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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures
and
Proposal for a Council Directive amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures, as regards certain provisions on vehicle taxation

{COM(2017) 275 final}
{COM(2017) 276 final}
{SWD(2017) 181 final}

GLOSSARY

Buses and coaches	Larger buses which are suited or intended to carry more than 16 passengers (having a permissible laden weight above 3.5 tonnes)
CO_2	Carbon dioxide
DSRC	Dedicated Short Range Communication, used in electronic tolling for remote communication between the on-board units (OBU) and the roadside equipment and/or mobile enforcement devices
EETS	European Electronic Toll Service: the possibility for road users to pay all electronic road tolls in the EU with one single OBU, one contract and one invoice. The EETS is mandated by Directive 2004/52/EC and defined in Decision 2009/750/EC.
Euro emission classes	Emission standards regulating the exhaust emissions of vehicles
Euro 6	Euro 6 emission standards for LDV as regards air pollutants, which are set out in Commission Regulation (EC) No 692/2008
Euro VI	Euro VI emission standard for HDV as regards air pollutants, which are set out in Regulation (EC) 595/2009
GHG	Greenhouse gases
GNSS	Global Navigation Satellite System: satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world.
HDV	Heavy-Duty Vehicle, i.e. trucks or lorries, coaches and buses (vehicles with a permissible laden weight above 3.5 tonnes)
HGV	Heavy Goods Vehicle, i.e. trucks or lorries (freight vehicles with a permissible laden weight above 3.5 tonnes)
LDV	Light-Duty Vehicle, i.e. cars, minibuses and vans (vehicles with a permissible laden weight up to 3.5 tonnes, including minibuses carrying up to 16 passengers)
NO_X	Nitrogen oxides (nitric oxide (NO) and nitrogen dioxide (NO_2)
PM	Particulate matter
Polluter pays principle	Principle stipulating that the one who produces pollution should bear the full social cost (including environmental costs and other external costs) of managing the pollution. The principle is enshrined in Article 191(2) of the Treaty on the Functioning of the European Union, as one of the principles underpinning the EU's environmental policy.
User pays principle	Aims at recovery of infrastructure costs. This is consistent with the elements of a fair and efficient pricing system for transport, where prices paid reflect the real costs of the journeys.
TEN-T	Trans-European Transport Network as defined in the TEN-T guidelines[1]

[1] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network

VECTO	Vehicle Energy consumption Calculation Tool
ZEV	Zero-emission vehicles: vehicles with no exhaust emissions

1. INTRODUCTION

1.1. Policy context

The promotion of sustainable transport is a key element of the common transport policy. The 2011 White Paper on transport[2] calls for moving towards full application of the 'polluter pays' and 'user pays' principles in order to ensure more sustainable transport and infrastructure financing. As part of a wider strategy to provide effective incentives to users in all transport modes through pricing, the 2011 White Paper suggested further actions to promote and harmonise road charging.

However, the current legislation on road charging has proven unfit for purpose, in two areas (in addition to the need for simplification and clarification): 1) The current scope of the legislation, including only heavy goods vehicles (HGVs), contains no provisions for passenger cars, vans and buses. These vehicles account for a significant amount of total transport volumes and impose an important strain on the environment and on the infrastructure. Due to their exclusion, these vehicles also do not benefit from any rules guaranteeing non-discriminatory road charging. 2) The current scope of externalities, addressing air pollution and noise, disregards CO_2, a growing problem in the road transport sector. While other instruments (e.g. CO_2 emission standards) are better placed for delivering significant CO_2 emissions reductions in the road transport sector, road pricing could provide a useful complementary contribution by incentivising the renewal of the vehicle fleet.

In line with the Paris Climate Agreement and increasing awareness of the magnitude and negative impacts of air pollution generated by transport, the *European Strategy for Low-Emission Mobility* adopted in 2016 framed the initiatives planned by the Commission in the coming years and mapped the areas in which options were explored: i) increasing the efficiency of the transport system; ii) scaling up the use of low-emission alternative energy sources; iii) moving towards zero-emission vehicles. It also showed how initiatives in related fields are linked and how synergies can be achieved[3].

To support the transition towards zero-emission vehicles, the *Low-Emission Mobility Strategy* acknowledged that incentives on both the supply- and demand-side are needed. On the supply-side, it foresees the revision of the CO_2 emission Regulations for new cars and vans and a proposal on a monitoring and reporting system for CO_2 emissions from heavy duty vehicles with a view of setting fuel efficiency standards. The revision of public procurement rules (revision of the Clean Vehicle Directive) and incentives via road charges to support the uptake and use of vehicles adhering to cleaner standards[4] would provide complementary contributions on the demand side. Thus, the *Strategy* indicated that "*the Commission will revise the Directive on the charging for lorries to enable charging also on the basis of carbon dioxide differentiation, and extend some of its principles to buses and coaches as well as passenger cars and vans*".

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[2] COM(2011) 144 final: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system

[3] COM(2016) 501 final: A European Strategy for Low-Emission Mobility

[4] The availability of VECTO and the monitoring and certification at EU level are enabling factors to allow for CO_2 differentiation in charging.

The *Strategy* further showed that fair and efficient pricing in road transport and other related initiatives, notably on the revision of the legislation on interoperable electronic tolling services and of the rules governing the internal market for road haulage and bus and coach services (see Annex 15), would contribute to the EU's approach to low-emission mobility by increasing the efficiency of the transport system.

Following the Action Plan[5] rolled out in the *Low-Emission Mobility Strategy,* the initiative is part of a larger package of proposals to be adopted by the Commission in 2017. It is a REFIT[6] initiative linked to the Commission's effort to create an Energy Union through the moderation of energy demand, by making road transport more efficient. It is also relevant for the internal market through its aim of 'getting prices right', a prominent objective of the 2011 White Paper on transport, and thus levelling the playing field when it comes to payment for the use of road infrastructure by transport operators.

1.2. Legal context

Directive 1999/62/EC[7] (the "Eurovignette" Directive) provides a detailed legal framework for charging heavy goods vehicles (HGVs) for the use of certain roads. The Directive aims to eliminate distortions of competition between transport undertakings by achieving step-by-step harmonisation of vehicle taxes and establishment of fair mechanisms for infrastructure charging. Thus the Directive has a double legal base, notably Article 71(1) and Article 93 of the Treaty establishing the European Community (Article 91(1) and Article 113 TFEU). It sets minimum levels of vehicle taxes for HGVs and provides for the way infrastructure charges should be set, including differentiation according to environmental performance (i.e. pollutant emissions reflected in Euro emission classes). Taking account of CO_2 emissions is currently not possible. The scope of the network to which the Directive applies is the TEN-T plus motorways.

The Directive does not oblige Member States to introduce user charges for HGVs, but specifies that if infrastructure charges are applied, they should be related to the cost of constructing, operating and developing infrastructure. Since 2006 (Directive 2006/38/EC), differentiation of infrastructure charges according to Euro class has been mandatory[8] with the possibility of greater variation of tolls and the inclusion of vehicles with a permissible laden weight above 3.5 tonnes[9].

The last amendment of the Directive (Directive 2011/76/EU) introduced the possibility for Member States to apply external cost charges related to traffic-based air pollution and noise. With the aim to attenuate congestion, it also adjusted the possibility to differentiate tolls according to time or type of the day or season.

The Communication on the application of national road infrastructure charges levied on light private vehicles[10] clarified how the Treaty provisions on non-discrimination and the

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5 COM(2016) 501 final, Annex 1: Action plan for low-emission mobility.
6 Regulatory Fitness and Performance Programme
7 Directive 1999/62/EC of the European Parliament and of the Council of 17 June 1999 on the charging of heavy goods vehicles for the use of certain infrastructures, OJ L 187, 20.7.1999, p. 42–50.
8 This only applies to distance-based schemes with the possibility to exempt long-term concession contracts.
9 With a possibility for exempting vehicles between 3.5 and 12 tonnes.
10 COM(2012)199 final

principle of proportionality apply to car vignettes, but provided only recommendations. And as already stated, there is no legal framework for passenger cars, vans or for buses.

1.3. Evaluation of the implementation

The Commission published its evaluation of Directive 1999/62/EC in 2013[11]. An 'Evaluation of the implementation and effects of EU infrastructure charging policy since 1995' was published in January 2014[12]. The evaluation identified various problems linked to road charging of heavy goods vehicles under the current legislative framework. While 24 Member States have implemented some form of road charging and there has been a tendency to move towards network-wide distance-based tolling at least in Central Europe, there are persistent inconsistencies in the implementation of the current legislation.

The evaluation found a wide variety of ways to vary charges according to Euro class, whereas a third of the Member States do not apply such variation at all[13]. This creates inconsistent price signals to users. Revenues from time-based charges (vignettes) are very low and do not meet the financial needs of infrastructure investment. Very few Member States have introduced time-varying charges to deal with congestion. These issues are linked to the provisions of the Directive:

- Time-based charges allowed by the Directive are ineffective in covering infrastructure costs, incentivising cleaner, more efficient operations or reducing congestion;
- The application of external cost charging is too complex, while Euro class variation is mandatory (with exemptions) and not well defined.
- Variation of charges to fight congestion: the revenue-neutrality requirement is too cumbersome and the variation could be seen as unfair if only applied to HGVs while all users contribute to congestion.

A natural limitation of the evaluation was that it could only focus on the current scope of the Directive, while the input from stakeholders has pointed at other relevant issues. There is broad consensus on the need to reduce CO_2 emissions from road transport. While emission standards are the most effective measure in this respect, they only address new vehicles and their impact over time will depend on the speed of the renewal of the fleet. Measures such as the modulation of road charges according to CO_2 emissions can make a useful complementary contribution by directly incentivising the renewal of the fleet; they can provide direct price incentives to road users at every single trip and apply to the entire fleet (i.e. new and old vehicles). In addition, as evidenced by the public consultation, road users would like road pricing to be non-discriminatory also in the case of passenger cars, which are outside the scope of the current legislation.

2. WHAT IS THE PROBLEM AND WHY IS IT A PROBLEM?

An efficient and reliable transport system is essential for the smooth functioning of the internal market and is a key sector of the economy. While road transport plays the most

[11] Ex-post evaluation of Directive 1999/62/EC, as amended, on the charging of heavy goods vehicles for the use of certain infrastructures, SWD(2013) 1 final

[12] http://ec.europa.eu/smart-regulation/evaluation/search/download.do?documentId=10296156

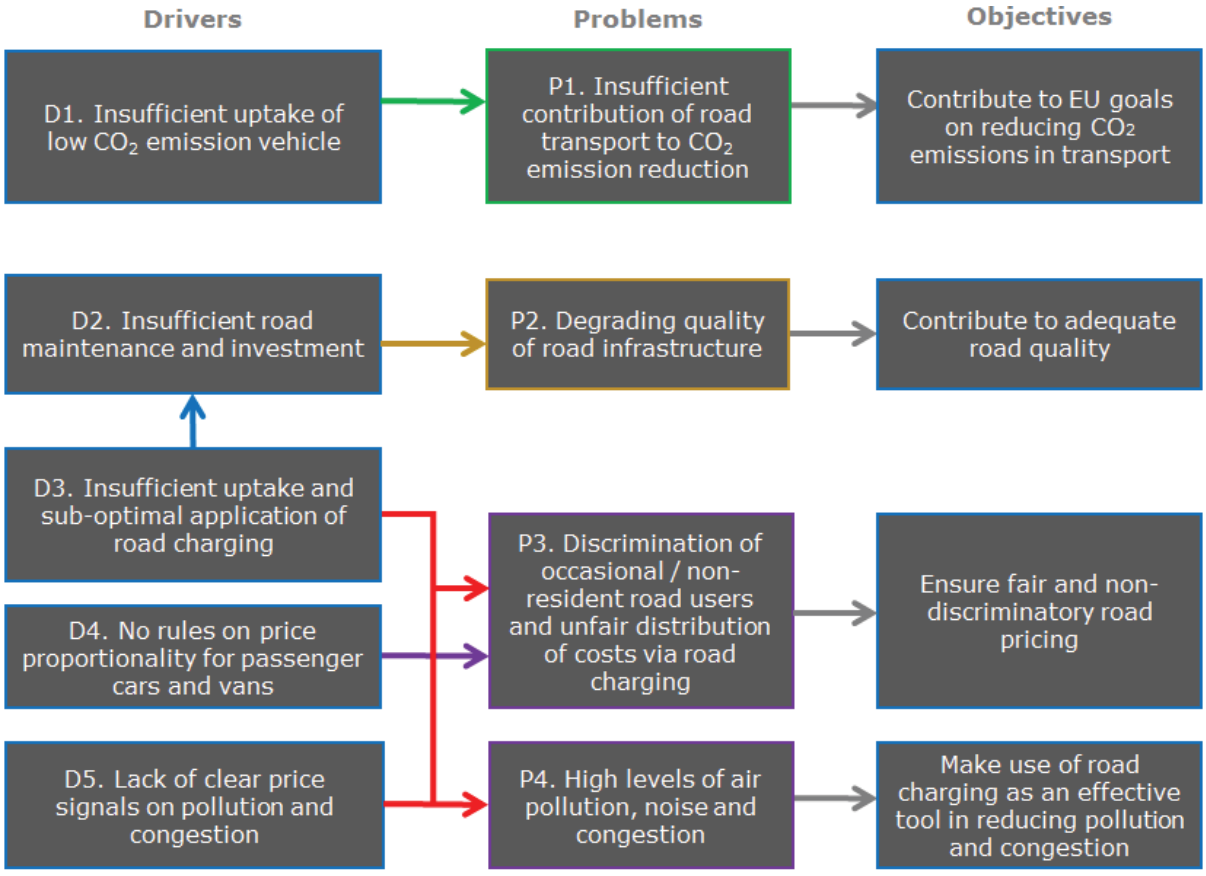
[13] Cf. Annex 10

important role in the inland transport system, it is a source of a number of socio-economic and environmental challenges (e.g. climate change, air pollution, noise, congestion). Road pricing can play a key role in incentivising cleaner, more efficient operations, and its coherent design is crucial to ensuring a level playing field among hauliers.

Figure 2-1 gives an overview of the problems and their drivers that have been identified on the basis of the ex-post evaluation, the impact assessment support study[14] and the feedback from stakeholders.

The problems and drivers, which will be explained in detail in chapter 2, are partly related to the vehicles currently in scope of the legislation, i.e. HGVs above 3.5 tonnes, which are part of P1, P2 and P4. Other vehicles, currently outside the scope of the current legislation (e.g. cars and vans), are specifically included in P3 but are also part of P1, P2 and P4.

Figure 2-1: Problem tree



[14] Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC. Note that evidence gathered by that study is referred to in academic format (endnotes) in this report.

2.1. What is the nature of the problem? What is the size of the problem?

2.1.1. P1: Insufficient contribution of road transport to overall CO_2 emission reduction

The Energy Union and the Energy and Climate Policy Framework for 2030 establish ambitious EU commitments to further reduce greenhouse gas emissions (by at least 40% by 2030 compared to 1990). Transport will need to contribute towards the 40% greenhouse gas emissions reduction target for 2030 and in particular to the 30% emissions reduction effort set for the non-Emission Trading Scheme sectors[15]. In this context, the analytical work underpinning the European Strategy for Low-Emission Mobility showed cost-effective emissions reductions of 18-19% for transport by 2030 relative to 2005[16]. For road transport, this translates into a cut of about 206-221 million tonnes of CO_2 by 2030 relative to 2005[17].

Transport was responsible for 23%[18] of EU greenhouse gas emissions in 2014 and road transport accounted for 73% of these. Figure 2-2 shows that CO_2 emissions from road transport in 2014 were still 17% higher than in 1990, despite the decrease observed between 2007 and 2013.

Approximately 25% of CO_2 emissions from road transport in the EU are caused by HGVs and buses (EEA, 2016). Improvements in energy efficiency for HGVs together with a decrease in road freight transport activity have led to a decrease of around 12% in CO_2 emissions between 2007 and 2012. However, the reductions have stalled since then and emissions levels in 2014 for HGVs and buses were still 13% higher relative to 1990. CO_2 emissions from light duty trucks have grown even faster than those of HGVs. Despite some reductions in recent years, in 2014 emissions from light duty trucks were still 56% above their 1990 levels and contributed about 12% of road transport CO_2 emissions. The highest share of road transport CO_2 emissions originates from passenger cars i.e. over 60% (EEA, 2016). Despite improvements in energy efficiency, driven by the CO_2 standards in place, CO_2 emissions from passenger cars in 2014 were still 13% higher than their 1990 levels.

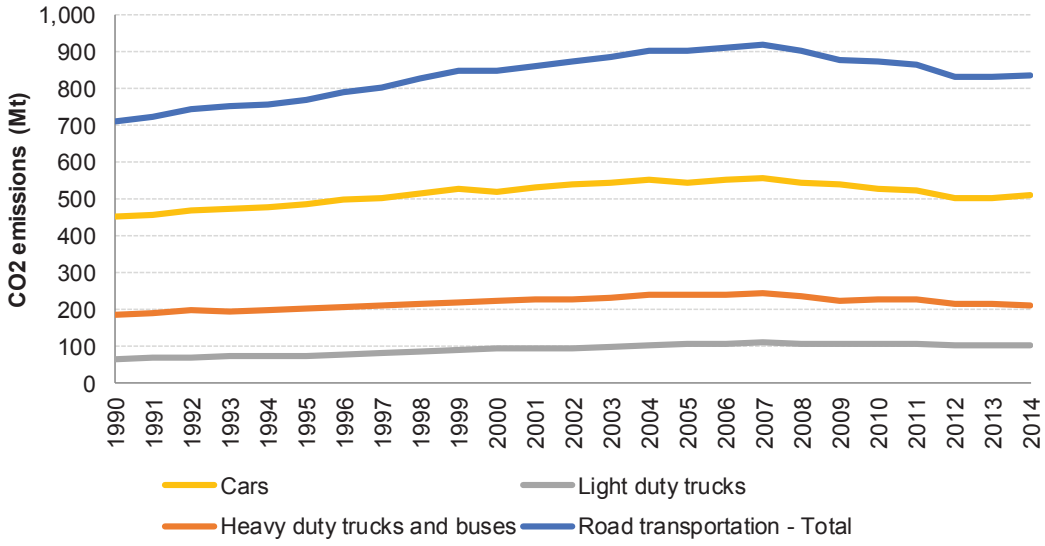
[15] i.e. transport, buildings, agriculture, small industry and waste

[16] This outcome is in line with the 2011 White Paper which established a milestone of 20% emissions reduction by 2030 relative to 2008 levels, equivalent to 19% emissions reduction compared to 2005 levels, and with the 2050 decarbonisation objectives.

[17] SWD(2016) 244 final

[18] This share does not cover the emissions from international shipping, which are not part of the 2020 and 2030 climate and energy targets.

Figure 2-2: CO_2 emissions from road transport (1990-2014)



Source: EEA (GHG data viewer), 2016

Under current trends and adopted policies, road freight activity (measured in tonne-km) is projected to increase by about 35% between 2010 and 2030 (56% for 2010-2050). CO_2 emissions from road freight transport would increase by 6% by 2030 compared to 2010 (11% for 2010-2050)[19]. At the same time, emissions from passenger cars and vans are projected to decrease by 22% between 2010 and 2030 (32% for 2010-2050) thanks to the CO_2 standards in place and the uptake of electro-mobility.

Overall, the declining trend in total transport emissions is expected to continue under current trends and adopted policies, leading to 13% lower emissions by 2030 compared to 2005 (15% by 2050). This is however not in line with the cost-effective emissions reduction of 18-19% that the transport sector would need to contribute towards achieving the 2030 climate and energy targets.

The problem is widely recognised not only by the scientific community and environmental organisations, but also by Member States as well as the automotive industry[20].

2.1.2. P2: Degrading quality of road infrastructure

While road maintenance is primarily a national or local competence, high quality infrastructure is essential for the efficient and sustainable functioning of the internal market as well as for road safety.

The impact assessment support study[21] found that it is difficult to compare the quality of road infrastructure between Member States due to a lack of consistency in monitoring and reporting practices. However, available **national reports** indicate that there are concerns

[19] See Annex 4 for a description of developments under current trends and adopted policies (Baseline scenario).

[20] http://www.acea.be/industry-topics/tag/category/co2-emissions

[21] Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC

over poor road quality in 13 out of 22 Member States for which national reports were available (59%).[22] Reports of poor road quality (even if not strongly correlated) tend to be associated with Member States where there is no charging, or where vignette systems are in place (e.g. Bulgaria, Belgium – which only introduced distance-based charging in 2016 –, the Baltic countries, Romania and non-toll roads in Spain).

It seems that the state of the existing road infrastructure is degrading in many Member States because of inadequate maintenance of the road network (section 2.2.2). Public spending on road infrastructure maintenance has decreased in the EU by about 30% (or 40% in relation to GDP) between 2006 and 2013[23] and stood at around 0.5% of GDP in 2013[24]. This leads to various negative economic, social and environmental impacts including:

- **Increased vehicle operating costs and emissions.** The World Bank estimated that necessary maintenance work, when it is not performed, generates costs to road users which are the double or triple of the cost of the road works, had they been done.[25] A study commissioned by the European Parliament[26] refers to estimates at national level showing higher vehicle operation costs and emissions.[27]
- **Increased journey times.** As the condition of carriageways deteriorates, vehicles travel more slowly and journey times increase. In Germany, severe deterioration of the bridge on the A1 motorway over the Rhine forced the authorities to temporarily close it for HGV traffic. It is estimated that this costs each haulage company active in the region on average EUR 17,000 per day in delays and detours.[28]
- **Accidents**. Poor condition of the road surface (low friction, deteriorated evenness) increases the risk of accidents (e.g. because road users take evasive action to avoid potholes or other hazards).[29] For example, an investigation of over 600 truck accidents in seven European countries (France, Germany, Hungary, Italy, the Netherlands, Slovenia and Spain) found that accidents linked to infrastructure conditions represented

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[22] However, the information is not strictly comparable between Member States due to the different methodologies and reporting techniques employed.

[23] Data extracted on 22 Jan 2017 from OECD.Stat, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_INV-MTN_DATA#

[24] http://www.cedelft.eu/publicatie/road_taxation_and_spending_in_the_eu/1899

[25] World Bank, *A review of institutional arrangements for road asset management*, 2010.

[26] European Parliament. (2014). *EU Road Surfaces: Economic and Safety Impact of the Lack of Regular Road Maintenance.* http://www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_STU(2014)529059

[27] In *Spain*, additional vehicle operating costs due to "moderately deficient road surfaces" have been estimated for light duty vehicles (34% increase in fuel consumption, 185% higher maintenance costs and 66% reduction in tyre lifetimes) and for heavy duty vehicles (12% increase in fuel consumption, 129% higher maintenance costs and 10% reduction in tyre lifetimes). In *Lithuania*, a national study indicated that: reconstruction of each kilometre of rural roads 300 thousands litres of fuel saved and 700 tCO2 avoided. In *Poland*, the additional operating cost per km has been estimated for vehicles travelling at 60 km/h as €0.004/km for passenger cars and €0.02km for heavy goods vehicles without trailers. A survey of SMEs in the *UK* found negative impacts in terms of time wasted, higher vehicle operating costs and fuel consumption, estimated at £13,600 per year (equivalent to €16,300).

[28] Rheinische Post Online, *IHK fordert Masterplan für die Sanierung der A1-Rheinbrücke*, 28.01.2013.

[29] https://ec.europa.eu/transport/road_safety/specialist/knowledge/road/managing_safety_of_roads_through_their_whole_life/road_and_pavement_maintenance_en

5.1% of total accidents. Over 10% of these accidents happened on highways (ETAC, 2007).

- **Noise**. Aged (rougher) surfaces generate more traffic noise.[30] After an initial settling-in period, road surfaces generally generate more road traffic noise as they age. Asphalt pavement noise increases about 3 dBA (this is a doubling of sound power) after six to seven years of usage and in later years of usage it can increase up to 4 dBA (European Parliament, 2014).
- **Wider economy.** The economic effects can be estimated in terms of e.g. impacts on journey times, productivity, external costs and asset value of roads. For example, ADAC (2011) claims that the worsening condition of roads in Germany causes macroeconomic impacts of 4% of German GDP, in the form of increased accidents, vehicle wear and tear and delays due to hampered traffic flow. Other calculations for Lithuania indicate net benefits of €2.20 to €2.80 for every Euro invested in road rehabilitation, maintenance and reconstruction (European Parliament, 2014).

These negative impacts have largely been confirmed by the perceptions of the respondents to the public consultation, a summary of which can be found in Annex 2, and in particular by professional organisations and associations that seemed to attach particular importance to the quality of roads (e.g. UEAPME).

2.1.3. P3: Discrimination of occasional / non-resident road users and unfair distribution of costs via road charging

Because the current legislation only covers heavy duty vehicles (HDV), all other vehicles – passenger cars, vans and buses – are left unaddressed without even the most basic provisions related to non-discrimination against foreign users, despite the significant amount of traffic by these vehicles.

Distance-based road charging is by definition proportional to the use, reflecting much better the external costs, and therefore inherently non-discriminatory; time-based vignettes (and/or vehicle taxes) are less proportional. Given that annual vignettes and circulation taxes are very similar instruments by nature, there is a risk of discrimination of foreign users when Member States compensate national users while introducing vignettes.

Moreover, unless prices of time-based vignettes are proportional, foreign/occasional users (typically buying short-term vignettes) may end up paying relatively more than national users (typically buying annual vignette). One example of such vignette schemes is the Slovenian one. Although it was made more proportionate following infringement proceedings, it is still considered by users to be disproportionately costly at €15 (the price of a weekly vignette) for a single trip (ITC, 2013).

A good indication of how relative vignette prices are perceived by the users is the share of annual vignettes in sales as shown in Table 2-3. In those countries where the price of the yearly vignette is relatively low compared to that of short-term vignettes (or where subsidies are in place for commuters, as in Austria) the take-up of annual vignettes is significantly higher.

[30] Ricardo-AEA, *Accompanying study to a previous impact assessment performed in 2013.*

Table 2-3: Uptake of annual passes for passenger cars and estimated proportion of foreign car journeys for selected vignette countries

Country	Take-up of annual pass by car owners	Estimated proportion of foreign car journeys on main routes
Austria	70%	26%
Czech Republic	45%	33%
Hungary	7%	19%
Slovenia	87%	39%
Slovakia	49%	27%

Source: (ITC, 2013)

Discrimination was also raised as one of the main arguments against Germany's plan to introduce a vignette system for passenger cars. On grounds of potential discrimination against drivers from other Member States, the Commission launched an infringement procedure in 2015.[31] Following adjustments to the initial plans, a political understanding was reached between the Commission and Germany on 1 December 2016. The case was formally closed on 17 May following the adoption by German of an amended law taking into account the Commission's legal concerns[32]. At the same time a number of other Member States are joining forces to argue against the introduction of the system, which, according to them, remains discriminatory, despite the amendments to the German laws.

The second part of the problem is related to the fact that buses, coaches, cars and vans, which are out of the scope of the Directive, do not provide sufficient contributions via road charges**,** even though these vehicles account for a significant share of transport activity and are responsible for a large part of the impact on wear and tear of infrastructure (and other external costs). As a consequence, the division of sharing the burden of external costs among the road users is not fair and not proportionate to the actual use of infrastructure. This situation is not only financially unsustainable, but also not fair to HGV users.

The fragmented coverage of various categories of vehicles with road charging also makes some of the measures addressing other transport externalities ineffective: e.g. congestion charging is only justifiable if it covers all vehicles. In addition, it also raises some concerns about fair competition between transport modes and means. Exclusion of buses and coaches from paying for the use of infrastructure is considered as an advantage over rail passenger transport which has to pay for the use of infrastructure. Similarly, favourable treatment of vans leads to increasing use of them over trucks.

[31] On 8 June 2015 a law was passed to introduce a road charging scheme for cars. In parallel a law was introduced ensuring that vehicles registered in Germany benefit from a deduction of the road charge from their annual vehicle tax bill. This 1:1 deduction of the vehicle tax from the road charge would lead to a de facto exemption from the charge, exclusively for cars registered in Germany. The Commission believed that this arrangement would discriminate against drivers from other Member States for two reasons. First, because German users would not effectively pay the road charge, as their vehicle tax bill would be reduced by the exact amount of the road charge. And second, because the price of short-term toll passes, which are typically bought by foreign drivers, would be disproportionally high for certain vehicles. Despite numerous exchanges with the German authorities since November 2014 to discuss how to render the German scheme compatible with EU law, the Commission's fundamental concerns remained unaddressed. Therefore, it launched an infringement procedure against Germany in June 2015 and the case was referred to the Court of Justice of the EU on 29 September 2016. http://europa.eu/rapid/press-release_IP-16-4221_en.htm

[32] http://europa.eu/rapid/press-release_MEMO-17-1280_en.htm

2.1.4. P4: High levels of air pollution, noise and congestion

External costs from road transport are a major issue. Passenger cars are at the source of about 2/3 of all external costs (including costs of climate change, air pollution, noise, accidents and other negative impacts) generated by road transport, or about 1.8-2.4% of GDP[33].

According to more recent estimates, the specific issue of air pollution from road transport costs up to 2% of GDP to society[34], representing half of the aggregate cost of air pollution. This appears to be supported by the findings from on-road tests carried out on heavy-duty and light-duty vehicles, suggesting that NO_X emissions from diesel cars are higher on average than those from heavy duty vehicles.[35]. The impact of this is felt especially in major urban areas across Europe[36], but it cannot be neglected on inter-urban routes.

According to the EEA, the total number of premature death attributable to air pollution in the EU was around 500.000 in 2013[37], with emissions from road transport being a main contributor. In addition, more than 100 million EU citizens are exposed to noise levels dangerous for their health, and this is mainly due to road transport[38].

With growing demand for transport, also congestion is an increasingly significant issue, which has only been sporadically addressed by Member States. Road traffic is typically concentrated in specific hours and/or periods of the year. These traffic peaks result in considerable economic, social and environmental costs, which according to various scientific estimations amount to 1-2% of EU GDP[39] i.e. EUR 146-293 billion per year, 2/3 of which is attributable to passenger cars. According to (Fermi & Fiorello, 2016), only the cost of delays from congestion accounted for 140 billion €/year or 1% of GDP in 2015, with 20-30% of this attributed to interurban traffic. However, congestion not only results in delays[40] but also in a waste of fuel – thus worsening the EU's already high oil dependence – and additional CO_2 and air pollutant emissions. Ultimately, it leads to loss of competitiveness.

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33 CE Delft, Infras, Fraunhofer ISI - External Costs of Transport in Europe, Update Study for 2008, Delft, CE Delft, November 2011: http://www.cedelft.eu/publicatie/external_costs_of_transport_in_europe/1258

34 OECD (2014), The Cost of Air Pollution: Health Impacts of Road Transport, OECD Publishing. http://www.oecd.org/env/the-cost-of-air-pollution-9789264210448-en.htm.

35 http://www.theicct.org/nox-europe-hdv-ldv-comparison-jan2017

36 See e.g. http://www.irceline.be/en/air-quality/measurements/nitrogen-dioxide/history for Belgium

37 http://www.eea.europa.eu/highlights/stronger-measures-needed/table-10-1-premature-deaths

38 COM/2017/0151 final, Report from the Commission to the European Parliament and the Council on the implementation of the Environmental Noise Directive in accordance with Article 11 of Directive 2002/49/EC

39 Numerous sources, including: CE Delft, INFRAS, Frauenhofer ISI, *External Costs of Transport in Europe*, Delft, November 2011. Christidis, Ibanez Rivas, *Measuring road congestion*, JRC Technical Notes, 2012; Fermi, F., & Fiorello, D. (2016). *Study on Urban Mobility – Assessing and improving the accessibility of urban areas - Task 2 Report – Estimation of European Urban Road Congestion Costs.*

40 Victoria Transport Policy Institute, Transportation Cost and Benefit Analysis II – Congestion Costs: http://www.vtpi.org/tca/tca0505.pdf

2.2. What are the main drivers?

2.2.1. D1. Insufficient uptake of vehicles with low CO2 emission

CO_2 emissions from road transport can be expressed as a function of (1) transport activity[41] and (2) specific CO_2 emissions[42]. Correct price signals can drive transport operators towards more efficient use of the fleet through improving loading factors, fewer empty runs and the use of low- and zero-emission vehicles. Similarly, for passenger cars the right price signals can lead to the use of more efficient vehicles. With a view to accelerating the technological shift needed to achieve an ambitious long-term reduction in road transport emissions, zero- and low-emission vehicles would need to gain significant market share by 2030. Incentives on both the supply- and demand-side will be needed to support the transition towards low- and zero-emission vehicles, as advocated by the European Strategy for Low-Emission Mobility adopted in 2016.

CO_2 standards are in place for light commercial vehicles since 2011 and for passenger cars since 2009 and have proven to be effective in reducing specific CO_2 emissions[43]. However, CO_2 emissions from trucks will only be monitored[44] and certified as of the end of the present decade with mandatory limits being considered as a possible future measure. In addition, CO_2 standards only address new vehicles and their impact over time depends on the speed of the renewal of the fleet.

Other existing environmental charges and taxes either target the purchase of new (i.e. registrations taxes) or the ownership of vehicles (i.e. annual circulation taxes) and can influence consumer choice when buying a new or used vehicle, but are not linked to the actual use of the vehicle and do not provide sufficient incentives for the renewal of the vehicle fleet. While the external costs of CO_2 emissions are best internalised through fuel taxation, existing fuel taxes do not necessarily reflect the carbon content of different fuels. The cost of fuel is taken into account by hauliers[45] but does not provide direct incentives for the renewal of the car fleet as once the driver has filled the tank it becomes a sunk cost.

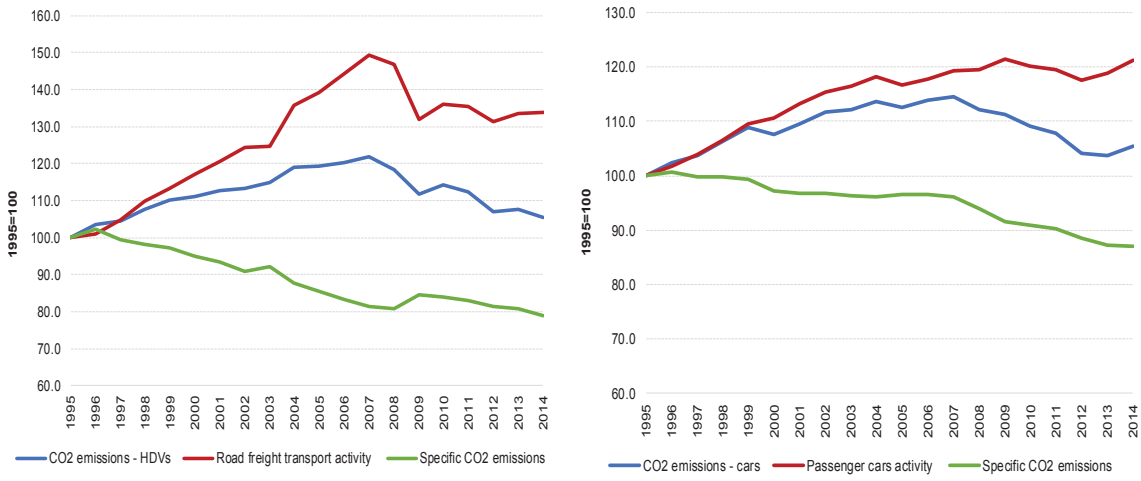
As shown in Figure 2-4 (below, to the left), while the average specific CO_2 emissions of HDV operations have improved over the last two decades, this has not been sufficient to offset the increase in demand for road freight transport resulting in higher total emissions from HDVs by 2014 relative to 1995[46]. While the automotive industry emphasises the significant progress made in fuel efficiency of HGVs over the last few decades, it acknowledges that there is substantial potential for further reducing the CO_2 emissions (in the range of 27 to 62% by 2030 and 2050 respectively) from HGVs thanks to technological innovations, such as in diesel engine technology, the use of alternative fuels, improvements

[41] Expressed in tonne-kilometres for road freight transport and in passenger-kilometres for passenger cars.
[42] Defined in terms of gCO2/tonne-kilometre for road freight and in terms of gCO2/passenger-kilometre for passenger cars.
[43] Evaluation of Regulations 443/2009 and 510/2011 on CO2 emissions from light-duty vehicles (report by Ricardo-AEA for the European Commission, https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/evaluation_ldv_co2_regs_en.pdf)
[44] http://ec.europa.eu/smart-regulation/roadmaps/docs/2015_clima_018_iaa_heavy_duty_vehicles_en.pdf
[45] Fuel costs represent around a third of the costs of operation and their minimization is among the objectives of the HGV fleet operators.
[46] Data on the split of CO2 emissions from HDVs between HGVs and buses is not available with EEA.

in the transmission and drive-train systems, hybrid drive technologies or the reduction of rolling- and air resistance[47].

