in the ISG were: Secretariat-General, Legal Service, Directorates-General GROW, RTD, CLIMA, ENV, JRC, CNECT, EMPL, JUST. The ISG met 6 times: 22 September 2021, 14 December 2021, 8 July 2022, 24 November 2022, 9 October 2023 and 9 November 2023. It was consulted throughout the different steps of the evaluation and impact assessment process: notably on stakeholder consultation questionnaire and deliverables of the external support study and on the draft Staff Working Documents. When necessary bilateral discussions were organised with the concerned services.

3. CONSULTATION OF THE RSB

The draft impact assessment and evaluation reports were submitted to the RSB on 20 November 2023 and were discussed by the Board on 13 December 2023. The RSB issued a positive opinion with reservations on 15 December 2023. The recommendations from the Board have been addressed in this final version of the Impact Assessment report as detailed in the table below.

Table 28: Modifications of the impact assessment report in response to RSB recommendations

RSB recommendations	Modifications to the IA report
Main considerations	
(1) The report is not sufficiently clear about the scale of the problem, the robustness of the underlying evidence and the assumptions made in the analysis.	Theses aspects have been clarified in section 2 of the impact assessment, as explained below under (1) and (2).

246 2023 Commission work programme – key documents (europa.eu)
247 Vehicle safety – revising the EU's roadworthiness package (europa.eu)

(2) The report does not clearly explain the reasoning behind the packaging of options. It does not sufficiently bring out the key policy choices and the related trade-offs, including in terms of reduced fatalities and injuries. The costs and benefits implications of key safety measures are not clearly presented.	The packaging of the options and the trade-offs were revisited and clarified, and are further described under points (3), (4), and (5) below. The costs and benefits are now further detailed in Annex 4 (e.g. in new section 6) and better explained also in the comparion of options.
(3) The comparison of options is not sufficiently detailed and nuanced, including in terms of coherence with the 'Vision Zero' road safety policy framework.	The comparison, including re 'Vision Zero' has been further detailed as described under point (6) below.
Adjustment requirements	
(1) The report should make clear what the scale of the problems identified is, including regarding vehicles currently exempted, such as motorcycles, or not subject to a yearly PTI, such as vehicles older than 9 years. The strength and robustness of the evidence underpinning the analysis of the problems and impact analysis and of related estimations should be made more explicit. The report should clarify supporting assumptions when it comes to the contribution of defects in vehicles to road crashes and the link between road safety and inspections. The geographical distribution of the problems identified should also be better explained, with clear references to the situation in different Member States.	The scale of the problem of unsafe and polluting vehicles has been explained in more detail, including geographical details, in section 2.1, 2.2 and 2.2.5. The level of confidence in the underpinning evidence has been clarified and backed by additional sensitivity analysis. Further details as regards the underlying assumptions and calculations are described sections 4 and 5 of Annex 4 (impact on road safety and emissions of individual measures and policy options).
(2) The report should more clearly acknowledge any uncertainties related to the evidence and assumptions used, in particular in relation to the analysis of the impacts of the odometer fraud measure. A sensitivity analysis should be carried out to show how these limitations affect the overall cost-benefit analysis (looking for instance at the assumptions on the number of cars affected and the economic damage caused by odometer fraud). The report should be clearer about the assumptions used and why different data points (lower bound in some cases) were selected for the estimations. It should also clarify to what extent key assumptions were validated by independent experts and represent the state of the art on this matter. Similarly, the report should clarify the scale and geographical	The uncertainty regarding the economic damage caused by odometer fraud and the number of cars affected is acknowledged in section 6.1.2.4 and section 6.1.3. Sensitivity analysis has been performed on the assumptions on the economic damage caused by odometer fraud and the number of cars affected, and its impacts in terms of overall cost-benefit analysis are reported in section 7.5 and Annex 4 (section 7). The calculations of the costs for measure PMC6 (Require roadworthiness certificate in electronic format only) have been revised to account for the volumes of inspections per Member State instead of using the lower bound of the estimates provided during the stakeholders consultation. The evidence underlying the problems and their drivers, as well as the assessment of impacts, is based on the best

distribution of the problem when it comes to older cars, lighter vehicles and mopeds not being (sufficiently) tested for roadworthiness and the consequences of this.	available evidence, including multiple studies involving scientific research, as well as thorough consultation with experts. This has been further emphasised in section 2 and section 6. Additional sensitivity analysis has also been performed and is reported in section 7.5 and Annex 4 (section 7). The scale and geographical distribution of the problem of older vehicles and powered two- and three-wheelers is clarified as explained above (1).
(3) The report should explain more clearly the reasoning behind the packaging of options. It should clarify why certain policy measures, such as recording the odometer reading or registration of certificates in digital formats are not included in all policy packages. Given that the policy measure aimed at tackling odometer fraud is expected to bring by far the most significant net benefits, excluding this measure in some policy packages would make them underperforming by design. The report should provide a clear justification why this key measure should not be included in the set of measures common for all options. If an exclusion can be convincingly argued, the report should present variants for options 1a/b including the odometer measure to allow a fairer and more balanced comparison of options.	Following the comments received from the Board, the measure on recording the odometer reading has now been included in all policy options. In addition, the mandatory yearly testing for vehicles that are 10-year-old or older (PM6) is now included in PO1b, PO2 and PO3. The changes are reflected in sections 5.2.
(4) The report should explain the reasoning behind advocating a non-binding measure for the testing of powerful motorcycles, despite its more limited potential beneficial impact on road safety. The explanation should also clarify why a non-binding measure is considered as an adequate measure exclusively in the safety case of powerful motorcycles but not for any other road safety problem area. When substantiating this reasoning, the report should make clear references to the evidence available from different Member States (which are currently applying a testing regime and which are not and what a non-binding or binding EU measure on this would bring)	Following the observations of the Board, the measure in question (PM1 – roadside inspection of motorcycles as an alterantive to PTI) has been revised. It is now presented as a binding measure, which indeed corresponds to the relvant calculations in terms of costs and benefits. The changes are reflected in sections 5.2, 6.1, as well as in the Annexes.
(5) The report should present better the key policy choices and related trade-offs, in particular regarding the benefits and costs of	The benefits of the measures were indeed assessed as part of the policy options, considering also the synergies between them.

several key road safety measures, including the mandatory yearly testing for older vehicles and the ending of the exemptions of motorcycles and light trailers. These measures are currently included as a bundle and assessed together only in the most ambitious option package 3. However, a complementary measure-by-measure benefit-cost assessment should allow the identification of potentially net beneficial measures in terms of overall reduced fatalities and injuries. As these are highly relevant for decision-making, the report should bring them out more clearly.	Their costs, however, were calculated individually. The estimated impacts (in terms of lives saved and external costs savings) of the options have now been split to show the impact of the relevant individual measures. The expected cumulative reduction in the number of fatalities and injuries by policy option and policy measure is now included in section 5 of Annex 4. In addition, the trade-offs regarding the costs and benefits of those policy measures are presented in a new section 6 of the same annex.
(6) The comparison of the revised set of options needs to be more nuanced and granular. To allow a more coherent effectiveness comparison of options the report should present one clear set of specific objectives avoiding overlaps with the general objectives. Regarding coherence, the report needs to demonstrate why packages 2 and packages 3 are scored the same, despite the significant differences with respect to contribution to the Vision Zero road safety goals. The comparison overview Table 25 should be reworked to allow a detailed overview of quantitative and qualitative key impacts, so that the key differences between the options become more obvious. On this basis, the report should better justify the choice of the preferred option, while being clear on the key trade-offs between options in terms of efficiency, effectiveness and coherence.	In section 7, a more detailed presentation of the key impacts (costs and benefits), both quantifiable and qualitative, has now been included. The comparison of effectiveness now focuses on achieving the specific objectives, while the limited differences in coherence between PO2 and PO3 are also explained in section 7 and Annex 14. Table 25 has been replaced with a detailed overview of the key impacts as requested. In section 8, the differences and trade-offs between the revised options are clarified in relation to the three criteria.

4. EVIDENCE, SOURCES AND QUALITY

The impact assessment and evaluation are based on several sources, using both quantitative and qualitative data, collected from Member States, industry, and other EU bodies. This includes:

- Stakeholder consultation activities (see dedicated annex);
- Regular meetings of the Expert Group on Roadworthiness and Vehicle Registration Documents (RWEG);
- External support studies carried out by independent consortia (the study supporting the evaluation was led by VVA and the one supporting the impact assessment was led by Ricardo). The external support studies will be published alongside this report;
- Ad-hoc consultation of industry experts; and

- The Commission's own experience in monitoring and implementing the Roadworthiness Package.

ANNEX 2: STAKEHOLDER CONSULTATION (SYNOPSIS REPORT)

This stakeholder consultation synopsis report provides a summary of the outcomes of the stakeholder consultation activities which were carried out as part of this back-to-back evaluation and impact assessment in view of a possible revision of the Roadworthiness Package (RWP). It provides a basic analysis of the responses of stakeholder groups involved in the consultation process and a summary of the main issues which they raised. The full analysis of the consultation results is presented in the stakeholder consultation reports annexed to the two external support studies. The same report is included in the evaluation SWD and in the impact assessment SWD, as an annex to both reports.

Stakeholder involvement was vital for the evaluation and impact assessment in order to collect facts, data and opinions enabling the Commission to:

- On the one hand, assess the performance of the RWP against the five evaluation criteria, identify possible issues with the existing legal framework and, on this basis, learn lessons for future action;

- On the other hand, (i) substantiate, validate and develop the problems and the underlying drivers, (ii) conceive corresponding policy objectives, (iii) elaborate a list of specific possible policy measures and policy options and (iv) assess their likely impacts on the various categories of stakeholders.

This report also aims at informing stakeholders on how their input has been considered.

This document should be regarded solely as a summary of the contributions made by stakeholders in the various consultation activities on the back-to-back evaluation and impact assessment in view of a possible revision of the Roadworthiness Package (RWP). It cannot in any circumstances be regarded as the official position of the Commission or its services. Responses to the consultation activities cannot be considered as a representative sample of the views of the EU population.

1. OVERVIEW OF CONSULTATION ACTIVITIES

Consultation activities took place from October 2021 to August 2023.

The consultation strategy set different focuses for the consultation activities for the evaluation and the IA to complement each other. The evaluation related survey and targeted interviews gathered stakeholders' views and input on the selected evaluation questions and evaluation criteria. They are complemented with the views expressed at the OPC.

The focus of the survey and interviews for the IA were on defining the different policy measures to meet the objectives set as part of the revision of the Roadworthiness Package, particularly the costs and potential impacts of these policy measures. The underlying problem drivers of the RWP were extensively discussed with stakeholders, e.g. in the Roadworthiness Expert Group and are also a result of the stakeholder consultation activities of the evaluation. Having said that, both the survey and interviews did briefly cover the baseline, problem drivers and objectives, as well as potential impacts of the measures, so on all parts of the IA.

The stakeholder consultation included the following activities:

- **Targeted online survey for the evaluation**: two online surveys were conducted targeting the stakeholders identified at the inception stage of the Evaluation Study and covered the 5 evaluation criteria of relevance, effectiveness, efficiency, coherence and EU value added. It was launched on 8 December 2022 and ran until 20 January 2023. One survey targeted relevant EU associations, relevant ministries of EU Member States, road safety authorities and OEMs; In total 38 responses were received: 17 from ministries and road safety authorities, 16 from EU associations, consumer organisations and NGOs, 5 from vehicle registration authorities. The other survey was addressed to PTI bodies and 11 responses were received.

- **Targeted semi-structured interviews for the evaluation** sought to explore the respondents' views on the RWP for each evaluation question defined. They took place in the period between November 2022 and April 2023. The interviews were conducted with representatives from 30 selected technical or policy related organisations including national registration authorities, technical inspection bodies, the Roadworthiness Committee, the Roadworthiness Expert Group and road safety and environmental NGOs. They were selected in order to gather additional evidence, to ensure geographical coverage and to increase the sample size in a group of interviewees by stakeholder type.
- **Exploratory interviews for the IA**. The aim of the exploratory interviews was to obtain early engagement with key stakeholders (including authorities, industry and user representatives). Introductory calls were made with key stakeholders, i.e. CITA, EReg, CORTE and EGEA, to discuss the engagement of these organisations and their members with the initiative, including the distribution of the survey and the identification of potential interviewees. In addition, user groups, such as FIA (car drivers), IRU (lorry drivers) and FEMA (motorcyclists), were informed about the initiative and were interviewed as well.
- **Targeted online survey for the IA.** The focus of the survey was on the policy measures under consideration, particularly the details of the measures, their potential costs and savings and potential impacts. The survey was online between 26 June and 14 August 2023. The survey targeted national authorities involved in inspection activities at various levels, including policy development, inspection supervision and enforcement, and industry representatives, including those that undertake inspections and supply garage equipment and vehicles. 75 responses were received to the survey.
- **Targeted stakeholder interviews for the IA.** The majority of interviews were based on the interviewee's survey response, with a focus on identifying information on costs. A minority of interviews were undertaken independent of a survey response, e.g. for those organisations, such as users and research representatives, for which a survey was less relevant. The interviews began at the same time as the survey and continued until the end of August 2023. Overall, 37 interviews were undertaken to refine responses provided in the targeted online survey and to collect evidence from relevant stakeholders not covered in the survey.
- **Evaluation roadmap / Inception impact assessment (IIA).** As part of the initial feedback mechanism, stakeholders had the possibility to provide views on the combined evaluation roadmap / inception impact assessment published on the "Have your say" webpage between 4 October and 1 November 2021. Responses were received from 210 respondents: 171 from EU citizens, 9 from business associations, 6 from companies or business organisations, 6 from NGOs, 3 from consumer organisations, 3 from non-EU citizens, 2 from public authorities, 1 from academia and 9 other. 174 responses were linked to a campaign from predominantly French citizens, while 36 were unique written responses, that were analysed individually.
- **Open public Consultation (OPC**) questionnaire, covering both the IA and the evaluation, was accessible on "Have Your Say" webpage from 6 July to 28 September 2022. 907 replies were received: 758 from EU citizens, 47 from companies or business organisations, 35 from business associations, 18 from non-governmental organisations (NGOs), 10 from non-EU citizens, 10 from public authorities, 5 from trade unions, 3 from consumer organisations, 2 from academic/research

institutions, 1 from an environmental organisation and 18 other. **731 of the responses received were part of a campaign from predominantly French citizens.** The factual summary report is available on the consultation page.

2. STAKEHOLDER GROUPS CONSULTED

This section provides a short overview of the main types of stakeholders identified and targeted as part of the consultation strategy. Overall, the consultation attracted interest from various types of stakeholders, which resulted in a good participation level and numerous contributions received. All identified stakeholder groups have been reached. However, the responses received are not representative of the EU population.

Table 29: Identification of key stakeholder groups and mapping against consultation activities

High-level stakeholder group	Description	Stakeholder engagement activity
Public authorities in charge of road safety	Authorities involved in different activities relating to the RWP, including vehicle registration, inspection, enforcement and policy. Initial engagement was undertaken via their various representative associations, such as CITA, EReg and CORTE.	Exploratory interviews Targeted surveys Targeted interviews OPC Call for Evidence
Industry associations and companies	Associations and companies involved in different aspects of RWP, particularly those involved in inspections and supplying equipment to garages. These were engaged with initially via their representative associations, such as CITA and EGEA. In addition, vehicle manufacturers and vehicle component suppliers were also contacted.	Exploratory interviews Targeted surveys Targeted interviews OPC Call for Evidence
Representations of user groups	Groups representing the drivers of the various vehicles covered by the RWP were engaged with to identify their views on the potential measures.	Targeted interviews OPC Call for Evidence
Road safety and environmental NGOs	The views of specialist NGOs were also sought to ensure that the safety and environmental aspects of the measures were sufficiently considered.	Targeted interviews OPC Call for Evidence
Research / academia	Interviews were undertaken with selected road safety academic experts.	Targeted interviews OPC Call for Evidence
Citizens	Citizens responded to the combined evaluation roadmap/IIA and OPC both individually and as part of a campaign, both from within and outside the EU.	OPC Call for Evidence

3. ANALYSIS OF THE KEY RESULTS OF THE STAKEHOLDER CONSULTATION

This chapter presents key findings from the analysis of stakeholder contributions to the consultation process.

3.1. Feedback received on the EU roadworthiness rules by evaluation criteria

Relevance

- Survey respondents and interviewed stakeholders generally consider that the **scope and objectives of the RWP are relevant** as a well-designed legislative package. Interviewed stakeholders overwhelmingly agree that the three Directives within the RWP are still thematically relevant to the wider EU policy goals.
- However according to the overwhelming majority of survey and interview respondents, there have been **numerous significant changes in vehicle technology since the RWP came into**

effect, which the current RWP does not account for. There is a **need to adapt the Directives to environmental and technological developments and digitalisation**. Additionally, according to the respondents, the current measurement methods outlined by the RWP are considered inadequate for obtaining accurate readings of air pollutants emitted by vehicles, and traditional smoke opacity testing methods are deemed outdated and insufficient in detecting various pollutants. Some interviewed stakeholders also emphasise the need to increase the frequency of inspections for all vehicles due to the growing prevalence of shared mobility strategies and suggest clarifying certain aspects of testing to make it more targeted.

- **Relevance of the current EU rules on periodic roadworthiness testing and technical roadside inspections in improving road safety**. Several stakeholder categories, including academic and research institutions, public authorities, and consumer organisations, who have participated in the OPC, consider the rules relevant or very relevant in areas such as minimum standards for testing centres, facilities, and equipment, as well as categorising deficiencies during periodic tests. However, there are varying opinions from some responding NGOs, EU citizens, and environmental organisations, who perceive some aspects of the rules as less or not relevant. In particular, many respondents being part of the campaign consider the periodic testing of high-speed tractors and heavy motorcycles and applying different time intervals between periodic tests according to the age of vehicle and vehicle type as less or not relevant.
- **Relevance of current EU rules on periodic roadworthiness testing and technical roadside inspections in reducing air pollutant emissions**. Business associations, public authorities, and trade unions, who participated in the OPC consider the rules relevant in areas such as establishing minimum standards for testing centres, facilities, equipment, and inspectors' competence, training, and objectivity. However, there are varying opinions from responding EU citizens, environmental organisations, and some public authorities, who perceive certain aspects of the rules as not relevant in reducing air pollutant emissions. In particular, many respondents being part of the campaign consider the rules related to periodic testing of high-speed tractors and heavy motorcycles as not relevant for the purpose of reducing air pollutant emissions.
- **Relevance of current EU rules on registration documents for vehicles in facilitating free movement of goods and people within the EU**. The majority of the respondents, who participated in the OPC, consider the current EU rules to be relevant or very relevant in facilitating free movement, regarding the obligation on Member States to recognise roadworthiness certificates upon change of ownership. Views among those who responded being part of the campaign are more varied.

Effectiveness

- **Effectiveness of the current EU rules on periodic roadworthiness testing and technical roadside inspections in improving road safety** and contributing to the reduction of road fatalities and serious injuries in road transport in the EU. The majority of respondents, who participated in the OPC, view the current EU rules as effective in improving road safety and contributing to the reduction of road fatalities and serious injuries in road transport in the EU in areas such as establishing minimum standards for testing centres, facilities, and equipment, categorising deficiencies during periodic tests, obliging Member States to perform roadside tests on commercial vehicles, and implementing different time intervals based on vehicle age and type, except for periodic testing of high-speed tractors and heavy motorcycles on which views are diverging. The respondents participating in the campaign, perceive the current EU rules on roadworthiness as less or not effective in in certain aspects, such as periodic testing of high-speed tractors and heavy motorcycles, and minimum standards for inspectors' competence, training, and objectivity. The majority of survey respondents and interview stakeholders agree that PTIs and RSIs helped reduce the number of circulating vehicles with dangerous defects.

- The feedback collected from survey respondents and interviewed stakeholders suggests that vehicles on the road are perceived to have generally been made safer through the introduction of common standards for testing centres and personnel training, as well as with the adoption of same rules for frequency, scope and method for vehicle testing. However, interviewed stakeholders acknowledge that reduction in road deaths witnessed over the past 10 years could be due to a combination of factors (e.g. gas prices, driver behaviour, infrastructure) and it is therefore difficult to determine how many accidents are directly caused by mechanical defects and how many of the lives saved and injuries avoided are specifically linked to PTIs/RSIs.
- **Effectiveness of current EU rules on periodic roadworthiness testing and technical roadside inspections in reducing air pollutant emissions**. 80 % of public authorities, who have responded to the OPC, consider as effective the rules regarding minimum standards for inspectors' competence, training, and objectivity. Respondents in the OPC part of the campaign, have differing perspectives, with a majority of those respondents viewing the rules as not effective for the periodic testing of high-speed tractors and heavy motorcycles and for applying different time intervals between periodic tests, according to the age of vehicles and vehicle type.
- However, interviewed stakeholders also pointed out that not all deficiencies can effectively be detected by applying the current technical standards for vehicle inspections. Among the survey respondents and interviewed stakeholders, there is no clear-cut opinion on the extent to which the provisions of the RWP Package have contributed to reduced air pollutants from road transport. According to surveyed ministries and road safety authorities, vehicles that have been tampered with defects which are not covered by the EOBD system or those specifically related to NOx emissions will not necessarily be detected by the current EU PTI regimes.
- **Effectiveness of current EU rules on registration documents for vehicles in facilitating free movement of goods and people within the EU**. The majority of respondents to the OPC from public authorities and business associations find the current EU rules effective in facilitating free movement. On the other side, the participants in the campaign have diverging opinion on the effectiveness of the current EU rules on registration documents for vehicles in facilitating free movement.

Efficiency

- **Cost-effectiveness of the roadworthiness rules.** Respondents in the targeted survey and the interviews deemed the **benefits** associated with its implementation generally **proportionate to the costs**, especially with regards to the improvement of air quality. This is in line with the views expressed by the survey respondents, who consider that the implementation of the RWP has generated limited extra costs for authorities, citizens, and businesses. PTI inspections have not become more expensive, and the use of the EUCARIS system is cost-effective according to survey respondents. However, certain provisions like OBD checks have incurred costs for citizens. Ministries, road safety authorities, and EU associations participating in the survey agree that the benefits of the RWP in terms of road safety and reduced air pollution justify the costs. EU associations also emphasise its potential in combating illegal pollution and the human costs of air pollution.

- However, while some respondents did not consider RWP provisions as extraordinarily expensive, others mentioned that the costs associated with installing and upgrading testing equipment for testing stations is high.
- Interviewed stakeholders consider the administrative burden generated by the three Directives to be smaller for businesses and citizens than for public authorities.
- Ministries and PTI bodies, who have participated in the survey, acknowledge that the RWP and its implementing acts have created to some extents **administrative burden** for public administration. They emphasise the need for digitalisation in vehicle re-registration to reduce costs and administrative workload, particularly through data exchange and document harmonisation. Vehicle registration authorities who have responded to the survey, call for improved legal provisions and digitalisation to streamline the process. Additionally, EU associations responding to the survey propose providing type-approval information to PTI centres without charge.
- Most respondents of the survey did not express an opinion on whether the RWP package and its implementing acts have imposed administrative burdens on businesses. Survey respondents emphasised the importance of mutual recognition to enhance cost effectiveness in inspections. They also recommended implementing systems like Car-Pass in Belgium on an EU-wide scale to address odometer fraud. Furthermore, it was highlighted by them that a well-assessed test methodology is crucial to avoid inaccurate outcomes in PTI and ensure a standardised approach to testing procedures and equipment.
- The majority of survey respondents did not express an opinion on the administrative burden imposed by the RWP Directives on citizens. However, EU associations suggested that implementing mobile vehicle registration documents could enhance the digitalisation of registration and data management processes, resulting in reduced costs for citizens.

Coherence

- While the Directives comprised in the **RWP are deemed internally coherent by the interviewed stakeholders,** a few **inconsistencies between the RWP and other road safety legislations** have been identified by interviewed stakeholders. As a response to the survey a similar message was passed by responding ministries, road safety authorities, and EU associations, who acknowledged that to some extent there are inconsistencies, overlaps, and gaps between the RWP Directives and other EU and international interventions.
- According to the interviewed stakeholders the **lack of harmonisation between the PTI and the type-approval legislations** makes it difficult to perform thorough inspections, as the number of automated devices, sensors and safety features is growing faster than the PTI operators' ability to check them.
- The need for consistency between periodic technical inspection (PTI) requirements and type-approval regulation was also emphasised by the respondents of the OPC. PTI should not go beyond what is specified in type-approval regulations according to their views. Moreover, according to OPC respondents, Member States have different conditions and contexts for L-category vehicles, and they should have the flexibility to determine effective ways to reduce accidents.
- The **Registration Directive and the Type-approval Regulation are not fully consistent** in the view of interviewed stakeholders: the fact that each country has the possibility of allowing a national type-approval with more flexibility than EU type-approval gives some Member States the chance to be less strict than others, thus raising road safety issues.

- According to the interviewed stakeholders the General Safety Regulation could better align with the RWP: for instance, the GSR identifies more responsibilities for manufacturers during the vehicle's lifecycle than those foreseen by the PTI legislation.
- The feedback received from interviewed stakeholders points to a lack of data coherence, whereby no one has a holistic view regarding the whole life of the vehicle: from vehicle definition to vehicle scrapping.
- According to the OPC respondents, **s**tandardisation of rules among EU countries is considered essential for the effectiveness of the EU technical control package. Disparate rules, particularly concerning the approval of controllers, need to be addressed in their view.

EU added value

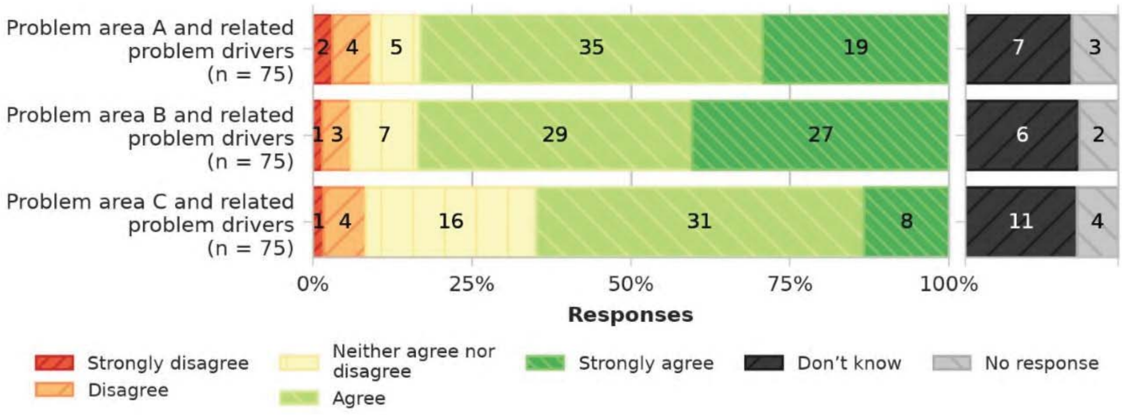
- **The EU rules on roadworthiness have added value for citizens and businesses** compared to what could be achieved by Member States at national and/or regional and international level according to the respondents to the OPC. There is disagreement among EU citizen responding to the OPC whether the EU rules on roadworthiness provide added value compared to what could be achieved at the national, regional, and international levels. However, there is a significant agreement among academic and research institutions, who have participated in the OPC that the EU rules do offer added value for citizens and businesses.
- The interviewed stakeholders widely acknowledged the added value of the three Directives in their contribution towards the harmonisation of roadworthiness rules among Member States. By setting up minimum standards for carrying out periodical technical inspections and roadside inspections, the RWP sets up a common framework to identify vehicle deficiencies, prevent accidents, reduce vehicle emissions and promote fair competition in the field of road transport.
- When expressing views in the survey, ministries, road safety authorities, and PTI bodies considered that additional EU action is necessary to enhance the RWP and achieve the objectives of reducing fatalities, serious injuries, and improving air quality through PTI and RSI inspections in the EU. They emphasised the need for minimum requirements across Member States to ensure effective PTI and RSI contributing to road safety and air quality.
- The overwhelming majority of interviewed stakeholders agree that if the RWP had not been implemented, the road safety scenario in the EU would be far more fragmented, with Member States taking greatly differing actions.

3.2. Feedback received on the problem definition

In the **OPC**, respondents were asked for their views on three problems that the revision of the RWP could address. A majority of respondents – between two-thirds and four-fifths in each case – supported a revision of the EU's roadworthiness rules addressing each of the specified problems. The problem that received most support was the need to address *vehicles circulating on the roads with defects or tampered components* (78%; 123, six 'no responses' or 'Don't knows'), followed by *methods for PTI of vehicles to test electronic safety and driver assistance systems in vehicles* (74%; 116, seven 'no responses' or 'Don't knows'). Two thirds (67%; 100, 14 'no responses' or 'Don't knows') of respondents also believed that a revision to the legislation should address the *availability of relevant vehicle data to enforcement authorities in the EU Member States in cross-border traffic*. Themes raised in response to the open questions included that it was important to update inspections to reflect changes to vehicles and their technology, that it was important to have access to in-vehicle data to support inspections, that more action was needed to address tampering and that it was important to support public authorities in the inspection of foreign vehicles on their roads. Others, while recognising that changes to inspections were needed, underlined that inspections had to remain affordable for consumers.

The **survey** produced similar results of support for the revision of the EU's roadworthiness rules addressing the different identified problem areas, see Figure 4.

Figure 5: Survey results on stakeholders' views on identified problems



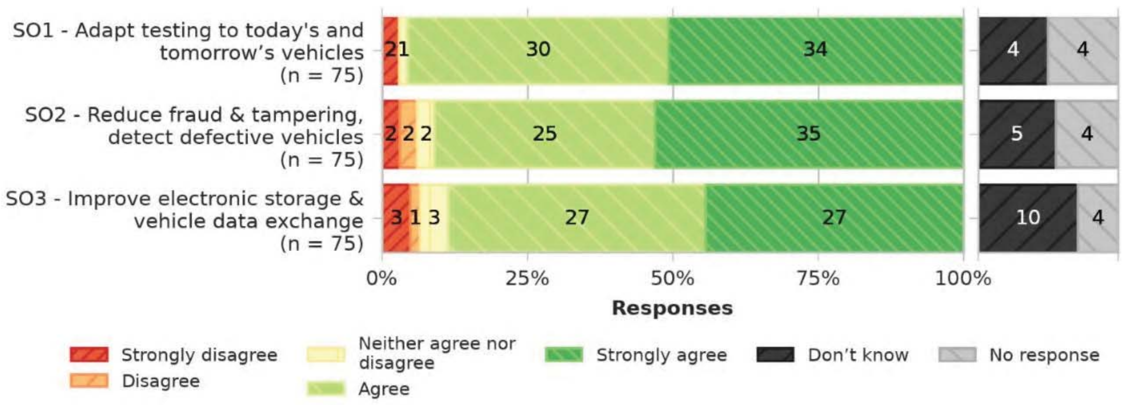
Source: Ricardo et al. (2023), Impact assessment support study, survey results

In the survey, respondents were asked for their views on more detailed problem areas, and their associated drivers and on three Specific Objectives (SOs):

- SO1: Adapt testing to today's and tomorrow's vehicles (improve consistency, objectivity and quality)
- SO2: Significantly reduce fraud and tampering (of safety and emission control systems) and improve the detection of defective vehicles)
- SO3: Improve electronic storage and exchange of relevant vehicle identification and status data.

There was a high level of agreement – around two thirds or more – for each set of problems and problem drivers, and overwhelming support (at least 89%) for each of the specific objectives.

Figure 6: Survey results: Stakeholders' views on identified specific objectives



Source: Ricardo et al. (2023), Impact assessment support study, survey results

Respondents to the **IIA** made a number of general comments about the revision. A common theme that was raised by those responsible for inspections was the importance of more consideration being given to coordinating between type-approval and roadworthiness legislation, and the importance of maintaining the independence of inspection organisations and inspectors from other parts of the automotive trade, including repair and maintenance. The importance of a more consistent approach to roadworthiness testing across the EU was also mentioned.

3.3. Feedback received on the baseline/ existing legislation

In their response to the **survey** and **interview** questions, respondents were often split between those who believed that the different factors listed had had a high impact on various aspects of roadworthiness, and those who believed that the impact had been low. The question to which respondents were mostly having a common view with 75% agreeing (51 of 75; seven ‘Don’t knows’ or no responses) – was in relation to the belief that the *enforcement of roadworthiness legislation* had had a high impact on the *number of unsafe vehicles* on the EU’s roads since 2014. The majority (60%; 40 of 75; eight ‘Don’t knows’ or no responses) of respondents also felt that *technological and market developments* had had a high impact on the *number of unsafe vehicles* on the EU’s roads since 2014. On the other hand, a majority of respondents believed that *technological and market developments* had had a low impact on reducing the *number of vehicles with tampered or defective noise control systems* (77%; 46 of 75; 15 ‘Don’t knows’ or no responses), or *tampered odometers* (64%; 39 of 75; 14 ‘Don’t knows’ or no responses), since 2014. The responses relating to the impact on the *number of vehicles with tampered or defective emissions control systems* and the *vehicle re-registration process* were much more split between those who felt that the impact had been high or low.

Respondents were asked to explain their responses. A common reason listed amongst those responsible for inspections, as well as users, was the need to update PTIs (and so the PTI Directive) to take account of the way in which vehicles have developed and will continue to develop. Many of these respondents also underlined the problem of detecting tampering during a PTI, particularly tampered odometers.

3.4. Feedback received on possible solutions

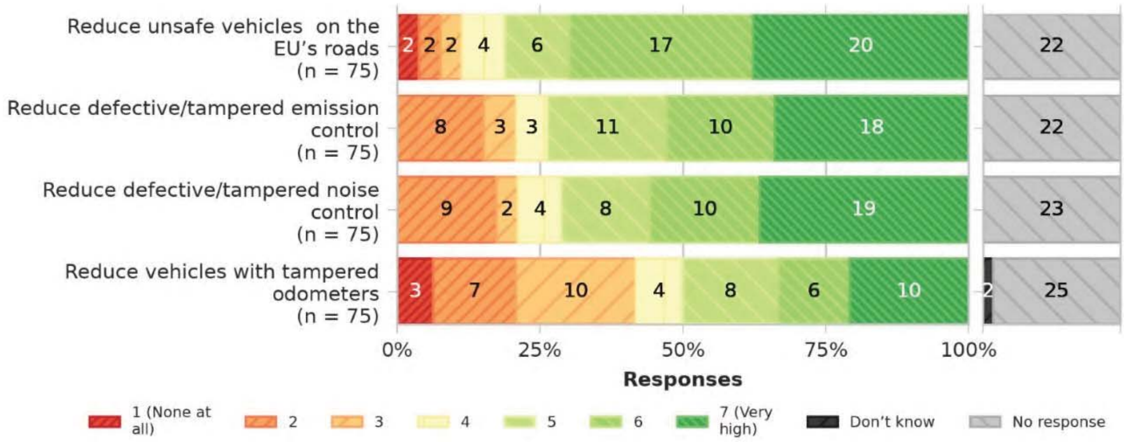
Policy measures: Scope of PTI Directive

The first group of policy measures related to the potential extension of the ***scope of the PTI Directive***. In their responses to the **IIA**, various industry respondents, including those organisations responsible for inspections, called for the extension of the PTI Directive to cover all vehicles that are able to use roads. For example, In the response for IIA, CITA called for the extension of the scope of PTI to L-category vehicles and light trailers, as it had undertaken a study that concluded that this would have a positive cost-benefit impact; it also specified its proposed frequency for inspecting these vehicles. The French National Council of Automotive Professions (Conseil national des professions de l'automobile; CNPA) and GOCA Vlaanderen also supported extending the scope of PTI to these vehicles. The Portuguese National Association of Automobile Inspection Centres (Associação Nacional de Centros de Inspeção Automóvel; ANCIA) called for testing to be mandatory for all motor vehicles used on public roads. Inspection company Applus also suggested that the general rule should be that all vehicles that can circulate on roads in the EU should be covered by the PTI Directive, although they proposed allowing some exceptions for certain L-category vehicles where alternative measures were in place. The European Garage Equipment Association (EGEA) also underlined the importance of extending roadworthiness testing to all road transport vehicles.

On the other hand, various motorcycle users’ groups that submitted contributions to the IIA argued against the mandatory extension of the scope of the PTI to motorcycles, in line also with the responses from the campaign. The Federation of European Motorcyclists’ Associations (FEMA) argued that the evidence was that the technical state of motorcycles only played a marginal role in accidents involving motorcycles..

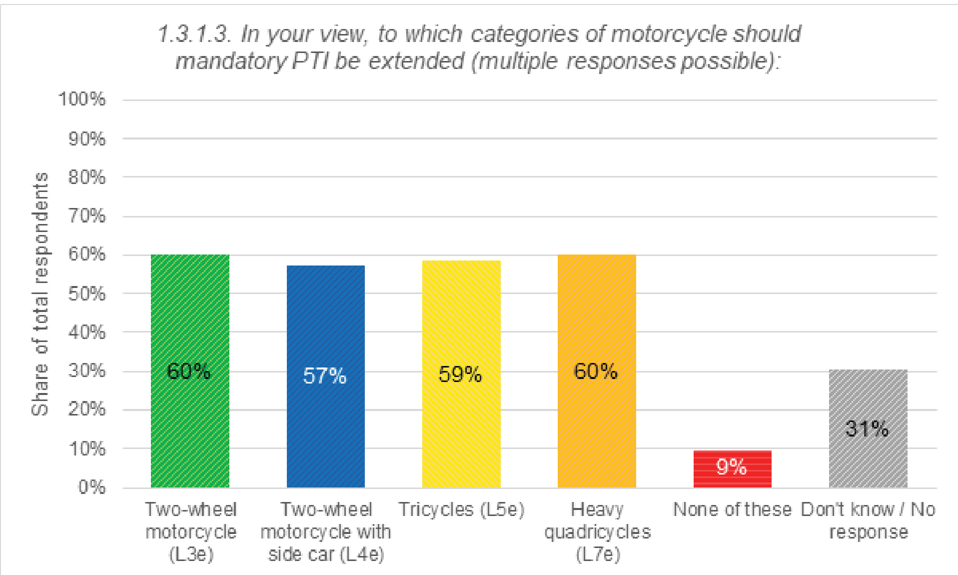
In the **OPC**, among the respondents not linked to the campaign, there was a small majority that supported extending the scope of the PTI Directive to cover L-category vehicles (53%; 73, 25 'no responses' or 'Don't knows'), whereas again the responses that were part of the campaign *were against* such an extension to motorcycles.

Figure 7: Survey responses: In your view what would the contribution of this measure be to:



Source: Ricardo et al. (2023), Impact assessment support study, survey results

Figure 8: Survey responses: In your view, to which categories of motorcycle should mandatory PTI be extended? (multiple responses possible):



Source: Ricardo et al. (2023), Impact assessment support study, survey results

In the **survey**, respondents were asked about different potential measures to extend the scope of the PTI Directive. For each of the potential measures, around two thirds or more of the respondents believed that the respective measure would contribute to a high level to delivering Specific Objective 2, i.e. extending the scope to motorcycles (80%; 41, 24 'no responses' or 'Don't knows'); agricultural and forestry tractors (78%; 31, 35 'no responses' or 'Don't knows'); and light trailers (66%; 27, 34 'no responses' or 'Don't knows'). In the **survey** and **interviews**, it was noted that many Member States already required a PTI for motorcycles, tractors and/or trailers. Some potential challenges of this measure were mentioned by the respondents, including the distance that would need to be travelled to take motorcycles and tractors for an inspection at an inspection centre, and whether a PTI should be required for tractors that were not used on public roads. In addition, for the lightest trailers (O_1), it was questioned whether a PTI was needed for these, due to the way in which these were used, and also due to the fact that these trailers are not registered in some countries, such as the Netherlands and France.

In the responses to the OPC, ***SMEs*** who had responded were much less supportive extending the scope of the PTI Directive to motorcycles than large enterprises participating in the OPC, with 38% (eight) not supporting it, compared to no ***large enterprise***. In the response to the survey and interviews, the fear was expressed that costs for SME inspection companies could increase, if they had to buy more equipment, or if SME rental companies had to have their vehicles tested more often.

Policy measures: Frequency of PTI tests

The second group of measures considered in the survey and interviews covered measures to increase the ***frequency of testing for certain vehicles***. In the **survey**, more than two thirds of respondents believed that four of the measures would contribute to a high level to delivering Specific Objective 2, i.e. an annual PTI for N_1 vehicles (70%; 30, 32 'no responses' or 'Don't knows'), an annual PTI for vehicles over 10 years olds (78%; 39, 25 'no responses' or 'Don't knows'), a mandatory PTI for crashed vehicles with significant damage (70%; 33, 28 'no responses' or 'Don't knows') and for vehicles with significant modification (67%; 32, 27 'no responses' or 'Don't knows'). On the other hand, a significant majority of respondents (85%; 34, 35 'no responses' or 'Don't knows') believed that the remaining measure, a simplified PTI for vehicles that had recently passed an RSI, would have a low contribution to delivering Specific Objective 2.

In the IIA response, CITA called for an increased frequency of PTI for some vehicles. For example, they supported annual tests for vehicles over 12 years' old, as the number of these was increasing in the EU and they would experience more frequent defects as they aged. GOCA Vlaanderen called for more frequent PTIs for certain vehicles, such as N1 vehicles and vehicles of more than 10 years' old. The EGEA also mentioned possibly increasing the frequency of inspections for high mileage vehicles. The French CNPA and a French inspection company called for the alignment of the frequency of testing of N1 vehicles, with those of N2 and N3 vehicles, arguing that in France, where N1 vehicles are tested at the same frequency as cars, they already often had many deficiencies by the time of their first PTI. The Spanish Association of PTI service providers (AECA-ITV) called for annual PTIs for all cars, light commercial vehicles and L-category vehicles. The Portuguese ANCIA also called for an increased frequency of testing for vehicles used for shared mobility or for public transport services. They also called for a mandatory PTI after a vehicle had been in an accident affecting its main safety components, which should have the active involvement of insurers, and on the transfer of ownership of a vehicle. Inspection company Applus also called for a mandatory PTI after a vehicle had been in an accident (as reported by an insurer), and on the transfer of ownership of a vehicle. Finally, they recommended that a quality standard for inspection entities and supervisory bodies be created to improve vehicle inspection and to make this more consistent across the EU.

A common argument in favour of more frequent testing for N1 vehicles, which were mentioned in different consultation exercises, was that such vehicles were used frequently, and often experienced a number of technical issues by the time of their first PTI, although other respondents were not convinced of the added value of this measure. For older vehicles, it was widely suggested that these deteriorate more quickly than newer vehicles, and so should be tested more frequently. The main argument against having a simplified PTI for vehicles that had recently passed an RSI was, that it was not possible to test a vehicle in an RSI in the same way as it was in a PTI -while the potential cost of setting up a system to record and exchange this information was noted-, as was the time that would be needed to amend each PTI to the take account of the recent RSI history of the vehicle. In relation to requiring a mandatory PTI for crashed vehicles with significant damage and for vehicles with significant modification, challenges were identified in relation to who makes the respective judgements and how the information is exchanged. In addition, some respondents considered that a standard PTI was not sufficient to determine the roadworthiness of some crashed or modified vehicles.

Policy measures: Mutual recognition of PTI certificates

The third set of measures included two alternative approaches to enable the ***recognition of PTI certificates in other countries***, i.e. other than the one in which the PTI was undertaken. In the **OPC**, a majority of respondents (63%; 97, 11 'no responses' or 'Don't knows') agreed with the proposal that measures were needed *to enable a vehicle owner to obtain a valid roadworthiness certificate, to be accepted throughout the EU, in a Member State other than the Member State of registration of the vehicle*. In the **survey**, respondents were split on the extent of the contribution of each of the two measures to Specific Objective 3. A marginal majority (51%; 19, 38 'no responses' or 'Don't knows') felt that requiring the mutual recognition of PTI certificates under certain conditions would have a high contribution to Specific Objective 3, whereas a minority (38%; 12, 43 'no responses' or 'Don't knows') felt that way about mutual recognition under bilateral agreements.

In responses to the variation consultation exercises, users and those not directly involved in inspections tended to be more in favour of the mutual recognition of PTI certificates under certain conditions, although some recognised that the mutual recognition under bilateral agreements would be a good first step. However, those more actively involved with inspections were concerned that the extent of the variation between the approach taken to PTIs in different Member States meant that mutual recognition would be difficult and potentially lead to adverse effects on safety, unless mutual recognition was the subject of a bilateral agreement. Linked to this, concerns were also raised that mutual recognition without the increased harmonisation of PTIs would lead to "PTI tourism", where drivers had their vehicles tested in countries where it was easier to pass a PTI.

Policy measures: Electronic roadworthiness certificates

The fourth set of measures consisted of a single measure, i.e. ***require that the roadworthiness certificate is issued in an electronic format***. In their responses to the **survey**, the overwhelming majority of respondents (94%; 49, 23 'no responses' or 'Don't knows') believed that this measure would have a high contribution to addressing Specific Objective 3, with a majority of these (63%; 33) believing that a paper version should still be available on request. In their responses to the **survey** and **interview**, various respondents underlined their support for this measure, and for the increased digitalisation of all aspects of the roadworthiness testing process more generally, due to its potential benefits for efficiency, the environment (less paper use), enforcement and in potentially opening the door for new services. The importance of retaining the option to have a paper copy of the certificate was underlined, so as not to exclude owners who were less digitally literate. The importance of having a standardised format for the electronic roadworthiness certificate was also a common remark of the respondents. A potential challenge of such digitalisation was identified for ***SMEs*** that undertake PTIs in some countries, if they were not yet digitally connected to the agency that oversaw inspections.

Policy measures: Content of PTI tests

The fifth group covered measures to ***improve the current PTI test requirements and procedures***. In their responses to the OPC, a small majority (60%; 91, 13 'no responses' or 'Don't knows') was in favour of *measures to specifically tackle noise-related tampering / non-compliance problems in* *vehicles inspected at the roadside.* ***SMEs responding to the OPC*** were less supportive of this measure, with 29% (six) not supporting it, compared to no ***large enterprise*** among the responding large enterprises.

In the **survey**, around two thirds or more of respondents believed that the measures would contribute to delivering the respective Specific Objectives to a high level, with one exception. The measure that the vast majority (91%; 50, 20 'no responses' or 'Don't knows') thought would contribute at a high level to achieving Specific Objective 1 was to require the training of PTI inspectors to inspect electric vehicles. Around two thirds thought that advanced noise testing for motorcycles (65%; 28, 32 'no responses' or 'Don't knows') and more advanced testing of braking for HDVs (69%; 27, 36 'no responses' or 'Don't knows') would contribute to Specific Objective 2 at a high level. The response was more ambivalent with respect to the contribution of advanced testing of advanced headlamps, as only a slight majority (52%; 23, 31 'no responses' or 'Don't knows') thought that this would make a contribution to addressing Specific Objective 2, although a majority (79%; 37, 28 'no responses' or 'Don't knows') thought that this measure would address Specific Objective 1 at a high level.

More detailed responses in both the **survey** and **interviews** regarding the advanced noise testing for motorcycles ranged from that this was already done in a number of countries, such as Spain, to a concern that such tests would not be effective, as users could remove any tampered devices before the PTI. The latter responses came from national authorities, inspecting companies and user groups, although some felt that such adaptation prior to the PTI was still an additional burden for users. With respect to the advanced testing of advanced headlamps, some, such as the FIA, were not yet clear of the scale of the problem, whereas others, such as CITA, argued that such testing was not yet possible. On the other hand, in some countries it was considered that such tests were already undertaken, e.g. in Germany and Belgium, using a range of different methods. Some respondents noted that there could be additional costs for ***SMEs*** resulting from these measures, if a measure required new equipment or additional training, particularly in countries with a decentralised testing system, such as the Netherlands.

The ***introduction of new PTI test requirements and procedures*** was the subject of the sixth group of measures. In the responses to the **OPC**, around two thirds of respondents supported similar measures to those covered in the survey and interviews. For example, 70% (106, 13 'no responses' or 'Don't knows') supported *methods to test the functioning of safety-relevant electronic components, advanced driver assistance systems (ADAS) and automated functions* being included in the revision of the PTI Directive, with 66% (100, 12 'no responses' or 'Don't knows') supporting the inclusion of *new methods to test vehicles with alternative powertrain technologies (hybrid, full-electric, hydrogen)* and 64% (96, 13 'no responses' or 'Don't knows') *new methods for measuring exhaust emissions, for example particle number (PN) and nitrogen oxides (NO_x)*. Many responses to the **IIA** also called for similar measures.

In the responses to the **survey**, at least 80% of respondents thought that the respective measures would address the specified Specific Objectives, e.g. 92% (46, 25 'no responses' or 'Don't knows') believed that updating the PTI to cover the safety systems introduced by the General Safety Regulation (GSR) would address Specific Objective 1 to a high level and 88% (45, 24 'no responses' or 'Don't knows') felt the same way about adapting the PTI to the particularities of EVs and hybrids. Similar proportions, 81% (43, 22 'no responses' or 'Don't knows') for mandatory PN counting and 82% for requiring NO_x testing according to the JRC methodology, thought that these measures would address both Specific Objective 1 and Specific Objective 2 to a high level. In the open responses to the **survey** and the **interviews**, there was some concern regarding the feasibility of applying NO_x testing according to the JRC methodology in northern Member States, particularly the requirement that testing be undertaken when the vehicle has a warm engine. Again, there were some concerns about the impact of any additional costs from these measures on ***SMEs*** that undertake inspections, particularly where the PTI system was decentralised.

Policy measures: Scope of RSI Directive

The seventh set of measures focused on ***extending the scope of RSIs***. In the responses to the **OPC**, there was a high level of support for *mandatory checks during roadside inspections of commercial vehicles to ensure the safe securing of cargo* (70%; 99, 22 'no responses' or 'Don't knows'). However, there was only a marginal majority in favour of *extending the rules to other vehicles, (e.g., light commercial vehicles, and passenger vehicles, including cars, powered two- and three-wheelers (N$_1$, M$_1$ and L-category vehicles)* (51%; 77, 14 'no responses' or 'Don't knows'). In particular, respondents who were ***SMEs*** were much <u>*less supportive*</u> of this measure, with 38% (eight) not supporting it, compared to no ***large enterprise*** participating in the OPC.

In the **survey**, between two-thirds and three-quarters of respondents believed that the respective measures would address the associated Specific Objectives at a high level, although in all cases at least half of the respondents to the survey did not express a view. On one hand, two-thirds of respondents (67%; 20, 45 'no responses' or 'Don't knows') believed that the introduction of mandatory standards in relation to cargo securing inspections would address Specific Objective 1 at a high level. On the other hand, around three quarters of respondents believed that the extension of the scope of the RSI Directive to N$_1$ and L-category vehicles would address Specific Objective 2 at a high level (76%; 28, 38 'no responses' or 'Don't knows'; and 74%; 23, 44 'no responses' or 'Don't knows', respectively). In their responses to the **survey** and **interview**, various respondents noted that some of these measures were already undertaken in their respective countries, although a minority of respondents were not convinced of the added value of each of these measures. In relation to introducing RSI for N$_1$ vehicles, it was suggested that this could bring additional costs, in terms of lost time, for ***SMEs*** operating such vehicles.

Policy measures: Content of RSIs

The ***introduction of new RSI test methods and procedures*** was the subject of the eighth group of measures. In the responses to the **OPC**, a small majority supported consideration of relevant measures, as 60% (91, 13 'no responses' or 'Don't knows') supported *measures to specifically tackle noise-related tampering / noncompliance problems in vehicles inspected at the roadside* and 53% (78, 17 'no responses' or 'Don't knows') supported *extended emission testing (e.g., NO$_x$ and PN), including the use of remote sensing equipment*. ***SMEs*** participating in the OPC were much <u>*less supportive*</u> of either of these measures (29% (six) and 40% (eight), respectively), compared to no respondent large enterprise in both cases.

In the responses to the **survey**, a majority of respondents, who expressed a view, thought that each of the proposed measures would contribute to addressing both Specific Objective 1 and Specific Objective 2 at a high level, although more than half of respondents did not have a view on any of these measures. For example, 81% (26, 43 'no responses' or 'Don't knows') believed that *PN testing for commercial vehicles* would address Specific Objective 2 at a high level, as did 77% (24, 44 'no responses' or 'Don't knows') for *NO$_x$ and noise testing for all vehicles using remote sensing*. The measure that the fewest respondents believed would address Specific Objective 2 at a high level was *plume chasing for commercial vehicles* (61%; 14, 52 'no responses' or 'Don't knows'). The responses relating to Specific Objective 1 were similar for each measure. In the responses to the open questions in the **survey** and **interviews**, various respondents from national authorities were not convinced of the added value of requiring PN counting during an RSI, if this was also measured in the course of a

PTI. It was also suggested that remote sensing would only be able to identify vehicles that exceed the respective emission standards significantly, rather than being able to identify slight exceedances.

In the IIA response in relation to the RSI Directive, CITA called for cargo securing requirements for cargo vehicles to be set in type-approval, in order to facilitate the inspection of the security of cargo in RSIs. Ireland's RSA called for some changes to improve the RSI Directive, including more specific wording around failures involving frontal protection systems and tampered emission control systems. They also suggested that consideration could be given to expanding the scope of the RSI Directive. The inspection company Applus suggested that the RSI Directive should be extended to all vehicles that were able to circulate on roads in the EU to check their emission levels, noise levels, overloading and other relevant technical issues. They also suggested that remote sensing could be used to identify the need for additional inspections for high polluting vehicles. The Nordic Logistics Association highlighted the importance of electronic data exchange and the storage of the results of RSIs, and for RSI authorities to have access to this information, in order to prevent drivers being subject to another RSI when they cross a border. They also underlined the importance of digital tools, including those that could support the registration of vehicles, in making it easier to inspect vehicles, and so make this more efficient, thus saving time for inspectors and for those being inspected.

Policy measures: Testing software in PTIs and RSIs

The ninth set of measures included a single measure relating to both the PTI and RSI Directives: ***require the testing of software status/integrity of safety and/or emission relevant systems in the PTI for all vehicles and as part of technical roadside inspections of commercial vehicles***. The **OPC** included a question on a similar measure, but only in relation to PTI, which was supported by two thirds of respondents (65%; 100, nine 'no responses' or 'Don't knows'). The importance of checking a vehicle's software, at least during PTIs, was highlighted by a number of inspection bodies in the **IIA**. In the **survey**, a high proportion of respondents believed that the measure would address both Specific Objective 1 (86%; 42, 26 'no responses' or 'Don't knows') and Specific Objective 2 (81%; 38, 28 'no responses' or 'Don't knows') at a high level. In the open responses to the **survey** and **interviews**, some authorities were concerned about the additional costs of this measure, particularly on ***SMEs***. On the other hand, those that undertook inspections believed that the test could be relatively straightforward, even automated, as long as those undertaking inspections had easy access to the relevant information within the vehicle and also to relevant manufacturer databases that contained the necessary information on the software used.

Policy measures: Access and exchange of information/data

The tenth set of measures focused on ***access and exchange of information/data*** that was needed to support PTIs and RSIs.

In the response to IIA, CITA called for all those undertaking inspections to have access to vehicle-specific original data in a non-discriminatory, free and independent manner, given that technical inspections are undertaken for the authorities of the Member States, They also underlined the importance of relevant stakeholders being able to verify that the right version of approved software was being used by the vehicle. Germany's Central Agency for PTI, the FSD, also underlined the importance of access to in-vehicle data and diagnostic information in an independent and reliable way, specifically the information made available in the context of EU type-approval legislation, along with unrestricted access to the vehicle data and software, covering the whole lifetime of the vehicle. Similarly, the Spanish AECA-ITV underlined the importance of PTI inspection providers having access to the original vehicle data, including up-to-date software, in a non-discriminatory, free and independent manner, so that vehicles could be appropriately tested. The Portuguese ANCIA also underlined the importance of testing services having access to the technical specifications of a vehicle's safety systems to be able to properly test these, and to be able to check that a vehicle's software was approved and up to date. Austrian VFT and BdF, and the German DKZ also underlined that, in order to facilitate the inspection of the functionality of safety systems, testing centres should have easy access to the relevant OBD data, free of charge. They also noted that the implementation of Regulation (EU) 2019/621 regarding ePTI had been more difficult than expected and so more detailed provisions should be included in the revised RWP. GOCA Vlaanderen also emphasised the importance of free access to specific PTI-related data for each individual vehicle in order to be able to properly inspect modern vehicles. Similarly, Ireland's RSA called for manufacturers to be required to provide to Member States with "accessible and standardised" information relating to the test items, at no cost to Member States, and to provide sufficient access to in-vehicle data in PTIs to enable the necessary inspections. They also argued that testing inspection companies should have similar access to these information and data. Inspection company Applus argued that organisations involved in statutory activities, such as vehicle inspections, should have a "clear and unfiltered access" to vehicle data, potentially via a central hub. They also called for the information needed for an inspection to be made available in a standardised format in an easy-to-access, computer-readable format on the European level, to facilitate access to the OBD, for example. Applus also underlined the importance of inspections being able to check that the appropriate, non-modified software was present on the vehicle. The EGEA underlined the importance of direct access to in-vehicle data to facilitate the testing of safety and environmental control systems, and also called for all inspection equipment to have digital network capability to enable the secure transmission of data between inspection sites and the respective authorities. GTÜ, the German association of independent PTI inspectors, also underlined the importance of being able to access vehicle data using standardised interfaces, and of having internet access at all inspection sites. They also noted that they would welcome a system that would allow Member States to issue inspection reports solely in a digital format. The FIA also underlined that the relevant diagnostic data and functions must be made "conveniently accessible" for inspection bodies free of charge, as these were undertaking a government activity, with the explicit consent of users. They also called for the implementation of an independent, vehicle security certification scheme to allow "efficient and effective" verification during testing to ensure that the most up-to-date security, safety and environmental protection updates have been installed. The ÖAMTC's response made similar points.

In the **OPC**, questions were asked about relevant measures relating to both PTIs and RSIs. Two-thirds of respondents (67%; 102, 11 'no responses' or 'Don't knows') supported *extending (or clarifying) existing rules on access to in-vehicle data…, with data protection safeguards* for PTIs, whereas a slightly smaller proportion (62%; 93, 15 'no responses' or 'Don't knows') supported this for RSIs. In both cases, ***vehicle and equipment manufacturers/suppliers,*** who participated in the OPC, were less supportive of this provision than other respondents, e.g. for PTI (58%; seven, three 'no responses' or 'Don't knows') and for RSI (50%; six, three 'no responses' or 'Don't knows'). In addition, 59% (92, nine 'no responses' or 'Don't knows') supported *new methods for reading out onboard data stored in the vehicles* for PTIs, although again ***vehicle and equipment manufacturers/suppliers,*** who participated in the OPC, were less supportive of this measure (38%; five, two 'no responses' or 'Don't knows') than other respondents. In addition, nearly two thirds of OPC respondents (64%; 96, 14 'no responses' or 'Don't knows') were supportive of *granting roadside inspection authorities access to electronic data*, which again was less supported by ***vehicle and equipment manufacturers/suppliers,*** who participated in the OPC, than other respondents (31%; four, two 'no responses' or 'Don't knows').

In the **survey**, a majority of respondents believed that *further defining data governance procedures and the means of access to vehicle technical information by testing centres free of charge and in standardised format* would address both Specific Objective 1 (87%; 45, 23 'no responses' or 'Don't knows') and Specific Objective 3 (75%; 38, 24 'no responses' or 'Don't knows') to a high level. A similarly high proportion believed that *enabling and use of independent remote access to in-vehicle data in the RSIs of commercial vehicles* would address both Specific Objective 1 (81%; 34, 33 'no responses' or 'Don't knows') and Specific Objective 2 (73%; 30, 34 'no responses' or 'Don't knows') to a high level. Around three-quarters of respondents (75%; 24, 43 'no responses' or 'Don't knows') believed that *requiring the electronic storage of RSI reports in national databases, as well as the access and exchange of RSI-relevant data to RSI authorities in other EU Member States through a common IT system* would address Specific Objective 3 at a high level. In response to the open **survey** and **interview** questions, various respondents underlined that *enabling and use of independent remote access to in-vehicle data* was as important for PTIs as it was for RSIs, and so underlined that this measure should also be considered in the context of PTIs. In this context, EReg underlined that they supported the three measures in this section applying to all three Directives that are part of the RWP. Various respondents, including CITA, EGEA and EReg, underlined the importance of free and easy access to in-vehicle data to enable the proper inspection of vehicles. Many respondents also underlined the importance of storing relevant data in a structured format, rather than storing the full RSI report. A couple of respondents suggested that ***SMEs*** would benefit from having easier access to information.

Policy measures: Measures relating to vehicle registration

The final – eleventh – set of measures focused on ***potential amendments to the Vehicle Registration Documents Directive***.

In the IIA response in relation to vehicle registration, CITA called for a standardised exchange of data between type-approval and licencing authorities, to eliminate the need to carry the registration certificate in the vehicle (or even its replacement entirely with an electronic version) and the possibility for relevant authorities and bodies to access vehicle registration data, no matter which Member State the vehicle was registered in. Spanish AECA-ITV called for the establishment of an electronic platform in which Member States were able to access the registration documents and certificates of conformity of all vehicles. The Nordic Logistics Association agreed with the difficulties in enforcing road safety measures in cross-border traffic and trade in the EU, and underlined its belief that sharing vehicle registration data, and other safety-relevant information, of vehicles between Member States was important to address this problem.

In the **OPC**, respondents were asked whether they supported four relevant measures, each of which was supported by around three-quarters of respondents, with the most popular being *adding data on major accidents of a vehicle to the vehicle register* (76%; 115, 13 'no responses' or 'Don't knows'). This was followed by *improved exchange of roadworthiness data between Member States in electronic format* (75%; 116, 10 'no responses' or 'Don't knows'), *full digitalisation of registration documents* (74%; 110, 16 'no responses' or 'Don't knows') and *adding odometer data to the vehicle register* (72%; 111, nine 'no responses' or 'Don't knows'). Responses to the **IIA** also supported the sharing of relevant information between Member States.

In the **survey**, a large majority of respondents that had a view (at least 85% in all cases) believed that the respective measures would have a high impact on the respective Specific Objectives. Over 90% of respondents believed that *providing electronic access to relevant data to the registration authorities of other EU Member States through the use of a common IT system* (95%; 38, 35 'no responses' or 'Don't knows') and *adding a minimum set of new data to the vehicle register* (93%; 42, 30 'no responses' or 'Don't knows') would address Specific Objective 3 to a high level. Slightly fewer respondents believed that *introducing the requirement that any vehicle transformation has to be approved and registered* and *increasing the harmonisation of the technical data in the vehicle registration documents on the basis of a common standard* would address Specific Objective 3 at a high level (91%; 30, 42 'no responses' or 'Don't knows'; and 88%; 28, 43 'no responses' or 'Don't knows', respectively). The proportion believing that *requiring issuing of the registration certificates (Annex I) in digital format* and that *requiring that Member States update vehicle registration data on a regular basis* would address Specific Objective 3 at a high level was marginally lower (85%; 23, 48 'no responses' or 'Don't knows'; and 86%; 25, 46 'no responses' or 'Don't knows', respectively).

In the responses to open questions in the **survey** and **interviews**, many national authority respondents highlighted that 17 Member States already used Eucaris for the purpose of data exchange, and that this system worked well. Many of the same organisations underlined that data on the vehicle register should be harmonised and available to all organisations that were involved in undertaking PTIs and RSIs for national authorities, while EReg and some if its members called for a larger set of data to be included in the vehicle register. EReg also generally supported the digitalisation of the vehicle registration documents and the mutual recognition of these. Various national authorities, and users, underlined the importance of the data in the vehicle register being updated as soon as relevant changes happen. It was suggested that additional costs could arise for ***SMEs*** that were not currently digitally connected in order to be able to access electronic documentation and information, although it was also suggested that SMEs would have a lot to gain by having better access to relevant standardised information.

3.5. Feedback received on policy options

Various industry respondents, including PTI operators, called for the extension of the PTI Directive to cover all road vehicles. PO3 and PO1b introduce the obligation to inspect motorcycles at PTI, albeit at a various level of stringency and with PO3 being more ambitious, while PO2 and PO1a allow to substitute PTI with RSI. While stakeholders belonging to motorcyclists' groups at EU or national level did not support such extension in the OPC, in the survey most of the respondents supported mandatory PTI for motorcycles with the objective to reduce tampering and the detection of defected vehicles. Stakeholders also noted that many Member States already required a PTI for motorcycles, as well as for tractors and/or trailers. In the consultations, SMEs were much more likely not to support extending the scope of the PTI Directive to motorcycles than large enterprises, arguing that costs for SME inspection companies could increase, if they had to buy more equipment.

All policy options include <u>mandatory testing after significant modification of a vehicle</u>, which was supported by stakeholders in the survey. Regarding the increased frequency of testing, PO1b and PO2 introduce annual emission testing for vans and a requirement for an annual PTI for vehicles over 10 years old, all these measures being supported by a majority of stakeholders in the survey.

<u>The recognition of PTIs conducted in another Member State</u> was an issue that the majority of stakeholders responding to the OPC considered as necessary to address. PO3 introduces a full recognition, while PO1b and PO2 require the recognition of the PTI from another MS than the MS of registration for a period of up to 6 months. PO1a on the other hand envisages only a recognition based on bilateral agreements. Stakeholder views on this differ to quite some extent: vehicle owners and those not directly involved in PTI inspections tended to be more in favour of the mutual recognition of PTI certificates under certain conditions, although some recognised that the mutual

recognition under bilateral agreements would be a good first step. Those more actively involved with inspections were concerned that the difference between the approach taken to PTIs in different Member States meant that mutual recognition would be difficult and potentially lead to adverse effects on safety. Concerns were also raised that mutual recognition without the increased harmonisation of PTIs would lead to "PTI tourism", where drivers had their vehicles tested in countries where it was easier to pass a PTI.

All policy options tackle odometer tampering. New methods for tackling odometer fraud were considered as necessary by 69% (107) respondents in the OPC and adding odometer data to the vehicle register was welcomed by 72% (111) respondents in the OPC. In the consultations, in relation to odometer readings, some stakeholders suggested that it should be mandatory to record odometer data at certain events, such as following accidents and the transfer of ownership, and that potential buyers should have access to all this information. Not all stakeholders were however positive about this measure: some called on odometer system manipulation to be addressed via type-approval legislation, rather than the revision of the PTI Directive (FIA), and others questioned the potential inclusion of new methods to tackle odometer fraud, arguing that inspection organisations did not have the legal means or ways to detect and sanction such fraud (CITA).

Regarding the content of RSI, PO1b, PO2 and PO3 introduce mandatory NOx and PN measurement and inspection of cargo securing. In the responses to the survey, a majority of respondents (81% and 77% respectively) thought that PN testing for commercial vehicles and NO_x and noise testing for all vehicles using remote sensing would improve the detection of defective vehicles and reduce tampering. In the OPC, a small majority supported extended emission testing (e.g., NO_x and PN), including the use of remote sensing equipment, during RSI. Regarding cargo securing, in the responses to the OPC, there was a high level of support for mandatory checks during roadside inspections of commercial vehicles to ensure the safe securing of cargo (70%; 99). In the survey, two-thirds of respondents (67%; 20) believed that the introduction of mandatory standards in relation to cargo securing inspections would contribute to road safety.

PO2 and PO3 also introduce the extension of scope of RSI to light commercial vehicles. In the OPC, there was only a marginal majority in favour of extending the rules to other vehicles (51%; 77). In the survey, around three quarters of respondents thought that the extension of the scope of the RSI to light commercial vehicles would contribute to better detection of defective and tampered vehicles (76%; 28). In relation to introducing RSI for these vehicles, some stakeholders suggested that this could bring additional costs, in terms of lost time, for SMEs operating such vehicles.

Regarding access and exchange of information/data, PO2 and PO3 both introduce the procedures for access to vehicle technical information by testing centres free of charge. In the OPC, two-thirds of respondents (67%; 102) supported clarifying the existing rules on access to in-vehicle data. Vehicle and equipment manufacturers/suppliers were less supportive of this provision than others. In the survey, a majority of respondents (87%; 45) supported this approach to address the objectives of the initiative. In response to the open survey and interview questions, various respondents (including CITA, EGEA and EReg), underlined the importance of free and easy access to in-vehicle data to enable the proper inspection of vehicles.

Finally, all policy options include measures aimed at facilitating exchange of PTI and registration data. PO1a, PO2 and PO3 furthermore introduce measures on the digitalisation of registration certificates and new data sets to be included. A large majority of stakeholders supported these measures. National authority respondents highlighted that 17 Member States already used Eucaris for the purpose of data exchange, and that this system worked well. They underlined that data on the vehicle register should be harmonised and available to all organisations that were involved in undertaking PTIs and RSIs for national authorities. EReg called for a larger set of data to be included in the vehicle register and generally supported the digitalisation of the vehicle registration documents and the mutual recognition of these. Various national authorities, and users, underlined the importance of the data in the vehicle register being up to date as soon as relevant changes happen.

ANNEX 3: WHO IS AFFECTED AND HOW?

1. PRACTICAL IMPLICATIONS OF THE INITIATIVE

Summary of the implementation of the preferred policy option

The primary objective of the initiative is to improve road safety in the European Union, by contributing to the objective of decreasing the casualties and serious injuries resulting from road crashes by 50% by 2030 as an important milestone of "Vision Zero" by 2050. At the same time, the initiative aims to improve the environmental performance of vehicles and in this way contribute to cleaner air and a lower environmental footprint of the road transport sector in the EU. The preferred policy option will ensure that today's and tomorrow's road vehicles remain safe and maintain their approved environmental performance throughout their lifetime. It will significantly reduce tampering of safety-related and emission control systems as well as odometer fraud and improve data exchange and cooperation among Member States, thereby reducing the external costs generated by road transport, improving consumer protection, and facilitating the free movement of people and goods.

The benefits of the preferred policy option are expected to fall on different stakeholder groups: citizens, vehicle owners, PTI centres, inspectors, public authorities.

Citizens will benefit from the increased road safety on EU roads, leading to less fatalities and injuries. They will also benefit from healthier environment due to reductions in air pollutant emissions (NOx and PM) and noise emissions thanks to better detection of defective and tampered vehicles.

Vehicle owners (businesses and citizens) will enjoy the benefits due to avoided odometer fraud. This will require mandatory recording and reporting to a national central database of vehicle mileage, whenever a vehicle undergoes repair/maintenance or in the case of tyre changes/replacement. It will help reduce odometer fraud in both, domestic sales of used vehicles as well as in cross-border sales. Additional benefits for vehicle owners will come from avoiding emission testing at PTI in case the vehicle passed a roadside inspection or was found to be in line with the applicable emission limits during a screening by remote sensing. They are also expected to save costs related to the recognition of PTI certificates in other Member States (for up to 6 months), as a result of avoided travel costs.

Measures involving an extension of vehicle scope or increase in testing frequency for particular vehicle categories will require additional inspections and will lead in increase of employment of **vehicle inspectors**. Benefits are expected also from the additional training for the inspectors that will have to deliver the new testing methods. Adapting PTI methods to the testing of electric vehicles, including the training of inspectors, will also provide a safer workplace for vehicle inspectors.

PTI centres will benefit from more frequent emission testing of light commercial vehicles and from the mandatory yearly testing for vehicles that are 10-year-old or older. They will also enjoy cost savings due to new data governance measure and access to relevant technical information.

National administrations are expected to benefit from significant cost savings due to the introduction of roadworthiness certificate in electronic format and the interlinking of national vehicle registers. As regards roadworthiness certificates, they should become mandatory in electronic format and gradually replace the paper and smartcard format. This would bring savings to national authorities as they would avoid the costs of printing, distribution, and handling of paper/plastic registration certificates. Additional saving should come from transition to issuing digital registration certificates instead of paper ones. They can also expect cost savings due to the time saved for the re-registration of a vehicle in another Member State.

The costs of the measures included in the preferred policy option are expected to fall on different stakeholder groups: national public authorities, periodic technical inspection (PTI) centres, vehicle repair shops, garages, vehicle owners (citizens and businesses).

National public authorities will face one-off adjustment costs linked to setting up a database for recording odometer history of the vehicles registered in their territory, the interconnection of national vehicle registers, adding new data elements to the registers and introducing remote sensing, which requires the purchase and installation of new roadside equipment as well as a monitoring system. They will also face additional administrative costs due to an increased number of roadside inspections.

PTI centres will face adjustment costs linked to updated and new test requirements, and an increased number of tests will require additional investments in equipment, testing capacity and training of inspectors. It is however expected that PTI centres will be able to recover the additional costs through the additional business opportunities (increased number of tests) and in some cases (depending on the Member State) through somewhat increased PTI charges (this aspect could not be quantified).

Vehicle repair shops, motor vehicle dealers and other garages will face additional administrative costs due to the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory. This includes one-off costs for software updates, to allow them to transfer their data to the central national database, and recurrent costs for the maintenance of the software and the time spent for recording the odometer readings.

Automobile manufacturers will face administrative costs related to the setting up of a governance framework for providing access to in-vehicle data necessary to carry out PTI and RSI to inspection centres and competent authorities. The costs are due to the adjustments to their IT systems to ensure access to the relevant data, and maintenance costs.

Some vehicle owners will also face additional costs due to the extension of the scope or frequency of PTI and roadside inspections. Vehicle owners may also face administrative costs related to the roadworthiness test following any significant modification that could affect safety or the environmental performance of the vehicle. Due to new testing requirements regarding safety, air pollutant emissions and noise, some vehicle owners will incur repair costs to ensure that their vehicles can pass the PTI inspection and remain in use. The regular inspection of cargo securing will lead to recurrent administrative costs for businesses vehicle owners.