Similarly, for passenger cars Figure 2-4 (below, to the right) shows that total emissions by 2014 were higher relative to 1995, despite significant progress brought about the CO_2 standards (see Figure 2-4 right).

Figure 2-4: Road transport indicators, 1995 to 2014 (1995=100) – road freight transport (left), passengers cars (right)



Notes: Absolute values for CO_2 emissions in kilotonnes; road freight transport activity in tonne-km and passenger cars transport activity in passenger-km; specific CO_2 emissions for road freight in grams/tonne-km and specific CO_2 emissions for passenger cars in grams/passenger-km; Source: EEA emission data and Eurostat

Differentiation of road charges according to CO_2 emissions could provide a direct price signal to hauliers as well as private motorists at every single trip, while applying to the entire fleet (i.e. new and old vehicles), and thus accelerate the renewal of the fleet and the uptake of low- and zero-emission vehicles. In this respect, differentiated (distance-based) road charges can complement the registration tax by reflecting the actual use in a proportionate manner (unlike an annual vehicle tax).

At the same time, the Eurovignette Directive encourages "*the use of road-friendly and less polluting vehicles […] through differentiation of taxes or charges*"[48]; however, such differentiation is only allowed either according to the Euro emission class[49] or time, but not according to the CO_2 emissions of vehicles.

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47 See e.g. VDA, Association of German Automotive Industry, Driven by ideas - Commercial Vehicles 2016: https://www.vda.de/en/services/Publications/driven-by-ideas---commercial-vehicles-2016.html or IRU Commercial Vehicle of the Future: A roadmap towards fully sustainable truck operations – still to be published

48 Recital 7of Directive 1999/62/EC

49 Which has helped reduce pollutant emissions from HGVs in a few Member States but is applied inconsistently across the EU because of exceptions and is becoming obsolete by 2020, as described in Annex 11 (section 11.1)

2.2.2. D2. Insufficient investment in road maintenance

As already mentioned in section 2.1.2, public spending on road infrastructure maintenance has decreased in the EU by about 30% (or 40% in relation to GDP) between 2006 and 2013[50] and stood at around 0.5% of GDP in 2013[51]. For comparison, the motorway network expanded by 25% only in the last decades[52] and infrastructure costs represent around 1.3% of GDP. At the same time, revenues from infrastructure charges represent less than €30 billion or just 16% of total road infrastructure costs, i.e. costs of construction and wear and tear. The insufficient funding of the maintenance of infrastructure can be partly attributed to the fact that Member States do not fully use the potential of distance-based road charges for financing road maintenance (cf. section 2.2.3).

In Member States where the roads are recognised as poor, there can be little doubt that there is a need for increased road maintenance. These investment needs are captured in the concept of a "maintenance backlog", which aims to quantify the amount of maintenance and rehabilitation that should have been completed in order to maintain roads in a good condition but has been deferred.[53] Examples of maintenance backlogs of several billions of euros are reported in several Member States (with an additional annual investment requirement of at least €6.5 billion in Germany, €260 million in Ireland, and €600-700 million in the Netherlands and the UK) – all of which currently have reports of overall good road quality. These are described in Annex 8 (section 8.1).

At times of budget cuts, **deferring maintenance** and investment in the road sector is a relatively quick way to reduce public spending and this has been pursued by a number of EU countries. For example, case studies on Italy, Spain and the UK revealed significant falls in maintenance expenditure that were reportedly due to budgetary pressures and the need to reduce government spending overall[54] (European Parliament, 2014). Such reductions will lead to increased maintenance needs in the future, since deferring required maintenance is not usually cost-effective in the long run. Figure 8-1 (Annex 8) shows road deterioration over time and the effect of maintenance in restoring road conditions and prolonging asset lifetimes.

While reduced maintenance funding brings short term savings for the infrastructure owner, in the longer term it results in overall losses for society. A study for Scotland showed that reducing road maintenance funding by 40% over 10 years would entail an overall social loss of €370 million despite apparent savings on maintenance works.[55]

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50 Data extracted on 22 Jan 2017 from OECD.Stat, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_INV-MTN_DATA#

51 http://www.cedelft.eu/publicatie/road_taxation_and_spending_in_the_eu/1899

52 European Commission, Statistical Pocketbook 2016: https://ec.europa.eu/transport/facts-fundings/statistics/pocketbook-2016_en

53 Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC

54 The Italian operator of national roads, ANAS, reported a reduction in the expenditure on road maintenance both in routine and structural budgets, respectively of 16% and 43% in the 2008 to 2012 period. In the UK, funding reduced by 30% between 2011 and 2015 for the Highways Agency. In Spain, national government allocation for maintenance and operational expenditures reduced from €1,257m in 2009 to €926m in 2012.

55 Transport Scotland, *Economic, Environmental and Social Impacts of Changes in Maintenance Spend on the Scottish Trunk Road Network*, 2012.

2.2.2.1. The role of the current legislation

Since Member States generally oppose obligations to "earmark" revenues from road charging, even though this opposition is not uniform[56], the Eurovignette Directive, merely encourages the reinvestment of toll revenues in the transport sector (*Article 9*). This encouragement has not been followed by Member States in a systematic and comprehensive manner.

In addition, current reporting requirements of the Directive do not ensure adequate follow-up of the use of revenues. According to Article 11, only Member States levying tolls have to report on toll rates and revenues raised from infrastructure and external cost charging, while making it possible to exclude systems that have not been changed since 2008. The reports are only due every 4 years.

2.2.3. D3. Insufficient uptake and sub-optimal application of road charging

While revenues from generalised distance-based charging could cover in a sustainable manner all maintenance needs of the road network, only 14 Member States apply distance-based charges to **HGVs**[57], and only eight to **passenger cars**. Furthermore, where in place they are typically not applied to the full network, and only apply to a subset of vehicle types. Overall, just over half of the Member States apply some sort of charging for all vehicle types.

As shown in Table 9-1 in Annex 9, only a small share of the road network and only certain vehicle categories are subject to road charges. Nb. the table refers to motorways only, while in many countries other roads are not tolled at all.

Without clear European rules, Member States apply different charging schemes to buses/coaches, passenger cars and vans without fully respecting the "user pays" principle (see maps in Annex 5). While, due to their similar weights and axle loads, buses and coaches cause similar damage to the infrastructure as HGVs, only 16 out of the 24 Member States having road charging in place apply similar charges to them. In the case of passenger cars, only 8 Member States apply distance-based charges, in most cases only on a limited part of the network.

There are a number of **obstacles** to increasing Member States uptake of (distance-based) road charging:

(1) Existing vehicle taxation, which is already considered by users as a payment for the use of infrastructure.
(2) Excessive notification requirements, especially in the case of external cost charging.
(3) Initial investment costs, which have decreased over time but are still significant.

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[56] Cf. responses to the stakeholder consultation indicate that those Member States, which already allocate road charging revenues to infrastructure maintenance acknowledge the benefits of systematic earmarking (Annex 2, section 2.3.1).

[57] See the map of road charging systems in the EU for an overview in Annex 5; even there, the recovery rate of the cost of maintenance is not uniform, see e.g. Annex 10.

Points (2) and (3) are also reasons why some **Member States prefer vignette systems**. Another reasoning that tends to come up (e.g. in the case of Estonian plans) is that the management of a time-based system is simple (as a vehicle tax) but also applies to foreign users.

2.2.3.1. The role of the current legislation

The Eurovignette Directives leaves **large room for interpretation** of road charging methods. It is up to the Member States to decide whether or not they want to implement road charging, on which part of their road network, and to what extent they want to recover the costs of infrastructure. Besides, the Directive allows the exemption from road charges of vehicles between 3.5 and 12 tonnes, which is practiced by the four Eurovignette countries[58] as well as the UK, while Germany applies tolls only to vehicles above 7.5 tonnes. These exemptions are also reflected in Table 10-1 in Annex 10. At the same time, the Directive sets minimum amounts for annual circulation taxes for HGVs above 12 tonnes. Member States would legitimately want to compensate their hauliers by decreasing the burden through the reduction of the vehicle tax if a more appropriate means to pay for the use of infrastructure and external costs – distance-based charging – is introduced. Due to the fact that only HGVs are included in the scope of the current legislation, the application of charges to buses, coaches, vans and passenger cars is left to Members States' discretion. The outcome is that road charging in most Member States is primarily focused on HGVs and does not reflect the 'user pays' and 'polluter pays' principles for all road users.

Besides, the Directive requires distance-based systems to be notified to the Commission, which is seen as cumbersome by some Member States; while capping the prices of vignettes at a low level. This results in a number of Member States applying or considering introducing time-based charging systems[59], which have significantly lower revenue raising potential[60] than distance-based systems (the difference can be as large as 1:20, see e.g. Table 10-1 in Annex 10), leading to less funding available for the maintenance of road infrastructure.

2.2.4. D4. No rules on price proportionality of vignettes for passenger cars and vans

While there are clear rules on vignette prices for HGVs, they do not exist for passenger cars and vans**.** As a consequence, the ratio between the average daily price of short-term (weekly or 10-days) vignettes and yearly vignettes varies between 2.5 (in Hungary) and 8.3 (Bulgaria)[61] as indicated in Table 2-5. This is considered disproportionate and discriminatory to foreigners by many stakeholders, with a large majority of

[58] Denmark, Luxemburg, The Netherlands and Sweden

[59] Currently 8 Member States apply vignettes for HGVs and Estonia has decided to do so too, cf. maps in Annex 5

[60] This is confirmed by the public consultation with some Member States advocating for increasing the caps on time-based charging to be able to cover costs, as well as by the figures presented in Table 9-2 in Annex 9

[61] The average daily price is calculated on the basis of the price of the vignette divided by its duration of validity.

consumers/citizens responding to the public consultation indicating that EU rules could introduce fairness for non-resident road users (cf. Annex 2).

Table 2-5: Vignette prices for light duty vehicles across Member States, 2017

Member State	Vignette prices [€]		Ratio of average daily price between shortest term and longest term vignette
	Shortest term vignettes (number of days)	Annual vignette (number of days)	
Passenger cars			
Austria	8.9 (10)	86.4 (365)	3.76
Bulgaria	8 (7)	50 (365)	8.34
Czech Republic	11.5 (10)	55.5 (365)	7.54
Germany (planned)	From 2.5 to 20	From 0 to 130	3.65 to 7.3
Hungary	9.5 (10)	138 (365)	2.53
Romania	3 (7)	28 (365)	5.59
Slovakia	10 (10)	50 (365)	7.30
Slovenia	15 (7)	110 (365)	7.11

In an opinion on the previous Austrian vignette scheme,[62] the Commission indicated that in order for it to be proportionate, the ratio between the average daily price of short-term vignettes and long-term vignettes should not be higher than 5.[63] Today, only Austria and Hungary would meet this criterion. It is worth noting that currently only one vignette system applies the recommendation of the Communication of 2012[64], by setting proportionate vignette prices as defined in a dedicated study[65].

2.2.5. D5. Lack of clear price signals on pollution and congestion

Efficient use of the transport system is largely dependent on effective price incentives provided to users via road charges. This in turn drives the amount of external costs from road transport, including air pollution and congestion.

Distance-based road charges, when properly reflecting vehicle characteristics, the time and the place of infrastructure use, are the most efficient tool to foster sustainable transport behaviour. However, the efficiency will depend on the consistency and transparency of the price signals received by users. Hauliers as well as private car and van owners may accelerate the purchase of cleaner and more efficient vehicles (as described in section 2.2.1) if they can save on tolls on itineraries they use[66]. Similarly, road charges could also direct users on the optimal time of driving provided that user charges consistently reflect the negative impacts of congestion.

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62 K(96) 2166 of 30 July 1996

63 While the opinion was issued in 1996, the technology of vignettes for passenger cars and the structure of other costs (distribution, etc.) did not change much (in fact the introduction of electronic vignettes even decreases the cost per vignette), meaning that the opinion can still be applied today.

64 COM(2012)199 final; i.e. by being in line with at least the benchmarks adapted to the different usage pattern of private vehicles (with weekly- and monthly-vignette prices respectively equal to 7% and 11% of the annual-vignette price in Hungary)

65 Booz & Co. (2012). *Study on Impacts of Application of the Vignette Systems to Private Vehicles.* According to the study the proportionate price for weekly and monthly vignettes would be 7.5% and 15.4% of the annual rate, respectively: http://ec.europa.eu/transport/modes/road/studies/doc/2012-02-03-impacts-application-vignette-private-vehicles.pdf

66 See e.g. http://www.fliegl-fahrzeugbau.de/fliegls-twin-programm/150/4812/4990/

An overview of road charges per km by freight vehicle category is provided in Annex 10 (Table 10-1). For passenger cars, the situation is similar to what is indicated in Table 10-1 for light goods vehicles, but charges are somewhat lower in all Member States. Interestingly, a majority of respondents to the consultation from EU-13 Member States felt strongly that road charges paid by light vehicles are too low. This is probably linked to the prevalence of vignette schemes in those countries.

With regards to **air pollution,** for HGVs, the incomplete application of the *polluter pays* principle is linked to two main issues: *a)* the use of time-based charges (and/or vehicle taxes) instead of distance-based; and *b)* the lack of uptake of external cost charging:

a) The use of time-based user charges (vignettes)

   Road user charges in the form of time-based vignettes, which are allowed by the current legislation, are not directly linked to the use of infrastructure and to the generation of externalities. Therefore, cost of air pollution and noise can only be adequately reflected in transport prices on the sections of the main road network where distance-based charges apply. This share of motorways subject to distance-based charges for HGVs is estimated to be around 58% of motorways and expressways (see Table 9-1 in Annex 9). Except for those Member States which apply network-wide tolls (see map in Annex 5), this share is even lower for national roads and for other vehicle categories, including passenger cars.

b) Lack of uptake of external cost charges

   Tolls currently in place do not make full use of the options provided by the Eurovignette Directive to account for the external costs of air pollution and noise. While about two thirds of the Member States apply a differentiation for HGVs by Euro standard[67], a differentiation by time of day to protect sensitive areas from noise is only applied in Austria and Slovenia. Similarly, the possibility to charge for the external cost of air pollution has only been used by Germany and Austria. This may be due to the Directive providing for two overlapping instruments to reflect the environmental performance of HGVs (see below).

For passenger cars and vans, which contribute to a significant amount of air pollution, Member States generally provide no incentives. This can partly be explained by the fact that these vehicles are outside the scope of the current legislation.

With regard to **congestion**, marginal cost pricing is the most efficient tool for reducing congestion. It provides economic incentives to users to opt for alternatives to single occupancy peak-hour car transport such as car sharing, collective (public) transport or off-peak travel. Despite the consensus on its positive impact on social welfare, congestion pricing is not widely applied on the interurban network. Of the 17 Member States that apply road charging to all vehicles, only a few have put in place some sort of time-of-day charge differentiation to control congestion (see Figure 10-2 in Annex 10). The existing real-world examples have proved to be effective. In the Czech Republic, increasing the charge by 25-50% during peak periods has resulted in a 15% decrease in traffic during

[67] See e.g. Ricardo et al. (2014) Evaluation of the implementation and effects of EU infrastructure charging policy since 1995

peak times. In France, increasing toll rates during weekend rush hours resulted in a 10% transfer to off-peak times.

2.2.5.1. The role of the current legislation

A fundamental problem with the Directive is that it provides for two competing instruments to reflect the environmental performance of HGVs:

- the differentiation of charges according to Euro classes and
- the possibility to charge for the external cost of air pollution and noise.

The Directive requires Member States to vary tolls (infrastructure charges) according to the Euro emission class (polluting emissions) of HGVs. However, the exact method of modulation is not harmonised, which results in a large variety of approaches across the EU (see Annex 10), while exemptions are allowed.

Since the modalities of the variation are not precisely defined, it is less cumbersome to apply this differentiation than following the strict and complex requirements set out to charge for external costs. It is thus not surprising that the latter has hardly been used by Member States.

There are also some regulatory obstacles to fully exploit road charging for optimisation of the infrastructure capacity. The current legislation allows differentiating tolls according to time of the day or season, but it requires that any differentiation be revenue-neutral. This requirement makes it burdensome for Member States to implement such schemes on specific parts of the network. At the same time, the Directive does not permit the application of genuine congestion charging, i.e. on top of the infrastructure charge, which could be financially interesting for Member States.

Another instrument whose potential is not fully exploited is the application of mark-ups on roads suffering from acute congestion or the use of which leads to significant environmental damage, provided that revenues are invested in priority projects on the same corridor, contributing directly to the alleviation of the problem (a mark-up of up to 15-25% can be applied depending on whether the project is cross-border or not). Since it is not possible to apply mark-ups outside mountainous areas, this possibility has only been used for the financing of the Brenner Base Tunnel between Austria and Italy.

2.3. Who is affected by the problem? What is the EU dimension of the problem?

CO_2 emissions from transport contribute to climate change, which is a global issue as greenhouse gases emitted anywhere contribute to global warming, rising sea levels, extreme weather conditions or desertification, with poorer world regions being most vulnerable. Mitigation measures have to be taken at all levels of governance and budgetary implications affect the entire population. The European automotive industry has an important role to play in exploiting the potential offered by technological progress.

The problem of degrading road infrastructure also affects large segments of society. Road users (hauliers and private motorists) are most directly affected by the negative impacts including damage to their vehicles and increased congestion. All road users, including vulnerable road users, are affected by the higher risk of accidents on badly maintained roads. Beyond these direct effects, poor road quality affects the real economy, as transport

becomes slower and more costly; peripheral regions and Member States suffer most in this regard. Finally, when carried out too late, maintenance works have a higher cost, and the additional budgetary burden is eventually placed on taxpayers.

Disproportionately expensive short-term vignettes essentially affect non-resident drivers. However, since such vignettes are in place in several Member States, all EU citizens who use their car for cross-border travel are potentially affected. Beyond the effect of discrimination *per se*, disproportionately priced vignettes can cause political division and damage to the coherence of the EU, as they are perceived as designed to "make foreigners pay".

Air pollution generated by road traffic and road congestion are primarily local externalities, affecting mainly communities living where the pollution occurs, though air pollutants can travel long distances. Congestion on the interurban and suburban networks, in particular on road axes of international importance belonging to the TEN-T network, also negatively affects international traffic, and in particular the functioning of the coach transport and logistics sectors - just-in-time deliveries as well as scheduled bus services are disturbed by the increased unpredictability of the time of arrival due to congestion along the route.

2.4. How is the problem likely to develop without action?

2.4.1. Insufficient decrease in CO_2 emissions from road transport

In the Baseline scenario, CO_2 emissions from road freight transport (HGVs and freight vans) are projected to increase by 6% between 2010 and 2030 (11% for 2010-2050).[68] For heavy goods vehicles, the increase would be somewhat higher (10% for 2010-2030 and 17% for 2010-2050). At the same time, emissions from passenger cars and minibuses are projected to decrease by 22% between 2010 and 2030 (32% for 2010-2050) thanks to the CO_2 standards in place and the uptake of electromobility. CO_2 emissions from buses and coaches are projected to remain virtually unchanged by 2030, compared to their 2010 levels, and to slightly increase post-2030 (3% increase for 2010-2050).

2.4.2. Degrading quality of road infrastructure with negative economic, social and environmental impacts

The current profile of annual road maintenance expenditure in Europe has been associated with declining road quality in some Member States. While more and more Member States are forced to start applying user financing, at least as a complementary measure, they often turn to the less efficient way of road charging (vignettes),[69] which have significantly lower revenue raising potential than distance-based charges.

Even though a number of Member States do allocate (at least part of) the toll revenues to the maintenance and construction of the road network[70], or to transport at large, since only a small share of the road network is tolled for only a share of vehicles and on those

[68] See Annex 4 for a description of the Baseline scenario.

[69] Estonia or Finland, the last two continental Member States without a road charging scheme, are planning to introduce time-based systems

[70] E.g. in France, toll revenues are the main financers of the transportations infrastructures. Tolling revenues are collected on the oldest sections in order to finance the most recent ones. For more details see Annex 9.

sections the toll per vehicle cannot be higher than actual costs, a large part of the necessary funding would still need to come from other sources (i.e. transport taxes or the general budget). However, revenues from fuel taxes are projected to decrease by around 9% between 2010 and 2030 (17% for 2010-2050) in the Baseline scenario, thanks to efficiency improvements (lower fuel consumption) and the increasing share of hybrid and electric vehicles[71]. It is thus difficult to see where the additional resources necessary to fill the financing gap would come from, unless distance-based road charging is generalised to cover the large majority of the road network and all vehicle categories. Such changes in the structure of taxes and charges do not happen overnight and require strong political backing and public support.

Without further action, it is therefore reasonable to expect a continuation of past trends of declining road quality and increasing maintenance backlogs, at least in some Member States[72]. In many cases the 'savings' from delaying maintenance will be false economies, as the roads will degrade to the point where they must be replaced, which is costly compared to ongoing maintenance or repair. These problems will be exacerbated due to expected increases in traffic volumes.

2.4.3. Potential discrimination against occasional/non-resident users and unfair distribution of costs via road charging

Table 2-6 shows the evolution of price ratios over the last 5 years, providing an indication on how the issue might develop in the future, including the forthcoming German scheme. While in half of the countries price ratios have decreased, in the other half, they have increased. However, it is clear that countries that priced short-term vignettes above a proportionate ratio of 3-4 in 2012 still have ratios above this level in 2017 (i.e., pricing remained disproportionate). In addition, the majority of Member States applying time-based charging schemes have significant differences (over a ratio of 5) between short-term and long-term vignette prices.

Table 2-6: Evolution of vignette price ratios for cars between 2012 and 2017

Member State	2012 Assessment Ratio of average daily prices for short-term vignettes compared to long-term vignettes (Booz & Co., 2012)	2017 Assessment Ratio of average daily prices for short-term vignettes compared to long-term vignettes
Austria	3.8	3.8
Bulgaria	7.9	8.3
Czech Republic	7.7	7.5
Germany (planned)	N/A	3.65 - 7.3
Hungary	3.7	2.5
Romania	5.4	5.6
Slovakia	7.1	7.3
Slovenia	8.2	7.1

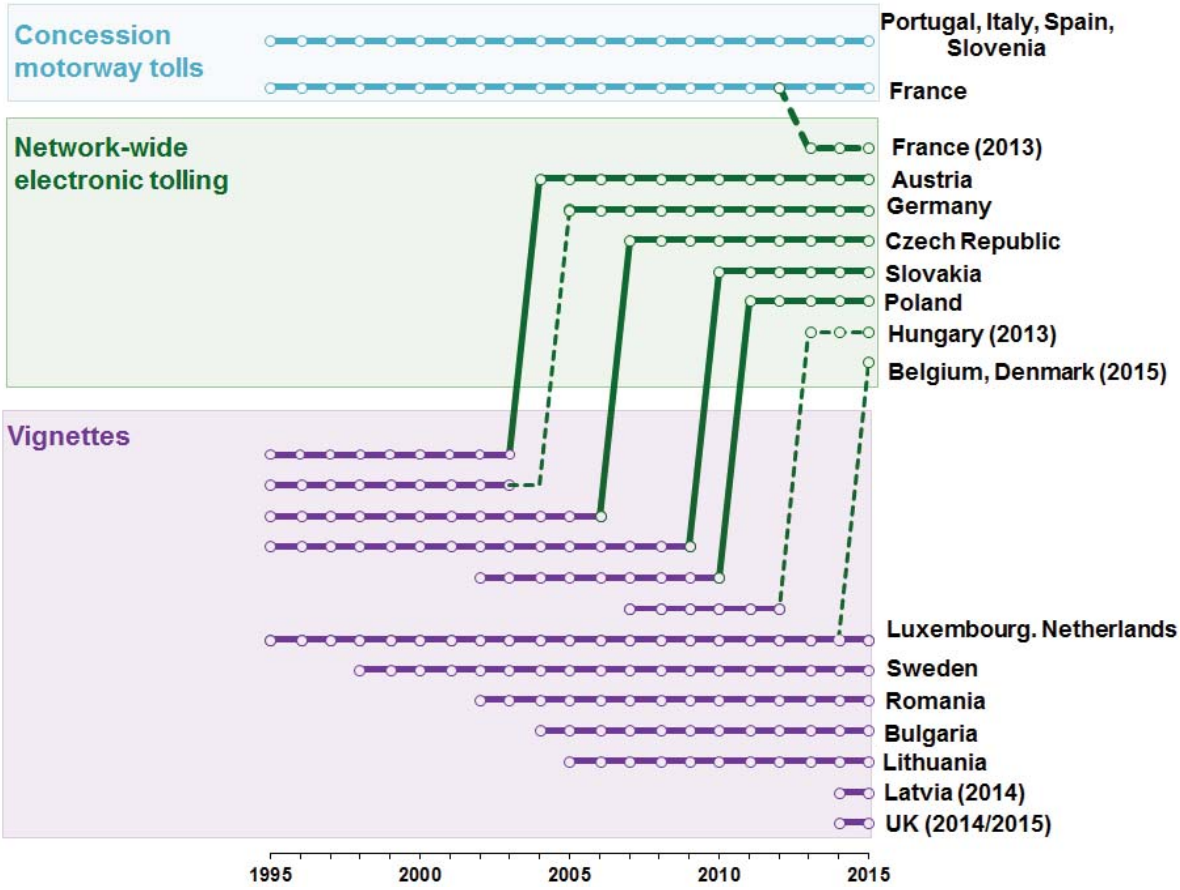
[71] Even though their share in total car sales is still limited, in the Netherlands and Denmark it reached 12% and 8% respectively in 2015. http://www.eea.europa.eu/highlights/reported-co2-emissions-from-new

[72] One exception could be Germany, where the Federal Transport Infrastructure Plan adopted at the end of 2016 has a value of EUR 270 billion until 2030 with 69% allocated to the preservation of existing infrastructure (up from 56% in 2003), and 49% allocated to roads: http://www.bmvi.de/SharedDocs/EN/PressRelease/2016/129-dobrindt-bvwp-2030.html?nn=187654 Nb. Germany is also extending its tolled network to all national roads and other vehicle categories.

Based on the above, it can be concluded that guidance documents on how to set up fair national vignette systems for light duty vehicles are not sufficient to ensure that vignettes are priced proportionately. There is no reason to assume that the issue would cease to exist without additional action.

It is also uncertain that Member States would shift to non-discriminatory distance-based charging systems. Over time, there has been an evolution from vignette systems towards network-wide distance-based electronic tolling in the case of HGVs, and the trend is expected to continue, for example with Bulgaria planning to introduce its new network-wide distance-based tolling system in 2018. However, in some cases advanced plans to adopt electronic tolling had to be abandoned or postponed for various reasons. This was the case for example in Denmark, France and the Netherlands (see Figure 2-7).

Figure 2-7: Development of infrastructure charging systems for HGVs in Europe 1995-2015



Source: Ricardo et al. (2014) Evaluation of the implementation and effects of EU infrastructure charging policy since 1995

Member States that have not had any road charging system in place so far seem likely to go down the same path of introducing a time-based (vignette). Recently Latvia and the UK introduced time-based schemes for HDVs, and Estonia and Finland are reported to have similar plans. The Commission has launched an infringement case against the UK on grounds of discrimination against foreign hauliers.

2.4.4. Negative environmental and socioeconomic impacts of road transport

Under the baseline scenario, NOx emissions would drop by about 56% by 2030 (64% by 2050) with respect to 2010 levels. The decline in particulate matter (PM2.5) would be less pronounced by 2030 at 51% (65% by 2050). By 2030, over 75% of the heavy goods vehicle stock is projected to be Euro VI in the Baseline scenario and more than 80% of the passenger cars stock. Overall, external costs related to air pollutants would decrease by about 56% by 2030 (65% by 2050). However, they would still represent an important cost for society (roughly €27 billion in 2030).

The increase in traffic would lead to further increase of noise related external costs of transport, by about 17% during 2010-2030 (24% for 2010-2050). Thanks to policies in place, external costs of accidents are projected to go down by about 46% by 2030 (-42% for 2010-2050) – but still remain high at over €100 billion in 2050.

As regards congestion, the situation is projected to worsen if its costs are ignored.[73] It is generally expected that congestion and its associated costs will increase, linked to the growth of economies, concentration of activities in urban areas and the rise in population. Under current trends and adopted policies, total congestion costs are projected to increase by about 24% by 2030 and 43% by 2050, relative to 2010. For heavy goods vehicles the delay cost from congestion is projected to increase by 76% by 2030. The growth of congestion on the inter-urban network would be the result of growing freight transport activity along specific corridors, in particular where these corridors cross urban areas with heavy local traffic (see also Figure 4-6 in Annex 4).

According to the contribution of the UK to the public consultation, if no action is taken by 2040 congestion will become a serious problem for many important routes in the UK – up to 16 hours stuck in traffic for every household each year, 28 million working days lost per year and a £3.7 billion annual cost to the freight industry, risking higher consumer prices.

While the Connecting Europe Facility and the application of mark-ups (in mountainous areas) can contribute to the financing of alternative infrastructure, not all problems of congestion can be solved through additional infrastructure capacity, as this may in itself generate additional traffic.

3. WHY SHOULD THE EU ACT?

3.1. The EU's right to act

Directive 1999/62/EC has a double legal base, notably Article 91 TFEU and Article 113 TFEU (Article 71(1) and Article 93 of the Treaty establishing the European Community). It is to be noted that most of the amendments to the Directive as discussed here pertain to tolls and user charges (Chapter III of the Directive), an area to which Article 91 TFEU applies.

As far as vehicle taxes may be affected by the amendment of certain provisions of Chapter II of the Directive, these would fall under Article 113 TFEU and would thus be subject to a separate legal proposal.

[73] http://inrix.com/wp-content/uploads/2015/08/Whitepaper_Cebr-Cost-of-Congestion.pdf

3.2. Subsidiarity check

The problems of emissions (in particular CO_2 being a global externality) have a clear cross-border dimension. While Member States have the means to promote more fuel efficient vehicles e.g. through subsidies, if such measures are not coordinated and applied consistently, their effectiveness will be subject to the willingness of other countries applying similar measures. In the case of a global problem, such as the issue of climate change, concerted action is much more effective.

The problem of degrading quality of roads, in particular of roads of international importance, such as TEN-T corridors, affects road users independently of their country of registration. Furthermore, as established in section 2.3, it negatively affects the functioning of the whole Internal Market, with a particularly heavy impact on peripheral regions. Impacts on efficient transport on trans-European corridors are not likely to be sufficiently taken into account by the Member States individual decisions on maintenance priorities, making some level of EU intervention justified. This EU intervention is limited, though, essentially to co-ordination and monitoring, as Member States retain a large level of control on the management of their own road networks.

The problem of discrimination of non-resident users by disproportionately priced vignettes is by definition of a cross-border nature, and can only be solved by co-ordinated action at a supra-national level. Such action is notably necessary to avoid chain reactions of other Member States to what could in some cases be seen as schemes designed to "charge the foreigners".

EU intervention to address interurban congestion is justified by the effect that it has on long-distance cross-border passenger and freight transport. This effect – disturbance to scheduled international bus services and to international road freight transport – has been described in section 2.3 above. However, since – with the exception to the abovementioned cases – congestion is a local externality, EU intervention is better placed for harmonising the tools used by Member States, rather than mandating any action.

Finally, air pollution is equally a local externality, and must primarily be addressed at the local level. However, as the existing legislation established minimum standards of air quality throughout the Community, the EU is also well positioned to offer the right tools to tackle the air pollution problem. In addition, particulate matter in air consists of a substantial trans-boundary component and so all Member States must take measures in order that the risks to the population in each Member States can be reduced. Moreover, the huge scale of the problem (500,000 premature deaths per year, i.e. 20 times more than fatalities in road accidents) calls for action at all governance levels. In any case, solutions specifically addressing air pollution ("external-cost charges") have already been included in the Eurovignette Directive but their use should be made simpler.

The extension of the analysis to passenger cars deserves special focus in the subsidiarity check. The private use of cars is predominantly limited to within the national borders of each Member States. Cross border travels are relatively sporadic, limited to holidays or commuting in border regions. Yet the impact of cars on problems on EU- and global levels must not be underestimated. The contribution of cars to overall transport CO_2 emissions

has already pushed the EU to legislate on mandatory CO_2 emission targets. Similarly, cars account for 2/3 of the total costs of road congestion and a large share of air pollution costs. It is therefore unlikely to be effective in terms of finding solutions to many of the problems identified, if passenger cars remain outside of the scope of EU action.

Taking the above considerations, none of the proposed options goes beyond what is necessary as the proposed measures are focused on the areas where EU is best positioned to act. In addition, since the problems linked to current text of the Directive cannot be overcome by Member States alone and can only be addressed by amending the existing legislation, there is a clear need for EU action.

3.3. EU added value

The action at EU level helps ensuring a more coordinated and effective application of road charging in Europe. The Eurovignette Directive brings coherence to national road charging policies by defining available tools and harmonising their deployment. This is necessary to preserve the coherence of the Internal Market and to avoid that road charging is used as a non-tariff barrier to trade, or that it becomes an obstacle to the free movement of people and goods.

As new challenges (global warming, road congestion, road financing gap) emerge, it is necessary that actions to tackle them are implemented in a harmonised and non-discriminatory way. There is a need for a EU response to these challenges and the Eurovignette Directive must evolve to accompany changes in the objectives of road charging schemes.

Without specific new provisions in the Directive on the problems identified in section 2.1, Member States are unlikely to use road charging to address new challenges. Besides, if rules at EU level are insufficiently developed, there is a risk is that road charging schemes could become an element of economic competition between Member States.

After 20 years and following two major amendments, the Eurovignette Directive has become a complex piece of legislation. A number of policy measures considered under various policy options below could contribute to simplifying the application of the instruments provided for in the current Directive. For example, the removal of one of the two competing measures (the obsolete differentiation based on Euro class) to promote more environmentally friendly vehicles, and making the application of the other (external cost charging) easier for Member States.

The timing for the initiative is well justified by the recent developments in Member States in the area of road charging. The existing schemes are becoming more mature so it has become clear what the main deficiencies of the existing rules are and where new elements need to be added. At the same time, an increasing number of Member States introduces or considers the introduction/extension of road charging schemes. Given that these plans do not always correspond to the most optimal approach from an EU perspective, it seems necessary to act now to give the right incentives and eliminate barriers to the deployment of efficient and effective road charging systems.

Also the recent technological developments call for changes in the existing rules. With the Euro classification becoming obsolete and new emission testing schemes becoming available it appears justified to reflect these developments in the Eurovignette Directive.

The progress and increasing uptake of electronic tolling also enables the use of more refined charging schemes and these new possibilities should be considered to facilitate better internalisation of external transport costs via tolling.

4. OBJECTIVES

The general objective of the initiative is to promote financially and environmentally sustainable and socially equitable road transport through wider application of the 'user pays' and 'polluter pays' principles (fair and efficient pricing).

The specific objectives (SO) for the revision of Directive 1999/62/EC are the following:

1. Contribute to the reduction of CO_2 emissions in transport via pricing (demand side) supported by supply side measure to come (standards).
2. Contribute to adequate quality of roads.
3. Ensure fair and non-discriminatory road pricing.
4. Make use of road charging as an effective tool in reducing pollution and congestion.

These objectives are directly linked to the problems identified in section 2, as shown in Figure 2-1, with clear synergies with the goal of ensuring adequate infrastructure financing through the application of proportionate pricing. There could be a trade-off between addressing CO_2 vs pollutant emissions, in that the most fuel-efficient vehicles might not be the cleanest and price signals could work against each other. This however can be overcome by removing unnecessary duplication of charge differentiation from the Directive and introducing CO_2 differentiation, with only the least polluting HDVs benefitting from lower rates. For cars and vans, incentivising fuel-efficiency only could lead to further 'dieselisation' with negative impacts on air pollution and fuel balance. If differentiation of charges is applied, it should thus take account of both CO_2 and pollutant emissions.

The objectives are in line with the Charter of Fundamental Rights, in particular by ensuring the non-discriminatory application of road charges that reflect the environmental performance of vehicles thereby contributing to sustainable development and the free movement of citizens. More specifically, the first objective is in line with EU goals of reducing CO_2 emissions and builds on the certification of CO_2 emissions from HDVs under type approval legislation to be adopted in 2017, on the initiative on the monitoring and reporting of heavy duty vehicle fuel consumption and carbon dioxide emissions to be proposed at the same time with this initiative, and with upcoming initiatives on emissions from cars and vans. The second one, linked to the problem of degrading road quality, is coherent with the aims of the legislation on road infrastructure safety[74]. Finally, the current revision of the legislation on electronic tolling (EETS)[75] will be instrumental in achieving the third and fourth objectives by making proportionate distance-based charging more affordable.

[74] Directive 2008/96/EC of the European Parliament and of the Council on road infrastructure safety management

[75] Directive 2004/52/EC on the interoperability of electronic road toll systems in the Community and Commission Decision 2009/750/EC on the definition of the European Electronic Toll Service and its technical elements

5. POLICY OPTIONS

Apart from the baseline scenario (no additional EU action), four policy packages are considered. Each of them addresses each policy objective but they differ in their focus and level of ambition. As some of the problems are linked to the current text of the Directive, the considered options all include regulatory elements, in line with the Commission Strategy on Low-emission Mobility, and simplification measures, in line with the objectives of ensuring regulatory fitness. This approach enjoys a wide stakeholder support as evidenced by the feedback received through the various consultation activities (cf. report on the stakeholder consultation in Annex 2).

The concrete measures in each policy option are described below, while the rationale for the selection of these measures is provided in Annex 11, along with indications on which Member States would be affected. The way in which each member States would need to adapt its road charging practice is presented in Annex 4 (section 4.3).

5.1. Baseline (no additional EU action)[76]

In the baseline scenario, Directive 1999/62/EC would continue to apply in its current form to HGVs only. Road charges for HGVs would not be differentiated according to the CO_2 emissions since the differentiation based on Euro class would remain mandatory for HGVs (with continued exceptions). The heavy methodological requirement for the application of external cost charging would continue to apply and the Directive would not offer effective provisions to address the issues of degrading road infrastructure and congestion.

Member States would thus continue their current practice of road charging and proceed with plans according to their own national objectives as illustrated in section 2.4 without necessarily being in line with EU objectives sometimes in contradiction with the principles of non-discrimination and proportionality (cf. section 2.1.3). This option has no real support among stakeholders and some Member States argue that at least the limits on vignette prices (for HGVs) should be increased (cf. sections 2.2.3.1 and 2.4.2).

5.2. Discarded policy measures

Soft law (e.g. a Communication with recommendations[77]) was used in the past to address the issue of disproportionately priced short-term vignettes for passenger cars but was found not to have significant impact. For addressing the shortcomings of existing legislation, it is not a viable option.

The most ambitious policy option introducing a full internalisation of external costs as suggested by the 2011 White Paper has also been discarded. This option is supported by some environmental NGOs in particular and remains a long-term goal of the European transport policy, but it does not currently appear to be achievable due to excessive implementation costs and for reasons of subsidiarity. Indeed, regarding certain aspects, it appears that Member States are best placed to act. For example, whether or not to apply road charging or congestion charging on a given part of the network can best be assessed at local/regional level.

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[76] See Figure 4-1 in Annex 4 for a summary of road charging systems applied by Member States in the Baseline scenario

[77] COM(2012)199 final

A number of measures considered at an initial stage have been discarded following the stakeholder consultation and a pre-screening with regard to effectiveness, administrative/implementation costs, legal feasibility, subsidiarity and proportionality. These measures are listed here with a description on the reasons for discarding them available in Annex 11:

- Making distance-based charging mandatory on the TEN-T network for HGVs / all goods vehicles
- Inclusion of the external costs of accidents not already covered by insurance schemes
- Mandatory application of genuine congestion charging on congested parts of the network in peak hours for HGVs / all vehicles
- Awarding discounts for the use of specific fuel-saving equipment, such as low-resistance tyres of aerodynamic devices
- Promotion of specific low carbon fuel technologies
- Making it possible to apply genuine congestion charging (i.e. on top of infrastructure charges) on congested parts of the network in peak hours for HGVs only
- Mandatory earmarking (ring-fencing) of revenues from road charging
- Requiring Member States to prepare national plans on the maintenance and upgrade of their road networks
- Introduction of rules on the liability of the keeper of a toll road to maintain the given road section in sufficiently good/safe condition

For all these measures, less restrictive alternatives have been retained that are easier to implement and/or at lower costs.

5.3. Policy option 1: minimum adjustments with rules for vehicles (including for passenger cars) (PO1)

This option proposes the necessary legislative changes to make the Directive more fit for purpose and, in order to make it possible to address all four objectives at least to some extent, extends the scope to buses and coaches and, for some provisions, to vans and passenger cars. The application of coherent rules to all HDVs (HGVs and buses/coaches) not only ensures fairer treatment of the users of these vehicles but also contributes to achieving the other three objectives. In the absence of the strongest possible instrument of mandatory reinvestment of toll revenues in transport, enhanced reporting including specific information on the quality of roads could incentivise Member States to allocate the necessary resources to road maintenance (cf. Annex 12).

In line with REFIT objectives, the option includes simplifications to current rules and proposes their more coherent application, while keeping the obligations on light vehicles to the minimum.

SO1: Contribute to reducing CO_2 emissions in transport:

- Allowing reduced toll rates (for both HDVs and LDVs) in order to promote zero-emission vehicles; in this respect, the measure would also contribute to the Commission's objective of reducing regulatory burden.

SO2: Contribute to adequate quality of roads:

- Monitoring and reporting by Member States through **regular infrastructure reports**, providing information on toll revenues, on their use, including expenditures on maintenance/operation of roads, as well as on the quality of roads based on key performance indicators.
- Introducing common **quality indicators**. A harmonised definition based on current national practices in monitoring road characteristics could be adopted by the Commission through an implementing/delegated act.

SO3: Ensure fair and non-discriminatory road pricing:

- Removing the possibility to exempt HGVs below 12 tonnes from being subject to road charging (after a period of 5 years);
- Extending the rules on tolls and user charges (Chapter III of the Directive) to include buses and coaches;
- Introducing non-discrimination and proportionality requirements for LDVs: defining the maximum ratio of average daily price (or price proportions) between short-term and long-term vignettes, and clarify rules concerning possible compensation of national users.

SO4: Make use of road charging as an effective tool in reducing pollution and congestion:

- Simplification of the requirements for external cost charging:
    - Merging the charging of noise costs with the cost of air pollution;
    - Using more proportionate values instead of weighted average charges;
    - Removing the requirement for Member States to notify the Commission where these provisions are respected (i.e. the values set in the Directive are applied).
- Reviewing of maximum values for external cost charging to better reflect external costs of pollution and noise;
- Extending the possibility to use mark-ups (of 15-25%) beyond mountain regions to contribute to the financing of removing bottlenecks on the TEN-T network, while keeping the condition of acute congestion or significant environment damage generated by vehicles. The measure would apply to all HDVs (HGVs + buses/coaches).

The measures set out in this option are generally supported by stakeholders. The promotion of zero-emission vehicles and the revision of rules on external cost charging are not contested by stakeholders. At the same time, some Member States oppose obligations regarding infrastructure maintenance (in particular the mandatory earmarking of revenues) voicing subsidiarity concerns, while SMEs, especially transport operators as well as private road users demand that any toll revenues be reinvested in roads. There is wide support for the application of the polluter pays and user pays principles, including proportionate pricing of vignettes. The exemption of HGVs below 12t is not considered justified by stakeholders, except for some Member States that still apply it. Regarding mark-ups, there is some interest in Member States to use the possibility outside mountain regions.

5.4. Policy option 2: rules for all vehicles and progressing on the 'polluter pays' and 'user pays' principles for HDVs (PO2)

This option would address CO_2 emissions in a more direct way by including a CO_2 element in the road charge for HDVs, while encouraging the introduction of distance-based charging by removing an obstacle created by Directive 1999/62/EC, i.e. the application of a minimum vehicle tax for HGVs. It goes a step further than PO1 in making the legislative framework more coherent by phasing out the less effective forms of charging for the use of roads and for external costs. Gradual phasing out of existing vignette schemes would give Member States sufficient time to adapt their charging systems. Moving towards distance-based charging is necessary to achieve the overall objective of implementing the 'polluter pays' and 'user pays' principles, i.e. contributing to all four specific objectives.

The concrete measures included in PO2, in addition to the measures of PO1, are described below.

SO1: Contribute to the reduction of CO_2 emissions in transport:

- Introducing a mandatory differentiation of infrastructure charges according to CO_2 emissions for HDVs once vehicle certification data on CO_2 emissions becomes available for new vehicles[78]. Distinction would be made between i) Euro 0-VI vehicles, ii) low-CO_2 (new or retrofitted) vehicles. Since the certification data would only be available in 2019/2020, the precise method for differentiating charges would be defined by the Commission in an implementing/delegated act. Taking into account existing fuel taxes, the differentiation would be revenue-neutral based on a bonus-malus principle in order to avoid "double taxation". The cleanest and most efficient vehicles would pay less than the average.

SO2 and SO3: Contribute to adequate quality of roads and ensure fair road pricing:

- Where HGVs are subject to road charging, buses and coaches would also have to be charged.
- Phasing out vignettes for HDVs (HGVs + buses/coaches) after 5 years (by 2023) – only distance based charging would be allowed for these vehicles. Distance-based charging would remain the only option facilitated by the possibility to decrease vehicle taxes (see measure below) but Member States would remain free to decide whether or not to introduce road charging on their territory and on which roads. Distance-based charging is also necessary to achieve SO1 and SO4.
- As a complementary measure to incentivise the introduction of distance-based charging: Removing minimum levels of vehicle circulation taxes for HGVs above 12 tonnes would allow Member States the reduction or complete abolishing of the tax in case of the application of distance-based charging. The measure would also contribute to the REFIT objective of reducing the burden on businesses.

SO4: Make use of road charging as an effective tool in reducing air pollution and noise:

- Phasing out differentiation of infrastructure charges for HGVs according to Euro emission classes (simplification) – with external cost charging remaining optional.

[78] VECTO – Vehicle Energy consumption Calculation Tool developed by DG CLIMA and the JRC – will be ready to provide this information for HGVs above 7.5 t as from 2019.

Since external cost charging would be made simpler (as in PO1), Member States would still have the opportunity to take account of the environmental performance of vehicles under this option. The measure would also be extended to buses/coaches.

A sensitivity case (**PO2s**) is provided for PO2 where the measures explained above are additionally implemented in Estonia and Finland. These two Member States plan to introduce road charges in the future but they do not qualify for being included in the Baseline because, at the time of preparing the impact assessment, the plans have not yet been adopted.[79]

The promotion of low-CO_2 vehicles has not met any notable opposition by stakeholders. While some Member States would prefer to keep the flexibility of opting in or out, others indicate that such a measure can only be effective if applied coherently. In practice, once CO_2 emission certification data is available, the new scheme could replace the current differentiation based on Euro class, which will become obsolete by then.

The phasing out of vignette schemes for HGVs is supported by many, including environmental NGOs, and representatives of the railway sector but also a number of Member States and operators, even though some Member States still operating such schemes would oppose this.

5.5. Policy option 3: reducing CO_2 and other externalities from all vehicles (PO3) – with two variants (3a and 3b)

With a view to tackle the issues, which are related to primarily to light vehicles, this option includes additional measures for cars and vans, addressing interurban congestion as well as CO_2 and pollutant emissions from all vehicles. The measures included in this option are described below, in addition to the measures of PO2.

SO4: Make use of road charging as an effective tool in reducing pollution and congestion (in both **PO3a and PO3b)**:

- Allowing (optional) genuine congestion charging on top of the infrastructure charge in distance-based environment, on congested parts of the network, for all vehicles (LDVs + HDVs) – such a congestion charge, should Member States decide to implement it, would apply to all vehicles (LDVs and HDVs) according to their size.

  The Directive would require the revenues generated by congestion charging to be invested in the maintenance/development of the road in question or alternative transport/mobility solutions. This could raise the level of acceptability of an extra charge by users[80].

SO1 and SO4: Contribute to the reduction of CO_2 emissions in transport and make use of road charging as an effective tool in reducing air pollution (only in **PO3b**):

- Introducing a mandatory differentiation of tolls and user charges (i.e. both distance- and time-based) for LDVs (vans and passenger cars) from 2020 when Member States apply road charging. Distinction would be made between different emission classes based on WLTP[81] for CO_2 and based on real driving emissions (RDE) testing for

[79] The Estonian Government has approved the introduction of a time-base road charging schemes for HGVs since, but it is still to be enacted by Parliament.

[80] Please see Annex 11 and for more background information.

[81] World harmonised Light vehicle Test Procedure adopted by the UNECE

pollutant emissions (NO_X). In order to provide a coherent price signal and have an effective impact, Member States would be required to differentiate tolls accordingly.

The stakeholder survey suggested that any legislation introduced should not be focused solely on HGVs, but on **all road vehicles** including both freight and passenger transport based on the *polluter pays* and *user pays* principles. While different options on congestion charging were met with scepticism, stakeholders agreed that if congestion charging was applied, it should cover all vehicles, not just HGVs. The proposed optional measure is in line with this view.

5.6. Policy option 4: optimisation of tolls for all vehicles (PO4)

While not obliging Member States to apply road charging, this is the most ambitious option as it extends the requirement to use distance-based tolling only to all vehicles, including passenger cars, while making external cost charging mandatory for heavy duty vehicles (HGVs above 3.5 tonnes and buses/coaches). The concrete measures would include measures of **PO3b** plus:

SO2, SO3 and SO4: Contribute to adequate quality of roads, ensure fair road pricing and make use of road charging as an effective tool in reducing air pollution, noise and congestion:

- Phasing out vignettes for vans – only distance based charging would be allowed for these vehicles.
- Phasing out vignettes for cars – only distance based charging would be allowed for these vehicles.

SO4: Make use of road charging as an effective tool in reducing air pollution and noise:

- Making external cost charging mandatory on the tolled TEN-T network for all heavy-duty vehicles.

A sensitivity case (**PO4s**) is provided for PO4 where the measures explained above are additionally extended to Belgium, Germany, Luxembourg and the Netherlands, to illustrate possible effects when distance-based charging is applied to all vehicles in all centrally located Member States (i.e. those with highest levels of transit traffic).

A general comment from the consultation was that the more restrictions were imposed on charging by the Directive, the less likely it was that a Member State would voluntarily implement a charging scheme, in spite of its potential benefits. This option, if selected, should be implemented with special care. The fact that it would bring HGVs and LDVs on a more level playing field was applauded by some stakeholders, including road transport associations and environmental organisations, while Member States are divided regarding the inclusion of vehicles lighter than 3.5t.

5.7. Overview of measures and objectives

Since other possibilities than revising the existing legislation have been ruled out (business as usual or soft law), the measures have been packaged in a way to put more or less emphasis on the different objectives while addressing passenger and freight transport. At the same time, truly alternative options (e.g. addressing only freight or only passenger transport) are not viable if all the objectives are to be addressed. The options show

therefore a cumulative pattern, which allows assessing the effects of key measures, which differentiate them, and gauging the desired level of ambition.

Figure 5-1: Relation between the proposed measures and the specific objectives

Measures and specific objectives	Policy Options				
	1	2	3a	3b	4
SO1: Contribute to the reduction of CO_2 emissions in transport					
Allowing reduced rates for ZEVs (HDVs and LDVs)	✓	✓	✓	✓	✓
Mandatory differentiation of infrastructure charges according to CO_2 emissions for HDVs		✓	✓	✓	✓
Mandatory differentiation of tolls and charges for LDVs according to CO_2 and pollutant emissions				✓	✓
SO2: Contribute to adequate quality of roads					
Regular infrastructure reports	✓	✓	✓	✓	✓
Road quality indicators	✓	✓	✓	✓	✓
Phase out vignettes for HDVs after 5 years – only distance-based charging		✓	✓	✓	✓
Phase out vignettes for vans – only distance based charging					✓
Phase out vignettes for passenger cars – only distance based charging					✓
SO3: Ensure fair and non-discriminatory road pricing					
Remove exemptions for HGVs <12t	✓	✓	✓	✓	✓
Extend rules on tolls and user charges to include busses and coaches	✓	✓	✓	✓	✓
Introduce non-discrimination and proportionality requirement for LDVs	✓	✓	✓	✓	✓
Phase out vignettes for HDVs after 5 years – only distance based charging		✓	✓	✓	✓
Remove minimum levels of vehicle circulation taxes for HGVs above 12 tonnes		✓	✓	✓	✓
Phase out vignettes for vans – only distance based charging					✓
Phase out vignettes for passenger cars – only distance based charging					✓
SO4: Make use of road charging as an effective tool in reducing pollution and congestion					
Simplification of the requirements for external cost charging	✓	✓	✓	✓	✓
Review of caps/values for external cost charging	✓	✓	✓	✓	✓
Extend the possibility to use mark-ups beyond mountain regions	✓	✓	✓	✓	✓
Phase out Euro class-differentiation		✓	✓	✓	✓
Allow genuine congestion charging for all vehicles (LDVs + HDVs)			✓	✓	✓
Mandatory differentiation of tolls and charges for LDVs according to CO_2 and pollutant emissions				✓	✓
Make external cost charging (for air pollution and noise) mandatory for HDVs on the tolled TEN-T (charges are applied on top of infrastructure costs)					✓
Phase out vignettes for passenger cars – only distance based charging					✓

Sensitivity cases (PO2s and PO4s) are not shown in the table above because they include the same measures as the main policy options (PO2 and PO4, respectively), while only extending the implementation of the measures to few additional Member States. Details are available in Annex 4 (section 4.3).

Some important clarifications at this point:

- Directive 1999/62/EC does not oblige Member States to introduce road charging on their TEN-T or motorway network. All policy options would maintain the same approach.

- Quantifying the impacts of such optional rules requires making assumptions on the uptake of road charging by Member States. These assumptions carry important uncertainties; the decision of France to abandon the deployment of its network-

wide distance-based tolling for HGVs (the so called Ecotaxe) just before its launch is an example of how national policy orientations can change unexpectedly. Denmark and the Netherlands had similar plans to introduce distance-based tolling for HGVs but they have also shelved them. For this reason, quantification, including modelling results, will only be used to indicate the scale of foreseeable impacts rather than their exact estimation. Two additional sensitivity cases (PO2s and PO4s) have been quantified for illustration purposes.

- A model suite has been used for the analytical work, combining the strengths of three different models: ASTRA, PRIMES-TREMOVE and TRUST. The model suite covers the entire transport system[82] and the macroeconomic impacts. A description of each model and its use is provided in Annex 4, section 4.3.

- For each policy option, assumptions on the changes in Member States responses to specific policy measures were made; they are described in Annex 4, section 4.3 (see Tables 4-1 to 4-13), and have been used as input for modelling. The proposed changes are assumed to be applied in full to the schemes that are already in place. That is, in case a Member State currently applies time-based charging and this possibility is phased out, it is assumed that it will apply distance-based charging in order to cover infrastructure costs. The alternative solution for such a Member State would be to cover the loss of revenue by increasing taxes (a plausible example is provided in Annex 3), but this decision is not possible to predict.

- The main economic, social and environmental impacts of these policy choices are summarised in the following section. A full description of quantifiable effects at national level for each policy option is provided in the impact assessment support study (see Annex A)[83]. Unless indicated otherwise, quantifiable impacts are expressed in percentage changes for each policy option in 2030 compared to the Baseline.

6. ANALYSIS OF IMPACTS

6.1. Economic impacts

6.1.1. Transport costs

The deployment of new tolling schemes and higher toll levels would increase the direct costs of both passenger and freight road transport (not taking account of the indirect savings accruing from better roads and less congested traffic).

Changes in transport costs and impact on overall mobility

The measures introduced in **PO1** would be expected to slightly increase road freight transport costs in those countries where a change in the existing charging system would

[82] E.g. transport activity represented at Member State level, by origin-destination and at link level, technologies and fuels at Member State level, air pollution emissions at Member State and link level and CO_2 emissions at Member State level.

[83] Idem Footnote 14

take place (i.e. extension of road charging to smaller HGVs or the introduction of mark-ups), with marginal impact on road freight transport activity and on its modal share.

The most significant increase in road freight costs (2.3% in 2030 relative to the Baseline) would take place in Germany, where the distance based charging system is extended to HGVs below 7.5 tonnes and the external costs charges for air and noise pollution would apply to all HGVs (see Figure 6-1).[84] In other Member States where road charging would be extended to all HGVs (i.e. Denmark, Luxembourg, the Netherlands, Sweden), smaller increases in road freight costs are projected (between 0.2 to 0.5% in 2030 relative to the Baseline); impacts are negligible in the UK given the possibility to deduct the vignette price from taxes. In Austria the application of higher external cost charges (i.e. for air and noise pollution) for HGVs would increase road freight transport cost by 0.8% in 2030 relative to the Baseline. The application of mark-ups would lead to a 0.5% increase in road freight transport costs in Slovenia in 2030 relative to the Baseline, while the impact would be more limited in France (0.1% increase).[85] Overall, at EU level PO1 would result in 0.2% increase in road freight transport costs in 2030 relative to the Baseline and 0.1% reduction in road freight transport activity (see Figure 6-2). The extension of road charging to buses would not have a significant impact on road passenger transport costs and activity in PO1 (see Figure 6-3 and Figure 6-4).

In **PO2** and **PO2s**, increases in road freight transport costs would be more significant (i.e. 0.9 to 1.0% in 2030 relative to the Baseline at EU level leading to around 0.2% decrease in road freight activity) since all Member States that already have a charging system in place for HGVs would have to apply **distance-based tolls to all HGVs**. The increases in road freight transport costs are projected to range between 1.1 and 3% in Denmark, Estonia, Finland, Latvia, Luxembourg, Lithuania, the Netherlands, Romania, Sweden and the United Kingdom to over 3% in Bulgaria, where current vignette prices are very low (see Figure 6-1). The phasing out of vignettes for buses and their replacement with distance-based tolls would results in 0.1 to 0.2% increase in road passenger transport costs in Bulgaria, Denmark, Finland, Hungary, Romania, Sweden and the United Kingdom, with no significant impact on road passenger transport costs and activity at EU level (see Figure 6-3 and Figure 6-4).

In **PO3**, the possible application of **congestion charging** on the inter-urban network in those Member States where this is allowed (i.e. Greece, Spain, France, Croatia, Ireland, Italy, Poland and Portugal[86]) would be expected to lead to a slight increase in road transport costs for both freight and passenger transport (0.1 to 0.6%) relative to the Baseline in 2030, except for those Member States where the assumed congestion charge is similar to the current (relatively low) level of infrastructure charge. The effects would be felt in areas where congestion charging is deployed (if a Member State decides so), i.e. around major agglomerations where local traffic meets long distance (mainly freight)

[84] Germany has introduced an external cost charge for air pollutants in 2015 and Austria an external cost charge for air pollutants and noise in 2017. For these two Member States that already have external cost charges in place, in PO1 it is assumed that the values of the external costs charges are aligned to those of the 2014 Handbook on external costs of transport. (Source: http://ec.europa.eu/transport/themes/sustainable/internalisation_en.)

[85] The differences in the magnitude of impact in the two countries can be justified by the lower share that the network charged for mark-ups in France has on the total tolled network in the country.

[86] Member States which apply distance-based charges to all vehicles.

transport. Overall, at EU level, road freight transport costs would increase by 1.0 to 1.1% in 2030 relative to the Baseline in PO3 and road passenger costs by up to 0.1%.

The mandatory external cost charging for HDVs and the **phasing out of vignette systems for vans** in **PO4** and **PO4s** would result in increased transport costs for users of these vehicles (e.g. up to 6% increase in road freight costs in Germany). For road passenger transport costs, the changes would be largest in Member States which are assumed to implement **distance-based charging for passenger cars** to replace existing vignette schemes (e.g. up to 15% increase in Austria). The overall increase in costs at EU level would reach 1.3 to 2% for road passenger transport, due to the phasing in of distance-based charges for passenger cars, and 1.5 to 2% for road freight transport with somewhat greater impact on transport activity (i.e. 0.2 to 0.6% decrease for road passenger transport and 0.3 to 0.5% for road freight transport in 2030 relative to the Baseline).

Figure 6-1: Percentage change in road freight transport costs by Member State in Policy Options 1 to 4 relative to the Baseline for 2030

Road freight cost (% change to the Baseline in 2030)	Baseline (in euro/tkm)	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
AT	0.18	0.8%	0.9%	0.9%	1.0%	1.0%	3.9%	4.4%
BE	0.21	0.2%	1.1%	1.1%	1.2%	1.2%	1.3%	3.7%
BG	0.22	0.0%	3.9%	3.9%	3.9%	4.0%	5.1%	5.1%
CY	0.34	0.0%	0.1%	0.1%	0.1%	0.1%	0.4%	0.4%
CZ	0.15	0.2%	0.6%	0.6%	0.6%	0.6%	0.7%	0.9%
DE	0.17	2.3%	1.9%	2.0%	2.0%	2.0%	2.1%	6.0%
DK	0.18	0.3%	2.6%	2.6%	2.6%	2.6%	2.6%	2.9%
EE	0.19	0.1%	0.6%	2.0%	0.6%	0.6%	0.7%	0.7%
EL	0.26	0.0%	-0.1%	-0.1%	0.1%	0.1%	0.4%	0.4%
ES	0.17	0.1%	-0.6%	-0.6%	-0.4%	-0.4%	-0.1%	0.0%
FI	0.24	0.0%	0.3%	1.1%	0.3%	0.3%	0.3%	0.3%
FR	0.22	0.1%	-1.3%	-1.3%	-1.0%	-1.0%	-0.5%	-0.5%
HR	0.18	0.3%	0.4%	0.4%	0.5%	0.5%	0.9%	1.2%
HU	0.18	0.2%	0.8%	0.9%	1.0%	1.1%	2.8%	3.1%
IE	0.29	0.0%	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
IT	0.19	0.0%	-0.6%	-0.6%	0.1%	0.3%	1.0%	1.1%
LT	0.19	0.2%	2.3%	2.3%	2.3%	2.3%	2.4%	2.7%
LU	0.19	0.5%	2.4%	2.4%	2.5%	2.5%	2.7%	5.1%
LV	0.18	0.3%	2.6%	2.9%	2.8%	2.7%	3.0%	3.5%
MT	0.23	0.0%	0.2%	0.2%	0.4%	0.4%	0.7%	0.7%
NL	0.21	0.3%	1.4%	1.4%	1.4%	1.4%	1.5%	3.9%
PL	0.17	0.1%	0.5%	0.5%	0.6%	0.6%	0.5%	0.7%
PT	0.20	0.0%	-0.6%	-0.6%	-0.5%	-0.5%	-0.3%	-0.3%
RO	0.18	0.1%	2.7%	2.7%	2.7%	2.8%	4.9%	5.0%
SE	0.20	0.2%	2.9%	3.0%	2.9%	2.9%	2.9%	3.1%
SI	0.22	0.5%	0.9%	0.9%	1.0%	1.0%	1.0%	1.3%
SK	0.17	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.6%
UK	0.27	0.0%	1.3%	1.3%	1.3%	1.3%	1.7%	1.8%

Source: ASTRA model; Note: Road freight transport costs cover fuel costs and road charges applied for HGVs and vans. For the Baseline, the levels of road transport costs are provided for 2030, expressed in euro per tonne-kilometre (euro/tkm).

Figure 6-2: Percentage change in road freight transport costs and road freight transport activity for EU28 in Policy Options 1 to 4 relative to the Baseline for 2030

Road freight transport (% change to the Baseline in 2030)	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
Road freight transport costs	0.2%	0.9%	1.0%	1.0%	1.1%	1.5%	2.0%
Road freight transport activity	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%	-0.3%	-0.5%

Source: ASTRA model

For freight transport, the modelled increase in transport costs takes into account the possible use of revenues from road charging to reduce vehicle taxation for HGVs and vans. The results of the modelling show therefore net changes in costs.

Figure 6-3: Percentage change in road passenger transport costs by Member State in Policy Options 1 to 4 relative to the Baseline for 2030

Road passenger cost (% change to the Baseline in 2030)	Baseline (in euro/pkm)	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
AT	0.18	0.0%	0.0%	0.0%	0.0%	-0.1%	14.8%	15.2%
BE	0.15	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.6%
BG	0.13	0.0%	0.1%	0.1%	0.1%	0.1%	2.3%	2.4%
CY	0.20	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.5%
CZ	0.17	0.0%	0.0%	0.0%	0.0%	-0.1%	2.9%	3.2%
DE	0.21	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	5.6%
DK	0.15	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.6%
EE	0.17	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
EL	0.20	0.0%	0.0%	0.0%	0.6%	0.3%	0.4%	0.4%
ES	0.16	0.0%	0.0%	0.0%	0.3%	0.2%	0.2%	0.2%
FI	0.16	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
FR	0.16	0.0%	0.0%	0.0%	0.4%	0.1%	0.1%	0.2%
HR	0.28	0.0%	0.0%	0.0%	0.0%	-0.2%	0.3%	0.5%
HU	0.17	0.0%	0.1%	0.1%	0.1%	-0.1%	1.7%	1.8%
IE	0.19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
IT	0.18	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%	0.5%
LT	0.13	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
LU	0.14	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	4.7%
LV	0.16	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%
MT	0.15	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%
NL	0.19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.8%
PL	0.15	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.2%
PT	0.21	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
RO	0.15	0.0%	0.1%	0.1%	0.1%	0.0%	4.7%	4.8%
SE	0.18	0.0%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%
SI	0.21	0.0%	0.2%	0.2%	0.2%	0.0%	1.3%	1.6%
SK	0.18	0.0%	0.0%	0.0%	0.0%	-0.2%	4.9%	5.0%
UK	0.18	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%

Source: ASTRA model; Note: Road passenger transport costs cover fuel costs and road charges applied for cars, buses and coaches. For the Baseline, the levels of road transport costs are provided for 2030, expressed in euro per passenger-kilometre (euro/pkm).

Figure 6-4: Percentage change in road passenger transport costs and road passenger transport activity for EU28 in Policy Options 1 to 4 relative to the Baseline for 2030

Road passenger transport (% change to the Baseline in 2030)	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
Road passenger transport costs	0.0%	0.0%	0.0%	0.1%	0.0%	1.3%	2.0%
Road passenger transport activity	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.2%	-0.6%

Source: ASTRA model

For passenger transport, the modelled increase in transport costs does not take into account any possible reduction in vehicle taxation, by which Member States might want to compensate for the higher costs attached to the introduction or extension of road charging to passenger cars and buses. The results of the modelling show therefore potentially larger increase in costs than what motorists might face in reality.

Impact on consumer prices

The extent to which the above cost increases for road freight would result in increased consumer prices depends on the extent to which road charges make up a significant proportion of the final costs (0.01 to 1.43% for typical consumer goods)[87], and the extent to which cost increases faced by hauliers are passed through. Even if 100% of cost increases are passed through to shippers, an assumption which is consistent with studies in Germany, Austria and Switzerland, the impact on consumer prices would be negligible. According to the impact assessment support study, the average increase in product prices would be in the range of up to 0.02% for PO1 and up to 0.25% for PO4.

6.1.2. Congestion cost

The level of road charges has an impact on the behaviour of road users, which can be affected in different ways: route shift, modal shift and travel frequency reduction. Time-differentiated charges also result in travel time shift.

In **PO1**, the level of charges would only change for the use of HGVs between 3.5 and 12 tonnes as explained above, which would result in a reduction of the HGVs delay costs from congestion of about 0.1% at EU level in 2030 relative to the Baseline (0.4% decrease in Germany). In areas with acute congestion, where significant environmental damage is caused by heavy traffic and mark-ups are applied for HGVs to finance the construction of alternative transport infrastructure (e.g. in France and Slovenia), there would be some limited redistribution of HGVs traffic on the adjacent network (1% reduction in Slovenia for HGVs delay costs in 2030 relative to the Baseline and 0.2% decrease in France). However, the overall road congestion costs at EU level (i.e. delay costs from congestion for passenger cars and HGVs) in PO1 are similar to those in the Baseline.

Under **PO2** and **PO2s** road congestion cost at EU level would only be marginally affected (0.2% reduction in 2030 relative to the Baseline) with a slightly more important decrease for HGVs (1.5% decrease) thanks to the generalised application for them of distance-based charging. HGVs delay costs from congestion would decrease by 3 to 7.1% in Belgium, Denmark, the Netherlands, Slovakia and the United Kingdom in 2030 relative to the

[87] Calculation assuming that road charges represent 1 to 15% of operating cost of hauliers and transport costs make up 0.8 to 9.5% of the final price. Cf. impact assessment support study. Nb. transport costs may not only mean road transport costs, nevertheless, these numbers provide a good indication of the magnitude of possible changes in consumer prices induced by the variation of road charges.

Baseline (0.7 to 1.7% decrease for overall road transport). Substantial decreases in road congestion costs (i.e. for passenger cars and HGVs) at EU level are only projected under PO3 (2.4% reduction in PO3a and 2.5% reduction in PO3b in 2030 relative to the Baseline) with the positive effects felt in those Member States in which congestion charging can be applied as all vehicles are charged per km (such as Greece, France, Italy, Poland and Portugal), and in PO4 and PO4s (2.5 to 6.1% reduction), under which vans and passenger cars are charged by distance and Member States can apply congestion charging on congested sections of the network.

Benefits resulting from congestion costs savings relative to the Baseline over time, represented as present value in 2015, are projected to be significant in PO3 and PO4 (i.e. €8.8 billion in PO3a, €8.9 billion in PO3b, €9.1 billion in PO4 and €22.2 billion in PO4s) while they are more limited in PO1 and PO2 (i.e. €0.1 billion and 0.8 billion).

6.1.3. Impact on SMEs[88]

Close to 100% of firms in the road freight sector are companies with fewer than 250 employees, while 90% are micro-enterprises (Eurostat, 2017). The proposed policy measures are likely to involve small increases in the costs of transport (see Section 6.1.1) due to the introduction of new road tolls in certain Member States and the greater use of external cost charges (under PO2, PO3 and PO4). However, because of very small profit margins in the road haulage sector, most of those increases (see Figure 6-1) would be passed through to shippers as indicated above (on average max. 1.5 to 2% increase in road freight costs in PO4 and PO4s in 2030 relative to the Baseline). As such, it is expected that increased transport costs in all policy options could only have minor negative impacts on SMEs; they may be less able to absorb additional costs, but no substantial distortions are expected.

Introducing congestion charging would also likely impact the small firms, which may have no choice but to drive in peak hours because they have to maximise utilisation of their vehicles (Mahendra, 2010). At the same time, the same firms would benefit from lower congestion, which would result in time savings and an effective increase in the catchment area for the business. Given limited experience with inter-urban congestion charging, it is difficult to say what the net impacts would be – however, evaluations of the London congestion charge found no discernible impact on businesses (TfL, 2008), suggesting that more limited, targeted interurban congestion charging foreseen in PO3 and PO4 would not have significant impacts on SMEs (positive or negative).

The measures to promote low and zero-emission vehicles (all POs) may benefit SMEs less in the short-term compared to larger firms, since SMEs may face more difficulties in making the upfront investment for more expensive low CO_2 vehicles[89]. If SMEs are less able to purchase or lease low CO_2 vehicles, they would *initially* benefit less from the

[88] More details are available in Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

[89] For example, Nissan e-NV200 electric van is 47% more expensive to purchase and lease compared to its diesel equivalent, the NV200 (Low Carbon Vehicle Partnership, 2016), and for electric trucks are priced 170-280% higher than a conventional equivalent (CE Delft, 2013).

measure compared to a larger firm. However, in the longer term it can be expected that the price of electric vehicles will reduce (Wolfram & Lutsey, 2016), making the upfront investment less of a barrier. Furthermore, SMEs typically buy their vehicles on the second-hand market (BCA, 2012). If the measure stimulates additional first-hand purchases of zero-emission vehicles, these would eventually reach the second-hand market and SMEs will also benefit from having access to zero-emission vehicles.