2. SUMMARY OF COSTS AND BENEFITS

I. Overview of Benefits (total for all provisions) – Preferred Option (PO2)		
Description	***Amount***	***Comments***
Direct benefits		
Administrative costs savings for Member States administrations, expressed as present value over 2026-2050, relative to the baseline	EUR 5.23 billion	Administrative cost savings for national administrations due to issuing the roadworthiness certificates in electronic format only, the interlinking of national vehicle registers, the time saved for the re-registration of a vehicle in another Member State, and due to avoiding the costs of printing, distribution and handling of paper/plastic registration certificates, estimated at EUR 5.23 billion, expressed as present value over

I. Overview of Benefits (total for all provisions) – Preferred Option (PO2)		
Description	***Amount***	***Comments***
		2026-2050.
Administrative costs savings for businesses (PTI centres), expressed as present value over 2026-2050, relative to the baseline	EUR 1.64 billion	Administrative costs savings for PTI centres due to the access to relevant technical information (data governance) estimated at EUR 1.64 billion, expressed as present value over 2026-2050.
Benefits for businesses (PTI centres) from additional technical inspections, expressed as present value over 2026-2050, relative to the baseline	EUR 39.10 billion	Benefits from additional periodic technical inspections for PTI centres due to the extension of scope of PTI and more frequent testing of certain vehicle categories, including for the yearly testing of vehicles that are 10-year-old or older. Estimated at EUR 39.10 billion expressed as present value over 2026-2050.
Administrative costs savings for other businesses (vehicle owners) expressed as present value over 2026-2050, relative to the baseline	EUR 1.29 billion	Administrative costs savings for other businesses (vehicle owners) due to the possibility to avoid emission testing at PTI in case the vehicle passed a roadside inspection or was in line with the emission limits during a screening by remote sensing. The savings are estimated at EUR 1.29 billion, expressed as present value over 2026-2050.
Benefits for other businesses (vehicle owners) due to avoided odometer fraud	EUR 118.34 billion	Benefits for other businesses (vehicle owners) due to mandatory recording and reporting to a national central database of vehicle mileage, whenever a vehicle undergoes repair/maintenance or in the case of tyre changes/replacement which helps reducing odometer fraud, estimated at EUR 118.34 billion, expressed as present value over 2026-2050.
Adjustment costs savings for citizens (vehicle owners) expressed as present value over 2026-2050, relative to the baseline	EUR 2.14 billion	Adjustment cost savings for citizens due to the recognition of PTI certificates issued by a Member State other than Member State of registration of up to six months, as a result of avoided travel costs back to the country of vehicle registration for a PTI. Estimated at EUR 2.14 billion relative to the baseline (expressed as present value over 2026-2050).
Administrative costs savings for citizens (vehicle owners) expressed as present value over 2026-2050, relative to the baseline	EUR 591.9 million	Administrative costs savings for citizens due to not requiring emission testing at PTI after the vehicle has successfully passed a screening by remote sensing, estimated at up to EUR 591.9 million, expressed as present value over 2026-2050.

I. Overview of Benefits (total for all provisions) – Preferred Option (PO2)		
Description	***Amount***	***Comments***
Benefits for citizens (vehicle owners) due to avoided odometer fraud	EUR 65.67 billion	Benefits due to the obligation for Member States to record odometer readings in a national database, as well as to make them available to other Member States in the case of a re-registration of a vehicle in order to reduce odometer fraud. Estimated at around EUR 65.67 billion, expressed as present value over 2026-2050.
Improvement in the functioning of the internal market		Positive impact on the functioning of the internal market is expected due to the the measures related to improving the availability and exchange of vehicle-related information, making the roadworthiness certificate available in electronic format, harmonising testing methods, the frequency of testing, requirements for the improvement of the PTI and the scope of testing. Harmonising vehicle registration documents across Member States will help to verify the vehicle's characteristics, and its registration status in the country of origin. This can help addressing potential obstacles to re-registration in another EU Member State where the vehicle is reported stolen, or its registration certificate is suspected of being fraudulent.
Benefits for citizens and administration due to 'digital by default'		The mandatory electronic format of roadworthiness certificates should have a positive impact on digital transformation in the EU. For the process of re-registration, it will save time and costs for authorities and citizens by moving away from information and data exchange via e-mail, which is less efficient and time consuming. A digital registration certificate should help reduce time and costs for authorities and citizens by making access and exchange of the relevant information easier, faster.
Increase in employment of PTI and RSI inspectors, relative to the baseline	PTI inspectors: 18,752 additional full-time inspectors in 2030 and 20,107 in 2050, relative to the baseline RSI inspectors: 204 additional full-time inspectors in 2030 and 243 in 2050, relative to the baseline	The preferred policy option will lead to additional inspections and the need for additional inspectors PTI and RSI to perform them due to extension of vehicle scope or increase in testing frequency for particular vehicle categories (such as annual emission testing of vans, mandatory yearly testing of vehicles that are 10-year-old or older, the noise testing of motorcycles and extension of RSI to vans). In addition, there will be benefits from the additional training for the inspectors that will be needed to be able

I. Overview of Benefits (total for all provisions) – Preferred Option (PO2)		
Description	***Amount***	***Comments***
		to deliver the new testing methods. The demand for additional and new testing equipment will lead to an increase in production-related jobs within Member States. There will also be employment opportunity related to providing ongoing maintenance for the new testing equipment.
Indirect benefits		
Reduction in the number of fatalities and serious injuries relative to the baseline (cumulative over 2026-2050)	6,912 lives saved and 64,885 serious injuries avoided	Indirect benefit to society at large. Significant positive effects on road safety are expected, in particular due to to the more effective identification of vehicles with major and dangerous defects in the fleet, which should lead to the reduction of road crashes caused by technical defects and, as a result, to reduced fatalities and injuries. Measures which relate to better implementation and enforcement of the roadworthiness legislation will also contribute. The impacts are estimated at 6,912 lives saved and 64,885 serious injuries avoided over the 2026-2050, relative to the baseline.
Reduction in external costs of accidents (fatalities and injuries), expressed as present value over 2026-2050, relative to the baseline	EUR 74.2 billion	Indirect benefit to society at large, due to the lives saved and injuries avoided. The reduction in the external costs of accidents is estimated at EUR 74.2 billion, expressed as present value over the 2026-2050 horizon (in 2022 prices) relative to the baseline.
Reduction of air pollutant emissions (kilo tonnes of NOx and PM2.5 avoided) (cumulative over 2026-2050)	Air pollutants reduction: 3,969 kilo-tonnes of NOx and 199 kilo-tonnes of PM	Indirect benefit to society at large Significant positive effects on environment are expected, due to the measures having an impact on air pollutant emissions and targeted at high emitters of NOx and particulate matter in the vehicle fleet, which should be effectively identified and repaired, with expected cumulative impact on air pollutants reduction 3,969 kilo-tonnes of NOx and 199 kilo-tonnes of PM over 2026-2050.
Reduction in the external costs of air pollutant emissions relative to the baseline, expressed as present value over 2026-2050	EUR 76.1 billion	Indirect benefit to society at large, due to the reduced air pollutant emissions. The reduction in the external costs of air pollution is estimated at EUR 76.1 billion, expressed as present value over the 2026-2050 horizon (in 2022 prices) relative to the baseline.
Reduction in the external costs of noise emissions	EUR 7.3 billion	Indirect benefit to society at large, due to the reduced noise emissions. The

I. Overview of Benefits (total for all provisions) – Preferred Option (PO2)		
Description	***Amount***	***Comments***
relative to the baseline, expressed as present value over 2026-2050		reduction in the external costs of noise pollution is estimated at EUR 7.3 billion, expressed as present value over the 2026-2050 horizon (in 2022 prices) relative to the baseline.

II. Overview of costs – Preferred option (PO2)						
	Citizens/Consumers		**Businesses**		**Administrations**	
	One-off	**Recurrent**	**One-off**	**Recurrent**	**One-off**	**Recurrent**
Direct adjustment costs (expressed as present value over 2026-2050, relative to the baseline)	-	-	For PTI centres: EUR 3.2 billion	For PTI centres: 20.1 billion	For national public authorities: EUR 29.7 million	For national public authorities: EUR 177.5 million
Direct administrative costs (expressed as present value over 2026-2050, relative to the baseline)	-	For citizens (vehicle owners): EUR 13.7 billion	For businesses: EUR 218 million, of which: - EUR 48.9 million for PTI centres - EUR 149.2 million for garages, repair stations, etc. - EUR 20 million for vehicle manufacturers	For businesses: EUR 26.1 billion, of which: - EUR 87.7 million for PTI centres - EUR 310.8 million for garages, repair stations, etc. - EUR 35.9 million for vehicle manufacturers - EUR 25.7 billion for other businesses (for vehicle owners)	For national public authorities: EUR 77.9 million	For national public authorities: EUR 2.31 billion
Direct regulatory fees and charges	-	-	-	-	-	-
Direct enforcement costs (expressed as present value over 2026-2050, relative to the baseline)	-	-	-	-	-	-
Indirect costs	-	-	-	-	-	-

III. Application of the 'one in, one out' approach – Preferred option (PO2)			
[M€]	**One-off** (annualised total net present value over the relevant period)	**Recurrent** (nominal values per year)	**Total**
Businesses			
New administrative burdens (INs)	EUR 25.5 million, of which: - EUR 5.7 million for the PTI centres - EUR 2.3 million for vehicle manufacturers - EUR 17.5 million for garages, repair stations	EUR 26.4 million, of which: - EUR 4.9 million for PTI centres - EUR 2 million for vehicle manufacturers - EUR 19.5 million for garages, repair stations, etc.	EUR 51.9 million, of which: -EUR 10.6 million for PTI centres -EUR 4.3 million for vehicle manufacturers -EUR 37 million for garages, repair stations, etc.
Removed administrative burdens (OUTs)	-	-	-
Net administrative burdens	**EUR 25.5 million**	**EUR 26.4 million**	**EUR 51.9 million**
Adjustment costs (expressed as present value over 2026-2050, relative to the baseline)	For PTI centres: EUR 3.2 billion	For PTI centres: 20.1 billion	
Citizens			
New administrative burdens (INs)	-	-	-
Removed administrative burdens (OUTs)	-	-	-
Net administrative burdens	-	-	-
Adjustment costs	-	-	
Total administrative burdens	**EUR 25.5 million**	**EUR 26.4 million**	**EUR 51.9 million**

3. RELEVANT SUSTAINABLE DEVELOPMENT GOALS

IV. Overview of relevant Sustainable Development Goals – Preferred Option (PO2)		
Relevant SDG	**Expected progress towards the Goal**	**Comments**
SDG 3 (Ensure healthy lives and promote well-being for all at all ages) including targets 3.6 (halving the number of deaths and injuries from road traffic accidents) and 3.9 (by 2030, substantially reduce the	Reduction in the number of fatalities and serious injuries relative to the baseline (cumulative over 2026-2050): 6,912 lives saved and 64,885 serious injuries avoided	Legislation on safe vehicles is a core element of the Safe System Approach in road safety and a core principle of the

IV. Overview of relevant Sustainable Development Goals – Preferred Option (PO2)		
Relevant SDG	**Expected progress towards the Goal**	**Comments**
number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination) for the air pollution emissions.	Reduction of air pollutant emissions (kilo tonnes of NOx and PM2.5 avoided), cumulative over 2026-2050: air pollutants reduction 3,969 kilo-tonnes of NOx and 199 kilo-tonnes of PM	2020 UN "Stockholm Declaration on road safety"[248]

[248] https://www.roadsafetysweden.com/contentassets/b37f0951c837443eb9661668d5be439e/stockholm-declaration-english.pdf

ANNEX 4: ANALYTICAL METHODS

1. DESCRIPTION OF THE ANALYTICAL METHODS USED

The main model used for developing the baseline scenario for this initiative is the PRIMES-TREMOVE transport model by E3Modelling, a specific module of the PRIMES models. The model has a successful record of use in the Commission's energy, transport and climate policy assessments. In particular, it has been used for the impact assessments underpinning the Communication on a 2040 climate target[249], the "Fit for 55" package[250], the impact assessments accompanying the 2030 Climate Target Plan[251] and the Staff Working Document accompanying the Sustainable and Smart Mobility Strategy[252], the Commission's proposal for a Long Term Strategy[253] as well as for the 2020 and 2030 EU's climate and energy policy framework. In addition, building on the PRIMES-TREMOVE model results, the baseline projections for the number of periodic technical inspections (PTI) have been developed by Ricardo et al. in the context of the impact assessment support study[254].

For the assessment of the impacts of the policy options, the PRIMES-TREMOVE model has been used for quantifying the impacts on the number of fatalities and injuries, as well as the impacts on the air pollutant and noise emissions. An Excel-based tool has been additionally developed in the context of the impact assessment support study, to quantify the impacts on costs and costs savings. The Excel-based tool draws on the Standard Cost Model. The proposed measures are assumed to be implemented from 2026 onwards, so that the assessment has been undertaken for the 2026-2050 period and refers to EU27. Costs and benefits are expressed as present value over the 2026-2050 period, using a 3% discount rate.

PRIMES-TREMOVE model

The PRIMES-TREMOVE transport model projects the evolution of demand for passengers and freight transport, by transport mode, and transport vehicle/technology, following a formulation based on microeconomic foundation of decisions of multiple actors. Operation, investment and emission costs, various policy measures, utility factors and congestion are among the drivers that influence the projections of the model. The projections of activity, equipment (fleet), usage of equipment, energy consumption and emissions (and other externalities) constitute the set of model outputs.

The PRIMES-TREMOVE transport model can therefore provide the quantitative analysis for the transport sector in the EU, candidate and neighbouring countries covering activity, equipment, energy and emissions. The model accounts for each country separately which means that the detailed long-term outlooks are available both for each country and in aggregate forms (e.g. EU level).

In the transport field, PRIMES-TREMOVE is suitable for modelling *soft measures* (e.g. eco-driving, labelling); *economic measures* (e.g. subsidies and taxes on fuels, vehicles, emissions; ETS for transport when linked with PRIMES; pricing of congestion and other externalities such as air pollution, accidents and noise; measures supporting R&D); *regulatory measures* (e.g. CO_2 emission performance standards for new light duty vehicles and heavy duty vehicles; EURO standards on road transport vehicles; technology standards for non-road transport technologies, deployment of Intelligent Transport Systems) and

[249] EUR-Lex - 52024DC0063 - EN - EUR-Lex (europa.eu)
[250] Delivering the European Green Deal | European Commission (europa.eu)
[251] SWD(2020)176 final.
[252] EUR-Lex - 52020SC0331 - EN - EUR-Lex (europa.eu)
[253] Source: 2050 long-term strategy (europa.eu)
[254] Ricardo et al. (2024), Impact assessment support study on the directives of the roadworthiness package, Contract no. MOVE/C2/SER/2022-583/SI2.895928, under FWC no. MOVE/2022/OP/0001

infrastructure policies for alternative fuels (e.g. deployment of refuelling/recharging infrastructure for electricity, hydrogen, LNG, CNG). Used as a module that contributes to the PRIMES energy system model, PRIMES-TREMOVE can show how policies and trends in the field of transport contribute to economy-wide trends in energy use and emissions. Using data disaggregated per Member State, the model can show differentiated trends across Member States.

The PRIMES-TREMOVE has been developed and is maintained by E3Modelling, based on, but extending features of, the open source TREMOVE model developed by the TREMOVE[255] modelling community. Part of the model (e.g. the utility nested tree) was built following the TREMOVE model.[256] Other parts, like the component on fuel consumption and emissions, follow the COPERT model.

Data inputs

The main data sources for inputs to the PRIMES-TREMOVE model, such as for activity and energy consumption, come from EUROSTAT databases and from the Statistical Pocketbook "EU transport in figures[257]. Excise taxes are derived from DG TAXUD excise duty tables. Other data comes from different sources such as research projects (e.g. TRACCS and New Mobility Pattern projects) and reports.

In the context of this exercise, the PRIMES-TREMOVE transport model is calibrated to 2005, 2010 and 2015 historical data. Available data on 2020 market shares of different powertrain types has also been taken into account.

2. BASELINE SCENARIO

In order to reflect the fundamental socio-economic, technological and policy developments, the Commission prepares periodically an EU Reference Scenario on energy, transport and GHG emissions. The socio-economic and technological developments used for developing the baseline scenario for this impact assessment build on the latest “EU Reference scenario 2020”[258]. The same assumptions have been used in the policy scenarios underpinning the impact assessments accompanying the “Fit for 55” package[259].

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[255] https://www.tmleuven.be/en/navigation/TREMOVE

[256] Several model enhancements were made compared to the standard TREMOVE model, as for example: for the number of vintages (allowing representation of the choice of second-hand cars); for the technology categories which include vehicle types using electricity from the grid and fuel cells. The model also incorporates additional fuel types, such as biofuels (when they differ from standard fossil fuel technologies), LPG, LNG, hydrogen and e-fuels. In addition, representation of infrastructure for refuelling and recharging are among the model refinements, influencing fuel choices. A major model enhancement concerns the inclusion of heterogeneity in the distance of stylised trips; the model considers that the trip distances follow a distribution function with different distances and frequencies. The inclusion of heterogeneity was found to be of significant influence in the choice of vehicle-fuels especially for vehicles-fuels with range limitations.

[257] EU transport in figures: Statistical Pocketbook - European Commission (europa.eu)

[258] EU Reference Scenario 2020 (europa.eu)

[259] Policy scenarios for delivering the European Green Deal (europa.eu)

Main assumptions of the Baseline scenario

The main assumptions related to economic development, international energy prices and technologies are described below.

Economic assumptions

The modelling work is based on socio-economic assumptions describing the expected evolution of the European society. Long-term projections on population dynamics and economic activity form part of the input to the model and are used to estimate transport activity, particularly relevant for this impact assessment.

Population projections from Eurostat[260] are used to estimate the evolution of the European population, which is expected to change little in total number in the coming decades. The GDP growth projections are from the Ageing Report 2021[261] by the Directorate General for Economic and Financial Affairs, which are based on the same population growth assumptions.

Table 30: Projected population and GDP growth per Member State

	Population			GDP growth	
	2020	2025	2030	2020-'25	2026-'30
EU27	447.7	449.3	449.1	0.9%	1.1%
Austria	8.90	9.03	9.15	0.9%	1.2%
Belgium	11.51	11.66	11.76	0.8%	0.8%
Bulgaria	6.95	6.69	6.45	0.7%	1.3%
Croatia	4.06	3.94	3.83	0.2%	0.6%
Cyprus	0.89	0.93	0.96	0.7%	1.7%
Czech Republic	10.69	10.79	10.76	1.6%	2.0%
Denmark	5.81	5.88	5.96	2.0%	1.7%
Estonia	1.33	1.32	1.31	2.2%	2.6%
Finland	5.53	5.54	5.52	0.6%	1.2%
France	67.20	68.04	68.75	0.7%	1.0%
Germany	83.14	83.48	83.45	0.8%	0.7%
Greece	10.70	10.51	10.30	0.7%	0.6%
Hungary	9.77	9.70	9.62	1.8%	2.6%
Ireland	4.97	5.27	5.50	2.0%	1.7%
Italy	60.29	60.09	59.94	0.3%	0.3%
Latvia	1.91	1.82	1.71	1.4%	1.9%
Lithuania	2.79	2.71	2.58	1.7%	1.5%
Luxembourg	0.63	0.66	0.69	1.7%	2.0%
Malta	0.51	0.56	0.59	2.7%	4.1%
Netherlands	17.40	17.75	17.97	0.7%	0.7%
Poland	37.94	37.57	37.02	2.1%	2.4%
Portugal	10.29	10.22	10.09	0.8%	0.8%
Romania	19.28	18.51	17.81	2.7%	3.0%
Slovakia	5.46	5.47	5.44	1.1%	1.7%
Slovenia	2.10	2.11	2.11	2.1%	2.4%

[260] EUROPOP2019 population projections: Eurostat - Data Explorer (europa.eu)
[261] The 2021 Ageing Report : Underlying assumptions and projection methodologies The 2021 Ageing Report: Underlying Assumptions and Projection Methodologies | European Commission (europa.eu)

	Population			GDP growth	
	2020	2025	2030	2020-'25	2026-'30
Spain	47.32	48.31	48.75	0.9%	1.6%
Sweden	10.32	10.75	11.10	1.4%	2.2%

Beyond the update of the population and growth assumptions, an update of the projections on the sectoral composition of GDP was also carried out using the GEM-E3 computable general equilibrium model. These projections take into account the potential medium- to long-term impacts of the COVID-19 crisis on the structure of the economy, even though there are inherent uncertainties related to its eventual impacts. Overall, conservative assumptions were made regarding the medium-term impacts of the pandemic on the re-localisation of global value chains, teleworking and teleconferencing and global tourism.

International energy prices assumptions

Alongside socio-economic projections, transport modelling requires projections of international fuel prices. The table below shows the oil prices assumptions of the baseline and policy options of this impact assessment, that draw on the modelling underpinning the REPowerEU package[262].

Table 31: Oil prices assumptions

Oil	2015	2020	2030	2040	2050
in $'15 per boe	52.3	39.8	92.1	97.4	117.9
in €'15 per boe	47.2	35.8	83.0	87.8	106.3

Technology assumptions

Modelling scenarios is highly dependent on the assumptions on the development of technologies, both in terms of performance and costs. For the purpose of the impact assessments related to the "Fit for 55" policy package, these assumptions have been updated based on a rigorous literature review carried out by external consultants in collaboration with the JRC and consulted with stakeholders[263]. In addition, the technology assumptions for heavy duty vehicles have been updated in the context of the work on the impact assessment accompanying the revision of the HDV CO_2 standards Regulation[264]. The same assumptions have been used in the context of this impact assessment.

Policies in the Baseline scenario

The EU Reference scenario 2020 (REF2020) is the starting point for the impact assessment of this initiative. The REF2020 takes into account the impacts of the COVID-19 pandemic that had a significant impact on the transport sector. More detailed information about the preparation process, assumptions, and results are included in the Reference scenario publication[265]. Building on REF2020, the baseline has been designed to include the initiatives of the 'Fit for 55' package proposed by the Commission on 14 July 2021[266] and the initiatives of the RePowerEU package proposed by the Commission on 18 May 2022[267]. The baseline scenario factors in the revision of the HDV CO_2 standards

[262] SWD(2022)230 final.
[263] EU Reference Scenario 2020 (europa.eu)
[264] SWD(2023) 88 final
[265] EU Reference Scenario 2020 (europa.eu)
[266] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
[267] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131

Regulation[268] and the new Euro 7 standards[269,270], the proposed end-of-life vehicles (ELV) Regulation[271,272] and the forthcoming initiative on fair and non-discriminatory access to in-vehicle data[273], as well as other initiatives part of the Road Safety package[274] and the Greening Freight package[275].

The baseline scenario assumes no further EU level intervention beyond the current Roadworthiness Package (i.e., the PTI and the RSI Directives as amended by the delegated Regulations to align with the evolution of type-approval legislation[276] and to introduce the testing of eCall at PTI[277], and the VRD Directive as last amended by the revision of the Eurovignette Directive[278]). As some of the provisions of the RWP allowed for a very long transition period[279], certain Member States are still notifying transposition measures to the Commission. In addition, the baseline reflects the introduction of PN measurement by three Member States[280].

The baseline also incorporates foresight megatrends[281] and developments captured in the 2022 Strategic Foresight Report[282]. Among others, it captures the trend of increasing demand for transport as population and living standards grow as well as the links between the digital and green transition. In particular, the projected transport activity draws on the long-term population projections from Eurostat and GDP growth from the *Ageing Report 2021*[283] by the Directorate General for Economic and Financial Affairs.

Baseline scenario results

Transport activity projections. In the baseline scenario, EU transport activity is projected to grow post-2020, following the recovery from the COVID pandemic. Road transport would maintain its dominant role within the EU by 2050. Road passenger transport activity (expressed in passenger-kilometres)[284] is projected to

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[268] Regulation (EU) 2024/1610.
[269] COM(2022) 586 final.
[270] Taking into account the expected effects of the Euro 7, based on the Commission's proposal, the currently dominant Euro 5/V and 6/VI vehicles should be gradually replaced by new ones complying with the Euro 7 standard. This would result in reduced levels of tampering and lower emissions, in particular for heavy-duty vehicles. A limitation to mention here is that the baseline reflects the Commission proposal. Following the changes by the co-legislators, the baseline likely overestimates the reduction in the air pollution emissions over time and thus slightly underestimates the contribution of this initiative to the air pollution emissions reduction. This is particularly relevant in the short to medium term. In the medium to long term this is less relevant due to the expected large-scale penetration of the zero-emission vehicles in the fleet.
[271] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0451
[272] The proposal for a Regulation on end-of-life vehicles (ELV) (COM(2023) 451 final) calls for data related to the reasons of deregistering vehicles to be recorded in the national vehicle registers (see Recital 86).
[273] According to current plans, the proposal on access to in-vehicle data would provide for non-discriminatory access to such data in a harmonised, machine-readable format. This will be key for vehicle inspection too, without, however, specifying the means of data access, which will continue to allow manufacturers to set their own (often cumbersome) rules.
[274] Proposal for a Directive amending the Driving Licence Directive, proposal for a Directive amending the Cross-Border Enforcement Directive and proposal for a Directive on the Union-wide effect of certain driving disqualifications.
[275] Green Deal: Greening freight for more economic gain with less environmental impact (europa.eu)
[276] https://eur-lex.europa.eu/eli/dir_del/2021/1717/oj and https://eur-lex.europa.eu/eli/dir_del/2021/1716/oj
[277] https://eur-lex.europa.eu/eli/reg/2015/758/oj
[278] Directive (EU) 2022/362 amending Directives 1999/62/EC, 1999/37/EC and (EU) 2019/520, as regards the charging of vehicles for the use of certain infrastructures, https://eur-lex.europa.eu/eli/dir/2022/362/oj
[279] For example, PTI for motorcycles (with a possibility for exemptions) since January 2022; the deadline to equip all test centres with all the required equipment was 20 May 2023 (five years after the date of application).
[280] Belgium, Germany and the Netherlands.
[281] https://knowledge4policy.ec.europa.eu/foresight/tool/megatrends-hub_en#explore
[282] COM(2022) 289 final.
[283] doi:10.2765/733565.
[284] Covering passenger cars, buses and coaches and power-two wheelers.

grow by 10% between 2015 and 2030 (27% for 2015-2050), while road freight transport activity (expressed in tonne-kilometres)[285] by 27% during 2015-2030 (52% for 2015-2050). Rail transport activity is projected to grow significantly faster than for road, driven in particular by the completion of the TEN-T core network by 2030 and of the comprehensive network by 2050, supported by the CEF, Cohesion Fund and ERDF funding, but also by measures of the 'Fit for 55' package[286] and the Greening Freight package. Passenger rail activity is projected to go up by 37% by 2030 relative to 2015 (86% for 2015-2050). Freight rail traffic would increase by 50% by 2030 relative to 2015 (107% for 2015-2050).

Zero-emission vehicles. The share of zero-emission vehicles in the light duty vehicle fleet (passenger cars and light commercial vehicles) is projected at 15% in 2030, going up to 95% in 2050 in the baseline scenario, while for heavy duty vehicle fleet (buses and coaches, and heavy goods vehicles) at 6% in 2030 and 72% in 2050. These developments are driven by the CO_2 standards Regulations, supported by the Alternative Fuels Infrastructure Regulation.

High-emitting vehicles. The current limitations of the emission testing methods applied under the PTI and RSI Directives are expected to persist in the baseline scenario, with the shares of high-emitting vehicles[287] in the Euro 5/V and Euro 6/VI fleet remaining largely the same. On the other hand, the share of high-emitting vehicles in the Euro 7 fleet is expected to be lower than for Euro 5/V and Euro 6/VI. The shares of high-emitting vehicles are further discussed in the section below.

Air pollution and CO_2 emissions projections. The uptake of zero-emission vehicles and the penetration of Euro 7 vehicles in the fleet, combined, are expected to result in significant reductions of the air pollution emissions from road transport in the baseline scenario. NOx emissions are projected to reduce by 52% in 2030 relative to 2015 (98% reduction for 2015-2050), while particulate matter (PM2.5) emissions would decrease by 43% in 2030 relative to 2015 (98% reduction for 2015-2050). CO_2 emissions from road transport are projected to decrease by 32% by 2030 relative to 2015, and be close to zero by 2050, thanks to the large-scale uptake of zero-emission vehicles and some use of renewable and low-emission fuels.

Projected number of fatalities and injuries. In the baseline scenario, the number of fatalities is projected to decrease by 24% by 2030 relative to 2015 and by 31% by 2050 relative to 2015[288]. The number of serious and slight injuries is projected to decrease by 19% between 2015 and 2030 and by 26% for 2015-2050. This is despite the increase in traffic over time. Relative to 2019, the number of fatalities would decrease by 15% by 2030 and 23% by 2050, and the number of serious injuries by 10% by 2030 and 18% by 2050. Thus, the targets of the EU Road Safety Policy Framework 2021-2030 – Next steps towards "Vision Zero", of reducing the number of road deaths and the number of serious injuries by 50% between 2019 and 2030, would not be met. In addition, this is still far from

[285] Covering heavy goods vehicles and light commercial vehicles.
[286] These measures increase to some extent the competitiveness of rail relative to road and air transport.
[287] It should be noted that there is no standard definition of a high emitter. One possible definition would be: a vehicle whose average emissions are at least 2 standard deviations higher than the average emissions of the sample tested (https://pure.iiasa.ac.at/id/eprint/10156/1/XO-12-019.pdf). A pragmatic approach has been used for the analysis, making use of information/data provided in relevant studies, while recognising that they are not always consistent in the definition applied. Furthermore, it should be noted that high emitters may be vehicles with defective emission or noise control systems or vehicles with tampered emissions/noise control systems. In the absence of more detailed information, a 50% share of defective and tampered vehicles is assumed in the total share of high emitters in the fleet.
[288] Projections refer to injuries in accidents in which a passenger vehicle (car), a light commercial vehicle (van), a bus or a truck, or a motorcycle is involved.

the goal of the Sustainable and Smart Mobility Strategy of a close to zero death toll for all modes of transport in the EU by 2050.

Number of periodic technical inspections and odometer fraud. In the baseline scenario, the number of periodic technical inspections (PTI) for LDVs, HDVs and motorcycles is projected to increase from 151.5 million in 2015 to 168.9 million in 2030 and 192.3 million in 2050[289]. For O1 and O2 vehicles the number of inspections is projected at 7.9 million in 2030 and 8.7 million in 2050. More details on these projections are presented below.

At the same time, the number of national second-hand vehicle sales with mileage fraud at EU level is projected at 1.63 million in 2026, 1.71 million in 2030 and 1.90 million in 2050, and that of cross border vehicle sales with mileage fraud at 3.18 million in 2026, 3.35 million in 2030 and 3.64 million in 2050. The national and cross-border odometer fraud is estimated to lead to damages for European consumers estimated at EUR 10.2 billion in 2026, EUR 10.7 billion in 2030 and EUR 11.7 billion in 2050[290]. Expressed as present value over 2026-2050 this amounts to EUR 194.6 billion.

Share of high emitter vehicles of air pollution emissions

The limitation of the current testing methods to effectively identify vehicles with defective or tampered emission control systems is expected to continue under the baseline scenario. As such, the current situation in terms of shares of high emitter vehicles and the resulting level of emissions from high emitters – per Euro standards and vehicle age group and Euro standard - is expected to remain largely the same. On the other hand, the move towards Euro 7 and the use of OBM will help reduce the level of tampering in comparison to Euro 5 and Euro 6. Therefore, the share of high emitters in the Euro 7 fleet is expected to be lower, although still increasing for older age groups.

It should however be noted that the increase in the share of zero-emission vehicles in the fleet over time, will reduce the number of defective/tampered vehicles and the associated tailpipe emissions in the overall fleet.

In the context of the stakeholders' consultation, the view expressed show no firm confidence that the current RWP can reduce the number of vehicles with defective or tampered emission control systems (weighted average of responses, in a scale of 1-None at all to 7-Very high, was 3.5). A similar assessment was provided in terms of the expected contribution to reducing high emitting vehicles on the road by technological development or by other measures taken at the Member State level (weighted average of responses of 3.6 and 3.8, respectively).

Data is limited but the analysis of available evidence based on remote sensing campaigns in different Member States has allowed to develop estimates on the shares of high emitters for different vehicle type and age groups.

Information on high emitter shares for motorcycles - and more generally for L-category vehicles - is even more limited. Data from PTI in Spain[291] reveal that 15% of the deficiencies in L-category vehicles are related to nuisance, which includes air pollutant and noise emissions. However, the information available does not provide the proportion of the fleet this represents. Data from Germany suggests that emission defects represent 0.4% of the total across the whole fleet tested. As expected,

[289] They are derived based on the 'testing frequency' and the average number of PTIs in the statistical life of a vehicle.
[290] The average cost of mileage fraud, due to higher purchase price and maintenance costs incurred, is estimated at EUR 2,119 per vehicle in 2022 prices drawing on a Belgian Car-Pass study (https://www.car-pass.be/files/article_files/file/7/crm%2520study%2520final%2520report.pdf).
[291] UC3M (2019), Roadworthiness testing contribution to vehicle safety and environment.

the percentage of defective vehicles is higher among older motorcycles (>9 years). However, in both cases the numbers refer to the results of PTI inspections that cannot effectively capture the occurrence of tampering. Hence, this is expected to underestimate the share of high emitters in the fleet. As for motorcycles no data is currently available from remote sensing campaigns, in the baseline it is assumed that motorcycles follow the same profile as petrol Euro 5 passenger car vehicles, in terms of shares of high emitters and emissions ratios. This is considered a conservative estimate in the absence of more specific data.

The tables below summarise the assumptions on the share of high emitters and their respective emission rates in the baseline scenario. These have been assumed to remain stable over time for the respective vehicle groups.

Table 32: Share (%) of M1 high emitter vehicles in the stock, by age group and Euro standard

	Diesel			Petrol		
Vehicle's age (years)	**Euro 5**	**Euro 6**	**Euro 7**	**Euro 5**	**Euro 6**	**Euro 7**
NOx						
0-4	2.5	2.5	1.3	3.5	3.3	1.6
5-9	5.0	5.0	3.0	6.5	6.5	3.3
10-14	7.5	7.5	4.5	9.8	9.8	4.9
15-19	10.0	10.0	5.0	13.0	13.0	6.5
PM/PN						
0-4	2.5	2.5	1.3	2.6	2.6	1.3
5-9	5.0	5.0	3.0	5.2	5.2	2.6
10-14	7.5	7.5	4.5	7.8	7.8	3.9
15-19	10.0	10.0	5.0	10.4	10.4	5.2

Source: Ricardo et al. (2024), Impact assessment support study

Table 33: Share (%) of N1 high emitter vehicles in the stock by age group and Euro standard

	Diesel			Petrol		
Vehicle's age (years)	**Euro 5**	**Euro 6**	**Euro 7**	**Euro 5**	**Euro 6**	**Euro 7**
NOx						
0-4	6.0	6.0	3.0	7.8	7.8	3.9
5-9	9.0	9.0	4.5	11.7	11.7	5.9
10-14	12.0	12.0	6.0	15.6	15.6	7.8
15-19	15.0	15.0	7.5	19.5	19.5	9.8
PM/PN						
0-4	6.0	6.0	3.0	6.2	6.2	3.1
5-9	9.0	9.0	4.5	9.4	9.4	4.7
10-14	12.0	12.0	6.0	12.5	12.5	6.2
15-19	15.0	15.0	7.5	15.6	15.6	7.8

Source: Ricardo et al. (2024), Impact assessment support study

Table 34: Shares (%) of N2/N3 and M2/M3 high emitter vehicles in the stock by Euro standard and age

Vehicle's age (years)	**Euro V**	**Euro VI**	**Euro 7**
NOx			
0-4	10.3	7.2	3.6

5-9	12.6	8.8	4.4
10-14	14.9	10.4	5.2
15-19	17.2	12.0	6.0
PM/PN			
0-4	10.3	7.2	3.6
5-9	12.6	8.8	4.4
10-14	14.9	10.4	5.2
15-19	17.2	12.0	6.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 35: Shares (%) of L high emitter vehicles in stock by age

Vehicle's age (years)	NOx	PM/PN
0-4	3.5	2.6
5-9	6.5	5.2
10-14	9.7	7.8
15-19	13.0	10.4

Source: Ricardo et al. (2024), Impact assessment support study

Emission rates

The emission rate is defined as the ratio between the emission of a defective vehicle and a vehicle with its emission control system functioning according to the requirements.

The values used in the baseline scenario, summarised in the table below, are based on the evidence available in the literature and on experts' consultation. Valuable source of information were the DIAS project[292], the CITA paper[293], and the TNO study[294].

Table 36: Emission rates of high emitters vehicles (defective and tampered) for air pollutants by Euro standard

Vehicle	Euro 5/V	Euro 6/VI	Euro 7
NOx			
M1/N1 diesel	4	10	20
M1/N1 petrol	6	10	20
N2/N3/M2/M3	4	10	20
L3-L7	5		
PM/PN			
M1/N1 diesel	10	10	50
M1/N1 petrol	5	5	25
N2/N3/M2/M3	4	10	50
L	5		

292 DIAS (2022), D6.5 Impact assessment and guidelines for future anti-tampering regulations.
293 CITA (2022), Monitoring of NOx emissions as part of the PTI. Position Paper.
294 TNO (2022), Approaches for detecting high NOx emissions of aged petrol cars during the periodic technical inspection. R10659v2.

Source: Ricardo et al. (2024), Impact assessment support study

Share of high emitter vehicles of noise emissions

Data for motorcycles – vehicle category L – exceeding the legal noise threshold is very limited and does not allow to reach specific conclusions. Feedback from stakeholders suggests that the issue of vehicles with defective or tampered noise control systems on the EU's roads has not been effectively addressed till now and it is expected to persist. It was noted that based on differences in the composition of the motorcycle fleet and the intensity of use of motorcycles between North and South Europe, the share of high emitters may be higher in the South.

According to data from PTI in Spain[295] around 15% of L-category vehicles tested showed major deficiencies related to emissions and vehicle noise. In Germany, where noise is reported separately, a very low share of total defects related to noise was identified (1%). However, especially in the case of noise tampering, PTI is considered as particularly ineffective due to the ease with which the noise control system can be activated or deactivated for L category vehicles. Therefore, the results from PTI are expected to underestimate the scale of the problem. The fact that the problem is more widespread than what shown at PTI is revealed by the 30% share of motorcycles with tampered noise control systems found by police in Bavaria, during roadside checks, during the European Bike Week in 2018[296].

In the baseline it is assumed that on average 30% of L-vehicles emit noise above the legal limit.

Share of vehicles with tampered odometers

There are limited sources of evidence in terms of the level and evolution of odometer tampering. According to a study commissioned by the European Parliament[297], tampering rates were estimated between 5% and 12% of national second hand vehicles sales and between 30% and 50% of cross-border second hand vehicles sales. Tampering was found to be more common among vehicles imported in EU12 Member States, estimated in the range of 30% to 80%, in comparison to 20%-40% of the second hand vehicles imported in EU15 countries.

More recent estimates provided by CarVertical[298], based on analysis of vehicle history reports, suggest overall lower odometer fraud rates for most of the countries reported than those in the European Parliament study. However, except for the Car-Pass system in Belgium, adopted in 2006, and a similar system implemented in the Netherlands, no other Member State has taken action so far. Both have achieved significant reduction to the level of odometer tampering – especially in relation to national sales, by requiring that readings are submitted after any maintenance, repair, assembly or inspection. It has been reported that odometer tampering has almost been eliminated (up to 97% success rates)[299] in Belgium, a point also supported by the Car-Pass manager during the stakeholders'

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[295] UC3M (2019), Roadworthiness testing contribution to vehicle safety and environment.
[296] About motorcycles (2018), Police control Bike Week Faaker, see 2018. Retrieved from About motorcycles: https://misfitmademotorcycles.com/police-control-bike-week-faaker-see-2018/
[297] Research for TRAN Committee - Odometer tampering: measures to prevent it (europa.eu)
[298] Overall mileage fraud analysis is available at : https://www.carvertical.com/blog/research-what-countries-have-the-highest-percentage-of-cars-with-a-fake-mileage and in the CarVertical Market transparency index (https://www.carvertical.com/transparency-index). Specific analysis of the share of odometer tampering for national and imported second hand vehicles is available at : https://www.carvertical.com/blog/research-local-or-imported-cars-have-more-mileage-rollbacks
[299] TRT (2017), Research for TRAN Committee (European Parliament) - Odometer tampering: measures to prevent it.

consultation. Other Member States (e.g. Slovakia, Luxembourg, France) are considering the introduction of relevant measures but so far no action has been taken.

The table below presents the estimated shares of odometer tampering for national and imported second hand vehicles. In the case of Member States where data is not available (cells in grey) the median values for EU12 and EU15 have been used. Values in blue and italics, concerning cross-border fraud rates, were based on the finding of the European Parliament study (also supported by CarVertical data) that cross border odometer fraud rates are around twice those of national odometer fraud rates. Values in green are drawing on the data from Car-Pass for Belgium[300]. The same rates are assumed for the Netherlands.

Table 37: National and cross-border odometer fraud rates as shares of national and cross-border second hand vehicle sales, respectively

	Cross border odometer fraud rates	National odometer fraud rates
AT	12.0%	4.0%
BE	*0.2%*	*0.1%*
BG	*9.7%*	**4.9%**
CY	12.0%	4.0%
CZ	**13.6%**	**7.1%**
DE	*6.8%*	**3.4%**
DK	*8.1%*	**4.1%**
EE	**18.9%**	**7.4%**
EL	12.0%	4.0%
ES	**10.3%**	**3.8%**
FI	*7.5%*	**3.8%**
FR	**10.4%**	**3.7%**
HR	**9.1%**	**6.8%**
HU	**13.8%**	**9.6%**
IE	12.0%	4.0%
IT	15.4%	5.3%
LT	**18.8%**	**7.3%**
LU	*20.0%*	**10.0%**
LV	**25.7%**	**9.2%**
MT	12.0%	4.0%
NL	*0.2%*	*0.1%*
PL	12.9%	5.6%
PT	*4.4%*	**2.2%**
RO	**18.7%**	**5.9%**
SE	12.0%	**10.0%**
SI	*7.4%*	**3.7%**
SK	*8.9%*	**4.5%**

Source: Ricardo et al. (2024), Impact assessment support study; Note: Values in bold are from CarVertical. Values in italics and blue are based on the finding of the European Parliament study (also supported by CarVertical data) that cross border odometer fraud rates are around twice those of national odometer fraud rates. Cells in grey reflect the median values. Values in green and italics are based on data from Car-Pass for Belgium.

There is no evidence that the fraud rates would change over time in lack of action. The input from stakeholders suggests that the issue of odometer tampering has not be effectively addressed up to this point. Respondents were rather sceptical in relation to the role of technological developments and of the existing roadworthiness package, but more positive on the role of national measures (weighted average of responses on a scale of 1-'None at all' to 7-'Very high' were 3.1, 3.6 and 4.3 respectively). They were even more sceptical when asked to indicate the expected contribution of technological developments, the existing roadworthiness package and national measures to reducing the level of

[300] Car-Pass annual report 2022 - News about Car-Pass

odometer tampering in the future (weighted average of responses on a scale of 1-‘None at all’ to 7-‘Very high’ were 3.2, 3.2 and 4.1 respectively). While recognising the possibility for action taken at national level by some Member States, in the baseline scenario it has been assumed that the odometer tampering rates will remain constant over time.

Based on the projected number of second hand vehicles sales and the fraud rates, the projected odometer tampering for national and cross-border sales in the baseline scenario are presented in the tables below.

Table 38: Odometer tampering for national sales by Member State (number of vehicles) in the baseline scenario

	2026	2030	2040	2050
AT	27,663	29,082	31,537	28,931
BE	459	483	475	463
BG	11,023	11,589	9,047	11,114
CY	1,313	1,381	1,263	1,411
CZ	54,579	57,377	60,172	59,126
DE	247,601	260,298	269,488	259,158
DK	20,920	21,993	24,297	23,783
EE	4,677	4,917	5,663	7,371
EL	28,388	29,844	23,627	30,595
ES	77,388	81,357	91,773	81,513
FI	18,869	19,836	18,836	18,401
FR	226,930	238,567	274,456	260,370
HR	12,940	13,604	12,965	18,986
HU	89,001	93,565	112,148	114,756
IE	11,869	12,478	13,847	14,412
IT	443,025	465,744	604,117	581,076
LT	18,756	19,718	22,992	22,508
LU	16,511	17,357	21,486	21,893
LV	3,733	3,925	5,245	5,221
MT	2,166	2,277	2,278	2,292
NL	1,595	1,677	1,981	1,704
PL	92,942	97,709	63,577	91,578
PT	10,552	11,093	13,362	12,903
RO	47,649	50,092	60,704	59,554
SE	135,124	142,053	130,506	140,141
SI	5,503	5,785	6,098	6,220
SK	20,755	21,819	23,834	23,287
EU27	**1,631,930**	**1,715,619**	**1,905,771**	**1,898,770**

Source: Ricardo et al. (2024), Impact assessment support study

Table 39: Odometer tampering for cross-border sales by Member State (number of vehicles) in the baseline scenario

	2026	2030	2040	2050
AT	124,483	130,867	141,915	130,189
BE	3,978	4,182	4,110	4,013
BG	83,946	88,251	68,893	84,640
CY	24,202	25,443	23,280	26,006
CZ	98,613	103,670	108,719	106,829
DE	237,345	249,517	258,326	248,424
DK	32,862	34,547	38,165	37,359
EE	40,536	42,615	49,087	63,891
EL	127,748	134,299	106,320	137,675

	2026	2030	2040	2050
ES	319,806	336,207	379,251	336,853
FI	38,438	40,409	38,372	37,485
FR	530,593	557,803	641,715	608,782
HR	37,087	38,989	37,159	54,415
HU	117,061	123,064	147,505	150,936
IE	53,558	56,305	62,483	65,035
IT	318,608	334,947	434,460	417,890
LT	150,151	157,851	184,061	180,185
LU	14,152	14,878	18,417	18,765
LV	28,139	29,582	39,530	39,352
MT	9,773	10,274	10,278	10,345
NL	3,419	3,594	4,245	3,651
PL	318,222	334,541	217,678	313,549
PT	51,145	53,768	64,764	62,543
RO	293,029	308,057	373,319	366,244
SE	65,211	68,555	62,983	67,633
SI	19,839	20,856	21,986	22,426
SK	49,222	51,746	56,524	55,227
EU27	**3,191,167**	**3,354,817**	**3,593,545**	**3,650,341**

Source: Ricardo et al. (2024), Impact assessment support study

Odometer damage cost per vehicle

Detailed analysis of the cost of odometer tampering is provided in a European Parliament study[301]. According to the study, the total damage from odometer fraud is a result of three elements, notably:

- Unaccounted depreciation, that results from a car's nominal (sales) value being higher than its actual market value. One of the key determinants of car price is its mileage. Cars from the same production year with a higher mileage cost less than cars with lower mileage. Odometer fraud leads to a situation where part of the existing depreciation is not reflected in the value of the car sold.
- Higher maintenance costs, that result from a higher frequency of repairs needed on a car with more mileage. This is due to the wear of mechanical components of the vehicle.
- Additional environmental damages, that are a result of the unaccounted emissions. Vehicle-kilometres missing from the odometer record have already been driven and the associated emissions have taken place. This third element is however not considered in the analysis as this is not a direct cost to the user.

Estimates on the damage from odometer fraud vary depending on vehicle size and level of mileage tampering. According to a Belgian Car Pass study[302], the costs of odometer fraud to the user, expressed in 2022 prices, are:

- For small cars: 3.4 EUR cents per missing vehicle-kilometre (vkm) for depreciation and 1.3 EUR cents per vkm for maintenance;
- For medium size cars: 5.2 EUR cents per missing vehicle-kilometre (vkm) for depreciation and 3.2 EUR cents per vkm for maintenance;

[301] https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[302] https://www.car-pass.be/files/article_files/file/7/crm%2520study%2520final%2520report.pdf

- For executive/large cars: 7.7 EUR cents per missing vehicle-kilometre (vkm) for depreciation and 3.8 EUR cents per vkm for maintenance.

On this basis, the total costs per vehicle for different levels of odometer tampering (i.e. different levels of mileage change) can be estimated. An weighted average per vehicle can be further derived based on the fleet distribution by vehicle size from the baseline scenario developed with the PRIMES-TREMOVE model for the period 2020-2050.

Table 40: Damage costs from odometer fraud per vehicle for different levels of odometer tampering

Vehicle size	Cost category	EUR cents per vkm	Tampering level (km)			
			10,000	30,000	60,000	90,000
Small (45% share)	Depreciation	**3.4**	345	1,035	2,069	3,104
	Maintenance	**1.3**	128	383	766	1,150
	Total		**473**	**1,418**	**2,835**	**4,253**
Medium (45% share)	Depreciation	**5.2**	524	1,571	3,142	4,713
	Maintenance	**3.2**	319	958	1,916	2,874
	Total		**843**	**2,529**	**5,058**	**7,587**
Executive/Large (10% share)	Depreciation	**7.7**	766	2,299	4,598	6,897
	Maintenance	**3.8**	383	1,150	2,299	3,449
	Total		**1,150**	**3,449**	**6,897**	**10,346**
Weighted average (in 2022 prices)			**706**	**2,119**	**4,239**	**6,358**

Source: Ricardo et al. (2024), Impact assessment support study

For estimating the total damage costs/costs savings from odometer fraud, the weighted average cost of EUR 2,119 per vehicle has been used, corresponding to tampering levels of 30,000 km, which is considered a conservative estimate[303].

Additional evidence was identified based on a number of sources providing estimates of the costs from odometer tampering, although with limited information on the assumptions used (e.g. level of mileage fraud, vehicle size) and, as a result, limited comparability. Nonetheless, all sources point to damage costs that are higher than EUR 2,000 per vehicle:

- According to CarVertical, tampered cars buyers spend 21% more on average for their vehicles. The higher price depends on many factors, such as the brand, year of manufacture, and the number of tampered kilometres[304]. The United Kingdom (29% higher price than a non-tampered car), Italy (29% higher price), and Lithuania (25% higher price) are among the countries where the value increase of tampered cars is the highest, while in Ukraine (17% higher price than a non-tampered car), Poland (19% higher price), and Romania (20% higher price) odometer fraud has the lowest impact on a car's value. More specifically:
  - For every 100,000 kilometres tampered, buyers overspend around EUR 2,000.
  - There are significant differences between car brands, with price increases varying from 15 to 27%, resulting in overspending between EUR 2,000 and EUR 10,700.
  - The highest fake increase in value is found for Land Rover (27%), Mercedes-Benz (24%), and BMW (24%) vehicles, while Dacia (15%), Mazda (15%), and Nissan (17%) models are impacted by odometer fraud the least.

[303] Evidence from UK (UK: average kilometers clocked on used cars with a tampered odometer by Model Year | Statista), suggests that the average kilometres of tampering has reduced over time with 30,000 representing an average.
[304] https://www.carvertical.com/blog/odometer-fraud-vs-car-value

- According to an European Parliament study, odometer tampering has seen the mileage rolled back on up to 50% of second-hand cars traded in the EU, with the price of vehicles fraudulently increasing by EUR 2,000 to 5,000 on average[305].
- According to ADAC, the fraudsters increase the value by an average of EUR 3,000 per car[306].

Projected number of periodic technical inspections (PTI)

The approach used to estimate the number of annual PTI inspections in each Member State and for each vehicle type draws on the 'testing frequency' and the average number of PTIs in the statistical life of a vehicle.

The formula used is:

Number of annual PTI inspections = Number of inspections during average life of vehicle x Number of registered vehicles

EU Directive 2014/45/EU defines the minimum testing frequency that Member States must comply with, but in many cases the testing is more frequent, as determined by national legislation. These testing regimes have been identified for light duty vehicles, motorcycles, trucks, buses and coaches, and trailers. The key sources of information are the European Commission website[307] and a 2022 report by EReg[308].

The average vehicle life by Member State draws on ACEA[309]. No data was available for motorcycles and trailers. Thus, for these two vehicle categories, an average life of 18 years has been used. This defines the period over which the number of PTIs are counted to estimate the average PTI number during the vehicle's life. The tables below present the testing regimes by Member State, the average life and the average number of inspections for each vehicle type over the vehicle's life.

The annual number of registered vehicles is based on the baseline scenario developed with the PRIMES-TREMOVE model.

Table 41: Testing regime for light duty vehicle

Member State	Testing regime	Average age	Number of inspections during average life
Croatia	1-1-1	13.0	13.0
Latvia	2-2-1-1	15.0	13.0
Belgium	4-1-1	10.0	7.0
Austria	3-2-1	9.0	6.0
Bulgaria	3-2-1	13.0	10.0
Sweden	3-2-1	10.0	7.0
Luxembourg	4-2-1	8.0	4.0
Ireland	4-2-2-2-1	9.0	3.5
Netherlands	4-2-2-1	11.0	6.0
Portugal	4-2-2-1	14.0	9.0

305 https://www.europarl.europa.eu/news/en/headlines/society/20180525STO04312/fighting-mileage-fraud-on-used-cars
306 https://www.adac.de/rund-ums-fahrzeug/auto-kaufen-verkaufen/gebrauchtwagenkauf/tacho-manipulation/
307 https://road-safety.transport.ec.europa.eu/road-safety-member-states/roadworthiness-certificate-and-proof-test_en
308 2022-the-vehicle-and-driver-chain.pdf (ereg-association.eu)
309 ACEA (2023), *Vehicles in use Europe 2023*, https://www.acea.auto/files/ACEA-report-vehicles-in-use-europe-2023.pdf

Member State	Testing regime	Average age	Number of inspections during average life
Slovenia	4-2-2-1	11.0	6.0
Spain	4-2-2-2-1	14.0	8.0
Finland	4-2-2-2-1	13.0	7.0
Romania	3-2-2-2-2-1	15.0	9.0
Cyprus	4-2-2	13.0	5.5
Estonia	4-2-2-2-1	17.0	11.0
Germany	3-2-2	10.0	4.5
Lithuania	3-2-2	15.0	7.0
Poland	3-2-1	15.0	12.0
Czechia	4-2-2	16.0	7.0
Denmark	4-2-2	9.0	3.5
France	4-2-2	11.0	4.5
Greece	4-2-2	17.0	7.5
Hungary	4-2-2	15.0	6.5
Italy	4-2-2	12.0	5.0
Malta	4-2-2	13.0	5.5
Slovakia	4-2-2	14.0	6.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 42: Testing regime for motorcycles (no values are shown for MS that have not yet introduce a testing regime)

Member State	Testing regime	Average age	Number of inspections during average life
Croatia	1-1-1	18	18.0
Latvia	2-2-2	18	9.0
Belgium			
Austria	3-2-1	18	15.0
Bulgaria	2-2-2	18	9.0
Sweden	4-2-2	18	8.0
Luxembourg	4-2-2	18	8.0
Ireland			
Netherlands			
Portugal			
Slovenia	4-2-2	18	8.0
Spain	4-2-2	18	8.0
Finland			
Romania	2-2-2	18	9.0
Cyprus	4-2-2	18	8.0
Estonia	4-2-2-2-1	18	12.0
Germany	2-2-2	18	9.0
Lithuania	3-2-2	18	8.5
Poland	3-1-1	18	16.0
Czechia	6-4-4	18	4.0
Denmark			
France	4-2-2	18	8.0
Greece	4-2-2	18	8.0
Hungary	4-2-2	18	8.0
Italy	4-2-2	18	8.0

Member State	Testing regime	Average age	Number of inspections during average life
Malta			
Slovakia	4-2-2	18	8.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 43: Testing regime for heavy duty vehicles designed and constructed primarily for the carriage of goods, having a maximum mass exceeding 3.5 tonnes (N2 and N3)

Member State	Testing regime	Average age	Number of inspections during average life
Croatia	1	14	14.0
Latvia	1	14	14.0
Belgium	1	13	13.0
Austria	1	7	7.0
Bulgaria	1	13	13.0
Sweden	1	13	13.0
Luxembourg	1	8	8.0
Ireland	1	11	11.0
Netherlands	1	10	10.0
Portugal	1	16	16.0
Slovenia	1	10	10.0
Spain	1	14	19.0
Finland	1	14	14.0
Romania	1	19	19.0
Cyprus	1	13	13.0
Estonia	1	18	18.0
Germany	1	10	10.0
Lithuania	1	10	10.0
Poland	1	13	13.0
Czechia	1	18	18.0
Denmark	1	8	8.0
France	1	9	9.0
Greece	1	23	23.0
Hungary	1	13	13.0
Italy	1	19	19.0
Malta	1	13	13.0
Slovakia	1	16	16.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 44: Testing regime for heavy duty vehicles designed and constructed primarily for the carriage of over eight persons and their luggage (M2 and M3)

Member State	Testing regime	Average age	Number of inspections during average life
Croatia	1	12	12.0
Latvia	1-1-0.5	14	26.0
Belgium	1	11	11.0
Austria	1	5	5.0
Bulgaria	0.5-0.5-0.5	12	24.0
Sweden	1	7	7.0
Luxembourg	1	6	6.0

Member State	Testing regime	Average age	Number of inspections during average life
Ireland	1	11	11.0
Netherlands	1	10	10.0
Portugal	1-1-1… (0.5-0.5 ≥8 years)	15	23.0
Slovenia	1-0.5-0.5	10	19.0
Spain	1-1-1… (0.5-0.5 ≥5 years)	12	20.0
Finland	1	12	12.0
Romania	1-0.5-0.5	20	39.0
Cyprus	1	12	12.0
Estonia	1-1-1…(0.5-0.5 ≥10 years)	13	17.0
Germany	1	8	8.0
Lithuania	1-0.5-0.5	14	27.0
Poland	1	16	16.0
Czechia	1	15	15.0
Denmark	1	8	8.0
France	0.5-0.5-0.5	8	16.0
Greece	1	19	19.0
Hungary	1	12	12.0
Italy	1	14	14.0
Malta	1	12	12.0
Slovakia	1-1-1 (0.5-0.5 ≥8 years for M3)	11	15.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 45: Testing regime for trailers designed and constructed for the carriage of goods or persons, as well as for the accommodation of persons, having a maximum mass not exceeding 3.5 tonnes (O1 and O2) (no values are shown for MS that have not yet introduce a testing regime)

Member State	Testing regime	Average age	Number of inspections during average life
Croatia	3-1-1	18	16.0
Latvia	2-2-2	18	9.0
Belgium	1-1-1	18	18.0
Austria	2-1-1	18	17.0
Bulgaria	1-1-1	18	18.0
Sweden	4-2-2	18	8.0
Luxembourg	4-2-2	18	8.0
Ireland			
Netherlands			
Portugal			
Slovenia	4-2-2	18	8.0
Spain	1-1-1	18	18.0
Finland	2-2-2	18	9.0
Romania	2-2-2	18	9.0
Cyprus	4-2-2	18	8.0
Estonia	1-1-1	18	18.0
Germany	2-2-2	18	9.0
Lithuania	3-2-2	18	8.5
Poland	3-2-2	18	8.5
Czechia	4-2-2	18	8.0

Member State	Testing regime	Average age	Number of inspections during average life
Denmark			
France			
Greece			
Hungary	4-2-2	18	8.0
Italy	4-2-2	18	8.0
Malta	2-2-2	18	9.0
Slovakia	4-2-2	18	8.0

Source: Ricardo et al. (2024), Impact assessment support study

The projected number of total periodic technical inspections for light duty vehicles, heavy duty vehicles and motorcycles in the baseline scenario by Member State is provided in the table below.

Table 46: Projected number of total periodic technical inspections for light duty vehicles, heavy duty vehicles and motorcycles in the baseline scenario

Member State	2015	2026	2030	2040	2050
AT	4,155,271	4,289,162	4,530,504	5,147,602	5,405,069
BE	4,627,640	4,645,244	4,717,772	4,863,174	4,804,878
BG	2,939,951	2,998,948	3,163,260	3,402,701	3,586,559
CY	278,758	318,686	344,851	382,206	418,612
DE	24,143,239	25,306,809	26,146,795	28,373,603	29,042,084
EE	553,898	608,122	646,300	767,699	887,990
FI	2,137,187	2,329,681	2,392,392	2,495,553	2,460,964
FR	17,804,012	18,516,590	18,836,560	20,515,273	21,086,208
EL	3,797,487	3,784,340	3,863,813	3,948,544	4,345,918
HR	1,818,815	1,900,904	2,061,143	2,280,267	2,639,968
HU	1,748,586	2,018,861	2,213,884	2,688,078	2,998,731
IE	975,524	1,123,119	1,207,534	1,361,256	1,476,122
IT	21,787,538	23,125,847	23,515,772	25,687,923	27,671,372
LT	684,749	772,006	800,382	954,701	999,994
LU	230,981	242,455	265,514	330,792	346,504
LV	697,880	688,124	685,111	713,317	788,612
MT	144,079	166,296	179,665	213,693	223,523
NL	5,001,465	5,035,101	5,392,059	6,113,987	6,092,085
PL	21,838,488	24,495,294	25,523,350	26,597,403	27,301,601
PT	3,954,336	4,263,212	4,352,909	4,466,218	4,565,840
RO	3,837,465	5,544,479	5,915,902	6,822,807	7,107,093
SE	4,008,852	4,384,731	4,426,372	4,836,699	5,059,638
SI	704,916	839,788	880,475	851,091	895,080
SK	1,143,786	1,284,672	1,400,369	1,635,656	1,716,079
ES	18,516,367	19,984,375	20,604,857	22,849,906	24,427,719
DK	1,139,841	1,267,055	1,353,595	1,435,067	1,488,357
CZ	2,828,535	3,198,299	3,496,014	4,066,895	4,513,062
EU27	**151,499,646**	**163,132,202**	**168,917,154**	**183,802,112**	**192,349,663**

Source: Ricardo et al. (2024), Impact assessment support study

Table 47: Projected number of total periodic technical inspections for the carriage of goods or persons, as well as for the accommodation of persons, having a maximum mass not exceeding 3.5 tonnes (O1 and O2)

Member State	2026	2030	2040	2050
AT	725,952	769,604	869,556	880,200
BE	241,444	245,555	251,418	244,638
BG	18,653	19,241	19,577	20,488
CY	4,785	5,200	5,758	6,263
DE	3,961,968	4,075,824	4,316,696	4,279,445
EE	121,803	127,946	153,685	181,224
FI	564,199	575,727	600,400	579,017
FR				
EL				
HR	32,120	34,543	39,538	46,621
HU	225,089	246,708	292,630	323,983
IE				
IT	129,160	130,008	142,941	153,072
LT	8,166	8,368	9,750	9,871
LU	11,428	12,537	16,081	16,879
LV	30,028	28,943	29,596	33,548
MT	1,258	1,406	1,613	1,630
NL				
PL	299,327	309,885	325,458	326,384
PT				
RO	218,840	240,811	274,248	281,309
SE	492,039	494,348	541,838	562,309
SI	12,203	12,755	11,999	12,573
SK	126,470	138,824	161,484	165,811
ES	216,501	223,033	252,025	260,511
DK				
CZ	206,773	226,256	254,357	275,993
EU27	7,648,208	7,927,521	8,570,650	8,661,771

Source: Ricardo et al. (2024), Impact assessment support study

3. IMPACTS BY POLICY MEASURE ON COSTS AND COSTS SAVINGS

This section explains the inputs used and provides the assessment of the impacts of the policy measures included in the policy options on costs and costs savings. The synergies between the measures included in the options are already captured in this section.

3.1. PMC1 - Adapt PTI to electric and hybrid vehicles (safety, environmental performance, standardised data), including training of inspectors

3.1.1. Adjustment costs for PTI centres

PMC1 will require PTI centres to make certain adjustments to be able to deliver PTI for electric and hybrid vehicles. The exact nature of the adjustments will depend on the specific requirements for the PTI and whether this will go beyond visual inspections. A number of stakeholders were in favour of visual inspections on the basis of a checklist that would not require new equipment. Others suggested that a specific electronic interface to support such inspection may be needed. One stakeholder (FSD – the German PTI agency) provided a cost estimate of EUR 500 for additional tools to measure insulation resistance and equipotential bonding. The number of PTI centres in the EU is estimated at 48,880. Given the current small share of EVs in the fleet and in the PTI tests, it is expected that one such tool will be sufficient per PTI centre for the initial period (i.e., 2026), with a second one added in 2030. The one-off adjustment costs are estimated at EUR 24.4 million in 2026 and EUR 24.4 million in 2030. Expressed as present value over 2026-2050, one-off adjustment costs are estimated at EUR 48.2 million (in 2022 prices) relative to the baseline.

Tailored training for inspectors that will deliver such PTI services will also be needed to ensure correct application of test procedure and, crucially, to maximise their own safety when checking high voltage components. Stakeholders' views differed as to whether the necessary training could be part of periodic training and the qualification examinations, most indicating that specific training would be needed. On the basis of the input from DEKRA – a PTI service provider – it is assumed that an additional three-day training per PTI inspector will take place in 2026. With an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour[310], and assuming 7.3 working hours per day, a three day training for a total of 128,536 inspectors across EU is estimated at EUR 95.4 million in 2026.

The new PTI tests for EVs will replace emission testing for ICE, that last a few minutes, and it is assumed that the new test will have a similar duration. Thus, no impact on PTI duration is expected that could give rise to higher labour costs per PTI.

The total adjustment costs for PTI expected as a result of this measure are summarised in the tables below. They are the same for all policy options.

Table 48: One-off adjustment costs for the PTI centres due to PMC1 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total one-off adjustment costs	119.8	24.4	0.0	0.0
One-off costs for adapting the PTI	24.4	24.4	0.0	0.0
One-off costs for training	95.4	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 49: One-off adjustment costs for the PTI centres due to PMC1 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total one-off adjustment costs	143.6	143.6	143.6	143.6
One-off costs for adapting the PTI	48.2	48.2	48.2	48.2
One-off costs for training	95.4	95.4	95.4	95.4

Source: Ricardo et al. (2024), Impact assessment support study

Depending on the Member State, the additional costs for the PTI centres may be passed through to vehicle owners (i.e., citizens and businesses). This will depend on how PTI charges are set by the Member State: where prices are not regulated, it is likely that PTI centres will seek to recover investment costs, possibly on a relatively short term. On the other hand, in Member States that regulate the level of PTI charges, the evolution of those charges will depend on the public contract agreed with the PTI service provider, potentially subject to renegotiation, or on the price-setting

[310] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

policy of the authority that is itself responsible for PTI. In these cases, costs may either be borne by the service provider/authority, or be recovered over a longer period.

3.2. PMC2 - Update PTI and RSI due to new requirements in General Safety Regulation and checking emission reduction systems (new test items, including checks of software status/integrity), by reading on-board diagnostics

PMC2 requires to update the PTI and RSI to new requirements in the General Safety Regulation (including software status/integrity of safety or emission relevant systems during PTI for all vehicles and at technical roadside inspections of commercial vehicles), using ePTI (electronic PTI: ISO 20730:2021).

3.2.1. Adjustment costs for PTI centres

No significant adjustment costs are expected to implement the updates due to new requirements of the General Safety Regulation, since ePTI uses the standard vehicle interface (OBD connector)[311] and a PTI scan tool is a mandatory equipment of PTI stations since May 2023. Nonetheless, some stakeholders indicated that there may be a need for software updates with cost estimates ranging from EUR 100 to EUR 1,000 in case of a standardised solution. Assuming an extra cost for the software update of EUR 500 per PTI tool and 128,536 PTI tools in the EU, the one-off adjustment costs are estimated at EUR 64.3 million in 2026.

No additional costs are expected for PTI inspections to perform the software status and integrity checks and update the safety and emission software. As these can be performed remotely (OTA) and the additional time taken during a PTI or RSI test is considered negligible, no increase in the costs of the PTI/RSI tests is assumed. For the PTI tests on vehicles, the tools necessary to perform the software checks are already available as they may currently be used for OBD checks of the emission and safety systems (such as anti-lock and electronic braking systems, steering or airbags).

In addition, training of 128,536 PTI inspectors would be needed, covering new test items for GSR and software status/integrity of safety and/or emission relevant systems. Assuming one extra training day per inspector, the one-off adjustment costs for training are estimated at EUR 31.8 million in 2026.

The introduction of ePTI will possibly lead to time and cost savings for PTI centres. However, PMC2 is not about the introduction of ePTI, but its use in relation to the new items to be checked as a result of the General Safety Regulation and would therefore not directly lead to time savings.

The total adjustment costs for PTI centres as a result of PMC2 are summarised in the tables below.

Table 50: One-off adjustment costs for PTI centres due to PMC2 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	96.1	0.0	0.0	0.0
One-off costs for updates due to General Safety Regulation	64.3	0.0	0.0	0.0
One-off costs for training	31.8	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

[311] https://www.iso.org/standard/73801.html

Table 51: One-off adjustment costs for PTI centres due to PMC2 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	96.1	96.1	96.1	96.1
One-off costs for updates due to General Safety Regulation	64.3	64.3	64.3	64.3
One-off costs for training	31.8	31.8	31.8	31.8

Source: Ricardo et al. (2024), Impact assessment support study

Depending on the Member State, the additional costs for the PTI centres may be passed through to vehicle owners (i.e., citizens and businesses). As indicated under PMC1, this will depend on the way PTI charges are set in the Member State.

3.2.2. Adjustment costs for national public authorities

Adjustment costs are also expected for national public authorities, in relation to equipment and training that is required for RSI. The requirement for testing of software status/integrity of safety and/or emission relevant systems at RSI would result in investments in OBD scanning tools. Based on input from one equipment supplier (Texa) the costs are estimated at EUR 1,000 per tool. One tool is required per RSI unit, and the number of RSI units total 131 at EU level. Training would also be required for RSI inspectors on software checks using OBD scanning tool. Two hours of training are assumed for each of the 393 RSI inspectors across EU27. An hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour[312] is used for estimating the costs of training. The total one-off adjustment costs are estimated at EUR 157,712 in 2026.

The adjustment costs for national public authorities responsible for RSI due to PMC2 are presented in the tables below.

Table 52: One-off adjustment costs for national public authorities due to PMC2 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	0.2	0.0	0.0	0.0
One-off adjustment costs	0.2	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 53: One-off adjustment costs for national public authorities due to PMC2 in the policy options relative to the baseline, expressed as present value over 2026-2050 (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	0.2	0.2	0.2	0.2
One-off adjustment costs	0.2	0.2	0.2	0.2

Source: Ricardo et al. (2024), Impact assessment support study

[312] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

3.3. PMC3 - Mandatory PN testing of LDVs and HDVs equipped with particle filter, at PTI, and of HDVs at technical roadside inspections of commercial vehicles

3.3.1. Adjustment costs for PTI centres

The introduction of a PN check as part of PTI, to replace the current exhaust gas opacity test at least[313] for vehicles equipped with particle filters, would lead to additional costs for PTI centres that will need to purchase and maintain the new PN testing equipment and provide additional training for inspectors.

To introduce a new emission check during PTI requires that PTI centres will be provided with new devices for the PN counting. For the 36,173 PTI centres in the EU affected by this measure (excluding Belgium, Germany and the Netherlands, which have already introduced such testing and are thus part of the baseline), the price per new PN measurement equipment is estimated at EUR 5,000, based on stakeholders' feedback. Two devices per PTI inspection centre would be needed. Thus, the one-off adjustment costs for the purchase of the new equipment are estimated at EUR 361.7 million in 2026.

In addition, recurrent maintenance and calibration costs are assumed at 5% of the capital costs (i.e., EUR 250 per PN measurement equipment), based on stakeholders' feedback[314]. Total recurrent adjustment costs are thus estimated at EUR 18.1 million per year from 2026 onwards. Expressed as present value over 2026-2050, the total recurrent adjustment costs for the maintenance of new equipment are estimated at EUR 324.4 million relative to the baseline.

In terms of training, an additional half day of training related to the use of PN testing for 88,776 inspectors (excluding Belgium, Germany and the Netherlands, which have already introduced such testing and are thus part of the baseline) is assumed to take place in 2026. The one-off adjustment costs are estimated at EUR 11 million in 2026[315].

No difference is expected in terms of emissions testing time by replacing the opacity test with the new PN testing. Therefore, no additional labour costs for PTI are expected.

The total adjustment costs for PTI centres due to PMC3 are summarised in the tables below.

Table 54: One-off and recurrent adjustment costs for PTI centres due to PMC3 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	390.8	18.1	18.1	18.1
One-off costs for new equipment	361.7	0.0	0.0	0.0
Recurrent costs for the maintenance of equipment	18.1	18.1	18.1	18.1
One-off costs for training	11.0	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 55: One-off and recurrent adjustment costs for PTI centres due to PMC3 in the policy options relative to the baseline, expressed as present value over 2026-2050 (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	697.1	697.1	697.1	697.1

[313] Where technically possible (i.e., the measuring equipment allows it), this could be extended to older emission standards. This possibility is not part of the cost calculations.
[314] According to GOCA, the yearly calibration cost of a PN measurement device is EUR 305, while that of a smoke tester, which it would replace is EUR 157.5. The 5% thus includes maintenance, too.
[315] Calculated using an hourly cost for technicians and professionals (ISCO 3) of EUR 34/hour.

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
One-off costs for new equipment	361.7	361.7	361.7	361.7
Recurrent costs for the maintenance of equipment	324.4	324.4	324.4	324.4
One-off costs for training	11.0	11.0	11.0	11.0

Source: Ricardo et al. (2024), Impact assessment support study

Depending on the Member State, the additional costs for the PTI centres may be passed through to vehicle owners (i.e., citizens and businesses). As indicated under PMC1, this will depend on the way PTI charges are set in the Member State.