6.1.4. Member States budgets

6.1.4.1. Revenues from tolling

One of the main impacts of the analysed options is on revenues from road transport. Percentage changes in toll revenues from road transport at EU level relative to the Baseline for 2030 are shown in Figure 6-5 and their absolute levels by Member State in Figure 6-6. Toll revenues are marginally affected by promotional rates for zero emission vehicles as generally these would still represent a small share of vehicle fleet in 2030.

In PO1, the main driver of the increase is the extension of tolling to HGVs below 7.5 tonnes in Germany, which is expected to increase revenues by 51% in 2030 relative to the Baseline. The introduction of vignettes for HGVs below 12 tonnes is expected to lead to increases in total revenues varying from 155% in Luxembourg (where most of domestic traffic is performed by vehicles below 12 tonnes) to 17% in Sweden in 2030 relative to the Baseline. In Slovenia the application of mark-ups would increase revenues from HGVs and buses by 13% in 2030 relative to the Baseline. In large countries, such as France, the effect of mark-ups on revenues would be smaller (2% increase in revenues from HGVs and buses).

In PO2 and PO2s, revenues would be larger thanks to the generalised application of distance-based tolls to HGVs and buses. In this case, overall revenues increase by 15% at EU level, with the entire burden borne by HGVs and buses. The impact on specific Member States would be different depending on whether they already have distance-based charging in place or not. For example, larger increases would take place in Member States that have treated buses differently so far (e.g. 58% increase in total toll revenues in Germany in 2030 relative to the Baseline, 23% increase in Belgium and 13% in Hungary). For Member States which do not currently have distance-based charging in place, increases in revenues vary between 32% in Romania and can reach up to a 19-fold increase in Luxembourg.

Under PO3a and PO3b, revenues would further increase by 25 to 28% compared to the Baseline in 2030 thanks to the application of congestion charges in eight Member States[90]. Overall increases are largest in Greece, Italy and Poland (over 20%), with significant increases (over 10%) in Portugal, Spain and France.

PO4 and PO4s will generate most revenues (60 to 160%) with the phase in of distance-based schemes for vans and passenger cars in Member States applying road charges.

Figure 6-5: Percentage change in EU toll revenues from road transport in Policy Options 1 to 4 relative to the Baseline for 2030

[90] Greece, Spain, France, Croatia, Ireland, Italy, Poland and Portugal.

Revenues from road charging (% change to the Baseline in 2030)	TOTAL	HGVs	Buses	Vans	Cars
Baseline (in billion euro)	39.5	12.1	0.0	1.1	26.2
PO1	5.2%	19.2%	2.6%	-0.9%	-1.1%
PO2	14.5%	49.3%	92.2%	-0.7%	-1.1%
PO2s	14.8%	50.3%	97.6%	-0.7%	-1.1%
PO3a	28.0%	54.2%	108.1%	13.2%	16.4%
PO3b	24.7%	54.2%	107.4%	26.2%	10.9%
PO4	60.2%	64.8%	154.3%	64.6%	57.7%
PO4s	160.5%	86.0%	173.0%	209.3%	192.9%

Source: ASTRA model

The level of revenues from road charging in the Baseline and PO1 to PO4 by Member State is provided in Figure 6-6.

Figure 6-6: Projected annual toll revenues from road transport by Member State in 2030 (in billion euro)

Country	Baseline	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
AT	2.2	2.3	2.4	2.4	2.4	2.3	8.8	8.7
BE	0.6	0.6	0.7	0.7	0.7	0.7	0.7	3.6
BG	0.1	0.1	0.3	0.3	0.3	0.3	0.6	0.6
CY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CZ	0.5	0.5	0.6	0.6	0.6	0.5	2.1	2.1
DE	4.2	6.3	6.6	6.6	6.6	6.6	6.6	39.9
DK	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2
EE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EL	0.9	0.8	0.8	0.8	1.2	1.0	1.1	1.1
ES	3.0	3.0	3.0	3.0	3.4	3.4	3.5	3.5
FI	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
FR	14.5	14.3	14.8	14.8	17.1	16.4	16.9	16.8
HR	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HU	0.7	0.7	0.8	0.8	0.8	0.7	1.2	1.2
IE	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
IT	8.6	8.5	8.5	8.5	10.5	10.4	10.7	10.7
LT	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
LU	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2
LV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NL	0.0	0.0	0.3	0.3	0.3	0.3	0.3	3.6
PL	0.8	0.8	1.0	1.0	1.1	1.0	1.0	1.0
PT	1.0	1.0	1.0	1.0	1.2	1.1	1.1	1.1
RO	0.5	0.5	0.7	0.7	0.7	0.7	3.2	3.2
SE	0.1	0.1	0.5	0.5	0.5	0.5	0.5	0.5
SI	0.4	0.5	0.5	0.5	0.5	0.5	0.9	0.9
SK	0.3	0.3	0.4	0.4	0.4	0.3	1.4	1.4

Country	Baseline	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
UK	0.1	0.2	1.2	1.2	1.2	1.2	1.4	1.4
EU28	39.5	41.5	45.2	45.4	50.6	49.3	63.3	102.9

Source: ASTRA model

The modelled increases in revenues does not take into account any possible reduction in vehicle taxation, by which Member States might want to compensate for the higher costs attached to the introduction or extension of road charging.

6.1.4.2. Costs to authorities

The setup of new electronic distance-based road charging systems induces considerable costs. For DSRC systems, roadside infrastructure constitutes the heaviest cost element: a gantry must be installed on each stretch of road at a cost of around €150,000[91]. For satellite based systems, on-board units (OBUs) are the most important setup cost element: an OBU for a satellite-based road charging scheme will cost between EUR 90 and EUR 150. While exact cost structure depends on the specific network covered, as a general rule satellite-based systems are more economic when a larger network is to be covered (over 1000 km) and building roadside infrastructure would be very expensive.

Under PO1, additional costs would not be significant as no new system would be implemented. The costs of PO2 and PO3 would be similar, driven by the replacement of vignette systems with distance-based tolls within 5 years for HGVs and buses. PO4 has the highest cost because of the assumed extension of distance-based systems to passenger cars and vans in some Member States as a result of phasing out time-based charging.

The costs were estimated using reference countries for which the system costs are well-understood[92]. It was assumed that countries with a larger tolled network would, in most cases, choose GNSS, whereas those with smaller ones would generally opt for DSRC[93]:

- GNSS: Bulgaria, Netherlands, Romania, United Kingdom
- DSRC: Denmark, Latvia, Lithuania, Luxemburg, Sweden

For Member States choosing to introduce new road tolls, this result in an initial investment cost of around €150 million (€82 million to €232 million, depending on the size of the country) and ongoing maintenance/enforcement costs of around €20 million per year (€9 million to €41 million). These costs would be largely counterbalanced by increased revenues from road user charges in all cases, which would be significantly greater than the ongoing costs.

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[91] Commission Staff Working Paper (2013), Impact Assessment accompanying the initiative on fair and efficient pricing (not published).

[92] For GNSS-based schemes the reference country is Belgium, for DSRC-based countries the reference country is Slovenia

[93] In line with the Study on "State of the Art of Electronic Road Tolling" MOVE/D3/2014-259, which reported that GNSS is generally of greater economic interest where the size of the tolled network is larger.

Figure 6-7: Impact on costs to authorities (in addition to the Baseline costs)

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Total investment costs	0 Not significant	€1,202 (main option) to €1,387 million (sensitivity option)			€1,334 to €2,139 million
Total annual operational costs		€ 168 (main option) to €200 million/year (sensitivity option)			€184 to €313 million/year
Total investment and operational costs till 2030 (present value)	0 Not significant	€2,036 (main option) to €2,382 million (sensitivity option)			€2,247 to €3,682 million

The investment expenditures of €1.2 to 1.4 billion in PO2 and PO3 and €1.3 to 2.1 billion in PO4 are assumed to take place in 2025, in line with the assumed introduction of distance-based charges. Figure 6-8 shows the impact on Member States budgets in 2030, considering the additional revenues from road charges relative to the Baseline and the costs to authorities in 2030.

Figure 6-8: Impact on Member States budgets in 2030

€ billion/year	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
Additional revenues from road charges relative to the Baseline in 2030	2.0	5.7	5.9	11.1	9.8	23.8	63.4
Additional annual costs to authorities	0	0.2	0.2	0.2	0.2	0.2	0.3
Balance	2.0	5.5	5.7	10.9	9.6	23.7	63.1

Figure 6-9 provides the overall impact on Member States budges over time by considering the present value of revenues from road charges and of the total investment and operation costs to authorities. The balance is positive for all policy options.

Figure 6-9: Overall impact on Member States budgets over time (till 2030)

Present value (in billion €)	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
Additional revenues from road charges relative to the Baseline	20.8	34.2	34.6	52.6	40.5	89.6	226.2
Total costs to authorities	0.0	2.0	2.4	2.0	2.0	2.2	3.7
Balance	20.8	31.8	32.2	50.2	38.1	85.9	222.6

6.1.5. Compliance costs to road users

Apart from increased transport costs shown in section 6.1.1, the main costs to road users relate to the on-board unit (OBU) procurement costs and related compliance costs. These are calculated based on the findings of the Support study for the Impact Assessment for the Revision of EETS Legislation[94]. The overall costs to users in PO4 is higher compared to PO2 and PO3 because of the large number of additional vehicles that are under the scope of the toll schemes (i.e. due to the relatively larger fleet of vans and passenger cars compared to HGVs and buses); however, the unit costs are the same, composed as follows:

[94] Ricardo/TRT/4icom, 2017

- 104€ yearly per OBU, for OBUs provided by the Member States[95];
- 15€ yearly per OBU, for OBUs provided by EETS providers, which corresponds to the extension to a new MS of the fees paid by users contracting with EETS providers[96].

It is assumed that passenger cars are not required to equip with OBUs (but may do so voluntarily, as a matter of convenience, as is the case today in France and Italy etc.). The impact of PO4 and PO4s on costs to road users is evaluated at €8 million yearly from 2020 (the assumed year of introduction of the new Bulgarian system) to 2025 and at €320 million yearly from 2025 onward, when the other Member States would have to adapt their charging systems. If passenger cars were equipped with OBUs, the annual cost would be €850 million. Detailed calculations are provided in Annex G of the impact assessment support study[97].

Figure 6-10: Impact on compliance costs to road users

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
OPEX (€million/year)	0 Not significant	€8 million/year from 2020 to 2025; €198 million/year from 2025 onward (€228 million/year from 2025 onward for the sensitivity case)			€8 million/year from 2020 to 2025; €240 million to 850 million /year from 2025 onward
OPEX (present value)	0 Not significant	€889 to €1,018 million (for the sensitivity case)			€1,070 million (€3,698 million if passenger cars were equipped with OBUs)

Overall compliance costs by 2030, expressed as present value, would be €889 to €1,027 million for PO2 and PO3 and €1,070 to €1,371 million in PO4 (€3,698 million if passenger cars were equipped with OBUs).

6.1.6. Road quality

Since Member States tend to allocate at least part of the toll revenues to the maintenance of roads, the level of the collected revenues can serve as a proxy indicator. Thus, it is assumed that if more revenues are collected from road charges, the quality of the corresponding network would improve. Under this assumption, PO1 would have very limited to no impact on road quality, while the subsequent options (PO2-3-4) would have increasingly positive impact thanks to the increasing amount of toll revenues. Since revenues from congestion charging would have to be allocated to investment in transport, the positive impact in PO3 and PO4 would in principle be greatest.

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[95] This is composed of the following average costs: rental or deposit of OBUs (€10,84), fees for bank guarantee (€6), installation/removal costs (€12,55); training to the drivers (for the use of OBU, compliance, €6,14); time losses (i.e. installation/removal of OBUs, registration at Service Point, €13,51); administrative costs (translated from FTEs, €55,28).

[96] The cost is much lower as it is assumed that users operating with this type of OBU already have an OBU for other countries by the time of the application of the measure; thus, additional costs include the extension to a new Member State of the fees paid by users contracting with EETS providers, i.e.: 0,5% fees applied on an assumed €250 monthly paid toll (0,5% x €250 x 12 = €15)

[97] Idem footnote 14

Based on the latest infrastructure maintenance plan of Germany[98], the yearly expenses necessary to keep main national roads in stable condition would amount to roughly €61 billion for the EU in 2030. This, compared to projected revenues gives an indication of the expected quality of roads. Figure 6-11 presents the difference compared to financing needs under each policy option. It appears that only in the case of PO4 would toll revenues cover all maintenance needs, thereby raising sufficient funds for developing alternatives to congested road transport.

Figure 6-11: Comparison of financing needs and road charging revenues for PO1 to PO4 against the Baseline in 2030

€ billion	Baseline	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
Revenues from tolls	39.5	41.5	45.2	45.4	50.6	49.3	63.3	102.9
Financial needs for road maintenance	60.8	60.8	60.8	60.8	60.8	60.8	60.8	60.8
Level of coverage of maintenance needs	65%	68%	74%	75%	83%	81%	104%	169%
Missing/remaining revenues	-21.3	-19.3	-15.6	-15.4	-10.2	-11.5	2.5	42.1

Annex 12 provides more information on the possible impact of specific measures designed to ensure better road quality and synergies with the main policy packages.

6.1.7. Regional distribution of impacts

Road pricing affects central and peripheral regions differently. While centrally located Member States are most affected by the negative impacts of transit traffic, they have the possibility to collect the corresponding higher amounts of revenues to mitigate those impacts (e.g. through external cost charging following the phasing out of differentiation according to Euro class in PO2, PO3 and PO4). At the same time, businesses (and to a lesser extent citizens) located in peripheral Member States can face higher overall costs from road charges depending on their choice of route but they are also the ones who make most use of the infrastructure and thus cause more environmental damage (they would not pay more per km). Looking simply at who pays more between central and peripheral Member States would only show one side of the coin.

Desk research[99] of studies on existing tolls across Europe indicates that regional impacts are small, and not necessarily clearly negative. Specifically, studies on the German toll and those conducted in Sweden and Switzerland (mountain regions) found that the impacts of tolls on businesses were insignificant (thanks to the relatively small share of road charges in the total cost of operation). In any case, lower level roads giving access to remote regions with no alternative transport solution are generally not tolled, while in the case of long distance travel there are usually different options to choose from. It can therefore be concluded that greater uptake of road tolls/external cost charges will result in small or negligible negative impacts for peripheral economies in relation to central regions.

Congestion charging would have additional impacts in PO3 and PO4. Since inter-urban congestion has not been studied as extensively as urban schemes, a parametric assessment

[98] Ibid Footnote 72
[99] Ibid Footnote 14

of the relationship between accessibility and local/regional impacts quantified according to literature was performed as part of the impact assessment support study[100]. The analysis found that congestion charging can have an effect of between -1.1% and +1.0% on regional GDP, depending on the case (but can be slightly negative or positive in each case). The impact would be largest and most likely positive in more congested areas such as around major economic centres. It seems plausible to assume that Member States would only implement congestion charging where local conditions justify it. Overall impacts would be small but increasing from PO1 to PO4 as shown in the table below.

Figure 6-12: Impact of road user charging on peripheral regions

Indicator	PO1	PO2	PO3a	PO3b	PO4
Road pricing	0 Negligible	× Peripheral regions could face a marginal increase in the costs for their imports and exports that in the short run may not be compensated by the increase in welfare from the reduction of externalities in the region. Overall, any negative impacts are expected to be small. Regions with a high proportion of through-traffic would benefit from the reduction of externalities and increased toll income			
Congestion charges	0 N/A		✓ Potential positive impact (up to 1% GDP) in some regions with high congestion, due to introduction of congestion charges		
CO_2 measures	0 Negligible				
Overall regional impacts	0 Negligible	0 Negligible	✓/× Small positive impact in regions of high congestion. Small negative to no impact on peripheral regions.		

6.1.8. Macroeconomic environment

The direct impact of road charging at macro-economic level is small due to the relatively low share of road charges in transport operation costs and even lower share in product prices (cf. section 6.1.1). The evaluation performed with the ASTRA model does not take into account the possible reinvestment of at least part of the additional toll revenues (relative to the Baseline), which, if used for the maintenance of roads typically generates 2 to 3 euro for each invested euro[101]. The results therefore do not reflect possible positive second order effects. The modelling results show very limited impacts (below 0.1% relative to the Baseline in 2030) on GDP at EU level in case of PO1, PO2 and PO3. PO4 and PO4s would result in 0.1% decrease of EU GDP in 2030 relative to the Baseline, in case no reinvestment of toll revenues is assumed. If 100% of the additional revenues relative to the Baseline were reinvested in road maintenance, the economic benefit generated at EU level would be in the range of €6.1 billion (PO1) to €190.2 billion (PO4s), equivalent to 0.04 to 1.2% of GDP in 2030. However, if only 30% of the additional revenues relative to the Baseline were reinvested in road maintenance, the economic

[100] Full details of the analysis can be found in Annex D of Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC. See Annex 13.

[101] According to the Impact Assessment accompanying the *Proposal for a Regulation of the European Parliament and of the Council on Union Guidelines for the development of the Trans-European Transport Network*, SEC(2011) 1212 final, the multiplier effect is 2.34

benefits would be more limited, in the range of €1.8 billion (PO1) to €57.1 billion (PO4s), equivalent to 0.01 to 0.36% of GDP in 2030. Effects on employment are described in section 6.3.1.

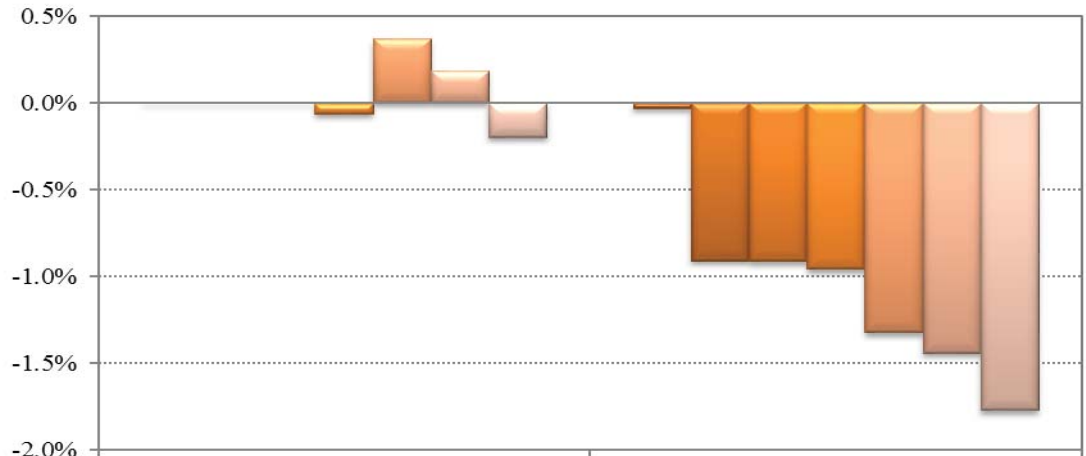
Figure 6-13: Potential economic benefits (in case of 30% and 100% earmarking to transport investments) – in 2030 compared to the Baseline

Earmarking	Additional benefits, expressed in:	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
30%	- € billions per year	1.8	5.2	5.3	10.0	8.8	21.4	57.1
	- % of annual GDP	0.01%	0.03%	0.03%	0.06%	0.06%	0.14%	0.36%
100%	- € billions per year	6.1	17.2	17.6	33.2	29.3	71.4	190.2
	- % of annual GDP	0.04%	0.11%	0.11%	0.21%	0.19%	0.45%	1.20%

At Member State level, the impacts may be larger depending on the size of the Member State and specific measures implemented. For example, in Slovenia the benefits could be higher due to the application of mark-ups; in this case the revenues must be reinvested to remove bottlenecks on the TEN-T network.

In addition, there will be positive impacts stemming from the reduction of negative externalities in PO2, PO3 and PO4 (cf. section 6.3.2); as well as from reducing the dependence on oil as shown in Figure 6-14, which is mostly imported.

Figure 6-14: Gasoline and diesel consumption from road sector relative to the Baseline in 2030 (% change)



	Gasoline	Diesel
	EU28	
PO1	0.0%	0.0%
PO2	0.0%	-0.9%
PO2s	0.0%	-0.9%
PO3a	-0.1%	-1.0%
PO3b	0.4%	-1.3%
PO4	0.2%	-1.4%
PO4s	-0.2%	-1.8%

6.1.9. Competitiveness of the EU economy

As shown in section 6.1.1, all policy options would affect transport operators in a limited way through a slight increase in transport costs but this would not have a significant impact on the EU economy. The reinvestment of revenues from road charging would bring economic benefits, as described in the previous section. Indirectly, operators who chose to adapt their behaviour to improve their efficiency would gain a competitive advantage, as well as contributing to the overall competitiveness of the EU economy.

Even under scenarios of 100% cost pass-through to customers, any reduction in the competitiveness of European manufacturing products on the global market would be minimal in all Policy Options. PO3 and PO4 would have more positive impact as congestion charging will improve the reliability of deliveries, which can allow keeping smaller stocks, and thus will be beneficial the competitiveness of businesses, especially those that make use of just-in-time manufacturing (where delays can cost much more than just the truck delay) or in which goods are perishable, costly or difficult to warehouse.[102]

The measures designed to promote low- and zero-emissions HGVs and buses (PO2, PO3 and PO4), and low- and zero-emission passenger cars and vans (PO3b and PO4) would have a positive impact on the automotive industry as they would speed up fleet renewal. According to the modelling results, in 2030 the share of hybrid HGVs below 12 tonnes at EU level would be about 3.6 percentage points higher in PO2, PO2s, PO3, PO4 and PO4s than in the Baseline scenario. For heavier HGVs the impact would be smaller (i.e. the share of hybrid HGVs above 12 tonnes would be 2.2 percentage point higher relative to the Baseline) but positive. These measures would also drive a slight increase in the share of LNG HGVs in PO2, PO2s, PO3, PO4 and PO4s (around 0.7 percentage points increase in 2030 relative to the Baseline). In PO3b, PO4 and PO4s the differentiation of charges according to CO_2 emissions additionally targets the fleet of passenger cars and vans, resulting in a slightly higher uptake of conventional hybrid (0.2 percentage points) and electric vehicles (0.2 percentage points) in 2030 relative to the Baseline, to the detriment of conventional diesel vehicles. The structure of the vehicle fleet in PO1 would be similar to the Baseline.

6.1.10. Functioning of the internal market

Tolls and user charges reflect a part of real costs that transport users generate in relation to infrastructure and other externalities. Unless these real costs of transport are paid by users, they will have to be borne by society through other instruments such as taxes. However, road user charges are more efficient – by sending the correct price signals: user charges can shape more sustainable transport behaviour, e.g. re-directing road users to acquiring and using cleaner vehicles or using the roads outside peak hours. Moreover, distance-based charges are paid by users independent of their country of establishment (unlike time-based vignettes or vehicle taxes).

Since road pricing across the EU becomes more consistent under each option (to an increasing extent from PO1 to PO4), the transport sector as well as other sectors relying on

[102] Cf. section 4.2.10 of the impact assessment support study.

transport services will face similar or at least proportionate costs when making use of the European road network. In this sense, PO1 will ensure minimal progress by eliminating exemptions and making all HGVs and buses subject to charging, while in PO2 and PO3, the level playing field will be further ensured for HGVs and buses due to generalised distance-based charging. PO4 will have the most positive impact as distance-based charges would also apply to vans and passenger cars.

In addition, in PO2, PO3 and PO4 more consistent price signals would be achieved through the phasing out of Euro class differentiation allowing more extensive use of external cost charging. PO3 and PO4 would add further benefits by allowing freer traffic flows by internalising the cost of congestion.

6.1.11. Impact on third countries

Third country residents would benefit from proportionate pricing of short term vignettes under each policy option as any occasional EU driver (see also section 6.3.4). By having access to proportionately priced vignettes for shorter time periods, users are more likely to consider single day leisure or business trips across borders encouraging cross border trading, commuting, commercial or social trips[103]. Where a Member State would replace their vignette scheme by distance-based charging (in PO4), the increase in transport costs would be the same for third country residents as for EU nationals.

Hauliers from Russia, Turkey, Ukraine and the Balkans, who are some of the EU's main commercial partners, are most likely to be impacted by the small increases in transport costs under PO2, PO3 and PO4. However, they are not likely to be more affected than European operators established in peripheral regions, as described in section 6.1.7.

6.2. Environmental impacts

6.2.1. CO_2 emissions

The impact of policy options on CO_2 emissions depend on changes in transport activity and in the share of low- and zero-emission vehicles in the fleet compared to the Baseline. **PO1** has no impact on HGVs fleet composition (the rebates applied to zero-emission vehicles alone would not have noticeable effect) and induces a marginal shift of traffic from road to rail transport (i.e. 0.1 percentage point decrease in road freight modal share in 2030 relative to the Baseline). Consequently, it has no significant impact on fuel consumption and road transport CO_2 emissions (157 ktonnes of CO_2 emissions saved) relative to the Baseline in 2030.

PO2, PO2s and PO3a introduce the differentiation of infrastructure changes according to CO_2 emissions for HGVs and buses. In addition, the generalisation of distance-based charges for HGVs and buses has somewhat larger effect on modal shift (i.e. 0.1 to 0.2 percentage point decrease in road freight modal share in 2030 relative to the Baseline) but this remains limited. Most of the impacts are thus driven by changes in fleet composition due to the modulation of charges. As noted in section 6.1.8, a shift away from diesel can

[103] Ibid Footnote 65

mainly be observed among vehicles below 12 tonnes (to hybrids and LNG trucks) and to a more limited extent for vehicles above 12 tonnes. This would result in a small reduction of 0.4% in road transport CO_2 emissions (i.e. 2,490 to 2,505 ktonnes of CO_2 emissions saved in PO2 and PO2s and 2,878 ktonnes of CO_2 emissions saved in PO3a) relative to the Baseline in 2030.

The differentiation of charges for vans and passenger cars under **PO3b, PO4 and PO4s** would drive changes in the composition of the fleet, resulting in a reduction of road diesel consumption of 1.3 to 1.8% and an increase in the use of electricity in road transport of 3.3 to 3.4% relative to the Baseline in 2030. In addition, in PO4 and PO4s, the phasing in of distance-based charging for vans and passenger cars further increases the CO_2 reduction potential. These changes would result in a reduction of CO_2 emissions from road transport of 0.5% in PO3b and 0.7 to 1.0% in PO4 and PO4s relative to the Baseline for 2030 (i.e. 3,812 ktonnes of CO_2 emissions saved in PO3b and 4,765 to 7,100 ktonnes saved in PO4 and PO4s).

As explained in section 2.1.1, the analytical work underpinning the European Strategy for Low-Emission Mobility showed cost-effective emissions reductions of 18-19% for transport by 2030 relative to 2005[104]. For road transport, this translates into a cut of about 206-221 Mtonnes of CO_2 by 2030 relative to 2005[105], 52 to 67 Mtonnes additional reduction relative to the Baseline. As explained above, PO2, PO3, and PO4 could save 2,490 to 7,100 ktonnes of CO_2 emissions. This represents between 4 to 14% of the additional road transport emission reductions needed on top of the Baseline by 2030 relative to 2005[106]. Monetising them, this translates into €0.3 to 0.7 billion of external costs savings by 2030 expressed as present value.

Overall, PO2, PO3 and PO4 would lead to around 17.4 to 17.9% CO_2 emissions reductions from road transport by 2030 relative to 2005 compared to 17.2% in the Baseline scenario (i.e. a reduction higher by 0.2 to 0.7 percentage points).

6.2.2. Air quality

Changes in air pollution generated by road transport would also depend on the extent to which the options can induce modal shift and fleet renewal. PO1 has no noticeable impact on NOx and PM emissions while PO2, PO2s and PO3a would reduce emissions of NO_X from road transport by 1% at EU level compared to the Baseline in 2030 (i.e. 6,774 to 6,796 tonnes of NOx saved in PO2 and PO2s and 6,911 tonnes of NOx saved in PO3a); the impact on PM emissions would be lower (0.2% reduction relative to the Baseline, equivalent to 79 tonnes of PM saved in PO2 and PO2s and 82 tonnes of PM saved in PO3a). PO3b, with the introduction of modulation of charges according to pollutant emissions for vans and passenger cars, would have a slightly larger impact (1.2% reduction in NO_X equivalent to 8,254 tonnes of NOx saved, and 1% reduction in PM equivalent to

[104] This outcome is in line with the 2011 White Paper which established a milestone of 20% emissions reduction by 2030 relative to 2008 levels, equivalent to 19% emissions reduction compared to 2005 levels, and with the 2050 decarbonisation objectives.

[105] SWD(2016) 244 final

[106] However, potential overlaps with future policy measures may lower these CO_2 emissions savings.

352 tonnes of PM saved) relative to the Baseline in 2030. The reduction is even more pronounced in PO4 and PO4s (1 to 1.4% reduction for NOx equivalent to 8,461 to 9,345 tonnes of NOx saved and 1 to 1.2% reduction for PM equivalent to 360 to 423 tonnes of PM saved), thanks to the extension of distance-based charging to vans and passenger cars[107]. The external costs of air pollution are discussed in section 6.3.2**.**

It is important to note that the transport network model used to simulate the changes in traffic flows[108] does not take into account existing and possibly extended traffic bans for certain type of vehicles on secondary roads. The diversion to these non-tolled roads may thus be overestimated and the real air quality improvements could be greater, especially in cases where Member States implemented network-wide distance-based charging, which would prevent traffic diversion.

6.2.3. Noise

Linked to the extent of modal shift and possible traffic diversion, there may be some impacts on the external costs of noise generated by road transport. Under PO1, since there could be some diversion of traffic to secondary roads (where the cost of noise is higher[109]), a marginal overall increase is projected relative to the Baseline in 2030 for some Member States (i.e. this is largely due to the inclusion of HGVs below 7.5 tonnes in the distance-based charging scheme in Germany). However, at EU level the impacts on the external costs of noise relative to the Baseline are not significant in 2030. In PO2, a slight increase in noise costs (0.4% relative to the Baseline in 2030) would take place due to the wider application of distance-based charges for HGVs and buses on the TEN-T network and on motorways. It is important to note that the transport network model does not take into account possible network-wide introduction of distance-based charges that would prevent any diversion of traffic to alternative routes.

For PO3 and PO4, the inclusion of congestion charging on the congested part of the inter-urban network is projected to result in an increase of 0.8 to 4.1% in noise cost, due to diversion of traffic to non-tolled roads. However, since congestion charging would be voluntary, it is reasonable to assume that Member States would only implement such schemes after thoroughly assessing local conditions and accompanied them with adequate complementary measures mitigating any undesired traffic diversion (such as improving access to alternative transport modes, limiting transit traffic on secondary roads or charging during peak hours). The impacts on noise levels are therefore considered to be the upper bound in case complementary measures are not taken by the Member States. As noted in section 6.2.2, the transport network model does not take into account possible traffic bans for certain type of vehicles on secondary roads. The diversion to these non-tolled roads is thus overestimated, suggesting higher noise costs.

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[107] The impacts on NOx emissions in relative terms are larger than those on CO_2 emissions. This is due to the slightly higher uptake of LNG and hybrid HGVs relative to the Baseline in PO2, PO3a, PO3b and PO4, which have a higher impact on NOx emissions.

[108] TRUST, a description of the model is available in Annex 4

[109] See e.g. Ricardo-AEA et al (2014), Update of the Handbook on External Costs of Transport: http://ec.europa.eu/transport/themes/sustainable/studies/sustainable_en

6.2.4. Land use

Costs in terms of habitat loss and fragmentation have been estimated to € 49-110 thousand per year for each kilometre of motorway (CE Delft, 2008). To the extent that policy options can shift transport activity to other modes and reduce congestion by spreading traffic more evenly and thus making more efficient use of the infrastructure, it can be expected that they would reduce the need for building new or expanding existing motorways and hence would have a positive impact compared to the Baseline. PO1 would not have a significant impact, while all other policy options would have some positive effects with respect to reducing road transport activity. PO3 and PO4 would have an additional benefit in terms of greater deployment of congestion-reducing schemes.

6.3. Social impacts

6.3.1. Impacts on employment

The impact of the options on employment levels depends on the extent to which increases in transport costs affect the competitiveness of businesses, and on the extent to which increased revenues are reinvested. The impact of transport costs were simulated by the ASTRA model, showing no significant impact in all policy options. The second-order effects of investing revenues in road maintenance are estimated based on literature. The results are closely linked to the estimated benefits described in section 6.1.8. As such, PO1 would have virtually no impact on employment, while in the other options the reinvestment of revenues from road tolls can generate jobs.

The Impact Assessment accompanying the proposal on TEN-T guidelines[110] included the job creating potential of public spending on transport infrastructure. According to a conservative estimate, the investment of EUR 1 billion would generate 21,260 new direct, indirect and induced jobs.[111] Using this figure, Figure 6-15 presents the estimated potential of the policy options to create new jobs in the EU economy.

Figure 6-15: Potential of the policy options to create jobs (30% and 100% earmarking to transport investments) – compared to the Baseline in 2030

Earmarking	Job creation potential	PO1	PO2	PO2s	PO3a	PO3b	PO4	PO4s
30%	Additional investment from toll revenues (in € billions)	0.6	1.7	1.8	3.3	2.9	7.1	19.0
	Job creation	12,978	36,571	37,386	70,588	62,345	151,734	404,305

[110] Impact Assessment accompanying the *Proposal for a Regulation of the European Parliament and of the Council on Union Guidelines for the development of the Trans-European Transport Network*, SEC(2011) 1212 final.

[111] First round effects concern direct employment in construction and materials supplying industries. A second round of employment and income effects occurs in the production sector in response to the demand for additional inputs required by construction materials supplying industries. A third round employment and income benefits occur in the guise of what is termed "induced" employment and reflects producers' response to an increase in the demand for all goods and services. Source: OECD, *Impact of Transport Infrastructure Investment on Regional Development*, 2002: http://www.internationaltransportforum.org/Pub/pdf/02RTRinvestE.pdf.

	potential							
100%	Additional investment from toll revenues (in € billions)	2.0	5.7	5.9	11.1	9.8	23.8	63.4
	Job creation potential	43,260	121,904	124,622	235,294	207,817	505,780	1,347,684

It needs to be underlined that the job creation potential has been estimated assuming that Member States reinvest 30% or 100% of revenues from new road charges (additional road charges to the Baseline in 2030) into transport infrastructure; in case some revenues are used for compensating measures, such as reduction of transport related taxes, the number of jobs created would be proportionately lower.

6.3.2. Public health

The impacts on public health are directly linked to the foreseen reduction in emissions of air pollutants from road transport such as CO, NO_x, volatile organic compounds (VOC) and particulate matter (PM); any possible change in noise levels, and in the risk of accidents. Given the limited impact on total road transport activity, on modal split and vehicle fleet composition at EU level compared to the Baseline in 2030, the model indicates small reductions in pollutant emissions from road transport for the policy options (see section 6.2.2). However, congestion charges (PO3 and PO4), leading to more important reductions in local traffic and pollution, can have a more significant positive impact on public health in the concerned areas. As noted in section 6.2.2, the road network model does not take into account possible traffic bans for certain type of vehicles on secondary roads. The diversion to these non-tolled roads is thus overestimated suggesting relatively higher levels of air pollution in more sensitive areas**.**

In addition, congestion charges have been associated with the reduction of accidents[112]. Better quality of roads thanks to the reinvestment of at least part of the additional toll revenues in road maintenance can have further positive impacts on road safety (cf. section 2.1.2), but no data exists which would allow quantifying these impacts. Overall, the impacts on public health would be small but positive in all scenarios.

Figure 6-16: Impact on public health and safety for each policy option

Indicator	PO1	PO2, PO2s and PO3a	PO3b	PO4 and PO4s
Overall assessment	Negligible	Small positive impact (0.3 to 0.4% reduction in external costs of pollution from road transport relative to the Baseline in 2030; €0.32 to 0.41 billion costs savings for air pollution and	Small positive impact (0.5% reduction in external costs of pollution from road transport relative to the Baseline in 2030; €0.37 billion costs savings for air pollution and accidents by 2030, expressed as present	Small positive impact (0.5 to 0.6% reduction in external costs of pollution from road transport & 0.2 to 0.6% reduction in accident costs relative to the Baseline in 2030; €0.82 to 1.56 billion costs savings for air pollution

[112] Cf. section 4.4.2 of the impact assessment support study.

Indicator	PO1	PO2, PO2s and PO3a	PO3b	PO4 and PO4s
		accidents by 2030, expressed as present value)	value)	and accidents by 2030, expressed as present value)

6.3.3. Social inclusion and distributional impacts

Distributional effects could potentially arise from any of the policy options, since they imply changes to the cost of transport. As seen in section 6.1.1 the potential for changes in freight costs to affect consumers via cost pass-through to increased product prices is rather limited; hence, the main element of relevance to distributional effects are changes to the costs of passenger transport.

The impact assessment support study has looked at different concepts of equity to consider the potential impacts. The findings suggest that greater implementation of the 'user-' and 'polluter-pays' principles have greater market equity compared to the current situation, as they place the primary responsibility for payment on those responsible for the use/pollution, and not on those too poor to afford vehicles or who choose to travel by other means (NTPP, 2010)[113].

While road pricing may disproportionately affect lower-income groups, the magnitude of impacts is expected to be negligible. For the case of PO1-2, no new tolls are introduced for passenger cars, so the policy measures would only result in very minor, if any, changes in their costs. The impacts would also be limited in PO3. For PO4, the impact depends on the phasing in of the distance-based charges for passenger cars, however, even in this case the impacts are small – annual toll charges typically amount to small share (i.e. around 2%) of the total annual ownership cost of a car[114].

Road pricing could also benefit lower-income groups as higher-income individuals tend to drive the most. Furthermore, the negative effects of congestion, traffic safety problems and air pollution often affect lower income groups much more than the higher income groups (van Amelsfort et al, 2015)[115]. The overall impact of all POs on mobility and outcome equity is considered to be low.

Congestion charging (PO3 and PO4) often raise equity concerns and has therefore been analysed in some depth. Different studies suggest that the social impacts of congestion charging depend on local conditions and that in the longer term winners and losers are difficult to identify as people change job or move house (Walker, 2011).[116] Whether in our case it would have overall positive or negative social impacts would depend on the use of revenues, which would be earmarked to transport in both options, and could be used by Member States to invest in alternative solutions to the individual use of private car.

Decisions regarding the design of such schemes would therefore have to be taken at the local level with the needs of lower income groups in mind. If new congestion charging scheme is perceived not to be equitable is likely to be rejected by the public in any case.

[113] Cf. section 4.4.3 of the impact assessment support study
[114] Annual ownership costs are approximately €6,000/year (Together EU, 2012).
[115] Ibid.
[116] Ibid.

Experience with urban road charging schemes show that where the system is well-designed and communicated to the public, after an initial period of reluctance, the public generally embraces the scheme when its positive impacts are becoming evident[117].

Whilst not contesting the potentially negative impact of congestion charging on social inclusion, users tend to overestimate the costs road user charges represent for them. As an Australian transport expert put it, "in Brisbane people object to paying a AUS$4 toll to use a new tunnel beneath the city – but do not hesitate to purchase a cup of coffee for the same amount of money".[118] Similarly, the increase in fuel prices between January 2009 and September 2012 increased the cost of the use of the vehicle on all roads and throughout the day by some 5 eurocents/km[119] without considerably affecting accessibility and social inclusion.

Figure 6-17: Impact on equity and distributional effects

Indicator	PO1	PO2	PO3b	PO3a	PO4
Overall assess-ment	0 Very minor / negligible	✓ Small positive impact due to phase out vignettes	✓ Greater internalisation of external congestion costs (all vehicles). Congestion charges are likely to be designed to be progressive / equitable to gain public acceptance		✓ Greater internalisation of external congestion costs & air pollution for bus/coach. Congestion charges are likely to be designed to be progressive / equitable to gain public acceptance.

6.3.4. Equal treatment of citizens

Equal treatment of citizens refers mainly to the principle of non-discrimination. The main policy measure that is relevant is the proposed change to the rules on pricing of long-term versus short-term vignettes (included in all POs). The measure targets the problem of discrimination directly by ensuring that price ratios of short-term versus long-term vignettes are proportionate. Consequently, drivers using short-term vignettes in any Member State that introduces a new passenger car and/or van vignette will experience benefits in terms of more equal treatment under PO1-4.

Estimating the magnitude of such impacts is challenging because data on the share of foreign road users that use short-term vignettes is limited. Available figures for selected Central and Eastern European Member States suggest that the estimated proportion of foreign car journeys on main routes is similar across the countries, with an average share around 30%[120]. Hence, around 30% of road users in a typical country could benefit from more equal treatment under PO1-4.

In addition, the expected generalisation of distance-based charging for HGVs and buses due to the phasing out of vignette systems (for PO2, PO3 and PO4), would make sure that

[117] See e.g. the examples of London or Stockholm

[118] *Road user charging: coming, ready or not?*, Thinking Highways, Vol. 7 No 4, 2013.

[119] Impact assessment accompanying the proposal for an Initiative on fair and efficient pricing (2013) based on fuel prices from the European Commission's Oil Bulletin, http://ec.europa.eu/energy/observatory/oil/bulletin_en.htm.

[120] AT, CZ, HU, SI, SK – cf. Table 2-3Table 2-3

hauliers are treated the same way when they use tolled roads in any Member States. This provision extends to the user of passenger cars and vans in PO4.

7. HOW DO THE OPTIONS COMPARE?

7.1. Key economic, social and environmental impacts

The analysis of **economic impacts** shows the most important differences. The main trade off is between the increased costs for transport users and to authorities, balanced against increased revenues and reductions in congestion costs and other externalities. There are also some potentially negative impacts in terms of distribution and impact on SMEs, as a result of increased costs, although these are minor in most options and small in PO4.

In terms of **environmental impacts**, PO4 and PO4s would have the largest positive effect, while PO3a and PO3b would also have measurable impact. In any case, this initiative has to act in concert with other instruments aiming at reducing emissions from transport, such as emission standards (supply side) for air pollutants and CO_2.

In terms of **social impacts**, all policies can be expected to make some positive contribution, in particular through their job creation potential and by increasing the fairness of road user charges. PO3 and PO4 are expected to have more positive effects due to greater internalisation of external costs (contributing to fairness) and somewhat higher benefits for public health and safety.

Figure 7-1: Main economic, environmental and social impacts

Key: Impacts expected				
××	×	O	✓	✓✓
Strongly negative	Weakly negative	No or negligible impact	Weakly positive	Strongly positive

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Economic impacts					
Transport costs Road passenger transport (% change to the Baseline in 2030)	0.0%	0.0%	0.1%	0.0%	1.3 to 2.0%
Transport costs Road freight transport % change to the Baseline in 2030)	0.2%	0.9 to 1.0%	1.0%	1.1%	1.5 to 2.0%
Congestion costs - % change to the Baseline in 2030	0.0%	-0.2%	-2.4%	-2.5%	-2.5% to -6.1%
Congestion costs savings by 2030 - present value (€bn)	0.1	0.8	8.8	8.9	9.1 to 22.2
Additional tolling revenues – present value (€bn)	20.8	34.2 to 34.6	52.6	40.5	89.6 to 226.2
Total costs to authorities – present value (€bn)	0.0	2.0 to 2.4	2.0	2.0	2.2 to 3.7

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Budgetary implications – present value (€bn)	20.8	32.1 to 32.2	50.5	38.4	87.3 to 222.5
Compliance cost to road users – present value (€bn)	Insignificant	0.889 to 1.018	0.889	0.889	1.070 to 3.698
Impact on SMEs	0/× Minor negative impacts due to the lower capacity of SMEs to absorb increases in cost, but no significant distortions expected				
Road quality Missing/remaining revenues (€bn/yr)	0/✓ Very minor positive impact due to 5% increase in revenues -19.3	✓ Small positive impact due to 15% increase in revenues -15.6 to -15.4	✓ Positive impact due to 28% increase in revenues -10.2	✓ Positive impact due to 25% increase in revenues -11.5	✓✓ Very positive impact due to 60 to 160% increase in revenues +2.5 to 42.1
Additional benefits due to investments in transport expressed in % of GDP	0.01 to 0.04%	0.03 to 0.11%	0.06 to 0.21%	0.06 to 0.19%	0.14 to 1.20%
Competitiveness	0 No impact on competitiveness of European manufacturing products on the global market.	✓ Minor positive impact on competitiveness due to differentiated CO_2 charging for HGVs and buses leading to slightly higher uptake of low- and zero-emission vehicles	✓ Minor positive impact on competitiveness due to differentiated CO_2 charging for HGVs and buses, and also for passenger cars and vans, leading to slightly higher uptake of low- and zero-emission vehicles. Increased uptake of congestion charging would be beneficial to the competitiveness of businesses, especially those that make use of just-in-time manufacturing or in which goods are perishable, costly or difficult to warehouse.		
Internal market	✓ Small positive impact due to removal of exemptions for HGVs < 12 tonnes and extension to buses/coaches	✓ Small positive impact due to phase out of vignettes and EURO class differentiation – potentially leading to more tolls and external cost charging	✓ As for PO2, plus allowing genuine congestion charging that would encourage more Member States to apply such charges on congested links		✓✓ Highest uptake of tolls likely due to phase out of vignettes for vans and the phase in of distance-based charging for passenger cars. Mandatory external cost charging
Environmental impacts					
CO_2 from road transport (1000 tonnes of CO_2 saved)	157	2,490 to 2,505	2,878	3,812	4,765 to 7,100
Air pollution: NOx and PM emissions from road transport (tonnes of NOx and PM saved)	267 4	6,774 to 6,796 79	6,911 82	8,254 352	8,461 to 9,345 360 to 423
Social impacts					
Employment – job creation potential	12,978 to 43,260	36,571 to 124,622	70,588 to 235,294	62,345 to 207,817	151,734 to 1,347,684

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Public health & safety	0 Negligible	✓ Small positive impact (0.3% reduction in external costs of pollution from road transport relative to the Baseline in 2030; €0.32 billion costs savings for air pollution and accidents by 2030, expressed as present value)	✓ Small positive impact (0.4% reduction in external costs of pollution from road transport relative to the Baseline in 2030; €0.41 billion costs savings for air pollution and accidents by 2030, expressed as present value)	✓ Small positive impact (0.5% reduction in external costs of pollution from road transport relative to the Baseline in 2030; €0.37 billion costs savings for air pollution and accidents by 2030, expressed as present value)	✓✓ Positive impact (0.5 to 0.6% reduction in external costs of pollution from road transport & 0.2 to 0.6% reduction in accident costs relative to the Baseline in 2030; €0.82 to 1.56 billion costs savings for air pollution and accidents by 2030, expressed as present value)
Social inclusion	0 Very minor / negligible	✓ Small positive impact due to phase out vignettes	✓✓ Greater internalisation of external congestion costs (all vehicles). Congestion charges are likely to be designed to be progressive / equitable to gain public acceptance		✓✓ Greater internalisation of external congestion costs & air pollution for bus/coach. Congestion charges are likely to be designed to be progressive / equitable to gain public acceptance
Equal treatment of EU citizens	✓ More proportionate charges for occasional users in countries with vignettes (52% lower for passenger cars; 45% for vans)				

7.2. Effectiveness

The analysis of the overall effectiveness of the options must consider the extent to which the objectives are achieved. Figure 7-2 presents the key indicators which have been developed to monitor the level of achievement of the specific objectives.

Figure 7-2: Linking of objectives to key indicators

Specific objective	Key indicators
Contribute to the reduction of CO_2 emissions from transport	Impact on CO_2 emissions from transport
Contribute to adequate quality of roads	Impact on road quality
Ensure fair and non-discriminatory road pricing	Impact on equal treatment of occasional / non-resident motorists Impact on the costs distribution among road users in line with the user pays principle
Make use of road charging as an effective tool in reducing pollution and congestion	Impact on external costs Impact on congestion costs

Figure 7-3: Effectiveness of the policy options presents the effectiveness of each option in achieving the specific objectives using the key indicators.

Figure 7-3: Effectiveness of the policy options

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Specific Objective 1: Contribute to the reduction of CO_2 emissions from transport					
CO_2 emissions from road transport	No significant effects expected	Small effect due to CO_2 differentiation for HGVs and buses 2,490 to 2,505 ktonnes of CO2 saved (-0.4%)	Small effect due to CO_2 differentiation for HGVs and buses 2,878 ktonnes of CO2 saved (-0.4%)	Positive effect due to CO_2 differentiation for HGVs and buses *and* passenger cars and vans 3,812 ktonnes of CO2 saved (-0.5%)	Most effective due to CO_2 differentiation for HGVs and buses *and* passenger cars and vans 4,765 to 7,100 ktonnes of CO2 saved (-0.7% and -1.0%)
Specific Objective 2: Contribute to adequate quality of roads					
Impact on road quality	In proportion to additional toll revenues (+5%)	In proportion to additional toll revenues (+15%)	In proportion to additional toll revenues (+28%)	In proportion to additional toll revenues (+25%)	In proportion to additional toll revenues (+60 to 160%)
Specific Objective 3: Ensure fair and non-discriminatory road pricing					
Equal treatment of occasional/non-resident motorists	All equally effective due to rule on proportionate pricing				
Fair distribution of cost among road users	All HDVs treated equally	Distance based charging for all HDVs (user pays) – heavy users pay proportionately more			Distance based charging for vans and passenger cars (user pays)
Specific Objective 4: Make use of road charging as an effective tool in reducing pollution and congestion					
Impact on external costs	No significant effects expected	Positive outcomes due to replacing vignettes by distance-based charging, but can be limited by the voluntary nature of external cost charging			Most effective due to mandatory external cost charging
Congestion costs - % change to the Baseline in 2030	No significant effects expected		Allows genuine congestion charging, although uptake is voluntary (-2.4%)	Allows genuine congestion charging, although uptake is voluntary (-2.5%)	Potentially most effective due to phase out of vignettes and phasing in of distance-based charges for passenger cars and vans, leading to infrastructure available for congestion charging in more countries (-2.5% to -6.1%)

In terms of effectiveness, PO1 and PO2 do not contribute significantly to the key objectives of reducing congestion costs and CO_2 emissions from transport. Conversely, PO3a, PO3b and PO4 show average or good effectiveness against all of the objectives, with PO4 being slightly ahead of PO3 due to the wider scope of road tolls (after phase out of vignettes for vans and passenger cars) and mandatory inclusion of external cost charges. The key uncertainty with respect to all POs is that the introduction of tolls remains voluntary, which makes the ultimate outcomes uncertain.

7.3. Efficiency

Efficiency can be defined as "the extent to which objectives can be achieved for a given level of resource/at least cost". The major costs of the policy options come in the form of higher direct transport costs, as well as the implementing and operational costs of the charging schemes. These additional costs can be balanced against the additional revenues generated by user charges, as well as the achievement of the objectives (outlined above).

As can be seen in Figure 7-4, higher additional costs are generally associated with higher additional benefits and vice versa.

- **PO1** shows limited effectiveness and limited costs.

- **PO2 and PO3a** perform similarly in terms of cost-effectiveness, since they have similar costs and benefits – although PO3a has slightly better effectiveness and higher revenues.
- **PO3b** shows better cost-effectiveness than PO2 and PO3a, since it has similar costs but much higher effectiveness.
- **PO4** has the highest effectiveness, but also involves higher costs to authorities and users (due to the larger user base that would result from including passenger cars and vans in road tolls schemes).

Figure 7-4: Indicators of efficiency

	PO1	PO2 and PO2s	PO3a	PO3b	PO4 and PO4s
Additional costs					
Total investment and operational costs for authorities (present value)	Insignificant	€2.4 billion			€3.7 billion
Compliance cost to users (present value)	Insignificant	€1 billion			€1.4 billion (€3.7 billion if passenger cars were equipped with OBUs)
Benefits					
Additional revenues from tolls relative to the Baseline (present value)	€20.8 billion	€ 34.2 to 34.6 billion	€52.6 billion	€40.5 billion	€89.6 to 226.2 billion
Effectiveness in achieving objectives	No significant effects expected	Some contribution to lower CO_2 and wider uptake of tolls	Good contribution to objectives to reduce CO_2 and external costs	Good contribution to objectives to reduce CO_2 and external costs (slightly higher than PO3a in terms of CO_2 reductions)	Potentially most effective due to widest uptake of tolls, congestion charges and external cost charges

Even with the highest cost among the options, PO4 achieves the objectives most efficiently as it not only is the most effective but also generates largest revenues that outweigh any costs by far. PO3b comes second since it is more effective in achieving the objectives than PO2 and PO3a, albeit at the same cost.

7.4. Coherence

Since the objectives are in line with those of relevant EU policies, including the Charter for fundamental rights (cf. section 4), in principle all options are also coherent with these as they point in roughly the same direction (the internalisation of external costs of transport through fair and efficient pricing). By promoting more proportionate pricing and stepwise harmonisation of road charging methods, all options contribute to achieving a *Deeper and Fairer Internal Market*, though because of its primary objective, the initiative is part of the actions aiming at creating a *Resilient Energy Union with a Forward-Looking Climate Change Policy.*

The differences are in the emphasis put on achieving one or the other specific objective and in the extent to which these can be achieved by the different options. In that sense, PO2 performs better than PO1 as it directly builds on the future certification, monitoring and reporting of CO_2 emissions from HGVs and buses as outlined in the European Strategy for low-emission mobility. PO3b performs even better as in addition it links road pricing

for passenger cars and vans to CO_2 emissions. PO3a does not include this measure but is still ahead of PO2 by also allowing efficient marginal cost charging to deal with the issue of congestion, a major problem identified in the 2011 White Paper on Transport. Finally, PO4 performs best in terms of internal coherence as it is closest to the full application of the polluter pays and user pays principles, as set out in the White Paper.

7.5. Proportionality

None of the options go beyond what is necessary to achieve the objectives. On the contrary, all of them can only contribute to a certain extent compared to the "ideal" scenario of full internalisation of external costs, with PO4 being the closest to the scenario, while PO1 can only achieve one objective satisfactorily. The scope of the options is limited in that where they address areas that are primarily national competence (infrastructure, congestion), they either do not interfere in how road quality is ensured or do not impose the application of congestion charging on Member States. Costs to Member States, businesses and citizens are limited compared to the potential benefits for each policy option. The choice of instrument (Directive) is adequate as it allows satisfactory achievement of the objectives, at least in PO2, PO3, and PO4. Soft law has not been able to achieve the objectives.

7.6. Preferred option

Based on the above assessment, it can be concluded that PO4 would be the most effective in reaching all four specific objectives, but at relatively higher cost than the other options. At the other end of the spectrum, PO1 can contribute to achieving the objectives only in a very limited way although at practically no cost. PO2, PO3a and PO3b are more balanced in their economic, social and environmental impacts and can achieve these results at a reasonable cost. While the differences compared to the baseline are limited between these three options, PO3b stands out somewhat in that it has more important positive environmental impacts, while also having significant impact on reducing congestion.

PO3b is therefore the preferred option. PO4 could be considered as an ambitious alternative, including the phasing out of time-based charges for passenger cars and light commercial vehicles and mandatory external cost charging for all heavy-goods vehicles and buses. If the additional revenues and other benefits under PO4 are appealing enough to face the expected opposition to generalised distance-based road charging for cars and the higher costs attached to this, then, subject to a phasing-in period, this could be the preferred option.

In the case PO4 is the selected option, the phasing out of time-based vignettes for passenger cars should be longer than for HDVs to allow for the effects of the revision of the EETS legislation to materialise (decrease in costs of implementation/operation), which is difficult to predict but could be after 2025 – this date is considered in PO4 as year of introduction of distance based systems for light vehicles in a number of Member States.

If an earlier or later date was selected, that would shift the increase in costs to that year but, in the absence of reliable estimates, it is not possible to indicate potentially higher or lower costs by then. Since at this stage there is no support from Member States for distance-based

charging for cars, a longer perspective is necessary for them to consider if they would indeed want to implement it.

7.7. Effectiveness in achieving the objective to reduce regulatory burden (REFIT objective)

It is clear that the regulatory costs related to the initiative would increase with the change to distance-based tolling, as it would increase the compliance costs for many market players. However, these costs would be compensated by higher revenues (toll chargers, Member States) and better road quality and more reliable travel times (road users). Moreover, the shift from time-based to distance-based system should be more looked at from the perspective of social benefits, which would increase, rather than from the reduction of the regulatory costs. Benefits would include reduced negative environmental and health impacts (citizens), and related external costs borne by society (taxpayers), while regulatory costs should be reduced by the initiative on the EETS.

The REFIT dimension of this proposal comes more from the simplification and updating of the requirements for distance-based charging so that they are fit for purpose, that is:

- replacing an obsolete system of not well-defined modulation according to Euro classes for HDVs with more adequate and harmonised CO_2 emission-based modulation of charges (to be based on a robust testing scheme);

- simplification of the application of the additional charges for external costs of noise and air pollution (that is a more accurate and thus fairer instrument than modulation by Euro class) by allowing the use of reference values without the need to do any calculation;

- updating of the unit values for external cost charging to better reflect the environmental impact of different vehicle categories;

- simplification and updating of the application of mark-ups and facilitation of application of congestion charges; and

- allowing the reduction of circulation taxes for HGVs above 12 tonnes, which would facilitate Member States in replacing these taxes with more progressive distance-based charges.

The simplifications concern mainly national authorities rather than businesses, with the exception of the last measure, which could decrease the burden on hauliers (SMEs) by 63% or over €2 billion in vehicle tax paid for the use of HGVs. Overall costs to road users, including citizens and business, are likely to increase, even if only to a small extent.

While regular infrastructure reports by Member States may cause some administrative costs, these should be relatively insignificant compared to:

- The benefits generated by the initiative, in particular in terms of improved road quality and reduced negative impacts attached to poor quality;

- The administrative burden Member States already face linked to reporting requirements under Regulation 1108/70 from 1970 introducing an accounting system for expenditure on infrastructure, which may be repealed – compared to that act, this initiative would only require the most relevant information, necessary for the monitoring of the progress towards the objectives, to be reported by Member States.

Much as it is difficult to quantify the impacts of these measures, they could also reduce the administrative burden and enforcement costs when applying distance-based charges. All these measures are applied from PO2 onwards and three out of five are already applied in PO1 and maintained in the other options. Thus, from the REFIT perspective all options perform better than the baseline. PO2, PO3 and PO4 introduce additional requirements that would increase administrative burden and compliance costs compared to the baseline, but these are necessary to meet the specific objectives of the initiative and should not be looked at from the REFIT perspective.

8. MONITORING AND EVALUATION

In order to assess the impact of the legislation on overcoming main identified problems, it would be necessary to make a thorough evaluation once all the changes have been phased in. 5 years after the new framework becomes applicable in its entirety would seem to be right moment to do such an evaluation.

8.1. Indicators

For the main policy objectives, the following core monitoring indicators have been identified:

- The evolution of CO_2 emissions form HDVs; specific and total:
    - CO_2 emissions from every single vehicle will be monitored using VECTO[121], making annual comparisons per vehicle category to the previous year;
    - Total CO_2 emissions will be monitored by the European Environment Agency based on data reported by manufacturers using VECTO.
- The state of tolled road infrastructure as reported by Member States through specific quality indicators (e.g. surface quality, safety, level of service…). Key performance indicators to be developed by CEDR[122] will also provide useful input.
    - Data on expenditure on the maintenance of road infrastructure will be reported by Member States through their annual infrastructure reports.
- The proportionality and coverage of social costs by road charges in the EU:
    - The Commission continuously keeps track of the evolution of road charging systems in the EU, including charged vehicle categories, charge levels,

[121] cf. upcoming proposal for a Regulation on the monitoring and reporting of heavy duty vehicle fuel consumption and carbon dioxide emissions resulting from the certification process planned for adoption by the Commission in Q2 2017.

[122] Conference of European Directors of Roads, http://www.cedr.eu/strategic-plan/fa3/

differentiation of charges according to environmental performance or time, vignette prices (with special attention to cars).

- The Commission observes the evolution of the vehicle fleet using toll roads according to environmental performance (Euro class, in the future CO_2 emissions) based on publically available industry and government data[123] (annual).

- The level of congestion on the inter-urban network in the EU:
  - Member States monitor and report annually the evolution of traffic levels in peak hours on the interurban road network with real life traffic observations performed on a representative number of congested road stretches belonging to the primary national network.
  - The Commission establishes and updates a register of congestion charging schemes deployed by Member States on the basis of the notifications in receives.

The benchmarks for these indicators are the Baseline developments, i.e. the projected situation in 2025 without further action. For the levels of CO_2 emissions and congestion, the values are readily available in the EU Reference scenario 2016 as indicated in section 2 of this report. Since estimating the future quality of roads or spending on maintenance is less straightforward, the current levels of indicators (satisfaction with road quality and expenditure data) can be used as benchmarks. The progress on applying the *polluter pays* and *user pays* principles can be made in a more qualitative way, based on different factors outlined above. The current levels of charges, the length of tolled network and covered vehicle categories as well as the practice in applying external cost charging will be a useful basis.

8.2. Operational objectives

Based on the preferred option, the following operational objectives have been identified (if not indicated otherwise, the measures would be applicable with immediate effect):

Objectives and targets	Indicator
Phase-out time-based charges for HDVs: No vignette systems for HDVs in the EU – in 5 years (2023).	• Level of implementation of the provision by Member States (number of infringement cases); • Number of new distance-based charging systems for HDVs
Introduce CO_2 differentiation of road charges for HDVs: Road charges are differentiated according to CO_2 emissions of HDVs (as soon as technically feasible, probably 2019-2020).	• Level of implementation of the provision by Member States (number of infringement cases)
Increase the application of external cost charging for HDVs: At least half of the Member States apply	Take-up of external cost charging by Member States (number of cases) for

[123] See e.g.: https://www.bag.bund.de/DE/Navigation/Verkehrsaufgaben/Statistik/statistik_node.html

external cost charging for HDVs (2020).	different vehicle categories
Introduce CO_2 differentiation of road charges for LDVs: Road charges are differentiated according to real-driving emissions (CO_2 and pollutant) for LDVs, from 2020.	• Level of implementation of the provision by Member States (number of infringement cases); • (Number of new distance-based charging systems for vans[124] and cars)
Ensure more proportionate pricing: Proportionate pricing for all HGVs, buses/coaches and light vehicles – after 2 years (2020).	• Level of implementation of the provision by Member States (number of infringement cases); • Changes in charging systems for buses and light vehicles
Increase application of time-differentiated charging: At least 8 Member States apply time-differentiated charging to address inter-urban congestion (2023).	Number and extent of new congestion charging schemes
Introduce requirement to monitor and report on toll revenues: All Member States monitor and report on toll revenues, expenditures on maintenance and on road quality indicators (2020).	Level of compliance by Member States, number and quality of reports received by the Commission.

[124] according to experience with Euro class differentiation for HGVs, the effects on fleet renewal in case of distance-based charging are more pronounced

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PART 2/2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures
and
Proposal for a Council Directive amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures, as regards certain provisions on vehicle taxation

{COM(2017) 275 final}
{COM(2017) 276 final}
{SWD(2017) 181 final}

ANNEXES

1. ANNEX 1: PROCEDURAL INFORMATION CONCERNING THE PROCESS TO PREPARE THE IMPACT ASSESSMENT REPORT AND THE RELATED INITIATIVE

1.1. Organisation and timing

The Directorate-General for Mobility and Transport is the lead service for the preparation of the initiative (2016/MOVE/004) and the work on the impact assessment.

An inter-service steering group (ISG), chaired by the Secretariat-General, was set up in May 2016 with the participation of the following Commission Directorates-General: Legal Service; Economic and Financial Affairs; Internal Market, Industry, Entrepreneurship and SMEs; Environment; Climate Action; Communications Networks, Content and Technology; Joint Research Centre; Regional and Urban Policy; Taxation and Customs Union; Justice and Consumers.

Invitations were also sent to DG Competition; DG Employment, Social Affairs and Inclusion; DG Energy; DG Neighbourhood and Enlargement Negotiations.

The ISG met three times between the end of May 2016 and the end of February 2017, discussing the inception impact assessment, the terms of reference for the external study, the questionnaire for the public consultation, as well as subsequent reports of the support study and the draft impact assessment.

1.2. Consultation of the RSB

The Regulatory Scrutiny Board received the draft version of the present impact assessment report on 1 March 2017 and following the Board meeting on 29 March 2017 issued a positive opinion with reservations on 31 March 2017. The Board made recommendations. Those were addressed in the revised IA report as follows:

RSB recommendations	Modification of the IA report
(1) The introduction of a new objective on CO_2 reduction is not sufficiently justified. As stated in the evaluation and the impact assessment, road charges are not the most cost-effective way of reducing CO_2 emissions. In addition, the report does not sufficiently demonstrate the proportionality and complementarity with other environmental charges and taxes linked to the ownership and use of vehicles;	Explanations on the proportionality and complementarity in relation to other environmental charges and taxes linked to the ownership and use of vehicles have been added in section 2.2.1.
(2) The impact assessment does not treat earmarking of revenues of road charges in a consistent way. While earmarking is in principle excluded on subsidiarity grounds, the preferred option makes it mandatory in the case of congestion charges;	Explanations on the reasons for this differentiation have been added in section 11.1.
(3) The problem definition does not clearly describe the main design deficiencies of the Eurovignette Directive. It does not sufficiently explain the main obstacles for increasing Member States' uptake of road charging;	Further explanation has been added to the problem definition (section 2.2).
(4) The report lacks a clear explanation of the reasons for discarding certain options (e.g. mandatory road charging, earmarking revenues) and for introducing new reporting requirements. The report does not describe the reasons for	Explanations on the reasons for discarding mandatory road charging and generalised earmarking of revenues, as well as on phasing-

introducing phasing-in periods for different option elements and their necessary duration;	in/out measures have been added in section 11.2.
(5) The analysis does not clearly present the expected contribution of this initiative towards reducing CO_2 emissions, improving quality of roads or reducing air pollution and congestion. It does not identify whether any Member States are particularly affected and how;	The contribution towards reducing CO_2 emissions is now presented under section 6.2.1. The contribution to the necessary investment in road maintenance is presented in section 6.1.6. Most affected Member States will be those where road quality is bad, as indicated in sections 2.1.2 and 2.2.2. The contribution to reduce air pollution and congestion is described in sections 6.2.2 and 6.1.2.
(6) Although this is a REFIT initiative, the report does not sufficiently develop the possibilities for simplification of the Directive and its implementation, and the quantification of the administrative burden.	More details have been added in section 7.3 as well as under the description of options (section 5). The quantification of costs to authorities is provided in section 6.1.4.2, while the administrative/compliance costs for users in section 6.1.5.
Further considerations and adjustment recommendations	
(1) Context and problem definition The report should briefly describe how the Eurovignette Directive has worked so far and identify the main shortcomings in its design. It should explain the main obstacles for increasing Member States' uptake of road charging, including for light duty vehicles. The report should clarify why many Member States prefer time-based vignettes. It should better justify the need to extend the scope beyond HGVs.	More explanation has been added in section 1.3 as well as in section 2, the description of the problem definition, and in particular the drivers.
(2) Objectives The report should better justify the CO_2 emission reduction objective of this initiative; given that, the report recognises that internalising external costs of emissions in the fuel cost would be a better instrument. It should demonstrate the consistency with other instruments contributing to the same objective (e.g. fuel taxes, vehicle registration taxes, CO_2 emission standards) and discuss whether there might be risks of duplication. The report should clarify if the initiative has an explicit simplification objective.	An explanation on the consistency with other instruments (e.g. fuel taxes, vehicle registration taxes, CO_2 emission standards) has been added in section 2.2.1.
(3) Options The report should better explain the choices made regarding the content of the options. For example, why is an option of making road charging mandatory discarded while at the same time proposing phasing-out time-based vignettes? It should explain why revenues from congestion charging are earmarked for investment in roads or mobility solutions, even though overall earmarking of revenues from road charging has been discarded due to subsidiarity concerns. The report should better justify the introduction	Partly covered by point 2 above; more explanation has been added under the options (section 5).

of inter-urban congestion charging. It should explain why, in the absence of earmarking of toll revenues, Member States need to report on their toll revenues and expenditure on toll road maintenance to improve the overall quality of roads. In contrast, the option does not foresee reporting on the proposed road quality indicators, which risks limiting their usefulness. The report should also describe for which option elements phasing-in periods are foreseen and what would be the appropriate duration.	Reporting does include information based on quality indicators – the description has been corrected in in section 5 with more detail provided under Annex 11 (section 11.1.).
(4) Impacts The report should present what contribution is expected from this initiative towards reducing CO2 emissions from road transport, improving quality of roads or reducing air pollution and congestion. It should identify if any Member States are particularly affected and how. The report should describe if and to what extent an increased uptake of the distance-based road charging in Member States is expected (given that there is no obligation to introduce it). It should strengthen the REFIT dimension by better identifying the specific simplification potential. The report should also explain the implications of phasing-in different option elements over longer time.	The contribution of the initiative to these goals is presented in the relevant subsections in chapter 6 and summarised in section 7.1. Changes in tolling revenues (6.1.4.1) as well as transport costs (6.1.1) are presented per Member State and particularly affected Member States are mentioned in the text. An increased uptake of distance-based charging is expected and the assumptions are introduced at the end of section 5 with detailed description in Annex 4. More explanation has been added under section 7.3 on the REFIT dimension and under options. The implications of phasing-in of distance-based charging (or the phasing out time-based schemes) are explained in the discussion on the preferred option, while detailed rationale for each measure are provided in Annex 11.

1.3. Evidence

The problem definition was based on previous evaluations carried out by the Commission as well as using external expertise (evaluation of the implementation of EU infrastructure charging policy since 1995, Update of the Handbook on external costs of transport[1]), complemented by additional research used to update and substantiate the problems identified in those evaluations (see external expertise below). In particular the Handbook on external costs of transport was peer reviewed by a group of selected experts in the field, including representatives of academia.

Regarding the current situation in road charging, evidence was based on information publically available on the websites of Member States/public authorities/road operators regarding the scope and levels of road infrastructure charges. For macro-economic trends

[1] Ricardo-AEA et al (2014), Update of the Handbook on External Costs of Transport: http://ec.europa.eu/transport/themes/sustainable/studies/sustainable_en

as well as emissions, the Impact Assessment report builds on the Baseline scenario described in section 4. This Baseline scenario has been developed with the PRIMES-TREMOVE model by ICCS-E3MLab and draws on the EU Reference scenario 2016[2] but additionally includes few policy measures adopted after its cut-off date (end of 2014) and some updates in the technology costs assumptions. As regards environmental data, European Environment Agency was used as data source.

In addition, the Impact Assessment report relies on a previous Impact Assessment prepared in 2013, accompanying a proposal for *Fair and efficient road pricing*, which was not adopted in view of political opportunity reasons.

1.4. External expertise

As indicated above, the impact assessment work was based on previous evaluations and an impact assessment partly informed by external expertise.

Following discussions with the ISG, a public tender for the impact assessment support study was launched in June 2016 and the consultant started working on the study in September 2016. Its reports (an advanced inception report including the definition of the problems, an intermediate report including assessment of stakeholder input, and a draft final report including the assessment of all major impacts) have been scrutinised by the ISG and commented by various services of the Commission.

[2] ICCS-E3MLab et al. (2016), EU Reference Scenario 2016: Energy, transport and GHG emissions - Trends to 2050.

2. ANNEX 2: STAKEHOLDER CONSULTATION SYNOPSIS REPORT

2.1. Consultation strategy

Title:	***Impact Assessment for the revision of Directive 1999/62/EC***
Background:	Directive 1999/62/EC (the "Eurovignette" Directive) provides a detailed legal framework for charging heavy goods vehicles (HGVs) for the use of certain roads. The Directive aims to eliminate distortions of competition between transport undertakings by achieving step-wise harmonisation of vehicle taxes and establishment of fair mechanisms of infrastructure charging. Following ex-post evaluations of the current legislative framework, the Commission has to assess the potential impacts of various options for a possible revision of the legislative act in question. The consultation of stakeholders is an integral part of the impact assessment process.
Objective of the consultation	
Goal:	The objective of the stakeholder consultation was to collect the views and opinions on the approach proposed in the Inception Impact Assessment. It was used to identifying gaps in the proposed intervention logic or areas requiring further attention.
Scope:	The consultation covered all elements of the impact assessment: problem definition and respective drivers/root causes, the issue of subsidiarity and the EU dimension of the problem, the preliminary options (policy measures). The consultation also allowed asking the stakeholders on their perception of the likely impacts of each option.
Identification of stakeholders	
Stakeholders:	**Member States; Public authorities:** Transport authorities/agencies in the Member States (CEDR) **Industry and industry associations from the road sector**: - infrastructure managers: ERF (association of stakeholders involved in construction, equipment and operation of Europe's road network), - toll chargers and service providers: ASECAP (association of toll chargers), AETIS (association of prospective European Electronic Toll Service providers) - road users: IRU and UETR (associations of hauliers), FIA (association of motorists), CLECAT (association for forwarding, transport, logistics and customs services) - automotive industry and sectors dependent on transport: ACEA (association of the automotive industry), BusinessEurope, UEAPME (association of SMEs) Companies and **associations from other modes of transport**: CER (association of railway companies); UIRR (association of intermodal transport) **Environmental associations:** Transport&Environment **Citizens**.