3.3.2. Adjustment costs to national public authorities

Roadside inspection authorities will incur costs for the purchase of PN testing equipment, to be used as part of roadside inspections. It is assumed that one PN measurement device is needed per RSI unit, at a cost of EUR 5,000 each (which is the same cost used for the PN testing). In total, 131 RSI units would need to purchase PN testing equipment[316]. The one-off adjustment costs for measurement equipment are estimated at EUR 0.7 million in 2026.

Recurrent maintenance and calibration costs are assumed at 5% of the capital cost, or EUR 250 per PN measurement device, based on stakeholders' feedback. Total recurrent adjustment costs are thus estimated at EUR 32,750 per year from 2026 onwards. Expressed as present value over 2026-2050, the total recurrent adjustment costs for the maintenance of new PN measurement devices are estimated at EUR 0.6 million relative to the baseline.

An additional half day of training related to the use of PN measurement devices is assumed for the estimated 393 RSI inspectors across the EU in 2026. The one-off adjustment costs are estimated at EUR 48,616 in 2026.

The total adjustment costs for national public authorities due to PMC3 are summarised in the tables below.

Table 56: One-off and recurrent adjustment costs for national public authorities due to PMC3 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	0.74	0.03	0.03	0.03
One-off costs for new equipment	0.66	0.00	0.00	0.00
Recurrent costs for the maintenance of equipment	0.03	0.03	0.03	0.03
One-off costs for training	0.05	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 57: One-off and recurrent adjustment costs for national public authorities due to PMC3 in the policy options relative to the baseline, expressed as present value over 2026-2050 (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	1.29	1.29	1.29	1.29
One-off costs for new equipment	0.66	0.66	0.66	0.66

[316] Estimation based on approximately 691 thousand of RSIs performed in 2021-2022, an average time per inspection of 30 minutes, and 3 inspectors per RSI unit.

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent costs for the maintenance of equipment	0.59	0.59	0.59	0.59
One-off costs for training	0.05	0.05	0.05	0.05

Source: Ricardo et al. (2024), Impact assessment support study

3.3.3. Cost for vehicle owners (citizens and businesses)

The adjustment costs incurred by testing centres may be passed through to vehicle owners in the form of higher PTI charges. In Member States where PTI charges are regulated, this may be more gradual than in those where prices are set by the market.

Owners of faulty LDVs/HDVs vehicles will also face a charge for repairing the non-compliant vehicle. This is not considered to be regulatory costs but is relevant in terms of the impact on maintenance costs. Where a vehicle is found to be tampered with, the owner/holder will face a fine that is supposed to be proportionate and dissuasive, as set by the Member State in which the offence is detected.

3.4. PMC4 – Mandatory NOx testing of LDV and HDV at PTI, and HDVs at roadside (based on ongoing work of JRC[317])

This policy measure will introduce mandatory NOx emission testing during PTI for LDVs and HDVs (from Euro 5b and Euro VI respectively) and at RSIs (for HDVs from Euro VI).

3.4.1. Adjustment costs for PTI centres

To introduce a NOx emission check during PTI requires that all PTI stations will be provided with new devices for the NOx measurement. The cost per NOx measurement equipment is estimated at EUR 15,000, which is the lower end of the range of estimates provided by stakeholders (between EUR 15 thousand and 40 thousand). The reason for using the lower bound estimate is the fact that this estimate is more recent and that experience with PN measurement device has shown a sharp decrease in prices as demand increased (even after the introduction of such tests in just three Member States). A similar trend is expected for NOx-measurement devices. Since the PN and NOx measurement devices will most likely be combined in one piece of equipment in the future, these numbers may still overestimate the costs. Each of the 48,880 PTI centres in the EU are assumed to be equipped with two devices. The total one-off adjustment costs are estimated at EUR 1.5 billion in 2026.

Recurrent adjustment costs (i.e., maintenance and calibration costs) are assumed at 5% of the capital cost. Total recurrent adjustment costs are thus estimated at EUR 73.3 million per year from 2026 onwards. Expressed as present value over 2026-2050, the total recurrent adjustment costs for the maintenance and calibration of new equipment are estimated at EUR 1.3 billion relative to the baseline.

In terms of training, an additional half day training related to the use of NOx testing is assumed to take place for the 128,536 inspectors. The one-off adjustment costs for training are estimated at EUR 15.9 million in 2026[318].

[317] https://www.mdpi.com/1996-1073/16/14/5520
[318] Calculated using an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour.

No additional staff, and corresponding higher PTI cost, is expected as no difference is foreseen in terms of emissions testing time.

The total adjustment costs for PTI centres expected as a result of this measure are summarised in the tables below.

Table 58: One-off and recurrent adjustment costs for PTI centres due to PMC4 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	1,555.6	73.3	73.3	73.3
One-off costs for equipment	1,466.4	0.0	0.0	0.0
Recurrent costs for equipment	73.3	73.3	73.3	73.3
One-off costs for training	15.9	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 59: One-off and recurrent adjustment costs for PTI centres due to PMC4 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	2,797.3	2,797.3	2,797.3	2,797.3
One-off costs for equipment	1,466.4	1,466.4	1,466.4	1,466.4
Recurrent costs for equipment	1,315.0	1,315.0	1,315.0	1,315.0
One-off costs for training	15.9	15.9	15.9	15.9

Source: Ricardo et al. (2024), Impact assessment support study

3.4.2. *Adjustment costs for national public authorities*

Roadside inspection authorities will incur costs for the purchase of NOx measurement equipment to be used as part of roadside inspections on HDVs.

One NOx measurement device is assumed per RSI unit, at a cost of EUR 15,000 each (which is the same value used for the NOx measurement equipment used in PTI centres). In total, 131 RSI units would need to purchase the equipment. Thus, the one-off adjustment costs for the measurement equipment are estimated at EUR 2 million in 2026.

Recurrent maintenance and calibration costs are assumed at 5% of the capital cost. Total recurrent adjustment costs are thus estimated at EUR 98,250 per year from 2026 onwards relative to the baseline. Expressed as present value over 2026-2050, they are estimated at EUR 1.8 million relative to the baseline.

An additional half day of training related to the use of NOx testing is assumed for the 393 RSI inspectors. The one-off adjustment costs for training are estimated at EUR 48,616 in 2026.

The total costs for national public authorities expected as a result of this measure are summarised in the tables below.

Table 60: One-off and recurrent adjustment costs for national public authorities due to PMC4 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	2.11	0.10	0.10	0.10
One-off costs for equipment	1.97	0.00	0.00	0.00
Recurrent costs for equipment	0.10	0.10	0.10	0.10
One-off costs for training	0.05	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 61: One-off and recurrent adjustment costs for national public authorities due to PMC4 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	3.78	3.78	3.78	3.78
One-off costs for equipment	1.97	1.97	1.97	1.97
Recurrent costs for equipment	1.76	1.76	1.76	1.76
One-off costs for training	0.05	0.05	0.05	0.05

Source: Ricardo et al. (2024), Impact assessment support study

3.4.3. Cost for vehicle owners (citizens and businesses)

The adjustment costs incurred by testing centres may eventually be passed through to vehicle owners in the form of higher PTI charges. As in the previous cases, this will change from Member State to Member State.

Owners of faulty vehicles will face a charge for repairing the non-compliant vehicle. However, this is not considered to be regulatory costs but is relevant in terms of the impact on maintenance costs.

3.5. PMC5 - Mandatory roadworthiness testing following significant modifications of the vehicle (e.g. change of class, propulsion system)

3.5.1. Administrative costs for citizens (vehicle owners)

PMC5 would result in additional costs for some vehicle owners by introducing mandatory testing of all vehicles that have undergone significant modifications. The average cost of a PTI for citizens is estimated at EUR 39.1 per vehicle (i.e., calculated as the weighted average of the median by Member State for M1 and L vehicle types). PTI cost data has been collected from CITA General Questionnaire 2020-21[319], and national online information sources.

Feedback from stakeholders indicated that in Spain and Germany the total number of modified vehicles was around 245,000 and 200,000, respectively, in 2022. This represents an annual average of 0.6% of the total fleet. However, many stakeholders highlighted that PTI following a modification is already a requirement in their Member State[320]. Therefore, the share of 0.6% is applied only to the vehicle fleet from countries where this is not already implemented in the baseline. In addition, it has been assumed that 40% of the cars registrations (M1 vehicle category) and 100% of motorcycles registrations (L vehicle category) are undertaken by citizens. The number of vehicles affected is estimated at 0.44 million in 2026, 0.45 million in 2030 and 0.53 million in 2050. The recurrent administrative costs, based on the number of vehicles affected and the cost per PTI, are estimated at EUR 17.1 million in 2026, EUR 17.7 million in 2030 and EUR 20.6 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 336.3 million relative to the baseline.

The total administrative costs for citizens due to PMC5 are summarised in the tables below.

Table 62: Number of vehicle affected and recurrent administrative costs for citizens due to PMC5 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of vehicles affected (million)	0.44	0.45	0.50	0.53

[319] https://citainsp.org/2021/06/28/cita-general-questionnaire-2020-21/
[320] EU Member States where stakeholders identified PTI following modification as an existing requirement are: Croatia, Finland, Austria, Netherlands, Germany, Sweden and Spain. This requirement is also in place for Iceland.

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative cost	17.1	17.7	19.4	20.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 63: Recurrent administrative costs for citizens due to PMC5 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative cost	336.3	336.3	336.3	336.3

Source: Ricardo et al. (2024), Impact assessment support study

3.5.2. Administrative costs for businesses (vehicle owners)

As explained above, PMC5 would result in additional costs for some vehicle owners by introducing mandatory testing of all vehicles that have undergone significant modifications. The average cost of a PTI for businesses is estimated at EUR 42.1 per vehicle (i.e., calculated as the weighted average of the median by Member State for M1, N1, N2/N3 and M2/M3 vehicle types). PTI cost data has been collected from CITA General Questionnaire 2020-21, and national online information sources.

Feedback from stakeholders indicated that in Spain and Germany the total number of modified vehicles was around 245,000 and 200,000, respectively, in 2022. This represents an annual average of 0.6% of the total fleet. However, many stakeholders highlighted that PTI following a modification is already a requirement in their Member State[321]. Therefore, the share of 0.6% is applied only to the vehicle fleet from countries where this is not already implemented in the baseline. In addition, it has been assumed that 60% of the cars registrations (M1 vehicle category) and 100% of vans, lorries and buses registrations (N1, N2/N3 and M2/M3 vehicle category) are undertaken by businesses. The number of vehicles affected is estimated at 0.64 million in 2026, 0.66 million in 2030 and 0.75 million in 2050. The recurrent administrative costs, based on the number of vehicles affected and the cost per PTI, are estimated at EUR 27 million in 2026, EUR 27.8 million in 2030 and EUR 31.6 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 524.2 million relative to the baseline.

The total administrative costs for businesses due to PMC5 are summarised in the tables below.

Table 64: Number of vehicle affected and recurrent administrative costs for businesses due to PMC5 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of vehicles affected (million)	0.64	0.66	0.72	0.75
Recurrent administrative cost	27.0	27.8	30.2	31.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 65: Recurrent administrative costs for businesses due to PMC5 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative cost	524.2	524.2	524.2	524.2

Source: Ricardo et al. (2024), Impact assessment support study

[321] EU Member States where stakeholders identified PTI following modification as an existing requirement are Croatia, Finland, Austria, Netherlands, Germany, Sweden and Spain. This requirement is also in place for Iceland.

3.5.3. *Benefits for PTI centres*

PMC5 would result in benefits for the PTI centres due to the mandatory testing of all vehicles that have undergone significant modifications. The costs for vehicle owners (citizens and businesses) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PMC5 are thus estimated at EUR 44.1 million in 2026, EUR 45.5 million in 2030 and EUR 52.3 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 860.5 million relative to the baseline.

Table 66: Benefits for PTI centres due to PMC5 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	44.1	45.5	49.6	52.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 67: Benefits for PTI centres due to PMC5 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres	860.5	860.5	860.5	860.5

Source: Ricardo et al. (2024), Impact assessment support study

3.6. PMC6 - Require the roadworthiness certificate in electronic format only

3.6.1. *Administrative costs for national public authorities*

PMC6 requires that the roadworthiness certificate be issued in electronic format only. According to national experts from Member States such as Finland, Croatia and Slovenia the measure would entail some software development. Developing the software for electronic certificates is estimated in the range of EUR 500 thousand to EUR 1 million. Assuming one-off costs of EUR 500,000 per IT system for each of the 15 Member States with smaller volumes of inspections[322], EUR 750,000 per IT system for each of the 7 Member States with medium volumes of inspections[323] and EUR 1,000,000 per IT system for each of the 5 Member States with higher volumes of inspections[324], the total one-off administrative costs at EU27 level are estimated at EUR 17.8 million in 2026.

Recurrent administrative costs for the maintenance and update of the system for electronic certificates are assumed at 5% of the investment costs, based on stakeholders' feedback. They are estimated at EUR 887,500 from 2026 onwards. Expressed as present value over 2026-2050, the recurrent administrative costs for national public administrations are estimated at EUR 15.9 million relative to the baseline.

3.6.2. *Administrative costs savings for national public authorities*

In the baseline, the cost of a paper RW certificate is estimated at 1 EUR per certificate, covering the cost of printing and the time spent to print the document. Around 2% of the total RW certificates are issued in a digital format in the baseline, in two Member States (Finland and Estonia). The number

[322] Below 2% of the total number of inspections at EU level in 2026 by Member State. These are: BG, CY, EE, FI, HR, HU, IE, LT, LV, LU, MT, SI, SK, DK and CZ.
[323] Between 2% and 10% of the total number of inspections at EU level in 2026 by Member State. These are: AT, BE, EL, NL, PT, RO and SE.
[324] Above 10% of the total number of inspections at EU level in 2026 by Member State. These are: DE, FR, IT, PL and ES.

of RW certificates issued in paper format in the baseline is estimated at 161.5 million in 2026, 167.3 million in 2030 and 190.6 million in 2050. Thus, the administrative costs saving due to issuing the RW certificates in electronic format only are estimated at EUR 161.5 million in 2026, EUR 167.3 million in 2030 and EUR 190.6 million in 2050. Expressed as present value over 2026-2050, the recurrent administrative costs savings for national public administrations are estimated at EUR 3.2 billion relative to the baseline.

Table 68: Costs and costs savings for national public authorities due to PMC6 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	18.6	0.9	0.9	0.9
One-off administrative costs	17.8	0.0	0.0	0.0
Recurrent administrative costs	0.9	0.9	0.9	0.9
Total administrative costs savings	161.5	167.3	182.0	190.6
Recurrent administrative costs savings	161.5	167.3	182.0	190.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 69: Costs and costs savings for national public authorities due to PMC6 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	33.7	33.7	33.7	33.7
One-off administrative costs	17.8	17.8	17.8	17.8
Recurrent administrative costs	15.9	15.9	15.9	15.9
Total administrative costs savings	3,155.0	3,155.0	3,155.0	3,155.0
Recurrent administrative costs savings	3,155.0	3,155.0	3,155.0	3,155.0

Source: Ricardo et al. (2024), Impact assessment support study

3.7. PMC7 - Provide electronic access to relevant data, including on PTI reports stored in national databases, to the registration authorities of other EU Member States using a common interface

3.7.1. Administrative costs for national public authorities

The measure under consideration entails costs for providing access to relevant data. All Member States already store the PTI information in their national vehicle register. The associated costs are however expected to be lower when existing systems (such as EUCARIS, ERRU or the MOVE-Hub) are used by all Member States. Most of the enforcement authorities are already connected to their local vehicle registration authority and could simply add this to the existing data exchange. Member States are free to use a EUCARIS offering or build their own solution to satisfy any legal obligations for data exchange. The costs and hence decisions will vary between Member States depending on the organisation of their national public authorities. If the national public authority that manages the road transport undertakings register (i.e., the connection to ERRU) also manages the PTI data then they can extend the solution they already have in place. If those two databases are in different national public authorities, it changes the decisions and the costs.

According to EReg's survey responses, requiring Member States to use an IT system for registration procedures that they are already using for other purposes would save costs compared to putting in place a new central hub. Either the EUCARIS peer-to-peer exchange system, or the hub-and-spoke system of MOVE-Hub could be adapted to the needs of PMC7, limiting the additional costs of implementing the measure and ensuring an effective exchange data mechanism. According to EReg, the creation of a central hub should not prevent the use of EUCARIS[325].

For the implementation of this measure, one-off administrative costs are expected for developing common interfaces for accessing the data. The one-off administrative costs for the interconnection of national registers are estimated at around EUR 300,000 per Member State in 2026. Thus, the total one-off administrative costs are estimated at EUR 8.1 million for the 27 EU Member States in 2026.

The recurrent administrative costs (i.e., service supply costs) for providing access to the relevant data are estimated at around 5% of the capital costs. They amount to EUR 405,000 per year from 2026 onwards. Expressed as present value over 2026-2050, recurrent administrative costs are estimated at EUR 7.3 million.

3.7.2. Administrative costs savings for national public authorities

According to EUCARIS, if all countries would exchange their registration data in a structured way via a common IT system, the number of situations when registration authorities would need to contact each other via different, less secure ways (e.g. e-mail) to get the data, would decrease significantly.

PMC7 is expected to lead to time savings of around 15 minutes per re-registration of a vehicle in another Member State because of less need of reaching out to other National Contact Points by phone/mail. Considering the 3.5 million re-registrations per year in the EU[326], and the average labour cost for ISCO 2 (professionals) of 40.9 EUR/hour[327], the administrative costs savings for national public authorities are estimated at EUR 35.8 million per year, or EUR 641.8 million expressed as present value over the 2026-2050 period relative to the baseline.

Table 70: Costs and costs savings for national public authorities due to PMC7 in 2026, 2030, 2040 and 2050 in the policy options (for all options) relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	8.5	0.4	0.4	0.4
One-off administrative costs	8.1	0.0	0.0	0.0
Recurrent administrative costs	0.4	0.4	0.4	0.4
Total administrative costs savings	35.8	35.8	35.8	35.8
Recurrent administrative costs savings	35.8	35.8	35.8	35.8

Source: Ricardo et al. (2024), Impact assessment support study

Table 71: Costs and costs savings for national public authorities due to PMC7 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	15.4	15.4	15.4	15.4
One-off administrative costs	8.1	8.1	8.1	8.1
Recurrent administrative costs	7.3	7.3	7.3	7.3
Total administrative costs savings	641.8	641.8	641.8	641.8
Recurrent administrative costs savings	641.8	641.8	641.8	641.8

Source: Ricardo et al. (2024), Impact assessment support study

[325] As reported in the evaluation report, the use of EUCARIS does not currently represent a significant cost for Member States.
[326] Source: https://ggiforum.com/consulting/immigration-executive/127-cross-border-car-registration-within-the-eu-to-be-simplified.html
[327] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

3.8. PMC8 - Harmonisation and regular update of the technical data in the vehicle registration documents (currently optional content)

3.8.1. Administrative costs for national public authorities

PMC8 will harmonise and clarify (where necessary) the contents related to the technical data of the vehicle to be provided in the registration document, as indicated in annexes I and II of the Directive 1999/37, and requires regular update.

The measure would likely result in additional administrative costs for Member State authorities for the harmonisation across MS, redesigning and setting up the new template for the registration documents. This is accompanied by a continuous review and update of the documents, with the addition of new items that may be needed in the future. Stakeholders provided a range of estimates for the one-off costs for harmonisation, from no cost to up to EUR 80,000, with an average of EUR 26,667 per Member State. This range reflects the different views of Member States concerning the need to transition to digital registration documents or the retention of physical documents (this decision is not part of the policy measure and is left to the choice of each MS). The total one-off administrative costs for the harmonisation of technical data in the vehicle registration documents are estimated at EUR 720,000 in 2026 for the 27 EU Member States relative to the baseline.

In addition, recurrent administrative costs are expected for the regular update of the vehicle registration documents with new items that may be found relevant in the future. Recurrent labour cost of 40.9 EUR/hour for ISCO 2 (professionals)[328], working for this specific function an average of 2 hours per day along the 220 working days of a regular year, are assumed. The total recurrent administrative costs for updating the technical data in vehicle registers is estimated at EUR 485,849 per year from 2026 onwards for all the EU countries. Expressed as present value over 2026-2050, the total recurrent administrative costs are estimated at EUR 8.7 million relative to the baseline (in 2022 prices).

The total administrative costs for national public authorities expected as a result of this measure are summarised in the tables below.

Table 72: One-off and recurrent administrative costs for national public authorities due to PMC8 in the policy options (all options), in 2026, 2030, 2040 and 2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	1.2	0.5	0.5	0.5
One-off costs to support the harmonisation of vehicle registration documents	0.7	0.0	0.0	0.0
Recurrent costs for regular updates of the vehicle registration documents	0.5	0.5	0.5	0.5

Source: Ricardo et al. (2024), Impact assessment support study

Table 73: One-off and recurrent administrative costs for national public authorities due to PMC8 in the policy options, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	9.4	9.4	9.4	9.4
One-off costs to support the harmonisation of vehicle registration documents	0.7	0.7	0.7	0.7

[328] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent costs for regular updates of the vehicle registration documents	8.7	8.7	8.7	8.7

Source: Ricardo et al. (2024), Impact assessment support study

3.8.2. Administrative cost savings for national public authorities and citizens

Harmonisation of vehicle registration documents could potentially reduce administrative costs related to cross-border vehicle registration and compliance, benefiting both national public authorities and citizens. However, these cost savings cannot be quantified with available data.

3.9. PMC9 – MSs to record odometer readings in a national database and make the records available to other MSs in the case of re-registration

PMC9 requires Member States to record odometer readings in a national database and make the records available to other MSs in the case of re-registration. Odometer readings for cars and vans (M1, N1) will need to be provided by garages, tyre and other repair service, in addition to PTI bodies, following every visit. OEMs will be required to provide odometer readings from connected vehicles.

PMC9 is intended to replicate across the EU the approach already followed in the Netherlands and Belgium. However, in comparison to the Belgian Car-Pass system PMC9 does not require the issuing of a certificate as part of a vehicle transaction. This currently costs around EUR 10 in Belgium and provides the main source of revenue to support the operation of the system in the country. In the Dutch National Auto Pas system, the delivery of the vehicle report is free of charge.

There is no requirement for the development of an EU wide dataset in PMC9 but Member States will need to share information on vehicle odometer readings from their respective national datasets when a cross-border sale of a vehicle takes place.

The one-off and recurrent costs for the operation of a similar system established in each Member State are estimated based on input from the Belgian Car-Pass and a 2018 European Parliament study[329]. PMC9 is expected to lead to costs for national public authorities for establishing and operating the system (including a relevant database with odometer readings covering all registered vehicles), for taking action when issues are identified, and for sharing data with other Member States when they receive requests. In addition, the measure is expected to lead to costs for garages/tyre and repair services for submitting the odometer readings (PTI centres already do so). No additional costs relative to the baseline are expected for OEMs due to this measure.

3.9.1. Administrative costs for national public authorities

The initial cost to set up the database with the odometer readings and the overall system of monitoring was around EUR 1.5 million in 2006 for Car-Pass[330]. However, it is expected that this cost is lower today, given the decrease in the costs of IT solutions in the recent past. For the assessment of PMC9, the one-off administrative costs are assumed at EUR 1 million for each of the 25 Member States concerned (i.e., excluding Belgium and the Netherlands which introduced the system already and are

[329] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf

[330] Based on an interview with Car-Pass.

part of the baseline). Thus, the total one-off administrative costs are estimated at EUR 25 million in 2026 relative to the baseline.

Based on the 2018 European Parliament study[331], the cost for operating the system is estimated at EUR 0.42 per vehicle (expressed in 2022 prices)[332]. The number of M1 and N1 vehicles relevant for PMC9 are projected at 254.7 million in 2026, 262.4 million in 2030 and 295.8 million in 2050. The recurrent administrative costs are estimated at EUR 108.1 million in 2026, EUR 111.4 million in 2030 and EUR 125.6 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 2.1 billion.

Table 74: Administrative costs for national public administrations due to PMC9 in 2026, 2030, 2040 and 2050 in all policy options relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of vehicles relevant for PMC9 (thousand), of which:	254,666	262,373	285,115	295,817
M1 vehicles	224,997	231,563	251,316	259,000
N1 vehicles	29,669	30,811	33,798	36,817
Total administrative costs (in million EUR)	133.1	111.4	121.0	125.6
One-off costs to set up the system	25.0	0.0	0.0	0.0
Recurrent costs for operating the system	108.1	111.4	121.0	125.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 75: Administrative costs for national public administrations due to PMC9 in PO1a, PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	2,122.1	2,122.1	2,122.1	2,122.1
One-off costs to set up the system	25.0	25.0	25.0	25.0
Recurrent costs for operating the system	2,097.1	2,097.1	2,097.1	2,097.1

Source: Ricardo et al. (2024), Impact assessment support study

3.9.2. Administrative costs for garages, motor vehicle dealers, tyre and repair stations, etc.

The costs for the garages, motor vehicle dealers, tyre and repair stations, etc. will relate to possible software updates to allow them to transfer their data to the central national database and the time needed to record the odometer readings. Based on input from Car-Pass system manager and the European Parliament study[333], the costs for software updates are estimated at EUR 229 per garage in 2022 prices[334]. In PMC9 these costs are relevant for 651,351 companies (470,765 repair shops and garages across the EU[335] and 180,586 motor vehicle dealers[336]), excluding those in Belgium and the

[331] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[332] The cost estimate from the 2018 European Parliament study is EUR 0.37 per vehicle in 2018 prices. Using the harmonised index of consumer prices (HICP) from Eurostat, this is equivalent to EUR 0.42 per vehicle in 2022 prices.
[333] European Parliament (2018), Odometer Manipulation in motor vehicles in Europe, https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
[334] The cost was estimated at EUR 200 per garage in 2018 prices. Using the harmonised index of consumer prices (HICP) from Eurostat, this is equivalent to EUR 229 per garage in 2022 prices.
[335] Eurostat, Structural business statistics, Enterprise statistics by size class and NACE Rev.2 activity (from 2021 onwards) [SBS_SC_OVW], Maintenance and repair of motor vehicles. Estimates for Ireland are based on 2020 data.
[336] Eurostat, Structural business statistics, Enterprise statistics by size class and NACE Rev.2 activity (from 2021 onwards) [SBS_SC_OVW], Sale of cars and light motor vehicles. Estimates for Ireland are based on 2020 data.

Netherlands, which implemented the measure already and are part of the baseline. Total one-off administrative costs are thus estimated at EUR 149.2 million in 2026.

The maintenance costs for the software are estimated at 10% of the one-off costs, or EUR 1.4 million per year from 2026 onwards. In addition, in order to calculate the costs related to the time needed to record the odometer readings, the European Parliament study assumed that 90% of the readings from garages will be done automatically via the IT system and only 10% of them will be encoded manually through a dedicated portal. Manual encoding is expected to take half a minute. Assuming an average cost per hour for technicians and associate professionals (ISCO level 3) of EUR 34, manual encoding is estimated at EUR 0.28 per encoding. In addition to the odometer readings during PTI, it is estimated that 1.5 readings per vehicle would take place per year. Furthermore, the share of connected vehicles is projected to increase over time from around 10% currently[337] to 20% in 2026, 60% in 2030 and 100% by 2040. No manual encoding is needed for the connected vehicles. Based on these assumptions and the projected M1 and N1 vehicles fleet size in the affected MS, the recurrent administrative costs for garages, motor vehicle dealers, tyre and repair stations are estimated at EUR 23.6 million in 2026, EUR 19.4 million in 2030 and EUR 14.9 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 310.8 million relative to the baseline.

For the purpose of the *'one in one out approach'*, the average annual recurrent administrative costs over 2026-2035 are estimated at EUR 19.5 million per year[338]. Considering the 651,351 companies relevant for PMC9, the average annual cost per company is estimated at EUR 29.9. In addition, as explained above, the one-off administrative costs are estimated at EUR 149.2 million in 2026.

Table 76: Administrative costs for garages, motor vehicle dealers, tyre and repair stations due to PMC9 in 2026, 2030, 2040 and 2050 in all policy options relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	172.7	19.4	14.9	14.9
One-off costs for updating the software	149.2	0.0	0.0	0.0
Recurrent costs for operating the system	23.6	19.4	14.9	14.9

Source: Ricardo et al. (2024), Impact assessment support study

Table 77: Administrative costs for garages, motor vehicle dealers, tyre and repair stations due to PMC9 in PO1a, PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	460.0	460.0	460.0	460.0
One-off costs for updating the software	149.2	149.2	149.2	149.2
Recurrent costs for operating the system	310.8	310.8	310.8	310.8

Source: Ricardo et al. (2024), Impact assessment support study

3.9.3. Reduction of odometer fraud and cost savings for citizens and businesses (vehicle owners)

PMC9 directly targets odometer tampering by aiming to replicate the key elements of the Car-Pass system adopted in Belgium since 2006 and more recently in the Netherlands.

The requirement for mandatory recording and reporting to a national central database of vehicle mileage, whenever a vehicle undergoes repair/maintenance or in the case of tyre

[337] https://www.car-pass.be/en/news/car-pass-annual-report-2022
[338] This is calculated as a simple average over 2026-2035, non discounted.

changes/replacement[339], allows to create a long record of a vehicle's mileage since its first time of registration. This allows to easily identify any tampering with the odometer. For example, the Car-Pass system led within a year[340] to a very significant drop in the level of odometer fraud in the case of second-hand vehicles registered in Belgium, from 13% to no more than 2%[341]. Similar effectiveness levels have been reported for the Dutch system, that shares many common elements with the Car-Pass system (albeit with no requirement for the issuing of a certificate). However, as explained by the manager of the Car-Pass system during the stakeholders' consultation, there are still important limitations when it comes to cross-border vehicle sales since access to mileage records from other countries is often limited or not available at all. Implementing the system across the EU is thus expected to help reduce odometer fraud in the Member States where such a system is not currently in place, both in terms of domestic sales of used vehicles, as well as in terms of cross-border sales where odometer tampering has been found to be more common.

The total volume of second hand vehicle sales (M1 and N1 vehicles) by citizens and businesses in the 25 Member States affected by PMC9 (excluding Belgium and the Netherlands, which have already implemented the system) is projected at around 62.3 million in 2026, 65.5 million in 2030 and 71 million in 2050[342] of which second hand cross border sales are estimated at 28.1 million in 2026, 29.5 million in 2030 and 31.7 million in 2050[343]. The average share of odometer tampering in national second-hand car sales is estimated at 4.8%[344] and in cross border second hand car sales at 11.3%[345], and they are assumed to remain constant over time in the baseline scenario. Thus, the number of national second-hand vehicle sales with mileage fraud is projected at 1.63 million in 2026, 1.71 million in 2030 and 1.90 million in 2050 in the baseline scenario, and that of cross border vehicle sales with mileage fraud at 3.18 million in 2026, 3.35 million in 2030 and 3.64 million in 2050.

For assessing the benefits of PMC9 for citizens and businesses, the reduction in the level of odometer fraud is assumed at 97% for domestic sales of second-hand vehicles, based on the experience with Car-Pass[346], and at 90% for the cross-border vehicle sales. If frequent odometer recording is implemented, and odometer history data is exchanged between Member States before re-registration, it is reasonable to assume that odometer fraud can be reduced at a similar level as in Belgium and the Netherlands. Furthermore, the rapid deployment of connected cars can be expected to significantly support the effectiveness of the measure.

The national mileage fraud avoidance in terms of number of vehicles is estimated at 1.58 million in 2026, 1.66 million in 2030 and 1.84 million in 2050 while the cross-border mileage fraud avoidance at 2.87 million in 2026, 3.01 million in 2030 and 3.28 million 2050. The average cost of mileage fraud, due to higher purchase price and maintenance costs incurred, is estimated at EUR 2,119 per

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339 This is in addition to the time of the PTI, which is part of the baseline.
340 EPRS_STU(2018)615637_EN.pdf (europa.eu)
341 The introduction of the system was supported by an extensive information campaign.
342 Projections of second hand vehicle sales are derived based on projections for new car sales from the PRIMES-TREMOVE baseline and available data on the ratio of second hand car to new car sales for selected countries from: https://www.bain.com/insights/the-outlook-for-the-european-used-car-market-brief/ and https://www.regitra.lt/lt/atviri-duomenys/?datayear=2017&dataquery=. The ratio of second hand car to new car sales is assumed to remain constant over time. For MS without relevant data, a ratio of second hand to new car sales of 4 has been assumed for EU12 countries and 3.5 for EU15 countries.
343 Projections for the second-hand cross border sales are developed based on data from https://www.carvertical.com/gb/transparency-index/metrics with some data gaps filled using the median value.
344 Source: https://www.carvertical.com/blog/research-what-countries-have-the-highest-percentage-of-cars-with-a-fake-mileage
345 Source: https://www.europarl.europa.eu/RegData/etudes/STUD/2018/615637/EPRS_STU%282018%29615637_EN.pdf
346 EPRS_STU(2018)615637_EN.pdf (europa.eu)

vehicle in 2022 prices as explained in detail in section 2 of Annex 4. The total costs savings for citizens and businesses are estimated at EUR 9.4 billion in 2026, EUR 9.9 billion in 2030 and EUR 10.8 billion in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 184 billion.

Table 78: Costs savings for citizens and businesses due to PMC9 in 2026, 2030, 2040 and 2050 in all policy options relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Volume of second hand national sales in the affected MS (million vehicles)	34.17	35.92	39.90	39.33
Volume of second hand cross border sales in the affected MS (million vehicles)	28.10	29.54	31.39	31.70
National second hand sales with mileage fraud (million vehicles)	1.63	1.71	1.90	1.90
Cross border sales with mileage fraud (million vehicles)	3.18	3.35	3.59	3.64
National mileage fraud avoidance (million vehicles)	1.58	1.66	1.85	1.84
Cross border mileage fraud avoidance (million vehicles)	2.87	3.01	3.23	3.28
Costs savings from fraud avoidance (EUR million), of which:	9,423.8	9,907.1	10,751.7	10,847.6
National	3,350.8	3,522.6	3,913.0	3,899.1
Cross border	6,073.0	6,384.5	6,838.7	6,948.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 79: Costs savings for citizens and businesses due to PMC9 in PO1a, PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in billion EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Consumer savings from fraud avoidance, of which:	184.0	184.0	184.0	184.0
National	65.9	65.9	65.9	65.9
Cross border	118.1	118.1	118.1	118.1

Source: Ricardo et al. (2024), Impact assessment support study

As shown in the table below, these cost savings are expected to be more significant for citizens and businesses in Central and Eastern European countries where the level of odometer fraud has been found to be higher in general and where cross-border sales of second-hand vehicles are higher than average.

Table 80: Estimated fraud avoidance and costs savings for citizens and businesses due to PMC9 in 2030 in all policy options relative to the baseline

	National and cross border mileage fraud avoidance (thousand vehicles)	Share of national and cross border mileage fraud avoidance in the total second hand vehicles sales (%)	Savings for citizens and businesses from fraud avoidance (million EUR, in 2022 prices)
AT	145,990	8%	309.4
BG	90,667	8%	192.2
CY	24,238	10%	51.4
CZ	148,959	9%	315.7
DE	477,055	4%	1,011.1
DK	52,426	5%	111.1
EE	43,122	15%	91.4
EL	149,818	8%	317.5

	National and cross border mileage fraud avoidance (thousand vehicles)	Share of national and cross border mileage fraud avoidance in the total second hand vehicles sales (%)	Savings for citizens and businesses from fraud avoidance (million EUR, in 2022 prices)
ES	381,502	7%	808.6
FI	55,609	5%	117.9
FR	733,433	6%	1,554.5
HR	48,286	8%	102.3
HU	201,515	11%	427.1
IE	62,778	8%	133.1
IT	753,224	7%	1,596.4
LT	161,193	15%	341.6
LU	30,226	12%	64.1
LV	30,430	19%	64.5
MT	11,455	8%	24.3
PL	395,864	9%	839.0
PT	59,152	3%	125.4
RO	325,840	13%	690.6
SE	199,491	10%	422.8
SI	24,382	6%	51.7
SK	67,736	6%	143.6
EU level	4,675,346	7%	9,907.1

Source: Ricardo et al. (2024), Impact assessment support study

To allocate the benefits due to the reduction of odometer fraud between citizens and businesses, the second hand M1 vehicle sales have been split between citizens and businesses using the share of new vehicle registered by citizens (i.e., 40%). For N1 vehicles it has been assumed that all benefits accrue to businesses. The tables below provide the split of the benefits between citizens and businesses at EU level.

Table 81: Costs savings for citizens due to PMC9 in 2026, 2030, 2040 and 2050 in all policy options relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Volume of second hand national sales in the affected MS (million vehicles)	12.24	12.87	14.37	14.06
Volume of second hand cross border sales in the affected MS (million vehicles)	10.00	10.51	11.11	11.15
National second hand sales with mileage fraud (million vehicles)	0.59	0.62	0.69	0.68
Cross border sales with mileage fraud (million vehicles)	1.14	1.20	1.27	1.29
National mileage fraud avoidance (million vehicles)	0.57	0.60	0.67	0.66
Cross border mileage fraud avoidance (million vehicles)	1.03	1.08	1.15	1.16
Costs savings from fraud avoidance (EUR million), of which:	3,380.8	3,554.2	3,841.0	3,856.7
National	1,204.2	1,265.9	1,411.1	1,398.4
Cross border	2,176.7	2,288.3	2,429.9	2,458.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 82: Costs savings for citizens due to PMC9 in PO1a, PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in billion EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Consumer savings from fraud avoidance, of which:	65.7	65.7	65.7	65.7
National	23.7	23.7	23.7	23.7
Cross border	42.0	42.0	42.0	42.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 83: Costs savings for businesses due to PMC9 in 2026, 2030, 2040 and 2050 in all policy options relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Volume of second hand national sales in the affected MS (million vehicles)	21.92	23.05	25.54	25.26
Volume of second hand cross border sales in the affected MS (million vehicles)	18.10	19.03	20.28	20.56
National second hand sales with mileage fraud (million vehicles)	1.04	1.10	1.22	1.22
Cross border sales with mileage fraud (million vehicles)	2.04	2.15	2.31	2.35
National mileage fraud avoidance (million vehicles)	1.01	1.07	1.18	1.18
Cross border mileage fraud avoidance (million vehicles)	1.84	1.93	2.08	2.12
Costs savings from fraud avoidance (EUR million), of which:	6,043.0	6,352.9	6,910.6	6,990.9
National	2,146.6	2,256.7	2,501.8	2,500.7
Cross border	3,896.4	4,096.2	4,408.8	4,490.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 84: Costs savings for businesses due to PMC9 in PO1a, PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in billion EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Consumer savings from fraud avoidance, of which:	118.3	118.3	118.3	118.3
National	42.2	42.2	42.2	42.2
Cross border	76.1	76.1	76.1	76.1

Source: Ricardo et al. (2024), Impact assessment support study

3.10. PM1 - RSI for heavy/powerful motorcycles (L category > 125cm3) as alternative measure, in Member States where they are not subject to PTI (i.e., using available opt-out)

3.10.1. Administrative costs for national public authorities

PM1 will require that those Member States (BE, FI, IE, NL, MT, PT)[347] that do not have a PTI requirement for motorcycles introduce roadside inspections for motorcycles over 125 cc as an

[347] Until the end of 2023, France had not introduced mandatory PTI for motorcycles but the French authorities had announced the intention to do so. For this reason, for the purposes of the analysis it was assumed that France would not be affected by the proposed measure. Denmark does not have mandatory PTI but it has introduced roadside inspections, and it is thus assumed to be part of the baseline. In the case of Portugal, current requirements cover only motorcycles over 250cc.

alternative. The roadside inspections are expected to cover 5% of the number of motorcycles registered every year.

The average duration of a roadside inspection for heavy goods vehicles is around 25-30 minutes[348] but in the case of motorcycles it can be reasonably expected that this will be much shorter, given the size of the vehicle and the list of parameters to be inspected. It is assumed that, on average[349], it will take 10 minutes which translates into an average cost of EUR 5.7 per inspection (assuming an hourly cost of EUR 34 for technicians and associate professionals – ISCO 3). The number of roadside inspections for motorcycles in PM1 is estimated at 80,443 in 2026, 82,566 in 2030 and 104,321 in 2050 for the 6 Member States concerned. The recurrent administrative costs are estimated at EUR 0.46 million in 2026, EUR 0.47 million in 2030 and EUR 0.59 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 9.1 million relative to the baseline.

3.10.2. Adjustment costs for national public authorities

Under PM1 it is assumed that the national public authorities of the 6 MS affected by the measure purchase additional equipment to support the additional inspections. For a 5% share of the motorcycles fleet, one extra RSI unit per MS is expected to be sufficient. With an estimated cost of EUR 20,000 per unit (according to input from stakeholders), the one-off adjustment costs are estimated at EUR 120,000 in 2026.

Recurrent adjustment costs (i.e., maintenance costs) are assumed to be around 10% of the capital costs and estimated at EUR 12,000 per year from 2026 onwards. Expressed as present value over 2026-2050, they are estimated at EUR 0.2 million relative to the baseline.

Table 85: Costs for national public authorities due to PM1 in 2026, 2030, 2040 and 2050 in policy options PO1a and PO2 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of roadside inspections	80,443	82,566	93,459	104,321
Administrative costs (million EUR)	0.46	0.47	0.53	0.59
Recurrent administrative costs	0.46	0.47	0.53	0.59
Total adjustment costs (million EUR)	0.13	0.01	0.01	0.01
One-off costs for equipment	0.12	0.00	0.00	0.00
Recurrent maintenance costs	0.01	0.01	0.01	0.01

Source: Ricardo et al. (2024), Impact assessment support study

Table 86: Costs for national public authorities due to PM1 in PO1a and PO2, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	9.12		9.12	
Recurrent administrative costs	9.12		9.12	
Total adjustment costs	0.34		0.34	
One-off costs for equipment	0.12		0.12	
Recurrent maintenance costs	0.22		0.22	

Source: Ricardo et al. (2024), Impact assessment support study

[348] SWD(2012)206

[349] This includes the larger share of inspections where there are no specific issues identified on the basis of an initial inspection (where the duration can be even shorter than 10 minutes) and the smaller number of inspections that may require more extensive testing.

3.10.3. *Administrative cost for citizens (vehicle owners)*

Vehicle owners will experience some costs for the time spent for cooperating on roadside inspections with the public authorities. As explained, the average time required for a roadside inspection is estimated at 10 minutes. Considering an average hourly labour cost of EUR 29.5 and the number of roadside inspections, the administrative costs for citizens are estimated at EUR 0.40 million in 2026, EUR 0.41 million in 2030 and EUR 0.51 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 7.9 million relative to the baseline.

Where a vehicle is found to be defective, the authorities may request the owner/holder of the vehicle to pay a charge corresponding to the cost of the test, in addition to the cost of repair. It is not possible to quantify the costs incurred in the form of such a charge, but they are expected to be limited. The cost of repair would have to be borne by the vehicle owner anyway; the RSI only helps identify the defects earlier.

The tables below summarise the costs expected for citizens due to PM1.

Table 87: Recurrent administrative costs for citizens due to PM1 in 2026, 2030, 2040 and 2050 in policy options PO1a and PO2 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of roadside inspections	80,443	82,566	93,459	104,321
Administrative costs (million EUR)	0.40	0.41	0.46	0.51
Recurrent administrative costs	0.40	0.41	0.46	0.51

Source: Ricardo et al. (2024), Impact assessment support study

Table 88: Recurrent administrative costs for citizens due to PM1 in PO1a and PO2, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	7.92		7.92	
Recurrent administrative costs	7.92		7.92	

Source: Ricardo et al. (2024), Impact assessment support study

3.11. PM2 - Mandatory PTI for motorcycles above 125cm3 (remove current opt-out)

This measure introduces removing the current opt-out from the mandatory PTI for motorcycles.

When motorcycles are not regularly tested, this has a non-negligeable impact on road safety. A comparison between the countries that apply PTI (ES, IT, DE) and FR that only introduced PTI for motorcycles in April 2024, is provided in the table below. The figures indicate the number of fatalities of occupants of powered two-wheelers in comparison to the fleet size of those vehicles in the four Member States. While the number of fatalities is highest in these Member States (with 542 motorcycle fatalities in DE, 417 in ES, 615 in FR, and 698 in IT, in 2019), the ratios below indicate that PTI for these vehicles probably has a noticeable impact. In fact, the differences are significant between the countries that apply PTI to both motorcycles and mopeds (ES and IT), to motorcycles only (DE) and FR that only introduced PTI for motorcycles in April 2024.

Table 89: Fatalities of occupants of powered two wheelers (i.e., motorcycles and mopeds) per 1000 powered two wheelers

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DE	0.19	0.20	0.17	0.16	0.16	0.17	0.14	0.15	0.16	0.13
ES	0.10	0.08	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
FR	0.28	0.29	0.28	0.28	0.29	0.29	0.29	0.26	0.25	0.25
IT	0.13	0.12	0.11	0.10	0.09	0.10	0.09	0.09	0.08	0.08

Source: CARE database and Statistical Pocketbook "EU transport in figures"

3.11.1. Adjustment costs for PTI centres

PM2 implies that the capacity of PTI centres in the MS where PTI is not in place (BE, FI, IE, NL, MT, PT, DK)[350] should be increased. The way that PTI services are organised in each Member States differ. The level of extra capacity and the associated costs that may arise to meet the extra demand are estimated recognising that there may be some differences among Member States.

The additional number of inspections in the 7 MS is estimated at 733,056 in 2026, 751,660 in 2030 and 941,911 in 2050[351].

Additional PTI lanes to deliver these inspections will be needed. Assuming a typical PTI lane operating 10 hours a day for 220 days, a total of up to 4,620 motorcycle inspections can be delivered. On the basis of the projected number of inspections, around 159 additional PTI lanes will be needed in 2026 and 45 additional ones by 2050 (204 additional PTI lanes in total over 2026-2050 relative to the baseline). The cost per PTI lane is estimated at EUR 20,000. The one-off adjustment costs are thus estimated at EUR 3.2 million in 2026, EUR 20,000 in 2030 and EUR 40,000 in 2050 relative to the baseline. Expressed as present value over 2026-2050, they are estimated at EUR 3.8 million relative to the baseline.

Recurrent maintenance costs for the PTI lanes are assumed at 10% of the capital costs (i.e., EUR 2,000 per lane). They are estimated at EUR 318,000 in 2026, EUR 326,000 in 2030, going up to EUR 408,000 in 2050 due to the additional PTI lanes added over time in line with the projected growth in the number of inspections. Expressed as present value over 2026-2050, the recurrent adjustment costs for the maintenance of the PTI lanes are estimated at EUR 6.3 million relative to the baseline.

The average duration of a PTI inspection for motorcycles is around 20 minutes. The labour costs per inspection are estimated at EUR 11.3, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of inspections, the recurrent adjustment costs are estimated at EUR 8.3 million in 2026, EUR 8.5 million in 2030 and EUR 10.7 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 165.5 million relative to the baseline.

The number of additional inspectors that need to be trained for performing the PTIs in the 7 Member States concerned by PM2 is estimated at 167 in 2026, and 48 additional ones by 2050 (215 inspectors to be trained in total over 2026-2050 relative to the baseline). They are estimated based on the projected number of additional PTIs in the 7 Member States and the average number of PTIs per inspector (i.e., 4,380). Assuming a two-day training for the additional inspectors, at an hourly cost of EUR 34 for technicians and associate professionals – ISCO 3), the total one-off adjustment costs for training are estimated at EUR 82,634 in 2026, EUR 495 in 2030 and EUR 990 in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 98,875 relative to the baseline.

[350] France has not introduced mandatory PTI for motorcycles up to now but the French authorities have announced the intention to do so. For this reason, for the purposes of the analysis it is assumed that France will not be affected by the proposed measure.

[351] This is estimated as the number of motorcycles in the baseline from the PRIMES-TREMOVE model, multiplied by the average number of inspections per motorcycle over its lifetime (estimated at 8) and divided by the average age of a motorcycle (18 years). The average number of inspections per motorcycle is calculated based on the assumed frequency and average age.

The tables below summarise the costs expected for PTI centres due to PM2.

Table 90: Adjustment costs for PTI centres due to PM2 in 2026, 2030, 2040 and 2050 in policy option PO1b relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections	733,056	751,660	847,034	941,911
Total adjustment costs	11.88	8.86	10.00	11.12
One-off costs for the additional PTI lanes	3.18	0.02	0.04	0.04
Recurrent costs for the maintenance of the PTI lanes	0.32	0.33	0.37	0.41
Recurrent labour costs for inspections	8.30	8.51	9.60	10.67
One-off costs for training	0.08	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 91: Adjustment costs for PTI centres due to PM2 in PO1b, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs		175.7		
One-off costs for the additional PTI lanes		3.8		
Recurrent costs for the maintenance of the PTI lanes		6.3		
Recurrent labour costs for inspections		165.5		
One-off costs for training		0.1		

Source: Ricardo et al. (2024), Impact assessment support study

3.11.2. Enforcement costs for national public authorities

The introduction of mandatory PTI will also imply some extra costs for the authorities that are responsible for monitoring the operation of the system, evaluating the quality of the PTI inspections. The Dutch authorities (RDW) reported that around EUR 4.5 per PTI is charged to vehicle owners to cover the costs of monitoring by authorities. The Dutch system includes random inspections of vehicles done by RDW as a way to check the quality of PTI inspections. This is not an approach adopted in other Member States and it is not a requirement of the Directive. As such, the cost of EUR 4.5 per PTI is not considered representative of the typical monitoring costs. For the calculations, an average monitoring cost of EUR 2.25 per PTI is assumed (50% of the cost provided by RDW). Recurrent enforcement costs are thus estimated at EUR 1.6 million in 2026, EUR 1.7 million in 2030 and EUR 2.1 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 32.9 million relative to the baseline.

Table 92: Enforcement costs for national public authorities due to PM2 in 2026, 2030, 2040 and 2050 in policy option PO1b relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent enforcement costs	1.6	1.7	1.9	2.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 93: Enforcement costs for national public authorities due to PM2 in PO1b, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent enforcement costs		32.9		

Source: Ricardo et al. (2024), Impact assessment support study

3.11.3. Administrative costs for citizens (vehicle owners)

Mandatory PTI for motorcycles translate into additional costs for vehicles owners in the Member States affected. Using the median of the charges per PTI test from the other Member States, estimated at EUR 20.1, the recurrent administrative costs for citizens are estimated at EUR 14.8 million in 2026, EUR 15.1 million in 2030 and EUR 19 million in 2050. Expressed as present value over the 2026-2050 period, they are estimated at EUR 294.1 million.

Motorcycle owners with identified defective motorcycles will incur costs to repair their motorcycles while they will also need to spend some time to travel to PTI centres, thus incurring some extra costs. However, these may vary significantly by vehicle and were not possible to quantify.

The tables below summarise the costs for citizens expected for PM2 in PO1b.

Table 94: Administrative costs for citizens (vehicle owners) due to PM2 in 2026, 2030, 2040 and 2050 in policy option PO1b relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs	14.8	15.1	17.1	19.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 95: Administrative costs for citizens (vehicle owners) due to PM2 in PO1b, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs		294.1		

Source: Ricardo et al. (2024), Impact assessment support study

3.11.4. Benefits for PTI centres

PM2 would result in benefits for the PTI centres in the 7 MS affected, due to the mandatory PTI for heavy/powerful motorcycles. The costs for vehicle owners (citizens) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PM2 are estimated at EUR 14.8 million in 2026, EUR 15.1 million in 2030 and EUR 19 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 294.1 million relative to the baseline.

Table 96: Benefits for PTI centres due to PM2 in 2026, 2030, 2040 and 2050 in policy option PO1b relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	14.8	15.1	17.1	19.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 97: Benefits for PTI centres due to PM2 policy option PO1b, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres		294.1		

Source: Ricardo et al. (2024), Impact assessment support study

3.12. PM3 - Extend PTI to all motorcycles (i.e., including from 50cm3 = all L3e, L4e, plus tricycles (L5e) and heavy quadricycles (L7e))

3.12.1. Adjustment costs for PTI centres

PM3 extends the type of motorcycles covered by PTI to those from 50cm3 in the eight Member States where such requirement is currently not in place (BE, FI, IE, NL, MT, PT, DK, CY[352]).

The additional number of inspections in the 8 MS affected is estimated at 845,522 in 2026, 869,017 in 2030 and 1,097,479 in 2050[353].

Similarly to PM2, additional PTI lanes to deliver these inspections will be needed. Assuming a typical PTI lane operating 10 hours a day for 220 days, a total of up to 4,620 motorcycle inspections can be delivered. On the basis of the projected number of inspections, around 183 additional PTI lanes will be needed in 2026 and 55 additional ones by 2050 (238 additional PTI lanes in total over 2026-2050 relative to the baseline). The cost per PTI lane is estimated at EUR 20,000. The one-off adjustment costs are estimated at EUR 3.7 million in 2026, EUR 20,000 in 2030 and EUR 60,000 in 2050 relative to the baseline. Expressed as present value over 2026-2050, they are estimated at EUR 4.4 million relative to the baseline.

Recurrent maintenance costs for the PTI lanes are assumed at 10% of the capital costs (i.e., EUR 2,000 per lane). They are estimated at EUR 366,000 in 2026, EUR 376,000 in 2030, going up to EUR 476,000 in 2050 due to the additional PTI lanes added over time in line with the projected growth in the number of inspections. Expressed as present value over 2026-2050, the recurrent adjustment costs for the maintenance of the PTI lanes are estimated at EUR 7.3 million relative to the baseline.

The average duration of a PTI inspection for motorcycles is around 20 minutes. The labour costs per inspection are estimated at EUR 11.3, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of inspections, the recurrent adjustment costs are estimated at EUR 9.6 million in 2026, EUR 9.8 million in 2030 and EUR 12.4 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 192.1 million relative to the baseline.

The number of additional inspectors that need to be trained for performing the PTIs in the 8 Member States concerned by PM3 is estimated at 193 in 2026, and 58 additional ones by 2050 (251 inspectors to be trained in total over 2026-2050 relative to the baseline). They are estimated based on the projected number of additional PTIs in the 8 Member States and the average number of PTIs per inspector (i.e., 4,380). Assuming a two-day training for the additional inspectors, at an hourly cost of EUR 34 for technicians and associate professionals – ISCO 3), the total one-off adjustment costs for

[352] In Cyprus motorcycles above 125cm3 are already covered.
[353] This is estimated as the number of motorcycles in the baseline from the PRIMES-TREMOVE model, multiplied by the average number of inspections per motorcycle over its lifetime (estimated at 8) and divided by the average age of a motorcycle (18 years). The average number of inspections per motorcycle is calculated based on the assumed frequency and average age.

training are estimated at EUR 95,499 in 2026, EUR 495 in 2030 and EUR 1,484 in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 115,102 relative to the baseline.

The tables below summarise the costs expected for PTI centres due to PM3.

Table 98: Adjustment costs for PTI centres due to PM3 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections	845,522	869,017	985,326	1,097,479
Total adjustment costs	13.70	10.24	11.65	12.97
One-off costs for the additional PTI lanes	3.66	0.02	0.06	0.06
Recurrent costs for the maintenance of the PTI lanes	0.37	0.38	0.43	0.48
Recurrent labour costs for inspections	9.58	9.84	11.16	12.43
One-off costs for training	0.10	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 99: Adjustment costs for PTI centres due to PM3 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs				203.9
One-off costs for the additional PTI lanes				4.4
Recurrent costs for the maintenance of the PTI lanes				7.3
Recurrent labour costs for inspections				192.1
One-off costs for training				0.1

Source: Ricardo et al. (2024), Impact assessment support study

3.12.2. Enforcement cost for national public authorities

The introduction of mandatory PTI will also imply some extra costs for the authorities that are responsible for monitoring the operation of the system, evaluating the quality of the PTI inspections. The Dutch authorities (RDW) reported that around EUR 4.5 per PTI is charged to vehicle owners to cover the costs of monitoring by authorities. The Dutch system includes random inspections of vehicles done by RDW as a way to check the quality of PTI inspections. This is not an approach adopted in other Member States and it is not a requirement of the Directive. As such, the cost of EUR 4.5 per PTI is not considered representative of the typical monitoring costs. For the calculations, an average monitoring cost of EUR 2.25 per PTI is assumed (50% of the cost provided by RDW). Recurrent enforcement costs are thus estimated at EUR 1.9 million in 2026, EUR 2 million in 2030 and EUR 2.5 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 38.1 million relative to the baseline.

Table 100: Enforcement costs for national public authorities due to PM3 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent enforcement costs	1.9	2.0	2.2	2.5

Source: Ricardo et al. (2024), Impact assessment support study

Table 101: Enforcement costs for national public authorities due to PM3 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent enforcement costs				38.1

Source: Ricardo et al. (2024), Impact assessment support study

3.12.3. Administrative cost for citizens (vehicle owners)

Mandatory PTI for motorcycles translate into additional costs for vehicles owners in the Member States affected. Using the median of the charges per PTI test from the other Member States, estimated at EUR 20.1, the recurrent administrative costs for citizens are estimated at EUR 17 million in 2026, EUR 17.5 million in 2030 and EUR 22.1 million in 2050. Expressed as present value over the 2026-2050 period, they are estimated at EUR 341.3 million.

Motorcycle owners with identified defective motorcycles will incur costs to repair their motorcycles while they will also need to spend some time to travel to PTI centres, thus incurring some extra costs. However, these may vary significantly by vehicle and were not possible to quantify them.

The tables below summarise the costs for citizens (vehicle owners) expected for PM3 in PO3.

Table 102: Administrative costs for citizens (vehicle owners) due to PM3 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs	17.0	17.5	19.8	22.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 103: Administrative costs for citizens (vehicle owners) due to PM3 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs				341.3

Source: Ricardo et al. (2024), Impact assessment support study

3.12.4. Benefits for PTI centres

PM3 would result in benefits for the PTI centres in the 8 MS affected, due to the extension of PTI to all motorcycles. The costs for vehicle owners (citizens) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PM3 are estimated at EUR 17 million in 2026, EUR 17.5 million in 2030 and EUR 22.1 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 341.3 million relative to the baseline.

Table 104: Benefits for PTI centres due to PM3 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	17.0	17.5	19.8	22.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 105: Benefits for PTI centres due to PM3 in policy option PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres				341.3

Source: Ricardo et al. (2024), Impact assessment support study

3.13. PM4 – Mandatory PTI for light trailers (O1 and O2 categories)

PM4 requires the mandatory PTI for light trailers (O1 and O2 categories). Eleven Member States would be affected by PM4: 7 Member States where there is currently no requirement for PTI for either O1 or O2 (DK, EL, FI, FR, NL, IE, PT) and 4 Member States where there is currently only a requirement for PTI for O2 (PL, SK, BE and ES).

3.13.1. Adjustment costs for PTI centres

Assuming a frequency scheme of 4/2/2 the additional number of inspections due to PM4 in the 11 MS is estimated at 1.3 million in 2026, 1.4 million in 2030 and 1.6 million in 2050[354], of which for O1 category 724,302 inspections in 2026, 753,381 in 2030 and 830,560 in 2050 and for O2 category 597,825 inspections in 2026, 638,053 in 2030 and 734,593 in 2050.

Additional PTI lanes to deliver these inspections may be needed, although it is possible that extra utilisation of the existing capacity may allow to cover at least part of the extra demand. For the assessment, it has been assumed that additional PTI lanes would be needed for inspections of O2 category trailers only[355]. Assuming a typical PTI lane operating for 220 days and allowing the inspection of 28 trailers per day, a total of up to 6,160 inspections can be delivered for O2 trailers per year by a PTI lane. On the basis of the projected number of inspections, around 97 additional PTI lanes will be needed in 2026 and 22 additional ones by 2050 (119 additional PTI lanes in total over 2026-2050 relative to the baseline). The cost of an additional PTI lane for trailers is estimated at EUR 10,000 per lane. The one-off adjustment costs are thus estimated at EUR 970,000 in 2026, EUR 20,000 in 2030 and no extra costs in 2050 relative to the baseline. Expressed as present value over 2026-2050, they are estimated at EUR 1.1 million relative to the baseline.

Recurrent maintenance costs for the PTI lanes are assumed at 10% of the capital costs (i.e., EUR 1,000 per lane). They are estimated at EUR 97,000 in 2026, EUR 104,000 in 2030, going up to EUR 119,000 in 2050 due to the additional PTI lanes added over time in line with the projected growth in the number of inspections. Expressed as present value over 2026-2050, the recurrent adjustment costs for the maintenance of the PTI lanes are estimated at EUR 2 million relative to the baseline.

The average duration of a PTI inspection for trailers is around 15 minutes. The labour costs per inspection are estimated at EUR 8.5, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of inspections, the recurrent

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[354] This is estimated as the number of trailers in the baseline, multiplied by the average number of inspections per trailer over its lifetime (estimated at 8) and divided by the average age of a trailer (18 years).

[355] For the inspection of O2 trailers a rolling brake test equipment will be needed (not needed for O1 trailers) which, given the expected volume of trailers to be tested may lead to the need of extra capacity. Some stakeholders indicated that the inspections can be carried out with the existing equipment but for the assessment it is considered that due to the significant extra volume of inspections expected, extra investment would be needed in PTI lanes for O2 trailers. In the case of O1 trailers visual inspection is expected to be sufficient and thus no additional PTI lanes are expected to be needed. The feedback received from stakeholders in the context of the stakeholders' survey indicated that no extra equipment is needed for O1 trailers. No stakeholder mentioned the need for extra space and the costs associated to it. Thus, although additional costs for O1 trailers are possible, they are not considered significant and not estimated.

adjustment costs are estimated at EUR 11.2 million in 2026, EUR 11.8 million in 2030 and EUR 13.3 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 222.3 million relative to the baseline.

No training costs are expected since the inspections required are similar to those of other vehicles.

Table 106: Adjustment costs for PTI centres due to PM4 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections, of which:	1,322,127	1,391,434	1,513,772	1,565,153
for O1 category	724,302	753,381	810,970	830,560
for O2 category	597,825	638,053	702,803	734,593
Total adjustment costs	12.3	11.9	13.0	13.4
One-off costs for the additional PTI lanes	1.0	0.0	0.0	0.0
Recurrent costs for the maintenance of the PTI lanes	0.1	0.1	0.1	0.1
Recurrent labour costs for inspections	11.2	11.8	12.9	13.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 107: Adjustment costs for PTI centres due to PM4 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs				225.4
One-off costs for the additional PTI lanes				1.1
Recurrent costs for the maintenance of the PTI lanes				2.0
Recurrent labour costs for inspections				222.3

Source: Ricardo et al. (2024), Impact assessment support study

3.13.2. Enforcement costs for national public authorities

Similarly to PM2 and PM3, the introduction of mandatory PTI will also imply some extra costs for the authorities that are responsible for monitoring the operation of the system and evaluating the quality of the PTI inspections. The approach for estimating the recurrent enforcement costs is similar to that explained under PM3. However, lower costs per trailer are assumed for monitoring in this case (EUR 1.5 per trailer inspection versus EUR 2.25 per motorcycle inspection). The recurrent enforcement costs for the 11 Member States affected by PM4 are estimated at EUR 2 million in 2026, EUR 2.1 million in 2030 and EUR 2.3 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 39.2 million.

Table 108: Enforcement costs for national public authorities due to PM4 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent enforcement costs	2.0	2.1	2.3	2.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 109: Enforcement costs for national public authorities due to PM4 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent enforcement costs				39.2

Source: Ricardo et al. (2024), Impact assessment support study

3.13.3. Administrative cost for businesses (vehicle owners)

Mandatory PTI for trailers translate into additional costs for vehicles owners in the Member States affected. To calculate the costs, it is assumed that all O2 trailers and half of the O1 trailers are owned by business. Charges for PTI for trailers are expected to be no greater than those for motorcycles, considering also that there is no emissions test. Assuming a fee per PTI test for trailers of EUR 20.1, the recurrent administrative costs for businesses are estimated at EUR 19.3 million in 2026, EUR 20.4 million in 2030 and EUR 23.1 million in 2050. Expressed as present value over the 2026-2050 period, they are estimated at EUR 385.1 million.

The tables below summarise the administrative costs for businesses expected for PM4.

Table 110: Administrative costs for businesses (vehicle owners) due to PM4 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs	19.3	20.4	22.3	23.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 111: Administrative costs for businesses (vehicle owners) due to PM4 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs				385.1

Source: Ricardo et al. (2024), Impact assessment support study

3.13.4. Administrative cost for citizens (vehicle owners)

As explained above, mandatory PTI for trailers translate into additional costs for vehicles owners in the Member States affected. To calculate the costs citizens, it is assumed that half of the O1 trailers are owned by citizens. Assuming a charge per PTI test for trailers of EUR 20.1, the recurrent administrative costs for citizens are estimated at EUR 7.3 million in 2026, EUR 7.6 million in 2030 and EUR 8.4 million in 2050. Expressed as present value over the 2026-2050 period, they are estimated at EUR 141.5 million.

The tables below summarise the administrative costs for citizens expected for PM4.

Table 112: Administrative costs for citizens (vehicle owners) due to PM4 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs	7.3	7.6	8.2	8.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 113: Administrative costs for citizens (vehicle owners) due to PM4 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs				141.5

Source: Ricardo et al. (2024), Impact assessment support study

3.13.5. Benefits for PTI centres

PM4 would result in benefits for the PTI centres in the MS affected, due to the mandatory PTI for light trailers. The costs for vehicle owners (citizens and businesses) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PM4 are estimated at EUR 26.6 million in 2026, EUR 28 million in 2030 and EUR 31.5 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 526.6 million relative to the baseline.

Table 114: Benefits for PTI centres due to PM4 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	26.6	28.0	30.5	31.5

Source: Ricardo et al. (2024), Impact assessment support study

Table 115: Benefits for PTI centres due to PM4 in policy option PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres				526.6

Source: Ricardo et al. (2024), Impact assessment support study

3.14. PM5 – Annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2 frequency

PM5 includes a requirement for annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2 frequency. It assumes additional emission testing in all Member States. The assessment of PM5 (included in PO1b, PO2 and PO3) takes into account the synergies with PMC3 on a proposed PN testing at PTI and with PMC4 on a new NOx test.

3.14.1. Adjustment costs for PTI centres

The additional number of emission testing for internal combustion light commercial vehicles due to PM5 is estimated at 14.3 million in 2026, 14.2 million in 2030 and 1.2 million in 2050 relative to the baseline[356]. The decrease in the number of emission testing is driven by the decrease in the number of internal combustion light commercial vehicles over time. This is due to the Regulation on CO_2 standards for LDVs that is included in the baseline.

PM5 is expected to lead to one-off adjustment costs for additional emission testing equipment. Based on stakeholders' feedback, the price for new PN measurement equipment is estimated at EUR 5,000 per equipment and that for new NOx measurement equipment at EUR 15,000. One tool per inspector is required.

[356] The number of inspections is estimated based on the projected number of internal combustion light commercial vehicles from the PRIMES-TREMOVE model.

The average number of full PTI inspections per inspector is estimated at 2,920 per year. However, emission testing is estimated to take only around 20% of the time of a full PTI inspection (i.e., around 6 minutes). Thus, it is estimated that up to 14,600 emission inspections per year can be delivered per inspector. Assuming that one emission testing equipment per inspector is needed, the required number of additional PN and NOx measurement equipment due to PM5 is estimated at 979 in 2026. Total one-off adjustment costs for equipment are thus estimated at EUR 19.6 million in 2026 relative to the baseline. Recurrent adjustment costs for the calibration and maintenance of PN and NOx equipment are estimated at 5% of the capital costs (i.e., EUR 250 per PN equipment and EUR 750 per NOx equipment), equivalent to EUR 979,000 per year from 2026 onwards. Expressed at present value over 2026-2050, the recurrent adjustment costs are estimated at EUR 17.6 million.

Training of additional inspectors will also be required due to PM5. The number of inspectors to be trained in 2026 is estimated at 979. Assuming a two-day training for the additional inspectors, including for the PN and NOx testing, at an hourly cost of EUR 34 for technicians and associate professionals – ISCO 3), the total one-off adjustment costs for training are estimated at EUR 484,425 in 2026.

Combined, the average duration of the new PN and NOx emission tests is around 6 minutes. The labour costs per emission testing are estimated at EUR 3.4, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of emission testing, the recurrent adjustment costs are estimated at EUR 48.6 million in 2026, EUR 48.2 million in 2030 and EUR 3.9 million in 2050[357]. Expressed as present value over 2026-2050, they are estimated at EUR 610.1 million relative to the baseline.

Table 116: Adjustment costs for PTI centres due to PM5 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of emission testing	14,287,176	14,187,947	8,012,878	1,156,079
Total adjustment costs	69.6	49.2	28.2	4.9
One-off costs for equipment	19.6	0.0	0.0	0.0
Recurrent costs for the maintenance of equipment	1.0	1.0	1.0	1.0
Recurrent labour costs for PN and NOx tests	48.6	48.2	27.2	3.9
One-off costs for training	0.5	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 117: Adjustment costs for PTI centres due to PM5 in PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	0.0	647.7	647.7	647.7
One-off costs for equipment	0.0	19.6	19.6	19.6
Recurrent costs for the maintenance of equipment	0.0	17.6	17.6	17.6
Recurrent labour costs for PN and NOx tests	0.0	610.1	610.1	610.1
One-off costs for training	0.0	0.5	0.5	0.5

Source: Ricardo et al. (2024), Impact assessment support study

3.14.2. Administrative cost for businesses (vehicle owners)

The introduction of annual emission testing for N1 vehicles will result in recurrent administrative costs for vehicle owners (i.e., businesses in case of N1 vehicles) due to the testing charges. Taking

[357] The labour costs decrease over time due to the decreasing number of internal combustion light commercial vehicles.

into account feedback from stakeholder interviews, the new emission test (involving PN and NOx testing) is expected to cover 20% (6 minutes) of the total PTI duration. Considering the median charge per vehicle of EUR 40.5 per N1 vehicle and the 20% share of the time covering the PN and NOx testing, the recurrent administrative costs for vehicle owners are estimated at 115.8 million in 2026, EUR 115 million in 2030 and EUR 9.4 million in 2050. Expressed as present value over the 2026-2050 period, they are estimated at EUR 1.5 billion relative to the baseline.

The tables below summarise the impact of PM5 (included in PO1b, PO2 and PO3) on businesses.

Table 118: Administrative costs for businesses (vehicle owners) due to PM5 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs	115.8	115.0	64.9	9.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 119: Administrative costs for businesses (vehicle owners) due to PM5 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs		1,454.8	1,454.8	1,454.8

Source: Ricardo et al. (2024), Impact assessment support study

3.14.3. Benefits for PTI centres

PM5 would result in benefits for the PTI centres due to the annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2 frequency. The costs for vehicle owners (businesses) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PM5 are estimated at EUR 115.8 million in 2026, EUR 115 million in 2030 and EUR 9.4 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 1.5 billion relative to the baseline.

Table 120: Benefits for PTI centres due to PM5 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	115.8	115.0	64.9	9.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 121: Benefits for PTI centres due to PM5 in policy options PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres		1,454.8	1,454.8	1,454.8

Source: Ricardo et al. (2024), Impact assessment support study

3.15. PM6 – Mandatory yearly testing for vehicles that are 10-year-old or older

Currently, 11 MS do not require annual PTI testing of light-duty vehicles after 10 years of their registration (CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK). All these Member States currently require an inspection every two years which means that the proposed measure will double the number of inspections for vehicles over 10 years.

The assessment of PM6 (included in PO1b, PO2 and PO3) takes into account the synergies with PMC3 on a proposed PN testing at PTI and with PMC4 on a new NOx test. It also takes into account the synergies with PMC1 concerning the PTI of electric vehicles and PMC2 on updates to cover General Safety Regulation Requirements. However, no additional costs are expected in relation to PMC1 and PMC2 given that the relevant update of the tools already used will need to take place irrespective of the frequency of the test.

Furthermore, the costs related to PM5 (included in PO1b, PO2 and PO3) for emission testing associated to N1 vehicles aged 10 years or older overlap with PM6 and are thus not considered under the assessment of PM6, to avoid double-counting in estimating the costs of PO1b, PO2 and PO3.

3.15.1. Adjustment costs for PTI centres

The additional number of PTIs for M1 vehicles category due to PM6 is estimated at 41.1 million in 2026, 42.1 million in 2030 and 47.5 million in 2050 and for N1 vehicle category at 4.3 million in 2026, 4.5 million in 2030 and 5.2 million in 2050.

PM6 is expected to lead to one-off adjustment costs for inspection centres for the additional emission testing equipment and for additional PTI lanes. As explained in PMC3 and PMC4, the cost per new PN testing equipment is assumed at EUR 5,000 and for NOx testing at EUR 15,000 per equipment. In addition, based on an interview with TUV Rheinland, the cost of a new PTI lane is assumed at EUR 50,000.

Based on the capacity of a PTI lane to process 3,080 inspections of M1 and N1 vehicles per year, the additional inspections will require 14,746 new PTI lanes across the EU27 in 2026 and 2,359 additional ones by 2050 (17,105 new PTI lanes in total over 2026-2050). Of this, the new PTI lanes for M1 vehicles represent 13,353 in 2026 and 2,057 additional ones by 2050 (15,410 new PTI lanes over 2026-2050). Each new lane for M1 vehicles in 2026 will also require one set of PN and NOx testing equipment[358]. Additional PN testing and NOx testing equipment is assumed only for M1 vehicles categories as the costs for such equipment related to N1 vehicles is already reflected in PM5. Thus, the one-off costs for equipment are estimated at EUR 1 billion in 2026, EUR 4.9 million in 2030 and EUR 1.7 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 1.1 billion.