Consultation methods and tools	
Methods:	A combination of consultation methods were used: 1) A standard 12-week **online open public consultation** was organised in between July and October 2016 via the website "Your Voice in Europe" on the basis of questionnaires. 2) **Targeted consultation with specific stakeholders and specialists** took place throughout the IA process and involved: a) **Thematic seminars with stakeholders and Member States** b) A **conference on the planned road initiatives** on 19 April 2016. The conference involved specialists, stakeholder associations as well as representatives of Member States and Members of the EP. c) 21 interviews with stakeholders selected based on specific data needs carried out by the contractor preparing the IA support study. An interview guide was agreed with the Commission.

2.2. Results of the open public consultation

The open public consultation (OPC) ran from 8 July to 5 October, although late contributions were still accepted. The OPC contained two set of questions: the first aimed at understanding the perceptions of users addressed to the general public, and a second, more technical one to experts. Respondents were also given the opportunity to provide any further comments. Some respondents also submitted additional documents providing further relevant information.

The questionnaires were based on the issues identified by the evaluation. The issues covered included the quality of road infrastructure, the fairness of road pricing (taxes and charges), the problems of congestion and CO_2-emissions, as well as the scope of EU legislation in the field. The questionnaires and statistics are available on the consultation webpage:
http://ec.europa.eu/transport/modes/road/consultations/2016-eurovignette_en

2.2.1. Objectives of the OPC

The main objectives of the OPC were: 1) to confirm/verify the problems identified during the ex post evaluation; 2) to seek the opinion of stakeholders on possible policy measures; and 3) to assess the expected impacts of the possible policy measures.

2.2.2. Statistical information

There were 135 responses to the questionnaires as well as 48 additional documents of which 27 were of relevance. These responses covered a variety of stakeholder groups, including transport undertakings and their representatives (42%), consumers/citizens and their representatives (14%), public authorities (13%), the construction industry (7%), public transport associations (4%), and tolling service/solution providers (4%).

There was a relatively high number of coordinated responses (36, i.e. 27%), following 12 different templates for answers, indicating that standard replies circulated by associations to their members and sent in high numbers.

Responses were received from respondents residing in, or organisations based in, 20 EU Member States, with the majority of responses (80%) are from EU-15 Member States. The highest number of responses was received from Belgium (24), Germany (20), Spain (19), Austria (11), and Hungary (8).

2.2.3. Main findings and position on the main potential policy measures

a. Opinions on the fairness of pricing

The majority of respondents (72%) were of the opinion that different taxes and charge systems are thought to cause market distortion, therefore supporting EU harmonisation. Transport undertakings were strongest in agreement with this, with 82% of respondents indicating that they felt that this was the case. 70% agreed that the exemption of lorries between 3.5t and 12t in some countries can distort competition.

Regarding light goods vehicles, there is mixed opinion over whether the fact that the Eurovignette Directive does not cover vans can cause market distortion within the freight transport industry. The majority of respondents agreed (54%) that this was the case, whereas 31% disagreed.

Regarding passenger cars, 60% of the respondents (85% of consumers/citizens) felt that EU rules could introduce fairness for non-resident road users to some extent or fairly significantly.

There was disagreement as to whether road users are paying enough based on these principles, with 65% of transport undertakings feeling that charges were too high, while 52% of consumers/citizens felt that charges were too low. In the case of light vehicles, respondents from EU-13 Member States felt strongly (67%) that prices are too low. This is probably linked to the prevalence of vignette schemes in those countries.

b. Scope of the rules and overall approach

The survey suggested that any legislation introduced should not be focused solely on HGVs, but on **all road vehicles** including both freight and passenger transport (54%) based on the *polluter pays* (75%) and *user pays* (80%) principles.

At the same time, only 51% agreed that the overall price of transport should cover all related externalities, with 42% were against. Consumers/citizens agreed in highest proportion (63%).

Regarding the geographic scope, 34% were in favour of applying legislation to all main or national roads, whilst 36% felt that the legislation would be best applied to road infrastructure of European importance, such as motorways and national roads carrying significant international traffic.

Regarding **congestion**, with the exception of toll service providers (strongly feeling that EU legislation should be applied, in order to address congestion on all of the TEN-T network, motorways, and interurban roads), most respondents felt that the problem should be dealt with by Member States and local authorities.

Most respondents (82%) agreed that the **revenues** generated from taxes and charges should be reinvested back into the maintenance, repair and upgrade of the road network, ensuring transparency of the process to the public. At the same time several felt that tax revenues should not be used solely for the support of infrastructure, but should be used to fund other transport-related services, e.g. public transport.

There was also broad agreement (74%) on the question whether the EU should make sure that all **vignette** prices are set proportionately.

On the way to address CO_2-emissions, many suggested the introduction of regulations covering fuel consumption and CO_2-emissions for heavy duty vehicles; that CO_2-emissions should be accounted for in fuel taxes; and that the focus should rest on taxing fuels appropriately.

In addition, there was some concern that by changing this Directive there would be a danger of 'double taxation', i.e. by another source for the same reason (e.g. annual road tax). The stakeholders believe that EU-wide harmonisation of the rules would be an ideal solution, as it would create fair competition rather than favouring companies in countries where taxes are lower.

c. On the proposed solutions

Overall the proposed changes were positively received, with the stakeholders considering all identified issues to be covered by the Eurovignette Directive as important.

1) Challenge of road maintenance

All three proposed measures received around 2/3 of approval, with monitoring and reporting of revenues and expenditures getting slightly higher mark (69%) than the introduction of rules on the liability of the keeper of the toll road, and the requirement of national plans on the maintenance and upgrade of roads (both 65%).

2) Fair pricing for HGVs

The stakeholders were proponents of phasing out vignette schemes in favour of distance-based charging for HGVs or all goods vehicles.

3) Fair pricing for other vehicles

Respondents felt the most favourable with the inclusion of light goods vehicles and buses/coaches was also suggested from the responses. Other options – including either light vehicles or buses/coaches received a lower level of approval.

4) Possible extension of mark-ups beyond mountainous regions

Responses were mixed: 32% felt that this provision should be extended, to use the revenues more flexibly, to support projects within the same corridor, or used to compensate for the higher costs linked to the use of an alternative infrastructure on the same corridor, while 29% were against. EU-15 Member States were more in favour with EU-13 respondents less so.

For some, further mark-ups may result in double charging, and no further mark-ups can be justified. If a mark-up is used in these areas, then there needs to be transparency in its calculation, with its contribution clearly separated from the base charge.

5) Measures addressing CO_2-emissions

The proposed measures for addressing CO_2 emissions from HGVs were supported by the stakeholders. The options that were most agreed with were the measures to promote fuel efficient vehicles and technologies by reduced road charges for them (68% and 66% respectively). By contrast, the only option which suffered a more mixed response was the phasing out of the EURO exhaust emissions standards. Even so, in this, 44% expressed agreement with the measure, whilst 33% disagreed.

The need for an adequate measuring methodology was widely accepted.

6) Addressing congestion

Proposals for congestion charging were met with scepticism. The greatest approval rate (40%) was given to 'allowing congestion charging for all vehicles', with the possibility to extend the application of mark-ups receiving the lowest disapproval (40%).

It was agreed that if congestion charging is applied, it should cover all vehicles, not just HGVs. Some said that congestion charging may not actually have the intended effects, as often users do not have alternatives.

d. Additional contributions

Fifty three **additional contributions** were received, of which 32 were of direct relevance. One third of the latter were from **public authorities** and nearly one quarter from **transport undertakings**.

In the additional contributions, there was a lot of **discussion of distance-based charging versus vignettes**. Most contributions supported distance-based charging and the phasing out of vignettes, as the former were best able to internalise external costs in line with the user-pays and polluter-pays principles. Other contributions underlined the greater costs associated with distance-based charging, and argued that while distance-based charging might be appropriate for HGVs, time-based vignettes were more appropriate and cheaper for other types of vehicles.

There were mixed views on the **internalisation of external costs**, with some additional contributions calling for the inclusion of external costs relating to congestion, accidents and CO_2 emissions in addition to air pollution and noise, while others believed that external cost charging was not appropriate or was difficult. For **congestion**, views ranged from support for such charges to be additional, rather than revenue-neutral, to arguing that additional provisions for congestion charging were not necessary, as the costs of congestion were already internalised by users. Some **public authorities** called for the maximum charging levels to be reviewed or even directly removed to enable charging that actually reflects the costs of pollution; a similar view was held by a motorway operator in relation to congestion. There was some support for replacing the possibility to differentiate charges by Euro emissions class with CO_2-differentiated charging, but it was noted that the latter was difficult in the short-term as a result of a lack of relevant information for HDVs. An alpine region called for mountainous areas to be allowed to implement additional tolls to cover the additional infrastructure and external costs imposed on these sensitive areas.

Views on the **use of revenue** varied between making it mandatory for revenues to be used to support the development and maintenance of transport infrastructure to a more general belief in revenues being used to decrease external costs and promote cleaner transport modes. **Member States**, on the other hand, tended to argue that the use of revenue should be left to public authorities.

There was some support for **the scope of the legislation** to be extended to buses and coaches, and even to all vehicles. Some supported the legislation being amended to require mandatory distance-based charging, although road users in particular did not support such mandatory charging. Some **Member States** supported the removal of the possibility of exempting HGVs over 3.5 tonnes and less than 12 tonnes, but did not support the extension of the Directive to any type of vehicle lighter than 3.5 tonnes.

2.3. Results of the targeted consultation

2.3.1. Interviews

In order to obtain better insight and more detailed information, a set of targeted interviews have been carried out. Contributions were received from 21 different stakeholders, including nine Member States (four EU-15 and five EU-13), five transport companies, including two SMEs, four EU level representative bodies, two tolling companies and one national industry association. Stakeholders were asked questions on the potential policy options for amending the Directive.

Most of the nine **Member States** supported action to **incentivise the use of fuel efficient vehicles** in general, but not all of these were convinced of the ease and value of implementing this through CO_2-differentiated charges. The Member States that were most

supportive of CO_2-based charges underlined that it needed to be applied simply and that a system of differentiation according to CO_2 emissions needed to be phased-in carefully as the Euro emissions class system was phased out. Where they expressed a view, Member States wanted CO_2-based charging to be voluntary.

Of those Member States that expressed an opinion, one stated that a CO_2-based charge should be revenue-neutral, while another argued that it should not, as ensuring revenue-neutral differentiation requires regular changes to the charges, which posed administrative challenges and was difficult to communicate to industry. Opinion was also divided on the challenges and costs of changing to a CO_2-based system, as one Member State noted that their existing toll system could be relatively easily adapted for CO_2-based charges, while others noted that the administrative burden was potentially the main issue, as verifying the appropriate CO_2 emissions could be high, at least in the transition period.

One Member State felt that there were still benefits to be gained from being able to differentiate charges according to Euro emissions class, which could be lost if CO_2-based charging, for which there was still a lack of data, was introduced. Another also supported retaining differentiation by Euro emissions class, as this was easier to identify for a vehicle.

Amongst the **other stakeholders**, there was generally broad support for the principal of CO_2-based charging, but in practice some issues were identified. Two of the four EU level stakeholder organisations explicitly supported charging based on the results that emerge from VECTO, which will be used to monitor and report CO_2 emissions from HDVs and for setting emission reduction targets for these vehicles. In spite of the fact that information from VECTO will not be available to be used for the purpose of charging until 2020, these stakeholders underlined that the current Eurovignette amendment should enable the use of the VECTO's information as it becomes available, and then possibly phase out the use of Euro emissions classes. Other EU level stakeholders noted that the results of VECTO would not be accurate in practice, as the CO_2 emissions of an HDV in use depended on lot of factors. In spite of this, one noted that a vehicle that performs well "in the laboratory" would also perform well on the road, so that VECTO's results would be a good proxy for real-world emissions. The two EU level stakeholders that expressed an opinion stated that such differentiated charging should be applied to all vehicles.

The representatives of **transport companies** were supportive of taking account of transport's CO_2 emissions. One argued that it would be better to do this through fuel taxes, but as this was politically difficult, an approach based on the results of VECTO would be appropriate. Another supported CO_2-differentiated charges, as long as this was mandatory for all vehicles, including light duty vehicles. A third thought that reaching an agreement on CO_2-based charges would be politically-difficult and lacked a clear rationale compared to internalising the external costs of CO_2, so instead was in favour of the latter being mandatory. The transport companies underlined that the way in which differentiated-charging was implemented was of fundamental importance. A national **industry association** underlined that any system should be simple and sufficiently reward hauliers that use fuel-efficient vehicles.

The two representatives of **transport SMEs** that were interviewed were both generally supportive of the CO_2 differentiation of charges, but both underlined that it would be better if the same system was implemented and enforced in all Member States, otherwise there would be impacts on competitiveness.

The representatives of **tolling companies** were less supportive of CO_2-diferentiated charging, even though generally they supported measures to improve the environmental performance of transport. One was concerned that any changes to the structure of tolls

always opened up wider discussions of contracts, which potentially led to problems. They argued that it would contractually **simpler for CO_2-differentiated charges to be revenue-neutral**, i.e. reduce charges for new vehicles while increasing charges for older vehicles, although it would be relatively easy to do this using an electronic charging system. They also noted that more charging was the obvious way of replacing fuel tax revenues, which were likely to decline. The other tolling company was concerned that CO_2-based charging would have an adverse effect on its business model and that it risked complicating tolling, as it would be more complex than differentiating charges according to Euro emissions classes.

Member States were generally not supportive of the policy options that might be implemented to **enhance the quality of road infrastructure**. With respect to existing tolled roads, it was underlined that in countries that have a lot of tolled roads already, such as Austria, Italy and Slovenia, the concessionaries already have performance indicators written into their contracts or agreements, which include *inter alia* maintaining the quality of their road network. In Member States that do not have extensive charging networks, **indicators** are sometimes used to monitor road quality and to prioritise investment. Concerns were raised that it would be difficult to agree a common set of indicators, as those relevant to Alpine countries would be different to those needed in relatively flat countries. Additionally, a standard set of EU-wide indicators could be difficult for some countries to achieve, as a result of a lower levels of resources. One Member State suggested that the Directive could include a general requirements to establish indicators, but leave it to Member States to decide what these should be, while another saw the value of common indicators, but did not want these to be imposed. Another Member State supported the establishment of EU performance indicators for infrastructure maintenance, but thought that these should not be implemented through the Eurovignette Directive.

Subsidiarity concerns were raised in many cases, with Member States suggesting that it should be up to them to decide how to manage and fund their respective road networks in light of other priorities, and to decide on what they should report. A concern was also raised that the policy options proposed were more administrative in nature and so would introduce administrative costs without necessarily delivering better roads. Three Member States noted that in their countries revenues from charges were earmarked for road development and maintenance, and one of these suggested that such **earmarking** could be a requirement more generally.

Other stakeholders were more supportive of action to ensure the quality of the road network, although many underlined that it was important to make a distinction between tolled and non-tolled roads. In general, it was considered that tolled roads were reasonably well maintained, although there was still support for a more common approach, particularly on the TEN-T network. Several stakeholders supported the development of a **common set of indicators**, although many also recognised the associated challenges of achieving this. To overcome this, an EU level trade association proposed having a common road quality monitoring system that could be used across the EU with a central authority. Some supported the use of a common set of indicators together with the development by Member States of **national maintenance and upgrading plans**. Other options proposed included the development of guidelines on the minimum level of maintenance, although the details should be left to individual countries, and a requirement to take action to remedy any issues identified by any indicators.

A number of interviewees noted that distance-based charging was a potential solution to the problem of funding non-tolled roads, while several explicitly supported the earmarking of revenues from such charges for road maintenance and development.

With respect to **vignettes**, Member States were split on the need for further measures to **avoid discrimination**, but there was little support for phasing out vignettes. There was some support for expanding the existing proportionality rules that applied to HGVs to other vehicles such as cars and buses, although others opposed this arguing that the focus of the Eurovignette Directive should remain HGVs as these were the main type of vehicles that travelled a lot internationally. One Member State argued that if it was considered that vignettes did not sufficiently cover costs, the response should not be to abolish vignettes, but to lift the restrictions on them as it was not currently possible to use these to cover the costs imposed by HGVs. Some Member States believed that there was no need for additional rules, as it was more a case of properly enforcing existing rules on **proportionality**, rather than creating additional legislation. Those Member States that already had a distance-based charging scheme in place for HGVs often did not object to phasing out vignettes for HGVs. Several Member States argued that, particularly **for LDVs**, the costs of implementing a distance-based charging scheme were prohibitive, whereas a time-based system could deliver similar results for much less in the way of costs, even though it was not the best way of implementing the user-pays principle. One Member State argued that some countries, if faced with a choice between a distance-based system and no charging would adopt the latter approach, and so phasing out vignettes could lead to less charging overall.

With respect to distance-based charging, **Member States** were again divided on the need for additional measures to **ensure a level playing field**, with one questioning the logic behind the need for action in the first place. Some Member States that already had – or were planning – a distance-based charging scheme in place for HGVs supported this being made mandatory on the TEN-T network and extended to LCVs, but noted that this might be a challenge in other countries. One Member State supported the extension of the road charging rules to all vehicles, including **cars**, as this would increase acceptability amongst road hauliers, while another supported an extension to buses and coaches. Other Member States were explicitly against mandatory distance-based charging for any vehicles or even a common approach to such charging, arguing that vignettes were more appropriate in some cases (see above). It was also pointed out that in those countries with lower levels of traffic, revenues from distance-based charging would be less, which would further undermine the benefits of the scheme.

The majority of **other stakeholders** were in favour of distance-based charging applying to all vehicles and the phasing out of vignettes, although some supported vignettes for reasons similar to the Member States. The arguments in favour of distance-based charging included that this was fairer and better applied the user- and polluter-pays principles. Many of the stakeholders supported mandatory distance-based charging, at least as the ultimate long-term goal, and noted that this needed to be phased in gradually. One stakeholder proposed that after HGVs, it would be most appropriate to apply distance-based charging to buses and coaches, followed by LCVs, as these were being used in some Member States instead of heavier commercial vehicles as their use is less regulated. A number of stakeholders noted that distance-based charging was the obvious way for Member States to maintain revenue levels from road transport, with the likely decline of revenues from fuel duties in light of the increasing electrification and improved efficiency of the new vehicle fleet.

Many stakeholders also stressed that any increase in costs as a result of increased charges should be compensated for by reductions in other transport-related taxes. Those that were in favour of retaining the possibility of maintaining a vignette system noted that the increased costs for short-term users were justifiable as a result of the flexibility that the system provides to these users, and that the costs of introducing distance-based charging for cars in particular would be prohibitive. An **EU trade association** that supported

distance-based charging argued that in the short-term the proportionality requirements on vignettes should be retained; a **transport company** supported such rules being applied to all vehicles.

Member States generally favoured more flexibility in the Directive to enable them to **ensure an efficient transport system**, rather than more prescriptive requirements. Several Member States argued that the current approach to external cost charging needed to be simplified and that restrictions on the ability to increase charges by the time of day should be lifted in order to give Member States more flexibility. One Member State argued that the maximum level of any charge should be fixed to ensure consistency between Member States. It was proposed that rather than the Directive setting more rules to govern charges, it would be simpler if Member States simply had to justify their actions. In relation to **congestion charging**, some argued that it was a very local issue so the Directive should provide sufficient scope to allow for appropriate local action. In relation to **external cost charging** more generally, it was noted that in countries with older vehicle fleets, introducing such charging could be expensive for users. A general comment was that the more restrictions that were imposed on charging by the Directive, the less likely it was that a Member State would voluntarily implement a charging scheme, in spite of its potential benefits.

Views on whether the Directive should apply to **all vehicles** were divided, with some not supporting any extension to vehicles of less than 3.5 tonnes, while others supported non-mandatory principles being applied more generally.

Of the **other stakeholders** interviewed, **many transport companies supported congestion charging**, as long as it was mandatory and applied to **all vehicles**, while others were not convinced of the need for congestion charging. A mandatory scheme was preferred, as it was considered that if the choice was left to Member States, they might take the easier option politically and only apply congestion charges to HGVs rather than to all vehicles. One stakeholder noted that it was important for the Directive to be seen to facilitate congestion charging, so this should be explicit and congestion should be included as one of the external costs that could be covered by user charges, although Member States should be left with flexibility as to how to apply the charge. The need for a common methodology for applying the charges allowed by the Eurovignette Directive was mentioned by a couple of stakeholders.

Others opposed allowing Member States to charge for congestion, arguing that the costs of congestion were already internalised by hauliers in terms of increased fuel, labour and vehicle costs. Others believed that for inter-urban roads, the provisions of the Eurovignette Directive were already sufficient to enable Member States to address congestion, or that there would be no need for congestion charging if distance-based charging was introduced. Those that expressed a view on the use of revenues, argued that these should be used for new transport infrastructure and abatement measures. A couple of stakeholders believed that the decision as to whether to implement external costs charging generally, and congestion charging specifically, should be left to Member States and cities. Few stakeholders had any views on **potential adverse or beneficial impacts on SMEs**. The main observation was that anything that increased costs or complexity had the potential to have an adverse impact.

2.4. Results of the stakeholder seminars and conference

In the context of the planned road transport initiatives, as described in the Commission Work Programme 2016[3], DG MOVE organised a series of five informal seminars during September and October 2015. In addition a conference was held in April 2016.

2.4.1. Insufficient financing

Member States were generally of the opinion that flexibility is required to spend revenues from road charging according to national priorities and according to national decisions. Others echoed that it is important to respect subsidiarity in the area of infrastructure and maintenance financing. Stakeholders on the other hand, and particularly **road users**, stressed that earmarking of revenues and proper maintenance is a prerequisite for acceptability of user charges. It was also stressed that user charges and earmarking should be seen in a wider context of providing users with incentives to encourage improved economic and environmental performance of the road transport sector.

2.4.2. Vignettes

Some **Member States** advocated phasing out vignettes and replacing these with distance-based tolls collected with the help of interoperable on-board units. Several other Member States, however, thought that the flexibility of the current Eurovignette framework should be maintained, at least in the short to medium term. A positive aspect of vignettes was considered to be its relative simplicity and low administrative costs, in particular in countries having low volumes of transit traffic. Views were divided as to whether the issue of discrimination of passenger cars should be addressed by an extension of the Eurovignette framework. A **slight majority were in favour of including passenger cars** while others were against in order not to increase the cost burden.

2.4.3. Price signals

Whilst **most Member States expressed their support for the application of the user and polluter pays principles**, only some requested measures to ensure clearer and more effective price signals. For instance, some Member States currently charging for external costs, or planning to do so, proposed to review caps currently imposed on external cost charges. It was also proposed by some to allow a **differentiation of user charges and tolls based on CO2** emissions to better reflect the environmental performance of vehicles. Views were divided on the possibility to allow Member States to charge for **congestion** as an additional charge rather than, as presently, a variation of user charges and tolls. Whilst some Member States were in favour, others did not consider that a congestion charge would impact behaviour given that international hauliers are unable to avoid main congestion centres at some stage of their international journey. As a consequence, it was considered by some that a congestion charge may add costs and not significantly contribute to reducing congestion. **Stakeholders confirmed that clear and consistent price signals were important** given the highly competitive nature of the road haulage sector. It was noted that recent evidence (Germany was cited) has demonstrated that clear price signals have contributed to reducing empty running and to the use of more environmentally friendly trucks.

[3] COM(2015)610 final.

2.5. Conclusions and use of the results

There were some differences of note with respect to the responses from the different elements of the consultation.

There was general support for measures to **incentivise the use of fuel efficient vehicles**, although less specific support for doing this through charges and phasing out the possibility of differentiating charges by a vehicle's Euro emissions class. Some additional contributions and many non-Member State interviewees supported the introduction of CO_2-based differentiation and the phasing out of differentiation by Euro emissions class, whereas Member State interviewees were generally less supportive of this approach. While doubts have been expressed regarding its short-term feasibility, there was no obvious opposition to the revenue-neutral differentiation of charges based on CO_2 emissions.

In relation to possible measures to **ensure the quality of road infrastructure**, there was a distinct difference between, on the one hand, the views expressed in the online public consultation and the views of most stakeholders interviewed, and on the other, the views of the Member States interviewed. The majority of respondents to the public consultation and other interviewed stakeholders generally supported the measures to ensure the quality of road infrastructure. On the other hand, Member States were generally not supportive of the measures, citing subsidiarity concerns, that the proposals were unnecessary as tolled roads were already of sufficient quality and the challenges with identifying a common set of indicators.

With respect to possible measures to **avoid discrimination and ensure a level playing field**, there is again a distinct difference between the views of Member States and others. Respondents to the online public consultation strongly supported the application of the user-pays and polluter-pays principles, and for the EU to ensure that vignette prices are set proportionately. Many additional contributions and non-Member State interviewees supported the phasing out of vignettes and the introduction of distance-based charging. On the other hand, Member State interviewees were divided on the need for further action in this respect, they generally did not support the phasing out of vignettes (particularly for cars) and tended to support distance-based charging only if they already had such a system in place. Many argued – as did some other interviewees – that vignettes were more appropriate and cheaper for cars.

With respect to **ensuring an efficient transport system**, the majority of respondents to the online public consultation believed that dealing with congestion should be left to Member States, with the most popular option for congestion charging being that it should apply to all vehicles. The need for any congestion charging to cover all vehicles, not just HGVs, was underlined by those non-Member State interviewees who supported congestion charging. Member State interviewees were in general in favour of more flexibility about implementing the measures to ensure an efficient transport system.

The results of all the consultation activities were used in designing the policy options and selecting the measures. The most rejected ones were discarded after the initial screening and the retained measures were grouped options with increasing level of regulatory intervention, so that decision makers have the possibility to judge on the desired level of ambition. The results of the consultation are referred to throughout the various sections of the impact assessment.

3. ANNEX 3. WHO IS AFFECTED BY THE INITIATIVE AND HOW

Type of stakeholder	Practical implications
Road hauliers and logistics companies – many of which SMEs	Transport and operating costs Direct costs in the form of road charges may slightly increase for the average haulier (SME), with a possibility to make savings on road charge and fuel cost by using the cleanest and most efficient vehicles. All hauliers will benefit form of increased reliability and speed of deliveries from lower congestion and better road quality implying savings on vehicle operating cost and delay costs, which would offset any increase in road charge. In addition, hauliers will probably be compensated through reduced taxes (as it was the case most recently in Belgium where vehicle taxes were reduced to the minimum when the distance-based charge was introduced). Firms can react in different ways to the introduction of new road tolls, external cost charges and congestion charges: instead of absorbing them, SMEs are likely to pass on these costs to their customers; or they can reduce the impact on operating costs by adapting their operations to the new circumstances through route shift, travel time shift, frequency reduction, modal shift, or increased uptake of low/zero emission vehicles. Firms investing in low/zero emission vehicles will benefit from lower fuel/running costs that are expected to more than compensate for increased purchase prices over the lifetime of the vehicles.
Shippers & consumers	Transport costs/prices Shippers might be required to adapt their shipping practices to slightly modified transport prices (depending on the itinerary), but would benefit from more efficient transport operations, reduced delays, more predictable delivery times. This is especially important to firms working for sectors such as manufacturing and retail (where there is high reliance on just-in-time delivery). Impacts on consumer prices are expected to be negligible, even under cases of 100% cost pass-through.
Private road users	Cost of mobility & behaviour Regular users of toll roads would experience hardly any difference in road charge on average but, like hauliers, would benefit from better road conditions and reduced congestion. Occasional road users would benefit from fairer treatment (lower charges) in Member States with time-based charging. Those travelling regularly alone by car in rush-hour on roads with distance-based charging may – only in case the Member State decides to introduce time-differentiated charging – either be

	required to change habits and/or transport mode, or would face higher road charges and be the main beneficiaries of reduced congestion in exchange. The exact level of road charge will depend on the specific local context; however, as an example, a trip with 10 km in near capacity condition (7 km on rural and 3 km on metropolitan motorway) may be charged up to 1-2 euro – a price very much comparable to an equivalent trip by train or bus. Indeed it would be possible to mitigate even this small cost by carpooling. Depending on the itinerary, the cost of long distance travel by bus may slightly increase (around 1 euro per passenger on a trip involving 400 km of motorways), which will be considered by the travellers when choosing between different transport modes, e.g. bus or train.
Road operators	<u>Revenues & budget</u> Assuming that a significant portion of collected tolls would be allocated to the operator of the toll road, they would dispose of a stable revenue stream to maintain their road network in good/safe condition. This would make it possible for road operators to time their maintenance activities in an optimal way thereby reducing long-term maintenance costs. <u>Monitoring & reporting</u> Those operators, which have no regular road quality monitoring in place, would be required to implement such a scheme; they may need to consult other operators for the purpose of exchanging good practices and capacity building, and would be required to report on the results on a yearly basis. The costs associated with these obligations would be covered by toll revenues (the inclusion of such costs in the calculation of tolls is already provided for in the Directive).
Member States' administrations	<u>Investment & budget</u> Those Member States, which currently apply vignettes for HDVs would have to choose between two possibilities if they want to replace revenues forgone due to the abolishing the scheme: (1) introduce distance-based charging within 5 years if they intend to collect user charges on their roads; alternatively, (2) they may choose to raise the equivalent amount of revenues via other channels, e.g. by slightly increasing transport taxes (fuel or vehicle). All other Member States would also be affected by additional costs where they introduce new road tolls (voluntarily). 1. Increasing fuel tax could be a meaningful alternative as it is paid in proportion of fuel burnt and in principle by all road users. It is very easy to implement at virtually no cost. For example, in the case of Luxembourg, the revenues forgone

	thanks to abolishing the Eurovignette system could be compensated by less than 2% increase in fuel tax. However, increasing fuel taxes can be politically difficult in some countries, and many Member States are seeking alternative sources of revenue as vehicles become more fuel efficient (eroding the tax base). 2. Road charging provides a more direct price signal to the user, whereas the fuel price, once paid, is already a sunk cost. Distance-based road charging can also be adjusted according to the environmental performance of vehicles, noise levels and time of day, thereby contributing to reducing external costs. Steady revenues collected from the users can ensure a quick payback period (generally within the same year), and long-term benefits in any case. Furthermore, the cost of operating different electronic toll schemes varies between 4.5 and 12% of toll revenues. The cost of on-board units is on a downward path. [4] For Member States choosing to introduce new road tolls, this result in an initial investment cost of around €150m (€82m to €232m, depending on the size of the county) and ongoing maintenance/enforcement costs of around €20m per year (€9m to €41m). At the same time, it is also possible to introduce electronic tolling at lower cost as in Hungary (below EUR 100 million). These costs would be counterbalanced by increased revenues from road user charges in all cases, which would be greater than the ongoing costs. <u>Reporting</u> There may be small additional costs for implementing the measures regarding monitoring and reporting of investments, expenditures and road quality (although several Member States already do this), but these would be very minor, especially in comparison to the system costs explained above.
Equipment manufacturers	Wider application of distance-based road charging will mean more business opportunities for electronic toll service providers, while the competitiveness of OEMs will be positively affected by increased demand for cleaner and more efficient vehicles.
Society at large	Society and the economy would benefit from the wider application of proportionate distance-based road pricing (i.e. the polluter pays and user pays principles), since it will incentivise more efficient transport operations, the use of cleaner vehicles and ultimately result in lesser negative impact from transport, lower level of externalities, including reduced CO_2 emissions.

[4] Ex-post evaluation of Directive 2004/52/EC on the interoperability of electronic road toll systems in the Community and Commission Decision 2009/750/EC on the definition of the European Electronic Toll Service and its technical elements

4. ANNEX 4. ANALYTICAL MODELS USED IN PREPARING THE IMPACT ASSESSMENT

4.1. Description of analytical models used

A model suite has been used for the analytical work, combining the strengths of three different models: ASTRA, PRIMES-TREMOVE and TRUST. The model suite covers the entire transport system (e.g. transport activity represented at Member State level, by origin-destination and at link level, technologies and fuels at Member State level, air pollution emissions at Member State and link level and CO_2 emissions at Member State level) and its macro-economic impacts:

- **Geography:** individually all EU Member States.
- **Time horizon:** 2005 to 2050 (5-year time steps) in PRIMES-TREMOVE. ASTRA has been run up to 2030 for this impact assessment.
- **Transport modes covered:** private road passenger (cars, powered 2 wheelers), public road passenger (buses and coaches), road freight (heavy goods vehicles, light commercial vehicles), passenger rail, freight rail, passenger aviation, freight and passenger inland navigation and short sea shipping. Numerous classes of vehicles and transport means with tracking of technology vintages.
- **Regions/road types:** traffic represented at country level in PRIMES-TREMOVE[5]; by origin at NUTS 2 level in ASTRA and at link level by NUTS 3 region in TRUST.
- **Energy:** all crude oil derived fuels, biofuels, CNG, LNG, LPG, electricity and hydrogen (PRIMES-TREMOVE[6] and ASTRA).
- **Emissions:** greenhouse gas emissions and pollutants emissions (CO, NOx, PM2.5), and VOC (ASTRA).
- **Stock of vehicles:** full dynamics of stock turnover for road (more refined) and non-road transport means.
- **Macro-economic impacts:** GDP and employment (ASTRA).

A brief description of each model is provided below, followed by an explanation of each model's role in the context of this impact assessment.

4.1.1. ASTRA model

ASTRA (ASsessment of TRAnsport Strategies) is an integrated assessment model using a system dynamics approach[7,8]. It projects and evaluates the impacts of policy measures on GDP, employment, transport demand performance by mode for passenger and freight, vehicle fleet composition and transport emissions at country level for each EU Member State. Transport demand is generated for passenger and freight at NUTS 2 level.

The model includes four main components: economy, transport, technology and environment. The *macro-economic component* consists of five elements: supply side, demand side (including an investment module), an input-output model based on 25

[5] For trip classes distinction between urban areas (distinguished into one metropolitan and other urban areas) and inter-urban areas (distinguished into motorways and other roads).

[6] PRIMES-TREMOVE additionally provides for the linkage to refuelling/recharging infrastructure by trip type.

[7] Source: http://www.astra-model.eu/index.htm

[8] Source: http://www.assist-project.eu/assist-project-en/content/deliverables.php

economic sectors, employment module and government module. In addition, two trade models are implemented (i.e. intra-EU trade and EU to rest-of-the-world trade). The *transport component* is represented by means of two classical 4-stage transport models, one for passenger and one for freight transport, including endogenous feedback on all stages[9]. The transport network is not explicitly represented but information on network capacity is considered for the different transport modes drawing on the TRUST model. The *technology component* covers the differentiation of road vehicle fleets into age classes and different emission standard categories[10,11]. Investments and learning curves are included in the simulation of the fleet development process. Efficiency improvements are also included for non-road modes. The *environment component* calculates the emissions from transport based on traffic flows, the information on the composition of the vehicle fleets and on emission factors. ASTRA quantifies the impacts on fuel consumption, CO_2 emissions and air pollutants (NOx, PM, CO and VOC).

ASTRA allows quantifying the impact of policies in the field of *pricing* (e.g. road charging schemes for light duty and heavy duty vehicles, railways infrastructure charges), *taxation* (e.g. energy taxation, vehicle taxation, feebates), *infrastructure* (e.g. TEN-T projects accelerated implementation, improving frequency and reliability of service), *internal market* (e.g. opening of the domestic rail passenger market, elimination of restrictions on cabotage, simplification of formalities for ships travelling between EU ports), *efficiency standards* (e.g. CO_2 emissions standards for light duty and heavy duty vehicles, standards for controlling air pollution), *transport planning* (e.g. city logistics/urban freight distribution/urban consolidation centres) and *research and innovation* (e.g. increased replacement rate of inefficient and polluting vehicles, electromobility).

ASTRA has been recently used for a study on the deployment of C-ITS in Europe[12], for a study on the cost of non-completion of the TEN-T[13] and for a 2013 study on the Eurovignette Directive, and in a series of Horizon 2020 and FP7 research projects like: REFLEX, FUTRE, ASSIST, GHG-TransPoRD[14].

ASTRA is a private model, developed and maintained by TRT, MFIVE and Fraunhofer-ISI[15]. A version of ASTRA, so-called ASTRA-EC, is available to external users through a user interface[16].

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9 Even if a full origin-destination matrix is not modelled, demand is segmented according to trip purpose and in different distance bands to better consider the competition between alternative modes.

10 Road freight transport demand is segmented by different vehicle types: light commercial vehicles (below 3.5 tonnes), medium heavy goods vehicles (from 3.5 to 12 tonnes) and large heavy goods vehicles (above 12 tonnes) - according to different spatial domains (i.e. local, short, national, international). Assumptions on the composition of vehicle fleet used in each spatial domain are made to reflect the use of each vehicle type. The demand for new heavy goods vehicles as well as the replaced vehicles is associated with emission standards depending on the year of registration but the model only covers conventional diesel technologies. Nevertheless, the version of the model used for the IA includes also differentiation by fuel technology, based on the input of the PRIMES-TREMOVE model. For cars, the model differentiates the engine types, including e.g. hybrid, electric and fuel cells.

11 See Annex A of Ricardo et al. (2017) Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

12 Source: http://ec.europa.eu/transport/sites/transport/files/2016-c-its-deployment-study-final-report.pdf

13 Source : http://ec.europa.eu/transport/sites/transport/files/themes/infrastructure/studies/doc/2015-06-fraunhofer-cost-of-non-completion-of-the-ten-t.pdf

14 Source: http://www.astra-model.eu/downloads-research-applications.htm

15 Source: http://www.astra-model.eu/index.htm

16 Source: http://www.assist-project.eu/assist-project-en/content/deliverables.php

4.1.2. PRIMES-TREMOVE transport model

The PRIMES-TREMOVE transport model projects the evolution of demand for passengers and freight transport by transport mode and transport mean. It is essentially a dynamic system of multi-agent choices under several constraints, which are not necessarily binding simultaneously. The model consists of two main modules, the transport demand allocation module and the technology choice and equipment operation module. The two modules interact with each other and are solved simultaneously.

The projections include details for a large number of transport means, technologies and fuels, including conventional and alternative types, and their penetration in various transport market segments for each EU Member State. They also include details about greenhouse gas and air pollution emissions (e.g. NOx, PM, SOx, CO), as well as impacts on external costs of congestion, noise and accidents.

In the transport field, PRIMES-TREMOVE is suitable for modelling *soft measures* (e.g. eco-driving, deployment of Intelligent Transport Systems, 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 passenger cars and new light commercial vehicles; EURO standards on road transport vehicles; technology standards for non-road transport technologies), *infrastructure policies for alternative fuels* (e.g. deployment of refuelling/recharging infrastructure for electricity, hydrogen, LNG, CNG). Used as a module which contributes to a broader PRIMES scenario, it 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, it can show differentiated trends across Member States.

PRIMES-TREMOVE has been used for the 2011 White Paper on Transport, Low Carbon Economy and Energy 2050 Roadmaps, the 2030 policy framework for climate and energy and more recently for the Effort Sharing Regulation, the review of the Energy Efficiency Directive, the recast of the Renewables Energy Directive and for the European strategy on low-emission mobility.

The PRIMES-TREMOVE is a private model that has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[17], based on, but extending features of the open source TREMOVE model developed by the TREMOVE[18] modelling community. Part of the model (e.g. the utility nested tree) was built following the TREMOVE model[19]. Other parts, like the component on fuel consumption and emissions, follow the COPERT model.

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[17] Source: http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[18] Source: http://www.tmleuven.be/methode/tremove/home.htm

[19] 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 and LNG. 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.

As module of the PRIMES energy system model, PRIMES-TREMOVE[20] has been successfully peer reviewed[21], most recently in 2011[22].

4.1.3. TRUST

TRUST (TRansport eUropean Simulation Tool) is a European scale transport network model covering road, rail and maritime transport[23]. TRUST covers the whole Europe and its neighbouring countries and allows for the assignment of origin-destination matrices at NUTS 3 level (about 1600 zones) for passenger and freight demand.

TRUST projects the average daily loads on road links split by demand segment and by country of origin, road traffic activity (passenger-km, tonnes-km, vehicle-km) per year by country (based on territoriality principle), origin-destination journey time, road accessibility measures by NUTS 3 region, energy consumption and emissions of NOx, PM, VOC, CO and CO_2 by link.

Road transport demand is modelled in TRUST by means of origin-destination matrices between NUTS 3 zones. Intra-NUTS 3 demand is not part of the matrices as it is not assigned to the network, but implicitly considered as pre-load on links. TRUST freight matrix includes tonnes transported by vehicles above 3.5 tonnes (i.e. heavy goods vehicles) and no differentiation of the matrix by heavy goods vehicle type is available. For this reason, the model works with an average charge (currently weighted on the composition of the vehicle fleet and on the charges by vehicle size and EURO classes, where applied). Average charges are applied to the road network as link-based tolls and are differentiated according to link types (e.g. motorway, roads with separate carriageways, two-lane roads) and at country level.

National vignettes are applied as equivalent distance fares (i.e. the fare of the yearly vignette is translated into a distance-base cost as ratio between the cost of the vignette and the average annual travelled mileage on the charged network). The links where extra-tolls are levied (e.g. tunnels, mark-ups etc.) are modelled case by case. Link tolls, together with other variable operating costs (fuel and, for trucks, driver costs) are relevant for path choice during the assignment step.

TRUST is particularly suitable for modelling *road charging schemes* for cars and heavy goods vehicles, and policies in the field of *infrastructure* (e.g. completion of the core and comprehensive TEN-T network).

TRUST is a private model, developed and maintained by TRT[24]. It has been used for the 2013 ex-post evaluation of transport infrastructure charging policy, for the TRACC -

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[20] The model can be run either as a stand-alone tool (e.g. for the 2011 White Paper on Transport and for the 2016 Strategy on low-emission mobility) or fully integrated in the rest of the PRIMES energy systems model (e.g. for the Low Carbon Economy and Energy 2050 Roadmaps, for the 2030 policy framework for climate and energy, for the Effort Sharing Regulation, for the review of the Energy Efficiency Directive and for the recast of the Renewables Energy Directive). When coupled with PRIMES, interaction with the energy sector is taken into account in an iterative way.

[21] Source: http://ec.europa.eu/clima/policies/strategies/analysis/models/docs/primes_model_2013-2014_en.pdf.

[22] https://ec.europa.eu/energy/sites/ener/files/documents/sec_2011_1569_2.pdf

[23] See Annex A of Ricardo et al. (2017) Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

[24] Source : http://www.trt.it/en/tools/trust/

TRansport ACCessibility at regional/local scale and patterns in Europe[25] and for other TEN-T projects focusing on e.g. improving the ports and multimodal transport links of the northern Adriatic[26].

4.1.4. ASTRA, PRIMES-TREMOVE and TRUST role in the impact assessment

PRIMES-TREMOVE transport model is a building block of the modelling framework used for developing the EU Reference scenario 2016, and has a successful record of use in the Commission's transport, climate and energy policy analytical work – it is the same model as used for the 2011 White Paper on Transport and the 2016 European strategy on low-emission mobility. In this impact assessment, it has been used to define the Baseline scenario, having as a starting point the EU Reference scenario 2016 but additionally including few policy measures that have been adopted after its cut-off date (end of 2014). In addition, the large number of transport means, technologies and fuels, including conventional and alternative types, and its ability to evaluate the impact of tolls on the vehicle fleet renewal (i.e. trend and composition), made PRIMES-TREMOVE particularly suitable for assessing the impacts of modulation of infrastructure charges according to CO_2 emissions.

TRUST model is a European scale transport network model that allows for the assignment of origin-destination matrices at NUTS 3 level for passenger and freight demand. As the transport network is not represented in either PRIMES-TREMOVE or ASTRA, TRUST was used for evaluating the impacts of road assignment on link-based indicators (e.g. traffic and NOx emissions at link level). At Member State level, the Baseline trend of road transport activity has been estimated on the trend of road transport demand in the ASTRA model, which is calibrated according to PRIMES-TREMOVE projections.

ASTRA has been used to quantify the impacts of policy options, taking the form of integrated policy packages, and to provide indicators for the direct effects on the transport system (e.g. transport activity, energy use, air pollutant and CO_2 emissions) and for the indirect effects of transport on the economic system (e.g. GDP, employment). The Baseline scenario has been calibrated on PRIMES-TREMOVE projections. For the modulation of the infrastructure charges according to CO_2 emissions, in the first stage the PRIMES-TREMOVE model has been run while in the second stage PRIMES-TREMOVE results (i.e. the structure of the vehicle fleet by type of powertrain, euro class and age and its evolution; increase in road charges for vehicles with CO_2 emissions above the average[27]) have been used in defining the integrated policy packages (i.e. policy options) in ASTRA. For each policy options, ASTRA provides the TRUST model with the average road charge by country (based on the new vehicle fleet composition) and with updated road demand growth rate by mode, country, Origin-Destination and spatial domain. For policy options

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25 http://www.espon.eu/main/Menu_Projects/Menu_ESPON2013Projects/Menu_AppliedResearch/tracc.html

26 https://ec.europa.eu/inea/en/ten-t/ten-t-project-implementation-successes/improving-ports-and-multimodal-transport-links-northern

27 The increase in road charges for the part of the vehicle fleet with CO_2 emissions above the average has been derived while respecting revenue-neutrality, i.e. while reducing charges for vehicles with lower than average CO_2 emissions.

including congestion charging, feedback loops from TRUST to ASTRA are implemented to take account of the impacts on the transport network[28].

4.2. Baseline scenario

4.2.1. Scenario design, consultation process and quality assurance

The Baseline scenario used in this impact assessment builds on the EU Reference scenario 2016 but additionally includes few policy measures adopted after its cut-off date (end of 2014) and some updates in the technology costs assumptions.

Building an EU Reference scenario is a regular exercise by the Commission. It is coordinated by DGs ENER, CLIMA and MOVE in association with the JRC, and the involvement of other services via a specific inter-service group.

For the EU Reference scenario 2016, Member States were consulted throughout the development process through a specific Reference scenario expert group which met three times during its development. Member States provided information about adopted national policies via a specific questionnaire, key assumptions have been discussed and in each modelling step, draft Member State specific results were sent for consultation. Comments of Member States were addressed to the extent possible, keeping in mind the need for overall comparability and consistency of the results.

Quality of modelling results was assured by using state of the art modelling tools, detailed checks of assumptions and results by the coordinating Commission services as well as by the country specific comments by Member States.

The EU Reference scenario 2016 projects EU and Member States energy, transport and GHG emission-related developments up to 2050, given current global and EU market trends and adopted EU and Member States' energy, transport, climate and related relevant policies. "Adopted policies" refer to those that have been cast in legislation in the EU or in MS (with a cut-off date end of 2014[29]). Therefore, the binding 2020 targets are assumed to be reached in the projection. This concerns greenhouse gas emission reduction targets as well as renewables targets, including renewables energy in transport. The EU Reference scenario 2016 provides projections, not forecasts. Unlike forecasts, projections do not make predictions about what the future will be. They rather indicate what would happen if the assumptions which underpin the projection actually occur. Still, the scenario allows for a consistent approach in the assessment of energy and climate trends across the EU and its Member States.

The report " EU Reference Scenario 2016: Energy, transport and GHG emissions - Trends to 2050"[30] describes the inputs and results in detail. In addition, its main messages are summarised in the impact assessments accompanying the Effort Sharing Regulation[31] and

[28] See Annex A of Ricardo et al. (2017) Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

[29] In addition, amendments to two Directives only adopted in the beginning of 2015 were also considered. This concerns notably the ILUC amendment to the Renewables Directive and the Market Stability Reserve Decision amending the ETS Directive.

[30] ICCS-E3MLab et al. (2016), EU Reference Scenario 2016: Energy, transport and GHG emissions - Trends to 2050

[31] SWD(2016) 247

the revision of the Energy Efficiency Directive[32], and the analytical work accompanying the European strategy on low-emission mobility[33].

PRIMES-TREMOVE is one of the core models of the modelling framework used for developing the EU Reference scenario 2016 and has also been used for developing the Baseline scenario of this impact assessment. The model was calibrated on transport and energy data up to year 2013 from Eurostat and other sources.

4.2.2. Main assumptions of the Baseline scenario

The projections are based on a set of assumptions, including on population growth, macroeconomic and oil price developments, technology improvements, and policies.

Macroeconomic assumptions

The Baseline scenario uses the same macroeconomic assumptions as the EU Reference scenario 2016. The population projections draw on the European Population Projections (EUROPOP 2013) by Eurostat. The key drivers for demographic change are: higher life expectancy, convergence in the fertility rates across Member States in the long term, and inward migration. The EU28 population is expected to grow by 0.2% per year during 2010-2030 (0.1% for 2010-2050), to 516 million in 2030 (522 million by 2050). Elderly people, aged 65 or more, would account for 24% of the total population by 2030 (28% by 2050) as opposed to 18% today.

GDP projections mirror the joint work of DG ECFIN and the Economic Policy Committee, presented in the 2015 Ageing Report[34]. The average EU GDP growth rate is projected to remain relatively low at 1.2% per year for 2010-2020, down from 1.9% per year during 1995-2010. In the medium to long term, higher expected growth rates (1.4% per year for 2020-2030 and 1.5% per year for 2030-2050) are taking account of the catching up potential of countries with relatively low GDP per capita, assuming convergence to a total factor productivity growth rate of 1% in the long run.

Fossil fuel price assumptions

Oil prices used in the Baseline scenario are the same with those of the EU Reference scenario 2016. Following a gradual adjustment process with reduced investments in upstream productive capacities by non-OPEC[35] countries, the quota discipline is assumed to gradually improve among OPEC members and thus the oil price is projected to reach 87 $/barrel in 2020 (in year 2013-prices). Beyond 2020, as a result of persistent demand growth in non-OECD countries driven by economic growth and the increasing number of passenger cars, oil price would rise to 113 $/barrel by 2030 and 130 $/barrel by 2050.

No specific sensitivities were prepared with respect to oil price developments. Still, it can be recalled that lower oil price assumptions tend to increase energy consumption and CO_2 emissions not covered by the ETS. The magnitude of the change would depend on the price elasticities and on the share of taxation, like excise duties, in consumer prices. For transport, the high share of excise duties in the consumer prices act as a limiting factor for the increase in energy consumption and CO_2 emissions.

Techno-economic assumptions

[32] SWD(2016) 405
[33] SWD(2016) 244
[34] European Commission/DG ECFIN (2014), The 2015 Ageing Report: Underlying Assumptions and Projection Methodologies, European Economy 8/2014.
[35] OPEC stands for Organization of Petroleum Exporting Countries.

For all transport means, except for light duty vehicles (i.e. passenger cars and light commercial vehicles), the Baseline scenario uses the same technology costs assumptions as the EU Reference scenario 2016.

For light duty vehicles, the data for technology costs and emissions savings has been updated based on a recent study commissioned by DG CLIMA[36]. Battery costs for electric vehicles are assumed to go down to 205 euro/kWh by 2030 and 160 euro/kWh by 2050; further reductions in the cost of both spark ignition gasoline and compression ignition diesel are assumed to take place. Technology cost assumptions are based on extensive literature review, modelling and simulation, consultation with relevant stakeholders, and further assessment by the Joint Research Centre (JRC) of the European Commission.

Specific policy assumptions

The key policies included in the Baseline scenario, similarly to the EU Reference scenario 2016, are[37]:

- CO2 standards for cars and vans regulations (Regulation (EC) No 443/2009, amended by Regulation (EU) No 333/2014 and Regulation (EU) No 510/2011, amended by Regulation (EU) No 253/2014); CO2 standards for cars are assumed to be 95gCO2/km as of 2021 and for vans 147gCO2/km as of 2020, based on the NEDC test cycle, in line with current legislation. No policy action to strengthen the stringency of the target is assumed after 2020/2021.
- The Renewable Energy Directive (Directive 2009/28/EC) and Fuel Quality Directive (Directive 2009/30/EC) including ILUC amendment (Directive 2015/1513/EU): achievement of the legally binding RES target for 2020 (10% RES in transport target) for each Member State, taking into account the use of flexibility mechanisms when relevant as well as of the cap on the amount of food or feed based biofuels (7%). Member States' specific renewable energy policies for the heating and cooling sector are also reflected where relevant.
- Directive on the deployment of alternative fuels infrastructure (Directive 2014/94/EU).
- Directive on the charging of heavy goods vehicles for the use of certain infrastructures (Directive 2011/76/EU amending Directive 1999/62/EC).
- Relevant national policies, for instance on the promotion of renewable energy, on fuel and vehicle taxation, are taken into account.

In addition, a few policy measures adopted after the cut-off date of the EU Reference scenario 2016 at both EU and Member State level, have been included in the Baseline scenario:

- Directive on weights & dimensions (Directive 2015/719/EU);
- Directive as regards the opening of the market for domestic passenger transport services by rail and the governance of the railway infrastructure (Directive 2016/2370/EU);

[36] Source: https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/technology_results_web.xlsx

[37] For a comprehensive discussion see the Reference scenario report: "EU Reference Scenario 2016: Energy, transport and GHG emissions - Trends to 2050"

- Directive on technical requirements for inland waterway vessels (Directive 2016/1629/EU), part of the Naiades II package;
- Regulation establishing a framework on market access to port services and financial transparency of ports[38];
- The replacement of the New European Driving Cycle (NEDC) test cycle by the new Worldwide harmonized Light-vehicles Test Procedure (WLTP) has been implemented in the Baseline scenario, drawing on work by JRC. Estimates by JRC show a WLTP to NEDC CO_2 emissions ratio of approximately 1.21 when comparing the sales-weighted fleet-wide average CO_2 emissions. WLTP to NEDC conversion factors are considered by individual vehicle segments, representing different vehicle and technology categories[39].
- For Germany, an extension of the toll network by roughly 40,000 kilometres of federal trunk road from 2018 onwards for all heavy goods vehicles over 7.5t.[40]
- For Austria, the incorporation of exhaust emissions and noise pollution in the distance based charges. All federal highways and motorways, totalling around 2,200 km, are subject to distance based charges.
- For Belgium, a distance based system replaced the former Eurovignette for heavy goods vehicles over 3.5t from April 2016. The system applies to all inter-urban motorways, main (national) roads[41] and all urban roads in Brussels.
- For Latvia, the introduction of a vignette system applied for goods vehicles below 3.5t on the motorways, starting with 1 January 2017. In addition, for all heavy goods vehicles over 3.5t the vignette rates applied on motorways for the EURO 0, EURO I, EURO II are increased by 10% starting with 1 January 2017.

[38] Awaiting signature of act (Source : http://www.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2013/0157(COD)&l=en)

[39] Simulation at individual vehicle level is combined with fleet composition data, retrieved from the official European CO_2 emissions monitoring database, and publicly available data regarding individual vehicle characteristics, in order to calculate vehicle CO_2 emissions and fuel consumption over different conditions. Vehicle CO_2 emissions are initially simulated over the present test protocol (NEDC) for the 2015 passenger car fleet; the accuracy of the method is validated against officially monitored CO_2 values and experimental data.

[40] Currently, 15,000 kilometres of federal trunk road and motorways are subject to tolls.

[41] E.g. http://www.viapass.be/fileadmin/viapass/documents/download/VlaanderenE.JPG

Figure 4-1: Summary of road charging systems applied by Member States in the Baseline

Current Situation			AT	BE	BG	CY	CZ	DE[42]	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge	Vignette	HGV <12t			■														■		■					■				
		HGV >12 t			■				■										■	■	■		■			■	■			■
		Buses			■											■			■		■					■				
		Vans	■		■		■									■			■		■					■		■	■	
		Cars	■		■		■									■										■		■	■	
	Toll	HGV <12t	■	■			■	▨			■	■		■	■	■	■	■						■	■			■	■	
		HGV >12 t	■	■			■	■			■	■		■	■	■	■	■						■	■			■	■	
		Buses	■				■				■	■		■	■		■	■						■	■			■	■	
		Vans									■	■		■	■		■	■						■	■					
		Cars									■	■		■	■		■	■						■	■					
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
EURO Class modulation		HGV		■	■		■		■							■			■	■	■		■	■			■	■	■	
		Buses			■		■												■		■			■				■	■	
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs		HGV	■					■																						
		Buses	■																											
Congestion charging		All																												
Mark-ups		HGV	■																											
		Buses	■																											
Reduced circulation taxes		HGV																												

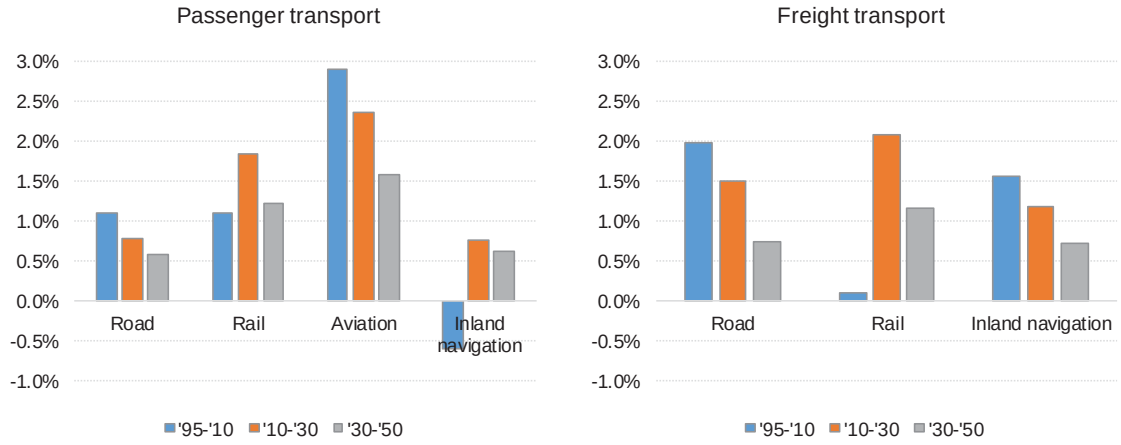
[42] In the Baseline only tolls for HGVs above 7.5 t apply.

4.2.3. Summary of main results of the Baseline scenario

EU transport activity is expected to continue growing under current trends and adopted policies beyond 2015, albeit at a slower pace than in the past. Freight transport activity for inland modes is projected to increase by 36% between 2010 and 2030 (1.5% per year) and 60% for 2010-2050 (1.2% per year). Passenger traffic growth would be slightly lower than for freight at 23% by 2030 (1% per year) and 42% by 2050 (0.9% per year for 2010-2050). The annual growth rates by mode, for passenger and freight transport, are provided in Figure 4-2[43].

Road transport would maintain its dominant role within the EU. The share of road transport in inland freight is expected to slightly decrease at 70% by 2030 and 69% by 2050. The activity of heavy goods vehicles expressed in tonnes kilometres is projected to grow by 35% between 2010 and 2030 (56% for 2010-2050) in the Baseline scenario, while light goods vehicles activity would go up by 27% during 2010-2030 (50% for 2010-2050). For passenger transport, road modal share is projected to decrease by 4 percentage points by 2030 and by additional 3 percentage points by 2050. Passenger cars and vans would still contribute 70% of passenger traffic by 2030 and about two thirds by 2050, despite growing at lower pace (17% for 2010-2030 and 31% during 2010-2050) relative to other modes, due to slowdown in car ownership increase which is close to saturation levels in many EU15 Member States and shifts towards rail.

Figure 4-2: Passenger and freight transport projections (average growth rate per year)



Source: Baseline scenario, PRIMES-TREMOVE transport model (ICCS-E3MLab)
Note: For aviation, domestic and international intra-EU activity is reported, to maintain the comparability with reported statistics.

Rail transport activity is projected to grow significantly faster than for road, driven in particular by the opening of the market for domestic passenger rail transport services and the effective implementation of the TEN-T guidelines, supported by the CEF funding, leading to the completion of the TEN-T core network by 2030 and of the comprehensive network by 2050. Passenger rail activity goes up by 44% between 2010 and 2030 (84% for 2010-2050), increasing its modal share by 1 percentage point by 2030 and an additional percentage point by 2050. Rail freight activity grows by 51% by 2030 and 90% during 2010-2050, resulting in 2 percentage points increase in modal share by 2030 and an additional percentage point by 2050.

[43] Projections for international maritime and international extra-EU aviation are presented separately and not included in the total passenger and freight transport activity to preserve comparability with statistics for the historical period.

Domestic and international intra-EU air transport would grow significantly (by 59% by 2030 and 118% by 2050) and increase its share in overall transport demand (by 3 percentage points by 2030 and by additional 2 percentage points by 2050). Overall, aviation activity including international extra-EU flights is projected to go up by 60% by 2030 and 124% by 2050, saturating European skies and airports.

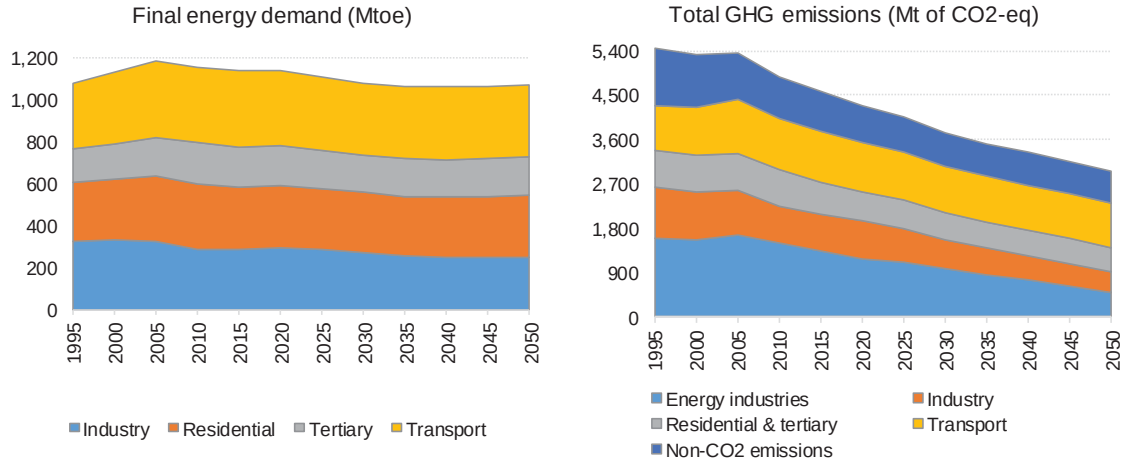
Transport activity of freight inland navigation[44] also benefits from the completion of the TEN-T core and comprehensive network, the promotion of inland waterway transport and the recovery in the economic activity and would grow by 26% by 2030 (1.2% per year) and by 46% during 2010-2050 (0.9% per year).

International maritime transport activity is projected to continue growing strongly with rising demand for oil, coal, steel and other primary resources – which would be more distantly sourced – increasing by 37% by 2030 and by 71% during 2010-2050.

Transport accounts today for about one third of final energy consumption. In the context of growing activity, energy use in transport is projected to decrease by 5% between 2010 and 2030 and to stabilise post-2030 (see Figure 4-3). These developments are mainly driven by the implementation of the Regulations setting emission performance standards for new light duty vehicles. Light duty vehicles are currently responsible for around 60% of total energy demand in transport but this share is projected to significantly decline over time, to 53% by 2030 and 49% by 2050. Energy use in passenger cars and passenger vans is projected to go down by 19% during 2010-2030 (-24% for 2010-2050). Heavy goods vehicles are projected to increase their share in final energy demand from 2010 onwards, continuing the historic trend from 1995. Energy demand by heavy goods vehicles would grow by 14% between 2010 and 2030 (23% for 2010-2050).

Bunker fuels for air and maritime transport are projected to increase significantly: by 17% by 2030 (33% for 2010-2050) and 24% by 2030 (42% for 2010-2050), respectively.

Figure 4-3: Evolution of total final energy consumption and GHG emissions for 1995-2050



Source: Baseline scenario, PRIMES model (ICCS-E3MLab)

Electricity use in transport is expected to increase steadily as a result of further rail electrification and the uptake of alternative powertrains in road transport; its share increases from 1% currently to 3% in 2030 and 4% in 2050. Battery electric and plug-in hybrid electric vehicles are expected to see faster growth beyond 2020, in particular in the segment of light duty vehicles, driven by EU and national policies offering various

[44] Inland navigation covers inland waterways and national maritime.

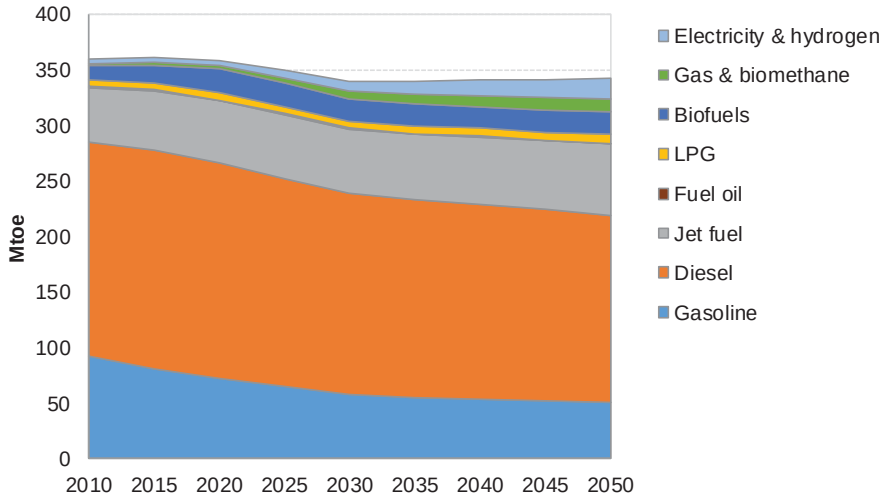
incentives and the decrease in battery costs. The share of battery electric and plug-in hybrid electric vehicles in the total light duty vehicle stock would reach about 6% by 2030 and 15% by 2050 (with the shares of battery electric being 2% in 2030 and 6% in 2050). The uptake of hydrogen would be facilitated by the increased availability of refuelling infrastructure, but its use would remain limited in lack of additional policies beyond those assumed in the Baseline scenario. Fuel cells would represent about 3% of the light duty vehicle stock by 2050.

LNG becomes a candidate energy carrier for road freight and waterborne transport, especially in the medium to long term, driven by the implementation of the Directive on the deployment of alternative fuels infrastructure and the revised TEN-T guidelines which represent important drivers for the higher penetration of alternative fuels in the transport mix. In the Baseline scenario, the share of LNG is projected to go up to 3% by 2030 (8% by 2050) for road freight and 4% by 2030 (7% by 2050) for inland navigation. LNG would provide about 4% of maritime bunker fuels by 2030 and 10% by 2050 – especially in the segment of short sea shipping.

Biofuels uptake is driven by the legally binding target of 10% renewable energy in transport (Renewables Directive), as amended by the ILUC Directive, and by the requirement for fuel suppliers to reduce the GHG intensity of road transport fuel by 6% (Fuel Quality Directive). Beyond 2020, biofuel levels would remain relatively stable at around 6% in the Baseline scenario. The Baseline scenario does not take into account the recent proposal by the Commission for a recast of the Renewables Energy Directive.

In the Baseline scenario, **oil products would still represent about 90% of the EU transport sector needs in 2030** and 85% in 2050, despite the renewables policies and the deployment of alternative fuels infrastructure which support some substitution effects towards biofuels, electricity, hydrogen and natural gas (see Figure 4-4).

Figure 4-4: Evolution of final energy use in transport by type of fuel



Source: Baseline scenario, PRIMES-TREMOVE transport model (ICCS-E3MLab)

The **declining trend in transport emissions is expected to continue**, leading to 13% lower emissions by 2030 compared to 2005, and 15% by 2050.[45] However, relative to 1990 levels, emissions would still be 13% higher by 2030 and 10% by 2050, owing to the fast rise in the transport emissions during the 1990s. The share of transport in total GHG

[45] Including international aviation but excluding international maritime and other transportation.

emissions would continue increasing, going up from 23% currently (excluding international maritime) to 25% in 2030 and 31% in 2050, following a relatively lower decline of emissions from transport compared to power generation and other sectors (see Figure 4-3). Aviation would contribute an increasing share of transport emissions over time, increasing from 14% today to about 18% in 2030 and 21% in 2050. Maritime bunker fuel emissions are also projected to grow strongly, increasing by 22% during 2010-2030 (38% for 2010-2050).

CO_2 emissions from road freight transport (heavy goods and light goods vehicles) are projected to increase by 6% between 2010 and 2030 (11% for 2010-2050) in the Baseline scenario. For heavy goods vehicles, the increase would be somewhat higher (10% for 2010-2030 and 17% for 2010-2050), in lack of specific measures in place. At the same time, emissions from passenger cars and passenger vans are projected to decrease by 22% between 2010 and 2030 (32% for 2010-2050) thanks to the CO_2 standards in place and the uptake of electromobility. CO_2 emissions from buses and coaches are projected to remain relatively unchanged by 2030 compared to their 2010 levels, and to slightly increase post-2030 (3% increase for 2010-2050).

The overall trend in transport emissions is determined by three broad components: transport activity levels (expressed in passenger or tonne-kilometres), the energy intensity of transport (defined as energy consumption per passenger or tonne-kilometre) and the carbon intensity of the energy used (given by the CO_2 emissions divided by energy consumption). Following this approach, it has been evaluated how much the projected transport emissions will increase/decrease (in percentage terms or Mt of CO_2) between 2010 and 2030 due to transport activity growth, improvements in energy intensity and carbon intensity (see Figure 4-5).[46,47]

Overall, CO_2 emissions from passenger transport decrease by 14% (109 Mt of CO_2) between 2010 and 2030 in the Baseline scenario. The 14% decrease in CO_2 emissions from passenger transport is due to transport activity growth (+21%, equivalent to 165 Mt of CO_2), improvements in energy intensity (-31%, equivalent to 246 Mt of CO_2) and in carbon intensity (-4%, equivalent to 28 Mt of CO_2). The trend for the three components and their contribution to emissions is different by transport mode. Efficiency gains play a decisive role in reducing emissions in road transport, while in aviation they would not offset the activity growth leading to higher fuel use and emissions. The use of less CO_2 intensive fuels contributes to a reduction of emissions for road and rail passenger transport with no effect on aviation by 2030.