Recurrent maintenance costs for the PTI lanes are assumed at 10% of the capital costs (i.e., EUR 5,000 per lane). In addition, annual maintenance costs to calibrate, repair and update the additional PN and NOx equipment for M1 vehicles inspections is estimated at 5% of the initial cost (around EUR 250 for PN-PTI equipment and 750 EUR for NOx equipment). Total recurrent adjustment costs for equipment are thus estimated at EUR 87.1 million in 2026, EUR 89 million in 2030, going up to EUR 98.9 million in 2050 due to the additional PTI lanes added over time in line with the projected growth in the number of inspections. Expressed as present value over 2026-2050, they are estimated at EUR 1.7 billion relative to the baseline.

Training of additional inspectors will also be required due to PM6. On average an inspector performs 2,920 PTI inspectors per year. Thus, PM6 is expected to require an additional 14,746 inspectors to be trained in 2026. Assuming a two-days training to cover the knowledge related to emission testing, but also testing of electric vehicles and GSR software update, and an hourly cost of EUR 34 for

[358] Additional equipment for PN testing and NOx testing is only assumed in 2026 and should accommodate the additional number of inspections. This is because of the increase in the share of zero-emission vehicles over time and thus the decrease in the number of PN and NOx testing relative to 2026.

technicians and associate professionals – ISCO 3), the one-off adjustment costs for training are estimated at EUR 7.3 million in 2026.

The average duration of a PTI inspection is 30 minutes. The labour costs per PTI inspection are estimated at EUR 17, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of inspections, the recurrent adjustment costs are estimated at EUR 771.7 million in 2026, EUR 792.1 million in 2030 and EUR 895.2 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 14.9 billion relative to the baseline.

Table 122: Adjustment costs for PTI centres due to PM6 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections, of which:	45,416,666	46,614,893	50,581,135	52,682,848
for M1 category	41,125,717	42,134,669	45,715,359	47,462,922
for N1 category	4,290,949	4,480,224	4,865,776	5,219,925
Total adjustment costs	1,870.5	886.0	962.4	995.7
One-off costs for equipment	1,004.4	4.9	7.5	1.7
Recurrent costs for equipment	87.1	89.0	95.5	98.9
Recurrent labour costs for inspections	771.7	792.1	859.5	895.2
One-off costs for training	7.3	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 123: Adjustment costs for PTI centres due to PM6 in PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total one-off adjustment costs		17,680.8	17,680.8	17,680.8
One-off costs for equipment		1,090.6	1,090.6	1,090.6
Recurrent costs for equipment		1,664.7	1,664.7	1,664.7
Recurrent labour costs for inspections		14,918.2	14,918.2	14,918.2
One-off costs for training		7.3	7.3	7.3

Source: Ricardo et al. (2024), Impact assessment support study

3.15.2. Administrative cost for citizens (vehicle owners)

The introduction of annual testing for M1 and N1 vehicles that are aged 10 years or older will result in recurrent administrative costs for vehicle owners due to testing charges. Considering the median charge per M1 vehicle of EUR 41.7, and the fact that around 40% of M1 vehicles are owned by citizens, the recurrent administrative costs for citizens are estimated at EUR 686.5 million in 2026, EUR 703.4 million in 2030 and EUR 792.3 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 13.2 billion relative to the baseline.

Table 124: Administrative costs for citizens (vehicle owners) due to PM6 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs for citizens	686.5	703.4	763.2	792.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 125: Administrative costs for citizens (vehicle owners) due to PM6 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs for citizens		13,241.7	13,241.7	13,241.7

Source: Ricardo et al. (2024), Impact assessment support study

3.15.3. Administrative cost for businesses (vehicle owners)

The introduction of annual testing for N1 and M1 vehicles that are aged 10 years or older will result in recurrent administrative costs for vehicle owners due to testing charges. Considering the median charge per M1 vehicle of EUR 41.7 and per N1 vehicle of EUR 40.5, and the fact that around 60% of M1 vehicles and 100% of N1 vehicles are owned by businesses, the recurrent administrative costs for businesses are estimated at EUR 1,203.7 million in 2026, EUR 1,236.6 million in 2030 and EUR 1,400 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 23.3 billion relative to the baseline.

Table 126: Administrative costs for businesses (vehicle owners) due to PM6 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs for businesses	1,203.7	1,236.6	1,341.9	1,400.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 127: Administrative costs for businesses (vehicle owners) due to PM6 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs for businesses		23,295.9	23,295.9	23,295.9

Source: Ricardo et al. (2024), Impact assessment support study

3.15.4. Benefits for PTI centres

PM6 would result in benefits for the PTI centres in the 11 MS affected due to the mandatory yearly testing for M1 and N1 vehicles that are aged 10 years or older. The costs for vehicle owners (citizens and businesses) discussed above represent revenues for the PTI centres. The total revenues for PTI centres due to PM6 are estimated at EUR 1.89 billion in 2026, EUR 1.94 billion in 2030 and EUR 2.19 billion in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 36.5 billion relative to the baseline.

Table 128: Benefits for PTI centres due to PM6 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	1,890.2	1,940.0	2,105.1	2,192.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 129: Benefits for PTI centres due to PM6 in PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres		36,537.6	36,537.6	36,537.6

Source: Ricardo et al. (2024), Impact assessment support study

3.16. PM7 - PTI certificates issued in any EU MS is recognised by the MS of registration, plus further harmonisation of test methods

PM7 requires that the Member State of registration recognises a PTI certificate issued by another Member State. This requires that the stringency of roadworthiness testing be more even across the EU than today. In addition to other relevant measures (such as PMC1, PMC2, PMC3 and others that improve the quality of PTI), this measure includes further harmonisation of test methods notably in the field of brake and suspension testing.

3.16.1. Adjustment costs for national public authorities

Several Member States have reported that their existing systems are capable of transferring data from other national systems or have mechanisms in place that make such transfers negligible in terms of costs. Therefore, no costs are expected for national public authorities due to PM7. Consequently, this measure focuses on Member States identified as having lower-stringency roadworthiness systems[359], which will need additional investments in the PTI centres.

3.16.2. Adjustment costs for PTI centres

PTI centres in the Member States with lower-stringency roadworthiness systems identified above will need to acquire new equipment to enhance their capacity, including an advanced brake testing device and a suspension tester[360].

Based on input from stakeholders, the advanced testing of HDV braking and of suspension (damping efficiency of shock absorbers) will lead to additional equipment costs. For HDV brake testing using extrapolation methods, VSG Italy indicated a cost range of EUR 2,000 to 3,000 for the necessary air pressure sensor and a few hundred EUR per year for maintenance. For the assessment, an average one-off cost of EUR 2,500 is assumed per PTI centre and EUR 250 annual maintenance costs. The purchase cost of a suspension tester for light vehicles is around EUR 10,000 and the maintenance costs are assumed at EUR 1,000 per year per tester. Considering the 11 Member States with lower-stringency roadworthiness systems, 29,922 of the 48,880 PTI centres would have to invest into advanced brake testing equipment and 28,322[361] into suspension testers. In addition, for advanced lighting testing, there is currently no method defined for advanced headlamp testing and stakeholders were not able to provide an indication of costs. The same one-off and maintenance costs as for braking have therefore been used, although it is assumed that all PTI centres will require new equipment and the costs will not occur before 2030 (as no test procedure has been defined yet). Total one-off adjustment costs are estimated at EUR 358 million in 2026 and EUR 122.2 million in 2030. Expressed as present value over 2026-2050, they are estimated at EUR 476.7 million relative to the baseline.

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[359] Based on a recent survey of national authorities conducted by the Commission services, these are: Bulgaria, Cyprus, Greece, Hungary, Italy, Lithuania, Malta, Poland, Romania, Slovenia and the Netherlands.
[360] Suspension testing is an optional element of PTI today.
[361] Hungary already applies special equipment for testing the damping of shock absorbers.

Recurrent adjustment costs for maintenance are estimated at EUR 35.8 million per year for 2026-2029 and at EUR 48 million per year from 2030 onwards, or EUR 814.5 million expressed as present value over 2026-2050 relative to the baseline.

In conjunction with the introduction of new equipment, it is essential to provide training to inspectors to enhance their proficiency in utilising these new methods. The number of inspectors that would need such training in the 11 Member States with lower-stringency roadworthiness systems is estimated at 65,976. Assuming an average of 4 hours of training at an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3), the one-off adjustment costs for training are estimated at EUR 9 million in 2026.

The adjustment costs for PTI centres due to PM7 are summarised in the tables below.

Table 130: Adjustment costs for PTI centres due to PM7 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	402.8	170.2	48.0	48.0
One-off costs for equipment	358.0	122.2	0.0	0.0
Recurrent costs for equipment	35.8	48.0	48.0	48.0
One-off costs for training	9.0	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 131: Adjustment costs for PTI centres due to PM7 in PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs				1,300.2
One-off costs for equipment				476.7
Recurrent costs for equipment				814.5
One-off costs for training				9.0

Source: Ricardo et al. (2024), Impact assessment support study

3.16.3. Adjustment costs savings for citizens (vehicle owners)

Due to PM7, citizens (i.e., vehicle owners) are expected to avoid driving unnecessary solely for the purpose of a mandatory PTI. This particularly affects foreigners and tourists who have vehicles stationed in a country different from their Member State of registration.

There is no data available for the number of vehicles registered in one Member State that are located in a different Member State and would benefit from such option. According to a 2011 IA study[362], 1,000 vehicles registered in the Netherlands and 1,000 vehicles registered in Sweden stationed in Spain, representing (on average) 0.015% of the total fleet of these countries. Assuming the same share at the EU level and using the PRIMES-TREMOVE baseline projections for the vehicle fleet, up to 967,379 vehicles may be stationed in a different MS than their registration country in 2026, 996,705 in 2030 and 1,112,669 in 2050. This represents an upper estimate since for a large number of Member State pairs the number of vehicles should be much lower than the pair considered, given that not all MS attract the same numbers of nationals of other countries for relatively long periods of time.

[362] Europe Economics (2011), Report of contribution to impact assessment of policy options to improve the EU system of PTI and of roadside vehicle testing

The cost savings from avoiding a trip back to the country of vehicle registration for a PTI are estimated based on the following assumptions. The average distance between European cities is around 1,200 km[363]. The travel cost for light vehicles is estimated at EUR 0.44 per km in 2022 prices[364]. Assuming an average PTI frequency of around 0.43 times per year, the recurrent adjustment cost savings for citizens are estimated at EUR 221.5 million in 2026, EUR 228.2 million in 2030 and EUR 254.8 million in 2050. Expressed as present value over 2026-2050, the cost saving amount to EUR 4.3 billion relative to the baseline.

The total cost savings for citizens (vehicle owners) due to PM7 are summarised in the tables below.

Table 132: Adjustment costs savings for citizens (vehicle owners) due to PM7 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Adjustment costs savings for citizens	221.5	228.2	247.9	254.8

Source: Ricardo et al. (2024), Impact assessment support study

Table 133: Adjustment costs savings for citizens (vehicle owners) due to PM7 in PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs savings for citizens				4,289.3

Source: Ricardo et al. (2024), Impact assessment support study

3.17. PM8 - PTI certificate issued in any EU MS is recognised by the MS of registration for a period of up to 6 months (for passenger cars only), on the condition that the next PTI is conducted in the MS of registration

3.17.1. Adjustment costs for national public authorities

Several Member States have reported that their existing systems are capable of transferring data from other national systems or have mechanisms in place that make such transfers negligible in terms of costs. Therefore, no costs are expected for national public authorities due to PM8.

3.17.2. Adjustment costs for PTI centres

PM8 is not expected to lead to any cost for PTI centres, considering that there are no changes to the PTI requirements. Some increase in the demand for PTI services make take place in specific Member States with higher number of nationals from other Member States. However, this is not expected to be at a level that would require additional investments.

3.17.3. Adjustment costs savings for citizens (vehicle owners)

In PM8, after a PTI certificate is issued in other EU MS than that of the MS of registration, the next PTI needs to be conducted in the MS of registration. Therefore, in PM8 it is assumed that the transport activity avoided is half of that in PM7. All other assumptions used for the estimation of costs savings are the same as in PM7. The recurrent adjustment cost savings for citizens are estimated at EUR

[363] Source: www.engineeringtoolbox.com on the distance among EU cities across the EU and took the median value among all pairs.

[364] Source: https://www.eurodev.com/blog/mileage-reimbursement-in-europe-2022

110.7 million in 2026, EUR 114.1 million in 2030 and EUR 127.4 million in 2050. Expressed as present value over 2026-2050, the cost saving amount to EUR 2.1 billion relative to the baseline.

The total cost savings for citizens (vehicle owners) due to PM8 are summarised in the tables below.

Table 134: Adjustment costs savings for citizens (vehicle owners) due to PM8 in 2026, 2030, 2040 and 2050 in policy options PO1b and PO2 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Adjustment costs savings for citizens	110.7	114.1	123.9	127.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 135: Adjustment costs savings for citizens (vehicle owners) due to PM8 in PO1b and PO2, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs savings for citizens		2,144.6	2,144.6	

Source: Ricardo et al. (2024), Impact assessment support study

3.18. PM9 - PTI in another MS recognised by MS of registration based on bilateral agreements

This measure would require that the PTI certificate issued in any other EU MS is recognised by the MS of registration on the basis of bilateral agreements.

3.18.1. Adjustment costs for national public authorities

National authorities will incur costs associated with establishing bilateral agreements, modifying national law as required and implementing procedures to facilitate inspections in another Member State. PM9 is expected to lead to one-off adjustment costs, mainly for designing the bilateral agreements. It is not expected that agreements will be signed among all pairs of Member states. Assuming that each Member State establishes three bilateral agreements, a total number of 41 agreements would be established[365]. Total one-off adjustment costs are estimated at EUR 1.4 million in 2026 (EUR 35,265 per agreement or EUR 53,550 per Member State), expressed in 2022 prices. The estimation is based on the bilateral agreements already in place between the Netherlands and Spain, as well as between the Netherlands and Belgium.

The total adjustment costs for national public authorities due to PM9 are summarised in the tables below.

Table 136: Adjustment costs for national public authorities due to PM9 in 2026, 2030, 2040 and 2050 in policy option PO1a relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
One-off adjustment costs for setting up bilateral agreements	1.4	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

[365] The total number of agreements is derived by multiplying the number of agreements by MS with the total number of MS and dividing by 2.

Table 137: Adjustment costs for national public authorities due to PM9 in PO1a expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
One-off adjustment costs for setting up bilateral agreements	1.4			

Source: Ricardo et al. (2024), Impact assessment support study

3.18.2. Adjustment cost savings for citizens (vehicle owners)

The cost savings for citizens (vehicle owners) due to the bilateral agreements, as a result of avoided travel costs for performing the PTI tests, are estimated at EUR 1.19 million per bilateral agreement (expressed in 2022 prices)[366]. Considering the 41 bilateral agreements assumed to be signed, the total recurrent adjustment costs savings are estimated at EUR 49 million per year from 2026 onwards. Expressed as present value over 2026-2050, they are estimated at EUR 878.2 million relative to the baseline.

The total cost savings for citizens (vehicle owners) expected as a result of PM9 are summarised in the tables below.

Table 138: Adjustment costs savings for citizens (vehicle owners) due to PM9 in 2026, 2030, 2040 and 2050 in policy option PO1a relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent adjustment costs savings for citizens	49.0	49.0	49.0	49.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 139: Adjustment costs savings for citizens (vehicle owners) due to PM9 in PO1a, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent adjustment costs savings for citizens	878.2			

Source: Ricardo et al. (2024), Impact assessment support study

3.19. PM10 - More advanced testing of noise for motorcycles

PM10 requires that all Member States perform noise testing for motorcycles at PTI, inspired by the procedure for pass-by noise test described in the UN Regulation no. 41. Few MSs (DE, ES, HR and SK) are already measuring L-vehicles noise emissions at PTI.

3.19.1. Adjustment costs for PTI centres

For the calculation of the adjustment costs incurred by the PTI centres it is assumed that only the proportion of PTI centres with a test track will be concerned by the measure.

The number of PTI centres with a test track is estimated by applying the projected share of L3-L4 vehicles in the total vehicle stock in 2026 (i.e., 6.2%)[367] to the total number of PTI centres in the

[366] Europe Economics (2011), Report of contribution to impact assessment of policy options to improve the EU system of PTI and of roadside vehicle testing

[367] The projected vehicles stock is based on the baseline projections from the PRIMES-TREMOVE model.

affected MS. Thus, 2,827 inspection centres are estimated to have a test track, out of the total of 45,585 PTI centres in the affected MS (excluding DE, ES, HR and SK).

The cost for purchasing a noise measurement device is estimated at EUR 800 per device (i.e., the average of the estimates provided by stakeholders, that is between EUR 600 and EUR 1,000), and 2 devices are assumed to be needed for each PTI centre with a test track. Thus, the total one-off adjustment costs for the purchase of new equipment are estimated at EUR 4.5 million in 2026. Recurrent adjustment costs for the maintenance and calibration of devices are assumed at 5% of the capital cost, or EUR 226,160 per year from 2026 onwards. Expressed as present value over 2026-2050, the recurrent adjustment costs for equipment are estimated at EUR 4.1 million relative to the baseline.

The additional noise testing will imply longer PTI sessions and for this reason would result in additional labour costs for the PTI centres. It is assumed that the noise measurement takes around 15 minutes, and the hourly cost is EUR 34 for technicians and associate professionals (ISCO 3). The number of noise tests is estimated at 6.9 million in 2026, 7.2 million in 2030 and 8.6 million in 2050. The recurrent adjustment costs are estimated at EUR 58.6 million in 2026, EUR 61.6 million in 2030 and EUR 73.4 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 1.2 billion.

The number of additional inspectors that need to be trained for performing the noise testing is estimated at 1,575 in 2026. They are estimated based on the projected number of additional noise tests and the average number of PTIs per inspector (i.e., 4,380). Assuming half a day of training, at an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3)[368], the total one-off adjustment costs for training are estimated at EUR 194,834 in 2026.

The total adjustment costs for PTI centres expected due to PM10 are summarised in the tables below.

Table 140: Adjustment costs for PTI centres due to PM10 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	63.6	61.8	66.4	73.7
One-off costs for equipment	4.5	0.0	0.0	0.0
Recurrent costs for equipment	0.2	0.2	0.2	0.2
Recurrent labour costs for inspections	58.6	61.6	66.2	73.4
One-off costs for training	0.2	0.0	0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 141: Adjustment costs for PTI centres due to PM10 in PO1b, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs		1,170.6	1,170.6	1,170.6
One-off costs for equipment		4.5	4.5	4.5
Ongoing costs for equipment		4.1	4.1	4.1
Ongoing costs for additional staff		1,161.8	1,161.8	1,161.8
One-off costs for training		0.2	0.2	0.2

Source: Ricardo et al. (2024), Impact assessment support study

[368] Data Sources: Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs

3.19.2. Costs for vehicle owners

Depending on the Member State, the additional costs for the PTI centres may be passed through to vehicle owners (i.e., citizens). As indicated under PMC1, this will depend on the way PTI charges are set in the Member State.

The limitation to PTI centres equipped with a test track will mean that some vehicle' owners will have to travel further than to the closest PTI centre, which means higher costs in terms of time spent for PTI and fuel consumed to get to the testing location. However, these costs are not expected to be significant.

Owners of faulty L3-L4 vehicles will face a charge for repairing the non-compliant vehicles. However, this is not considered to be regulatory costs but is relevant in terms of the impact on maintenance costs.

3.20. PM11 - Data governance: further define the procedures and the means of access to vehicle technical information by testing centres free of charge

PM11 is expected to result in one-off administrative costs for national public authorities and OEMs for adapting the IT systems and their interconnection. This could for instance concern the testing centres that are not digitally connected yet. Additional recurrent administrative costs are expected to maintain the IT systems.

According to EUCARIS, using the same procedure as for the exchange of eCoC data[369] could reduce additional costs but costs are still expected during the transition. ACEA expects costs similar to the introduction of Commission Implementing Regulation (EU) 2019/621 for PM11. EReg mentioned costs for PTI centres that are not digitally connected, with varying impacts by Member State, and negligible costs for those already digitally connected.

3.20.1. Administrative costs for national public authorities

Based on the NL and SI case studies and stakeholders' interviews, the one-off cost for the adaptation of the IT system is estimated at EUR 300,000 to EUR 1,000,000 per country, depending on the volume of PTI inspections per country. Assuming one-off costs of EUR 300,000 per IT system for each of the 15 Member States with smaller volumes of inspections[370], EUR 500,000 per IT system for each of the 7 Member States with medium volumes of inspections[371] and EUR 1,000,000 per IT system for each of the 5 Member States with higher volumes of inspections[372], the total one-off administrative costs at EU27 level are estimated at EUR 13 million in 2026. Recurrent administrative costs for maintenance are estimated at around 10% of the capital costs, or EUR 1.3 million per year from 2026 onwards. Expressed as present value over 2026-2050, the recurrent administrative costs are estimated at EUR 23.3 million relative to the baseline.

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[369] EUR-Lex - 32021R0133 - EN - EUR-Lex (europa.eu)

[370] Below 2% of the total number of inspections at EU level in 2026 by Member State. These are: BG, CY, EE, FI, HR, HU, IE, LT, LV, LU, MT, SI, SK, DK and CZ.

[371] Between 2% and 10% of the total number of inspections at EU level in 2026 by Member State. These are: AT, BE, EL, NL, PT, RO and SE.

[372] Above 10% of the total number of inspections at EU level in 2026 by Member State. These are: DE, FR, IT, PL and ES.

Table 142: Administrative costs for national public administrations due to PM11 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	14.3	1.3	1.3	1.3
One-off costs for IT systems	13.0	0.0	0.0	0.0
Recurrent costs for maintenance of the IT systems	1.3	1.3	1.3	1.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 143: Administrative costs for national public administrations due to PM11 in PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs			36.3	36.3
One-off costs for IT systems			13.0	13.0
Recurrent costs for maintenance of the IT systems			23.3	23.3

Source: Ricardo et al. (2024), Impact assessment support study

3.20.2. Administrative costs for OEM

OEMs will also need to make adjustments to their own IT systems to ensure access to the relevant data. According to one manufacturer, the one-off costs are expected to be around EUR 1 million per OEM. The total one-off administrative costs are estimated at EUR 20 million in 2026 for the 20 OEMs in the EU.

Recurrent administrative costs are estimated at 10% of the capital costs or EUR 100,000 per OEM. For the 20 OEMs, they amount to EUR 2 million per year from 2026 onwards. Expressed as present value over 2026-2050, they are estimated at EUR 35.9 million relative to the baseline.

Table 144: Administrative costs for OEMs due to PM11 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	22.0	2.0	2.0	2.0
One-off costs for IT systems	20.0	0.0	0.0	0.0
Recurrent costs for maintenance of the IT systems	2.0	2.0	2.0	2.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 145: Administrative costs for OEMs due to PM11 in PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs			55.9	55.9
One-off costs for IT systems			20.0	20.0
Recurrent costs for maintenance of the IT systems			35.9	35.9

Source: Ricardo et al. (2024), Impact assessment support study

3.20.3. Administrative costs for PTI centres

For PTI centres, the one-off administrative costs for the adaptation of the IT systems are estimated at EUR 1,000 per centre. Total one-off administrative costs would amount to EUR 48.9 million in 2026, for the 48,880 PTI centres across the EU.

Recurrent administrative costs for the maintenance of the IT systems are estimated at 10% of the capital costs, or EUR 100 per PTI centre. Total recurrent administrative costs are estimated at EUR

4.9 million per year from 2026 onwards, or EUR 87.7 million expressed as present value over 2026-2050 relative to the baseline.

Table 146: Administrative costs for PTI centres due to PM11 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	53.8	4.9	4.9	4.9
One-off costs for IT systems	48.9	0.0	0.0	0.0
Recurrent costs for maintenance of the IT systems	4.9	4.9	4.9	4.9

Source: Ricardo et al. (2024), Impact assessment support study

Table 147: Administrative costs for PTI centres due to PM11 in PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs			136.5	136.5
One-off costs for IT systems			48.9	48.9
Recurrent costs for maintenance of the IT systems			87.7	87.7

Source: Ricardo et al. (2024), Impact assessment support study

3.20.4. Administrative cost savings for PTI centres

The access to relevant technical information is also expected to bring some limited time savings for PTI centres. Time savings of 3 minutes are assumed per PTI. This represents 10% of the average of 30 minutes per PTI for a passenger car. No potential for higher time saving per inspection is estimated due to PM11 because most of the time during a PTI is allocated to the visual inspection or the emissions and other testing. Furthermore, not all PTI centres are expected to benefit of this measure, as access to relevant information is often already available. It is expected that only 30% of PTIs would benefit of PM11. Assuming an average cost per hour for technicians and associate professionals (ISCO level 3) of EUR 34, the recurrent administrative costs savings for PTI centres are estimated at EUR 84.1 million in 2026, EUR 87.1 million in 2030 and EUR 99.3 million in 2050. Expressed as present value over 2026-2050, they amount to EUR 1.6 billion relative to the baseline.

Table 148: Administrative costs savings for PTI centres due to PM11 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs savings	84.1	87.1	94.8	99.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 149: Administrative costs savings for PTI centres due to PM11 in PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs savings			1,643.4	1,643.4

Source: Ricardo et al. (2024), Impact assessment support study

3.21. PM12 – NOx, PM, and noise measurement by remote sensing in RSI of all vehicles (with option for simplified PTI if vehicle passed recent RSI)

PM12 (included in PO1b, PO2 and PO3) requires NOx, PM, and noise measurement by remote sensing in technical roadside inspections of all vehicle types, and optional plume chasing in technical roadside inspections of commercial vehicles. It also includes the option for simplified PTI (i.e., no emission/noise testing) if the vehicle passed a recent RSI (including by remote sensing).

The introduction of this measure will require the purchase, maintenance and periodic calibration of remote sensing equipment (for NOx and PM) and acoustic camera equipment by national public authorities. It will also imply additional costs for vehicles and testing equipment for the plume chasing option, as well as costs for training of inspectors to use the new equipment. In addition, it will also imply some extra costs for additional emissions tests for the owners of vehicles (businesses or citizens) identified as high emitters by the remote sensing or plume chasing measurements and some extra adjustment costs for the PTI centres that will need to deliver these additional tests.

On the other hand, PM12 is expected to lead to costs savings for citizens and businesses (vehicle owners) that successfully pass the remote sensing or plume chasing measurement by avoiding some costs associated with PTI.

3.21.1. Adjustment costs for national public authorities

Remote sensing

Roadside inspection authorities are expected to incur costs for the purchase of remote sensing equipment for measuring NOx and PM emissions of all vehicle types. 250 remote sensing devices would be needed in EU27 to be able to analyse via remote sensing at least 30% of the road fleet[373].

The capital cost of a remote sensing equipment, based on stakeholders' consultation, is assumed at EUR 85,000. In addition, maintenance and calibration costs are assumed at 5% of the capital costs, and the cost for the processing and data management at EUR 24,000 per year per device.

The total one-off adjustment costs for remote sensing equipment are thus estimated at EUR 21.3 million in 2026. Recurrent adjustment costs for maintenance and calibration, and for the processing and data management are estimated at EUR 7.1 million from 2026 onwards. Expressed as present value over 2026-2050, recurrent adjustment costs amount to EUR 126.7 million relative to the baseline.

In addition, one day of training for the use of NOx and PM remote sensing equipment is assumed for the 393 RSI inspectors. With an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour[374], and assuming 7.3 working hours per day, the one-off adjustment costs for training are estimated at EUR 97,231 in 2026.

Plume chasing (optional)

PM12 gives the possibility of implementing plume chasing to measure NOx and PM emissions of HDVs (from Euro VI). The cost of plume chasing equipment is assumed at EUR 32,500 per equipment, based on input from stakeholders. Assuming on average two equipped vehicles per Member State for 26 Member States (Denmark has already implemented the system), the one-off adjustment costs are estimated at EUR 1.7 million in 2026.

The maintenance and calibration costs are assumed at EUR 1,625 per equipment per year (5% of the capital cost), based on inputs from stakeholders, resulting in total maintenance costs of EUR 84,500 per year from 2026 onwards for the 26 Member States relevant for PM13 (excluding Denmark). In addition, labour costs are estimated assuming one inspector per plume chasing vehicle and four days

[373] Hooftman N., Ligterink N., Bhoraskar, A., (2020) Analysis of the 2019 Flemish remote sensing campaign. Commissioned by the Flemish Government - Flanders Environment Agency - Team Air quality policy

[374] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

per week of plume chasing[375]. Considering on average 44 working weeks per year and an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour, the total labour costs are estimated at EUR 2.26 million per year from 2026 onwards. Thus, total recurrent adjustment costs for maintenance of equipment and labour costs amount to EUR 2.3 million per year from 2026 onwards, or EUR 42.1 million expressed as present value over 2026-2050.

In addition, two days of training are assumed for the 52 inspectors. With an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour[376], and assuming 7.3 working hours per day, the one-off adjustment costs for training are estimated at EUR 25,730.

Acoustic cameras

Acoustic cameras would need to be added to remote sensing equipment to measure noise at the roadside. The one-off cost per acoustic camera is assumed at EUR 2,000[377], and the maintenance cost at 5% of the capital cost. Thus, total one-off adjustment costs for equipment are estimated at EUR 500,000 in 2026 and the recurrent adjustment costs at EUR 25,000 per year from 2026 onwards. Expressed as present value over 2026-2050, the recurrent adjustment costs for acoustic cameras are estimated at EUR 448,389.

In addition, a half-day training would be needed for 393 RSI inspectors, for using the acoustic cameras. The one-off adjustment costs for training are estimated at EUR 48,616.

The total adjustment costs for national public authorities expected due to PM12 are summarised in the tables below.

Table 150: Adjustment costs for national public authorities due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	33.0	9.4	9.4	9.4
One-off costs for remote sensing equipment	21.3	0.0	0.0	0.0
Recurrent costs for maintenance and data management for remote sensing equipment	7.1	7.1	7.1	7.1
One-off costs for plume chasing equipment	1.7	0.0	0.0	0.0
Recurrent costs for maintenance and staff for plume chasing equipment	2.3	2.3	2.3	2.3
One-off costs for acoustic cameras	0.5	0.0	0.0	0.0
Recurrent maintenance costs for acoustic cameras	0.03	0.03	0.03	0.03
One-off costs for training (for remote sensing, plume chasing and acoustic cameras)	0.2	0.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 151: Adjustment costs for national public authorities due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs		192.9	192.9	192.9
One-off costs for remote sensing equipment		21.3	21.3	21.3
Recurrent costs for maintenance and data management for remote sensing equipment		126.7	126.7	126.7

375 Four days per week of plume chasing, with an average of 44 working weeks per year, and 52 vehicles at a rate of 25 unique licence plates measured per day, would cover around 3% of the HDVs fleet in the 26 MS relevant for PM12.
376 Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.
377 Average of the stakeholders' input, ranging between EUR 1,000 and EUR 3,000 per device.

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
One-off costs for plume chasing equipment		1.7	1.7	1.7
Recurrent costs for maintenance and staff for plume chasing equipment		42.1	42.1	42.1
One-off costs for acoustic cameras		0.5	0.5	0.5
Recurrent maintenance costs for acoustic cameras		0.4	0.4	0.4
One-off costs for training		0.2	0.2	0.2

Source: Ricardo et al. (2024), Impact assessment support study

3.21.2. Administrative costs for citizens (vehicle owners)

The remote sensing is expected to lead to an identification of a share of high emitters among M1 internal combustion engine (ICE) vehicles. The results will need to be verified via roadside inspections (limited to 0.5% of the fleet) or sent for extra emissions tests in PTI centres. Owners of these M1 vehicles - around 40% of which are citizens - will incur costs for these additional emissions tests. These have been estimated to be around 0.86% of the internal combustion engine vehicles fleet[378]. Considering the fee for an emission test at 20% of the total PTI fee for an M1 vehicle (EUR 41.7), the cost per extra emission test is estimated at EUR 8.3. The recurrent administrative costs for citizens are estimated at EUR 6.5 million in 2026, EUR 5.8 million in 2030 and EUR 0.3 million in 2050. The costs decrease over time as the share of zero-emission vehicles increases over time in the baseline scenario. Expressed as present value over 2026-2050, the administrative costs for the citizens are estimated at EUR 72.2 million relative to the baseline.

Table 152: Administrative costs for citizens due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Extra PTI emission tests following the identification of high emitters by remote sensing	781,040	713,217	340,538	40,325
Recurrent administrative costs (in million EUR)	6.5	5.8	2.8	0.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 153: Administrative costs for citizens due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs		72.2	72.2	72.2

Source: Ricardo et al. (2024), Impact assessment support study

3.21.3. Administrative costs for businesses (vehicle owners)

Similar to citizens, business that own M1, N1 and heavy duty vehicles will incur extra costs for emissions testing if the vehicles are identified as high emitters via the use of remote sensing or plume chasing and are sent for PTI due to the 0.5% limit in the capacity for roadside inspections. It is estimated that, on average, 0.86% of the M1 internal combustion engine vehicles will need an extra emission test, 1.62% of the N1 internal combustion engine vehicles and 1.26% of the heavy duty (N2/N3/M2/M3) internal combustion engine vehicles[379]. Assuming that an emission test will cost 20% of the full PTI fee per vehicle (EUR 41.7 for M1, EUR 40.5 for N1, EUR 61.6 for N2/N3 and EUR 70.8 for M2/M3) and the fact that around 60% of M1 vehicles and 100% of N1, N2/N3 and M2/M3 vehicles are owned by businesses, the recurrent administrative costs for businesses are

[378] More explanations are provided in section 4.2.12 of Annex 4.
[379] More explanations are provided in section 4.2.12 of Annex 4.

estimated at EUR 14.8 million in 2026, EUR 14.0 million in 2030 and EUR 1.2 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 175 million relative to the baseline.

Table 154: Administrative costs for businesses due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Extra PTI emission tests following the identification of high emitters by remote sensing or plume chasing, of which:	1,748,404	1,644,389	858,688	134,284
for HDVs	88,279	89,827	71,883	33,635
for LDVs	1,660,125	1,554,562	786,805	100,649
Recurrent administrative costs (in million EUR)	14.8	14.0	7.4	1.2

Source: Ricardo et al. (2024), Impact assessment support study

Table 155: Administrative costs for businesses due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs	0.0	175.0	175.0	175.0

Source: Ricardo et al. (2024), Impact assessment support study

3.21.4. Administrative costs savings for citizens (vehicle owners)

In PM12, passing a remote sensing test allows a simplified PTI for vehicle owners within the following 6 months. This is expected to result in administrative costs savings related to inspections, as they do not have to undertake the emissions and/or noise tests.

The emissions and noise tests represent a relatively small share of the total charge for an inspection, estimated at around 20% of the total PTI fee[380]. Around 30% of the EU fleet would be subject to remote sensing in PM12 and it is assumed that a share of non high emitters (90% on average for M1 vehicles) that go through a remote sensing test would benefit of costs savings. Using the estimated numbers of PTI tests per year for M1 vehicles that are not high emitters and pass a remote sensing, half of them is assumed to benefit from the measure (i.e., those that are expected to go through a PTI within six months). In addition, it is assumed that around 40% of the M1 vehicles are owned by citizens. Thus, the number of PTI emission/noise tests avoided by citizens due to PM12 is estimated at 6.4 million in 2026, 5.8 million in 2030 and 329,684 in 2050. The reason for the decreasing number of PTI tests avoided over time is the increasing share of zero-emission vehicles in the baseline scenario. Based on the charge per PTI test[381] and the share of costs saved (i.e., 20% as explained above), the recurrent administrative costs savings for citizens are estimated at EUR 53.4 million in 2026, EUR 48.8 million in 2030 and EUR 2.8 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 591.9 million relative to the baseline.

Table 156: Administrative costs savings for citizens due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of PTI emission and noise tests avoided	6,396,137	5,848,537	2,788,026	329,684

[380] Based on the analysis of the PTI charges available.
[381] The median PTI charge at EU level for M1 vehicles is EUR 41.7 per PTI.

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative costs savings (in million EUR)	53.4	48.8	23.3	2.8

Source: Ricardo et al. (2024), Impact assessment support study

Table 157: Administrative costs savings for citizens due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs savings		591.9	591.9	591.9

Source: Ricardo et al. (2024), Impact assessment support study

3.21.5. Administrative costs savings for businesses (vehicle owners)

Similar to citizens, in PM12 passing a remote sensing test allows a simplified PTI for businesses (i.e., vehicle owners) within the following 6 months. This is expected to result in administrative costs savings related to inspections, as they do not have to undertake the emissions and noise tests.

The emissions and noise tests represent a relatively small share of the total fee for an inspection, estimated at around 20% of the total PTI charge[382]. Around 30% of the EU fleet would be subject to remote sensing in PM12 and it is assumed that a share of non high emitters (90% on average for M1 and N1 vehicles and 85% on average for N2-N3 and M2-M3 vehicles) that go through a remote sensing test would benefit of costs savings. Using the estimated numbers of PTI tests per year for LDVs and HDVs that are not high emitters and pass a remote sensing, half of them is assumed to benefit from the measure (i.e., those that are expected to go through a PTI within six months). In addition, it is assumed that around 60% of the M1 vehicles are owned by businesses, and 100% of the N1, N2-N3 and M2-M3 vehicles. Thus, the number of PTI emission/noise tests avoided by businesses due to PM12 is estimated at 12.7 million in 2026, 11.9 million in 2030 and EUR 1 million in 2050. The reason for the decreasing number of PTI tests avoided over time is the increasing share of zero-emission vehicles in the baseline scenario. Based on the charge per PTI test[383] and the share of costs saved (i.e., 20% as explained above), the recurrent administrative costs savings for businesses are estimated at EUR 109.4 million in 2026, EUR 102.6 million in 2030 and EUR 10.1 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 1.3 billion relative to the baseline.

Table 158: Administrative costs savings for businesses due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of PTI emission and noise tests avoided, of which:	12,689,889	11,863,044	6,166,765	1,032,002
for HDVs	956,206	969,249	768,250	359,122
for LDVs	11,733,683	10,893,795	5,398,515	672,880
Recurrent administrative costs savings (in million EUR)	109.4	102.6	54.4	10.1

Source: Ricardo et al. (2024), Impact assessment support study

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382 Based on the analysis of the PTI charges available.

383 The median PTI charge at EU level for M1 vehicles is EUR 41.7 per PTI, for N1 vehicles EUR 40.5 per PTI, for N2/N3 EUR 61.6 and for M2/M3 EUR 70.8 per PTI.

Table 159: Administrative costs savings for businesses due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs savings		1,287.3	1,287.3	1,287.3

Source: Ricardo et al. (2024), Impact assessment support study

3.21.6. Adjustment costs for PTI centres

The additional emission tests for internal combustion vehicles (M1, N1, N2/N3 and M2/M3) due to PM12 (i.e. vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission test in a PTI centre) are estimated at 2.5 million in 2026, 2.4 million in 2030 and 174,609 in 2050 relative to the baseline[384]. The decrease in the number of emission testing is driven by the increase in the number of zero-emission vehicles over time in the baseline.

PM12 is expected to lead to recurrent adjustment costs for the PTI for the additional emissions tests. Due to the small share of the fleet affected it is assessed that no additional emission testing equipment will be needed and that the available PTI lanes will be able to serve the additional demand. As such, the only additional costs concern the labour costs for inspectors.

Combined, the average duration of new PN and NOx emission tests is estimated at around 6 minutes. The labour costs per emission testing are estimated at EUR 3.4, assuming an hourly cost of EUR 34 for technicians and associate professionals (ISCO 3). To deliver the estimated additional number of emission testing, the recurrent adjustment costs are estimated at EUR 8.6 million in 2026, EUR 8.0 million in 2030 and EUR 0.6 million in 2050[385]. Expressed as present value over 2026-2050, they are estimated at EUR 99 million relative to the baseline.

Table 160: Adjustment costs for PTI centres due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of tests	2,529,443	2,357,606	1,199,226	174,609
Recurrent adjustment costs (in million EUR)	8.6	8.0	4.1	0.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 161: Adjustment costs for PTI centres due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent adjustment costs		99.0	99.0	99.0

Source: Ricardo et al. (2024), Impact assessment support study

3.21.7. Benefits for PTI centres

PM12 would also result in benefits for the PTI centres due to the vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission test in a PTI centre. The costs for vehicle owners (citizens and businesses) discussed above represent revenues for the PTI

[384] The number of inspections is estimated based on the projected number of internal combustion engine vehicles from the baseline scenario, developed with the PRIMES-TREMOVE model, and the estimated share of vehicles identified as high emitters using remote sensing or plume chasing (for HDVs) and not checked via roadside inspections (0.86% for M1, 1.62% for N1 and 1.26% for N2/N3 and M2/M3 vehicles).
[385] The labour costs decrease over time due to the decreasing number of internal combustion engine vehicles.

centres. The total revenues for PTI centres due to PM12 are estimated at EUR 21.4 billion in 2026, EUR 19.7 billion in 2030 and EUR 1.6 billion in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 247.2 billion relative to the baseline.

Table 162: Benefits for PTI centres due to PM12 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Revenues for PTI centres	21.4	19.7	10.2	1.6

Source: Ricardo et al. (2024), Impact assessment support study

Table 163: Benefits for PTI centres due to PM12 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Revenues for PTI centres		247.2	247.2	247.2

Source: Ricardo et al. (2024), Impact assessment support study

3.22. PM13 – Mandatory inspection of cargo securing

PM13 introduces mandatory standards in relation to cargo securing inspections. Currently 5 Member States (EE, FR, IE, LV and LU) do not require either minimum training or specify test requirements relating to cargo securing during RSI in their national transposition of Directive 2014/47/EC. N2 and N3 vehicles in these Member States represent around 13% of the EU-wide fleet. 14 Member States[386], covering 67% of the N2/N3 fleet, do not specify minimum training requirements for cargo securing.

3.22.1. Adjustment costs for national public authorities

PM13 is expected to lead to one-off adjustment costs for national public authorities for training in the 14 MS which currently do not require minimum training of inspectors. Training for cargo securing is assumed to take 3 hours, with 264 roadside inspectors requiring training. Assuming an hourly cost for technicians and associate professionals (ISCO 3) of EUR 34/hour[387], the total one-off adjustment costs for training are estimated at EUR 26,916 in 2026.

In addition, retraining of inspectors is foreseen on a biennial basis. Assuming 3 hours of training for the 264 roadside inspectors, the recurrent adjustment costs for training are estimated at EUR 26,916 per year every second year after 2026. Expressed as present value over 2026-2050, they are estimated at EUR 224,549.

3.22.2. Administrative costs for national public authorities

Recurrent administrative costs are expected for national public authorities, covering the labour costs for the additional cargo securing inspections. It is assumed that Member States that do not have in place minimum testing requirements for cargo securing do not perform cargo securing inspections. Based on stakeholders' interviews, a cargo securing inspection takes on average 20 minutes. Cargo securing inspections are expected to cover 5% of the N2/N3 fleet in the Member States affected by the measure (EE, FR, IE, LV, LU). Assuming an hourly cost for technicians and professionals (ISCO 3) of EUR 34/hour[388], the recurrent administrative costs for national public authorities in the 5 Member States are estimated at EUR 0.48 million in 2026, EUR 0.51 million in 2030 and EUR 0.63

[386] BE, DK, DE, EE, FR, IE, LV, LU, BG, FI, IT, NL, PL and PT.
[387] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.
[388] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 9.8 million relative to the baseline.

Table 164: Adjustment and administrative costs for national public authorities due to PM13 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total adjustment costs	0.03	0.03	0.03	0.03
One-off costs for training	0.03	0.00	0.00	0.00
Recurrent costs for training	0.00	0.03	0.03	0.03
Recurrent administrative costs	0.48	0.51	0.57	0.63

Source: Ricardo et al. (2024), Impact assessment support study

Table 165: Adjustment and administrative costs for national public authorities due to PM13 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs		0.25	0.25	0.25
One-off costs for training		0.03	0.03	0.03
Recurrent costs for training		0.22	0.22	0.22
Recurrent administrative costs		9.84	9.84	9.84

Source: Ricardo et al. (2024), Impact assessment support study

3.22.3. Administrative costs for businesses (vehicle owners)

From the vehicle owner point of view, there will be some extra cost for the additional time for cooperating on the cargo securing inspections. Considering an average hourly labour cost of EUR 21.9 for drivers[389], the average time per inspection (20 minutes) and the number of roadside inspections, the recurrent administrative costs for businesses (vehicle owners) are estimated at EUR 0.42 million in 2026, EUR 0.44 million in 2030 and EUR 0.55 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 8.5 million relative to the baseline.

Table 166: Administrative costs for businesses (vehicle owners) due to PM13 in 2026, 2030, 2040 and 2050 in policy options PO1b, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of additional inspections	42,477	44,813	50,414	55,526
Recurrent administrative costs (in million EUR)	0.42	0.44	0.50	0.55

Source: Ricardo et al. (2024), Impact assessment support study

Table 167: Administrative costs for businesses (vehicle owners) due to PM13 in PO1b, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs		8.5	8.5	8.5

Source: Ricardo et al. (2024), Impact assessment support study

There may also be costs for subsequent adjustments following these inspections, which may result in additional time and potential cost if the vehicle has to be taken to a garage for repair. These costs are difficult to estimate, and they do not represent costs directly arising from the implementation of the

[389] Part of ISCO 8 (Plant and machine operators and assemblers).

measure but are a consequence of the fact that specific vehicles may not be compliant with the proposed minimum requirements.

3.23. PM14 - Extend the scope of application of roadside inspections to light commercial (N1) vehicles

PM14 extends the scope of application of roadside inspections to N1 vehicles, and sets 2% as target for the share of inspections of the N1 vehicle fleet. The extension of roadside inspections to cover N1 vehicles is expected to lead to administrative costs for 22 Member States. On the basis of the information available, few Member States (ES, HU, SE, SK and FI) already conduct roadside inspections for N1 vehicles, although without a certain target set and thus checking a low number of vehicles. For the purposes of the assessment it is assumed that these five Member States will not be affected. To perform the inspections, additional roadside inspection units will be needed in the 22 Member States resulting in adjustment costs for national public authorities.

3.23.1. Administrative costs for national public authorities

Performing inspections for 2% of the N1 vehicle fleet in the Member States affected by PM14 translates into 479,626 additional inspections in 2026, 497,627 in 2030 and 588,721 additional inspections in 2050. With an assumed average duration of 20 minutes per roadside inspection, assuming an average wage of EUR 34 EUR/hour for ISCO 3 (technicians and associate professionals), the cost per inspection is estimated at EUR 11.3. Thus, the total recurrent administrative costs are estimated at EUR 5.4 million in 2026, EUR 5.6 million in 2030 and EUR 6.7 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 107.5 million relative to the baseline.

3.23.2. Adjustment costs for national public authorities

The extra inspections will be delivered by an estimated total of 182 inspectors[390] in around 61 roadside inspection units (assuming three inspectors per roadside inspection unit). These units will need to be equipped with relevant equipment. The one-off cost of the roadside equipment is around EUR 50,000, and the maintenance cost is estimated at 10% of the capital cost. Thus, the total one-off adjustment costs for the 61 roadside inspection units are estimated at EUR 3.1 million in 2026. Recurrent adjustment costs amount at EUR 305,000 per year from 2026 onwards, or EUR 5.5 million expressed as present value over 2026-2050.

Additional training costs may also arise for the additional inspectors. Assuming one-day training per inspector and an average wage of EUR 34 EUR/hour for ISCO 3 (technicians and associate professionals), the one-off adjustment costs for training are estimated at EUR 45,028 in 2026.

Table 168: Adjustment and administrative costs for national public authorities due to PM14 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections	479,626	497,627	547,848	588,721
Recurrent administrative costs	5.4	5.6	6.2	6.7
Total adjustment costs	3.4	0.3	0.3	0.3
One-off costs for equipment	3.1	0.0	0.0	0.0
Recurrent costs for equipment	0.3	0.3	0.3	0.3

[390] Estimated assuming that each inspector performs roadside inspections on average 4 hours/day for a total of 220 days/year.

	Difference to the baseline			
	2026	2030	2040	2050
One-off costs for training	0.05	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 169: Adjustment and administrative costs for national public authorities due to PM14 in PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs			107.5	107.5
Total adjustment costs			8.6	8.6
One-off costs for equipment			3.1	3.1
Recurrent costs for equipment			5.5	5.5
One-off costs for training			0.05	0.05

Source: Ricardo et al. (2024), Impact assessment support study

3.23.3. Administrative costs for businesses (vehicle owners)

Business (vehicle owners) will incur some costs due to the time spent for cooperating on inspections. Considering the average duration of 20 minutes per roadside inspection, and the average hourly labour cost of EUR 21.9 for drivers[391], the recurrent administrative costs for businesses are estimated at EUR 10.5 million in 2026, EUR 10.9 million in 2030 and EUR 12.9 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 208 million relative to the baseline.

There may also be costs for the repairs needed as a result of these inspections. These costs are difficult to estimate and they do not represent costs directly arising from the implementation of the measure but a consequence of the fact that the specific vehicles are non-compliant.

Table 170: Administrative costs for businesses (vehicle owners) due to PM14 in 2026, 2030, 2040 and 2050 in policy options PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of additional inspections	479,626	497,627	547,848	588,721
Recurrent administrative costs (in million EUR)	10.5	10.9	12.0	12.9

Source: Ricardo et al. (2024), Impact assessment support study

Table 171: Administrative costs for businesses (vehicle owners) due to PM14 in PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs			208.0	208.0

Source: Ricardo et al. (2024), Impact assessment support study

3.24. PM15 - Extend the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3)

PM15 extends the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3) and establishes a threshold of 1% of the vehicle fleet for roadside inspections.

[391] Part of ISCO 8 (Plant and machine operators and assemblers).

3.24.1. *Administrative costs for national public authorities*

The measure is expected to lead to additional costs for the enforcement authorities responsible for roadside inspections. This will mainly cover the need to deploy more inspectors to conduct the additional number of inspections, together with the additional mobile units needed to support the increased number of roadside inspections. Few Member States (SE, SI, AT, FI, DK, HU, RO) already perform such inspections although they do not report the exact number of inspections of motorcycles separately and do not indicate a specific target. In the absence of more specific data it is assumed that these Member States will not be affected by PM15.

Establishing a 1% threshold for roadside inspections of L3 vehicles for the 20 Member States would result in 169,098 additional roadside inspections in 2026, 176,228 in 2030 and 227,291 additional inspections in 2050. An average of 10 minutes per inspection is assumed. With an average wage of EUR 34 EUR/hour for ISCO 3 (technicians and associate professionals), the cost per inspection is estimated at EUR 5.7. The total recurrent administrative costs for inspections are estimated at EUR 0.96 million in 2026, EUR 1 million in 2030 and EUR 1.29 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 19.5 million relative to the baseline.

3.24.2. *Adjustment costs for national public authorities*

The additional volume of RSI will require the purchase of additional mobile inspection units to support the extra inspections. On the basis of the additional number of inspections to be conducted it is estimated that a total of 32 inspectors will be needed for the 20 Member States. With an average of 3 inspectors per unit, each Member State will need a minimum of one additional set of roadside equipment for testing of motorcycles. The one-off cost per equipment is estimated at EUR 20,000, and the recurrent maintenance cost at 10% of the initial cost. Thus, the total one-off adjustment costs amount to EUR 400,000 in 2026 and the recurrent adjustment costs at EUR 40,000 per year from 2026 onwards. Expressed as present value over 2026-2050, the recurrent adjustment costs are estimated at EUR 717,422.

Additional training costs may also arise for the additional inspectors. Assuming one-day training per inspector and an average wage of EUR 34 EUR/hour for ISCO 3 (technicians and associate professionals), the one-off adjustment costs for training are estimated at EUR 7,917 in 2026 for the 32 inspectors.

Table 172: Adjustment and administrative costs for national public authorities due to PM15 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Additional number of inspections	169,098	176,228	199,644	227,291
Recurrent administrative costs	0.96	1.00	1.13	1.29
Total adjustment costs	0.45	0.04	0.04	0.04
One-off costs for equipment	0.40	0.00	0.00	0.00
Recurrent costs for equipment	0.04	0.04	0.04	0.04
One-off costs for training	0.01	0.00	0.00	0.00

Source: Ricardo et al. (2024), Impact assessment support study

Table 173: Adjustment and administrative costs for national public authorities due to PM15 in PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs				19.52
Total adjustment costs				1.13
One-off costs for equipment				0.40

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent costs for equipment				0.72
One-off costs for training				0.01

Source: Ricardo et al. (2024), Impact assessment support study

3.24.3. Administrative costs for citizens (vehicle owners)

Citizens (motorcycle owners) will incur some costs due to the time spent for cooperating on inspections. Considering the average duration of 10 minutes per roadside inspection, and the average hourly labour cost of EUR 29.5, the recurrent administrative costs for citizens are estimated at EUR 0.8 million in 2026, EUR 0.9 million in 2030 and EUR 1.1 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 16.9 million relative to the baseline.

There may also be costs for the repairs needed as a result of these inspections. These costs are difficult to estimate and they do not represent costs directly arising from the implementation of the measure but are a consequence of the fact that the specific vehicles are non-compliant.

Table 174: Administrative costs for citizens (vehicle owners) due to PM15 in 2026, 2030, 2040 and 2050 in policy option PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Number of additional inspections	169,098	176,228	199,644	227,291
Recurrent administrative costs (in million EUR)	0.8	0.9	1.0	1.1

Source: Ricardo et al. (2024), Impact assessment support study

Table 175: Administrative costs for citizens (vehicle owners) due to PM15 in PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative costs				16.9

Source: Ricardo et al. (2024), Impact assessment support study

3.25. PM16 - Introduce issuing the registration certificates in digital format to gradually replace current paper (and smart card) documents

PM16 requires to issue the Registration Certificate (Annex I) for all vehicles types in digital format. The measure is expected to lead to administrative costs for national public authorities for setting up and operating the system, but also to administrative costs savings.

3.25.1. Administrative costs for national public authorities

Based on stakeholders' interviews[392], the one-off cost for the adaptation of the IT system is estimated at EUR 300,000 to EUR 1,000,000 per country, depending on the volume of new registrations. Assuming one-off costs of EUR 300,000 per IT system for each of the 16 Member States with smaller volumes of new registrations[393], EUR 500,000 per IT system for each of the 6 Member States with

[392] Different agencies, such as the Centre for Vehicles of Croatia and the Norwegian Public Roads Administration, anticipate various software and resource requirements, while DGT Spain foresees significant time and resource costs for implementation. TÜV Rheinland expects additional IT development and management costs but considers them not significant due to existing data availability.

[393] Below 2% of the total number of new registrations at EU level in 2026 by Member State. These are: BG, CY, DK, EE, FI, HR, HU, IE, LT, LV, LU, MT, PT, SE, SI and SK.

medium volumes of new registrations[394] and EUR 1,000,000 per IT system for each of the 5 Member States with higher volumes of new registrations[395], the total one-off administrative costs at EU27 level are estimated at EUR 12.8 million in 2026. Recurrent administrative costs for maintenance are estimated at around 10% of the capital costs, or EUR 1.3 million per year from 2026 onwards. Expressed as present value over 2026-2050, the recurrent administrative costs are estimated at EUR 23 million relative to the baseline. Since certain Member States (e.g. DE, ES, FI) have started to work on the implementation of digital registration documents, the actual costs incurred by these Member States may be lower than estimated here.

Table 176: Administrative costs for national public administrations due to PM16 in 2026, 2030, 2040 and 2050 in policy options PO1a, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	14.1	1.3	1.3	1.3
One-off costs for IT systems	12.8	0.0	0.0	0.0
Recurrent costs for maintenance of the IT systems	1.3	1.3	1.3	1.3

Source: Ricardo et al. (2024), Impact assessment support study

Table 177: Administrative costs for national public administrations due to PM16 in PO1a, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total administrative costs	35.8		35.8	35.8
One-off costs for IT systems	12.8		12.8	12.8
Recurrent costs for maintenance of the IT systems	23.0		23.0	23.0

Source: Ricardo et al. (2024), Impact assessment support study

3.25.2. Administrative cost savings for national public authorities

PM16 is expected to bring administrative costs savings for national public authorities, by avoiding the costs of printing, distribution and handling of paper/plastic documents.

Considering that the information related to registration certificates is already stored in national databases, the costs savings due to PM16 are limited to the time spent for preparing and printing the documents and the costs of delivering the documents. It is assumed that around 2 minutes of work per document could be saved, at an average cost per hour for technicians and associate professionals (ISCO level 3) of EUR 34, plus EUR 2 per document for paper and mail cost.

Recurrent administrative costs savings are estimated at EUR 75.4 million in 2026, EUR 79.3 million in 2030 and EUR 86.3 million in 2050. Expressed as present value over 2026-2050, they are estimated at EUR 1.4 billion relative to the baseline.

Table 178: Administrative costs savings for national public administrations due to PM16 in 2026, 2030, 2040 and 2050 in policy options PO1a, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Recurrent administrative cost savings	75.4	79.3	85.2	86.3

Source: Ricardo et al. (2024), Impact assessment support study

[394] Between 2% and 10% of the total number of new registrations at EU level in 2026 by Member State. These are: AT, BE, CZ, EL, NL and RO.
[395] Above 10% of the total number of new registrations at EU level in 2026 by Member State. These are: DE, FR, IT, PL and ES.

Table 179: Administrative costs savings for national public administrations due to PM16 in PO1a, PO2 and PO3, expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Recurrent administrative cost savings	1,429.5		1,429.5	1,429.5

Source: Ricardo et al. (2024), Impact assessment support study

3.26. PM17 - Add new data to the vehicle register – minimum mandatory set (including among others: country of 1st registration, registration status, PTI status, changes due to transformation)

PM17 provides for increasing the set of data to be included in the national vehicle registers. The additional data that could be included is detailed in Annex 7 (section 2).

3.26.1. Administrative costs for national public authorities

A consensus has been reached among 18 vehicle authorities (including 15 from EU Member States) regarding a minimum set of items for the vehicle registers[396]. This data set comprises 94 items, including mandatory and optional data elements referred to in the VRD Directive (Directive 1999/37/EC), as well as a number of additional elements.

In several Member States, some of these items might already be part of their registration databases, making the costs associated with aligning their datasets with EReg's recommendations negligible. For instance, according to EReg, inspection data is registered by Registration Authorities in most MS, with the exception of HR, FR, IE and LT[397]. Other MS will have to include new data items in their vehicle registers. The Slovenian authorities, that provided input to the stakeholders' consultation survey, estimated the one-off costs of adding the minimum dataset to its vehicle register at around EUR 50,000. Based on the hourly wage rate for clerks (ISCO 4) in Slovenia, of EUR 14.7/hour, the one-off costs are equivalent to 2.1 full-time equivalents working 220 days per year, 7.3 hours per day.

For the assessment of PM17, it should be acknowledged that not all Member States would need to update their databases or integrate new data, as many of them already store most of these data items. The Member States that store fewer data items than the average were identified, pointing to a cluster of countries with insufficient data registration standards. This low-standard data storage group includes eight countries: BE, FR, EL, HU, IE, LT, PL and PT. For the purpose of the assessment, it is assumed that this specific group will bear one-off administrative costs for harmonising the dataset. The one-off administrative costs are derived drawing on input from Slovenia, assuming 2.1 full-time equivalents working 220 days per year, 7.3 hours per day. Using the hourly wage rate for clerks (ISCO 4)[398] in each of the 8 concerned Member States, the one-off administrative costs are provided in the table below. At EU level, they are estimated at EUR 494,593 in 2026.

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[396] EReg (2021), EReg Topic Group XXI Harmonisation of registration procedures and data quality, Proposal on the registration of vehicle data, available at: https://www.ereg-association.eu/media/2742/final-report-topic-group-xxi-proposal-on-the-registration-of-vehicle-data.pdf

[397] EReg (2021), ibid.

[398] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

Table 180: One-off administrative costs for national public authorities, by Member State, due to PM17 in 2026 in policy options PO1a, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

Low-standard data storage group	Average hourly wage for clerks (ISCO 4), in 2022 prices	One-off administrative costs (EUR)
BE	31.6	106,427
IE	31.0	104,390
EL	16.3	54,870
FR	30.1	101,353
LT	8.7	29,294
HU	9.1	30,551
PL	8.4	28,372
PT	11.7	39,336
Total		**494,593**

Source: Ricardo et al. (2024), Impact assessment support study

In addition, recurrent administrative costs are expected for the continuous data updates and broader maintenance of the dataset for all EU Member States. The effort for data updates and broader maintenance is assumed at 25% of the one-off costs, or around 0.5 full-time equivalents per Member State. Assuming 220 working days per year, 7.3 working hours per day at an hourly wage rate for clerks (ISCO 4)[399], the recurrent administrative costs by national public authority are provided in the table below. At EU level, they are estimated at EUR 440,680 per year from 2026 onwards, or expressed as present value over 2026-2050 at EUR 7.9 million relative to the baseline.

Table 181: Recurrent administrative costs for national public authorities, by Member State, due to PM17 in 2026, 2030, 2040 and 2050 in policy options PO1a, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Average hourly wage for clerks (ISCO 4), in 2022 prices	Recurrent administrative costs (EUR)
BE	31.6	25,340
BG	4.8	3,823
CZ	12.1	9,709
DK	45.1	36,152
DE	33.2	26,624
EE	12.7	10,149
IE	31.0	24,855
EL	16.3	13,064
ES	21.0	16,794
FR	30.1	24,132
HR	10.2	8,189
IT	27.6	22,102
CY	14.5	11,637
LV	9.9	7,940
LT	8.7	6,975
LU	34.0	27,187
HU	9.1	7,274
MT	15.6	12,523
NL	31.1	24,874
AT	32.2	25,749
PL	8.4	6,755
PT	11.7	9,366

[399] Eurostat Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs.

	Average hourly wage for clerks (ISCO 4), in 2022 prices	Recurrent administrative costs (EUR)
RO	7.3	5,849
SI	14.7	11,785
SK	11.2	8,930
FI	30.1	24,142
SE	35.9	28,761
Total		**440,680**

Source: Ricardo et al. (2024), Impact assessment support study

The total administrative costs at EU level for national public authorities, expected as a result of PM17, are summarised in the tables below.

Table 182: Administrative costs for national public authorities due to PM17 in 2026, 2030, 2040 and 2050 in policy options PO1a, PO2 and PO3 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	2026	2030	2040	2050
Total administrative costs	0.9	0.4	0.4	0.4
One-off administrative costs	0.5	0.0	0.0	0.0
Recurrent administrative costs	0.4	0.4	0.4	0.4

Source: Ricardo et al. (2024), Impact assessment support study

Table 183: Administrative costs for national public authorities due to PM17 in PO1a, PO2 and PO3 expressed as present value over 2026-2050 relative to the baseline (in million EUR, 2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Total adjustment costs	8.4		8.4	8.4
One-off administrative costs	0.5		0.5	0.5
Recurrent administrative costs	7.9		7.9	7.9

Source: Ricardo et al. (2024), Impact assessment support study

Increased and more accessible data to authorities and inspection centres would facilitate re-registration and RSI.

3.27. Summary of costs and costs savings by option and by measure

The summary of recurrent and one-off costs and costs savings by stakeholder group, by option and by measure, expressed as present value over 2026-2050, and for 2026, 2030 and 2050 relative to the baseline are provided in the tables below.

3.27.1. PTI centres

Table 184: Recurrent and one-off costs, costs savings and benefits for PTI centres in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	**3,734.1**	**23,507.9**	**23,332.2**	**25,061.7**
PMC1	143.6	143.6	143.6	143.6
PMC2	96.1	96.1	96.1	96.1
PMC3	697.1	697.1	697.1	697.1
PMC4	2,797.3	2,797.3	2,797.3	2,797.3
PM2		175.7		
PM3				203.9
PM4				225.4

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
PM5		647.7	647.7	647.7
PM6		17,680.8	17,680.8	17,680.8
PM7				1,300.2
PM10		1,170.6	1,170.6	1,170.6
PM12		99.0	99.0	99.0
Administrative costs	**0.0**	**0.0**	**136.5**	**136.5**
PM11			136.5	136.5
Administrative costs savings	0.0	0.0	1,643.4	1,643.4
PM11			1,643.4	1,643.4
Benefits	**860.5**	**39,394.2**	**39,100.1**	**39,968.0**
PMC5	860.5	860.5	860.5	860.5
PM2		294.1		
PM3				341.3
PM4				526.6
PM5		1,454.8	1,454.8	1,454.8
PM6		36,537.6	36,537.6	36,537.6
PM12		247.2	247.2	247.2
Net benefits	**-2,873.6**	**15,886.2**	**17,274.7**	**16,413.2**

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 185: One-off costs for PTI centres in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	**2,094.7**	**3,221.3**	**3,217.4**	**3,708.7**
PMC1	143.6	143.6	143.6	143.6
PMC2	96.1	96.1	96.1	96.1
PMC3	372.7	372.7	372.7	372.7
PMC4	1,482.3	1,482.3	1,482.3	1,482.3
PM2		3.9		
PM3				4.5
PM4				1.1
PM5		20.1	20.1	20.1
PM6		1,097.9	1,097.9	1,097.9
PM7				485.6
PM10		4.7	4.7	4.7
Administrative costs	**0.0**	**0.0**	**48.9**	**48.9**
PM11			48.9	48.9
Net costs	**2,094.7**	**3,221.3**	**3,266.3**	**3,757.6**

Source: Ricardo et al. (2024), Impact assessment support study

Table 186: Recurrent and one-off costs, costs savings and benefits for PTI centres in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	2,162	115.8	91.4	4,186	1,130	1,177	4,175	1,121	1,166	4,603	1,313	1,241
PMC1	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0
PMC2	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0
PMC3	390.8	18.1	18.1	390.8	18.1	18.1	390.8	18.1	18.1	390.8	18.1	18.1
PMC4	1,556	73.3	73.3	1,556	73.3	73.3	1,556	73.3	73.3	1,556	73.3	73.3

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM2				11.9	8.9	11.1						
PM3										13.7	10.2	13.0
PM4										12.3	11.9	13.4
PM5				69.6	49.2	4.9	69.6	49.2	4.9	69.6	49.2	4.9
PM6				1,870	886.0	995.7	1,870	886.0	995.7	1,870	886.0	995.7
PM7										402.8	170.2	48.0
PM10				63.6	61.8	73.7	63.6	61.8	73.7	63.6	61.8	73.7
PM12				8.6	8.0	0.6	8.6	8.0	0.6	8.6	8.0	0.6
Admin costs	0.0	0.0	0.0	0.0	0.0	0.0	53.8	4.9	4.9	53.8	4.9	4.9
PM11							53.8	4.9	4.9	53.8	4.9	4.9
Admin costs savings	0.0	0.0	0.0	0.0	0.0	0.0	84.1	87.1	99.3	84.1	87.1	99.3
PM11							84.1	87.1	99.3	84.1	87.1	99.3
Benefits	44.1	45.5	52.3	2,086	2,135	2,275	2,071	2,120	2,256	2,115	2,166	2,309
PMC5	44.1	45.5	52.3	44.1	45.5	52.3	44.1	45.5	52.3	44.1	45.5	52.3
PM2				14.8	15.1	19.0						
PM3										17.0	17.5	22.1
PM4										26.6	28.0	31.5
PM5				115.8	115.0	9.4	115.8	115.0	9.4	115.8	115.0	9.4
PM6				1,890	1,940	2,192	1,890	1,940	2,192	1,890	1,940	2,192
PM12				21.4	19.7	1.6	21.4	19.7	1.6	21.4	19.7	1.6
Net benefits	-2,118	-70.3	-39.1	-2,100	1,006	1,097	-2,073	1,082	1,184	-2,458	934.7	1,163

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 187: One-off costs for PTI centres in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**2,071**	**24.4**	**0.0**	**3,111**	**29.4**	**1.7**	**3,107**	**29.3**	**1.7**	**3,479**	**151.6**	**1.7**
PMC1	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0	119.8	24.4	0.0
PMC2	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0	96.1	0.0	0.0
PMC3	372.7	0.0	0.0	372.7	0.0	0.0	372.7	0.0	0.0	372.7	0.0	0.0
PMC4	1,482	0.0	0.0	1,482	0.0	0.0	1,482	0.0	0.0	1,482	0.0	0.0
PM2				3.3	0.02	0.04						
PM3										3.8	0.02	0.06
PM4										1.0	0.02	0.00
PM5				20.1	0.0	0.0	20.1	0.0	0.0	20.1	0.0	0.0
PM6				1,012	4.9	1.7	1,012	4.9	1.7	1,012	4.9	1.7
PM7										367.0	122.2	0.0
PM10				4.7	0.0	0.0	4.7	0.0	0.0	4.7	0.0	0.0
Administrative costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**48.9**	**0.0**	**0.0**	**48.9**	**0.0**	**0.0**
PM11							48.9	0.0	0.0	48.9	0.0	0.0
Net costs	**2,071**	**24.4**	**0.0**	**3,111**	**29.4**	**1.7**	**3,156**	**29.3**	**1.7**	**3,528**	**151.6**	**1.7**

Source: Ricardo et al. (2024), Impact assessment support study

3.27.2. Garages, motor vehicle dealers, tyre and repair stations, etc.

Table 188: Recurrent and one-off costs for garages, motor vehicle dealers, tyre and repair stations, etc. in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	**460.0**	**460.0**	**460.0**	**460.0**
PMC9	460.0	460.0	460.0	460.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 189: Recurrent and one-off costs for garages, motor vehicle dealers, tyre and repair stations, etc. in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**172.7**	**19.4**	**14.9**	**172.7**	**19.4**	**14.9**	**172.7**	**19.4**	**14.9**	**172.7**	**19.4**	**14.9**
PMC9	172.7	19.4	14.9	172.7	19.4	14.9	172.7	19.4	14.9	172.7	19.4	14.9

Source: Ricardo et al. (2024), Impact assessment support study

Table 190: One-off costs for garages, motor vehicle dealers, tyre and repair stations, etc. in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**149.2**	**0.0**	**0.0**	**149.2**	**0.0**	**0.0**	**149.2**	**0.0**	**0.0**	**149.2**	**0.0**	**0.0**
PMC9	149.2	0.0	0.0	149.2	0.0	0.0	149.2	0.0	0.0	149.2	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

3.27.3. OEMs

Table 191: Recurrent and one-off costs for OEMs in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	**0.0**	**0.0**	**55.9**	**55.9**
PM11			55.9	55.9

Source: Ricardo et al. (2024), Impact assessment support study

Table 192: Recurrent and one-off costs for OEMs in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**22.0**	**2.0**	**2.0**	**22.0**	**2.0**	**2.0**
PM11							22.0	2.0	2.0	22.0	2.0	2.0

Source: Ricardo et al. (2024), Impact assessment support study

Table 193: One-off costs for OEMs in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**20.0**	**0.0**	**0.0**	**20.0**	**0.0**	**0.0**

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM11							20.0	0.0	0.0	20.0	0.0	0.0

Source: Ricardo et al. (2024), Impact assessment support study

3.27.4. Other businesses (vehicle owners)

Table 194: Recurrent costs, costs savings and benefits for other businesses (vehicle owners) in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Administrative costs	**524.2**	**25,458.4**	**25,666.4**	**26,051.5**
PMC5	524.2	524.2	524.2	524.2
PM4				385.1
PM5		1,454.8	1,454.8	1,454.8
PM6		23,295.9	23,295.9	23,295.9
PM12		175.0	175.0	175.0
PM13		8.5	8.5	8.5
PM14			208.0	208.0
Administrative costs savings	**0.0**	**1,287.3**	**1,287.3**	**1,287.3**
PM12		1,287.3	1,287.3	1,287.3
Benefits	**118,340.5**	**118,340.5**	**118,340.5**	**118,340.5**
PMC9	118,340.5	118,340.5	118,340.5	118,340.5
Net benefits	**117,816.3**	**94,169.4**	**93,961.3**	**93,576.3**

Source: Ricardo et al. (2024), Impact assessment support study

Table 195: Recurrent costs, costs savings and benefits for other businesses (vehicle owners) in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Administrative costs	**27.0**	**27.8**	**31.6**	**1,362**	**1,394**	**1,443**	**1,372**	**1,405**	**1,456**	**1,392**	**1,425**	**1,479**
PMC5	27.0	27.8	31.6	27.0	27.8	31.6	27.0	27.8	31.6	27.0	27.8	31.6
PM4										19.3	20.4	23.1
PM5				115.8	115.0	9.4	115.8	115.0	9.4	115.8	115.0	9.4
PM6				1,204	1,237	1,400	1,204	1,237	1,400	1,204	1,237	1,400
PM12				14.8	14.0	1.2	14.8	14.0	1.2	14.8	14.0	1.2
PM13				0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.5
PM14							10.5	10.9	12.9	10.5	10.9	12.9
Administrative costs savings	**0.0**	**0.0**	**0.0**	**109.4**	**102.6**	**10.1**	**109.4**	**102.6**	**10.1**	**109.4**	**102.6**	**10.1**
PM12				109.4	102.6	10.1	109.4	102.6	10.1	109.4	102.6	10.1
Benefits	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**	**6,043**	**6,353**	**6,991**
PMC9	6,043	6,353	6,991	6,043	6,353	6,991	6,043	6,353	6,991	6,043	6,353	6,991
Net benefits	**6,016**	**6,325**	**6,959**	**4,791**	**5,062**	**5,558**	**4,780**	**5,051**	**5,545**	**4,761**	**5,030**	**5,522**

Source: Ricardo et al. (2024), Impact assessment support study

3.27.5. Citizens (vehicle owners)

Table 196: Recurrent costs, costs savings and benefits for citizens (vehicle owners) in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Adjustment costs	**344.2**	**13,944.3**	**13,658.1**	**14,150.0**
PMC5	336.3	336.3	336.3	336.3
PM1	7.9		7.9	
PM2		294.1		
PM3				341.3
PM4				141.5
PM6		13,241.7	13,241.7	13,241.7
PM12		72.2	72.2	72.2
PM15				16.9
Adjustment costs savings	**878.2**	**2,144.6**	**2,144.6**	**4,289.3**
PM7				4,289.3
PM8		2,144.6	2,144.6	
PM9	878.2			
Administrative costs savings	**0.0**	**591.9**	**591.9**	**591.9**
PM12		591.9	591.9	591.9
Benefits	**65,666.9**	**65,666.9**	**65,666.9**	**65,666.9**
PMC9	65,666.9	65,666.9	65,666.9	65,666.9
Net benefits	**66,200.9**	**54,459.0**	**54,745.2**	**56,398.0**

Source: Ricardo et al. (2024), Impact assessment support study

Table 197: Recurrent costs, costs savings and benefits for citizens (vehicle owners) in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			**PO1b**			**PO2**			**PO3**		
	2026	**2030**	**2050**	**2026**	**2030**	**2050**	**2026**	**2030**	**2050**	**2026**	**2030**	**2050**
Administrative costs	**17.5**	**18.1**	**21.1**	**724.9**	**742.0**	**832.3**	**710.6**	**727.3**	**813.8**	**735.3**	**752.8**	**844.9**
PMC5	17.1	17.7	20.6	17.1	17.7	20.6	17.1	17.7	20.6	17.1	17.7	20.6
PM1	0.4	0.4	0.5				0.4	0.4	0.5			
PM2				14.8	15.1	19.0						
PM3										17.0	17.5	22.1
PM4										7.3	7.6	8.4
PM6				686.5	703.4	792.3	686.5	703.4	792.3	686.5	703.4	792.3
PM12				6.5	5.8	0.3	6.5	5.8	0.3	6.5	5.8	0.3
PM15										0.8	0.9	1.1
Adjustment costs savings	**49.0**	**49.0**	**49.0**	**110.7**	**114.1**	**127.4**	**110.7**	**114.1**	**127.4**	**221.5**	**228.2**	**254.8**
PM7										221.5	228.2	254.8
PM8				110.7	114.1	127.4	110.7	114.1	127.4			
PM9	49.0	49.0	49.0									
Administrative costs savings	**0.0**	**0.0**	**0.0**	**53.4**	**48.8**	**2.8**	**53.4**	**48.8**	**2.8**	**53.4**	**48.8**	**2.8**
PM12				53.4	48.8	2.8	53.4	48.8	2.8	53.4	48.8	2.8
Benefits	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**	**3,381**	**3,554**	**3,857**
PMC9	3,381	3,554	3,857	3,381	3,554	3,857	3,381	3,554	3,857	3,381	3,554	3,857
Net benefits	**3,412**	**3,585**	**3,885**	**2,820**	**2,975**	**3,155**	**2,834**	**2,990**	**3,173**	**2,920**	**3,078**	**3,269**

Source: Ricardo et al. (2024), Impact assessment support study

3.27.6. National public authorities

Table 198: Recurrent and one-off costs, and costs savings for national public authorities in the policy options, expressed as present value over 2026-2050 relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline			
	PO1a	PO1b	PO2	PO3
Adjustment costs	**7.0**	**198.3**	**207.2**	**208.0**
PMC2	0.2	0.2	0.2	0.2
PMC3	1.3	1.3	1.3	1.3
PMC4	3.8	3.8	3.8	3.8
PM1	0.3		0.3	
PM9	1.4			
PM12		192.9	192.9	192.9
PM13		0.3	0.3	0.3
PM14			8.6	8.6
PM15				1.1
Administrative costs	**2,233.8**	**2,190.4**	**2,387.5**	**2,397.9**
PMC6	33.7	33.7	33.7	33.7
PMC7	15.4	15.4	15.4	15.4
PMC8	9.4	9.4	9.4	9.4
PMC9	2,122.1	2,122.1	2,122.1	2,122.1
PM1	9.1		9.1	
PM11			36.3	36.3
PM13		9.8	9.8	9.8
PM14			107.5	107.5
PM15				19.5
PM16	35.8		35.8	35.8
PM17	8.4		8.4	8.4
Enforcement costs	0.0	32.9	0.0	77.4
PM2		32.9		
PM3				38.1
PM4				39.2
Administrative costs savings	**5,226.3**	**3,796.8**	**5,226.3**	**5,226.3**
PMC6	3,155.0	3,155.0	3,155.0	3,155.0
PMC7	641.8	641.8	641.8	641.8
PM16	1,429.5		1,429.5	1,429.5
Net benefits	**2,985.5**	**1,375.2**	**2,631.6**	**2,543.1**

Source: Ricardo et al. (2024), Impact assessment support study

Table 199: Recurrent and one-off costs, and costs savings for national public authorities in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**4.6**	**0.1**	**0.1**	**36.1**	**9.6**	**9.6**	**39.6**	**9.9**	**9.9**	**39.9**	**9.9**	**9.9**
PMC2	0.2			0.2			0.2			0.2		
PMC3	0.7	0.03	0.03	0.7	0.03	0.03	0.7	0.03	0.03	0.7	0.03	0.03
PMC4	2.1	0.1	0.1	2.1	0.1	0.1	2.1	0.1	0.1	2.1	0.1	0.1
PM1	0.1	0.01	0.01				0.1	0.01	0.01			
PM9	1.4											
PM12				33.0	9.4	9.4	33.0	9.4	9.4	33.0	9.4	9.4
PM13				0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
PM14							3.4	0.3	0.3	3.4	0.3	0.3

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM15										0.45	0.04	0.04
Administrative costs	176.9	115.3	129.7	161.9	113.7	128.0	197.1	122.8	138.3	197.6	123.3	139.0
PMC6	18.6	0.9	0.9	18.6	0.9	0.9	18.6	0.9	0.9	18.6	0.9	0.9
PMC7	8.5	0.4	0.4	8.5	0.4	0.4	8.5	0.4	0.4	8.5	0.4	0.4
PMC8	1.2	0.5	0.5	1.2	0.5	0.5	1.2	0.5	0.5	1.2	0.5	0.5
PMC9	133.1	111.4	125.6	133.1	111.4	125.6	133.1	111.4	125.6	133.1	111.4	125.6
PM1	0.5	0.5	0.6				0.5	0.5	0.6			
PM11							14.3	1.3	1.3	14.3	1.3	1.3
PM13				0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6
PM14							5.4	5.6	6.7	5.4	5.6	6.7
PM15										1.0	1.0	1.3
PM16	14.1	1.3	1.3				14.1	1.3	1.3	14.1	1.3	1.3
PM17	0.9	0.4	0.4				0.9	0.4	0.4	0.9	0.4	0.4
Enforcement costs	**0.0**	**0.0**	**0.0**	**1.6**	**1.7**	**2.1**	**0.0**	**0.0**	**0.0**	**3.9**	**4.0**	**4.8**
PM2				1.6	1.7	2.1						
PM3										1.9	2.0	2.5
PM4										2.0	2.1	2.3
Administrative costs savings	**272.7**	**282.3**	**312.7**	**197.3**	**203.0**	**226.4**	**272.7**	**282.3**	**312.7**	**272.7**	**282.3**	**312.7**
PMC6	161.5	167.3	190.6	161.5	167.3	190.6	161.5	167.3	190.6	161.5	167.3	190.6
PMC7	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
PM16	75.4	79.3	86.3				75.4	79.3	86.3	75.4	79.3	86.3
Net benefits	**91.2**	**166.8**	**182.9**	**-2.4**	**78.1**	**86.7**	**35.9**	**149.6**	**164.5**	**31.2**	**145.0**	**159.0**

Source: Ricardo et al. (2024), Impact assessment support study; Note: negative values for net benefits represent net costs.

Table 200: One-off costs for national public authorities in the policy options, in 2026, 2030 and 2050, relative to the baseline, in million EUR (2022 prices)

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
Adjustment costs	**4.4**	**0.0**	**0.0**	**26.5**	**0.0**	**0.0**	**29.7**	**0.0**	**0.0**	**30.0**	**0.0**	**0.0**
PMC2	0.2			0.2			0.2			0.2		
PMC3	0.7			0.7			0.7			0.7		
PMC4	2.0			2.0			2.0			2.0		
PM1	0.1						0.1					
PM9	1.4											
PM12				23.6			23.6			23.6		
PM13				0.03			0.03			0.03		
PM14							3.1			3.1		
PM15										0.4		
Administrative costs	**64.9**	**0.0**	**0.0**	**51.6**	**0.0**	**0.0**	**77.9**	**0.0**	**0.0**	**77.9**	**0.0**	**0.0**
PMC6	17.8			17.8			17.8			17.8		
PMC7	8.1			8.1			8.1			8.1		
PMC8	0.7			0.7			0.7			0.7		
PMC9	25.0			25.0			25.0			25.0		
PM11							13.0			13.0		
PM16	12.8						12.8			12.8		

	Difference to the baseline											
	PO1a			PO1b			PO2			PO3		
	2026	2030	2050	2026	2030	2050	2026	2030	2050	2026	2030	2050
PM17	0.5						0.5			0.5		
Net costs	**69.3**	**0.0**	**0.0**	**78.1**	**0.0**	**0.0**	**107.6**	**0.0**	**0.0**	**107.9**	**0.0**	**0.0**

Source: Ricardo et al. (2024), Impact assessment support study

4. IMPACTS BY POLICY MEASURE ON SAFETY, EMISSIONS AND NOISE

This section explains the inputs used for deriving the impacts of the policy options on safety, emissions and noise.

In the first step, the impacts by policy measure have been assessed, drawing on relevant inputs. These are explained in detail in the sections below. Only the measures with significant impact, which have been quantified, are included in the sections below. The table below summarises the list of relevant measures by policy option and type of impact.

Table 201: Summary of measures by type of impact

Measure	Relevant options	Safety	Air pollutant emissions	Noise
PMC2	PO1a, PO1b, PO2, PO3	Y		
PMC3	PO1a, PO1b, PO2, PO3		Y	
PMC4	PO1a, PO1b, PO2, PO3		Y	
PM1	PO1a/ PO2	Y	Y	Y
PM2	PO1b	Y	Y	Y
PM3	PO3	Y	Y	Y
PM4	PO3	Y		
PM5	PO1b, PO2, PO3		Y	
PM6	PO1b, PO2, PO3	Y	Y	
PM10	PO1b, PO2, PO3			Y
PM12	PO1b, PO2, PO3		Y	Y
PM13	PO1b, PO2, PO3	Y		
PM14	PO2, PO3	Y	Y	Y
PM15	PO3	Y	Y	Y

In the second step, the inputs by policy measure are aggregated into policy options and used in the PRIMES-TREMOVE model to assess the impacts on the level of fatalities and injuries, emissions and external costs of accidents, emissions and noise.

4.1. Impacts on road safety

4.1.1. Introduction

A number of the proposed measures are expected to have a direct impact on road safety through more effective identification of vehicles with major and dangerous defects in the fleet and the subsequent fix of such defects to restore the vehicles to a safe status. This can be achieved either through more frequent tests or more effective tests, better capable of capturing defects and also covering new technologies. The reduction in the number of unsafe vehicles should eventually lead to a reduction of road accidents caused by technical defects and, as a result, a reduction in the number of fatalities and injuries (i.e., serious and slight injuries).

In addition, a broader set of measures that are expected to increase the effectiveness of the implementation and enforcement of overall roadworthiness legislation (such as those related to the exchange of data among authorities) can also indirectly contribute to the reduction of unsafe vehicles.

4.1.2. Approach

Additional or more effective PTI and/or RSI inspections can help identify safety related defects and, by mandating repair, eliminate the safety related risk. This contributes to a reduction of the number of road accidents resulting in a reduction in the total number of fatalities and injuries compared to the baseline.

The approach used for the assessment of the road safety impacts of individual measures is based on the following formula:

% reduction of fatalities/injuries relative to the baseline = TD x PTI/RSI_Share x IE x RSI_EFF

Where:

- **TD** refers to the contribution of technical defects to accidents. A value of 6% is assumed for motorcycles and 4% for all other vehicle categories (see below).
- **PTI/RSI_Share** refers to share of a specific vehicle category in the fleet that is expected to be subject to PTI/RSI inspection on an annual basis. This is based on the scope of the measure and determined by the vehicles average age and the test frequency[400].
- **IE** refers to the effectiveness of PTI/RSI inspections in identifying major and dangerous defects, assumed to be 95%.
- **RSI_EFF** is relevant only in the case of measures including RSI and refers to the expected enhanced effectiveness of targeted roadside inspections to identify vehicles with technical defects, when compared to the PTI where there is no such targeted approach. A factor of three is used[401]. As example, if the fleet includes a 10% share of high emitters, RSI based on random selection would identify 10 high emitters in 100 roadside inspections, while targeted RSIs are expected to be able to identify 30 high emitters (3 x 10) in 100 roadside inspections.

The formula aims to identify the expected percentage reduction of road accidents and thus of fatalities/injuries in relation to the baseline levels for each policy measure and vehicle category.

In the second step, in order to calculate the combined effect on safety of the policy measures included in each option by Member State, the common residual method is applied:

$CE_{A, B, C, \ldots} = 1-[(1-I_A)x(1-I_B)x(1-I_C)x(1-\ldots)]$

Where:

[400] For example, in the case of an average vehicle age of 15 years and a PTI frequency of 4/2/2 (four years for the first inspection and 2 thereafter) we can calculate a total of 6.5 inspections until the age 15 which means an annual frequency of 0.43 (=6.5/15) inspections. For L and O vehicle types the average vehicle age is 18 years and the total number of inspections over the lifetime of the vehicle is 8 resulting in an annual frequency of 0.44 (=8/18).

[401] Based on a comparison of the share of defective vehicles found at RSI in Member States applying targeted checks (based on risk rating for the selection of HDVs) to those that select vehicles randomly, the factor of 3 is assessed to be a conservative estimate. For LDVs, remote sensing will help selecting vehicles to be tested at roadside.

- $CE_{A, B, C}$ denotes the combined effect of measures A, B, C, etc.
- I_A, I_B and I_c correspond to the expected level of impact (in percentage terms) of each measure.

The resulting percentage reduction by policy option and Member State is used as input in the PRIMES-TREMOVE model and translated into absolute levels of avoided fatalities and injuries relative to the baseline. Based on the number of fatalities and injuries avoided, the reduction in the external costs of accidents is calculated[402].

4.1.3. Key assumptions

The **TD** parameter relating to the contribution of technical defects on fatalities is a key parameter in the assessment as it determines the maximum impact that can be possibly achieved by the removal of unsafe vehicles from EU roads. As presented in more detail in the baseline section, there is significant uncertainty in relation to this parameter, with estimates that range between 0.5% to up to 20% in terms of the share of road accidents caused by technical defects. It should however be noted that methodologies vary significantly and they are often not comparable. Following a review of the literature[403], a conservative approach has been used. A 4% contribution of technical defects to road accidents is assumed in the case of LDVs, HDVs and trailers. For motorcycles, given the presence of some evidence of higher levels of contribution of this vehicle type, 6% is assumed[404]. Given the high uncertainty, sensitivity analysis has been performed, considering alternatives of 1% and 7% contribution for LDVs, HDVs and trailers and 3% and 9% for motorcycles.

The **IE** parameter refers to the expected effectiveness of the inspections. A value of 95% is assumed based on the fact that inspections need to follow an extensive list, covering all vehicle aspects as defined in the annexes of the PTI and RSI Directives (2014/45/EU and 2014/47/EU). Furthermore, given the focus of this analysis on major or dangerous defects, it is reasonable to assume that in the majority of cases these will be effectively identified during the inspections, by a trained inspector.

In addition, a one-to-one relationship between the impact on road accidents and fatalities and injuries is assumed. Namely, a 1% reduction in the number of road accidents is assumed to lead to a 1% reduction in fatalities and injuries. This is considered a reasonable assumption, even though it is possible that the adoption of new vehicle technologies in the future may change this relationship over time.

Another important assumption made is that unsafe vehicles inspected and repaired to pass a follow up PTI inspection, will maintain their roadworthy status following the PTI and will not deteriorate until the next PTI. This is an important assumption, especially when considering older vehicles where faster deterioration is more likely. There is however no standard approach or evidence available for assessing the impact of such deterioration over time. There are also certain limiting factors of such an effect. This includes the possibility that some vehicle owners will repair their vehicles before the

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402 The 2019 Handbook on the external costs of transport (Source: https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1) has been used to monetise the costs. According to the Handbook, the external cost of a fatality in 2022 prices is estimated at EUR 3.9 million and that of a serious injury at EUR 0.6 million.

403 Hudec (2021), Examination of the results of the vehicles technical inspections in relation to the average age of vehicles in selected EU states; SAFERWHEELS (2018), Study on Powered Two-Wheeler and Bicycle Accidents in the EU, Final Report, Brussels

404 The 4% and 6% are two percentage points lower than the levels of contribution assumed in the 2012 impact assessment support study. Reduced rates were considered more appropriate because the estimated impact on fatalities in the 2012 impact assessment support study was significantly higher than what was actually observed on the basis of data from the CARE database.

PTI date, when a serious defect that may pose safety issues is identified. Further to that, roadside inspections can also help identify such defects, although their effectiveness is limited by the small share of the fleet affected and the fact that they are only mandatory for HDVs.

4.1.4. PMC2 - Update PTI and RSI due to new requirements in General Safety Regulation and checking emission reduction systems (new test items, including checks of software status/integrity), by reading on-board diagnostics

PMC2 requires to update the PTI and RSI to new requirements in the General Safety Regulation (including software status/integrity of safety or emission relevant systems during PTI for all vehicles and at technical roadside inspections of commercial vehicles), resulting in safety benefits. The enhanced testing requirements are expected to ensure detecting and resolving defects for vehicle safety features introduced by the General Safety Regulation (GSR), thus enabling the full safety benefit of GSR to be realised.

The impact assessment accompanying the GSR[405] estimated the number of fatalities that could be prevented by GSR across all vehicle categories during 2021-2037 for EU27 plus UK (line (a) in the table below). These estimates were converted to EU27 (line (b) in the table below) by deducting the UK's fleet share, and then translated to the period 2026-2050 by first annualising them and then multiplying by 25 years (line (c) in the table below).

Defects in ADAS would result in a reduced effectiveness of the GSR measures. This is calculated by applying an ADAS defect rate (line (e) in the table below) to the share of fatalities that could be avoided (line (d) in the table below). The ADAS defect rate is assumed to be the same as the defect rate of electronic safety components, which was estimated at 17% by the initiative for Diagnosis of Electronic Systems in Motor Vehicles for PTI[406]. This provides a maximum share of total fatalities that could be reduced by addressing ADAS defects. In the case of passenger cars this is estimated at 9.4% reduction of fatalities from the baseline levels.

Finally, a success rate of PTI inspections to capture defects (95%) is applied (line (f) in the table below). For example, for M1 vehicles PMC2 could reduce fatalities and injuries from MS affected by 1.5% (line (g) in the table below).

The table below presents the data for the calculation of the impact of PMC2 on safety, as outlined above.

Table 202: Estimated impact of PMC2 on fatalities and injuries

Variable	M1	N1	N2/N3	M2/M3	Explanation/source
MS affected	All	All	All	All	
Share of EU fatalities affected	100%	100%	100%	100%	
Total fatalities prevented by GSR safety measures across all vehicle categories over the period 2021–2037 for EU27 plus UK (a)	21,337	1,283	1,947	227	Assumed to equal the total GSR life-saving potential of PO3. Source: SWD(2018)190

[405] SWD(2018)190
[406] SWD(2012)206

Variable	M1	N1	N2/N3	M2/M3	Explanation/source
Total fatalities prevented by GSR safety measures across all vehicle categories over the period 2021–2037 for EU27 (b)	19,051	1,146	1,738	203	Using the share of UK fleet into the total EU27 plus UK fleet (12% according to Eurostat data: Stock of vehicles by category and NUTS 2 regions [TRAN_R_VEHST])
Total fatalities prevented by GSR safety measures across all vehicle categories over the period 2026–2050 across EU27 (c)	28,016	1,685	2,556	298	Converted to 2026-2050 period by annualising and multiplying by 25 years
Proportion of fatalities prevented by GSR safety measures across all vehicle categories across EU27 (d)	9.4%	3.0%	3.4%	2.5%	GSR fatalities prevented / total fatalities in the baseline
Defect rate of ADAS systems (e)	17%	17%	17%	17%	Assumed to be the same as the defect rate of ESC, which is estimated at 17% by IDELSY
Success rate of PTI/RIS to capture defects and address them (f)	95%	95%	95%	95%	Assumption
% reduction of fatalities/injuries in the MS affected (g)=(d)x(e)x(f)	**1.5%**	**0.5%**	**0.5%**	**0.4%**	Decrease in fatalities relative to the baseline

Source: Ricardo et al. (2024), Impact assessment support study

4.1.5. PM1 - RSI for heavy/powerful motorcycles (L category > 125cm3) as alternative measure, in the Member States where they are not subject to PTI (i.e., using available opt-out)

PM1 will require that those Member States (BE, FI, IE, NL, MT, PT)[407] that do not have a PTI requirement for motorcycles introduce roadside inspections for motorcycles over 125 cc as an alternative. The roadside inspections are expected to cover 5% of the number of motorcycles registered every year. The motorcycle fleet of these Member States represent on average 8.6% of the fleet over 2026-2050. Furthermore, as the measure does not cover L3-L7 motorcycles of less than 125cc, the scope of the measure is also reduced (84.2% of the total L3-L7 on average over 2026-2050).

On the basis of the assumed effectiveness of roadside inspections (RSI) in detecting defective vehicles when inspected (i.e., 95%=100%-5%) and the expected enhanced effectiveness of RSI to identify defective vehicles (factor of 3), the share of defective motorcycles that is expected to be identified on an annual basis is estimated. With 5% of the fleet inspected annually, the reduction in

[407] Until the end of 2023, France had not introduced mandatory PTI for motorcycles, but the French authorities had announced the intention to do so. For this reason, for the purposes of the analysis it was assumed that France would not be affected by the proposed measure. Denmark does not have mandatory PTI but it has introduced roadside inspections, and it is thus assumed to be part of the baseline. In the case of Portugal, current requirements cover only motorcycles over 250cc.

the number of fatalities and injuries is estimated at 0.7% relative to the baseline for the six MS affected.

Table 203: Estimated impact of PM1 on fatalities and injuries

Variable	Values	Label	Calculation
Share of EU fleet affected (L3-L7)	8.6%	(a)	
Share of L3-L7 in measure scope	84.2%	(b)	
Share of fatalities/injuries of MS affected in EU total	8%	(c)	
Share of accidents directly caused by motorcycle technical defects	6%	(d)	
Share of motorcycles inspected in RSI	5%	(e)	
Parameter reflecting RSI enhanced capacity to select defective vehicles for RSI	3.0	(f)	
Failure rate of inspections in detecting defective vehicles	5%	(g)	
% reduction in fatalities/injuries from affected MS	**0.7%**	(h)	(h)=(1–(g)) x (f) x (e) x (b) x (d)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.6. *PM2 - Mandatory PTI for motorcycles above 125cm3 (remove opt-out)*

PM2 introduces mandatory PTI for all motorcycles over 125cm3 (removing opt-out). Besides the Member States identified in PM1, Denmark will also need to introduce PTI for motorcycles over 125cm under PM2. Thus, the Member States affected by PM2 are BE, DK, FI, IE, MT, NL and PT.

In this case the impact will depend on the expected frequency of the PTI inspections which has been assumed to be the minimum one provided for M1/N1 vehicles in the Directive (4/2/2), leading to an average frequency of 0.44 inspections per year[408]. Assuming 5% failure rate of PTI in detecting defective vehicles and a 6% contribution of technical defects to road accidents, the reduction in the number of fatalities/injuries in the MS affected is estimated at 2.2% relative to the baseline.

Table 204: Estimated impact of PM2 on fatalities and injuries

Variable	Value	Label	Calculation
Share of EU fleet affected (L3-L7)	8.8%	(a)	
Share of L3-L7 in measure scope	85.9%	(b)	
Share of fatalities/injuries of MS affected in EU total	8.5%	(c)	
Share of accidents directly caused by motorcycle technical defects	6%	(d)	

[408] For L vehicle types the average vehicle age is 18 years and the total number of inspections over the lifetime of the vehicle is 8 resulting in an annual frequency of 0.44 (=8/18).

Variable	Value	Label	Calculation
Average share of vehicles tested in PTI per year	44%	(e)	
Failure rate of PTI in detecting defective vehicles	5%	(f)	
% reduction in fatalities/injuries for affected MS	**2.2%**	(g)	(g)=(1-(f)) x (b) x (c) x (d) x (e)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.7. PM3 - Extend PTI to all motorcycles (i.e., incl. from 50cm3 = all L3e, L4e, plus tricycles (L5e) and heavy quadricycles (L7e)

PM3 extends the type of motorcycles covered by PTI to those from 50cm3 in the eight Member States where such requirement is currently not in place (BE, FI, IE, NL, MT, PT, DK, CY[409]).

As in the case of PM2, a 5% failure rate of PTI in detecting defective vehicles is assumed and an average frequency of 0.44 inspections per year. The reduction in the number of fatalities/injuries for the MS affected is estimated at 2.5% relative to the baseline.

Table 205: Estimated impact of PM3 on fatalities and injuries

Variable	Value	Label	Calculation
Share of EU fleet affected (L3-L7)	10.2%	(a)	
Share of L3-L7 vehicle fleet in measure scope	100%	(b)	
Share of fatalities/injuries of affected MS in EU total	9%	(c)	
Share of accidents directly caused by motorcycle technical defects	6%	(d)	
Average share of vehicles tested in PTI per year	44%	(e)	
Failure rate of PTI in detecting defective vehicles	5%	(f)	
% reduction in fatalities/injuries for affected MS	**2.5%**	(g)	(g)=(1-(f)) x (b) x (d) x (e)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.8. PM4 - Mandatory PTI for light trailers (O1 and O2 categories)

PM4 requires the mandatory PTI for light trailers (O1 and O2 categories). Eleven Member States would be affected by PM4: 7 Member States where there is currently no requirement for PTI for either O1 or O2 (DK, EL, FI, FR, NL, IE, PT) and 4 Member States where there is currently only a requirement for PTI for O2 (PL, SK, BE and ES).

In the case of O1 around 21.5% of the total EU fleet of O1 vehicles will be affected while in the case of O2 around 9.3%. Due to the significant data gaps in the number of O1 and O2 vehicles in the EU, the shares above are based on estimates linking the number of trailers with the number of passenger

[409] In Cyprus motorcycles above 125cm3 are already covered.

cars in the fleet[410].

There is also no detailed data on the number of fatalities from O1/O2 vehicles. Data from the CARE database concerning the fatalities and injuries of passenger cars with trailers has been used, since passengers cars are not permitted to pull trailers over 3,500 kg. Data is available for only a small number of Member States[411] for the period 2019-2021. For the 10 Member States where data is available, the average total number of fatalities per year is 16. Considering that these Member States represent around 26% of the estimated number of trailers in the EU fleet, the total number of fatalities at EU level is estimated at around 62. On the basis of CARE database, and using a similar approach, the level of serious injuries at EU level in which O1/O2 vehicles are involved is estimated at around 324 per year and slight injuries at 1,778 per year.

Assuming a contribution of technical defects of light trailers to road accidents of 4%, an average frequency of 0.44 inspections per year[412] and a 5% failure rate of PTI detecting defective vehicles, the percentage reduction in the number of fatalities and injuries due to PM4 is estimated at 1.7% relative to the baseline for both O1 and O2 for the MS affected.

Table 206: Estimated impact of PM4 on fatalities and injuries

Variable	O1	O2	Label	Calculation
Share of EU fleet affected	21.5%	9.3%	(a)	
Share of MS affected fleet in measure scope	100%		(b)	
Share of accidents directly caused by vehicle technical defects	4%		(c)	
Average share of vehicles tested in PTI per year	44%		(d)	
Failure rate of PTI in detecting defective vehicles	5%		(e)	
% reduction in fatalities/injuries for affected MS	**1.7%**	**1.7%**	(f)	(f)=(1-(e)) x (b) x (c) x (d)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.9. PM6 - Mandatory yearly testing for vehicles that are 10-year-old or older

Currently, 11 MS do not require annual PTI testing of light-duty vehicles after 10 years of their registration (CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK). All these Member States currently

[410] Data from Eurostat passenger car stock (road_eqs_carage) has been used to calculate the number of O1/O2 trailers per passenger cars for the Member States where data is available. The median was used to estimate the number of trailers in the MS where data is missing. A 50% split of O1/O2 was used where data was not available.
[411] AT, BG, DK, ES, FI, IT, LT, LV, PT and SE.
[412] This is based on an average lifetime of 18 years and a frequency pattern of 4/2/2 (8 inspections within the 18 year period). The average lifetime is estimated based on the average age of vehicles.

require an inspection every two years which means that the proposed measure will double the number of inspections for vehicles over 10 years.

The share of older vehicles that contribute to accidents due to technical defects is calculated by multiplying the share of accidents directly caused by technical defects (4%) by 1.77, to account for the higher rate of technical defects for older vehicles. The scaling factor (1.77) is calculated based on the IGLAD study[413], on the distribution of vehicle accidents by age. A 5% failure rate of PTI detecting defective vehicles is assumed.

The reduction in fatalities and injuries for the affected MS is calculated separately for M1 and N1 vehicles, as shown in the table below, and is estimated at 1.2% for M1 vehicles and 0.9% for N1 vehicles relative to the baseline.

Table 207: Estimated impact of PM6 on fatalities and injuries

Variable	M1	N1	Label	Calculation
MS affected by measure	CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK	CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK	(a)	
Share of fatalities in MS affected in EU total	53%	41%	(b)	
Share of vehicle fleet in measure scope	53%	52%	(c)	
Share of accidents directly caused by technical defects	4%	4%	(d)	
Scale factor for increased older vehicle accidents	1.77	1.77	(e)	
Increase in the share of vehicles tested per year	33%	26%	(f)	
Failure rate of PTI in detecting defective vehicles	5%	5%	(g)	
% reduction in fatalities/injuries for affected MS	**1.2%**	**0.9%**	(h)	(h)=(1-(g)) x (c) x (d) x (e) x (f)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.10. PM13 - Mandatory inspection of cargo securing

PM13 introduces mandatory standards in relation to cargo securing inspections. Currently 5 Member States[414] do not require either minimum training or specify test requirements relating to cargo securing during RSI in their national transposition of Directive 2014/47/EU. For calculating the impacts, the vehicle fleet of the affected Member States are considered. N2 and N3 vehicles in these

[413] http://www.iglad.net/.
[414] EE, FR, IE, LV and LU.

Member States represent around 13% of the EU-wide fleet. 14 Member States[415], covering 67% of the N2/N3 fleet, do not specify minimum training requirements for cargo securing.

Based on MS data and available estimates[416], up to 25% of crashes involving N2/N3 vehicles are linked to cargo securing defects. The share of fatalities attributable to cargo unsafe vehicles was assumed to be proportionate to the share of cargo-related accidents. The failure rate of cargo inspections in detecting unsafe cargo loading (in line with the 2014 European best practise guidelines[417]) is assumed to be 5%.

To calculate the percentage reduction in fatalities due to this measure in the affected MS, the accuracy of cargo inspections was multiplied by the share of the fleet undergoing RSI each year and the share of fatalities attributable to unsafe cargo. The impact of introducing minimum training requirements was weighted by 50%, to reflect its lower contribution in reducing fatalities compared to minimum testing requirements. PM13 is estimated to reduce the number of fatalities and injuries in MS with no testing requirements by 1.19% relative to the baseline and in MS with no training requirements by 0.59%.

Table 208: Estimated impact of PM13 on fatalities and injuries

Variable	Value	Label	Calculation
MS which lack testing minimum requirements & training	EE, FR, IE, LV and LU	(a)	
MS which only lack minimum training requirements	BE, DK, DE, EE, FR, IE, LV, LU, BG, FI, IT, NL, PL and PT	(b)	
Weighting of fatality contribution due to the lack of training requirements	50%	(c)	
Share of fatalities in MS which lack testing and training minimum requirements in EU total	13%	(d)	
Share of fatalities in MS which lack training minimum requirements in EU total	69%	(e)	
Share of crashes where N2/N3 cargo defects played a role	25%	(f)	
Share of vehicles undergoing RSI annually	5%	(g)	
Failure rate of cargo inspections in detecting unsafe cargo loading	5%	(h)	
% reduction in fatalities/injuries for affected MS with no testing requirements	**1.19%**	(i)	(i)=(f) x (g) x (1-(h))

[415] BE, DK, DE, EE, FR, IE, LV, LU, BG, FI, IT, NL, PL and PT.
[416] https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/safe-vehicles/cargo-securing-and-abnormal-loads_en
[417] Cargo securing for road transport - Publications Office of the EU (europa.eu)

Variable	Value	Label	Calculation
% reduction in fatalities/injuries for affected MS with no training requirements	**0.59%**	(j)	(j)=(f) x (g) x (1-(h)) x (c)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.11. PM14 - Extend the scope of application of roadside inspections to light commercial (N1) vehicles

PM14 extends the scope of application of roadside inspections to N1 vehicles, and sets 2% as target for the share of inspections of the N1 vehicle fleet. On the basis of the information available, few Member States (ES, HU, SE, SK and FI) already conduct roadside inspections for N1 vehicles, although without a certain target set and thus checking a low number of vehicles. For the purposes of the assessment it is assumed that these five Member States will not be affected.

The inspections in the 22 Member States affected are expected to lead to the identification of defective vehicles and thus lead to the restoration of their safe vehicle status, with positive impacts on safety.

The failure rate of inspections in detecting defective vehicles is assumed at 5%. Further, the effectiveness of RSI to identify defective vehicles is considered to be 3 times higher than that of PTI tests (due to the more targeted approach adopted in selecting vehicles for the tests). Also considering the annual target of 2% of the N1 fleet being inspected and the fact that 4% of N1 vehicle accidents are directly caused by technical defects, the reduction in the number of fatalities and injuries for the 22 Member States affected is estimated at 0.23% relative to the baseline.

Table 209: Analysis of expected impact of PM14 on fatalities and injuries

Variable	Value	Label	Calculation
Share of EU fleet in MS affected	77%	(a)	
Share of EU fatalities in MS affected in EU total	89%	(b)	
Share of N1 vehicle accidents directly caused by technical defects	4%	(c)	
Share of N1 vehicles inspected	2%	(d)	
Parameter reflecting RSI enhanced capacity to identify defective vehicles	3.0	(e)	
Failure rate of inspections in detecting defective vehicles	5%	(f)	
% reduction in fatalities/injuries for affected MS	**0.23%**	(g)	(g)=(1–(f)) x (c) x (d) x (e)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.12. PM15 - Extend the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3)

PM15 extends the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3) and establishes a threshold of 1% of the vehicle fleet for roadside inspections.

Few Member States (SE, SI, AT, FI, DK, HU, RO) already perform such inspections although they do not report the exact number of inspections of motorcycles separately and do not indicate a specific target. In the absence of more specific data it is assumed that these Member States will not be affected by PM15.

The failure rate of inspections in detecting defective vehicles is assumed at 5%. Further, the effectiveness of RSI to identify defective vehicles is considered to be 3 times higher than that of PTI tests (due to the more targeted approach adopted in selecting vehicles for the tests). Also considering the annual target of 1% of the N1 fleet being inspected and the fact that 6% of motorcycle-related accidents are directly caused by technical defects, the reduction in the number of fatalities and injuries for the 20 Member States affected is estimated at 0.17% relative to the baseline.

Table 210: Estimated impact of PM15 on fatalities and injuries

Variable	Value	Label	Calculation
Share of fleet in MS affected in EU total	92%	(a)	
Share of EU fatalities in MS affected in EU total	91%	(b)	
Share of accidents directly caused by motorcycle technical defects	6%	(c)	
Share of motorcycles inspected	1%	(d)	
Parameter reflecting RSI enhanced capacity to select defective vehicles	3.0	(e)	
Failure rate of inspections in detecting defective vehicles	5%	(f)	
% reduction in fatalities/injuries for affected MS	**0.17%**	(g)	(1 – (f)) x (c) x (d) x (e)

Source: Ricardo et al. (2024), Impact assessment support study

4.1.13. Impact on safety by policy option

On the basis of the analysis of the impacts of each individual measure, the combined impact of the measures for each policy option is estimated using the common residual method explained above. The tables below summarise the expected impact on fatalities and injuries relative to the baseline (% change from the baseline) for each policy option, by Member State and vehicle type. These are used as inputs in the PRIMES-TREMOVE model to derive the number of fatalities and injuries avoided, as well as the reduction in the external costs of accidents.

Table 211: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for M1 vehicle category

	PO1a	PO1b	PO2	PO3
AT	1.5%	1.5%	1.5%	1.5%
BE	1.5%	1.5%	1.5%	1.5%
BG	1.5%	1.5%	1.5%	1.5%
CY	1.5%	2.7%	2.7%	2.7%
DE	1.5%	2.7%	2.7%	2.7%
EE	1.5%	1.5%	1.5%	1.5%

	PO1a	PO1b	PO2	PO3
FI	1.5%	1.5%	1.5%	1.5%
FR	1.5%	2.7%	2.7%	2.7%
EL	1.5%	2.7%	2.7%	2.7%
HR	1.5%	1.5%	1.5%	1.5%
HU	1.5%	2.7%	2.7%	2.7%
IE	1.5%	1.5%	1.5%	1.5%
IT	1.5%	2.7%	2.7%	2.7%
LT	1.5%	2.7%	2.7%	2.7%
LU	1.5%	1.5%	1.5%	1.5%
LV	1.5%	1.5%	1.5%	1.5%
MT	1.5%	2.7%	2.7%	2.7%
NL	1.5%	1.5%	1.5%	1.5%
PL	1.5%	1.5%	1.5%	1.5%
PT	1.5%	1.5%	1.5%	1.5%
RO	1.5%	1.5%	1.5%	1.5%
SE	1.5%	1.5%	1.5%	1.5%
SI	1.5%	1.5%	1.5%	1.5%
SK	1.5%	2.7%	2.7%	2.7%
ES	1.5%	1.5%	1.5%	1.5%
DK	1.5%	2.7%	2.7%	2.7%
CZ	1.5%	2.7%	2.7%	2.7%

Source: Ricardo et al. (2024), Impact assessment support study

Table 212: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for N1 vehicle category

	PO1a	PO1b	PO2	PO3
AT	0.5%	0.5%	0.7%	0.7%
BE	0.5%	0.5%	0.7%	0.7%
BG	0.5%	0.5%	0.7%	0.7%
CY	0.5%	1.4%	1.6%	1.6%
DE	0.5%	1.4%	1.6%	1.6%
EE	0.5%	0.5%	0.7%	0.7%
FI	0.5%	0.5%	0.5%	0.5%
FR	0.5%	1.4%	1.6%	1.6%
EL	0.5%	1.4%	1.6%	1.6%
HR	0.5%	0.5%	0.7%	0.7%
HU	0.5%	1.4%	1.4%	1.4%
IE	0.5%	0.5%	0.7%	0.7%
IT	0.5%	1.4%	1.6%	1.6%
LT	0.5%	1.4%	1.6%	1.6%
LU	0.5%	0.5%	0.7%	0.7%
LV	0.5%	0.5%	0.7%	0.7%
MT	0.5%	1.4%	1.6%	1.6%
NL	0.5%	0.5%	0.7%	0.7%
PL	0.5%	0.5%	0.7%	0.7%

	PO1a	PO1b	PO2	PO3
PT	0.5%	0.5%	0.7%	0.7%
RO	0.5%	0.5%	0.7%	0.7%
SE	0.5%	0.5%	0.5%	0.5%
SI	0.5%	0.5%	0.7%	0.7%
SK	0.5%	1.4%	1.4%	1.4%
ES	0.5%	0.5%	0.5%	0.5%
DK	0.5%	1.4%	1.6%	1.6%
CZ	0.5%	1.4%	1.6%	1.6%

Source: Ricardo et al. (2024), Impact assessment support study

Table 213: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for N2/N3 vehicle categories

	PO1a	PO1b	PO2	PO3
AT	0.5%	0.5%	0.5%	0.5%
BE	0.5%	0.5%	0.5%	0.5%
BG	0.5%	1.1%	1.1%	1.1%
CY	0.5%	0.5%	0.5%	0.5%
DE	0.5%	0.5%	0.5%	0.5%
EE	0.5%	1.7%	1.7%	1.7%
FI	0.5%	1.1%	1.1%	1.1%
FR	0.5%	1.7%	1.7%	1.7%
EL	0.5%	0.5%	0.5%	0.5%
HR	0.5%	1.1%	1.1%	1.1%
HU	0.5%	0.5%	0.5%	0.5%
IE	0.5%	1.7%	1.7%	1.7%
IT	0.5%	1.1%	1.1%	1.1%
LT	0.5%	0.5%	0.5%	0.5%
LU	0.5%	1.7%	1.7%	1.7%
LV	0.5%	1.7%	1.7%	1.7%
MT	0.5%	0.5%	0.5%	0.5%
NL	0.5%	1.1%	1.1%	1.1%
PL	0.5%	1.1%	1.1%	1.1%
PT	0.5%	1.1%	1.1%	1.1%
RO	0.5%	0.5%	0.5%	0.5%
SE	0.5%	1.1%	1.1%	1.1%
SI	0.5%	0.5%	0.5%	0.5%
SK	0.5%	0.5%	0.5%	0.5%
ES	0.5%	1.1%	1.1%	1.1%
DK	0.5%	0.5%	0.5%	0.5%
CZ	0.5%	0.5%	0.5%	0.5%

Source: Ricardo et al. (2024), Impact assessment support study

Table 214: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for M2/M3 vehicle categories

	PO1a	PO1b	PO2	PO3
AT	0.4%	0.4%	0.4%	0.4%

	PO1a	PO1b	PO2	PO3
BE	0.4%	0.4%	0.4%	0.4%
BG	0.4%	0.4%	0.4%	0.4%
CY	0.4%	0.4%	0.4%	0.4%
DE	0.4%	0.4%	0.4%	0.4%
EE	0.4%	0.4%	0.4%	0.4%
FI	0.4%	0.4%	0.4%	0.4%
FR	0.4%	0.4%	0.4%	0.4%
EL	0.4%	0.4%	0.4%	0.4%
HR	0.4%	0.4%	0.4%	0.4%
HU	0.4%	0.4%	0.4%	0.4%
IE	0.4%	0.4%	0.4%	0.4%
IT	0.4%	0.4%	0.4%	0.4%
LT	0.4%	0.4%	0.4%	0.4%
LU	0.4%	0.4%	0.4%	0.4%
LV	0.4%	0.4%	0.4%	0.4%
MT	0.4%	0.4%	0.4%	0.4%
NL	0.4%	0.4%	0.4%	0.4%
PL	0.4%	0.4%	0.4%	0.4%
PT	0.4%	0.4%	0.4%	0.4%
RO	0.4%	0.4%	0.4%	0.4%
SE	0.4%	0.4%	0.4%	0.4%
SI	0.4%	0.4%	0.4%	0.4%
SK	0.4%	0.4%	0.4%	0.4%
ES	0.4%	0.4%	0.4%	0.4%
DK	0.4%	0.4%	0.4%	0.4%
CZ	0.4%	0.4%	0.4%	0.4%

Source: Ricardo et al. (2024), Impact assessment support study

Table 215: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for L3-L7 vehicle categories

	PO1a	PO1b	PO2	PO3
AT	0.0%	0.0%	0.0%	0.0%
BE	0.7%	2.2%	0.7%	2.7%
BG	0.0%	0.0%	0.0%	0.2%
CY	0.0%	0.0%	0.0%	0.2%
DE	0.0%	0.0%	0.0%	0.2%
EE	0.0%	0.0%	0.0%	0.2%
FI	0.7%	2.2%	0.7%	2.5%
FR	0.0%	0.0%	0.0%	0.2%
EL	0.0%	0.0%	0.0%	0.2%
HR	0.0%	0.0%	0.0%	0.2%
HU	0.0%	0.0%	0.0%	0.0%
IE	0.7%	2.2%	0.7%	2.7%
IT	0.0%	0.0%	0.0%	0.2%
LT	0.0%	0.0%	0.0%	0.2%

	PO1a	PO1b	PO2	PO3
LU	0.0%	0.0%	0.0%	0.2%
LV	0.0%	0.0%	0.0%	0.2%
MT	0.7%	2.2%	0.7%	2.7%
NL	0.7%	2.2%	0.7%	2.7%
PL	0.0%	0.0%	0.0%	0.2%
PT	0.7%	2.2%	0.7%	2.7%
RO	0.0%	0.0%	0.0%	0.0%
SE	0.0%	0.0%	0.0%	0.0%
SI	0.0%	0.0%	0.0%	0.0%
SK	0.0%	0.0%	0.0%	0.2%
ES	0.0%	0.0%	0.0%	0.2%
DK	0.0%	2.2%	0.0%	2.5%
CZ	0.0%	0.0%	0.0%	0.2%

Source: Ricardo et al. (2024), Impact assessment support study

Table 216: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for O1 vehicle category

	PO1a	PO1b	PO2	PO3
AT				0.0%
BE				1.7%
BG				0.0%
CY				0.0%
DE				0.0%
EE				0.0%
FI				1.7%
FR				1.7%
EL				1.7%
HR				0.0%
HU				0.0%
IE				1.7%
IT				0.0%
LT				0.0%
LU				0.0%
LV				0.0%
MT				0.0%
NL				1.7%
PL				1.7%
PT				1.7%
RO				0.0%
SE				0.0%
SI				0.0%
SK				1.7%
ES				1.7%
DK				1.7%

	PO1a	PO1b	PO2	PO3
CZ				0.0%

Source: Ricardo et al. (2024), Impact assessment support study

Table 217: Estimated reduction in the number of fatalities and injuries by policy option, relative to the baseline, for O2 vehicle category

	PO1a	PO1b	PO2	PO3
AT				0.0%
BE				0.0%
BG				0.0%
CY				0.0%
DE				0.0%
EE				0.0%
FI				1.7%
FR				1.7%
EL				1.7%
HR				0.0%
HU				0.0%
IE				1.7%
IT				0.0%
LT				0.0%
LU				0.0%
LV				0.0%
MT				0.0%
NL				1.7%
PL				0.0%
PT				1.7%
RO				0.0%
SE				0.0%
SI				0.0%
SK				0.0%
ES				0.0%
DK				1.7%
CZ				0.0%

Source: Ricardo et al. (2024), Impact assessment support study

4.2. Impacts on air pollutant emissions and noise

4.2.1. Introduction

In the case of impacts on emissions and noise, the approach adopted was to estimate the expected contribution of each measure on the identification and removal of high emitter vehicles (whether due to defective emissions control systems or tampering) from the fleet. It is assumed that high emitters identified will undergo repair (whether this refers to the replacement of malfunctioning filters, sensor or sound control system or the necessary modifications of the engine). The focus of the analysis is on high emitters only (i.e., vehicles with emissions multiple times higher than the type-approval limits) as these are expected to be possible to capture during PTI and RSI or with the help of remote sensing.

It should be noted that there is no standard definition of a high emitter[418]. A pragmatic approach has been used for the analysis, making use of information/data provided in relevant studies, while recognising that they are not always consistent in the definition applied. Furthermore, it should be noted that high emitters may be vehicles with defective emission or noise control systems or vehicles with tampered emissions/noise control systems. In the absence of more detailed information, a 50% share of defective and tampered vehicles is assumed in the total share of high emitters in the fleet. There is also a need to separate the two since it can be expected that tampered vehicles will not be effectively captured as part of a PTI. Their owners may be expected to activate the relevant control system before the PTI and then deactivate it again. This is possibly a simplification of reality so it is assumed that only 10% of tampered vehicles will be captured as part of the PTI.

The analysis of the impacts on emissions focuses on the two pollutants that are targeted in the proposed measures, namely, NOx and PN/PM. Other pollutants have not been considered in detail although it is conceivable that, by identifying high emitters for these two categories of pollutants, there may also be benefits related to other pollutant types (e.g. CO, HC, SO2).

4.2.2. Approach

The approach used to estimate the impacts on air pollutant emissions focuses on the extent to which additional or more effective PTI and/or RSI inspections can help identify high emitter vehicles and, by mandating repair, align the vehicle emissions with the type-approval values. As a result, these would contribute to the reduction of the total emissions relative to the baseline.

The approach used for the assessment of the impacts of individual measures is based on the following formula:

Percentage reduction of high emitters share = ((PTI_Share x (DEF + TAMP x PTI_TE) + RSI_Share (DEF + TAMP) x RSI_EFF)) x IE / HE

Where:

- **PTI_Share** refers to share of vehicles in the fleet that are expected to be subject to PTI on an annual basis. This is based on the scope of the measure, and determined by the vehicles average age and the test frequency[419]. Increased scope and frequency of PTI should in principle lead to a higher share of high emitters identified in the fleet.
- **RSI_Share** refers to share of vehicles in the fleet that are expected to be subject to RSI inspection on an annual basis. This is based on the scope of the measure. Increased scope of inspections should in principle lead to a higher share of high emitters identified in the fleet.
- **DEF** refers to the share of vehicles with defective emissions or noise control systems in the fleet in the baseline, for the specific vehicle category, fuel and EURO standard. In the absence of more

[418] One possible definition would be: a vehicle whose average emissions are at least 2 standard deviations higher than the average emissions of the sample tested (https://pure.iiasa.ac.at/id/eprint/10156/1/XO-12-019.pdf). Euro 7 on-board monitoring principle sets detecting exceedances at a level of at least 2,5 times the relevant exhaust emission limit value.

[419] For example, in the case of an average vehicle lifetime of 15 years and a PTI frequency of 4/2/2 (four years for the first inspection and 2 thereafter) we can calculate a total of 6.5 inspections until the age 15 which means an annual frequency of 0.43 (=6.5/15) inspections. For L and O vehicle types the average vehicle age is 18 years and the total number of inspections over the lifetime of the vehicle is 8, resulting in an annual frequency of 0.44 (=8/18).

detailed data these are assumed to be half of the total high emitters for the specific vehicle category, fuel and EURO standard.

- **TAMP** refers to the share of vehicles with tampered emissions or noise control systems in the fleet in the baseline. They are assumed to represent the remaining half of the total high emitters for the specific vehicle category, fuel and EURO standard.
- **PTI_TE** reflects the limited capacity of PTI to capture tampered vehicles. A share of 10% is assumed to be captured as part of the PTI[420].
- **RSI_EFF** is relevant only in the case of measures including RSI and refers to the expected enhanced effectiveness of targeted roadside inspections to identify vehicles with technical defects when compared to the PTI (where there is no such targeted approach). A factor of three is used[421]. As example, if the fleet includes a 10% share of high emitters, RSI based on random selection would identify 10 high emitters in 100 roadside inspections, while targeted RSIs are expected to be able to identify 30 high emitters (3 x 10) in 100 roadside inspections.
- **IE** refers to the effectiveness of the specific test method used to identify high emitting vehicles. This varies depending on the method used and is explained under the relevant policy measures.
- **HE** is the total share of high emitters in the baseline, equal to TAMP + DEF.

The above formula aims to identify the expected level of reduction of high emitters in the fleet, as a percentage of the baseline figures. Namely, a 10% reduction relative to the baseline high emitters shares of 10% will mean a reduction by one percentage point, leading to a new level of high emitters of 9%. This can then be translated into actual emissions reductions, on the base of the emission factors of high emitters defined in the baseline.

Furthermore, as in the case of safety, in order to calculate the combined effect of the policy measures included in each option, the common residual method is applied:

$CE_{A, B, C, \ldots} = 1-[(1-I_A)x(1-I_B)x(1-I_C)x\ (1-\ldots)]$

Where:

- $CE_{A, B, C}$ denotes the combined effect of measures A, B, C, etc.
- $I_{A,}$ and I_B and I_c correspond to the expected level of impact (in percentage terms) of each measure.

Similarly to the impacts on road safety, the percentage reduction of high emitters by policy option relative to the baseline is used as input in the PRIMES-TREMOVE model to calculate the reduction in air pollutant emissions, and in the external costs of emissions and noise[422].

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[420] Giechaskiel, B., et al., (2022), Effect of tampering on on-road and off-road diesel vehicle emissions. Sustainability, 14(10), p. 6065.

[421] Based on a comparison of the share of defective vehicles found at RSI in Member States applying targeted checks (based on risk rating for the selection of HDVs) to those that select vehicles randomly, the factor of 3 is assessed to be a conservative estimate. For LDVs, remote sensing will help selecting vehicles to be tested at roadside.

[422] The 2019 Handbook on the external costs of transport (Source: https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1) has been used to monetise the costs.

4.2.3. *Key assumptions*

As indicated above, an assumption is made on the limited capacity of PTIs to capture tampering. These are those vehicles which are not brought back to their original pre-tampering state in view of the testing. A share of 10% of tampered vehicles is assumed to be captured as part of the PTI[423]. An enhanced effectiveness factor of 3 is used for RSI to reflect its targeted character[424].

An additional important assumption made in the assessment of the impacts is that following the identification of a high emitting vehicle and its repair/correction, while emission systems may not become as good as new, it can still be expected that any deterioration will be limited and will not lead to vehicles becoming high emitters again until the next PTI. This is considered to be a reasonable assumption, especially in the case of older vehicles where PTI frequency is higher. Since the analysis and estimation of impacts on emissions is based on the expected reduction in the share of high emitters, there is no risk of overestimation of the impacts due to the ongoing durability of the repairs following PTI. Further to that, the role of roadside inspections towards achieving continuous compliance should be noted, even if the number of roadside inspections are relatively small and currently only cover heavy duty vehicles. Furthermore, enhanced durability of vehicles and components (at least partly driven by legal requirements) can also help maintain the performance of vehicles over time. Euro 7 standards, part of the baseline, are expected to extend the durability requirements from the current levels of 100,000 km and 5 years (that do not cover older age vehicles), to 200,000 km[425].

4.2.4. *PMC3 - Mandatory PN testing of LDVs and HDVs equipped with particle filter, at PTI, and of HDVs at technical roadside inspections of commercial vehicles*

The implementation of PN emissions testing is expected to reduce the number of defective vehicles with PN emissions consistently over the legal value (that is, not temporarily higher than the legal requirement because of a just regenerated diesel particulate filter). PMC3 is thus expected to have an impact on air pollutant emissions. No impact on noise emissions is expected due to PMC3.

The capacity of identifying faulty vehicles at PTI is assumed to be 95%. Some tampered vehicles will also be identified during PTI. These are those vehicles which are not brought back to their original pre-tampering state in view of the testing[426]. In addition, following the DIAS[427] example, the share of fleet with defective emissions control system was assumed to be equal to the share of fleet with tampered emission control system. As explained above, it is assumed that 10% of the tampered vehicles are identified at PTI. The proportion of high emitters identified at PTI will also depend on the percentage of vehicles that undergo PTI checks.

To estimate the impact of implementing the new PN test at PTI, the calculation is performed by using as multiplicative factor (line (h) in the table below), the difference between the capabilities of identifying high emitters by the new methodology (line (g) in the table below) and the capabilities of

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[423] Giechaskiel, B., et al., (2022), Effect of tampering on on-road and off-road diesel vehicle emissions. Sustainability, 14(10), p. 6065.

[424] Based on a comparison of the share of defective vehicles found at RSI in Member States applying targeted checks (based on risk rating for the selection of HDVs) to those that select vehicles randomly, the factor of 3 is assessed to be a conservative estimate. For LDVs, remote sensing will help selecting vehicles to be tested at roadside.

[425] Related to this a recent analysis by the UK government on the possible impact of a one year extension of the initial inspection, estimated a possible increase in PTI failure in terms of emissions at 1 to 4.6%.

[426] Giechaskiel, B., et al., (2022), Effect of tampering on on-road and off-road diesel vehicle emissions. Sustainability, 14(10), p. 6065.

[427] DIAS (2022), D6.5 Impact assessment and guidelines for future anti-tampering regulations.

identifying high emitters by the currently used methods (line (f) in the table below). Therefore, the percentage of high emitters identified in PMC3 is calculated based on the table below, as: (h) x (e) x ((c) + (i) x (d)), where the letters stand for the labels of the lines in the table.

To obtain the reduction in high emitters relative to the baseline for the MSs affected (line (j) in the table below), the percentage of high emitters identified in PMC3 is divided by the share of high emitters in the baseline fleet (b).

The table below summarises, as example, the steps followed to calculate the expected reduction in high emitters in the M1 diesel Euro 5 fleet brought by implementing PMC3.

Table 218: Steps followed to estimate the impact of PMC3 on the M1 diesel Euro 5 fleet by age group relative to the baseline

					Label	Calculation/ Assumption
Vehicle category	**M1 diesel Euro 5**					
MS affected	**All MSs except for NL, DE, BE**					
Age group	**0-4**	**5-9**	**10-14**	**15-19**		
Share of vehicle fleet in measure scope (per age group)	65%	67%	92%	97%	(a)	PRIMES-TREMOVE baseline
Share of high emitters in the fleet in the baseline	2.5%	5.0%	7.5%	10%	(b)	See section on the baseline
Share of fleet with defective emissions control systems	1.25%	2.50%	3.75%	5.00%	(c)	50% x (b)
Share of fleet with tampered emission control systems	1.25%	2.50%	3.75%	5.00%	(d)	50% x (b)
% of vehicles that undergo PTI checks per year (per age group)	24%	65%	79%	80%	(e)	Estimation based on the MSs frequencies for PTIs
Accuracy of current PTI emission test at identifying tampered/defective emission control systems	3.6%	3.6%	3.6%	3.6%	(f)	The same level of accuracy is assumed as for the current NOx test (Boveroux & al, 2021)
PTI capacity to identify faulty vehicles (% of total)	95%	95%	95%	95%	(g)	Assumption
Change in detection accuracy due to the introduction of PN PTI testing	91.4%	91.4%	91.4%	91.4%	(h)	(h) = (g) - (f)
Share of tampered vehicles identified at PTI	10%	10%	10%	10%	(i)	Assumption
% reduction in the level of high emitters relative to the baseline for MS affected	**12%**	**33%**	**40%**	**40%**	(j)	(j)= (h) x (e) x ((c) + (i) x (d))/(b)
% reduction in the level of high emitters - total EU fleet	**8%**	**22%**	**37%**	**38%**	(k)	(k) = (j) x (a)
% of high emitters in the fleet following the implementation of the measure	**2.2%**	**3.4%**	**4.5%**	**6%**	(l)	(l) = (b) - (j) x (b)

Source: Ricardo et al. (2024), Impact assessment support study

For HDVs, PMC3 envisages to use the new PN measuring methodology at RSI as well (in addition to PTI). The table below presents first the methodology for assessing the impacts on emissions due to PTI for HDVs, which is similar to the one for M1 vehicles explained above. The second part of the table presents the methodology for assessing the impacts on emissions due to RSI.

Roadside inspections have the capability of identifying both defective and tampered emission systems. Therefore, no factor is used representing the limited capacity to capture tampering (as in the case of PTI). It is reasonable to expect that the combination of PN checks at both roadside and PTI will also have some deterrent effect on tampering, but this is not possible to quantify.

The proportion of high emitting HDVs identified at RSI will be proportional to the percentage of vehicles that undergo RSI checks (assumed at 5%), to the capacity of portable PN measuring devices to identify faulty vehicles (assumed 95% as for measurements at PTI), and to the share of fleet with defective/tampered emissions control systems. Furthermore, the effectiveness factor reflecting the targeted nature of RSI is used in the calculations.

The proportion of identified high emitting HDVs at RSI due to PMC3, based on the table below, is given by the product (k) x (l) x (m) x (b), where the letters stand for the labels of the lines in the table. The reduction in high emitters relative to the baseline is provided in line (n) in the table below.

The combined impact of PN checks at both PTI and RSI on HDVs is estimated as the sum of the impacts of the PTI and RIS inspections minus their product and is provided in line (o) of the table below.

The table below summarises, as example, the steps followed to estimate the reduction in high emitters in the HDVs Euro VI fleet due to PMC3, relative to the baseline.

Table 219: Steps followed to estimate the impact of PMC3 on HDVs Euro VI fleet by age group

					Label	**Calculation/ Assumption**
Vehicle category	**N2/N3/M2/M3 Euro VI**					
MS affected	PTI checks: **all MSs except NL, DE, BE** RSI checks: **all MSs**					
Age group	**0-4**	**5-9**	**10-14**	**15-19**		
Share of vehicle fleet in measure scope (per age group)	85%	88%	95%	97%	(a)	PRIMES-TREMOVE baseline
Share of high emitters in the fleet in the baseline	7.2%	8.8%	10.4%	12.0%	(b)	See baseline section
Share of fleet with defective emissions control system	3.6%	4.4%	5.2%	6.0%	(c)	50% x (b)
Share of fleet with tampered emission control system	3.6%	4.4%	5.2%	6.0%	(d)	50% x (b)
% of vehicles that undergo PTI checks per year (per age group)	100%	100%	100%	100%	(e)	Estimation based on the MSs frequencies for PTIs
Accuracy of current PTI emission test at identifying tampered/defective emission control systems	3.6%	3.6%	3.6%	3.6%	(f)	The same level of accuracy is assumed as for the current NOx test (Boveroux & al, 2021)
PTI capacity to identify faulty vehicles (% of total)	95%	95%	95%	95%	(g)	Assumption

					Label	Calculation/ Assumption
Vehicle category	**N2/N3/M2/M3 Euro VI**					
MS affected	PTI checks: **all MSs except NL, DE, BE** RSI checks: **all MSs**					
Age group	**0-4**	**5-9**	**10-14**	**15-19**		
Change in detection accuracy due to introduction of PN-PTI testing	91.4%	91.4%	91.4%	91.4%	(h)	(h) = (g) – (f)
Share of tampered vehicles identified at PTI	10%	10%	10%	10%	(i)	Assumption
% reduction in the level of high emitters from baseline for MS affected (PTI only)	**50%**	**50%**	**50%**	**50%**	(j)	(j) = (h) x (e) x ((c) + (i) x (d))/(b)
% reduction in the level of high emitters from baseline - EU fleet (PTI only)	**43%**	**44%**	**48%**	**49%**	(k)	(k) = (j) x (a)
Share of fleet checked at RSI	5%	5%	5%	5%	(l)	Assumption
PN portable equipment effectiveness at RSI	95%	95%	95%	95%	(m)	Assumption
RSI effectiveness factor	3	3	3	3	(n)	Assumption
% reduction in high emitters (RSI only)	**14%**	**14%**	**14%**	**14%**	(o)	(o) = (l) x (m) x (n) x (b) / (b)
% reduction in high emitters from baseline (RSI only) - EU fleet	**12%**	**13%**	**14%**	**14%**	(p)	(p) = (o) x (a)
% reduction in level of high emitters (combination RSI and PTI)	**57%**	**57%**	**57%**	**57%**	(q)	(q) = (j) + (o) – (j) x (o)
% reduction in the level of high emitters in EU fleet (combination RSI and PTI)	**49%**	**51%**	**54%**	**56%**	(r)	(r) = (q) x (a)
% of high emitters in the fleet following the implementation of the measure	**3.7%**	**4.3%**	**4.7%**	**5.3%**	(s)	(s) = (b) – (r) x (b)

Source: Ricardo et al. (2024), Impact assessment support study

The tables below summarise the estimated reduction, relative to the baseline, in the share of high emitters due to checks at PTI for LDVs and at PTI and RSI for HDVs (defined as the percentage of high emitters identified divided by the baseline share of high emitters). The estimates are presented for diesel vehicles only, as the PN measurement method is still under development for petrol vehicles.

Table 220: Reduction in the share of PN high emitters for M1 and N1 diesel vehicles (all Euro standards) by age group relative to the baseline

Age group (years)	Reduction in high emitters relative to the baseline M1 and N1	Reduction in high emitters in EU fleet M1 diesel	Reduction in high emitters in EU fleet N1 diesel
0-4	12%	8%	9%
5-9	33%	22%	24%
10-14	40%	37%	33%
15-19	40%	38%	36%

Source: Ricardo et al. (2024), Impact assessment support study

Table 221: Reduction in the share of PN high emitters due to PTI only, RSI only, and their combined impact on N2/N3/M2/M3 vehicles (all Euro standards) by age group relative to the baseline

Age group (years)	Reduction in high emitters from baseline (PTI only)	Reduction in high emitters in EU fleet (PTI only)	Reduction in high emitters from baseline (RSI only)	Reduction in high emitters in EU fleet (RSI only)	Reduction in high emitters from baseline (PTI + RSI)	Reduction in high emitters in EU fleet (PTI + RSI)
0-4	50%	43%	14%	12%	57%	49%
5-9	50%	44%	14%	13%	57%	51%
10-14	50%	48%	14%	14%	57%	54%
15-19	50%	49%	14%	14%	57%	56%

Source: Ricardo et al. (2024), Impact assessment support study

4.2.5. PMC4 – Mandatory NOx-testing of LDV and HDV at PTI, and HDVs at roadside inspections

This measure is similar to PMC3 but applies NOx testing. PMC4 will introduce mandatory NOx emission testing during PTI for LDVs and HDVs (from Euro 5b and Euro VI respectively) and at RSIs (for HDVs from Euro VI). As a result, the number of defective LDVs and HDVs with NOx emissions over the legal value is expected to decrease. PMC4 is thus expected to have an impact on air pollutant emissions. No impact on noise emissions is expected due to PMC4.

The approach used to estimate the impacts is similar to that for PMC3, described in Section 4.2.4.

The assumption used for the NOx measuring devices is that the capacity of identifying faulty vehicles is 95% for both the equipment used at PTI and at RSI. Similarly to PMC3, it is assumed that only 10% of the tampered vehicles are identified at PTI. The LDV and HDV fleets of all EU Member States are expected to be affected by this measure, as none of the MSs are currently measuring NOx emissions.

For RSI, similarly to PMC3, a factor of 3 is used to represent their effectiveness relative to PTI, to take into account that the inspections are usually not random but targeted.

The tables below summarise the estimated reduction, relative to the baseline, in the share of high emitters due to checks at PTI for LDVs and at PTI/RSI for HDVs (defined as the percentage of high emitters identified divided by the baseline share of high emitters).

Table 222: Reduction in the share of NOx high emitters for M1 and N1 diesel and petrol vehicles (all Euro standards) by age group relative to the baseline

Age group (years)	Reduction in high emitters relative to the baseline Petrol and diesel M1 and N1
0-4	13%
5-9	34%
10-14	41%
15-19	42%

Source: Ricardo et al. (2024), Impact assessment support study

Table 223: Reduction in the share of NOx high emitters due to PTI only, RSI only, and their combined impact on N2/N3/M2/M3 vehicles (all Euro standards) by age group relative to the baseline

Age group (years)	Reduction in high emitters from baseline (PTI only)	Reduction in high emitters from baseline (RSI only)	Reduction in high emitters from baseline (PTI + RSI)
All age groups	52%	14%	59%

Source: Ricardo et al. (2024), Impact assessment support study

4.2.6. PM1 - RSI for heavy/powerful motorcycles (L category > 125cm3) as alternative measure, in the Member States where they are not subject to PTI (i.e., using available opt-out)

PM1 will require that those Member States (BE, FI, IE, NL, MT, PT)[428] that do not have a PTI requirement for motorcycles introduce roadside inspections for motorcycles over 125 cc as an alternative. The roadside inspections are expected to cover 5% of the number of motorcycles registered every year. The motorcycle fleet of these Member States represent on average 8.6% of the fleet over 2026-2050. Furthermore, as the measure does not cover L3-L7 motorcycles of less than 125cc, the scope of the measure is also reduced (84.2% of the total L3-L7 on average over 2026-2050).

The share of high emitters of air pollution and noise emissions in the baseline is assumed at 8% and 30%, respectively, based on limited information from the literature and the PTI data analysis (see baseline section).

PM1 is expected to have an impact on air pollutant emissions and noise emissions. Similar to the approach used for assessing the impacts on road safety, the failure rate of inspections in detecting defective vehicles is assumed at 5%. To reflect the enhanced effectiveness of RSI in targeting defective vehicles compared to PTI, a factor of 3 is used. The proportion of motorcycle undergoing

[428] Until end 2023, France had not introduced mandatory PTI for motorcycles, but the French authorities had announced the intention to do so. For this reason, for the purposes of the analysis it was assumed that France would not be affected by the proposed measure. Denmark does not have mandatory PTI but since it has introduced roadside inspections, and it is thus assumed to be part of the baseline. In the case of Portugal, current requirements cover only motorcycles over 250cc.

roadside inspections (5%) and the share of motorcycles in the scope of the measure is also taken into account in the assessment.

The share of high emitters of air pollutant emissions and noise is estimated to reduce by 12% in the MS affected (1% at the EU level) due to PM1, relative to the baseline.

Table 224: Estimated impact of PM1 on the share of high emitters of air pollutant emissions and noise

Variable	Emissions	Noise	Label	Calculation
MS affected	FI, NL, MT, PT, BE, IE			
Share of EU fleet affected	8.6%		(a)	
Share of vehicle fleet in measure scope	84.2%		(b)	
Share of fleet inspected in RSI	5%		(c)	
RSI effectiveness factor	3.0		(d)	
Share of high emitters in the fleet in the baseline (emissions/noise)	8%	30%	(e)	
Share of fleet with defective emissions/noise control systems (emissions/noise)	4%	15%	(f)	50% x (e)
Share of fleet with tampered emission/noise control systems (emissions/noise)	4%	15%	(g)	50% x (e)
Failure rate of inspections in detecting defective vehicles	5%		(h)	
% reduction in the share of high emitters relative to the baseline in the Member States affected (emissions/noise)	**12%**		(i)	(i) = (1 – (h)) x (c) x (d) x (b)
% reduction in the share of high emitters relative to the baseline at EU level (emissions/noise)	**1%**		(j)	(j) = (i) x (a)
% of high emitters in the fleet following the implementation of the measure (emissions/noise)	**7%**	**26%**	(k)	(k) = (e) - (e) x (i)

Source: Ricardo et al. (2024), Impact assessment support study

4.2.7. PM2 - Mandatory PTI for motorcycles above 125cm3 (remove current opt-out)

PM2 introduces mandatory PTI for all motorcycles over 125cm3 (removing opt-out). Besides the Member States identified in PM1, Denmark will also need to introduce PTI for motorcycles over 125cm under PM2. Thus, the Member States affected by PM2 are BE, DK, FI, IE, MT, NL and PT.

PM2 is expected to have an impact on air pollutant emissions and noise emissions. The impact of PM2 is based on the expected effectiveness of PTI for motorcycles to identify high emitters, applying the emission measurements and test methods already considered in PMC3 and PMC4. Considering the MS affected by PM2, the measure is expected to have an impact on a small share of the EU fleet

(8.8%)[429]. Furthermore, as it does not encompass all motorcycle categories (only L3-L7, except L3-1a), a reduced scope is used to estimate the impacts on the total motorcycle fleet (85.9%)[430].

The share of high emitters of air pollution and noise emissions in the baseline is assumed at 8% and 30%, respectively, based on limited information from the literature and the PTI data analysis (see baseline section).

Similar to the approach used for assessing the impacts of PM1, the failure rate of inspections in detecting defective vehicles is assumed at 5%. The impact will also depend on the expected frequency of the PTI inspections which has been assumed to be the minimum one provided for M1/N1 vehicles in the Directive (4/2/2), leading to an average frequency of 0.44 inspections per year[431]. In addition, it is assumed that 10% of the tampered vehicles are identified at PTI. The share of motorcycles in the scope of the measure is also taken into account in the assessment.

The share of high emitters of air pollutant emissions and noise is estimated to reduce by 20% in the MS affected (1.7% at the EU level) due to PM2, relative to the baseline.

Table 225: Estimated impact of PM2 on the share of high emitters of air pollutant emissions and noise

Variable	Emissions	Noise	Label	Calculation
MS affected	BE, DK, FI, IE, MT, NL, PT			
Share of EU fleet affected	8.8%		(a)	
Share of vehicle fleet in measure scope	85.9%		(b)	
Share of high emitters in the fleet in the baseline (emissions / noise)	8%	30%	(c)	
Share of fleet with defective emissions control systems	4%	15%	(d)	50% x (c)
Share of fleet with tampered emission control systems	4%	15%	(e)	50% x (c)
% of vehicles that undergo PTI per year	44%		(f)	4/2/2 over 18 years (i.e., 8 inspections)
PTI capacity to identify tampering (% of total)	10%		(g)	
Failure rate of inspections in detecting defective vehicles	5%		(h)	
% reduction in the share of high emitters relative to the baseline in the Member States affected (emissions/noise)	**20%**		(i)	(i) = (f) x ((g) x (e) + (d)) x (1 – (h)) x (b) / (c)

[429] This reflects the average over 2026-2050 based on the PRIMES-TREMOVE baseline.
[430] This reflects the average over 2026-2050 based on the PRIMES-TREMOVE baseline.
[431] For L vehicle types the average vehicle age is 18 years and the total number of inspections over the lifetime of the vehicle is 8 resulting in an annual frequency of 0.44 (=8/18).

Variable	Emissions	Noise	Label	Calculation
% reduction in the share of high emitters relative to the baseline at EU level (emissions/noise)	**1.7%**		(j)	(j) = (i) x (a)
% of high emitters in the fleet following the implementation of the measure (emissions/noise)	**6.4%**	**24%**	(k)	(k) = (c) - (c) x (i)

Source: Ricardo et al. (2024), Impact assessment support study

4.2.8. PM3 - Extend PTI to all motorcycles (i.e., including from 50cm3 = all L3e, L4e, plus tricycles (L5e) and heavy quadricycles (L7e))

PM3 extends the type of motorcycles covered by PTI to those from 50cm3 in the eight Member States where such requirement is currently not in place (BE, FI, IE, NL, MT, PT, DK, CY[432]).

The approach followed for the assessment is the same as in the case of PM2. The only difference is that the extended scope of the measure to cover vehicles over 50cm3 leads to increased share of the fleet affected as shown in the table below.

The share of high emitters of air pollutant emissions and noise is estimated to reduce by 23.2% in the MS affected (2.4% at the EU level) due to PM3, relative to the baseline.

Table 226: Estimated impact of PM3 on the share of high emitters of air pollutant emissions and noise

Variable	Emissions	Noise	Label	Calculation
MS affected	BE, FI, IE, NL, MT, PT, DK, CY			
Share of EU fleet affected	10.2%		(a)	
Share of vehicle fleet in measure scope	100%		(b)	
Share of high emitters in the fleet in the baseline (emissions/noise)	8%	30%	(c)	
Share of fleet with defective emissions control systems (emissions/noise)	4%	15%	(d)	50% x (c)
Share of fleet with tampered emission control systems (emissions/noise)	4%	15%	(e)	50% x (c)
% of vehicles that undergo PTI per year	44%		(f)	4/2/2 over 18 years (i.e., 8 inspections)
PTI capacity to identify tampering (% of total)	10%		(g)	
Failure rate of inspections in detecting defective vehicles	5%		(h)	

[432] In Cyprus motorcycles above 125cm3 are already covered.

Variable	Emissions	Noise	Label	Calculation
% reduction in the share of high emitters relative to the baseline in the Member States affected (emissions/noise)	**23.2%**		(i)	(i) = (f) x ((g) x (e) + (d)) x (1 – (h)) x (b) / (c)
% reduction in the share of high emitters relative to the baseline at EU level (emissions/noise)	**2.4%**		(j)	(j) = (i) x (a)
% of high emitters in the fleet following the implementation of the measure (emissions/noise)	**6.1%**	**23%**	(k)	(k) = (c) - (c) x (i)

Source: Ricardo et al. (2024), Impact assessment support study

4.2.9. PM5 - Annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2 frequency

PM5 includes a requirement for annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2 frequency. It assumes additional emission testing in all Member States. While certain Member States (e.g. LT and FR) apply yearly (emission) testing from a certain vehicle age, this means smoke opacity test or EOBD test that are not considered effective. PM5 is expected to have an impact on air pollutant emissions. No impact on noise emissions is expected due to PM5.

Based on the DIAS study[433], it is assumed that 50% of the high emitters are caused by tampering. As tampering of vehicles is more difficult to detect, the emission test is assumed to only detect 10% of the tampered vehicles. The accuracy of the new PTI emission test at identifying tampered/defective emission control systems is assumed at 95%. Taking also into account the share of the age group in the vehicle fleet and the percentage increase in the number of inspections, the table below provides the calculations and impact on the share of high emitters of air pollutant emissions for the 0-4 age group.

Table 227: Estimated impact of PM5 on the share of high emitters of air pollutant emissions for the 0-4 years age group

Variable	Value	Label	Calculation
Share of EU vehicle fleet in measure scope	100%	(a)	
Share of age group in N1 fleet	18.7%	(b)	
Percentage increase in inspections across EU27	34%	(c)	
Percentage of high emitter vehicles which are tampered	50%	(d)	
PTI capacity to identify tampering (% of total)	10%	(e)	
Share of vehicles with tampered or defective emission systems which are detected	55%	(f)	(f) = (d) + (b) x (e)

433 DIAS (2022), D6.5 Impact assessment and guidelines for future anti-tampering regulations.

Variable	Value	Label	Calculation
Accuracy of new PTI emission test at identifying tampered/defective emission control systems	95%	(g)	
% reduction in the share of high emitters at the EU level compared to the baseline	**16.93%**	**(h)**	**(h) = (a) x (c) x (g) x (f)**

Source: Ricardo et al. (2024), Impact assessment support study

The percentage reductions in the shares of high emitters across the EU for four age groups of the N1 vehicle category are shown in the table below. The differences between age groups are due to the additional number of inspections relative to the baseline and the share of each age group in the N1 vehicle fleet.

Table 228: Estimated reduction of the share of high emitters of air pollutant emissions for N1 vehicles, by age group

Variable	Age group			
Vehicle age group (years)	0-4	5-9	10-14	15-19
% reduction in the share of high emitters in the fleet at EU level compared to the baseline	16.93%	16.13%	1.89%	1.88%

Source: Ricardo et al. (2024), Impact assessment support study

4.2.10. PM6 - Mandatory yearly testing for vehicles that are 10-year-old or older

Currently, 11 MS do not require annual PTI testing of light-duty vehicles after 10 years of their registration (CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK). All these Member States currently require an inspection every two years which means that the proposed measure will double the number of inspections for vehicles over 10 years. PM6 is expected to have an impact on air pollutant emissions. No impact on noise emissions is expected due to PM6.

Based on the DIAS study[434], it is assumed that 50% of the high emitters are caused by tampering. As tampering of vehicles is more difficult to detect, the emission test is assumed to only detect 10% of the tampered vehicles. The accuracy of the new PTI emission test at identifying tampered/defective emission control systems is assumed at 95%. The reduction in the share of high emitters in the affected MS is calculated by also taking into account the increase in the number of inspections for the N1 and M1 vehicle categories relative to the baseline. To calculate the percentage reduction in the share of high emitters in the fleet at EU level compared to baseline, the share of EU fleet affected is further taken into account.

The calculation approach for the 10-14 years age group of M1 and N1 vehicles is provided in the table below.

[434] DIAS (2022), D6.5 Impact assessment and guidelines for future anti-tampering regulations.

Table 229: Estimated impact of PM6 on the share of M1 and N1 high emitters of air pollutant emissions for the 10-14 years age group

Variable	M1 values (a)	N1 values (b)	Label	Calculation
MS affected by measure	CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK	CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK	(a)	
Share of EU fleet affected	47%	49%	(b)	
% increase in the number of inspections relative to the baseline	33%	26%	(c)	
Percentage of high emitter vehicles which are tampered	50%	50%	(d)	
PTI capacity to identify tampering (% of total)	10%	10%	(e)	
Share of vehicles with tampered or defective emission systems which are detected	55%	55%	(f)	(f) = (d) + (b) x (e)
Accuracy of new PTI emission test at identifying tampered/defective emission control systems	95%	95%	(g)	
% reduction in the share of high emitters in the fleet in the MS affected compared to baseline	**17.24%**	**13.59%**	**(h)**	**(h) = (c) x (f) x (g)**
% reduction in the share of high emitters in the fleet at EU level compared to baseline	**8.08%**	**6.64%**	**(i)**	**(i) = (h) x (b)**

Source: Ricardo et al. (2024), Impact assessment support study

It is assumed that the vehicles older than 10 years are evenly distributed between the 10-14 years and 15-19 years age groups. This is also the case of the increase in the number of inspections relative to the baseline. Therefore, the percentage reductions in the shares of N1 and M1 high emitters (line (f) in the table above) are the same for the 10-14 years and 15-19 years age groups.

4.2.11. PM10 - More advanced testing of noise for motorcycles

PM10 requires that all Member States perform noise testing for motorcycles at PTI, inspired by the procedure for pass-by noise test described in the UN Regulation no. 41. Four MSs (DE, ES, HR, SK) currently require testing of noise for L-category vehicles at PTI. Even though the stringency and effectiveness of current testing methods in these MS may be lower than the noise testing methods proposed in UN Regulation 41 for pass-by noise tests, they represent a significant improvement compared to the subjective assessment by the inspector, which is required by the PTI Directive. PM10 is expected to have an impact on noise emissions.

The measure is expected to affect 72% of the L3-7 vehicle fleet across the EU. The share of the vehicle fleet which will be subject to the new advanced noise test each year is calculated by assuming a standard PTI frequency for L-category vehicles of 4-2-2 and an average vehicle life of 18 years. In addition, it is assumed that 50% of the high noise-emitting motorcycles are caused by tampering and 50% by defective noise control systems. As tampering of vehicles is more difficult to detect during PTI, the advanced noise test is assumed to only detect 10% of tampered vehicles during PTI.

The introduction of advanced noise testing for motorcycles is expected to reduce the share of high emitter L vehicles by 22% in the MS affected, relative to the baseline. The approach for calculating the reduction in the share of high emitter vehicles is provided in the table below.

Table 230: Estimated impact of PM10 on the share of noise high-emitter L vehicles in the fleet

Variable	Values	Label	Calculation
Share of vehicle fleet in measure scope	72%	(a)	All MSs except for DE, ES, HR, SK
Share of high emitters in the fleet in the baseline	30%	(b)	
Percentage of high emitter vehicles which are tampered	50%	(c)	
Proportion of high emitter vehicles due to defective systems	50%	(d)	
PTI capacity to identify tampering (% of total)	10%	(e)	
Share of fleet inspected annually	44%	(f)	Estimate based on 4-2-2 PTI frequency
Noise test effectiveness	90%	(g)	
Tampered vehicles identified at PTI	0.6%	(h)	(h) = (b) x (c) x (e) x (f) x (g)
Defective vehicles identified at PTI	6.0%	(i)	(i) = (b) x (d) x (f) x (g)
% reduction in the share of high emitter vehicles in the fleet in the MS affected	**22.0%**	**(j)**	**(j) = ((h) + (i))/(b)**
% of high emitters in the fleet following the implementation of the measure	**23.4%**	**(k)**	**(k) = (b) – (b) x (j)**

Source: Ricardo et al. (2024), Impact assessment support study

4.2.12. PM12 – NOx, PM, and noise measurement by remote sensing in RSI of all vehicles (with option for simplified PTI if vehicle passed recent RSI)

PM12 requires NOx and PM measurement by remote sensing in technical roadside inspections of all vehicle types, and optional plume chasing in technical roadside inspections of commercial vehicles. In addition, acoustic cameras would need to be added to remote sensing equipment to measure noise at the roadside. Thus, it is expected that PM12 will decrease the number of LDVs and HDVs with tampered/faulty emission system leading to high exhaust of NOx and particle emissions, and also decrease the number of M1, N1 vehicles and motorcycles with tampered/faulty exhaust system leading to high noise emissions.

NOx and PN high emitter light duty and heavy duty vehicles

The potential reduction in high emitter vehicles depends on:

- the effectiveness of remote sensing (RS), which is intrinsically penalised by the short time scale during which a measurement takes place, and by the possible contamination of the plume by near vehicles, is assumed at 70% (line (c) in the table below). The effectiveness of plume chasing is assumed to be 95% as for the RSI measurements (line (h) in the table below);
- the proportion of false positives (that is, vehicles wrongly identified as high emitters by remote sensing and plume chasing) is assumed at 5% (line (e) in the table below);
- the capacity of identifying NOx and PN high emitters at RSI is assumed to be 95% (line (d) in the table below);
- the target proportion of the fleet analysed by remote sensing is assumed to be 30% (line (f) in the table below);
- the targeted proportion of the HDVs fleet analysed by plume chasing is assumed to be 3% (line (i) in the table below); and
- the capacity of RSI, that is, the highest proportion of the whole LDV and HDV fleets that is feasible to check through RSI is assumed to be 0.5% (line (b) in the table below).

The table below summarises the steps followed to estimate the impact of PM12 on the share of NOx high emitters Euro VI HDVs relative to the baseline.

Remote sensing and plume chasing are used as a filtering tool for a better targeted RSI. The high emitters flagged as high emitters, which contain both real high emitters and false positives, are sent either to RSI (line (m) in the table below) or, in case the number of vehicles is too high compared to the capacity of RSI, to a testing centre (PTI station) to be double checked.

The proportion of vehicles flagged as high emitters will be proportional to the percentage of the fleet analysed, the remote sensing and plume chasing[435] effectiveness and the share of high emitters in the fleet.

In the case of HDVs, the option of plume chasing is added: it is possible to find high emitting HDVs (line (k)) proportionally to the share of fleet measured via plume chasing (line (i)), and the plume chasing capacity of identifying faulty vehicles (line (h)). For LDVs this additional share of identified high emitters by plume chasing does not exist.

All vehicles flagged as potential high emitters by remote sensing and plume chasing will be sent to RSI up to the RSI capacity of 0.5% of the fleet (b).

The proportion of the real high emitters identified at RSI (line (n) in the table below) will be the product of the percentage of the fleet correctly identified as high emitter by RS and the effectiveness of the test, that is: (n) = (m) x (d).

The share of vehicles identified by remote sensing as high emitters – including possible false positives - that are not checked via RSI due to capacity limitations are to be sent to a PTI station for further testing (o). This is multiplied by (1-(e)) to take into account the percentage of false positives (line (p) in the table below), that is vehicles that are flagged as high emitters by remote sensing but that at a second check are found emitting within the legal limit.

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[435] Relevant only for HDVs.

Of these vehicles, as in PMC4 (section 4.2.5) it is expected that half (50%) will be tampered and 50% faulty. PTI is assumed to only be able to capture 10% of tampered vehicles as a large part of them will be set to the pre-tampering stated before the inspection, while faulty ones will be captured with an effectiveness of 95%. The high emitting vehicles captured at the PTI (line (u) in the table below) are the combination of the tampered vehicles identified and the faulty vehicles identified.

The total high emitters identified are the sum of those captured by RSI and at PTI stations following their screening by remote sensing and plume chasing – in the case of HDVs only (line (v) in the table below). The percentage reduction in the share of high emitters, defined as the percentage of total high emitters identified divided by the baseline share of high emitters is provided in line (z) of the table below.

Table 231: Estimated impact of PM12 on the share of high emitters Euro VI HDVs, by age group, at EU level (relative to the baseline)

					Label	Calculation/ Assumption
Vehicle category	**N2/N3/M2/M3 Euro VI**					
MS affected	**All MSs**					
Age group	**0-4**	**5-9**	**10-14**	**15-19**		
Share of vehicle fleet in measure scope (per age group)	100%	100%	100%	100%		
Share of high emitters in the fleet in the baseline	**7.2%**	**8.8%**	**10.4%**	**12.0%**	**(a)**	**See the baseline section**
Maximum RSI capacity (% of whole fleet)	0.5%	0.5%	0.5%	0.5%	(b)	Assumption
Remote sensing (RS) capacity to identify faulty vehicles (% of high emitters correctly identified by RS)	70%	70%	70%	70%	(c)	Assumption
% high emitters correctly identifiable by NOx/PN RSI test	95%	95%	95%	95%	(d)	Assumption
Remote sensing and plume chasing false positives (% of the vehicles flagged as high emitters which are not real high emitters)	5%	5%	5%	5%	(e)	Assumption
Proportion of the fleet analysed by remote sensing	30%	30%	30%	30%	(f)	Assumption
Proportion of the fleet identified as high emitter by RS	**1.51%**	**1.85%**	**2.18%**	**2.52%**	**(g)**	**(g) = (f) x (c) x (a)**
Plume chasing capacity to identify faulty vehicles	95%	95%	95%	95%	(h)	Assumption
Share of fleet measured via plume chasing	3%	3%	3%	3%	(i)	Assumption
Share of fleet identified as high emitters by plume chasing	**0.21%**	**0.25%**	**0.30%**	**0.34%**	**(k)**	**(k) = (h) x (i) x (a)**
Total share of fleet identified as high emitters by remote sensing and plume chasing	**1.72%**	**2.10%**	**2.48%**	**2.86%**	**(l)**	**(l) = (k) + (g)**
Sent to RSI (pre-selected by RS)	0.5%	0.5%	0.5%	0.5%	(m)	if (l) <= (b), (m) =(l); otherwise (m) = (b)
Proportion of the real high emitters identified by RSI	**0.48%**	**0.48%**	**0.48%**	**0.48%**	**(n)**	**(n) = (m) x (d)**
Vehicles sent to PTI stations: vehicles flagged as high emitters	**1.22%**	**1.60%**	**1.98%**	**2.36%**	**(o)**	**(o) = (l) – (m)**

					Label	Calculation/ Assumption
Vehicle category	**N2/N3/M2/M3 Euro VI**					
MS affected	**All MSs**					
Age group	**0-4**	**5-9**	**10-14**	**15-19**		
by remote sensing and plume chasing but not inspected at RSI						
Vehicles sent to PTI stations which are actually high emitters	1.16%	1.52%	1.88%	2.24%	(p)	(p) = (o) x (1- (e))
Share of high emitters that are tampered	50%	50%	50%	50%	(q)	Assumption
Vehicles sent to PTI stations which are high emitters because they are tampered	0.58%	0.76%	0.94%	1.12%	(r)	(r) = (p) x (q)
PTI capacity to identify tampered vehicles	10%	10%	10%	10%	(s)	Assumption
NOx/PN -PTI test effectiveness	95%	95%	95%	95%	(t)	Assumption
High emitters identified at PTI stations	**0.61%**	**0.80%**	**0.99%**	**1.18%**	**(u)**	**(u) = (r) x (s)+(1-(r)) x (t)**
Total high emitters identified at PTI stations and RSI	**1.08%**	**1.27%**	**1.46%**	**1.65%**	**(v)**	**(v) = (u) + (n)**
% reduction in the share of high emitters (RS + RSI) relative to the baseline	**15.03%**	**14.46%**	**14.06%**	**13.78%**	**(z)**	**(z) = (v) / (a)**

Source: Ricardo et al. (2024), Impact assessment support study

Noise emissions from N1, M1, and L-vehicles

Acoustic cameras can be installed before a RSI site to optimise the detection rates of N1, M1, and L-vehicles emitting noise over the legal limit. Coupling with a PTI is a possibility; however, this is not expected to be particularly effective in all cases of tampered vehicles, as for motorcycles, for example, altering some parts of the exhaust system and reinstating their original settings is relatively easy (for instance, removing/re-installing the muffler).

The proportion of the fleet that is high emitters and is identifiable at RSI (line (e) in the table below) is derived as the product of the share of high emitters in the fleet in the baseline (line (a) in the table below), the remote sensing capacity of identifying faulty vehicles (line (d) in the table below), and the RSI noise test effectiveness (line (c) in the table below). The effectiveness assumed for the measurements at roadside is lower than the one assumed at PTI, to reflect the challenge of measuring in a noisy environment. The acoustic camera effectiveness is considered higher than noise measurements at roadside because it is the result of more than one measurement.

As only a portion (line (f) in the table below) of the fleet will be analysed by the acoustic cameras, the proportion of the fleet that is high emitters and is identifiable at RSI (line (g)) is derived as: (g) = (f) x (e), where the letters stand for the labels of the rows in the table below. However, the maximum percentage of noise high emitters eventually identified (line (h)) is limited by the RSI capacity (line (b)).

The table below summarises the steps and assumptions used to estimate the percentage reduction in the share of M1, N1, and L noise high emitting vehicles.

Table 232: Estimated impact of PM12 on the share of noise high emitters for N1, M1 vehicles, and motorcycles relative to the baseline

				Label	Calculation/ Assumption
Vehicle category	**N1**	**L3-L7**	**M1**		
MSs affected	**All MSs**	**All MSs**	**All MSs**		
Share of vehicle fleet in measure scope	100%	100%	100%		
Share of high emitters in the fleet in the baseline	4%	30%	4%	(a)	See the baseline section
Share of fleet selected via remote sensing and sent to RSI (i.e., maximum RSI capacity)	0.5%	5.0%	0.5%	(b)	Assumption
Noise test effectiveness	80%	80%	80%	(c)	Assumption
Remote sensing capacity to identify faulty vehicles (% of total)	70%	70%	70%	(d)	Assumption
Proportion of the fleet that is high emitters and is identified at RSI if 100% inspected of the fleet is analysed via RS and inspected at RSI	2.2%	16.8%	2.2%	(e)	(e) = (d) x (c) x (a)
Proportion of the fleet analysed by RS	30%	30%	30%	(f)	Assumption
Proportion of the fleet that is high emitters and is identifiable at RSI	0.7%	5.0%	0.7%	(g)	(g =(f) x (e)
High emitters identified at RSI with limited RSI capacity (RS+RSI)	0.5%	5.0%	0.5%	(h)	If (g) <= (b) then (h) = (g); Otherwise (h) = (b)
% reduction in the share of high emitters (remote sensing + RSI)	**12.5%**	**16.7%**	**12.5%**	(i)	(i) = (h) / (a)

Source: Ricardo et al. (2024), Impact assessment support study

4.2.13. PM14 - Extend the scope of application of roadside inspections to light commercial (N1) vehicles

PM14 extends the scope of application of roadside inspections to N1 vehicles, and sets 2% as target for the share of inspections of the N1 vehicle fleet. The introduction of roadside inspections of N1 category vehicles can contribute further to the identification of vehicles with defective or tampered emissions/noise control systems. To the extent that these roadside inspections are expected to be targeted (as is currently the case in most Member States), this can be a particularly effective measure in removing defective vehicles. PM14 is expected to have an impact on both air pollutant and noise emissions.

On the basis of the information available, few Member States (ES, HU, SE, SK and FI) already conduct roadside inspections for N1 vehicles, although without a certain target set and thus checking a low number of vehicles. For the purposes of the assessment it is assumed that these Member States will not be affected. The N1 vehicles fleet of the 22 Member States affected represent around 77% of the N1 vehicles fleet in the EU.

Depending on the age, Euro standard and fuel type, the share of air pollutant high emitter N1 vehicles ranges between 4% and 20% in the baseline. The share of noise high emitter N1 vehicles is estimated at 4% in the baseline. Of these, half are assumed to be tampered and half defective.

The RSI inspections would cover 2% of the N1 vehicle fleet annually in PM14. Due to the enhanced effectiveness as a result of the targeted nature of RSIs, the number of high emitters identified will, on average, be three times higher than if the inspections were completely random. Similar to the approach for assessing the impact on road safety, it is assumed that the effectiveness of roadside inspections in detecting high emitters is 95%.

PM14 is estimated to reduce by 5.7% the share of high emitter vehicles in the Member States affected relative to the baseline (4.4% at EU level).

Table 233: Estimated impact of PM14 on the share of high emitters of air pollutant emissions and noise

	Emissions	Noise	Label	Calculation
Share of EU fleet affected	77%		(a)	
Share of high emitters in the fleet in the baseline	4%-20% depending on age, Euro standard and fuel type	4%	(b)	
Share of fleet with defective emissions control system	2%-20%	2%	(c)	(c) = 50% x (b)
Share of fleet with tampered emission control system	2%-20%	2%	(d)	(c) = 50% x (b)
RSI fleet target	2%		(e)	
Parameter reflecting RSI enhanced capacity to identify defective vehicles	3		(f)	
Failure rate of inspections in detecting defective vehicles	5%		(g)	
% reduction in the share of high emitter vehicles (emissions/noise) in the MS affected, relative to the baseline	**5.7%**		**(h)**	**(h) = (e) x (f) x ((c) + (d)) x (1-(g)) / (b)**
% reduction in the share of high emitter vehicles at EU level relative to the baseline	**4.4%**		**(i)**	**(i) = (h) x (a)**

Source: Ricardo et al. (2024), Impact assessment support study

4.2.14. PM15 – Extend the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3)

PM15 extends the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3) and establishes a threshold of 1% of the vehicle fleet for roadside inspections. Few Member States (SE, SI, AT, FI, DK, HU, RO) already perform such inspections although they do not report the exact number of inspections of motorcycles separately and do not indicate a specific target. In the absence of more specific data it is assumed that these Member States will not be affected by

PM15. The L-category vehicle fleet of the 20 Member States affected is estimated to represent on average 92% of the L-category vehicle EU fleet over 2026-2050[436]. PM15 is expected to have an impact on air pollutant emissions and noise emissions.

The share of high emitters of air pollution and noise emissions in the baseline is assumed at 8% and 30%, respectively, based on limited information from the literature and the PTI data analysis (see baseline section).

Similar to the approach used for assessing the impacts on road safety, the failure rate of inspections in detecting defective vehicles is assumed at 5%. To reflect the enhanced effectiveness of RSI in targeting defective vehicles compared to PTI, a factor of 3 is used.

PM15 is estimated to reduce by 2.9% the share of high emitter vehicles in the Member States affected relative to the baseline (2.6% at EU level).

Table 234: Estimated impact of PM15 on the share of high emitters of air pollutant emissions and noise

	Emissions	Noise	Label	Calculation
Share of EU fleet affected	92%		(a)	
Share of high emitters in the fleet in the baseline	8%	30%	(b)	
Share of fleet with defective emissions control system	4%	15%	(c)	(c) = 50% x (b)
Share of fleet with tampered emission control system	4%	15%	(d)	(c) = 50% x (b)
Share of fleet checked in RSI	1%		(e)	
Parameter reflecting RSI enhanced capacity to identify defective vehicles	3		(f)	
Failure rate of inspections in detecting defective vehicles	5%		(g)	
% reduction in the share of high emitter vehicles (emissions/noise) in the MS affected, relative to the baseline	**2.9%**		**(h)**	**(h) = (e) x (f) x ((c) + (d)) x (1-(g)) / (b)**
% reduction in the share of high emitter vehicles at EU level relative to the baseline	**2.6%**		**(i)**	**(i) = (h) x (a)**

Source: Ricardo et al. (2024), Impact assessment support study

[436] The share is calculated based on the PRIMES-TREMOVE baseline projections.

4.2.15. *Impacts on air pollutant emissions and noise emissions by policy option*

Air pollutant emissions

On the basis of the analysis of the impacts of each individual measure, the combined impact of the measures for each policy option is estimated using the common residual method explained above. The tables below summarise the expected reduction in the share of high emitter vehicles relative to the baseline, by vehicle category, Euro standard and fuel type at EU level. They are provided separately for NOx and PN high emitter vehicles. These are used as inputs in the PRIMES-TREMOVE model to derive the reduction in the air pollution emissions and external costs of air pollution emissions relative to the baseline.

Table 235: Reduction in the share of NOx high emitter vehicles by policy option relative to the baseline

Vehicle category	Euro standard	Fuel	Age group	PO1a	PO1b	PO2	PO3
M1	**Euro 5**	**Diesel**	**0-4**	12.0%	29.2%	29.2%	29.2%
M1	**Euro 5**	**Diesel**	**5-9**	32.1%	42.3%	42.3%	42.3%
M1	**Euro 5**	**Diesel**	**10-14**	42.6%	54.3%	54.3%	54.3%
M1	**Euro 5**	**Diesel**	**15-19**	43.0%	54.2%	54.2%	54.2%
M1	**Euro 5**	**Petrol**	**0-4**	12.0%	26.9%	26.9%	26.9%
M1	**Euro 5**	**Petrol**	**5-9**	32.1%	41.6%	41.6%	41.6%
M1	**Euro 5**	**Petrol**	**10-14**	42.6%	54.0%	54.0%	54.0%
M1	**Euro 5**	**Petrol**	**15-19**	43.0%	54.0%	54.0%	54.0%
M1	**Euro 6**	**Diesel**	**0-4**	12.0%	29.2%	29.2%	29.2%
M1	**Euro 6**	**Diesel**	**5-9**	32.1%	42.3%	42.3%	42.3%
M1	**Euro 6**	**Diesel**	**10-14**	42.6%	54.3%	54.3%	54.3%
M1	**Euro 6**	**Diesel**	**15-19**	43.0%	54.2%	54.2%	54.2%
M1	**Euro 6**	**Petrol**	**0-4**	12.0%	27.2%	27.2%	27.2%
M1	**Euro 6**	**Petrol**	**5-9**	32.1%	41.6%	41.6%	41.6%
M1	**Euro 6**	**Petrol**	**10-14**	42.6%	54.0%	54.0%	54.0%
M1	**Euro 6**	**Petrol**	**15-19**	43.0%	54.0%	54.0%	54.0%
M1	**Euro 7**	**Diesel**	**0-4**	12.0%	29.6%	29.6%	29.6%
M1	**Euro 7**	**Diesel**	**5-9**	32.1%	44.3%	44.3%	44.3%
M1	**Euro 7**	**Diesel**	**10-14**	42.6%	55.4%	55.4%	55.4%
M1	**Euro 7**	**Diesel**	**15-19**	43.0%	55.4%	55.4%	55.4%
M1	**Euro 7**	**Petrol**	**0-4**	12.0%	29.6%	29.6%	29.6%
M1	**Euro 7**	**Petrol**	**5-9**	32.1%	43.9%	43.9%	43.9%
M1	**Euro 7**	**Petrol**	**10-14**	42.6%	55.2%	55.2%	55.2%
M1	**Euro 7**	**Petrol**	**15-19**	43.0%	54.9%	54.9%	54.9%
N1	**Euro 5**	**Diesel**	**0-4**	12.0%	37.4%	40.3%	40.3%
N1	**Euro 5**	**Diesel**	**5-9**	32.1%	50.5%	52.8%	52.8%
N1	**Euro 5**	**Diesel**	**10-14**	42.6%	53.9%	56.1%	56.1%
N1	**Euro 5**	**Diesel**	**15-19**	43.0%	54.0%	56.2%	56.2%
N1	**Euro 5**	**Petrol**	**0-4**	12.0%	36.7%	39.7%	39.7%
N1	**Euro 5**	**Petrol**	**5-9**	32.1%	50.2%	52.5%	52.5%
N1	**Euro 5**	**Petrol**	**10-14**	42.6%	53.7%	55.9%	55.9%
N1	**Euro 5**	**Petrol**	**15-19**	43.0%	53.8%	56.0%	56.0%

Vehicle category	Euro standard	Fuel	Age group	PO1a	PO1b	PO2	PO3
N1	**Euro 6**	**Diesel**	**0-4**	12.0%	37.4%	40.3%	40.3%
N1	**Euro 6**	**Diesel**	**5-9**	32.1%	50.5%	52.8%	52.8%
N1	**Euro 6**	**Diesel**	**10-14**	42.6%	53.9%	56.1%	56.1%
N1	**Euro 6**	**Diesel**	**15-19**	43.0%	54.0%	56.2%	56.2%
N1	**Euro 6**	**Petrol**	**0-4**	12.0%	36.7%	39.7%	39.7%
N1	**Euro 6**	**Petrol**	**5-9**	32.1%	50.2%	52.5%	52.5%
N1	**Euro 6**	**Petrol**	**10-14**	42.6%	53.7%	55.9%	55.9%
N1	**Euro 6**	**Petrol**	**15-19**	43.0%	53.8%	56.0%	56.0%
N1	**Euro 7**	**Diesel**	**0-4**	12.0%	40.1%	42.9%	42.9%
N1	**Euro 7**	**Diesel**	**5-9**	32.1%	51.9%	54.2%	54.2%
N1	**Euro 7**	**Diesel**	**10-14**	42.6%	54.9%	57.0%	57.0%
N1	**Euro 7**	**Diesel**	**15-19**	43.0%	54.8%	56.9%	56.9%
N1	**Euro 7**	**Petrol**	**0-4**	12.0%	38.8%	41.7%	41.7%
N1	**Euro 7**	**Petrol**	**5-9**	32.1%	51.3%	53.6%	53.6%
N1	**Euro 7**	**Petrol**	**10-14**	42.6%	54.4%	56.6%	56.6%
N1	**Euro 7**	**Petrol**	**15-19**	43.0%	54.4%	56.6%	56.6%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**0-4**	59.1%	65.2%	65.2%	65.2%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**5-9**	59.1%	65.0%	65.0%	65.0%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**10-14**	59.1%	64.8%	64.8%	64.8%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**15-19**	59.1%	64.7%	64.7%	64.7%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**0-4**	59.1%	66.5%	66.5%	66.5%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**5-9**	59.1%	66.0%	66.0%	66.0%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**10-14**	59.1%	65.7%	65.7%	65.7%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**15-19**	59.1%	65.5%	65.5%	65.5%
L3-L7			**All ages**	1.0%	1.7%	1.0%	5.1%

Source: Ricardo et al. (2024), Impact assessment support study

Table 236: Reduction in the share of PN high emitter vehicles by policy option relative to the baseline

Vehicle category	Euro standard	Fuel	Age group	PO1a	PO1b	PO2	PO3
M1	**Euro 5**	**Diesel**	**0-4**	7.5%	25.6%	25.6%	25.6%
M1	**Euro 5**	**Diesel**	**5-9**	20.6%	32.5%	32.5%	32.5%
M1	**Euro 5**	**Diesel**	**10-14**	37.8%	50.5%	50.5%	50.5%
M1	**Euro 5**	**Diesel**	**15-19**	38.1%	50.4%	50.4%	50.4%
M1	**Euro 5**	**Petrol**	**0-4**	7.5%	23.2%	23.2%	23.2%
M1	**Euro 5**	**Petrol**	**5-9**	20.6%	31.7%	31.7%	31.7%
M1	**Euro 5**	**Petrol**	**10-14**	37.8%	50.1%	50.1%	50.1%
M1	**Euro 5**	**Petrol**	**15-19**	38.1%	50.1%	50.1%	50.1%
M1	**Euro 6**	**Diesel**	**0-4**	7.5%	25.6%	25.6%	25.6%
M1	**Euro 6**	**Diesel**	**5-9**	20.6%	32.5%	32.5%	32.5%
M1	**Euro 6**	**Diesel**	**10-14**	37.8%	50.5%	50.5%	50.5%
M1	**Euro 6**	**Diesel**	**15-19**	38.1%	50.4%	50.4%	50.4%
M1	**Euro 6**	**Petrol**	**0-4**	7.5%	23.5%	23.5%	23.5%
M1	**Euro 6**	**Petrol**	**5-9**	20.6%	31.7%	31.7%	31.7%

Vehicle category	Euro standard	Fuel	Age group	PO1a	PO1b	PO2	PO3
M1	**Euro 6**	**Petrol**	**10-14**	37.8%	50.1%	50.1%	50.1%
M1	**Euro 6**	**Petrol**	**15-19**	38.1%	50.1%	50.1%	50.1%
M1	**Euro 7**	**Diesel**	**0-4**	7.5%	26.0%	26.0%	26.0%
M1	**Euro 7**	**Diesel**	**5-9**	20.6%	34.9%	34.9%	34.9%
M1	**Euro 7**	**Diesel**	**10-14**	37.8%	51.7%	51.7%	51.7%
M1	**Euro 7**	**Diesel**	**15-19**	38.1%	51.6%	51.6%	51.6%
M1	**Euro 7**	**Petrol**	**0-4**	7.5%	26.0%	26.0%	26.0%
M1	**Euro 7**	**Petrol**	**5-9**	20.6%	34.3%	34.3%	34.3%
M1	**Euro 7**	**Petrol**	**10-14**	37.8%	51.4%	51.4%	51.4%
M1	**Euro 7**	**Petrol**	**15-19**	38.1%	51.1%	51.1%	51.1%
N1	**Euro 5**	**Diesel**	**0-4**	8.1%	34.6%	37.7%	37.7%
N1	**Euro 5**	**Diesel**	**5-9**	22.7%	43.7%	46.3%	46.3%
N1	**Euro 5**	**Diesel**	**10-14**	33.4%	46.5%	49.1%	49.1%
N1	**Euro 5**	**Diesel**	**15-19**	33.7%	46.5%	49.1%	49.1%
N1	**Euro 5**	**Petrol**	**0-4**	8.1%	33.9%	37.0%	37.0%
N1	**Euro 5**	**Petrol**	**5-9**	22.7%	43.3%	46.0%	46.0%
N1	**Euro 5**	**Petrol**	**10-14**	33.4%	46.3%	48.8%	48.8%
N1	**Euro 5**	**Petrol**	**15-19**	33.7%	46.3%	48.9%	48.9%
N1	**Euro 6**	**Diesel**	**0-4**	8.1%	34.6%	37.7%	37.7%
N1	**Euro 6**	**Diesel**	**5-9**	22.7%	43.7%	46.3%	46.3%
N1	**Euro 6**	**Diesel**	**10-14**	33.4%	46.5%	49.1%	49.1%
N1	**Euro 6**	**Diesel**	**15-19**	33.7%	46.5%	49.1%	49.1%
N1	**Euro 6**	**Petrol**	**0-4**	8.1%	33.9%	37.0%	37.0%
N1	**Euro 6**	**Petrol**	**5-9**	22.7%	43.3%	46.0%	46.0%
N1	**Euro 6**	**Petrol**	**10-14**	33.4%	46.3%	48.8%	48.8%
N1	**Euro 6**	**Petrol**	**15-19**	33.7%	46.3%	48.9%	48.9%
N1	**Euro 7**	**Diesel**	**0-4**	8.1%	37.4%	40.4%	40.4%
N1	**Euro 7**	**Diesel**	**5-9**	22.7%	45.3%	47.9%	47.9%
N1	**Euro 7**	**Diesel**	**10-14**	33.4%	47.7%	50.2%	50.2%
N1	**Euro 7**	**Diesel**	**15-19**	33.7%	47.4%	49.9%	49.9%
N1	**Euro 7**	**Petrol**	**0-4**	8.1%	36.1%	39.1%	39.1%
N1	**Euro 7**	**Petrol**	**5-9**	22.7%	44.6%	47.2%	47.2%
N1	**Euro 7**	**Petrol**	**10-14**	33.4%	47.2%	49.7%	49.7%
N1	**Euro 7**	**Petrol**	**15-19**	33.7%	47.0%	49.5%	49.5%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**0-4**	48.7%	56.4%	56.4%	56.4%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**5-9**	50.6%	57.8%	57.8%	57.8%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**10-14**	54.4%	60.8%	60.8%	60.8%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**15-19**	54.5%	60.8%	60.8%	60.8%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**0-4**	48.7%	58.0%	58.0%	58.0%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**5-9**	50.6%	59.0%	59.0%	59.0%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**10-14**	54.4%	61.8%	61.8%	61.8%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**15-19**	54.5%	61.7%	61.7%	61.7%

Vehicle category	Euro standard	Fuel	Age group	PO1a	PO1b	PO2	PO3
L3-L7			**All ages**	1.0%	1.7%	1.0%	5.1%

Source: Ricardo et al. (2024), Impact assessment support study

Table 237: Share of NOx high emitter vehicles in the baseline and policy options

Vehicle category	Euro standard	Fuel	Age group	Baseline level	PO1a	PO1b	PO2	PO3
M1	**Euro 5**	**Diesel**	**0-4**	2.5%	2.2%	1.8%	1.8%	1.8%
M1	**Euro 5**	**Diesel**	**5-9**	5.0%	3.4%	2.9%	2.9%	2.9%
M1	**Euro 5**	**Diesel**	**10-14**	7.5%	4.3%	3.4%	3.4%	3.4%
M1	**Euro 5**	**Diesel**	**15-19**	10.0%	5.7%	4.6%	4.6%	4.6%
M1	**Euro 5**	**Petrol**	**0-4**	3.5%	3.1%	2.6%	2.6%	2.6%
M1	**Euro 5**	**Petrol**	**5-9**	6.5%	4.4%	3.8%	3.8%	3.8%
M1	**Euro 5**	**Petrol**	**10-14**	9.8%	5.6%	4.5%	4.5%	4.5%
M1	**Euro 5**	**Petrol**	**15-19**	13.0%	7.4%	6.0%	6.0%	6.0%
M1	**Euro 6**	**Diesel**	**0-4**	2.5%	2.2%	1.8%	1.8%	1.8%
M1	**Euro 6**	**Diesel**	**5-9**	5.0%	3.4%	2.9%	2.9%	2.9%
M1	**Euro 6**	**Diesel**	**10-14**	7.5%	4.3%	3.4%	3.4%	3.4%
M1	**Euro 6**	**Diesel**	**15-19**	10.0%	5.7%	4.6%	4.6%	4.6%
M1	**Euro 6**	**Petrol**	**0-4**	3.3%	2.9%	2.4%	2.4%	2.4%
M1	**Euro 6**	**Petrol**	**5-9**	6.5%	4.4%	3.8%	3.8%	3.8%
M1	**Euro 6**	**Petrol**	**10-14**	9.8%	5.6%	4.5%	4.5%	4.5%
M1	**Euro 6**	**Petrol**	**15-19**	13.0%	7.4%	6.0%	6.0%	6.0%
M1	**Euro 7**	**Diesel**	**0-4**	1.3%	1.1%	0.9%	0.9%	0.9%
M1	**Euro 7**	**Diesel**	**5-9**	3.0%	2.0%	1.7%	1.7%	1.7%
M1	**Euro 7**	**Diesel**	**10-14**	4.5%	2.6%	2.0%	2.0%	2.0%
M1	**Euro 7**	**Diesel**	**15-19**	5.0%	2.9%	2.2%	2.2%	2.2%
M1	**Euro 7**	**Petrol**	**0-4**	1.6%	1.4%	1.1%	1.1%	1.1%
M1	**Euro 7**	**Petrol**	**5-9**	3.3%	2.2%	1.8%	1.8%	1.8%
M1	**Euro 7**	**Petrol**	**10-14**	4.9%	2.8%	2.2%	2.2%	2.2%
M1	**Euro 7**	**Petrol**	**15-19**	6.5%	3.7%	2.9%	2.9%	2.9%
N1	**Euro 5**	**Diesel**	**0-4**	6.0%	5.3%	3.8%	3.6%	3.6%
N1	**Euro 5**	**Diesel**	**5-9**	9.0%	6.1%	4.5%	4.2%	4.2%
N1	**Euro 5**	**Diesel**	**10-14**	12.0%	6.9%	5.5%	5.3%	5.3%
N1	**Euro 5**	**Diesel**	**15-19**	15.0%	8.6%	6.9%	6.6%	6.6%
N1	**Euro 5**	**Petrol**	**0-4**	7.8%	6.9%	4.9%	4.7%	4.7%
N1	**Euro 5**	**Petrol**	**5-9**	11.7%	7.9%	5.8%	5.6%	5.6%
N1	**Euro 5**	**Petrol**	**10-14**	15.6%	9.0%	7.2%	6.9%	6.9%
N1	**Euro 5**	**Petrol**	**15-19**	19.5%	11.1%	9.0%	8.6%	8.6%
N1	**Euro 6**	**Diesel**	**0-4**	6.0%	5.3%	3.8%	3.6%	3.6%
N1	**Euro 6**	**Diesel**	**5-9**	9.0%	6.1%	4.5%	4.2%	4.2%
N1	**Euro 6**	**Diesel**	**10-14**	12.0%	6.9%	5.5%	5.3%	5.3%
N1	**Euro 6**	**Diesel**	**15-19**	15.0%	8.6%	6.9%	6.6%	6.6%
N1	**Euro 6**	**Petrol**	**0-4**	7.8%	6.9%	4.9%	4.7%	4.7%
N1	**Euro 6**	**Petrol**	**5-9**	11.7%	7.9%	5.8%	5.6%	5.6%

Vehicle category	Euro standard	Fuel	Age group	Baseline level	PO1a	PO1b	PO2	PO3
N1	Euro 6	Petrol	10-14	15.6%	9.0%	7.2%	6.9%	6.9%
N1	Euro 6	Petrol	15-19	19.5%	11.1%	9.0%	8.6%	8.6%
N1	Euro 7	Diesel	0-4	3.0%	2.6%	1.8%	1.7%	1.7%
N1	Euro 7	Diesel	5-9	4.5%	3.1%	2.2%	2.1%	2.1%
N1	Euro 7	Diesel	10-14	6.0%	3.4%	2.7%	2.6%	2.6%
N1	Euro 7	Diesel	15-19	7.5%	4.3%	3.4%	3.2%	3.2%
N1	Euro 7	Petrol	0-4	3.6%	3.2%	2.2%	2.1%	2.1%
N1	Euro 7	Petrol	5-9	4.4%	3.0%	2.1%	2.0%	2.0%
N1	Euro 7	Petrol	10-14	5.2%	3.0%	2.4%	2.3%	2.3%
N1	Euro 7	Petrol	15-19	6.0%	3.4%	2.7%	2.6%	2.6%
N2/N3/M2/M3	Euro VI	Diesel	0-4	7.2%	2.9%	2.5%	2.5%	2.5%
N2/N3/M2/M3	Euro VI	Diesel	5-9	8.8%	3.6%	3.1%	3.1%	3.1%
N2/N3/M2/M3	Euro VI	Diesel	10-14	10.4%	4.3%	3.7%	3.7%	3.7%
N2/N3/M2/M3	Euro VI	Diesel	15-19	12.0%	4.9%	4.2%	4.2%	4.2%
N2/N3/M2/M3	Euro 7	Diesel	0-4	3.6%	1.5%	1.2%	1.2%	1.2%
N2/N3/M2/M3	Euro 7	Diesel	5-9	4.4%	1.8%	1.5%	1.5%	1.5%
N2/N3/M2/M3	Euro 7	Diesel	10-14	5.2%	2.1%	1.8%	1.8%	1.8%
N2/N3/M2/M3	Euro 7	Diesel	15-19	6.0%	2.5%	2.1%	2.1%	2.1%
L3-L7			0-4	3.5%	3.5%	3.5%	3.5%	3.3%
L3-L7			5-9	6.5%	6.4%	6.4%	6.4%	6.2%
L3-L7			10-14	9.8%	9.6%	9.6%	9.6%	9.2%
L3-L7			15-19	13.0%	12.9%	12.8%	12.9%	12.3%

Source: Ricardo et al. (2024), Impact assessment support study

Table 238: Share of PN high emitter vehicles in the baseline and policy options

Vehicle category	Euro standard	Fuel	Age group	Baseline level	PO1a	PO1b	PO2	PO3
M1	Euro 5	Diesel	0-4	2.5%	2.3%	1.9%	1.9%	1.9%
M1	Euro 5	Diesel	5-9	5.0%	4.0%	3.4%	3.4%	3.4%
M1	Euro 5	Diesel	10-14	7.5%	4.7%	3.7%	3.7%	3.7%
M1	Euro 5	Diesel	15-19	10.0%	6.2%	5.0%	5.0%	5.0%
M1	Euro 5	Petrol	0-4	2.6%	2.4%	2.0%	2.0%	2.0%
M1	Euro 5	Petrol	5-9	5.2%	4.1%	3.6%	3.6%	3.6%
M1	Euro 5	Petrol	10-14	7.8%	4.9%	3.9%	3.9%	3.9%
M1	Euro 5	Petrol	15-19	10.4%	6.4%	5.2%	5.2%	5.2%
M1	Euro 6	Diesel	0-4	2.5%	2.3%	1.9%	1.9%	1.9%
M1	Euro 6	Diesel	5-9	5.0%	4.0%	3.4%	3.4%	3.4%
M1	Euro 6	Diesel	10-14	7.5%	4.7%	3.7%	3.7%	3.7%
M1	Euro 6	Diesel	15-19	10.0%	6.2%	5.0%	5.0%	5.0%
M1	Euro 6	Petrol	0-4	2.6%	2.4%	2.0%	2.0%	2.0%
M1	Euro 6	Petrol	5-9	5.2%	4.1%	3.6%	3.6%	3.6%
M1	Euro 6	Petrol	10-14	7.8%	4.9%	3.9%	3.9%	3.9%
M1	Euro 6	Petrol	15-19	10.4%	6.4%	5.2%	5.2%	5.2%
M1	Euro 7	Diesel	0-4	1.3%	1.2%	1.0%	1.0%	1.0%

Vehicle category	Euro standard	Fuel	Age group	Baseline level	PO1a	PO1b	PO2	PO3
M1	**Euro 7**	**Diesel**	**5-9**	3.0%	2.4%	2.0%	2.0%	2.0%
M1	**Euro 7**	**Diesel**	**10-14**	4.5%	2.8%	2.2%	2.2%	2.2%
M1	**Euro 7**	**Diesel**	**15-19**	5.0%	3.1%	2.4%	2.4%	2.4%
M1	**Euro 7**	**Petrol**	**0-4**	1.3%	1.2%	1.0%	1.0%	1.0%
M1	**Euro 7**	**Petrol**	**5-9**	2.6%	2.1%	1.7%	1.7%	1.7%
M1	**Euro 7**	**Petrol**	**10-14**	3.9%	2.4%	1.9%	1.9%	1.9%
M1	**Euro 7**	**Petrol**	**15-19**	5.2%	3.2%	2.5%	2.5%	2.5%
N1	**Euro 5**	**Diesel**	**0-4**	6.0%	5.5%	3.9%	3.7%	3.7%
N1	**Euro 5**	**Diesel**	**5-9**	9.0%	7.0%	5.1%	4.8%	4.8%
N1	**Euro 5**	**Diesel**	**10-14**	12.0%	8.0%	6.4%	6.1%	6.1%
N1	**Euro 5**	**Diesel**	**15-19**	15.0%	9.9%	8.0%	7.6%	7.6%
N1	**Euro 5**	**Petrol**	**0-4**	6.2%	5.7%	4.1%	3.9%	3.9%
N1	**Euro 5**	**Petrol**	**5-9**	9.4%	7.2%	5.3%	5.1%	5.1%
N1	**Euro 5**	**Petrol**	**10-14**	12.5%	8.3%	6.7%	6.4%	6.4%
N1	**Euro 5**	**Petrol**	**15-19**	15.6%	10.3%	8.4%	8.0%	8.0%
N1	**Euro 6**	**Diesel**	**0-4**	6.0%	5.5%	3.9%	3.7%	3.7%
N1	**Euro 6**	**Diesel**	**5-9**	9.0%	7.0%	5.1%	4.8%	4.8%
N1	**Euro 6**	**Diesel**	**10-14**	12.0%	8.0%	6.4%	6.1%	6.1%
N1	**Euro 6**	**Diesel**	**15-19**	15.0%	9.9%	8.0%	7.6%	7.6%
N1	**Euro 6**	**Petrol**	**0-4**	6.2%	5.7%	4.1%	3.9%	3.9%
N1	**Euro 6**	**Petrol**	**5-9**	9.4%	7.2%	5.3%	5.1%	5.1%
N1	**Euro 6**	**Petrol**	**10-14**	12.5%	8.3%	6.7%	6.4%	6.4%
N1	**Euro 6**	**Petrol**	**15-19**	15.6%	10.3%	8.4%	8.0%	8.0%
N1	**Euro 7**	**Diesel**	**0-4**	3.0%	2.8%	1.9%	1.8%	1.8%
N1	**Euro 7**	**Diesel**	**5-9**	4.5%	3.5%	2.5%	2.3%	2.3%
N1	**Euro 7**	**Diesel**	**10-14**	6.0%	4.0%	3.1%	3.0%	3.0%
N1	**Euro 7**	**Diesel**	**15-19**	7.5%	5.0%	3.9%	3.8%	3.8%
N1	**Euro 7**	**Petrol**	**0-4**	3.1%	2.9%	2.0%	1.9%	1.9%
N1	**Euro 7**	**Petrol**	**5-9**	4.7%	3.6%	2.6%	2.5%	2.5%
N1	**Euro 7**	**Petrol**	**10-14**	6.2%	4.2%	3.3%	3.1%	3.1%
N1	**Euro 7**	**Petrol**	**15-19**	7.8%	5.2%	4.1%	3.9%	3.9%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**0-4**	7.2%	3.7%	3.1%	3.1%	3.1%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**5-9**	8.8%	4.3%	3.7%	3.7%	3.7%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**10-14**	10.4%	4.7%	4.1%	4.1%	4.1%
N2/N3/M2/M3	**Euro VI**	**Diesel**	**15-19**	12.0%	5.5%	4.7%	4.7%	4.7%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**0-4**	3.6%	1.8%	1.5%	1.5%	1.5%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**5-9**	4.4%	2.2%	1.8%	1.8%	1.8%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**10-14**	5.2%	2.4%	2.0%	2.0%	2.0%
N2/N3/M2/M3	**Euro 7**	**Diesel**	**15-19**	6.0%	2.7%	2.3%	2.3%	2.3%
L3-L7			**0-4**	2.6%	2.6%	2.6%	2.6%	2.5%
L3-L7			**5-9**	5.2%	5.1%	5.1%	5.1%	4.9%
L3-L7			**10-14**	7.8%	7.7%	7.7%	7.7%	7.4%
L3-L7			**15-19**	10.4%	10.3%	10.2%	10.3%	9.9%

Source: Ricardo et al. (2024), Impact assessment support study

Noise emissions

On the basis of the analysis of the impacts of each individual measure, the combined impact of the measures for each policy option is estimated using the common residual method explained above. The tables below summarise the expected reduction in the share of noise high emitter vehicles relative to the baseline, by vehicle type and Member State. These are used as inputs in the PRIMES-TREMOVE model to derive the reduction in the external costs of noise emissions relative to the baseline.

Table 239: Reduction in the share of noise high emitter M1 vehicles by policy option relative to the baseline

	PO1a	PO1b	PO2	PO3
AT	0.0%	12.5%	12.5%	12.5%
BE	0.0%	12.5%	12.5%	12.5%
BG	0.0%	12.5%	12.5%	12.5%
CY	0.0%	12.5%	12.5%	12.5%
DE	0.0%	12.5%	12.5%	12.5%
EE	0.0%	12.5%	12.5%	12.5%
FI	0.0%	12.5%	12.5%	12.5%
FR	0.0%	12.5%	12.5%	12.5%
EL	0.0%	12.5%	12.5%	12.5%
HR	0.0%	12.5%	12.5%	12.5%
HU	0.0%	12.5%	12.5%	12.5%
IE	0.0%	12.5%	12.5%	12.5%
IT	0.0%	12.5%	12.5%	12.5%
LT	0.0%	12.5%	12.5%	12.5%
LU	0.0%	12.5%	12.5%	12.5%
LV	0.0%	12.5%	12.5%	12.5%
MT	0.0%	12.5%	12.5%	12.5%
NL	0.0%	12.5%	12.5%	12.5%
PL	0.0%	12.5%	12.5%	12.5%
PT	0.0%	12.5%	12.5%	12.5%
RO	0.0%	12.5%	12.5%	12.5%
SE	0.0%	12.5%	12.5%	12.5%
SI	0.0%	12.5%	12.5%	12.5%
SK	0.0%	12.5%	12.5%	12.5%
ES	0.0%	12.5%	12.5%	12.5%
DK	0.0%	12.5%	12.5%	12.5%
CZ	0.0%	12.5%	12.5%	12.5%

Source: Ricardo et al. (2024), Impact assessment support study

Table 240: Share of noise high emitter M1 vehicles in the baseline and policy options

	Baseline	PO1a	PO1b	PO2	PO3
AT	4.0%	4.0%	3.5%	3.5%	3.5%
BE	4.0%	4.0%	3.5%	3.5%	3.5%
BG	4.0%	4.0%	3.5%	3.5%	3.5%
CY	4.0%	4.0%	3.5%	3.5%	3.5%
DE	4.0%	4.0%	3.5%	3.5%	3.5%

	Baseline	PO1a	PO1b	PO2	PO3
EE	4.0%	4.0%	3.5%	3.5%	3.5%
FI	4.0%	4.0%	3.5%	3.5%	3.5%
FR	4.0%	4.0%	3.5%	3.5%	3.5%
EL	4.0%	4.0%	3.5%	3.5%	3.5%
HR	4.0%	4.0%	3.5%	3.5%	3.5%
HU	4.0%	4.0%	3.5%	3.5%	3.5%
IE	4.0%	4.0%	3.5%	3.5%	3.5%
IT	4.0%	4.0%	3.5%	3.5%	3.5%
LT	4.0%	4.0%	3.5%	3.5%	3.5%
LU	4.0%	4.0%	3.5%	3.5%	3.5%
LV	4.0%	4.0%	3.5%	3.5%	3.5%
MT	4.0%	4.0%	3.5%	3.5%	3.5%
NL	4.0%	4.0%	3.5%	3.5%	3.5%
PL	4.0%	4.0%	3.5%	3.5%	3.5%
PT	4.0%	4.0%	3.5%	3.5%	3.5%
RO	4.0%	4.0%	3.5%	3.5%	3.5%
SE	4.0%	4.0%	3.5%	3.5%	3.5%
SI	4.0%	4.0%	3.5%	3.5%	3.5%
SK	4.0%	4.0%	3.5%	3.5%	3.5%
ES	4.0%	4.0%	3.5%	3.5%	3.5%
DK	4.0%	4.0%	3.5%	3.5%	3.5%
CZ	4.0%	4.0%	3.5%	3.5%	3.5%

Source: Ricardo et al. (2024), Impact assessment support study

Table 241: Reduction in the share of noise high emitter N1 vehicles by policy option relative to the baseline

	PO1a	PO1b	PO2	PO3
AT	0.0%	12.5%	17.5%	17.5%
BE	0.0%	12.5%	17.5%	17.5%
BG	0.0%	12.5%	17.5%	17.5%
CY	0.0%	12.5%	17.5%	17.5%
DE	0.0%	12.5%	17.5%	17.5%
EE	0.0%	12.5%	17.5%	17.5%
FI	0.0%	12.5%	12.5%	12.5%
FR	0.0%	12.5%	17.5%	17.5%
EL	0.0%	12.5%	17.5%	17.5%
HR	0.0%	12.5%	17.5%	17.5%
HU	0.0%	12.5%	12.5%	12.5%
IE	0.0%	12.5%	17.5%	17.5%
IT	0.0%	12.5%	17.5%	17.5%
LT	0.0%	12.5%	17.5%	17.5%
LU	0.0%	12.5%	17.5%	17.5%
LV	0.0%	12.5%	17.5%	17.5%
MT	0.0%	12.5%	17.5%	17.5%
NL	0.0%	12.5%	17.5%	17.5%
PL	0.0%	12.5%	17.5%	17.5%

	PO1a	PO1b	PO2	PO3
PT	0.0%	12.5%	17.5%	17.5%
RO	0.0%	12.5%	17.5%	17.5%
SE	0.0%	12.5%	12.5%	12.5%
SI	0.0%	12.5%	17.5%	17.5%
SK	0.0%	12.5%	12.5%	12.5%
ES	0.0%	12.5%	12.5%	12.5%
DK	0.0%	12.5%	17.5%	17.5%
CZ	0.0%	12.5%	17.5%	17.5%

Source: Ricardo et al. (2024), Impact assessment support study

Table 242: Share of noise high emitter N1 vehicles in the baseline and policy options

	Baseline	PO1a	PO1b	PO2	PO3
AT	4.0%	4.0%	3.5%	3.3%	3.3%
BE	4.0%	4.0%	3.5%	3.3%	3.3%
BG	4.0%	4.0%	3.5%	3.3%	3.3%
CY	4.0%	4.0%	3.5%	3.3%	3.3%
DE	4.0%	4.0%	3.5%	3.3%	3.3%
EE	4.0%	4.0%	3.5%	3.3%	3.3%
FI	4.0%	4.0%	3.5%	3.5%	3.5%
FR	4.0%	4.0%	3.5%	3.3%	3.3%
EL	4.0%	4.0%	3.5%	3.3%	3.3%
HR	4.0%	4.0%	3.5%	3.3%	3.3%
HU	4.0%	4.0%	3.5%	3.5%	3.5%
IE	4.0%	4.0%	3.5%	3.3%	3.3%
IT	4.0%	4.0%	3.5%	3.3%	3.3%
LT	4.0%	4.0%	3.5%	3.3%	3.3%
LU	4.0%	4.0%	3.5%	3.3%	3.3%
LV	4.0%	4.0%	3.5%	3.3%	3.3%
MT	4.0%	4.0%	3.5%	3.3%	3.3%
NL	4.0%	4.0%	3.5%	3.3%	3.3%
PL	4.0%	4.0%	3.5%	3.3%	3.3%
PT	4.0%	4.0%	3.5%	3.3%	3.3%
RO	4.0%	4.0%	3.5%	3.3%	3.3%
SE	4.0%	4.0%	3.5%	3.5%	3.5%
SI	4.0%	4.0%	3.5%	3.3%	3.3%
SK	4.0%	4.0%	3.5%	3.5%	3.5%
ES	4.0%	4.0%	3.5%	3.5%	3.5%
DK	4.0%	4.0%	3.5%	3.3%	3.3%
CZ	4.0%	4.0%	3.5%	3.3%	3.3%

Source: Ricardo et al. (2024), Impact assessment support study

Table 243: Reduction in the share of noise high emitter L3-L7 vehicles by policy option relative to the baseline

	PO1a	PO1b	PO2	PO3
AT	0.0%	35.0%	35.0%	35.0%
BE	12.0%	48.0%	42.8%	51.5%

	PO1a	PO1b	PO2	PO3
BG	0.0%	35.0%	35.0%	36.9%
CY	0.0%	35.0%	35.0%	36.9%
DE	0.0%	16.7%	16.7%	19.0%
EE	0.0%	35.0%	35.0%	36.9%
FI	12.0%	48.0%	42.8%	50.1%
FR	0.0%	35.0%	35.0%	36.9%
EL	0.0%	35.0%	35.0%	36.9%
HR	0.0%	16.7%	16.7%	19.0%
HU	0.0%	35.0%	35.0%	35.0%
IE	12.0%	48.0%	42.8%	51.5%
IT	0.0%	35.0%	35.0%	36.9%
LT	0.0%	35.0%	35.0%	36.9%
LU	0.0%	35.0%	35.0%	36.9%
LV	0.0%	35.0%	35.0%	36.9%
MT	12.0%	48.0%	42.8%	51.5%
NL	12.0%	48.0%	42.8%	51.5%
PL	0.0%	35.0%	35.0%	36.9%
PT	12.0%	48.0%	42.8%	51.5%
RO	0.0%	35.0%	35.0%	35.0%
SE	0.0%	35.0%	35.0%	35.0%
SI	0.0%	35.0%	35.0%	35.0%
SK	0.0%	16.7%	16.7%	19.0%
ES	0.0%	16.7%	16.7%	19.0%
DK	0.0%	48.0%	35.0%	50.1%
CZ	0.0%	35.0%	35.0%	36.9%

Source: Ricardo et al. (2024), Impact assessment support study

Table 244: Share of noise high emitter L3-L7 vehicles in the baseline and policy options

	Baseline	PO1a	PO1b	PO2	PO3
AT	30.0%	30.0%	19.5%	19.5%	19.5%
BE	30.0%	26.4%	15.6%	17.2%	14.5%
BG	30.0%	30.0%	19.5%	19.5%	18.9%
CY	30.0%	30.0%	19.5%	19.5%	18.9%
DE	30.0%	30.0%	25.0%	25.0%	24.3%
EE	30.0%	30.0%	19.5%	19.5%	18.9%
FI	30.0%	26.4%	15.6%	17.2%	15.0%
FR	30.0%	30.0%	19.5%	19.5%	18.9%
EL	30.0%	30.0%	19.5%	19.5%	18.9%
HR	30.0%	30.0%	25.0%	25.0%	24.3%
HU	30.0%	30.0%	19.5%	19.5%	19.5%
IE	30.0%	26.4%	15.6%	17.2%	14.5%
IT	30.0%	30.0%	19.5%	19.5%	18.9%
LT	30.0%	30.0%	19.5%	19.5%	18.9%
LU	30.0%	30.0%	19.5%	19.5%	18.9%
LV	30.0%	30.0%	19.5%	19.5%	18.9%

	Baseline	PO1a	PO1b	PO2	PO3
MT	30.0%	26.4%	15.6%	17.2%	14.5%
NL	30.0%	26.4%	15.6%	17.2%	14.5%
PL	30.0%	30.0%	19.5%	19.5%	18.9%
PT	30.0%	26.4%	15.6%	17.2%	14.5%
RO	30.0%	30.0%	19.5%	19.5%	19.5%
SE	30.0%	30.0%	19.5%	19.5%	19.5%
SI	30.0%	30.0%	19.5%	19.5%	19.5%
SK	30.0%	30.0%	25.0%	25.0%	24.3%
ES	30.0%	30.0%	25.0%	25.0%	24.3%
DK	30.0%	30.0%	15.6%	19.5%	15.0%
CZ	30.0%	30.0%	19.5%	19.5%	18.9%

Source: Ricardo et al. (2024), Impact assessment support study

5. Impacts by policy option on safety, emissions and noise

5.1. Impacts on road safety

As explained in section 6.2.1 and in Annex 4 (section 4.1), given that the general objective of the initiative is to improve road safety in the EU, several measures to achieve this objective were included in the policy options. Direct impact on road safety is expected due to the more effective identification of vehicles with major and dangerous defects in the fleet, which should lead to the reduction of road crashes caused by technical defects and, as a result, to reduced fatalities and injuries (serious and light). Policy options also include other measures contributing to road safety, which relate to better implementation and enforcement of the roadworthiness legislation (such as the exchange of data among Member States' authorities).

Several assumptions were used to establish the impacts on road safety. They are explained in detail, by policy measure, in section 4.1 of Annex 4. These inputs[437] were subsequently used in the PRIMES-TREMOVE model to derive the impacts on the number of lives saved and injuries avoided. It should be noted that an important element in this assessment relates to the contribution of vehicle technical defects to road crashes. As explained in section 2.1.1, various studies indicate that their share as a contributing factor of the cause of crashes is between 3 and 19%, depending on the scope and methodology of the study; for motorcycles, it is 5% to 12% of crashes. For this assessment, a conservative approach was taken assuming a 4% contribution of technical defects on road crashes in the case of light-duty vehicles, heavy-duty vehicles and trailers and 6% in the case of motorcycles. Considering the uncertainty, a sensitivity analysis has been performed and is included in section 6 of Annex 4.

All policy options are expected to result in lives saved and injuries avoided relative to the baseline scenario. The table below provides the reduction in the number of fatalities and injuries relative to the baseline in 2030 and 2050, as well as the cumulative number of lives saved and injuries avoided relative to the baseline over the 2026-2050 horizon. Cumulatively, over the period 2026-2050, PO3 is expected to result in 7,013 lives saved, followed by PO2 (6,912 lives saved), PO1b (6,847 lives saved) and PO1a (4,661 lives saved). The numbers of severe and slight injuries avoided follow a similar pattern with PO3 having the highest impact, followed by PO2, PO1b, and PO1a.

[437] See more details in Annex 4 (section 4.1) on the inputs by measure and their aggregation into policy options.

Table 245: Expected reduction in the number of fatalities and injuries in the POs relative to the baseline, in 2030 and 2050, and cumulative reduction over the period 2026-2050

		Fatalities	Serious injuries	Slight injuries
PO1a	**2030**	195	1,768	9,929
	2050	173	1,587	9,011
	Cumulative over 2026-2050	**4,661**	**42,272**	**239,803**
	% reduction	**1.1%**	**1.2%**	**1.3%**
PO1b	**2030**	287	2,711	15,099
	2050	253	2,420	13,658
	Cumulative over 2026-2050	**6,847**	**64,640**	**364,155**
	% reduction	**1.6%**	**1.8%**	**1.9%**
PO2	**2030**	289	2,721	15,162
	2050	255	2,429	13,712
	Cumulative over 2026-2050	**6,912**	**64,885**	**365,665**
	% reduction	**1.6%**	**1.8%**	**1.9%**
PO3	**2030**	293	2,753	15,274
	2050	259	2,460	13,826
	Cumulative over 2026-2050	**7,013**	**65,686**	**368,498**
	% reduction	**1.6%**	**1.8%**	**2.0%**

Source: Ricardo et al. (2024), Impact assessment support study

It should be noted that the assessment of the impacts at option level has considered all synergies between policy measures included in the options, by vehicle category. As such, the impact of a policy measure may differ depending on whether it is assessed as part of a package or in isolation. While it is quite straightforward for assessing the costs and costs savings by policy measure and policy option, it is much more challenging to assess the impacts on the number of fatalities and injuries, and on external costs.

To split the impacts on lives saved and injuries avoided, and the respective external costs, by policy option and policy measure the synergies between measures need to be considered. One possibility would be to assess various combinations of measures and look at differences between such combinations. This would however result in a large number of policy options that is neither practical nor proportionate for the analysis. On the other hand, considering that the PRIMES-TREMOVE model calculates the impacts on road safety for each category of vehicle, an approximation of the impacts by policy option and policy measure can be derived based on: the difference between policy options where only one policy measure is related to a certain vehicle category (if relevant) and the inputs used for estimating the impacts on road safety by policy measure and the combined effect of measures, according to the common residual method. The table below presents the impacts on lives saved and injuries avoided, cumulatively over the period 2026-2050, by policy option and policy measure relative to the baseline.

Table 246: Expected cumulative reduction in the number of fatalities and injuries (over the period 2026-2050) by policy option and policy measure relative to the baseline

Policy option	Policy measure	Fatalities	Severe injuries	Slight injuries
PO1a	**Total**	**4,661**	**42,272**	**239,803**
	PMC2	4,643	42,137	239,239
	PM1	19	135	564
PO1b	**Total**	**6,847**	**64,640**	**364,155**
	PMC2	4,643	42,137	239,239
	PM2	60	430	1,726
	PM6	1,841	21,392	120,521
	PM13	304	681	2,669

Policy option	Policy measure	Fatalities	Severe injuries	Slight injuries
PO2	**Total**	**6,912**	**64,885**	**365,665**
	PMC2	4,643	42,137	239,239
	PM1	19	135	564
	PM6	1,841	21,392	120,521
	PM13	304	681	2,669
	PM14	105	540	2,671
PO3	**Total**	**7,013**	**65,686**	**368,498**
	PMC2	4,643	42,137	239,239
	PM3	71	552	2,004
	PM4	4	25	137
	PM6	1,841	21,392	120,521
	PM13	304	681	2,669
	PM14	105	540	2,671
	PM15	45	359	1,257

Source: Ricardo et al. (2024), Impact assessment support study

The most significant impact on road safety is estimated to come as a result of the new testing requirements in PTIs and roadside inspections, which will ensure that safety-related technologies to be fitted in new vehicles as required by the General Safety Regulation (GSR) operate as expected (PMC2). Due to inspections which will be able to detect defective ADAS systems there should be fewer road crashes and thus fewer fatalities and injuries. This measure is included in and has an impact on all policy options. In the case of **PO1a**, additional positive impacts are expected due to roadside inspection of motorcycles over 125cc for those Member States[438] where no PTI is currently in place for such motorcycles (PM1), assuming that they will choose this option instead of PTI.

For **PO1b**, in addition to the impacts of new testing requirements for safety-related technologies mandated by the GSR (PMC2), there are additional impacts expected from mandatory annual PTI testing of vehicles over 10-year-old (PM6), mandatory PTI for motorcycles over 125cc (PM2) and mandatory cargo securing inspections (PM13). The mandatory annual PTI testing of vehicles over 10-year-old (PM6) will lead to an increase of the PTI frequency in 11 Member States[439], and has the second most significant impact on road safety after PMC2. PM2 is expected to help in the identification of motorcycles over 125cc with significant safety defects during PTI inspections in those countries that do not apply this measure yet[440]. Mandatory inspections of cargo securing (PM13) should ensure that appropriate standards are applied across all the EU, thus contributing to the avoidance of accidents caused by cargo defects from HGVs (vehicle category N2/N3)[441]. In **PO2**, further positive, albeit smaller impact is expected due to the introduction of a systematic roadside inspection of vans (PM14), which has a high effectiveness in capturing defective N1 vehicles. Finally**,** **PO3** goes further in road-safety related measures and besides the impact of measures PMC2, PM6, PM13 and PM14, there is additional positive impact expected from the extended scope of PTI to all motorcycle over 50 cc (PM3), which would mean a higher share of these vehicles subject to PTI and

[438] BE, FI, IE, MT, NL, PT (DK already applies RSI for motorcycles and FR plans to introduce PTI in 2024).
[439] CY, DE, LT, CZ, DK, FR, EL, HU, IT, MT, SK
[440] BE, FI, IE, MT, NL, PT (FR is expected to introduce PTI in 2024 and is thus part of the baseline).
[441] This concerns only Member States (BE, BG, DK, DE, EE, FI, FR, IE, IT, LV, LU, NL, PL, PT) where there are no such inspections or no adequate standards in place yet.

a higher share of detected defects. Mandatory PTI for O1 and O2 light trailers[442] would affect around 21.5% of the total EU fleet of O1 trailers and around 9.3% of the O2 trailers (PM4). Extending the scope of roadside inspections to all 2- and 3-wheeled vehicles (PM15) with a target of 1% of the fleet is expected to bring an additional reduction of fatalities and serious injuries in comparison to baseline levels. It will cover most of the EU Member States except those[443] that indicated that they already have RSI inspections for motorcycles in place, although with no clearly stated target.

The table below provides the reduction in the external costs of accidents relative to the baseline, expressed as present value over the 2026-2050 period. The 2019 Handbook on the external costs of transport[444] was used to monetise the costs[445]. As a result of the positive impacts on lives saved and injuries avoided presented above, PO3 shows the highest impact in terms of reduction in the external costs of accidents relative to the baseline (expressed as present value over the 2026-2050 period), estimated at EUR 75.2 billion. It is followed by PO2 with EUR 74.2 billion, PO1b with EUR 73.9 billion, and PO1a with EUR 48.1 billion.

Table 247: Reduction in the external costs of accidents in the POs relative to the baseline, expressed as present value over the 2026-2050 horizon, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Fatalities	11,677	17,498	17,633	17,902
Serious injuries	21,348	33,235	33,299	33,821
Slight injuries	15,053	23,196	23,251	23,521
Total	**48,079**	**73,929**	**74,183**	**75,244**

Source: Ricardo et al. (2024), Impact assessment support study

The table below presents the impacts on external costs of accidents by policy option and policy measure relative to the baseline, expressed as present value over the 2026-2050 period. The split by policy measure considers the synergies between the measures included in the options. Considering the caveats explained above, this should be seen as an approximation of the impacts by policy measure.

Table 248: Reduction in the external costs of accidents by policy option and policy measure relative to the baseline, expressed as present value over the 2026-2050 horizon, in 2022 prices (million EUR)

Policy measure	PO1a	PO1b	PO2	PO3
PMC2	47,885	47,885	47,885	47,885
PM1	193		193	
PM2		615		
PM3				739
PM4				32
PM6		24,200	24,200	24,200
PM13		1,229	1,229	1,229
PM14			675	675
PM15				483

[442] Eleven Member States would be affected by PM4: 7 Member States where there is currently no requirement for PTI for either O1 or O2 (DK, EL, FI, FR, NL, IE, PT) and 4 Member States where there is currently only a requirement for PTI for O2 (PL, SK, BE and ES).
[443] SE, SI, AT, FI, DK, HU, RO
[444] https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1
[445] Based on the Handbook, the external cost of a fatality in 2022 prices is estimated at around EUR 3.5 million, that of a serious injury at around EUR 0.5 million and that of a slight injury at around EUR 0.04 million. These values are multiplied by the number of fatalities, serious and slight injuries, respectively, to monetise the external costs of accidents in the context of this impact assessment.

Policy measure	PO1a	PO1b	PO2	PO3
Total	**48,079**	**73,929**	**74,183**	**75,244**

Source: Ricardo et al. (2024), Impact assessment support study

5.2. Impacts on air pollution emissions and noise

Impacts on air pollutant emissions. As explained in section 6.3, the analysis of the impact on emissions has focused on the two pollutants that are targeted in the proposed measures, NOx and particulate matter (particulates). Other pollutants have not been considered although it is plausible that by targeting high emitters for these two pollutants, there will also be benefits related to other air pollutants (e.g. CO, HC, SO2). The measures included in the analysis having an impact on air pollutant emissions are targeted at high emitters of NOx and particulate matter in the vehicle fleet, which should be effectively identified and repaired.

All four policy options include the two measures aimed at NOx and particulate matter, PMC3 (mandatory PN testing) and PMC4 (NOx testing). All policy options include a combination of measures specific for motorcycles (PM1 and PM15 for roadside inspections, and PM2 and PM3 for PTI). In addition, all options but PO1a include more frequent emissions testing for vans (PM5), mandatory annual PTI for cars and vans older than 10 years (PM6), and NOx and PM measurement by remote sensing in roadside inspection of all vehicles and plume chasing in RSI of commercial vehicles (PM12).

It is expected that the proposed new testing methods under PMC3 and PMC4 (PN measurement and new NOx emissions testing) will be more effective in identifying high emitters than currently used methods such as opacity tests. This, combined with an increased scope and frequency of inspection, should in principle lead to a higher share of high emitters in the fleet identified. It is also expected that roadside inspections of air pollutants (as provided in PM1 and PM15 for motorcycles, and in PM14 for vans) will be very effective in identifying tampered vehicles since their owners will not be prepared for the specific inspection and, in the majority of the cases, will not have the time to deactivate the tampering device. In the case of measures related to PTI inspections (i.e., PM2 and PM3 for motorcycles) it can be expected that they are less effective in identifying tampered vehicles as the owners can remove or deactivate the tampering device before the PTI inspection and activate it again after the inspection. Detailed tables with the expected impact of the four policy options in terms of the expected level of reduction of high emitters in comparison to the baseline levels for each vehicle category with reference to the total EU fleet are provided in section 4.2.15 of Annex 4.

Regarding both NOx and particle matter emissions, PO1a has the least impact among all options, relative to the baseline, since it only includes common PTI measures PMC3 and PMC4 for PN and NOx measurement, respectively, and PM1. PO1b, PO2 and PO3 are all expected to have a higher impact than PO1a, in particular for light commercial vehicles (vans), as a result of the introduction of more frequent emission testing starting from the first year for vans (PM5) and the requirement of annual PTI for vehicles older than 10 years (PM6). Additional positive impacts of these three options should arise from the introduction of remote sensing and plume chasing (PM12). However, more positive impacts are expected for PO2 and PO3 due to the additional mandatory roadside inspection for vans (PM14). Compared to PO1b, PO2 has a higher total expected impact on emissions from PM1 due to assumed higher effectiveness of RSI inspections, especially in capturing tampered vehicles, while PTIs are considered less effective in capturing of tampered vehicles. In the case of PO3, the slightly higher level of impacts in comparison to PO2 comes from the broader scope of motorcycles to be covered by PTI (>50 cc, PM3).

The table below presents the expected impact on the level of emissions in comparison to the baseline for each policy option. PO2 and PO3 are expected to have the highest cumulative impact on air pollutants reduction over 2026-2050 (3,969 kilo-tonnes of NOx in PO2 and 3,970 kilo-tonnes of NOx in PO3, and 199 kilo-tonnes of PM in both PO2 and PO3), representing a decrease of 21% and 18.7% for NOx and PM, respectively, relative to the baseline. PO1b shows somewhat lower levels of emissions reductions (20.8% for NOx and 18.5% for PM). PO1a is expected to bring the least reduction of both air pollutants over the 2026-2050 period (3,176 kilo-tonnes of NOx, representing a 16.8% reduction relative to the baseline, and 135 kilo-tonnes of PM, representing 12.7% reduction).

Table 249: Impact on air pollutant emissions (kilo tonnes of NOx and PM2.5 avoided relative to the baseline in 2030 and in 2050, and cumulative over 2026-2050; % change in cumulative air pollution emissions relative to the baseline)

	2030	2050	Cumulative over 2026-2050	% change to baseline
NOx (kilo tonnes of NOx avoided)				
PO1a	200.5	12.1	3,176	-16.8%
PO1b	253.1	13.9	3,925	-20.8%
PO2	255.9	14.0	3,969	-21.0%
PO3	255.9	14.0	3,970	-21.0%
PM2.5 (kilo tonnes of PM avoided)				
PO1a	7.8	0.6	135	-12.7%
PO1b	12.0	0.8	196	-18.5%
PO2	12.1	0.8	199	-18.7%
PO3	12.1	0.8	199	-18.7%

Source: Ricardo et al. (2024), Impact assessment support study

The external cost savings due to the reduction of air pollutant emissions (NOx and PM) were calculated using the 2019 Handbook on the external costs of transport[446]. PO2 and PO3 are expected to lead to the highest levels of reduction in external costs, estimated at around EUR 76.1 billion, expressed as present value over the 2026-2050 period. This is slightly higher than PO1b (EUR 75.2 billion) and much higher than PO1a (EUR 58.7 billion). Results are presented in the table below.

Table 250: Reduction in the external costs of air pollutant emissions relative to the baseline, expressed as present value over 2026-2050, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Reduction in external costs related to NOx emissions	46,966	58,054	58,646	58,659
Reduction in external costs related to PM emissions	11,707	17,193	17,429	17,429
Total reduction in external costs of air pollutant emissions	**58,673**	**75,247**	**76,075**	**76,088**

Source: Ricardo et al. (2023), Impact assessment support study

Impact on noise emissions. The measures which are expected to have the highest impact on noise reduction are PM12, by the use of remote sensing with acoustic cameras, and PM10, through more advanced testing methods for motorcycles at PTI. Positive impact on noise reduction is also expected due to measures focusing on high emitters, such as the extension of scope of PTI to cover motorcycles (PM3, but also PM1 and PM2), and extending the roadside inspections to cover motorcycles (PM15) and light commercial (N1) vehicles (PM14). As in the case of exhaust gas aftertreatment systems, PTI on its own is not expected to have a sizeable impact on identifying tampering of noise control systems. Roadside inspections are generally expected to be a more effective tool, which was confirmed by the stakeholders that responded on this point during the consultations. The limiting

446 https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1

factor in this case is the capacity of roadside inspections to cover a large share of the fleet. Detailed explanations on the input by policy measure used to quantify the impacts are provided in section 4.2 of Annex 4.

When comparing the policy options, the impact on the reduction of high emitters and thereby on noise is expected to be the lowest in PO1a as it does not contain any measure directly targeted at noise (it has a small positive impact through PM1, the introduction of roadside checks for motorcycles in six Member States where they are not fully covered by PTI[447]). A higher impact is expected in the case of PO1b and PO2, combining more advanced noise testing in PTI (PM10) and use of remote sensing to support roadside inspections (PM12). For PO2 and PO3, additional positive impacts can also arise from the increase in roadside inspection of vans but the highest impacts in terms of noise reduction are expected in PO3, due to the mandatory RSI for motorcycles (PM15). The table below presents the estimated reduction in the external costs of noise for the four policy options, with PO3 providing the largest savings of around EUR 7.8 billion, expressed as present value over 2026-2050 relative to the baseline. PO1b and PO2 are expected to bring similar reductions in external noise cost (EUR 7.3 billion over the same period). The reduction under PO1a would be significantly lower (EUR 0.2 billion). As for the costs of accidents and air pollution, the external costs of noise were calculated using the PRIMES-TREMOVE model, based on the 2019 Handbook on the external costs of transport.

Table 251: Reduction in the external costs of noise emissions relative to the baseline, expressed as present value over 2026-2050, in 2022 prices (million EUR)

	PO1a	PO1b	PO2	PO3
Reduction in external costs related to noise emissions	154	7,323	7,319	7,757

Source: Ricardo et al. (2024), Impact assessment support study

6. TRADE-OFFS IN TERMS OF COSTS AND BENEFITS OF SOME KEY POLICY MEASURES

As explained in section 5.1 of Annex 4, the assessment of the impacts at option level has considered all synergies between policy measures included in the options, by vehicle category. As such, the impact of a policy measure may differ depending on whether it is assessed as part of a package or in isolation. While in this case this is quite straightforward for assessing the costs and costs savings by policy measure and policy option, it is much more challenging to assess the impacts on external costs.

To split the impacts on lives saved, injuries avoided, the reduction in air pollution and noise emissions and the respective external costs by policy option and policy measure, the synergies between measures need to be considered. One possibility would be to assess various combinations of measures and look at differences between such combinations. This would however result in a large number of policy options that is neither practical nor proportionate for the analysis. On the other hand, considering that the PRIMES-TREMOVE model calculates the impacts on road safety, air pollution and noise external costs corresponding to each category of vehicle, an approximation of the external costs savings by policy option and policy measure can be derived based on: (1) the difference between policy options where only one policy measure is related to a certain vehicle category (if relevant), (2) the inputs used for estimating the impacts on road safety and (3) the share of high-emitting vehicles by policy measure and the combined effect of measures, according to the common residual method.

While keeping in mind the caveats above, the tables below illustrate the benefits, costs, and benefits to costs ratio for policy measures related to motorcycles (see Table 252), for the policy measure related to trailers (see Table 253) and older vehicles (see Table 254), and for the policy measure

[447] BE, FI, IE, MT, NL, PL

related to odometer readings (see Table 255). All costs and benefits are expressed as present value over 2026-2050, relative to the baseline.

While the cost and benefits of the measures addressing motorcycles and trailers are rather limited (due to the relatively small number of Member States and number of vehicles affected), the impacts of testing cars and vans older than 10 years annually is much more significant. This is even more so for the policy measure related to odometer readings that shows the highest benefits.

Table 252: Benefits and costs for policy measures related to motorcycles, expressed as present value over 2026-2050 (in million EUR)

	Benefits and costs (present value, in million EUR)
PM1	
Benefits	**350.9**
External costs savings	350.9
Costs	**17.4**
Citizens	7.9
National public administrations	9.5
Benefits to costs ratio	**20.2**
PM2	
Benefits	**1,212.2**
External costs savings	918.1
Other benefits for PTI centres (increased number of inspections)	294.1
Costs	**502.7**
PTI centres	175.7
Citizens	294.1
National public administrations	32.9
Benefits to costs ratio	**2.4**
PM3	
Benefits	**1,477.8**
External costs savings	1,136.5
Other benefits for PTI centres (increased number of inspections)	341.3
Costs	**583.4**
PTI centres	203.9
Citizens	341.3
National public administrations	38.1
Benefits to costs ratio	**2.5**
PM15	
Benefits	**693.9**
External costs savings	693.9
Costs	**37.6**
Citizens	16.9
National public administrations	20.6
Benefits to costs ratio	**18.5**

Source: Ricardo et al. (2024), Impact assessment support study

Table 253: Benefits and costs for the policy measure related to trailers, expressed as present value over 2026-2050 (in million EUR)

	Benefits and costs (present value, in million EUR)
PM4	
Benefits	**558.8**
External costs savings	32.2
Other benefits for PTI centres (increased number of inspections)	526.6
Costs	**791.3**
PTI centres	225.4
Other businesses (vehicle owners)	385.1
Citizens	141.5
National public administrations	39.2
Benefits to costs ratio	**0.7**

Source: Ricardo et al. (2024), Impact assessment support study

For older vehicles (PM6), because of the high costs linked to additional investment in new PTI lanes and equipment, and, most importantly, additional human resources, the benefits to costs ratio is 1.4 when considering the economic benefits to PTI centres due to the increased number of inspections.

Table 254: Benefits and costs for the policy measure related to older vehicles (cars and vans), expressed as present value over 2026-2050 (in million EUR)

	Benefits and costs (present value, in million EUR)
PM6	
Benefits	**73,872.8**
External costs savings	37,335.2
Other benefits for PTI centres (increased number of inspections)	36,537.6
Costs	**54,218.4**
PTI centres	17,680.8
Other businesses (vehicle owners)	23,295.9
Citizens	13,241.7
Benefits to costs ratio	**1.4**

Source: Ricardo et al. (2024), Impact assessment support study

The policy measure related to odometer readings (PMC9) is estimated to lead to the highest benefits to costs ratio among the measures. This is due to the significant benefits expected for citizens and businesses (vehicle owners) due to the reduction in odometer fraud. Even if the effectiveness of the measure in reducing the number of vehicles with tampered odometers was significantly lower, the benefits and the efficiency of the measure is still expected to remain high.

Table 255: Benefits and costs for the policy measure related to odometer readings, expressed as present value over 2026-2050 (in million EUR) relative to the baseline

	Benefits and costs (present value, in million EUR)
PMC9	
Benefits	184,007.4
Other businesses (vehicle owners)	118,340.5
Citizens	65,666.9
Costs	2,638.0
Garages, motor vehicle dealers, tyre and repair stations, etc.	460.0
OEMs	55.9

	Benefits and costs (present value, in million EUR)
National public administrations	2,122.1
Benefits to costs ratio	**69.8**

Source: Ricardo et al. (2024), Impact assessment support study

7. Sensitivity analysis

Sensitivity analysis on contribution of technical defects to road crashes and share of high emitting vehicles of air pollution and noise in the fleet. As indicated in section 6.2.1, there is significant uncertainty around the contribution of technical defects to road crashes. The central assumption used is that 4% of road crashes are caused by technical defects in the case of cars, vans, heavy duty vehicles and trailers and 6% in the case of motorcycles. A sensitivity analysis has been performed to understand the implications of lower or higher contribution of technical defects to road crashes. The following cases have been assessed:

- Low case: 3% for motorcycles and 1% for all other categories;
- High case: 9% for motorcycles and 7% for all other vehicle categories.

In addition, considering the uncertainty of the share of high emitting vehicles of air pollution and noise in the fleet, the implications of alternative shares of high and low emitters in the baseline scenario have been assessed. More specifically, compared to the central case the following assumptions have been used:

- Low case: shares of high emitters 25% lower than in the baseline;
- High case: shares of high emitters 25% higher than in the baseline.

Subsequently, the impacts on external costs and the efficiency of the policy options is assessed for the low and high case, including both elements related to safety and emissions.

The table below presents the impacts on the external costs of accidents, air pollution and noise, in the low case, central case (i.e. central estimate used in the assessment) and high case.

Table 256: External costs savings by policy option in the low case, central case and high case, expressed as present value over 2026-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total external costs savings - low case	**91,372.4**	**116,754.9**	**117,340.6**	**118,216.9**
Reduction in external costs of air pollution emissions	42,119.0	55,690.0	56,322.0	56,332.0
Reduction in external costs of noise emissions	1,271.4	5,589.9	5,585.6	5,920.9
Reduction in external costs of accidents	47,982.0	55,475.0	55,433.0	55,964.0
Total external costs savings - central case	**106,906.2**	**156,499.4**	**157,577.4**	**159,088.7**
Reduction in external costs of air pollution emissions	58,673.0	75,247.0	76,075.0	76,088.0
Reduction in external costs of noise emissions	154.2	7,323.4	7,319.4	7,756.7
Reduction in external costs of accidents	48,079.0	73,929.0	74,183.0	75,244.0

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total external costs savings - high case	**126,790.2**	**197,380.7**	**198,932.4**	**201,093.3**
Reduction in external costs of air pollution emissions	76,510.0	95,745.0	96,758.0	96,774.0
Reduction in external costs of noise emissions	2,104.2	9,251.7	9,245.4	9,799.3
Reduction in external costs of accidents	48,176.0	92,384.0	92,929.0	94,520.0

Source: Ricardo et al. (2024), Impact assessment support study

The following table presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the low case, central case and high case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to change in the low case and high case relative to the central case estimates.

Table 257: Summary of costs and benefits of the policy options in the low case, central case and high case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Low case	282,344.8	347,977.0	351,341.5	355,230.4
Central case	297,878.6	387,721.5	391,578.3	396,102.2
High case	317,762.6	428,602.8	432,933.3	438,106.8
Net benefits				
Low case	275,041.5	282,184.7	285,437.6	286,631.5
Central case	290,575.3	321,929.3	325,674.4	327,503.3
High case	310,459.3	362,810.5	367,029.4	369,507.9
Benefits to costs ratio				
Low case	38.7	5.3	5.3	5.2
Central case	40.8	5.9	5.9	5.8
High case	43.5	6.5	6.6	6.4

Source: Ricardo et al. (2024), Impact assessment support study

Sensitivity analysis on odometer fraud. As explained in sections 6.1.2.4 and 6.1.3, it should be acknowledged that there is uncertainty regarding the economic damage caused by odometer fraud and the number of vehicles affected. For this reason, sensitivity analysis has been performed on the economic damage caused by odometer fraud and the number of vehicles affected.

With regard to the economic damage caused by odometer fraud, a central estimate of EUR 2,119 per vehicle has been used and it is explained in more detail in Annex 4 (section 2). The following cases have been assessed:

- Low economic damage case: 20% lower damage costs/costs savings per vehicle (EUR 1,696 per vehicle);
- High economic damage case: 20% higher damage costs/costs savings per vehicle (EUR 2,543 per vehicle).

Subsequently, the impacts on the benefits due to avoided odometer fraud and the efficiency of the policy options is assessed for the low economic damage and high economic damage case.

The table below presents the benefits due to avoided odometer fraud for national and cross-border sales, in the low economic damage case, central case (i.e. central estimate used in the assessment) and high economic damage case.

Table 258: Benefits due to avoided odometer fraud by policy option in the low economic damage case, central case and high economic damage case, expressed as present value over 2026-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Low economic damage case	147,205.9	147,205.9	147,205.9	147,205.9
National	52,718.5	52,718.5	52,718.5	52,718.5
Cross border	94,487.4	94,487.4	94,487.4	94,487.4
Central case	184,007.4	184,007.4	184,007.4	184,007.4
National	65,898.2	65,898.2	65,898.2	65,898.2
Cross border	118,109.2	118,109.2	118,109.2	118,109.2
High economic damage case	220,808.9	220,808.9	220,808.9	220,808.9
National	79,077.8	79,077.8	79,077.8	79,077.8
Cross border	141,731.1	141,731.1	141,731.1	141,731.1

Source: Ricardo et al. (2024), Impact assessment support study

The following table presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the low economic damage case, central case and high economic damage case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to change in the low economic damage case and high economic damage case relative to the central case estimates.

Table 259: Summary of costs and benefits of the policy options in the low economic damage case, central case and high economic damage case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Low economic damage case	261,077.0	350,920.0	354,776.4	359,300.6
Central case	297,878.5	387,721.5	391,577.8	396,102.1
High economic damage case	334,680.0	424,523.0	428,379.3	432,903.6
Net benefits				
Low economic damage case	253,773.7	285,127.7	288,872.5	290,701.7
Central case	290,575.2	321,929.2	325,674.0	327,503.2
High economic damage case	327,376.7	358,730.7	362,475.4	364,304.7
Benefits to costs ratio				
Low economic damage case	35.7	5.3	5.4	5.2
Central case	40.8	5.9	5.9	5.8
High economic damage case	45.8	6.5	6.5	6.3

Source: Ricardo et al. (2024), Impact assessment support study

With regard to the number of vehicles affected, the central assumptions used for the shares of vehicles with tampered odometers are provided in Annex 4 (section 2), Table 37. The following cases have been assessed:

- Fewer vehicles affected case: share of affected vehicles 20% lower than in the central case;

- More vehicles affected case: share of affected vehicles 20% higher than in the central case.

The table below presents the benefits due to avoided odometer fraud for national and cross-border sales, in the fewer vehicles affected case, central case (i.e. central estimate used in the assessment) and more vehicles affected case.

Table 260: Benefits due to avoided odometer fraud by policy option in the fewer vehicles affected case, central case and more vehicles affected case, expressed as present value over 2026-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Fewer vehicles affected case	147,205.9	147,205.9	147,205.9	147,205.9
National	52,718.5	52,718.5	52,718.5	52,718.5
Cross border	94,487.4	94,487.4	94,487.4	94,487.4
Central case	184,007.4	184,007.4	184,007.4	184,007.4
National	65,898.2	65,898.2	65,898.2	65,898.2
Cross border	118,109.2	118,109.2	118,109.2	118,109.2
More vehicles affected case	220,808.9	220,808.9	220,808.9	220,808.9
National	79,077.8	79,077.8	79,077.8	79,077.8
Cross border	141,731.1	141,731.1	141,731.1	141,731.1

Source: Ricardo et al. (2024), Impact assessment support study

The following table presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the fewer vehicles affected case, central case and more vehicles affected case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to change in the fewer vehicles affected case and more vehicles affected case relative to the central case estimates.

Table 261: Summary of costs and benefits of the policy options in the fewer vehicles affected case, central case and more vehicles affected case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	PO1b	PO2	PO3
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Fewer vehicles affected case	261,077.0	350,920.0	354,776.4	359,300.6
Central case	297,878.5	387,721.5	391,577.8	396,102.1
More vehicles affected case	334,680.0	424,523.0	428,379.3	432,903.6
Net benefits				
Fewer vehicles affected case	253,773.7	285,127.7	288,872.5	290,701.7
Central case	290,575.2	321,929.2	325,674.0	327,503.2
More vehicles affected case	327,376.7	358,730.7	362,475.4	364,304.7
Benefits to costs ratio				
Fewer vehicles affected case	35.7	5.3	5.4	5.2
Central case	40.8	5.9	5.9	5.8
More vehicles affected case	45.8	6.5	6.5	6.3

Source: Ricardo et al. (2024), Impact assessment support study

The number of vehicles affected in 2026, 2030, 2040 and 2050 in the fewer vehicles affected case, central case and more vehicles affected case is further provided in the table below.

Table 262: Number of vehicles affected in 2026, 2030, 2040 and 2050 in the fewer vehicles affected case, central case and more vehicles affected case

	Difference to the baseline			
	2026	2030	2040	2050
Fewer vehicles affected case				
National second hand sales with mileage fraud (million vehicles)	1.30	1.37	1.52	1.52
Cross border sales with mileage fraud (million vehicles)	2.55	2.68	2.87	2.91
National mileage fraud avoidance (million vehicles)	1.26	1.33	1.48	1.47
Cross border mileage fraud avoidance (million vehicles)	2.29	2.41	2.58	2.62
Central case				
National second hand sales with mileage fraud (million vehicles)	1.63	1.71	1.90	1.90
Cross border sales with mileage fraud (million vehicles)	3.18	3.35	3.59	3.64
National mileage fraud avoidance (million vehicles)	1.58	1.66	1.85	1.84
Cross border mileage fraud avoidance (million vehicles)	2.87	3.01	3.23	3.28
More vehicles affected case				
National second hand sales with mileage fraud (million vehicles)	1.96	2.06	2.28	2.28
Cross border sales with mileage fraud (million vehicles)	3.82	4.02	4.30	4.37
National mileage fraud avoidance (million vehicles)	1.90	1.99	2.22	2.21
Cross border mileage fraud avoidance (million vehicles)	3.44	3.61	3.87	3.93

Source: Ricardo et al. (2024), Impact assessment support study

In addition, the ***combined impact of the economic damage caused by odometer fraud and vehicles affected*** has been assessed as follows:

- Low economic damage and vehicles affected case: 20% lower damage costs/costs savings per vehicle (EUR 1,696 per vehicle) and the share of affected vehicles 20% lower than in the central case;
- High economic damage and vehicles affected case: 20% higher damage costs/costs savings per vehicle (EUR 2,543 per vehicle) and the share of affected vehicles 20% higher than in the central case.

Subsequently, the impacts on the benefits due to avoided odometer fraud and the efficiency of the policy options is assessed for the low economic damage and vehicles affected case and for the high economic damage and vehicles affected case.

The table below presents the benefits due to avoided odometer fraud for national and cross-border sales, in the low economic damage and vehicles affected case, central case (i.e. central estimate used in the assessment) and high economic damage and vehicles affected case.

Table 263: Benefits due to avoided odometer fraud by policy option in the low economic damage and vehicles affected case, central case and high economic damage and vehicles affected case, expressed as present value over 2026-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Low economic damage and vehicles affected case	117,764.7	117,764.7	117,764.7	117,764.7
National	42,174.8	42,174.8	42,174.8	42,174.8
Cross border	75,589.9	75,589.9	75,589.9	75,589.9
Central case	184,007.4	184,007.4	184,007.4	184,007.4
National	65,898.2	65,898.2	65,898.2	65,898.2
Cross border	118,109.2	118,109.2	118,109.2	118,109.2
High economic damage and vehicles affected case	264,970.6	264,970.6	264,970.6	264,970.6
National	94,893.4	94,893.4	94,893.4	94,893.4
Cross border	170,077.3	170,077.3	170,077.3	170,077.3

Source: Ricardo et al. (2024), Impact assessment support study

The following table presents the impacts on total benefits, net benefits and benefits to costs ratio by policy option in the low economic damage and vehicles affected case, central case and high economic damage and vehicles affected case. It shows that all policy options are expected to result in net benefits under the three cases considered. It also shows that the ranking of the policy options is not expected to significantly change in the low economic damage and vehicles affected case and high economic damage and vehicles affected case relative to the central case estimates.

Table 264: Summary of costs and benefits of the policy options in the low economic damage and vehicles affected case, central case and high economic damage and vehicles affected case, expressed as present value over 2025-2050 compared to the baseline (in million EUR, in 2022 prices)

	Difference to the Baseline			
	PO1a	**PO1b**	**PO2**	**PO3**
Total costs	7,303.3	65,792.3	65,903.9	68,598.9
Total benefits				
Low economic damage and vehicles affected case	231,635.9	321,478.8	325,335.2	329,859.5
Central case	297,878.5	387,721.5	391,577.8	396,102.1
High economic damage and vehicles affected case	378,841.8	468,684.7	472,541.1	477,065.4
Net benefits				
Low economic damage and vehicles affected case	224,332.5	255,686.6	259,431.3	261,260.6
Central case	290,575.2	321,929.2	325,674.0	327,503.2
High economic damage and vehicles affected case	371,538.5	402,892.5	406,637.2	408,466.5
Benefits to costs ratio				
Low economic damage and vehicles affected case	31.7	4.9	4.9	4.8
Central case	40.8	5.9	5.9	5.8
High economic damage and vehicles affected case	51.9	7.1	7.2	7.0

Source: Ricardo et al. (2024), Impact assessment support study

8. TESTING TECHNOLOGIES

It should be noted that most of the technologies required for more advanced testing in the policy measures are available. However certain test methods need to be developed. This is true for electric vehicles, advanced driver assistance systems, as well as for testing the emissions of modern vehicles. Although electric vehicles have now been subject to PTI for some time, the PTI Directive has no specific provision to test high-voltage systems and thus the risks associated with them. Certain Member States have applied their own test methods but there is scope for harmonising the items to be checked as well as the methods used. An overview of the main technologies/test methods relevant for specific measures is provided in the table below.

Table 265: Technology/methods required by specific policy measures

Measure	Technology/test procedure required	Current status
PMC1	Visual testing and tools to measure insulation resistance and equipotential bonding	This technology and equipment already exists (see for example: https://www.hioki.com/euro-en/learning/applications/detail/id_n1265994) – a number of stakeholders confirmed this (e.g. TUV, ARBO, CITA, FSD) but indicated that they do not take place in general as this is not required for roadworthiness testing. See also: https://citainsp.org/wp-content/uploads/2023/06/CITA_WP_BEV_REV1_15062023_FINAL.pdf A recent proposal from FR focused on visual inspection on the basis that this is faster/cheaper and, in FR's view, sufficient.
PMC2	PTI scan tool	Already exists and being used, though not as widely and regularly as it could be. PTI centres are required to have scan tools since May 2023 only and their use is optional. As such, only a few MSs have made use of it for testing electronic safety systems or checking the status of emission control systems. An ISO standard describing the checks of safety-related systems has only been developed recently.
PMC3	PN testing equipment	Already exists and has been used by three Member States that have made PN testing a requirement. Most other Member States did not indicate a clear intention to introduce these existing test methods as requirement.
PMC4	NOx testing equipment and standardised testing procedure	NOx testing procedures exist but JRC is still working on a test method. Current experience (e.g. Flanders) suggest that this is expensive but over time and with large scale adoption costs may come down. Cost can also be a barrier for PTI adoption given the consideration that PTI should not be an expensive test. The intention is to combine this test with the PN test.
PMC6	Digital technology for electronic roadworthiness certificate	Generally available – not barrier/issue for adoption besides investment costs
PM7	Need to apply advanced testing of suspension (damping efficiency of shock absorbers) for all vehicles and specific	Relevant equipment and testing methods are in place and used in some Member States (according to SE, DE authorities and CITA). Reason for no broader adoption is mainly the cost.

Measure	Technology/test procedure required	Current status
	braking test (extrapolation method) for HDVs.	
PM10	Advance noise testing similar to pass-by noise test described in the UN Regulation no. 41	Existing technology already used in some Member States (DE, ES, HR and SK). A barrier for broader adoption is the cost of equipment and/or requirements for ensuring silence (according to Dutch authorities, EGEA) that may require additional investment.
PM12	Remote sensing, plume chasing equipment for NOx and PM and acoustic cameras for noise	Technologies already exist and also methodologies are in place. Main barrier for adoption is the reliability of the methods along with investment cost, and the fact that they are not seen by some stakeholders as replacing PTI (e.g. TUV (DE), AECA-ITV (BE)) but as complementary (AEEC refers to a few member states (DK, BE) that have tried remote sensing or plume chasing). There is no clear indication of expected broader uptake at Member State level. FI indicated that the approach should not become mandatory and ES that they do not see this as priority for RSI.
PM16	No specific technologies needed – digital technologies already in place	Barrier for broader adoption is the cost/investment needed. Most authorities supported the measure in principle but proposed that it should not be mandatory (e.g. NL, DE, FI, SI, NO, SK, LV) although others prefer it to be mandatory (ES, SE, HR).

ANNEX 5: COMPETITIVENESS CHECK

1. OVERVIEW OF IMPACTS ON COMPETITIVENESS

Dimensions of Competitiveness	Impact of the initiative (++ / + / 0 / - / -- / n.a.)	References to sub-sections of the main report or annexes
Cost and price competitiveness	0/+	6.1.2, 6.1.4 and Annex 4 (section 3)
International competitiveness	n.a.	n.a.
Capacity to innovate	+	6.1.5
SME competitiveness	0/+	6.1.6 and Annex 10

2. SYNTHETIC ASSESSMENT

Cost and price competitiveness

PTI centres and businesses that own and use light and heavy-duty vehicles are expected to face significant costs related to additional testing requirements and data governance in PO2. Total one-off costs for PTI centres have been estimated at EUR 3.3 billion. Recurrent costs are expected to amount to EUR 20.2 billion for PTI centres and EUR 25.7 billion for other businesses (vehicle owners), expressed as present value over 2026-2050 relative to the baseline. Vehicle manufacturers, and garages will face comparatively lower costs (one-off costs: EUR 20 million for vehicle manufacturers and EUR 149.2 million for garages; recurrent administrative costs: EUR 35.9 million for vehicle manufacturers and EUR 310.8 million for garages).

At the same time, PTI centres will benefit from administrative cost savings (EUR 1.6 billion, expressed as present value over 2026-2050 relative to the baseline) and, more importantly, the expectation of new business creation and thus revenues (EUR 39.1 billion). Total net benefits for PTI centres are estimated at EUR 17.3 billion, expressed as present value over 2026-2050 relative to the baseline. As shown in section 6.1.2.1 (Table 11), net benefits per PTI centre would represent around 6.3% of the turnover. It is further expected that PTI centres may be able to pass on the incurred costs related to investments in equipment to vehicle owners (businesses and citizens). This will vary from Member State to Member State and depend on whether PTI prices are regulated or not, as well as on the type of contract/agreement PTI providers have with the competent national authority. Thus, PO2 is expected to lead to an increase in the profitability of PTI centres.

As explained above, additional costs are expected to arise for businesses that own and use light and heavy-duty vehicles, either because of the expected increase in the frequency and costs of PTI or the extra time spent during roadside inspections. These will be more than counterbalanced by cost savings and other benefits, in particular by the benefits due to avoided odometer fraud. The net benefits for businesses that own and use light and heavy-duty vehicles are estimated at EUR 94 billion, expressed as present value over 2026-2050 relative to the baseline.

Vehicle manufacturers and garages will face comparatively lower costs, as explained above, and no costs savings, resulting in net costs of EUR 55.9 million and EUR 460 million, respectively, expressed as present value over 2026-2050 relative to the baseline.

International competitiveness

This initiative has no evident impact on the international competitiveness of EU businesses related to the provision of PTI services that need to take place in the EU. Non-EU businesses in the specific sector cannot be expected to benefit. Since the corresponding test requirements would be first introduced in the EU, garage equipment and other testing equipment manufacturers could benefit from a possible first mover advantage that can also arise for EU manufacturers. However, the measures and requirements should apply equally to European and non-European manufacturers, to the extent that they have equal access to the EU market on the basis of the EU standards. Finally, EU based transport operators and other business that use vehicles on a frequent basis may experience some extra costs as a result of the more demanding measures and time spent during roadside inspections but would at the same time benefit significantly from the avoided odometer fraud. Transport operators from third countries active in Europe may benefit from some reduced PTI costs in comparison to their EU competitors although they can still be subject to roadside inspections by authorities.

Put together, there is no evidence of a strong positive or strong negative impact on international competitiveness. Businesses in equipment manufacturing sectors may benefit from the first mover advantage while transport operators may face stricter PTI requirements that will not arise for their counterparts outside Europe but active in Europe. Those non-EU hauliers will however equally be subject to more advanced roadside inspections. These positive or negative impacts are expected to be limited.

Capacity to innovate

As explained in section 6.1.5, positive impacts on innovation are expected from requiring more stringent and advanced test methods that also need to be adjusted to the general requirement for a PTI to be quick, simple and affordable. The initiative would provide garage and testing equipment manufacturers with new opportunities, mainly on the basis of increased demand that will arise from the implementation of the policy measures. The measures outlined will largely rely on existing measurement and testing technologies, which are not expected to require significant innovation in design. However, they can still be expected to require adaptations and further improvements to meet the needs of PTI and roadside inspections, facilitating process innovation. There will also be a need to establish and implement the accompanying standards for the widespread adoption of the measurement and testing methods related to NOx and PN measurements, remote sensing, the use of ePTI and noise measurement, which can further facilitate their adoption but can also provide the basis for the development of alternative, competing, solutions. To the extent that there is eventually a broader adoption of such technologies, a possible first mover advantage can arise for EU manufacturers. However, in principle, it should benefit equally European and non-European manufacturers, to the extent that they have equal access to the EU market based on the EU standards set.

The consulted stakeholders expect a positive impact on the innovative capacity of the sectors affected from measures related to new PTI/RSI test requirements, improved access and exchange of information and the digitalisation of vehicle documents.

Furthermore, increased demand for new test methods and equipment can be expected to generate further development of relevant technologies by developers of measurement equipment, a viewpoint supported by the representatives of the sector in their contribution to the stakeholder consultation.

Together with that, relevant training of inspectors to the new test methods will enhance the availability of technical skills and expertise that can have a broader positive impact. As such, most of the common measures are expected to have some positive impact on innovation (PMC1 on the testing of electric vehicles, PMC2 using ePTI, PMC3 and PMC4 on new emission tests, PMC6 on digital PTI certificates, and PMC7 on more efficient exchange of vehicle data).

While in the case of PO1a the digitalisation of the registration certificates (PM16) may require further innovation, PO1b would introduce remote sensing and plume chasing (PM12) to monitor air pollutants and noise emitted by vehicles. Remote sensing also relies on existing technologies but requires adaptations to scale them up to cover the desired share of the vehicle fleet. Deploying these technologies at a larger scale than today would also necessitate process innovation. PO2 and PO3 combine the benefits of both measures.

SME competitiveness

As explained in Annex 10 and in section 6.1.6, for PTI centres, while it was not possible to split the costs and benefits between SME and others due to the lack of data, a large part of costs and benefits are expected to be attributed to SMEs. In PO2, net benefits for *PTI centres* are expected to represent around 6.3% of the turnover.

Garage equipment manufacturers are expected to benefit from additional business opportunities linked to higher demand for testing equipment, although such impacts were not possible to quantify.

Garages, motor vehicle dealers, tyre and repair workshops, etc., mostly SMEs, will be affected by the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory (PMC9). As explained in section 6.1.2.2, total one-off and recurrent administrative costs would amount to EUR 460 million (EUR 706 per company), expressed as present value over 2026-2050.

For *businesses owning vehicles*, as explained in section 6.1.2.4, PO2 is expected to result in net benefits estimated at EUR 94 billion, expressed as present value over 2025-2050 relative to the baseline. Based on the available information, it was however not possible to assess how many of the businesses owning vehicles are SMEs. Only few of the measures in PO2 are expected to affect the road haulage sector largely composed of SMEs (e.g., PM13 on cargo securing inspections, which would result in minimal costs, while hauliers could also benefit from the savings of avoided emission tests at PTI after having passed a RSI or a remote sensing check). The overall impact on the road haulage sector is expected to be limited but rather positive, although the available data did not allow a split of the costs and benefits between the two groups of operators (i.e., SME and others).

ANNEX 6: BACKGROUND ON ROADWORTHINESS LEGISLATION AND PTI ORGANISATION IN MEMBER STATES

This annex provides background information related to:

- the evolution of the EU roadworthiness legislation;
- the way PTI is organised in Member States;
- the average prices of PTI in Member States.

1. EVOLUTION OF EU ROADWORTHINESS LEGISLATION

Figure 9: Road safety policy and PTI in the EU

Source: EUR-Lex, DEKRA presentation, CITA International Conference 2023, Rotterdam

2. ORGANISATION OF PTI IN MEMBER STATES

Table 266: Periodic technical inspection in Member States, passenger cars

Country	Frequency (in years)	Conducted by	Country	Frequency (in years)	Conducted by
Austria	3-2-1-1-	A	Ireland	4-2-2-2-1-1	B
Belgium	4-1-1-1-	B	Italy	4-2-2-2-	D
Bulgaria	3-2-1-1-		Lithuania	3-2-2-2	B
Cyprus	4-2-2-2-	B	Luxembourg	4-2-1-1-	B
Czechia	4-2-2-2-		Latvia	2-2-1-1-	B & C & D
Germany	3-2-2-2-	B	Malta	4-2-2-2-	B
Denmark	4-2-2-2-		The Netherlands	Petrol/electric 4-2-2-1-1 diesel/other 3-1-1-1	A
Estonia	4-2-2-2-1	B	Poland	3-2-1-1-	B
Greece	4-2-2-2-	B & D	Portugal	4-2-2-1-	B
Spain	4-2-2-2-1-	B & D	Romania	3-2-2-2-2-1-	B & D
Finland	4-2-2-2-1-	B	Sweden	3 years – 2 years – 14 months – 14 months – 14 months	B
France	4-2-2-2-	B	Slovenia	4-2-2-1-	B
Croatia	2-1-1-1-	B	Slovakia	4-2-2-2-	B
Hungary	4-2-2-2-	B & D			

A: Commercial garages: commercial garages that are also allowed to carry out repairs
B: Private inspection centres: privately owned vehicle inspection centres
C: Central Licencing Authority: the central licencing authority in the country
D: Public inspection centres: governmental owned vehicle inspection centres
Sources: *https://road-safety.transport.ec.europa.eu/road-safety-member-states/roadworthiness-certificate-and-proof-test_en*, *https://www.ereg-association.eu/publications/the-vehicle-and-driver-chain-in-europe/*

3. Overview of PTI consumer prices in EU Member States

Table 267: PTI consumer prices by Member State

MEMBER STATE	PTI PRICE LIGHT VEHICLES	PTI PRICE HEAVY VEHICLES	REFERENCES
Austria	Vary from garage to garage: Petrol and Diesel cars €49.70 – 125.70 (average €82.38) Members of ÖAMTC €49,70. Members of ARBÖ €59,90 Electric cars €49,70 – 131,04 (average: €84,69	Vary from deals between garage and transport businesses	Authority interview https://wien.arbeiterkammer.at/beratung/konsumentenschutz/auto/202305_KFZ-Pickerlkosten.pdf
Belgium	38.2€ (VAT 21% included) + 4.90 (spark ignition) + 14.60 (diesel)	68.1€ (VAT 21% included)	https://www.autoveiligheid.be/sites/default/files/tarieven_ak_2023.pdf https://www.autocontrole.be/fr/tarifs
Bulgaria	For M1 vehicles the price including VAT is 50 BGN (approx. 25,58 €)	For M2 and M3 vehicles the price including VAT is 70 BGN (approx. 35,81 €)	https://dekra-automotive.bg/annual-technical-inspections
Croatia	Technical inspection of a personal vehicle – 20,25 € + VAT ECOtest DIESEL – 13,61 € + VAT Forms and technical inspection registers 2 – € 1,24 + VAT (8,78) €Total – 43,88 € The price of PTI for L vehicles (without VAT) is 12,30 €	For PTI of M2 and M3 vehicles, the price without VAT (25%) is 32,55 €	VEHICLE TECHNICAL INSPECTION AND VEHICLE REGISTRATION - Price (plocice.hr) https://narodne-novine.nn.hr/clanci/sluzbeni/2022_12_155_2459.html
Cyprus	For M1 vehicles, the IKTEO (Private Technical Inspection Centres for Vehicles) fee is 35 € (incl. VAT)	For M2 vehicles, the IKTEO fee is 65 € (incl. VAT) For M3 vehicles, the IKTEO fee is 85 € (incl. VAT)	The Motor Vehicles (Roadworthiness Tests and Technical Inspection Centres) Law of 2007 - 1(I)/2007 (cylaw.org) The 4 IKTEOs licensed by the Ministry of Education. Transport/Price List (brief.com.cy) Τιμοκατάλογος – M.O.T Paralimni | Giovanis (motgiovanis.com) The MOT test: governmental vehicle inspection (pitsasinsurances.com)
Czechia	Price for regular technical inspection of M1 and N1 vehicles: 1 200 CZK (approx. 49,09 €)	Trailers category O1 up to 750kg: 800 CZK (approx. 32,72 €)	Price list - Pronto STK s.r.o. (stkpraha.cz)

MEMBER STATE	PTI PRICE LIGHT VEHICLES	PTI PRICE HEAVY VEHICLES	REFERENCES
	For category L vehicles (mopeds/motorcycles) the price is 800 CZK (approx. 32,72 €)	Trailers category O2 from 750kg to 3500kg: 1100 CZK (approx. 44,99 €)	
Denmark	Varies from garage to garage and depending on the time of the day. In 2016, the average price was €50.	Varies from deals between garage and transport businesses	Authority interview https://www.europe-consommateurs.eu/fileadmin/Media/PDF/PDF_EN/Cross_border_car_purchase_2016/PDF_EN/Country_fact_sheets___purchase/Country_fact_sheets_purchase_FINAL-DK.pdf
Estonia	M1 vehicles - 43,95/49,95€	M2 vehicles - 53,95/59,95€ M3 vehicles - 65,95/71,95 €	Hinnakiri | Tehnoülevaatus al. 19€ | Tehnoülevaatus.ee (tehnoulevaatus.ee)
Finland	Vary from garage to garage – 25-70 EUR		Authority interview
France	Between 74,85 and 90 €	Between 74,85 and 90 €	Prix contrôle technique | moncontroletechnique.fr
Germany	Vary from garage and regions, between EUR 133,90 - 145 Euro		https://www.handelsblatt.com/unternehmen/tuev-kosten-2023-so-teuer-sind-hauptuntersuchung-und-abgasuntersuchung-aktuell-/27005938.html
Greece	Passenger cars €45-60 Motorcycles €20-35 Taxi €30-45	Trucks (up to 3.5t) €54-70 Recheck €3-6	https://www.gocar.gr/news/feed/28822,Poso_kostizei_to_KTEO.html https://www.checkyourcar.gr/
Hungary	The price for passenger car inspection is HUF 21,000-24,000 (EUR 54,68-62,49) in the case of four-wheel drive passenger cars HUF 25,000-28,000 (EUR 65,09-72,90).	Technical examination of trucks for 2-4 wheel drive vehicles costs HUF 22,000-26,000 (EUR 57,28-67,7) and HUF 27,000-30,000 (EUR 70,30-78,11)	2023 Műszaki vizsga ára (Jármű típus szerint) – Qjob.hu
Ireland	55 EUR		https://www.rsa.ie
Italy	If performed by the national authority “Motorizzazione civile”, the cost of PTI is 45 €. If performed by private inspection centres, the cost varies depending on the centre: the average the price for cars in 2023 ranges between € 50 and € 80. Example of a cost breakdown of inspection at private centres - € 54.95 plus VAT, DMS fees and payment commissions: 54.95 € mandatory revision fee + 12.09 € VAT 22% on the	Same as light vehicles	https://www.rattiauto.it/it-it/blog/curiosita/revisione-auto-2023-prezzi-e-rimborsi#:~:text=Per%20effettuare%20la%20revisione%20auto,euro%20e%20gli%2080%20euro https://www.revisioneauto.eu/domande-frequenti/revisione-auto-normativa-costi-scadenza-sanzioni

MEMBER STATE	PTI PRICE LIGHT VEHICLES	PTI PRICE HEAVY VEHICLES	REFERENCES
	compulsory audit fee + 10.20 € DMS fee + 1.76 € DMS fee payment commission		https://assicurazioni.segugio.it/news-assicurazioni/revisione-auto-modalita-scadenze-e-costi-per-il-2023-00037311.html#:~:text=In%20particolare%2C%20presso%20la%20Motorizzazione,euro%20a%2079%2C02%20euro.
Latvia	Basic test for a vehicle of category M1 - 29,40 €	Basic test for a vehicle of category M2- 32,97 € Basic test for a vehicle of category M3 - 50,19 €	Bus with a laden weight of more than 5 tonnes (category M3) | Payments for technical inspection | Technical inspection | Vehicle (csdd.lv)
Lithuania	For M1 vehicles prices for technical inspections range from 23 to 28,90 € For motorcycles/mopeds, the price is 11,30 €	Inspection of M2 class small buses – 26, 6 € Inspection of M3 class buses, trolleybuses – 37,8 € Inspection of M3 class connected buses, trolleybuses – 42,8 €	Compulsory roadworthiness testing prices | TUVLITA
Luxembourg	64 EUR	77 EUR	https://www.snct.lu/clients-particuliers/tarifs-du-controle-technique
Malta	VRT testing for car now costs € 30.27, as against the € 25.27 that used to be charged until 2022		Cost of VRT testing up €5 as from January - The Malta Independent
Netherlands	Varies from garage to garage (and depends on age of vehicle): e.g., €42-78.50, or €43.10-52.80	Varies from garage to garage: e.g., €100-193 or €68.10	https://vanabeelen.nl/tarieven https://www.km.be/autokeuring/tarieven
Poland	The cost of periodic technical inspection is determined by the ministry and in the case of passenger cars it is PLN 99 (approx. € 21,33). Owners of vehicles with LPG/CNG gas installations pay PLN 162 (approx. 34,90 €) Motorbikes: 62 PLN incl. VAT (approx. 13,32 €)	Passenger cars, buses designed to carry no more than 15 people including the driver, lorries: 98 PLN incl. VAT (approx. 21,05 €) Buses designed to carry more than 15 people including the driver:199 PLN incl. VAT (approx. 42, 75 €)	https://beesafe.pl/porady/ile-kosztuje-przeglad-samochodu/#:~:text=Koszt%20okresowego%20przegl%C4%85du%20technicznego%20ustalany,z%20gazem%20kosztuje%20162%20z%C5%82ote. https://www.infor.pl/akt-prawny/DZU.2004.223.0002261,rozporzadzenie-ministra-infrastruktury-w-sprawie-wysokosci-oplat-zwiazanych-z-prowadzeniem-stacji-kontroli-pojazdow-oraz-przeprowadzaniem-badan-technicznych-pojazdow.html https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20042232261

MEMBER STATE	PTI PRICE LIGHT VEHICLES	PTI PRICE HEAVY VEHICLES	REFERENCES
Portugal	Light-duty vehicles: 27.80 € Mopeds: 14.00 €	Heavy-duty vehicles: 41,60 €	Realizar as Inspeções Periódicas a Veículos - ePortugal.gov.pt
Romania	ITP fee Taxi or Driving School = 80 lei (approx. 16,09 €) ITP fee Petrol or petrol + LPG cars = 120 lei (approx. 24,14 €) ITP fee Diesel cars = 150 lei (approx. 30,18 €) ITP fee Motorcycles = 120 lei (approx. 24,14 €) ITP fee Mopeds = 120 lei (approx. 24,14 €)	ITP fee Minibuses, motorhomes, vans, mixed, specialised = 150 lei (approx. 30,18 €) ITP fee Vehicles with 4x4 all-wheel drive = 150 lei (approx. 30,18 €)	PTI tariffs - periodic technical inspection (itp-automoto.ro)
Slovakia	PTI prices vary greatly between the eastern and western areas. As an example, in Bratislava PTI price for passenger cars, vans, tricycles and quads is 45 € including VAT.	In Bratislava, the PTI price for M2 and M3 vehicles is 70 €	https://www.dekra.sk/en/pti-bratislava-petrzalka/
Slovenia	Passenger car (weight up to 2.5 T): 36,74 € Passenger car (weight over 2.5 T): 46,28 € Motorcycle and quadricycle (L1 to L7) and Moped wheel (L1 to L5): 19,09 €	Bus (M2): 84,45 € Coach articulated (M3) and truck and towing vehicles (N3): 96,86 €	Roadworthiness tests | AMZS
Spain	30,39€ (40,95€ with VAT)	49,73€ (64,35€ with VAT)	ITVASA - Tarifas de vehículos
Sweden	64 EUR		Average price across vehicle types – CITA survey

Source: VVA (2023), Evaluation support study and own elaboration

ANNEX 7: DETAILED DESCRIPTION OF THE RETAINED POLICY MEASURES

1. COMMON MEASURES INCLUDED IN THE POLICY OPTIONS

PMC1 – Adapt PTI to electric and hybrid vehicles (safety, environmental performance, standardised data), including training of inspectors

Concerns: Directive 2014/45/EU (PTI)

The measure will introduce new items to be tested as part of PTI concerning vehicles equipped with high-voltage systems, such as battery electric and hybrid vehicles. The following groups of items could be included in Annex I of Directive 2014/45/EU in the section referring to electrical equipment:

- Visual inspection of the traction battery cover and the batteries;
- Visual inspection and/or operation of the high voltage wiring harness and connectors, including the charging cable;
- Visual inspection and operation of high voltage electrical and electronic equipment;
- Anti-starting system: functional check by verifying that the vehicle cannot move by itself with the charging cable plugged.

As in the case of all other test items, deficiencies would be categorised as minor, major or dangerous, depending on the reason for failure, such as slightly/heavily deteriorated or defective items.

PMC2 – Update PTI and RSI due to new requirements in General Safety Regulation and checking emission reduction systems (new test items, including checks of software status/integrity), by reading on-board diagnostics

Concerns: Directive 2014/45/EU (PTI) and Directive 2014/47/EU (RSI)

This measure will introduce new items to be tested as part of PTI and RSI using the on-board diagnostic (OBD) scanners connected to the electronic vehicle interface (OBD port). Since May 2023, testing centres are required to be equipped with such scan tools, however, their use has been limited so far. The current PTI and RSI Directives do not require the actual use of OBD scanners but refer to them as an alternative to visual inspection (of warning devices) for the checking of certain safety systems, such as anti-lock braking system (ABS), electronic brake system (EBS), Electronic Power Steering (EPS), the functioning of safety belts and airbag systems and the Electronic Stability Control (ESC).

Thanks to recently developed standards[448], it is now also possible to query ePTI-relevant system information, including software identification, software integrity, current and/or

[448] ISO 20730-1:2021 and 20730-3:2021, https://www.iso.org/standard/73801.html

stored values, and to electronically test the safety systems required by the General Safety Regulation, such as: automated lane keeping system (ALKS), automated braking, intelligent speed assistance, reversing detection with camera or sensors, acoustic vehicle alerting to prevent collisions with pedestrians or cyclists, emergency braking signal, or tyre pressure monitoring systems.

Using ePTI will also allow checking additional safety-relevant items, like automatic lighting, adaptative headlights, speed limiter and adaptative cruise control.

PMC3 - Mandatory PN testing of LDVs and HDVs equipped with particle filter, at PTI, and of HDVs at technical roadside inspections of commercial vehicles

Concerns: Directive 2014/45/EU (PTI) and Directive 2014/47/EU (RSI)

The measure will require using particle number (PN) measurement for the exhaust gas emission testing (item 8.2 in the list of items to be tested under the PTI and RSI Directive). This would replace the currently required exhaust gas opacity test first for diesel vehicles equipped with particle filters, at PTI, and for HDVs, at technical roadside inspections of commercial vehicles. The focus is on these vehicles as they are subject to a solid particle number limit at their type-approval (from Euro 5b LDVs and Euro VI HDVs), which is used as a reference point to determine the threshold for high-emitting vehicles. In fact, three Member States (BE, NL and DE) have already introduced such a test for Euro 5 and Euro 6/VI vehicles and the measure is about applying harmonised measurement across the EU. In the case of pre-Euro 5 and Euro VI vehicles equipped with DPF, Member States would be required to indicate the result of emissions higher than the limit on the roadworthiness certificate to draw the attention of the owner that the filter needs to be replaced. Alternatively, e.g., where the vehicle tax is differentiated based on the presence or not of a particle filter, Member States may allow to de-register the filter and apply higher vehicle taxes to such vehicles.

The test requirements will be based on the procedure described in the Commission's Recommendation on PN measurement for the PTI of vehicles equipped with compression ignition engines[449], which allow for a fast, simple and inexpensive test. The use of the currently recommended pass/fail limit of 250.000/cm^3 would be required.

Initially, older vehicles not equipped with DPF would continue to be checked using the currently required opacity testing, which was adapted to the air pollutant emission limits of earlier standards (pre-Euro 5). The Commission would have to consult the Roadworthiness Expert Group (RWEG) to investigate the technical feasibility of using PN measurement for those vehicles with higher thresholds, while ensuring that this does not generate disproportionate costs, notably through the need to replace existing equipment.

Since the equipment used for PN-measurement are portable devices, the same test method can be applied at roadside inspections, including for checks following the identification of a high-emitting vehicle using remote sensing technology (required by PM13).

[449] https://eur-lex.europa.eu/eli/reco/2023/688/oj

Later, once the corresponding test method is developed for testing vehicles equipped with positive ignition engines, PN measurement should also be extended to them. As soon as sufficient data from tailpipe emission testing at PTI and readings from the on-board monitoring system (OBM) of Euro 7 vehicles provide confidence as regards the equivalence of OBM with tailpipe tests, Member States may authorise the use of OBM only.

PMC4 - Mandatory NOx-testing of LDV and HDV at PTI, and HDVs at roadside inspections

Concerns: Directive 2014/45/EU (PTI) and Directive 2014/47/EU (RSI)

Similar to PN testing under PMC3, this measure will require the testing of NOx emissions at PTI and RSI for light and heavy vehicles, first for diesel, focussing on the identification of malfunctioning SCR systems. Later, once the test method is adapted to positive ignition engines, also vehicles powered by petrol and liquefied or compressed natural gas (LNG/CNG) could be tested. The test procedure has been developed by the Commission's Joint Research Centre[450] with the technical and metrological requirements of the instruments and a NOx threshold value expected to be defined by the end of 2023. The measure would therefore likely be implemented through a delegated act amending point 8.2 in the list of items to be tested under the PTI and RSI Directives.

The test procedure is being set up in a way that it aligns with the procedure applied for PN testing, in order to allow for simultaneous PN and NOx testing, which in the future could also be performed using one single instrument featuring both particle and NOx analysers. This will allow keeping the testing time as it is today and limit the additional equipment costs.

As in the case of PN testing, as soon as sufficient data from tailpipe emission testing at PTI and readings from the on-board monitoring system (OBM) of Euro 7 vehicles provide confidence as regards the equivalence of OBM reading with tailpipe tests, Member States may authorise the use of OBM only.

PMC5 - Mandatory roadworthiness testing following significant modifications of the vehicle (e.g. change of class, propulsion system)

Concerns: Directive 2014/45/EU (PTI)

This measure will require vehicles that have undergone major technical modifications to pass a roadworthiness test. Such modifications may include changes to the propulsion system, retrofitting the emission control system, modifications to the chassis, wheels and tyres and/or the engine performance of the vehicle and may thus have both safety- and emissions-related impacts.

PMC6 – Require the roadworthiness certificate in electronic format only

[450] https://www.mdpi.com/1996-1073/16/14/5520

Concerns: Directive 2014/45/EU (PTI)

While the current PTI Directive allows the use of "electronically produced" roadworthiness certificates, it requires a certified printout to be handed to the person presenting the vehicle for PTI. The measure will limit the requirement to issuing an electronic document only, while providing a printout will be left as an option for Member States.

The exchange of PTI-related data under PMC7 will allow enforcing authorities to check the status of any vehicle registered in the EU in the case of a roadside check or for the purpose of re-registration, without the need for the owner of the vehicle to present a printed certificate.

PMC7 – Provide electronic access to relevant data, including on PTI reports stored in national databases, to the registration authorities of other EU Member States using a common interface

Concerns: Directive 2014/46/EU (VRD)

The current VRD Directive requires that Member States assist each other in the implementation of the Directive and indicates that this may be done by exchanging vehicle-related information by electronic means. However, it does not specify the means and does not actually require such data exchange. This measure will require that Member States provide access to other Member States requesting registration or PTI-related vehicle data for the vehicles registered in their territory. Such exchanges already take place on bilateral basis using EUCARIS[451], albeit this is not systematically the case for every Member State.

In order to facilitate the data exchange, the measure would require Member States to connect their national databases (vehicle registers and related PTI databases as the case may be) to the MOVE-HUB platform developed and run by the Commission for the purpose of exchanging various road transport-related information among Member States.

The EUCARIS peer-to-peer network and the Commission's hub-and-spoke network are the connectivity layer to send messages from one Member State to another – there is no significant difference in the development effort between the two. When implementing a new message type, Member States have two options, they can develop their own software, or they can use the EUCARIS module for that message type. This choice is independent of the routing of the messages via the hub.

The methodology of the EUCARIS software sending messages via MOVE-HUB is well known and already implemented for in similar road transport related applications like ERRU, RSI, ProDriveNet and TACHOnet; for these solutions it is specified in the corresponding legislation that messages must be routed via the hub. RESPER and the ODOCAR pilot use a hybrid solution, routing messages both on the EUCARIS peer-to-peer network and via the hub.

[451] https://www.eucaris.net/

The Proposal for the ELV Regulation referred to in section 1 would also require that messages between national (registration) authorities and customs are routed via MOVE-HUB for the purpose of determining whether or not a vehicle is eligible for export, i.e.,, roadworthy is based on the information from the Member State where it was last registered.

The use of MOVE-HUB for message routing over EUCARIS is based on the following considerations:

- The Commission has the competence to enforce the application of EU legislation;
- MOVE-HUB can monitor the exchange for compliance with the legislation;
- The Commission can follow-up message exchange errors with Member States.

In both cases, there is no need to develop additional software to gather messaging statistics. In addition, the fact that the hub is a single point of failure (a possible disadvantage over a peer-to-peer network), is mitigated by relying on the Commission's highly redundant network layer and by having redundant servers in the application layer.

PMC8 – Harmonisation and regular update of the technical data in the vehicle registration documents (of currently optional content)

Concerns: Directive 2014/46/EU (VRD)

Apart from a set of mandatory data elements to be included in vehicle registration documents, the VRD Directive also provides for a series of optional elements that Member States include or not according to their needs and preferences, taking into account the limited space on the currently required physical registration certificate. Optional data items include e.g. the vehicle category, the number of axles, data about the environmental performance of the vehicle, etc. For example, item V.7 of the registration certificates refers to CO_2 emissions (in g/km for light vehicles), but it does not specify whether this should be the emissions measures in accordance with the NEDC or the more recent WLTP testing procedures[452].

The measure aims at harmonising the set of data included in vehicle registration documents and provides for their update in case relevant vehicle characteristics change due to modifications (e.g., to the engine, the chassis, or the emission control system). This requires the harmonisation of those data items in national vehicle registers and their update as soon as they are modified.

As indicated in the evaluation, there is also a need to align certain data elements with the data elements record in the certificate of conformity.

PMC9 – MSs to record odometer readings in a national database and make the records available to other MSs in the case of re-registration

Concerns: Directive 2014/45/EU (PTI) and Directive 2014/46/EU (VRD)

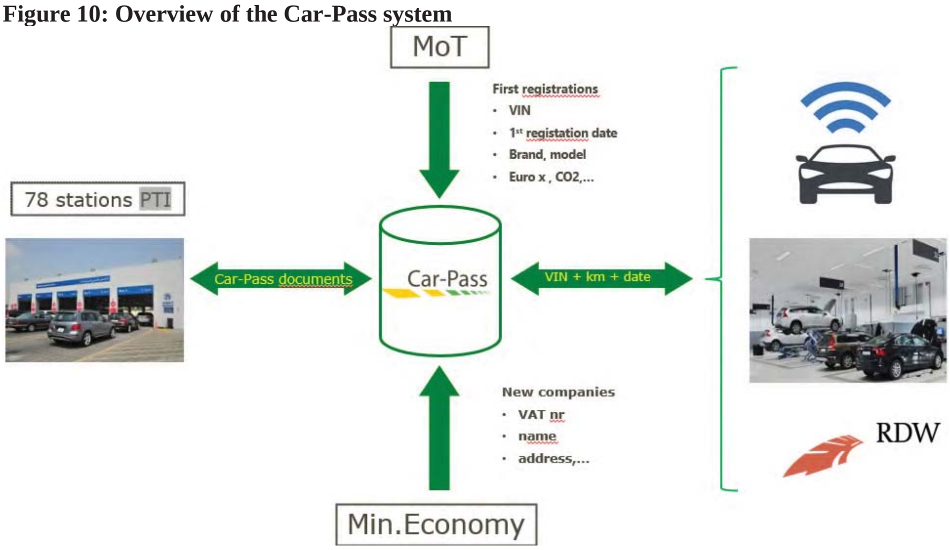
[452] Both developed by the UNECE: https://unece.org/press/unece-adopts-more-accurate-fuel-efficiency-and-co2-test-new-cars-wltp; see also https://www.wltpfacts.eu/

For the purpose of reducing odometer fraud, the PTI Directive requires the recording of vehicle mileage at each PTI and that its manipulation be a punishable offence. However, PTIs are only conducted every year at most (in many Member States only every two years), with the first PTI taking place only after four years in most cases. A significant part of odometer fraud will already have happened by that time since larger price gains can be achieved by rolling back the odometers of relatively new vehicles.

This measure would replicate the national systems established by Belgium (Car-Pass[453]) and the Netherlands (Nationale Auto Pas, NAP)[454] across all Member States. Both systems collect odometer readings from vehicles in between PTIs and well before the first PTI and exchange odometer history data between the national databases. The readings are provided by various vehicle repair workshops, including tyre and windscreen repair services as well as by manufacturers though their dealer management systems. In Belgium, manufacturers provide odometer readings from connected cars at least four times a year. In comparison to the Belgian Car-Pass system, PMC9 does not require the issuing of a certificate as part of a vehicle transaction[455]. In the Dutch NAP system, the delivery of the vehicle report is free of charge.

The measure requires that Member States establish such national databases and feed them with odometer readings in a similar way. Since the issue is of particular concern in the case of cars and vans, those vehicles would have to be covered as a minimum. Where the registration of a vehicle is moved to another Member States, the Member State of registration would have to share the mileage history of that car or van with the re-registering Member States.

Figure 10: Overview of the Car-Pass system



[453] https://www.car-pass.be/en/about-car-pass
[454] https://www.rdw.nl/en/buying-a-car/tips-for-buying-a-car
[455] This currently costs around EUR 10 in Belgium and provides the main source of revenue to support the operation of the system in the country.

2. POLICY MEASURES INCLUDED ONLY IN SOME OF THE POLICY OPTIONS

PM1 - RSI for heavy/powerful motorcycles (L category > 125cm3) as alternative measure, in Member States where they are not subject to PTI (i.e., using the available opt-out)

Concerns: Directive 2014/45/EU (PTI) and Directive 2014/47/EU (RSI)

The measure would apply to L-category vehicles with an engine displacement exceeding 125cm3, i.e., vehicles that are currently in the scope of the PTI Directive with a possibility for Member States to apply alternative road safety measures instead of PTI. As such, it would only affect the Member States that make use of the opt-out[456] by requiring that the alterative measure be roadside inspection for these vehicles. The share of the vehicle subject to RSI every year is must be 5% of the corresponding fleet in the Member States concerned.

PM2 – Mandatory PTI for motorcycles above 125cm3 (remove opt-out)

Concerns: Directive 2014/45/EU (PTI)

This measure would simply remove the existing possibility to apply alternative road safety measures instead of making heavy motorcycles subject to PTI. Just like the previous measures, this would affect a few Member States. It would however leave the choice of the frequency of testing to Member States, as it is the case today.

PM3 – Extend PTI to all motorcycles (i.e., incl. from 50cm3 = all L3e, L4e), plus tricycles (L5e) and heavy quadricycles (L7e)

Concerns: Directive 2014/45/EU (PTI)

This measure would extend the scope of the PTI Directive to all motorcycles, i.e., including smaller ones from 50cm3 (all L3e, L4e), plus tricycles (L5e) and heavy quadricycles (L7e). It would however leave the choice of the frequency of testing to Member States, as it is the case today for heavy motorcycles.

PM4 – Mandatory PTI for light trailers (O1 and O2 categories)

Concerns: Directive 2014/45/EU (PTI)

This measure would extend the scope of the PTI Directive to all light trailers, including O1 (with maximum mass not exceeding 750 kg) and O2 categories (maximum mass exceeding 750 kg but not exceeding 3500 kg). It would however leave the choice of the frequency of testing to Member States, as it is the case today for heavy motorcycles.

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[456] These Member States are BE (only requires a roadworthiness test before selling the vehicle or after an accident), FI, IE, MT, NL, PT (only testing vehicles with engines > 250 cm^3). France has not introduced PTI for motorcycles up to now, but the French authorities have announced the intention to do so in 2024. Denmark does not have mandatory PTI but since 1 January 2022 it has introduced roadside inspections.

PM5 – Annual emission testing for light commercial vehicles (N1) instead of the currently required 4-2-2- frequency

Concerns: Directive 2014/45/EU (PTI)

The measure will increase the minimum frequency of emission testing for vans and require annual testing from the first year following the date of first registration of the vehicle. While a few Member States apply more frequent PTI to vans that the minimum frequency required by the PTI Directive (i.e., first test within 4 years of the date of first registration and every 2 years thereafter), most Member States apply the minimum requirements.

As such, it will increase the number of vehicles to be tested per year, however, vehicles that are subject only to emission testing would not have to occupy the capacity of PTI lanes as such tests can be carried out using the portable measurement devices.

PM6 – Mandatory yearly testing for vehicles that are 10-year-old or older

Concerns: Directive 2014/45/EU (PTI)

The measure will increase the frequency of roadworthiness testing for cars and vans (M1 and N1 vehicles) and require annual PTI after 10 years following the date of first registration of the vehicle. As indicated in Annex 6, a number of Member States[457] already apply yearly PTI to cars and vans beyond a certain age instead of the minimum frequency of 2 years following the first PTI required by the PTI Directive. The other 11 MS apply the minimum requirements.

PM7 – PTI certificate issued in any EU MS is recognised by the MS of registration + further harmonisation of test methods

Concerns: Directive 2014/45/EU (PTI)

Under the current PTI rules, for the purposes of free circulation and of re-registering a vehicle that has already been registered in another Member State, the PTI certificate issued in that other Member State must be recognised by each Member State as if it had itself issued that certificate, provided that the PTI certificate is still valid in terms of the frequency intervals established for PTI by the re-registering Member State.

However, such recognition is not required for the purpose of complying with periodic testing requirements. In fact, the PTI Directive requires that PTI is carried out by the Member State of registration or by bodies or establishments designated and supervised by that Member State.

The measure would require that the Member State of registration recognises PTI certificates issued in the EU for the purpose of ensuring compliance with periodic testing of vehicles, provided that the PTI certificate is still valid in terms of the frequency intervals that Member State has established for PTI. In order for such a measure to be agreeable by Member States, it is necessary to further harmonise the methods of testing (i.e. certain

[457] AT, BE, BG, EE, ES, FI, HR, IE, LV, LU, NL, PL, PT, RO, SE and SI.

items that Member States may currently test in different ways). Examples are brake testing for HDVs or efficiency testing of the suspension system. The measure would set specific requirements for these items.

The reason why PTI certificate recognition is currently limited to allowing free circulation and re-registration (and it is not allowed to undergo PTI in a Member State other than the Member State of registration) is that the stringency of PTIs does differ among Member States while testing a relatively stable number of vehicles per year also ensures planning certainty for Member States, which is particularly relevant where the PTI service is subject to longer term contracts (concessions). Full recognition could lead to PTI shopping, unless there is almost full harmonisation of the test methods, which is considered in PM7. PM7 is only part of the most ambitious option as such level of harmonisation may affect the structural organisation of PTI in certain Member States, e.g., advanced suspension testing requires more space that may be available in small commercial garages that are responsible for conducting PTIs in a number of cases. On the other hand, the recognition of PTIs via bilateral agreements (PM9) could be a first step towards further harmonisation and enhanced free movement.

PM8 – PTI certificate issued in any EU Member State to be recognised by the MS of registration for a period of up to 6 months (for passenger cars only), on the condition that the next PTI is conducted in the MS of registration

Concerns: Directive 2014/45/EU (PTI)

To further facilitate free movement and not to oblige citizens spending time in a Member State other than the Member State of registration of the vehicle they are using to travel abroad, PM8 would require the Member State of registration to recognise the PTI certificate issued in another Member State where the vehicle could undergo PTI when it is due. The validity of this certificate could be up to six months.

The measure applies to passenger cars, on condition that the next PTI is conducted in the Member State of registration. It would complement the provision of the PTI Directive requiring that PTI is carried out by the Member State of registration or by bodies or establishments designated and supervised by that Member State.

PM9 – PTI in another EU MS recognised by MS of registration based on bilateral agreement

Concerns: Directive 2014/45/EU (PTI)

PM9 would explicitly allow establishing bilateral agreements between Member States in order to recognise each other's PTI certificates. This measure would leave the choice of concluding such agreements and thus recognising PTI certificates issued in other Member States. Member States would have the freedom to apply such agreements to any vehicle category. The measure would complement the provision of the PTI Directive requiring that PTI is carried out by the Member State of registration or by bodies or establishments designated and supervised by that Member State.

PM10 – More advanced testing of noise for motorcycles

Concerns: Directive 2014/45/EU (PTI)

The current PTI Directive requires subjective evaluation of the noise suppression system, "*unless the inspector considers that the noise level may be borderline, in which case a measurement of noise emitted by stationary vehicle using a sound level meter may be conducted*" (point 8.1 of Annex I). The same requirement is included in Annex II of the RSI Directive applicable to HDVs, which also indicates that the item "*can only be checked to some extent without the use of equipment*".

The measure would require the use of noise measuring equipment when the inspector considers that the noise level may be borderline. Such measurement could be inspired by the methods described in UN Regulation 41 for pass-by noise tests[458], even though not all the conditions of such a test applied in the case of type-approval may be fulfilled at PTI centres (for example, there may not be sufficient space and whether conditions will not always be favourable to fully comply with Regulation 41). Therefore, a simplified test should be carried out. Few MSs (DE, ES, HR and SK) are already measuring L-vehicles noise emissions at PTI.

PM11 – Data governance: further define the procedures and the means of access to vehicle technical information by testing centres free of charge

Concerns: Directive 2014/45/EU (PTI)

Recital 17 of the PTI Directive explains the rationale behind this measure: "*For the inspection of vehicles, and especially for their electronic safety components, it is crucial to have access to the technical specifications of each individual vehicle. Consequently, vehicle manufacturers should provide the data needed for verification of the functionality of safety and environment-related components. The provisions concerning access to repair and maintenance information should likewise be applied for that purpose, allowing inspection centres to have access to all information necessary for roadworthiness testing. The data should include the details that allow the functionality of the vehicle safety systems to be monitored in a way that allows such systems to be tested in a periodic technical inspection environment. This is of crucial importance, especially in the field of electronically controlled systems, and should cover all elements that have been installed by the manufacturer*."

Accordingly, Article 4(3) required the Commission to adopt implementing acts to define a set of technical information necessary for roadworthiness testing and for the use of the recommended test methods, and detailed rules concerning the data format and the procedures for accessing the relevant technical information. It also requires that manufacturers make the technical information available to testing centres and competent authorities "*free of charge or at a reasonable price*" and in a non-discriminatory manner.

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458 Regulation No 41 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of motor cycles with regard to noise (OJ L 317 14.11.2012, p. 1, ELI: http://data.europa.eu/eli/reg/2012/41/oj)

In addition, it requires that the Commission examines the feasibility of establishing a single point of access for that technical information.

As a result, Implementing Regulation 2019/621[459] defines a basic set of technical information and lays down the principles of the procedure for accessing such data and regarding their format, however, it fails to specify them in sufficient detail, leaving a large room for manoeuvre to manufacturers to define their own procedures and data formats.

These issues, specifically regarding in-vehicle data is being addressed by the ongoing initiative on access to vehicle data, functions and resources[460]. The proposal on access to in-vehicle data should provide for non-discriminatory access to such data in a harmonised, machine-readable format, which will be key for vehicle inspection. However, it is unlikely that it will specify the means of data access specifically for the purpose of vehicle inspection, which is the focus of this measure.

The specific requirements would be laid down in an implementing act amending Implementing Regulation 2019/621 and would aim at establishing a single point of access for the necessary technical information, e.g., through an independent body that would collect the vehicle data from manufacturers and distribute it to competent authorities and authorised PTI centres. Such a solution has notably been called for by CITA.

PM12 – NOx, PM, and noise measurement by remote sensing in RSI of all vehicles (with option for simplified PTI if vehicle passed recent RSI)

Concerns: Directive 2014/47/EU (RSI)

PM12 requires the use of remote sensing technology for measuring NOx, PM, and noise emissions of all vehicle types and all emission classes. This will allow the monitoring of the emissions of a very significant part of the vehicle fleet, depending on the exact scale of implementation in the Member States. It also includes the option for a simplified PTI if a vehicle successfully passed a recent RSI (including by remote sensing). That is, the Member State of registration may exempt the vehicle from the emission and/or noise testing during the next PTI if the result of the RSI is less than 6 months old. A successful RSI result could include not only if the vehicle is stopped and checked at the roadside but also if it has passed a (specified number of) emission screening by remote sensing with the results consistently showing low emissions.

The use of stationary remote sensing units may be replaced or complemented by plume chasing, which can be a viable alternative, notably to measure NOx emissions from HDVs. The figures below illustrate available technologies that could be used to fulfil the requirements of PM12 as regards pollutant emissions. Monitoring noise by remote sensing

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[459] Commission Implementing Regulation (EU) 2019/621 of 17 April 2019 on the technical information necessary for roadworthiness testing of the items to be tested, on the use of the recommended test methods, and establishing detailed rules concerning the data format and the procedures for accessing the relevant technical information, https://eur-lex.europa.eu/eli/reg_impl/2019/621/oj

[460] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13180-Access-to-vehicle-data-functions-and-resources_en

allows identifying individual noisy vehicles even in dense traffic, as demonstrated by the NEMO project[461], allowing local and national authorities to take remedial action.

The introduction of this measure will require remote sensing equipment (for NOx and PM) and acoustic cameras (a range of microphones for noise) by national enforcing authorities.

Figure 11: Remote sensing solutions

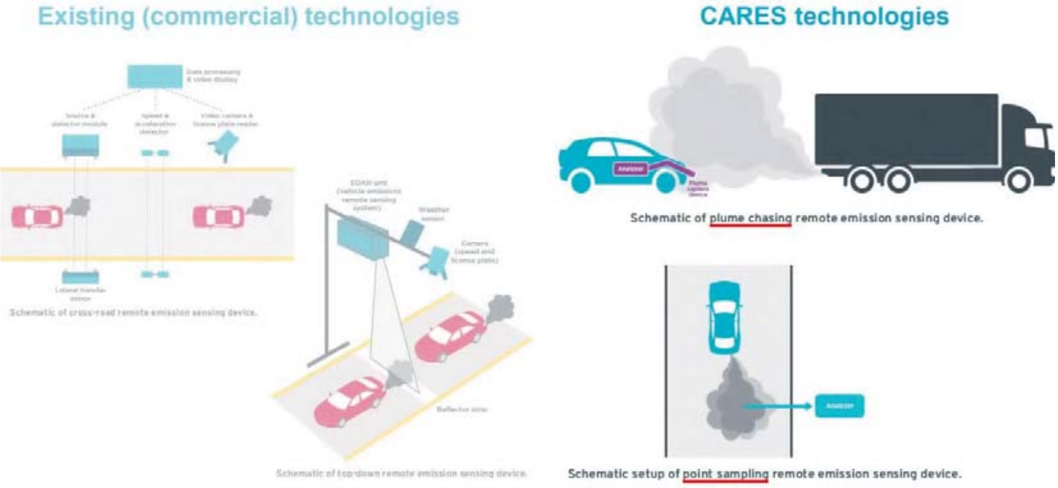


Figure 12: Plume chasing

Source: MODALES and CARES projects, https://modales-project.eu/wp-content/uploads/2021/10/ITSWC2021-Beyond-Eco-driving-2-CARES_HERE.pdf

PM13 – Mandatory inspection of cargo securing

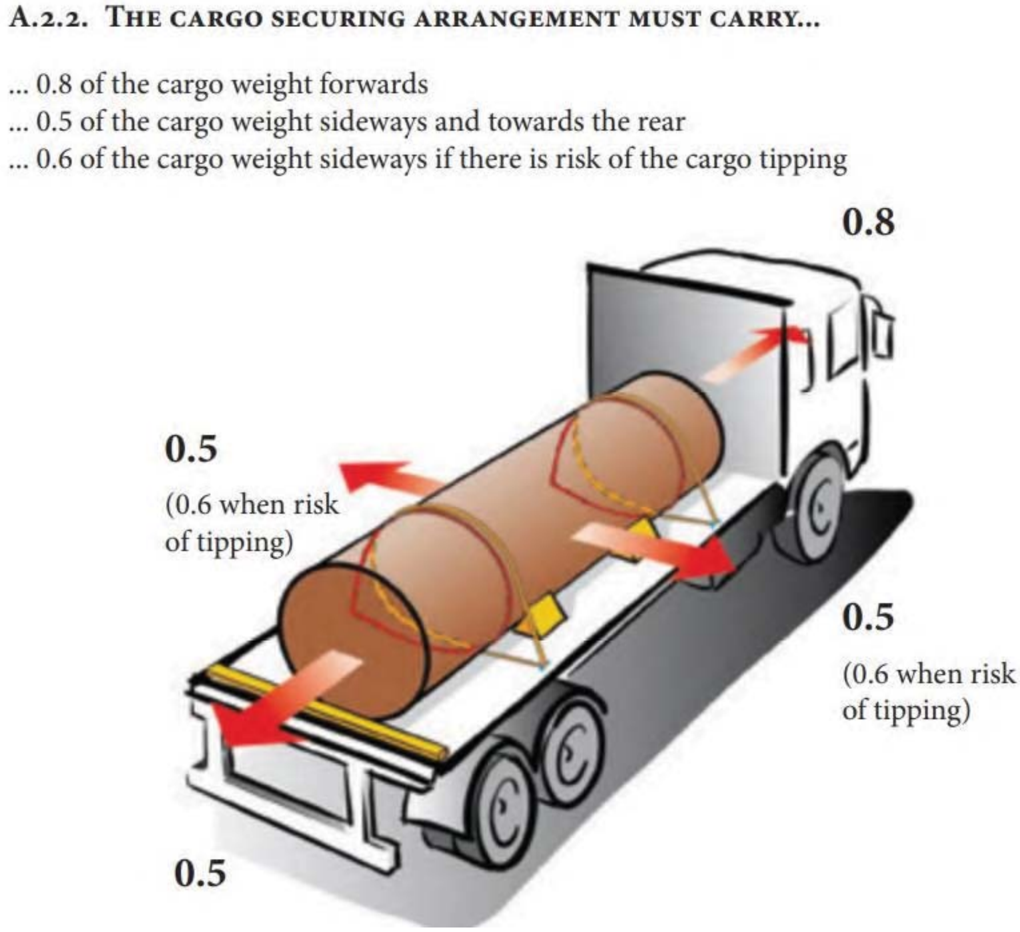
Concerns: Directive 2014/47/EU (RSI)

The current RSI Directive provides for the standards applicable to cargo securing inspections, however the inspection of cargo securing itself remains optional. As such, Member States have only partially implemented the use of those standards. The measure requires Member States to apply the methods described in Annex III of the Directive and the inspectors conducting such inspections to undergo appropriate training.

[461] https://nemo-cities.eu/remote-sensing-device-for-noise/

Following the adoption of the RSI Directive in 2014, the Commission presented guidelines for Member States and practitioners on the best practices in cargo securing[462] referring to various types of cargo. The first principle provided for in Annex III of the RSI Directive is illustrated the figure below.

Figure 13: Forces resulting from acceleration and deceleration that cargo securing must withstand



Source: Cargo securing for road transport – 2014 European best practices guidelines

PM14 – Extend the scope of application of roadside inspections to light commercial (N1) vehicles

Concerns: Directive 2014/47/EU (RSI)

PM14 requires that Member States apply technical roadside inspection to vans, i.e., commercial vehicles with a maximum permissible laden mass not exceeding 3.5 tonnes. Since the number of these vehicles in the EU fleet is about four times the number of HGVs, a lower target would be applied to them, e.g., 2% instead of the 5% share that Member States are supposed to aim for in the case of RSI for HDVs.

[462] European Commission (2014), Cargo securing for road transport – 2014 European best practices guidelines, Publications Office, https://data.europa.eu/doi/10.2832/80373

For testing vans at RSI, largely the same inspection units could be used as for HDVs. RSI for vans could be particularly useful to detect vehicles with defective emission control systems, including tampered ones, which may relatively easily avoid being caught at PTI. The mere fact that a van may be subject to roadside checks is expected to play a deterrent role.

PM15 – Extend the scope of application of roadside inspections to 2- and 3-wheeled vehicles (L-vehicles from L3)

Concerns: Directive 2014/47/EU (RSI)

This measure requires that Member States apply technical roadside inspection to motorcycles. Taking into account the number of these vehicles in the EU fleet a target of 1% would be applied.

RSI for motorcycles could be particularly useful to detect vehicles with defective and tampered noise suppression systems, which may very easily avoid being caught at PTI. Here again, the fact that motorcycles may be subject to roadside checks is expected to play a deterrent role.

PM16 – Introduce issuing the registration certificates in digital format to gradually replace current paper (and smart card) documents

Concerns: Directive 2014/46/EU (VRD)

The VRD Directive currently requires that registration certificates be issued either as a paper document or as a smart card. The measure will introduce the requirement to issue new registration certificates in a digital format. The technical details of the digital/mobile registration certificate will be defined in an implementing act and refer to the relevant ISO standards as in the case of the digital driving licence. Just like the mobile driving licence, the digital registration certificate will rely on the eIDAS initiative whose legislative proposal[463] is still discussed by the co-legislators and certain technical features are not yet consolidated in detail.

The measure applies to all vehicle categories that are subject to registration in the Member States. For the purposes of identifying vehicles in road traffic as well as for re-registration, Member States will have to recognise the digital version of the registration certificate. As the physical documents, the digital vehicle registration certificate would be used to confirm the registration of the vehicle, to check certain technical data about it (the digital version could store more data than the paper version), and to allow verification by the authorities. With the digital certificate enforcers can have direct access to the vehicle register, and it is also significantly easier to update than the physical documents.

The figures below illustrate the processes involved in issuing, using, and updating the digital certificate, and its possible appearance.

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[463] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0281

Figure 14: Issuing the digital registration certificate

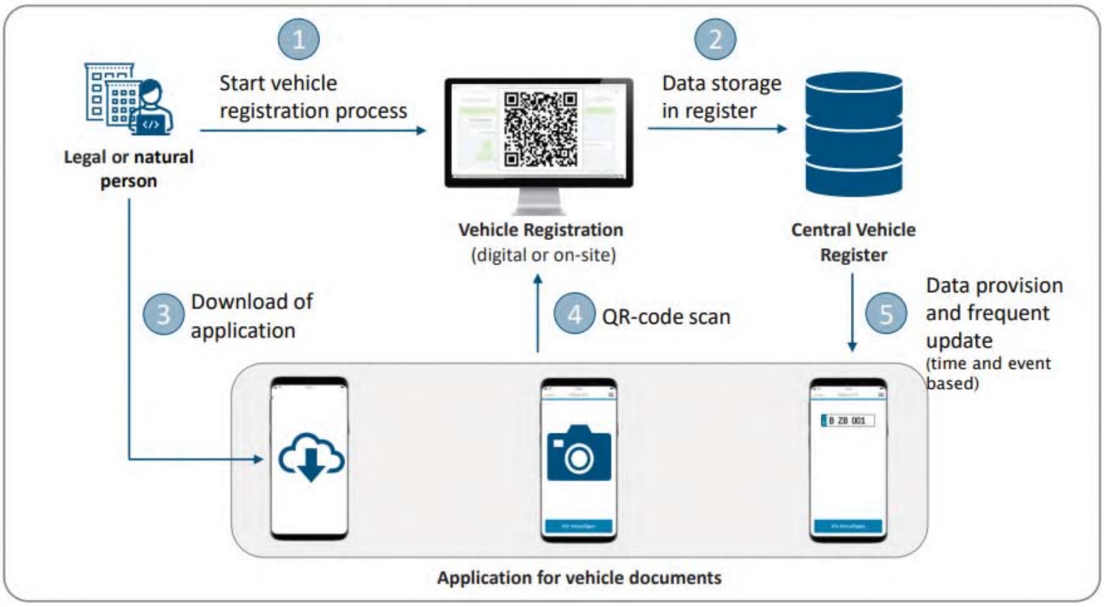
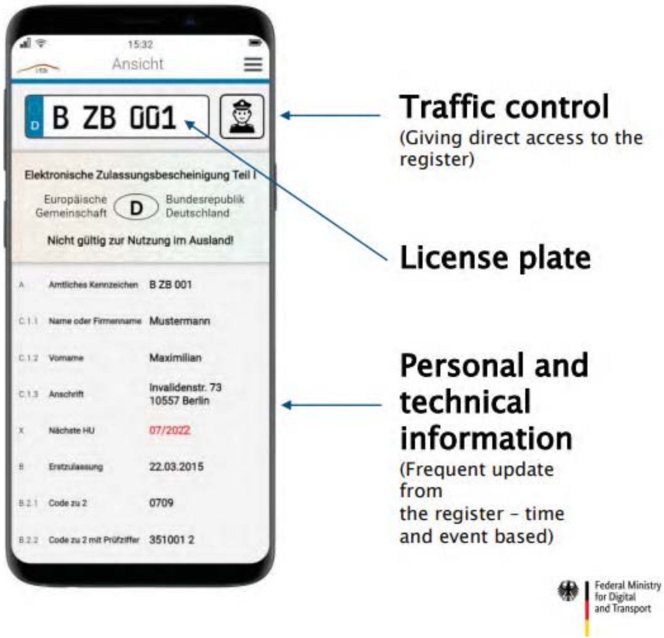


Figure 15: Layout of a digital registration certificate



Source: Presentation by the Federal Ministry for Digital and Transport, Germany, at the meeting of the Expert Group on Roadworthiness and Vehicle Registration Documents, September 2022

PM17 – Add new data to the vehicle register – minimum mandatory set (including among others: country of 1st registration, registration status, PTI status, changes due to transformation)

Concerns: Directive 2014/46/EU (VRD)

This measure will provide for a minimum set of mandatory data to be registered by member States. New data elements could include among others:

- Country where the vehicle was registered for the first time;
- Vehicle status (e.g. de-registered, temporarily de-registered, suspended, exported, end-of-life, destructed) (see below)
- PTI status (passed with no or minor defects, limited validity with major defects, failed – critical defects) and
    i. validity of the roadworthiness certificate (including expiry date),
    ii. status of the battery (for EVs): battery identification number; and information if the battery has been repaired or replaced;
- Changes in documentation or transformation – any important vehicle refurbishment to be approved and registered (process not yet harmonised);
- For a vehicle which is permanently de-registered, information on the reasons for de-registration, based on the assessment accompanying the proposal for the revision of the legislation on end-of-life vehicles.
    i.

Based on what most Member States already record, a longer list of data items to be recorded has been proposed by EReg[464].

[464] https://www.ereg-association.eu/media/2742/final-report-topic-group-xxi-proposal-on-the-registration-of-vehicle-data.pdf

ANNEX 8: DISCARDED POLICY MEASURES

The possibility to adopt further recommendations or a communication from the Commission was discarded at early stage as non-regulatory measures could not be sufficiently effective in addressing the problems identified and would have limited effect on harmonisation. Most stakeholders, including public authorities participating in the open public consultation, agreed that a legislative review of the RWP would be more effective (see also Annex 2).

Out of the more than 40 policy measures discussed at five meetings with the Expert Group on Roadworthiness and vehicle registration documents (RWEG), the following measures are among the discarded ones:

- **Extending the scope of the PTI Directive** to mopeds (vehicle category L1 and L2) was discarded due to subsidiarity and proportionality reasons. While making mopeds subject to PTI could have significant positive impact on road safety and air pollutants reduction, these vehicles are used locally, and the cost-benefit ratio could vary significantly depending on the specific local context (including the electrification of the fleet[465], which will significantly reduce the negative impacts of these vehicles on air and noise pollution over time). There would be also technical feasibility issues with such measure since some Member States do not require registration of mopeds. Therefore, from a subsidiarity and proportionality point of view, the testing of mopeds would best be left for Member States to legislate.
- **Extending the scope of the PTI Directive** to agricultural tractors (category T with design speed exceeding 40km/h) was discarded as there was not sufficient evidence of the road safety and environmental/health risk posed by these vehicles, due to their limited use of public roads.
- **Setting maximum mileage limit between two PTIs** (e.g., 100,000 km/200,000 km) was discarded as there are practical difficulties in monitoring mileage and calling vehicles for tests. It could also create additional incentives for odometer tampering.
- Requiring a **roadworthiness test following a crash with significant damage** (affecting the main safety components) was not retained on the grounds of the difficulty to find a commonly agreed definition for significant damage (legal feasibility).
- New test methods - **continuous technical inspection (CTI)** (for autonomous vehicles) was not retained as it was considered by the experts of the RWEG to be premature to define such methods at this stage of autonomous mobility development.

The table below provides the full list of discarded policy measures (13) and the reason for discarding them.

Table 268: Discarded policy measures and the reason for discarding them

Measure	Reason for being discarded
Extend scope of RWP to mopeds (i.e.L1e-B and L2e)	There are technical feasibility issues with such measure since some Member States do not require registration of mopeds. Moreover, these vehicles are used locally, and the cost-benefit ratio could vary

[465] For example, in the Netherlands, the share of electric mopeds in the sales of mopeds increased from 3% in 2017 to 46% in 2022. The share in the EU was 34% in 2022.

Measure	Reason for being discarded
	significantly depending on the specific local context (including the electrification of the fleet, which will significantly reduce the negative impacts of these vehicles on air pollution over time). Due to subsidiarity and proportionality point of view, this measure was discarded.
Extending the scope of the PTI Directive to agricultural tractors (category T with design speed exceeding 40km/h)	There was not sufficient evidence of the road safety and environmental/health risk posed by these vehicles due to their limited use of public roads.
Setting maximum mileage limit between two PTIs (maximum limit to be determined e.g. 100,000 km/200,000 km)	There are practical difficulties in monitoring mileage and calling vehicles for tests. It could also create additional incentives for odometer tampering. The measure was discarded due to technical feasibility reasons.
To make PTI mandatory before transfer of ownership of a vehicle	The PTI Directive requires that the roadworthiness certificate be recognised, as a matter of principle, "in the event that the ownership of the vehicle – having a valid proof of roadworthiness test – changes". There are also practical questions as regards the implementation of such a measure (length of validity of a new certificate required before sales). Limited support among Member States. Discarded due to unnecessary burden on vehicle owners and lack of evidence regarding potential benefits.
PTIs mandatory for crashed vehicles with significant damage (affecting the main safety components)	Difficulties in defining significant damage in a consistent way and limited support among stakeholders during the consultations. Discarded due to legal and political feasibility reasons.
To require that PTI certificate issued in a third country outside the EU is recognised by MS of registration	No support among Member States authorities during the consultations. Difficulties to monitor/ensure quality of PTI in third countries. Discarded due to technical and political feasibility reasons.
To require that results of on-board fuel consumption monitoring (OBFCM required by Regulation 2021/392) are reported on the PTI certificate	Measure considered not directly relevant for the RWP. Nevertheless, Member States are not prevented from reporting that information on the PTI certificate.
Require more advanced testing of braking (regenerative braking)	Limited support and considered as not relevant from the vehicle roadworthiness perspective (rather a question of energy efficiency)
New test methods - continuous technical inspection (CTI) (for autonomous vehicles)	Considered by the experts of the RWEG to be premature to define such methods at this stage of autonomous mobility development (technical feasibility reasons).
Extend the scope of application of roadside inspections to motorhomes	Very limited expected impact and very limited support among Member States authorities.
Improve administrative processes regarding handling prohibitions/suspensions after roadside inspection and self-cancelling prohibitions following subsequent PTI	Limited support among experts as not considered to be a key issue and there was not sufficient evidence about the extent of the problem the measure would address.

Measure	Reason for being discarded
New data items necessary for the treatment of end-of-life vehicles (ELV)	Considered outside the scope of this initiative since already covered by the impact assessment prepared for the revision of the legislation on ELV (but aiming at amending the Directive on vehicle registration documents).
Improve administrative processes by requiring that re-registration of vehicles in another MS is conducted online (on the basis of the presence of appropriate IT system)	Considered as going beyond what is necessary to address the problem and is considered to be already sufficiently covered by the SDG Regulation.

ANNEX 9: COMPARISON OF POLICY OPTIONS IN TERMS OF MEETING THE OBJECTIVES

Strongly negative	Negative	No or limited impact	Positive	Strongly positive	Unclear

Impact	PO1a	PO1b	PO2	PO3
General objective 1: Improve road safety in the EU				
% reduction in the level of fatalities and injuries and associated external costs	Expected reduction of fatalities by 4,661, severe injuries by 42,272 and slight injuries by 239,803 (cumulative over 2026-2050, relative to the baseline). Estimated external cost savings of EUR 48.1 billion, expressed as present value over 2026-2050 relative to the baseline. (++)	Expected reduction of fatalities by 6,847, severe injuries by 64,640 and slight injuries by 364,155 (cumulative over 2026-2050, relative to the baseline). Estimated external cost savings of EUR 73.9 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)	Expected reduction of fatalities by 6,912, severe injuries by 64,885 and slight injuries by 365,665 (cumulative over 2026-2050, relative to the baseline). Estimated external cost savings of EUR 74.2 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)	Expected reduction of fatalities by 7,013, severe injuries by 65,686 and slight injuries by 368,498 (cumulative over 2026-2050, relative to the baseline). Estimated external cost savings of EUR 75.2 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)
General objective 2: Contribute to sustainable mobility				
% reduction in the level of pollutant emissions from road transport and associated external costs	Expected reduction of NOx emissions by 3,176 kt over 2026-2050 (16.8% reduction from the baseline) Expected reduction of PM emissions by 135 kt over 2026-2050 (12.7% reduction from the baseline) Estimated external cost savings of EUR 58.7 billion, expressed as present value over 2026-2050 relative to the baseline. (++)	Expected reduction of NOx emissions by 3,925 kt over 2026-2050 (20.8% reduction from the baseline) Expected reduction of PM emissions by 196 kt over 2026-2050 (18.5% reduction from the baseline) Estimated external cost savings of EUR 75.2 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)	Expected reduction of NOx emissions by 3,969 kt over 2026-2050 (21.0% reduction from the baseline) Expected reduction of PM emissions by 199 kt over 2026-2050 (18.7% reduction from the baseline) Estimated external cost savings of EUR 76.1 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)	Expected reduction of NOx emissions by 3,970 kt over 2026-2050 (21.0% reduction from the baseline) Expected reduction of PM emissions by 199 kt over 2026-2050 (18.7% reduction from the baseline) Estimated external cost savings of EUR 76.1 billion, expressed as present value over 2026-2050 relative to the baseline. (+++)

Strongly negative	Negative	No or limited impact	Positive	Strongly positive	Unclear

Impact	PO1a	PO1b	PO2	PO3
% reduction in the level of noise from road transport and associated external costs	Limited impact on noise levels by a 1% reduction of share of share of motorcycle high emitters Estimated external cost savings of EUR 0.2 billion, expressed as present value over 2026-2050 relative to the baseline. (0/+)	Significant impact on noise levels by expected reduction of high emitters by 12.5% for M1 and N1 and 31.1% for L3-L7 Estimated external cost savings of EUR 7.3 billion, expressed as present value over 2026-2050 relative to the baseline. (++)	Significant impact on noise levels by expected reduction of high emitters by 12.5% for M1, 12.5% for N1 and 30.7% for L3-L7 Estimated external cost savings of EUR 7.3 billion, expressed as present value over 2026-2050 relative to the baseline. (++)	Significant impact on noise levels by expected reduction of high emitters by 12.5% for M1, 16.4% and N1 and 33.4% for L3-L7 Estimated external cost savings of EUR 7.8 billion, expressed as present value over 2026-2050 relative to the baseline. (++)
General objective 3: Facilitate the free movement of persons and goods in the EU				
Removal of obstacles to re-registration of vehicles in another MS	Positive contribution based on enhanced access to other MS PTI databases via the common interface (PMC7) and the harmonisation of the vehicle registration documents (PMC8) Additional positive contribution towards removal of obstacles on the basis of the digital vehicle registration certificate (PM16) combined with additional data included in the vehicle register (PM17) (++)	Positive contribution based on enhanced access to other MS PTI databases via the common interface (PMC7) and the harmonisation of the vehicle registration documents (PMC8) (+)	Positive contribution based on enhanced access to other MS PTI databases via the common interface (PMC7) and the harmonisation of the vehicle registration documents (PMC8) Additional positive contribution towards removal of obstacles on the basis of the digital vehicle registration certificate (PM16) combined with additional data included in the vehicle register (PM17) (++)	Positive contribution based on enhanced access to other MS PTI databases via the common interface (PMC7) and the harmonisation of the vehicle registration documents (PMC8) Additional positive contribution towards removal of obstacles on the basis of the digital vehicle registration certificate (PM16) combined with additional data included in the vehicle register (PM17) (++)
Removal of obstacles related to the roadworthiness testing of vehicles (recognition of certificates issued by other MSs)	Positive but partial impact on the removal of obstacles dependent on the level/number of bilateral agreements signed that are expected to cover only part of the EU Member States (+)	Positive impact on the removal of obstacles expected due to the EU-wide recognition of PTI certificates in another Member State but limited only to passenger cars and only for a period of 6 months (++)	Positive impact on the removal of obstacles expected due to the EU-wide recognition of PTI certificates in another Member State but limited only to passenger cars and only for a period of 6 months (++)	Positive impact on the removal of obstacles expected due to the EU-wide recognition of PTI certificates in another Member State extended to all vehicles without time limit (+++)

Strongly negative	Negative	No or limited impact	Positive	Strongly positive	Unclear

Impact	PO1a	PO1b	PO2	PO3
Specific objective 1: Ensure the adequacy, consistency, objectivity, and quality of roadworthiness testing of today's and tomorrow's vehicles				
Use of available test methods and procedures appropriate to assess the roadworthiness of vehicles, including new internal combustion engine and electric vehicles and their electronic safety and emission control systems	Use of new test methods in PTI and RSI ensuring that ADAS and other GSR related technologies operate as expected and update of PTI to cover the safety of electric vehicles Small scope extension of RSI for motorcycles (8.6% of the fleet covered) (+)	Use of new test methods in PTI and RSI ensuring that ADAS and other GSR related technologies operate as expected and update of PTI to cover the safety of electric vehicles Systematic cargo securing inspections Significant increase in the number of vehicles covered at PTI: M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1). Small extension of the number of motorcycles tested at PTI (8.8% increase) (+++)	Use of new test methods in PTI and RSI ensuring that ADAS and other GSR related technologies operate as expected and update of PTI to cover electric vehicles Systematic cargo securing inspections Significant increase in the number of vehicles covered at PTI: M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1). Small extension of the scope of RSI for motorcycles covered and higher frequency (8.6% increase) (+++)	Use of new test methods in PTI and RSI ensuring that ADAS and other GSR related technologies operate as expected and update of PTI to cover electric vehicles safety aspects Systematic cargo securing inspections Significant increase in the number of vehicles covered at PTI: M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1) and a further extension of the scope for motorcycles (9% increase) (+++)
Use of available test methods and procedures appropriate to assess the roadworthiness of vehicles including new internal combustion engine and electric vehicles and their electronic safety and emission control systems	Adoption of new and effective test methods to measure NOx and PN emissions during PTI and RSI for all vehicle categories (ICE) Small extension of the scope of RSI for motorcycles (8.6 % increase) (+)	Adoption of new and effective test methods to measure NOx and PN emissions during PTI and RSI for all vehicle categories (ICE), including the use of remote sensing and plume chasing Significant increase in the scope of vehicles covered for N1 vehicles (annual tests from year 1) (increase by 14.2 million emission inspection in 2030) and for all M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1) and a small extension of the number of motorcycles tested at PTI (8.8% increase) (+++)	Adoption of new and effective test methods to measure NOx and PN emissions during PTI and RSI for all vehicle categories (ICE), including the use of remote sensing and plume chasing Significant increase in the scope of vehicles covered for N1 vehicles (annual tests from year 1) (increase by 14.2 million emission inspection in 2030) and for all M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1) and a small extension of the scope of RSI for motorcycles (8.8% increase) (+++)	Adoption of new and effective test methods to measure NOx and PN emissions during PTI and RSI for all vehicle categories (ICE), including the use of remote sensing and plume chasing Significant increase in the scope of vehicles covered for N1 vehicles (annual tests from year 1) (increase by 14.2 million emission inspection in 2030) and for all M1/N1 vehicles over 10 years old (increase by 42.1 million PTI for M1 in 2030 and 4.5 million inspections for N1) and further extension of the scope of PTI for motorcycles (9% increase) (+++)

Strongly negative	Negative	No or limited impact	Positive	Strongly positive	Unclear

Impact	PO1a	PO1b	PO2	PO3
Specific policy objective 2: Significantly reduce fraud and tampering and improve the detection of defective vehicles				
Impact (% of reduction) on the number of defective and tampered vehicles in terms of emission control systems	Expected reduction of vehicles with defective and tampered emission control systems for NOx and PN/PM (high emitters) on the basis of advanced PTI by up to 33% by 2030 and 42% by 2050 for NOx and 26% by 2030 and 38% by 2050 for PN (weighted average for the whole fleet) (++)	Expected reduction of vehicles with defective emission control systems for NOx and PN/PM (high emitters) on the basis of advanced PTI and RSI by up to 48% by 2030 and 56% by 2050 for NOx and 43% by 2030 and 53% by 2050 for PN (weighted average for the whole fleet) (+++)	Expected reduction of vehicles with defective emission control systems for NOx and PN/PM (high emitters) on the basis of advanced PTI and RSI by up to 48% by 2030 and 56% by 2050 for NOx and 43% by 2030 and 53% by 2050 for PN (weighted average for the whole fleet) (+++)	Expected reduction of vehicles with defective emission control systems for NOx and PN/PM (high emitters) on the basis of advanced PTI and RSI by up to 48% by 2030 and 56% by 2050 for NOx and 43% by 2030 and 53% by 2050 for PN (weighted average for the whole fleet) (+++)
Impact (% reduction) on the number of vehicles with tampered emission/noise control system	Very limited impact on identification of tampered vehicles focusing on HGVs as part of the advanced RSI inspections and for motorcycles (for those MSs that use RSI) (0/+)	Positive impact on identification of tampered vehicles covering all vehicle categories on the basis of advanced RSI inspection combined with the use remote sensing and plume chasing (for HGVs) as part of RSI (+)	Significant impact on identification of tampered vehicles covering all vehicle categories on the basis of advanced RSI inspection combined with the use remote sensing and plume chasing (for HGVs) as part of RSI and the introduction of RSI for N1 (++)	Significant impact on identification of tampered vehicles covering all vehicle categories on the basis of advanced RSI inspection combined with the use of remote sensing and plume chasing (for HGVs) as part of RSI and the introduction of RSI for N1 and motorcycles (+++)
Impact (% reduction) on level of odometer tampering and associated cost savings for consumers	Significant reduction of odometer tampering estimated to help avoid tampering for 4.7 million M1 and N1 vehicles in 2030 and 5.1 million in 2050, 64% of which related to cross border sales. Benefits of EUR 118.3 billion to businesses owners of vehicles and EUR 65.7 billion consumers for the period 2026-2050, expressed as present value relative to the baseline. (+++)	Significant reduction of odometer tampering estimated to help avoid tampering for 4.7 million M1 and N1 vehicles in 2030 and 5.1 million in 2050, 64% of which related to cross border sales. Benefits of EUR 118.3 billion to businesses owners of vehicles and EUR 65.7 billion consumers for the period 2026-2050, expressed as present value relative to the baseline. (+++)	Significant reduction of odometer tampering estimated to help avoid tampering for 4.7 million M1 and N1 vehicles in 2030 and 5.1 million in 2050, 64% of which related to cross border sales. Benefits of EUR 118.3 billion to businesses owners of vehicles and EUR 65.7 billion consumers for the period 2026-2050, expressed as present value relative to the baseline. (+++)	Significant reduction of odometer tampering estimated to help avoid tampering for 4.7 million M1 and N1 vehicles in 2030 and 5.1 million in 2050, 64% of which related to cross border sales. Benefits of EUR 118.3 billion to businesses owners of vehicles and EUR 65.7 billion consumers for the period 2026-2050, expressed as present value relative to the baseline (+++)

Strongly negative	Negative	No or limited impact	Positive	Strongly positive	Unclear

Impact	PO1a	PO1b	PO2	PO3
Specific policy objective 3: - Improve electronic storage and exchange of relevant vehicle identification and status data				
Reduction of time/costs associated with the access and exchange of relevant vehicle data by inspection centres and enforcement and registration authorities	Positive impact on costs for authorities estimated at EUR 642 million for the period 2026-2050 on the basis of the enhanced access to electronic data related to PTI for authorities (PMC7) combined with enhanced access to relevant vehicle technical information for PTI centres (PM16) with additional savings of up to EUR 1.43 billion for the period 2026-2050 (+++)	Positive impact on costs for authorities estimated at EUR 642 million for the period 2026-2050 on the basis of the enhanced access to electronic data related to PTI for authorities (PMC7) (+)	Positive impact on the basis of the enhanced access to electronic data related to PTI for authorities estimated at EUR 642 million for the period 2026-2050 (PMC7) combined with enhanced access to relevant vehicle technical information for PTI centres (PM16) with additional savings of up to EUR 1.43 billion for the period 2026-2050 (+++)	Positive impact on the basis of the enhanced access to electronic data related to PTI for authorities estimated at EUR 642 million for the period 2026-2050 (PMC7) combined with enhanced access to relevant vehicle technical information for PTI centres (PM16) with additional savings of up to EUR 1.43 billion for the period 2026-2050 (+++)

Source: Ricardo et al. (2023), Impact assessment support study

Annex 10: SME test

Step (1) of SME test (identification of affected businesses).

In the road transport sector 99% of companies are SMEs (enterprises employing up to 250 people and with a turnover of less than EUR 50 million[466]). Roadside inspections under the RSI Directive have been specifically targeted at commercial vehicle fleets, which are predominantly operated by SMEs. The exact number of SMEs among PTI centres could not be established since there are no statistics on the share of PTI centres that are SMEs and due to the situation where in each Member State there are different PTI organisational models in place. In some Member States (e.g. Sweden) there are a few big companies that provide PTI services while in others (e.g. Netherlands), there are multiple small independent garages. In the majority of the Member States, there is a mix of a small number of large PTI centres and a large number of small (SMEs) ones. Garages, motor vehicle dealers, tyre and repair stations, affected by the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory, are almost entirely SMEs (above 99% of the companies are SMEs).

Step (2) of SME test (consultation of SME stakeholders).

In the OPC, looking at the responses of companies, i.e., those organisations that classified themselves as a ‘company or business organisation’ and which are clearly a company, there were 21 separate responses from SMEs and 16 from larger companies. In the context of the OPC and the targeted stakeholder consultation, the responses suggested a higher sensitivity of SME respondents towards the expected costs of some of the measures (extension of scope of PTI and RSI in the case of motorcycles and vans, and for more demanding tests), mainly in relation to the costs for new equipment and facilities for small PTI centres and for small transport companies.

According to the stakeholders consulted in the survey, a slightly positive impact on the SME competitiveness would be expected from measures related to access and exchange of information, extended scope of RSI and new RSI test methods, new PTI/RSI test requirements, vehicle registration measures and roadworthiness certificates in electronic format. Some stakeholders also considered there should be a positive impact for SMEs despite the additional cost on equipment. They stated that the policy options should have a positive economic impact because vehicles, which need a mandatory PTI also need to be maintained regularly and this is normally done by garages, tyre and repair stations, which almost entirely SMEs. On the other hand, the survey responses showed that SMEs are concerned by the financial burden these new testing requirements and equipment adaptations may pose on them. These additional costs can be particularly challenging for smaller PTI centres to bear. It was also noted that some SMEs are involved in developing these new testing methods and could benefit from this. Regarding data access for SME technology companies, it was widely agreed that facilitating access would enhance the competitiveness of smaller firms, levelling the playing field in

[466] Eurostat: Services by employment size class. https://ec.europa.eu/eurostat/databrowser/view/SBS_SC_1B_SE_R2__custom_3493320/default/table

their competition against larger companies. Harmonised data governance should be particularly beneficial for SMEs.

Step (3) of SME test (assessment of the impacts on SMEs).

PTI centres are affected as described in section 6.1.2.1. The additional equipment costs for PTI centres mean additional revenues for ***garage equipment manufacturers***, many of which are also SMEs. It was however not possible to quantify these revenues. Beyond the impact of the common measures on SMEs, no additional impact on costs for PTI centres is expected for **PO1a**. Both **PO1b** and **PO2** will, in addition to the common measures, include increased costs for SMEs due to additional emission tests for light commercial vehicles (PM5), extra tests on vehicles over 10 years old (PM6), equipment and training of inspectors for motorcycle noise testing (PM10), and the additional emission tests for vehicles that are found as high emitters during remote sensing or plume chasing and are sent for emission tests in a PTI centre (PM12). PO1b will also include costs for equipment and training of inspectors for the mandatory PTI for motorcycles above 125cm3 (PM2). **PO3** (in addition to the common measures, plus PM5, PM6, PM10 and PM12) is expected to have an impact on SMEs through PM3, leading to motorcycle test adaptation costs. Additionally, PM4 concerning PTI for light trailers requires the acquisition of supplementary devices. PM7, which aims to harmonise tests and procedures, is associated with increased expenses for SMEs operating testing centres due to the need to invest in standardised equipment. These measures collectively are expected to lead to some financial challenges for SME testing centres in adapting to the new testing requirements, in particular in the first years of implementation, and provide new opportunities to garage equipment manufacturers. PO1b, PO2 and PO3 are expected to have the most significant impact on SMEs.

As shown in section 6.1.2.1, all policy options are estimated to result in adjustment costs for PTI centres, with the highest costs arising for PO3, and under PO2 and PO3 also in some increase in the administrative costs. The increase in costs for new equipment and facilities (estimated in the range of EUR 20,000 to EUR 100,000 per new PTI lane depending on the specific vehicle category) can have a greater impact on some smaller PTI centres that may find it more challenging to finance additional investments. On the other hand, in all policy options SMEs can expect to benefit from the additional business opportunities due to the extension of the scope and/or the frequency of PTI. The largest benefits due to the extension of the scope and/or the frequency of PTI are expected in PO3. Overall, as explained in section 6.1.2.1, PO2 is expected to result in the highest net benefits for PTI centres (EUR 17.3 billion, expressed as present value over 2026-2050), followed by PO3 (EUR 16.4 billion) and PO1b (EUR 15.9 billion) while PO1a is expected to result in net costs (EUR 2.9 billion). Net benefits in PO2 represent around 6.3% of the turnover per PTI centre, in PO3 around 6% of the turnover, in PO1b around 5.8% of the turnover per PTI centre, while the net costs in PO1a around 1.1% of the turnover. While it was not possible to split the costs and benefits between the two groups (i.e., SME and others), due to the lack of data, a large part of the net benefits in PO1b, PO2 and PO3 and of the net costs in PO1a are expected to be attributed to SMEs.

Garages, motor vehicle dealers, tyre and repair stations, etc., mostly SMEs, will be affected by the requirement for Member States to set up a system to record odometer readings from the cars and vans registered in their territory (PMC9) in all policy options. As explained in section 6.1.2.2, total one-off and recurrent administrative costs would amount to EUR 460 million (EUR 706 per company), expressed as present value over 2026-2050.

Businesses owning vehicles. As explained in section 6.1.2.4, all policy options are expected to result in net benefits for businesses owning vehicles, estimated at EUR 117.8 billion in PO1a, EUR 94.2 billion in PO1b, EUR 94 billion in PO2 and EUR 93.6 billion in PO3, expressed as present value over 2025-2050 relative to the baseline (in 2022 prices). Based on the available information, it was however not possible to assess how many of the businesses owning vehicles are SMEs.

Only few of the measures are expected to affect the road haulage sector largely composed of SMEs (e.g., PM13 on cargo securing inspections in PO1b, PO2 and PO3, which would result in minimal costs, while hauliers could also benefit from the savings of avoided emission tests at PTI after having passed a RSI or a remote sensing check). The overall impact on the road haulage sector is expected to be limited but rather positive, although the available data did not allow a split of the costs and benefits between the two groups of operators (i.e., SME and others).

Step (4) of SME test (minimizing negative impacts on SMEs).

A large part of costs and benefits for PTI centres are expected to be attributed to SMEs. Depending on the Member State, the additional costs for the SMEs due to the additional requirements per PTI may be passed through to vehicle owners. Where Member States do not regulate prices, the PTI centres would likely be able to recover investment costs. Where Member States regulate the level of PTI charges, the costs may either be borne by the service provider or be recovered over a longer period. On the other hand, the higher costs due to the increased number of inspections (i.e. due to the extended scope) can be fully passed through to the vehicle owners and will represent benefits for the SMEs. Likewise, garages, motor vehicle dealers, tyre and repair workshops, which are mostly SMEs, will be affected by the requirement to set up a system to record odometer readings from the cars and vans registered in the same Member State. The related costs could be partly offset with pass-through of the costs to vehicle owners.

For businesses owning vehicles**,** it was not possible to assess how many of the businesses owning vehicles are SMEs. Measures such as cargo securing inspections are expected to affect the road haulage sector largely composed of SMEs, which would result in minimal costs. On the other hand, hauliers would be able to benefit from the savings of avoided emission tests at PTI after having passed a RSI. The overall impact on the road haulage sector is expected to be limited but rather positive, although the available data did not allow a split of the costs and benefits between the two groups of operators (i.e., SME and others).

A key issue highlighted by respondents in the stakeholder consultation in relation to SMEs are the aspects related to the renewal of testing equipment: the financial implications, the timeline for completing the investment, and the availability of support or financing options to facilitate this transition. One possible solution could be the extension of the transitional period for SMEs to update their equipment/facilities. A smoother transition with a longer time for adjustment could make it easier for smaller PTI centres to prepare and minimise the negative impact.

ANNEX 11: LINKS BETWEEN THE CONCLUSIONS OF THE EX-POST EVALUATION AND THE IMPACT ASSESSMENT

The links between the conclusions of the ex-post evaluation and the impact assessment are summarised in the table below.

Table 269: Links between the main conclusions of the ex-post evaluation and the impact assessment

Main ex-post evaluation conclusions	Impact Assessment
Conclusions on relevance	
The RWP is not adapted to the latest technologies such as advanced driver assistance systems (e.g. ADAS) and electronic safety features, for which the RWP currently does not provide a sufficiently comprehensive framework. It does not contain specific testing protocols which would ensure the compliance and maintenance of electric, hybrid and hydrogen vehicles, including software updates. Technical inspections would have to be updated for the efficient acquisition of important safety-related data and the monitoring of new sensors and functions. Regarding emissions, some of the PTI tests and equipment must be adapted as they are no longer capable of detecting emission failures in the most recent internal combustion engine vehicles.	The impact assessment analyses specific measures dedicated to addressing the challenges posed by recent and upcoming vehicle technology, in particular testing ADAS, software updates and electric vehicles. Similarly, measures aiming at improved access to vehicle data for the purposes of vehicle testing are assessed. As for emission testing, measures to introduce new test methods based on recent technical developments to replace outdated methods are defined.
Conclusions on effectiveness	
Regarding roadworthiness emission checks, the effectiveness of the RWP is limited as the current test requirements under PTI and RSI are not suited to testing the functioning of recent emission control systems and must therefore be updated. Opacity testing measurement is outdated as it cannot detect diesel vehicles with defective particle filters or a tampered catalyst, which lead to high particle and NOx emissions. Instead, PN and NOx measurement should be used to verify newer diesel and petrol vehicles to detect defects and tampering with emission control systems. Regarding improvement of the exchange of information on testing results between Member States, the current framework for information exchange has not been effective. Although the legislation mentions electronic data exchanges between Member States authorities as a possibility, not all countries use this. Even if the harmonisation of vehicle registration documents made it easier for citizens to register vehicles from other Member States and EEA, there is room for improvement of the digitalisation process, to make it even easier. Re-registration can still be a cumbersome process and the RWP currently prevents the mutual recognition of PTIs between Member States, which represents a barrier to free movement.	The impact assessment analyses the impacts of replacing outdated emission test methods for modern vehicles, in particular exhaust gas opacity testing required by the current PTI and RSI Directives. It assesses the benefits of measures introducing particle number (PN) counting and NOx-measurement, as well as remote sensing and/or plume chasing. The impact assessment looks at specific measures facilitating cross-border exchange of vehicle data. Similarly, it assesses the expected effects of various alternatives of mutual recognition of PTI certificates.
Conclusions on efficiency	
Digitalisation can help in streamlining the vehicle re-registration process: the RWP should use the benefits of digital data exchange and more harmonisation of vehicle documents to reduce the administrative burden and costs associated with the process. Also, digital (mobile) vehicle registration documents could further	The impact assessment looks at specific measures facilitating cross-border exchange of vehicle data to address the issue of inefficient re-registration processes, for example the harmonisation of registered data and the

Main ex-post evaluation conclusions	Impact Assessment
facilitate the digitalisation of the vehicle registration and data-keeping processes and reduce costs.	interlinking of national vehicle registers, as well as the possible introduction of digital registration documents.
Conclusions on coherence	
More consistency should be ensured between the type-approval regulation and the RWP. The coherence between the RWP and relevant EU instruments could be improved through the standardisation of safety-relevant vehicle data and the related responsibilities for manufacturers during the vehicle's lifecycle. Defining responsibilities more clearly and mandating that relevant information is made available for PTIs across Member States could reduce uncertainty and time spent on searching for the relevant information, thus improving the overall accuracy and efficiency of inspections. The RWP should be also better aligned with the General Safety Regulation (GSR) (EU) 2019/2144.	Roadworthiness testing relies to a large extent on type-approval, including when it comes to safety-relevant vehicle data. While the initiative on access to in-vehicles data is meant to address the need to standardise data formats, this impact assessment considers a measure that aims to specify the means of access to such data for the purpose of vehicle inspection. It also analyses the impacts of a measure focusing on testing ADAS, mandated by the GSR.
Conclusions on EU Added Value	
The RWP sets a minimum standard for all Member States and provides a basic framework for detecting and addressing roadworthiness defects, ensuring that all Member States take action to improve road safety. Further harmonisation of the minimum PTI and RSI requirements would be useful to improve consistency of legislation, standards and practices within the EU. There is scope to improve mutual recognition of PTI inspections between the Member States, which would add value to the EU internal market, while it would also help to increase vehicle safety and environmental protection.	One aim of the initiative is to update the RWP to evolving technology, to maintain its added value. It therefore includes a series of measures aimed at further improving road safety and environmental protection through further harmonisation. Measures are also defined to enhance the mutual recognition of PTIs conducted in another Member State.

ANNEX 12: IMPACTS ON FUNDAMENTAL RIGHTS

This annex discusses in more detail the impacts on fundamental rights. The policy options were assessed to determine if they have an impact on the fundamental rights and/or equal treatment of EU citizens. The starting point of the assessment of the fundamental rights is the Charter of Fundamental Rights of the European Union[467]. All POs were assessed having regard to the relevant EU instrument and it was concluded that they maintain full respect for human and fundamental rights, and none will have any negative impact thereon.

All options contain common measures (PMC3 and PMC4) to help reduce the level of air pollutant emissions from vehicles, thereby helping to improve the quality of the environment, in line with Article 37 of the Charter. However, options PO1b, PO2, and PO3 go further than option PO1a in this regard, due to measures PM5 (annual emission testing for light commercial vehicles), PM6 (yearly testing of vehicles that are 10-year-old or older) and PM12 (NOx measurement in RSI by remote sensing and plume chasing).

All policy options contain a measure (PMC1) to adapt PTI methods to the testing of electric vehicles including the training of inspectors. This will provide a safer workplace for vehicle inspectors. In addition, PO1b, PO2, and PO3 contain a measure (PM13) to include mandatory inspection of cargo securing in RSI. These three policy options will therefore provide a safer working environment than option PO1a for professional drivers (Article 31).

All policy options contain a measure designed to combat odometer fraud (PMC9), thereby increasing consumer protection (Article 38). Policy options PO3 as well as PO1b and PO2 each contain a measure (PM7 or PM8) to provide for mutual recognition of roadworthiness certificates. Policy options PO1a, PO2 and PO3 contain a measure to digitalise registration documents (PM16). Therefore, PO2 and PO3 would have the greatest impact on assisting freedom of movement and residence (Article 45).

All policy options contain a measure (PMC3) on PN measurement at PTI for light and heavy-duty vehicles and at RSI for commercial vehicles. However, policy options PO1b, PO2 and PO3 also contain a roadside inspection measure for NOx and PM measurement (remote sensing and plume chasing – PM12). Therefore, these three options go further than PO1a in ensuring that vehicles with tampered emission control systems, which could otherwise pass at PTI, will be caught at RSI. By ensuring that owners of non-tempered vehicles are not placed at a disadvantage compared to tampered vehicles, these three options do the most in promoting equality before the law (Article 3).

PO2 and PO3 contain a measure on data governance (regarding cost-free access to vehicle testing by testing centres – PM11), which refers to technical data related to the vehicle's specifications and current state (e.g., sensor values). All options include a measure on odometer readings (PMC9), which considers privacy issues when data is stored and exchanged. During the consultations, some stakeholders expressed concern over the data privacy issues in common measures related to the possibility of electronic roadworthiness electronic certificates, and access thereto (PMC6 and PMC7). From a road safety perspective, the automatic accessibility of certificates through a shared system holds significant advantages, particularly in facilitating cross-border inspections and enhancing consumer convenience. However, the implementation of a digital

[467] https://commission.europa.eu/aid-development-cooperation-fundamental-rights/your-rights-eu/eu-charter-fundamental-rights_en

roadworthiness certificate demands a careful examination of potential privacy issues and the formulation of robust privacy protection measures.

ANNEX 13: IMPACTS ON THE FUNCTIONING OF THE INTERNAL MARKET AND COMPETITION

As described in section 6.1.7, the existing divergence between vehicle registration documents and the information included and quality of the data stored in the vehicle registers creates challenges in coordinating enforcement actions by Member States. Furthermore, the non-recognition of roadworthiness certificates among EU Member State creates additional trade barriers for cross-border operation or sale of vehicles, hindering the efficient functioning of the internal market, business operations and the freedom of movement of people within the EU. All policy options are expected to have a positive impact on the functioning of the internal market.

The combination of the measures related to improving the availability and exchange of vehicle-related information, making the roadworthiness certificate available in electronic format, harmonising testing methods, the frequency of testing, requirements for the improvement of the PTI and the scope of testing, can have a positive impact on the functioning of the internal market and on competition.

All policy options include the common measures on the harmonisation of testing methods (PMC3, PMC4), and requirements for improving PTI (PMC1, PMC2 and PMC5) which could facilitate the free movement of vehicles, since more harmonised testing across Member States can enhance consumer confidence in purchasing vehicles from other countries, thereby promoting competition. Odometer tampering concerns at the moment of purchasing a second-hand vehicle are addressed by PMC9 in all policy options.

Harmonising vehicle registration documents across Member States (PMC8) can have a positive contribution to internal market and competition. The standardised information helps to verify the vehicle's characteristics, and its registration status in the country of origin. This verification process helps to address potential obstacles to re-registration in another EU Member State, for example where the vehicle is reported stolen, or its registration certificate is suspected of being fraudulent. By harmonising the technical data in vehicle registration documents, the measure can simplify and streamline cross-border trade in vehicles within the EU.

Providing electronic access to relevant data, including on PTI reports stored in national databases, to the registration authorities in another Member State (PMC7), is also expected to have a positive impact on the EU internal market, helping to avoid fraud and eliminate trade obstacles. An additional positive impact on fraud avoidance is expected from the requirement to issue roadworthiness certificates in electronic format only (PMC6).

Qualitative assessment shows that PO2 and especially PO3 are expected to have the highest positive impact on the internal market and competition. PO2 incorporates additional measures aimed at extending roadside inspections to light commercial vehicles, and facilitating access to vehicle data necessary for thorough testing by PTI centres. This comprehensive approach is expected to have a stronger impact than PO1a and PO1b due, to its emphasis on these factors. PO3 has a stronger positive impact due to PM7, which requires that a PTI certificate issued in any Member State is recognised by the Member State of registration, as well as further harmonisation of test methods. In addition, PO3 introduces mandatory PTI for all motorcycles and light trailers, which are not currently tested by all Member States. The inclusion of L-category vehicles in the scope of RSI (PM15) is expected to reduce the number of tampered vehicles. PO3 applies more ambitious measures regarding the mutual recognition of the PTI certificates, and the standardisation of tests methods than provisions already included in the other policy options. As such, PO3 is expected to deliver the most significant positive impact on the internal market and competition.

ANNEX 14: COHERENCE, SUBSIDIARITY AND PROPORTIONALITY (DETAILED ANALYSIS)

Coherence

Internal coherence assesses how various elements of the proposed options are expected to work together to achieve the objectives. Although all four policy options address the identified specific objectives and underlying problem drivers, they do so in different ways, and with a different level of intervention.

The measures common to all policy options address different aspects of the problem covering test methods and procedures for both PTI and RSI, frequency of inspections related to vehicles with modifications, and measures related to facilitating exchange of PTI and registration data among Member States. There are no evident contradictions and inconsistencies among these measures. In some case there are possible synergies in terms of costs to implement them, such as the introduction of new test methods for PN and NOx, where the goal is to eventually use one single device and one single measurement for both tests. Importantly, the measure addressing odometer fraud, by increasing the number of readings and the exchange of relevant data in the case of cross-border sales, will benefit from the implementation of the measure that will facilitate the easier exchange of relevant data among Member States.

PO1a focuses on better exchange of vehicle data and there are clear synergies between the common measures on the frequent update of data in vehicle registration and the introduction of a digital vehicle certificate. Digital vehicle certificate should also simplify the approach to the data to be included in vehicle certificate dataset and facilitate re-registration of vehicles and enforcement activities.

PO1b has the focus more on testing and reducing safety- and emissions-related fraud and tampering and improving the detection of defective vehicles. It includes additional test methods and procedures besides those in the common measures. It aims at higher combined impact in terms of identification of defective vehicles, for example through measures such as the annual emission testing of light commercial vehicles. It also shows synergies with introducing mandatory PTI for motorcycles and the use of more advanced noise testing for motorcycles. The use of remote sensing and plume chasing for HDVs measuring NOx and particle emissions complements the new PTI and RSI methods, helps to better target inspections and increases the share of the vehicle fleet checked between PTI inspections. Given that it does not include any of the measures related to digital certificate or the extension of data to be included in the registration certificate, some of the combined benefits in PO1b are likely to be smaller.

Synergies indicated in relation to PO1a and PO1b are expected to increase in the case of PO2 and PO3, containing more comprehensive sets of measures and even lead to extra synergies, for example due to measures on registration certificate and more harmonised registered data. Some measures such as introduction of RSI for vans will be complementary to the use of new testing methods (PN and NOx testing). PO3 goes even further than PO2 by including RSI for motorcycles, complementing the mandatory PTI for motorcycles with extended scope (>50cc), and by requiring PTI of trailers below 3.5t (O1 and O2 categories).

To summarise, all policy options ensure internal coherence. Among the four options, it can be concluded that PO2 and PO3 are expected to benefit from a broader range of synergies that can contribute to a higher level of achievement of the objectives.

External coherence focuses on the compliance of the initiative with other EU instruments and relevant EU policies, as well as national policies and international obligations. All identified policy options show strong links to several EU instruments.

All policy options appear consistent with the objectives and priorities set in the 2020 **Sustainable and Smart Mobility Strategy (SSMS) and the EU Green Deal** by ensuring that vehicles on the roads maintain an adequate level of safety and environmental performance over time. By the expected reduction in fatalities, all policy options are in line with the objectives set in the **EU Road Safety Policy Framework**, and will contribute to the achievement of the objective of 50% reduction of fatalities and serious injuries by 2030. Still, PO2 and even more so PO3 are the policy options with the greatest level of contribution towards this objective. The proposed options are also expected to have a significant contribution towards the EU's clean air policy objectives, including those of the Ambient Air Quality Directives and of the National Emission reduction Commitments Directive, by better identifying and reducing the presence of high polluters that represent a very large share of total emissions from road transport.

All policy options are also consistent with the **Single Digital Gateway Regulation** by facilitating online access to vehicle-related information, relevant administrative procedures and assistance and problem-solving services. PO1b is less coherent than the other options as it does not include the digitalisation of vehicle registration certificates and adding further data to the vehicle registers. Otherwise, the options are also serving the objectives of the **EU's Data Strategy** for the development of European Data spaces for public administrations that can support enforcement of legislation, including road safety and environmental legislation. Exchange of information related to roadworthiness and registration data will have to be aligned with relevant rules on data protection (**GDPR**).

All options are consistent with the **General Safety Regulation**. They will ensure that any new equipment introduced to ensure compliance with that Regulation will perform as expected and, as a result, ensure that the benefits materialise. All policy options are coherent with the safety and environmental requirements as set out in the **Type-approval Regulations**[468]. These Regulations also set out the market surveillance requirements for these vehicles. All policy options include measures which aim at ensuring that minimum standards are maintained by owners throughout the lifetime of the vehicle. They include alignment between PTI and RSI testing and the type-approval process, including in relation to the use of ePTI. Remote sensing in RSI of all vehicles (part of PO1b, PO2 and PO3) is particularly relevant for the purposes of market surveillance as it allows screening a large part of the vehicle fleet providing valuable insight into recurrent issues with specific technologies/solutions used as part of emission control systems, vehicle models, model years etc.

Further to that, there are expected synergies with the new **Euro 7 Regulation** for all options, including the use of On-Board Monitoring functions to facilitate the assessment of NOx emissions during PTI and RSI inspections. Finally, all policy options are coherent with the requirements of the legislation **on end-of-life vehicles (ELV)**, through providing electronic access to data to the registration authorities of other EU Member States and adding new, including ELV-related data to

[468] i.e. Regulation (EU) 2018/858 for most passenger and freight vehicles and their trailers, Regulation (EU) 167/2013 for tractors, and Regulation (EU) 168/2013 for two- and three-wheel vehicles and quadricycles.

the vehicle register.

In terms of external coherence, all policy options are therefore considered consistent with relevant EU strategies and legal instruments and contribute to EU policy priorities. In relative terms, PO3 and PO2 are expected to be the most coherent with the policy objectives in related EU legislation and strategies, followed by PO1b and PO1a being slightly less coherent. PO2 is considered somewhat more coherent than PO3 in relation to existing national policies and structural differences on the ground (further explained under subsidiarity below).

Subsidiarity and proportionality

As described in sections 3.2 and 3.3, EU action is justified on the basis that Member States alone would not be able to reach the objectives of the initiative, i.e., updating the harmonised rules on roadworthiness testing, including coordinated exchange of vehicle-related data. What differentiates the policy options beyond the common measures necessary to achieve the objectives at a minimum level is their focus (between PO1a and PO1b) and the extent to which they can fulfil the objectives (PO2 and PO3 going beyond the other two).

In terms of the relevant measures for the recognition of PTI certificate in other Member States, measures PM8 (included in PO1b and PO2) and especially PM7 (in PO3) may be considered by Member States as going beyond what is necessary to address the problem, while PM9 (in PO1a) – based on bilateral agreements (essentially voluntary recognition) – leaves greater scope for Member States to decide which PTIs to accept depending on differences between national solutions. However, this is expected to significantly limit the benefits to a limited number of citizens and businesses, thus also delivering less in terms of the achievement of the objectives. As regards the measures on the PTI and RSI tests and procedures, similar measures are already in place in the Member States, based on the current Directives. Requiring that certain standards are applied concerning the tests methods and procedures is intended to ensure a harmonised approach across the EU and should not, in principle, raise any subsidiarity issues.

In relation to the measures concerning the extension of the scope of PTI and/or RSI to motorcycles, PM1 (in PO1a and PO2) aims to ensure harmonisation while giving the option for Member States to choose whether to use PTI or RSI for motorcycles. PM2 (in PO1b) and PM3 (in PO3) requiring all Member States to apply PTI to motorcycles would effectively harmonise the roadworthiness testing of these vehicles, with the change affecting only seven or eight Member States. Furthermore, the fact that motorcycles are responsible for a significant share of road crashes and environmental pollution (air and noise), and may also take part in international traffic, appears to justify their regular testing while leaving the specification of the frequency and contents of the inspections to Member States.

In terms of proportionality, as the level of intervention and associated costs increase from PO1a to PO3, the level of positive impacts also increases, although not proportionally (as shown by the efficiency ratios). In general, the scope of the options is limited to what can best be achieved at the EU level (in terms of harmonisation of methods and scope of testing, as well as in finding common solutions to ensure efficient sharing and access to the necessary vehicle data). For example, vehicles that are mostly used locally, such as mopeds and tractors are not targeted by the retained measures. At the same time, there are differences in the focus and extent to which the options aim to harmonise the scope of vehicles and the content of testing.

As for the choice of the instrument for Union action, amending the existing RWP Directives is considered to be the most appropriate solution. This allows achieving the objectives through taking the next logical step in the process of gradual harmonisation in this area, while leaving sufficient room for manoeuvre for Member States to implement the changes in their specific national context, by continuing to apply well-established national arrangements in roadworthiness testing. This choice, using minimum requirements instead of a one-size-fits-all approach will also allow industry to develop the most efficient technical solutions that this continuously evolving field requires.

ANNEX 15: MONITORING

The following elements related to RSI are important for the monitoring:

- The biennial RSI reports drawn up by Member States cover major and dangerous deficiencies detected during roadside inspections of heavy-duty vehicles (lorries, buses/coaches, and tractors). As permitted by the RSI Directive, some Member States apply targeted inspections based on the risk rating of transport undertakings, which can significantly increase the share of vehicles found defective at the roadside. Although this increases the effectiveness of the measure, it also means that the results reported by those Member States are not representative of the actual share of defective vehicles that may be circulating. In addition, those reports are not comparable to reports from other Member States that do not apply targeted checks. Their usefulness is thus limited.
- Instead, reporting the results of PTIs, which are collected by all Member States and cover almost the entire vehicle fleet will be a much more useful source of information, allowing better comparability of the implementation and results achieved according to the effectiveness criteria, e.g., in terms of the numbers of defective and tampered vehicles detected (even if not perfect due to varying stringency of PTIs among Member States). For vehicles that are subject to PTI, this should be the primary reference, with RSI results a possible addition. On the other hand, for vehicles that remain outside of the scope of PTI, RSI results can be a valuable source to assess the implementation of roadworthiness testing in the EU. The frequency of reporting (biennial) is considered adequate.
- To gain a clearer view and to monitor the evolution the share of high-emitting vehicles, remote sensing data should be available from all Member States. Such data would provide an overview of the state of the vehicle fleet and help identify recurrent issues with specific technologies and brands or models that should be subject to further investigation e.g., through market surveillance actions and may be subject to recalls and software updates[469].
- In addition, as demonstrated by the evaluation and this impact assessment, data about the number of PTI centres, PTI lanes and inspectors are scarce, which hinder the accurate assessment of the effects of the policies implemented so far as well as the that of the impacts of measures still to be adopted. It is therefore necessary that Member States regularly inform the Commission about these basic data, which should be part of the biennial reports starting from the date of implementation of the revised RWP.

To measure the progress and the actual effects of the initiative, the following operational objectives and indicators have been identified:

Operational objective	Indicators

[469] Hooftman N., Ligterink N., Bhoraskar, A., (2020) Analysis of the 2019 Flemish remote sensing campaign. Commissioned by the Flemish Government - Flanders Environment Agency - Team Air quality policy

Operational objective	Indicators
Apply newly available safety and emission testing methods at PTI and RSI	Number of MSs applying test methods specific to EVs Number of MSs applying ePTI methods Number of MSs applying PN measurement Number of MSs applying NOx measurement Number of MSs applying remote sensing - To screen pollutant emission - To measure noise Number of MSs applying plume chasing Numbers of vehicles screened by remote sensing / plume chasing
Interconnect Member States' vehicle registers and odometer databases through a common hub	Number of MSs having an odometer database Number of MSs connected to the MOVE-HUB Number of messages sent per month
Digitalise vehicle documents	Number of MSs issuing digital PTI certificates Number of MSs issuing digital registration certificates
Reduce the number of defective and tampered vehicles on EU roads	Number of defective vehicles detected at PTI/RSI - With safety-related defects - With emissions-related defects Number of vehicles stopped at RSI following remote emission screening Number of vehicles invited to PTI following remote emission screening

The data for assessing these operational objectives will draw on regular reporting by Member States as well as ad hoc data collection actions, including by data exchange systems, such as the MOVE-HUB.

ANNEX 16: SYNERGIES WITH OTHER POLICY INSTRUMENTS

Roadworthiness testing relies on the technical specifications of the vehicles[470] that are harmonised at EU level and beyond (UNECE[471]). Vehicle registration remains a national competence, although it relies on the Certificate of Conformity also defined in type-approval legislation[472]. The most recent and relevant safety- and emissions-related type-approval regulations are the **General Safety Regulation** (GSR)[473] and the **Euro 7 Regulation (EU) 2024/1257**[474]. The GSR requires that, from July 2022, new types of motor vehicles are equipped with advanced driver assistant systems aimed at reducing the number of fatalities and serious injuries; these will also be used in automated vehicles[475]. The Euro 7 standards will gradually replace existing emission rules for cars and vans (Euro 6) and lorries and buses (Euro VI), ensuring that new cars, vans, lorries and buses are cleaner in real driving conditions and that they remain clean for longer than required by the existing (durability) rules. However, for passenger cars and vans, the current Euro 6 test conditions and exhaust emissions limits were maintained, as well as the current Euro VI testing conditions for buses and lorries.

The focus of the RWP is different from the market surveillance legislation mentioned above. Whereas market surveillance provisions aim to ensure that vehicles continue to meet their type-approval requirements when placed on the market and for a limited period thereafter, and so are effectively focusing on the responsibilities of the manufacturer, the RWP focuses on ensuring that minimum standards are maintained by owners throughout the lifetime of the vehicle. Also, while market surveillance requires testing a limited number of vehicles per model, PTI applies to almost all registered vehicles. Thus, the RWP complements the market surveillance legislation in ensuring road safety and the environmental performance of vehicles during their lifetime.

Since 20 May 2023, real-world fuel and/or energy consumption data are collected from light vehicles when they undergo PTI, as required by the rules **on on-board fuel consumption monitoring**[476]. This is made possible since from that date, all PTI centres are required to be equipped with scan tools capable of reading out data from the on-board diagnostics of the vehicle. The same kind of data could

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[470] Cf. the various type-approval legislation (Regulation (EU) 2018/858, Regulation (EU) 167/2013, Regulation (EU) 168/2013).
[471] World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe. For example, a proposal has been endorsed in UNECE General Safety Provisions Working Party to introduce odometer accuracy and anti-tampering provisions in UN Regulation No. 39, 02 series of amendment.
[472] https://eur-lex.europa.eu/eli/reg/2018/858/oj
[473] https://eur-lex.europa.eu/eli/reg/2019/2144/oj
[474] Regulation - 2024/1257 - EN - EUR-Lex
[475] For all new vehicle types from 6 July 2022 onwards and for all new vehicles from 7 July 2024, the following safety features are mandatory: **for all road vehicles** (cars, vans, trucks and buses) - intelligent speed assistance, reversing detection with camera or sensors, attention warning in case of driver drowsiness or distraction, event data recorders as well as an emergency stop signal; **for cars and vans** - additional features such as lane keeping systems and automated braking; **for buses and trucks** - technologies for better recognising possible blind spots, warnings to prevent collisions with pedestrians or cyclists and tyre pressure monitoring systems.
[476] Commission Implementing Regulation (EU) 2021/392 on the monitoring and reporting of data relating to CO_2 emissions from passenger cars and light commercial vehicles, https://eur-lex.europa.eu/eli/reg_impl/2021/392/oj

also be collected from heavy-duty vehicles (HDVs) undergoing PTI as soon as the corresponding legislation so requires.

The Commission is also currently working on an initiative on fair and non-discriminatory **access to in-vehicle data**[477], which is crucial for technical inspection centres to be able to carry out their daily tasks. That initiative will complement the Commission's proposal for the Data Act[478] by more specific provisions on access to functions and resources, essential for the provision of data-dependent services in the automotive sector. It will standardise the relevant datasets and ensure effective non-discriminatory and secure access for aftermarket and mobility services. A range of automotive service providers, including vehicle repair and inspection companies and authorities have called for an ambitious Commission proposal, to ensure a level-playing field and unhindered access to the relevant in-vehicle data[479]. The revision of the PTI Directive (and of its implementing act on the technical information necessary for roadworthiness testing[480]) could complement the access to in-vehicle data proposal, through specific provisions facilitating access to the data necessary for technical inspections.

Further EU legislation relevant for vehicle registration and roadworthiness are the **Single Digital Gateway** Regulation (SDG)[481] and the Directive on the treatment of **end-of-life vehicles (ELV)**[482]. The SDG Regulation provides for registering a motor vehicle originating from or already registered in a Member State among the procedures to be carried fully online, where possible. The Commission's proposal to replace the ELV Directive with a Regulation[483] aims at linking export requirements to roadworthiness and relies on more effective and efficient exchange of vehicle registration data among national authorities, including customs authorities, to address the problem of missing vehicles. For that purpose, it calls for a proposal to revise the Vehicle Registration Documents Directive. It specifically suggests that the revision of the VRD Directive should require electronic recording of data related to the reasons for the cancellation of a registration of a vehicle, especially if a vehicle has been treated as an end-of-life vehicle in an authorised treatment facility, re-registered in another Member State, exported outside the Union, or stolen.

In March 2023, the Commission made three other road safety-related proposals, out of which two are relevant for the revision of the RWP, namely the revision of the **Directives on driving licences and on facilitating cross-border exchange of information on road-safety-related traffic offences**[484]. Coherence will need to be ensured between the rules on vehicle registration documents and the possible future digitalisation of documents, as well as regards the exchange of vehicle-related information among Member States for enforcement purposes.

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[477] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13180-Access-to-vehicle-data-functions-and-resources_en
[478] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1113
[479] See e.g. open letter from CITA: https://citainsp.org/wp-content/uploads/2023/03/L2023-006-Data-Act.pdf
[480] https://eur-lex.europa.eu/eli/reg_impl/2019/621/oj
[481] https://eur-lex.europa.eu/eli/reg/2018/1724/oj
[482] https://eur-lex.europa.eu/eli/dir/2000/53/oj
[483] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0451
[484] COM(2023) 127 and COM(2023) 126 final, https://transport.ec.europa.eu/news-events/news/european-commission-proposes-updated-requirements-driving-licences-and-better-cross-border-2023-03-01_en

EU legislation on road tolling[485] also relies on the harmonised Union codes defined in the VRD Directive, which were last (slightly) amended as part of the revision of rules on road pricing (Eurovignette Directive)[486].

Finally, the **EU Decision on the Digital Decade Policy Programme 2030**[487] foresees that the European Parliament, the Council, the Commission and the Member States shall cooperate with a view to achieving digital targets in the Union by 2030. Among those, the digitalisation of public services, where there is 100% online accessible provision of key public services and, where relevant, it is possible for citizens and businesses in the Union to interact online with public administrations.

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[485] Directive (EU) 2019/520 on the interoperability of electronic road toll systems and facilitating cross-border exchange of information on the failure to pay road fees in the Union, https://eur-lex.europa.eu/eli/dir/2019/520/oj
[486] Directive (EU) 2022/362 amending Directives 1999/62/EC, 1999/37/EC and (EU) 2019/520, as regards the charging of vehicles for the use of certain infrastructures, https://eur-lex.europa.eu/eli/dir/2022/362/oj
[487] Publications Office (europa.eu)

ANNEX 17: EVALUATION REPORT (SEPARATE DOCUMENT)

Separate document: Evaluation SWD and specific annexes.