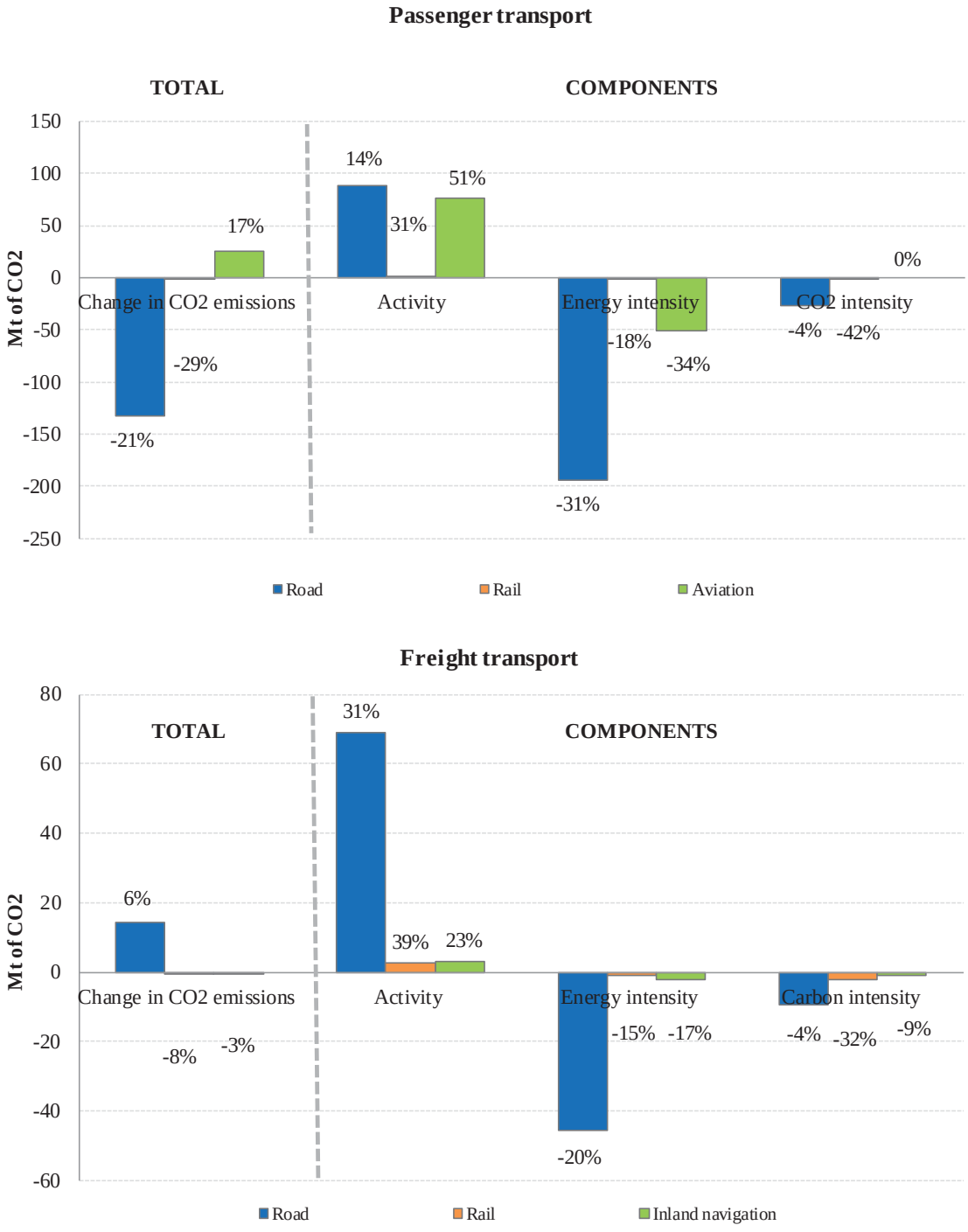
For freight transport, the 5% (13 Mt of CO_2) increase in CO_2 emissions between 2010 and 2030 is the result of transport activity growth (+30%, equivalent to 75 Mt of CO_2), improvements in energy intensity (-20%, equivalent to 49 Mt of CO_2) and in carbon intensity (-5%, equivalent to 13 Mt of CO_2). The efficiency gains and the uptake of alternative fuels for road freight transport are not sufficient to offset the effects of activity growth, and thus CO_2 emissions go up between 2010 and 2030. The electrification in rail has positive effects on emissions, despite the growth in traffic volumes. For inland

[46] The proposed method is the Montgomery decomposition. For a recent application of the method see: De Boer, P.M.C. (2008) Additive Structural Decomposition Analysis and Index Number Theory: An Empirical Application of the Montgomery Decomposition, Economic Systems Research, 20(1), pp. 97-109.

[47] The decomposition analysis only takes into account the tank to wheel emissions, under the assumption that biofuels are carbon neutral.

navigation, efficiency gains and to some lower extent the uptake of LNG has also positive effects on emissions reduction.

Figure 4-5: Decomposition of CO_2 emissions in the Baseline scenario (2010-2030)



Source: EC elaboration based on the Baseline scenario, PRIMES-TREMOVE transport model (ICCS-E3MLab)

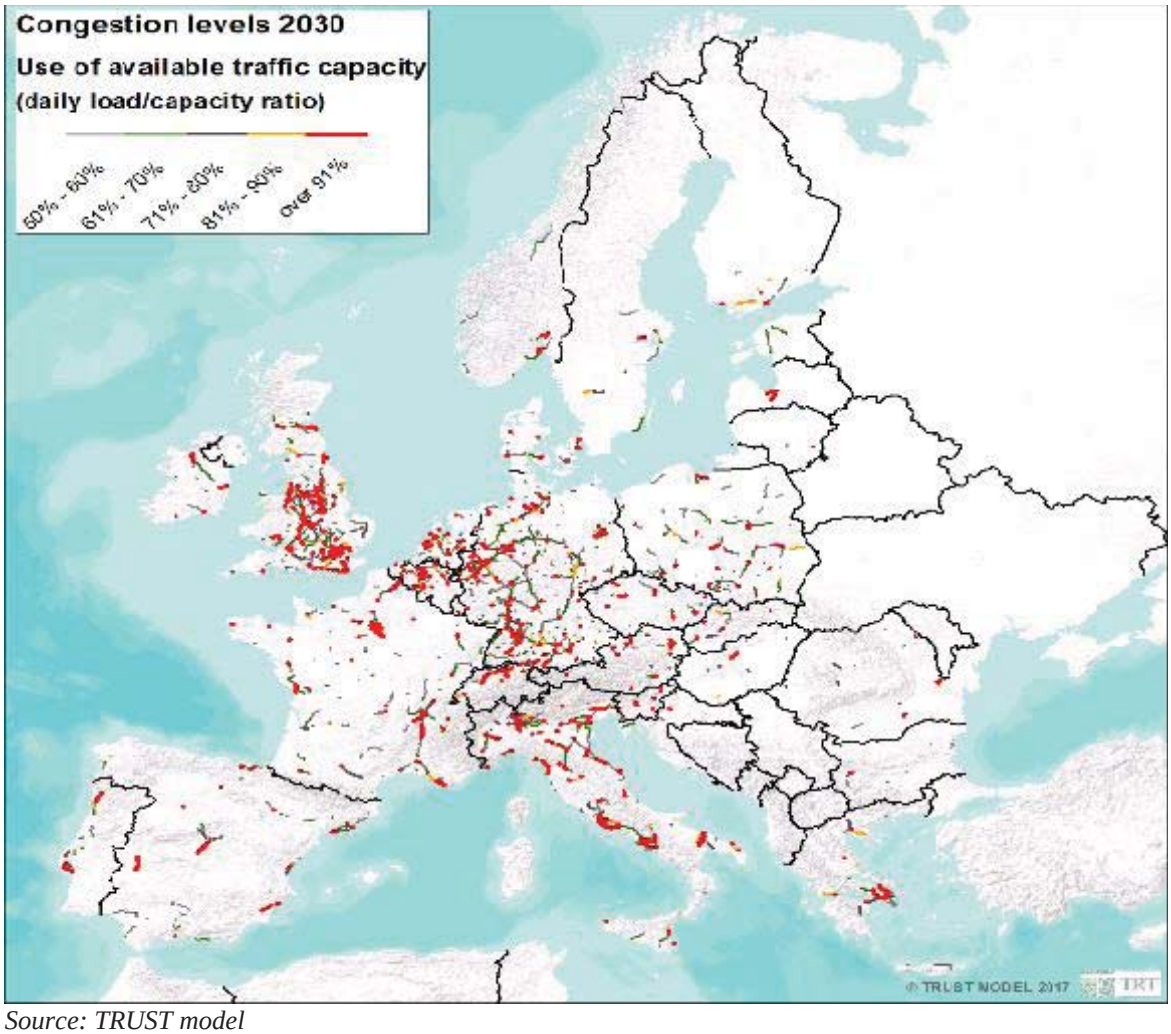
Note: The figures report the changes in CO_2 emissions due to the three broad components (transport activity levels, energy intensity of transport and carbon intensity of the energy used) in two ways: in levels and in relative terms compared to 2010. The size of each column bar, read on the left axis, represents the change in terms of CO_2 emissions compared to 2010, expressed in Mt of CO_2. The percentage changes reported above the column bars represent relative changes in these emissions compared to their respective 2010 levels. Provided that CO_2 levels for 2010 corresponding to each transport mode are not comparable in size, the

percentage changes reported in the figures are not directly comparable. The figures above include only tank to wheel emissions.

NOx emissions would drop by about 56% by 2030 (64% by 2050) with respect to 2010 levels. The decline in **particulate matter** (PM2.5) would be less pronounced by 2030 at 51% (65% by 2050). By 2030, over 75% of heavy goods vehicle stock is projected to be Euro VI in the Baseline scenario and more than 80% of the passenger cars stock is projected to be Euro 6. Overall, external costs related to air pollutants would decrease by about 56% by 2030 (65% by 2050).[48]

High congestion levels are expected to seriously affect road transport in several Member States by 2030 in the absence of effective countervailing measures such as road pricing. While urban congestion will mainly depend on car ownership levels, urban sprawl and the availability of public transport alternatives, congestion on the inter-urban network would be the result of growing freight transport activity along specific corridors, in particular where these corridors cross urban areas with heavy local traffic (see Figure 4-6). The largest part of congestion will be concentrated near densely populated zones with high economic activity such as Belgium and the Netherlands – to a certain extent as a result of port and transhipment operations – and in large parts of Germany, the United Kingdom and northern Italy. Congestion patterns differ significantly among Member States though, since their hourly, daily and seasonal variation depends on local conditions.

Figure 4-6: Congestion levels on the inter-urban network in the Baseline scenario for 2030



Source: TRUST model

[48] External costs are expressed in 2013 prices. They cover NOx, PM2.5 and SOx emissions.

Estimating the costs of congestion is not straightforward, because it occurs mostly during certain times of the day, often caused by specific bottlenecks in the network. In the Baseline scenario, total **congestion costs for urban and inter-urban network are projected to increase** by about 24% by 2030 and 43% by 2050, relative to 2010.

Noise related external costs of transport would continue to increase, by about 17% during 2010-2030 (24% for 2010-2050), driven by the rise in traffic. Thanks to policies in place, external **costs of accidents** are projected to go down by about 46% by 2030 (-42% for 2010-2050) – but still remain high at over €100 billion in 2050. Overall, external costs[49] are projected to decrease by about 10% by 2030 and to increase post-2030; by 2050 they stabilise around levels observed in 2010.

4.3. Detailed description of the policy measures and assumptions used in the Policy Options

4.3.1. Policy Option 1

PO1 builds on the Baseline scenario and additionally includes the following modelling assumptions (see **Figure 4-7** for a summary of measures by Member State):

- **Remove exemptions for HGVs below 12 tonnes:** it is assumed that time-based charges for HGVs below 12 tonnes are introduced in Denmark, Luxembourg, the Netherlands, Sweden and the United Kingdom starting from 2025. The rates for HGVs below 12 tons are set at 65% of those already existing for HGVs above 12 tons. For Germany an extension of the tolling system to HGVs below 7.5 tons is assumed from 2020 onwards.
- **Promote zero-emission vehicles by allowing reduced rates:** starting with 2020 it is assumed that zero-emission HGVs and buses are exempt from charging and zero-emission vans and cars benefit of a 50% reduction.[50]
- **Extension of mark-ups beyond mountain regions:** introduction of mark-ups is assumed on some roads in France and in Slovenia. For modelling purposes plans for mark-ups are mainly assumed in mountain regions; this is because they are the only real examples available to test the introduction of possible future schemes. These examples can also show the possible differences in effect on larger and smaller Member States.
- **Reviewing of maximum values for external cost charging** to better reflect external costs of air pollution and noise. The maximum permissible external cost charge limits and the external cost charges currently applied in Germany and Austria[51] are provided in Annex 5. For modelling purposes, in PO1 it is assumed that external costs are increased from 2020 onwards in Germany for HGVs and in Austria for HGVs and buses according to the values of the 2014 Handbook on external costs of transport[52]. The review implies using more proportionate values for external cost charges, i.e. differentiated according to vehicle weight (heavier trucks pollute more than lighter ones). The values do not change between policy options and are set in line with the 2014 Handbook on external costs of transport.

[49] External costs cover here air pollution, congestion, noise and accidents.
[50] Reduced rates are implemented only in Member States where road charging systems are in place.
[51] Currently these are the only Member States making use of this possibility offered by Directive 1999/62/EC
[52] Ricardo-AEA et al (2014), Update of the Handbook on External Costs of Transport: http://ec.europa.eu/transport/themes/sustainable/studies/sustainable_en

Figure 4-7: Summary of policy measures introduced in PO1 relative to the Baseline

			AT	BE	BG	CY	CZ	DE[53]	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge variations	**Vignette**	HGV <12t																												
		HGV >12 t																												
		Buses																												
		Vans																												
		Cars																												
	Toll	HGV <12t																												
		HGV >12 t																												
		Buses																												
		Vans																												
		Cars																												
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
Phasing out EURO Class modulation		HGV																												
		Buses																												
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs[54]		HGV																												
		Buses																												
Congestion charging		All																												
Mark-ups		HGV																												
		Buses																												
Reduced circulation taxes		HGV																												

Note: measures included in PO1 relative to the Baseline are reported in green.

[53] In PO1 tolls for HGVs also apply below 7.5 t.

[54] In the context of reviewing the maximum values for external cost charging to better reflect external costs for air pollution and noise, the charges for HGVs and buses for Austria and for HGVs for Germany are increased in line with the values of the 2014 Handbook on external costs of transport.

4.3.2. Policy option 2

PO2 builds on PO1 and additionally includes the following modelling assumptions:

- **Phase out vignettes for HGVs above 3.5 tonnes and buses** starting in 2025[55] with the introduction of new distance based charging systems in Denmark, Lithuania, Luxembourg, Latvia, the Netherlands, Romania, Sweden and the United Kingdom and the extension of the existing ones to cover also buses in Belgium, Germany and Hungary. Additionally, for Bulgaria the phasing out of vignette for HGV is assumed starting with 2020[56]. The average charges assumed for modelling purposes are summarised in Figure 4-8.

Figure 4-8: Assumed average distance-base charges replacing existing vignettes (€cent/km)

Country	HGV 3.5t - 12t	HGV> 12 t	Buses
BE	Unchanged	Unchanged	13,5
BG	8,18	14,49	8,18
DE	13,5	Unchanged	13,5
DK	13,5	16,3	13,5
HU	Unchanged	Unchanged	11,7
LT	8,18	14,49	8,18
LU	13,5	16,3	13,5
LV	8,18	14,49	8,18
NL	13,5	16,3	13,5
RO	8,18	14,49	8,18
SE	13,5	16,3	13,5
UK	13,5	16,3	13,5

- **Phase out Euro class-differentiation and more extensive use of external cost charging** starting in 2025. The measure is simulated through the elimination of modulation of infrastructure charges by Euro class in all Member States where it is applied and the assumed introduction of external cost charging for air and noise pollution in those Member States, based on 2014 Handbook on external costs of transport[57]. More specifically, external cost charging for HGVs would be additionally applied in PO2 in Belgium, Bulgaria, Czech Republic, Denmark, Hungary, Lithuania, Latvia, Luxembourg, the Netherlands, Poland, Sweden, Slovenia and Slovakia and for buses in Bulgaria, Czech Republic, Lithuania, Latvia, Poland, Slovenia and Slovakia.

- **Phasing in of revenue-neutral modulation of infrastructure charges according to CO_2 emissions for HGVs above 3.5 tonnes and buses** starting in 2025. The measure is assumed to apply in all Member States except Cyprus, Estonia, Finland and Malta (where no charging system is applied). The revised charges are based on the results of the PRIMES-TREMOVE model (ICCS-E3MLab)[58]. The assumptions used for the modulation of infrastructure charges according to CO_2 emissions are provided in **Figure 4-9**.

[55] Assumptions about changes in the charging systems were made in 5-year steps. The assumptions regarding the timing of the introduction of the measures are conservative, considering the uncertainty.

[56] The time of the introduction of the measure has been assumed in line with the Government plans. These plans have not yet been adopted in law and thus they are not considered in the Baseline.

[57] http://ec.europa.eu/transport/themes/sustainable/internalisation_en

[58] This measure has been modelled in two steps. In the first step, the PRIMES-TREMOVE model has been run. In the second step, PRIMES-TREMOVE results (i.e. the structure of the vehicle fleet by type of powertrain, age and its evolution; the increase in road charges for vehicles with CO_2 emissions above the average) have been used in defining the integrated policy package in ASTRA model.

Figure 4-9: Assumptions used for the modulation of infrastructure charges according to CO_2 emissions for HGVs and buses/coaches

Environmental performance	Euro 0-VI	New low CO_2-emission vehicles[59]
Heavy goods vehicles between 3.5 tonnes and 7.5 tonnes plus buses/coaches	Charge above average rate	Assume 25% reduction in charges versus Euro 0-VI
Heavy goods vehicles above 7.5 tonnes	Charge above average rate	Assume 25% reduction in charges versus Euro 0-VI

- **Rebates for all zero emission vehicles** are assumed starting with 2020 in almost all MSs (except Cyprus, Estonia, Finland and Malta where no charging system is applied). Rebates imply the full exemption from tolls for zero emission HGV and buses and 50% reduction for zero emission vans and passenger cars. Exemptions for HGV below 12 tonnes are phased in from 2025 onwards in Denmark, Lithuania, Luxembourg, Latvia, the Netherlands, Romania, Sweden and the United Kingdom, and from 2020 onwards for BG[60].
- **Reduction of circulation taxes for HGV above 12 tonnes and below 12 tonnes**, according to **Figure 4-10**, where a 50% reduction is assumed for distance-based systems already in place and exemptions for new distance-based systems.

Figure 4-10: Implementation of reduced circulation taxes

Country	HGVs > 12 tonnes and HGVs < 12 tonnes
AT	2020 (50% reduction)
BE	2020 (50% reduction)
BG	2020 (Exemption)
CY	-
CZ	2020 (50% reduction)
DE	2020 (50% reduction)
DK	2025 (Exemption)
EL	2020 (50% reduction)
ES	2020 (50% reduction)
FR	2020 (50% reduction)
HR	2020 (50% reduction)
HU	2020 (50% reduction)
IE	2020 (50% reduction)
IT	2020 (50% reduction)
LT	2025 (Exemption)
LU	2025 (Exemption)
LV	2025 (Exemption)
MT	-
NL	2025 (Exemption)
PL	2020 (50% reduction)
PT	2020 (50% reduction)
RO	2025 (Exemption)
SE	2025 (Exemption)
SI	2020 (50% reduction)
SK	2020 (50% reduction)
UK	2025 (Exemption)

Figure 4-11 below provides a summary of the measures included in PO2, by Member State.

[59] 'Low emission' vehicles are defined as below the average (VECTO baseline).

[60] Differences in the timing of introduction are linked to the introduction of distance-based systems in these Member States.

Figure 4-11: Summary of policy measures introduced in PO2 relative to the Baseline

			AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge variations	Vignette	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
	Toll	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
Phasing out EURO Class modulation		HGV																												
		Buses																												
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs		HGV																												
		Buses																												
Congestion charging		All																												
Mark-ups		HGV																												
		Buses																												
Reduced circulation taxes		HGV																												

Note: measures included in PO1 and PO2 are reported in green; additional measures included in PO2 are reported in blue.

4.3.3. Policy option 2 – sensitivity case (PO2s)

PO2s (sensitivity case) builds on PO2 but additionally includes the following modelling assumptions:

- Phase-in of distance-based charges for all HGVs and buses in Estonia and Finland starting with 2025.
- Phase-in of revenue-neutral modulation of infrastructure charges according to CO_2 emissions for HGVs above 3.5 tonnes and buses starting with 2025 for Estonia and Finland. Similarly to PO2, the revised charges are based on the results of the PRIMES-TREMOVE model (ICCS-E3MLab).
- Rebates for all zero emission vehicles starting with 2025 in Estonia and Finland.
- Exemption of circulation taxes for HGVs from 2025 onwards in Estonia and Finland.

Figure 4-12 below provides a summary of the measures included in PO2s, by Member State.

Figure 4-12: Summary of policy measures introduced in PO2s (sensitivity case) relative to the Baseline

			AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge variations	Vignette	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
	Toll	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
Phasing out EURO Class modulation		HGV																												
		Buses																												
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs		HGV																												
		Buses																												
Congestion charging		All																												
Mark-ups		HGV																												
		Buses																												
Reduced circulation taxes		HGV																												

Note: measures included in PO1 and PO2 are reported in green; measures included in PO2 and PO2s are reported in blue; additional measures included in PO2s are reported in light blue.

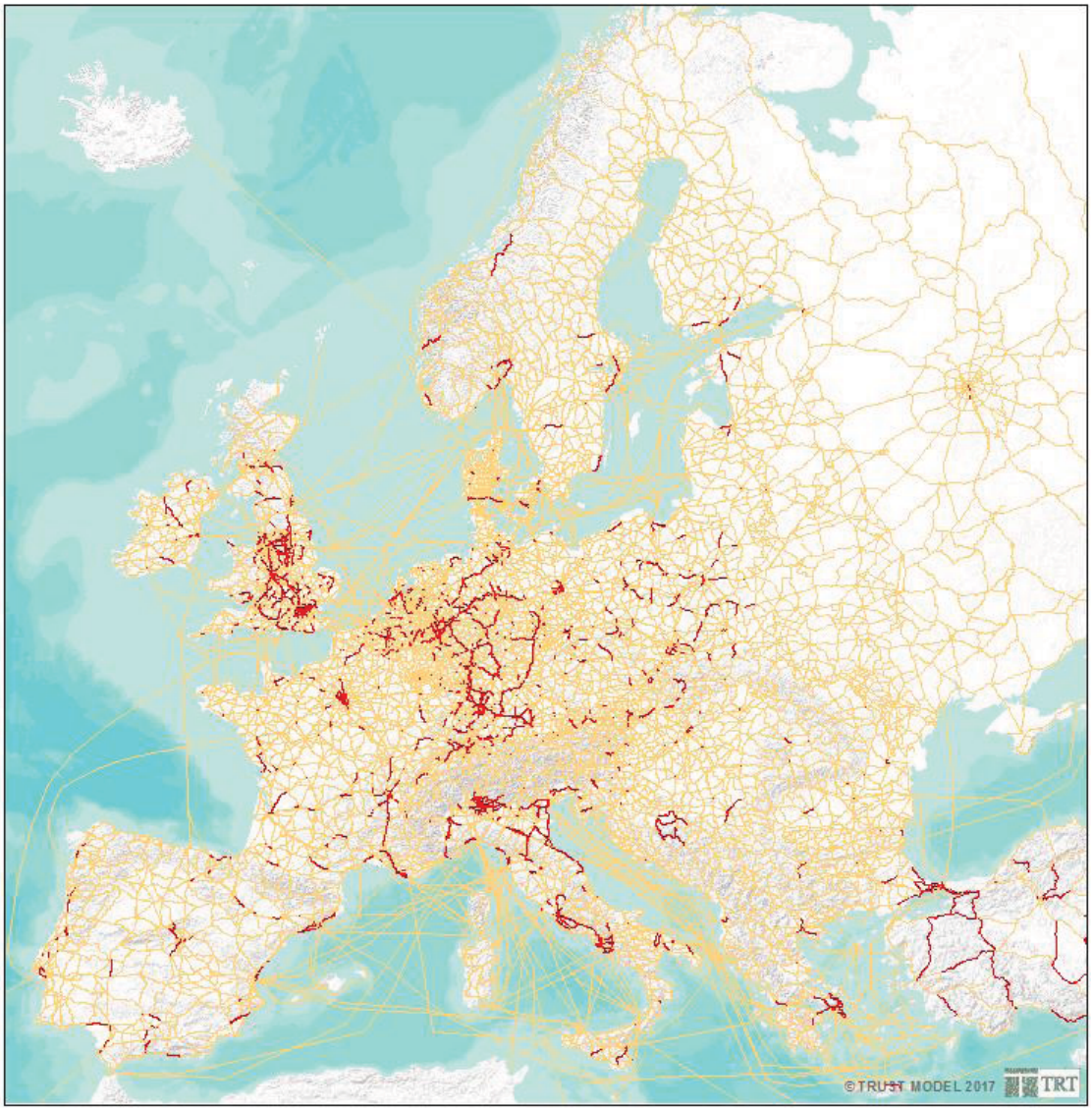
4.3.4. Policy option 3a

PO3a builds on PO2 and additionally includes the following modelling assumptions:

- **Phase in genuine congestion charging in distance-based environment for all vehicles,** i.e. in Greece, Spain, France, Croatia, Ireland, Italy, Poland and Portugal[61] from 2025.

The modelling of congestion charging required the identification of potential congested links where charges should be phased in. The identification of the most congested links is made on the basis of the TRUST model's output of road traffic assignment in 2030, assuming a load/capacity ratio of 0.5 computed on daily traffic as representative of congestion during peak time (Figure 4-13).

Figure 4-13: Congested links in TRUST 2030 network (Daily load/capacity ratio >= 0.5)



[61] These are the Member States currently applying distance-based charging for all vehicle categories, therefore the only ones that can make use of the instrument.

Source: TRUST model

The level of additional charges is based on the specific country values for traffic conditions close to road capacity available from the 2014 Handbook on external costs of transport[62], detailed by road type (motorways and main roads) and vehicle type.

The daily average charges are expressed in 2015 prices. To translate peak charges into average daily charges the share of cars and HDV traffic in the peak periods (from 7:00 to 11:00 and from 16:00 to 20:00) has been used, considering the available set of real traffic data for motorways and main roads in EU countries.

The average daily congestion charges modelled in PO3a are summarised in Figure 4-14.

Figure 4-14: Average daily efficient marginal congestion costs, € per vkm

	Car		Rigid truck		Articulated truck		Bus	
Country	Motorway	Main Roads	Motorway	Main Roads	Motorway	Main Roads	Motorway	Main Roads
EL	0,074	0,093	0,108	0,163	0,165	0,249	0,142	0,215
ES	0,082	0,104	0,121	0,182	0,184	0,278	0,159	0,24
FR	0,089	0,112	0,13	0,196	0,198	0,3	0,171	0,258
HR	0,049	0,062	0,072	0,108	0,109	0,165	0,094	0,142
IE	0,105	0,132	0,154	0,232	0,235	0,354	0,202	0,305
IT	0,083	0,105	0,122	0,184	0,186	0,28	0,16	0,242
PL	0,052	0,065	0,076	0,114	0,115	0,174	0,099	0,15
PT	0,066	0,083	0,096	0,146	0,147	0,222	0,127	0,191

Additional assumptions on maximum congestion charges are made considering the specific length of the congested links in the TRUST model network. Given the strategic level of the network implemented in European models such as TRUST, links are generally characterized by a certain length (e.g. 20–30 km) and the increase of charges due to congestion should consider only a portion of the link to reflect the real situation where, if congestion occurs, it is generally localised a on shorter portion of the links. In this respect, a threshold of 10 kilometres is imposed.

A feedback of the results obtained from TRUST into the ASTRA model (as an exogenous input) allowed for ASTRA indicators to include the impact of congestion charging. Specifically, TRUST provided the share of traffic (by vehicle type) travelling on links subject to congestion charging with respect to the total traffic on tolled road network in each NUTS I zone of a country. These shares were used to calculate the average value of congestion charge (applied on top of the infrastructure charge) at the NUTS I level, which was introduced in ASTRA as an input to calculate travel costs, affecting modal split and revenues from road charging.

Figure 4-15 below provides a summary of the measures assessed in in PO3a, by Member State.

[62] http://ec.europa.eu/transport/themes/sustainable/internalisation_en

Figure 4-15: Summary of policy measures introduced in PO3a relative to the Baseline

			AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge variations	Vignette	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
	Toll	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
Phasing out EURO Class modulation		HGV																												
		Buses																												
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs		HGV																												
		Buses																												
Congestion charging		All																												
Mark-ups		HGV																												
		Buses																												
Reduced circulation taxes		HGV																												

Note: measures included in PO1, PO2 and PO3a are reported in green; measures included in PO2 and PO3a are reported in blue; measures additionally included in PO3a are provided in purple.

4.3.5. Policy option 3b

PO3b also builds on PO2 and additionally includes the following modelling assumptions:

- **Genuine congestion charging in distance-based environment for all vehicles**, i.e. in Greece, Spain, France, Croatia, Ireland, Italy, Poland and Portugal from 2025. Assumptions concerning congestion charges are the same as in PO3a (see section 4.3.4).
- **Phasing in the modulation of infrastructure charges according to CO_2/pollutant emission for vans and passenger cars** by 2025 as shown in Figure 4-16. The revised charges are based on the results of the PRIMES-TREMOVE model (ICCS-E3MLab)[63].

Figure 4-16: Assumptions used for the modulation of infrastructure charges according to CO_2/pollutant emissions for vans and passenger cars

Environmental performance	Conformity factor above 2.1	Maximum 168 mg NOx and maximum 95 gCO2/km for passenger cars (147 gCO2/km for vans) in 2020	Maximum 80 mg NOx and maximum 95 gCO2/km for passenger cars (147 gCO2/km for vans) from 2021
Charge per km	Above average rate	-15% versus highest rate	-30% versus highest rate

Figure 4-17 below provides a summary of the measures implemented in PO3b by Member State.

[63] This measure has been modelled in two steps. In the first step, the PRIMES-TREMOVE model has been run. In the second step, PRIMES-TREMOVE results (i.e. the structure of the vehicle fleet by type of powertrain, age and its evolution; the increase in road charges for vehicles with CO_2 emissions above the average) have been used in defining the integrated policy package in ASTRA model.

Figure 4-17: Summary of policy measures introduced in PO3b relative to the Baseline

			AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Road infrastructure charge variations	Vignette	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
	Toll	HGV <12t																												
		HGV >12t																												
		Buses																												
		Vans																												
		Cars																												
Phasing out vignette		HGV																												
		Buses																												
		Vans																												
		Cars																												
Phasing out EURO Class modulation		HGV																												
		Buses																												
Phasing in CO2/pollutant modulation		HGV																												
		Buses																												
		Vans																												
		Cars																												
Rebates for zero emission vehicles		HGV																												
		Buses																												
		Vans																												
		Cars																												
External costs		HGV																												
		Buses																												
Congestion charging		All																												
Mark-ups		HGV																												
		Buses																												
Reduced circulation taxes		HGV																												

Note: measures included in PO1, PO2, PO3a and PO3b are reported in green; measures included in PO2, PO3a and PO3b are reported in blue; measures included in PO3a and PO3b are provided in purple; measures additionally included in PO3b are reported in orange.

4.3.6. Policy option 4

PO4 builds on PO3b and additionally includes the following modelling assumptions:

- **Mandatory external cost charging** for air pollution and noise for HGVs and buses on the TEN-T network in all countries where road charging is applied.
- **Phase out vignettes for vans** by 2025 and phase-in of distance-based charging for these vehicles in Austria, Bulgaria, Czech Republic, Hungary, Lithuania, Latvia, Romania, Slovenia and Slovakia.
- **Phasing out of vignettes for passenger cars and phase-in of distance based charges for passenger cars** in Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovenia and Slovakia.
- **Extension of genuine congestion charging** also to Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovenia and Slovakia. The assumptions used for the average daily congestion charges in PO4, based on the 2014 Handbook on external costs of transport values, are summarised in Figure 4-18.
- **Exemption from circulation taxes** for vans in Austria, Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Romania, Slovenia and Slovakia from 2025 onwards. Assume a 50% reduction for vans for the distance-based systems already in place in Greece, Spain, France, Croatia, Ireland, Italy, Poland and Portugal from 2020 onwards.

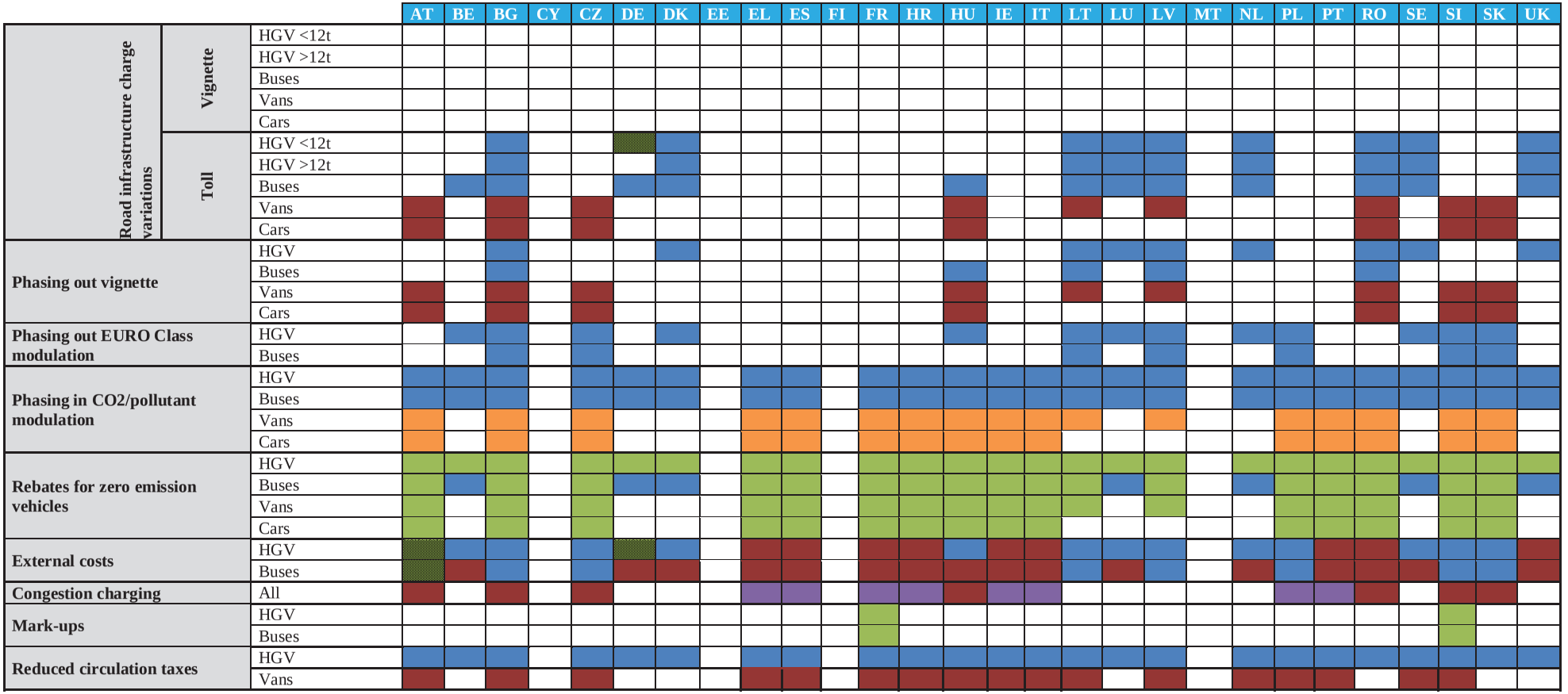
Figure 4-18: Average daily efficient marginal congestion costs, € per vkm

	Car		Rigid truck		Articulated truck		Bus	
Country	Motorway	Main Roads	Motorway	Main Roads	Motorway	Main Roads	Motorway	Main Roads
AT	0,104	0,131	0,152	0,23	0,232	0,351	0,2	0,302
BG	0,036	0,046	0,053	0,080	0,081	0,122	0,070	0,105
CZ	0,066	0,083	0,096	0,145	0,146	0,221	0,126	0,19
EL	0,074	0,093	0,108	0,163	0,165	0,249	0,142	0,215
ES	0,082	0,104	0,121	0,182	0,184	0,278	0,159	0,24
FR	0,089	0,112	0,13	0,196	0,198	0,3	0,171	0,258
HR	0,049	0,062	0,072	0,108	0,109	0,165	0,094	0,142
HU	0,053	0,067	0,078	0,118	0,119	0,18	0,103	0,155
IE	0,105	0,132	0,154	0,232	0,235	0,354	0,202	0,305
IT	0,083	0,105	0,122	0,184	0,186	0,28	0,16	0,242
PL	0,052	0,065	0,076	0,114	0,115	0,174	0,099	0,15
PT	0,066	0,083	0,096	0,146	0,147	0,222	0,127	0,191
RO	0,039	0,049	0,056	0,085	0,086	0,130	0,074	0,112
SI	0,07	0,088	0,102	0,154	0,156	0,236	0,135	0,203
SK	0,06	0,076	0,088	0,134	0,135	0,204	0,116	0,176

Source: TRT elaborations based on 2014 Handbook on external costs of transport

Figure 4-19 below provides a summary of the measures included in PO4, by Member State.

Figure 4-19: Summary of policy measures introduced in PO4 relative to the Baseline



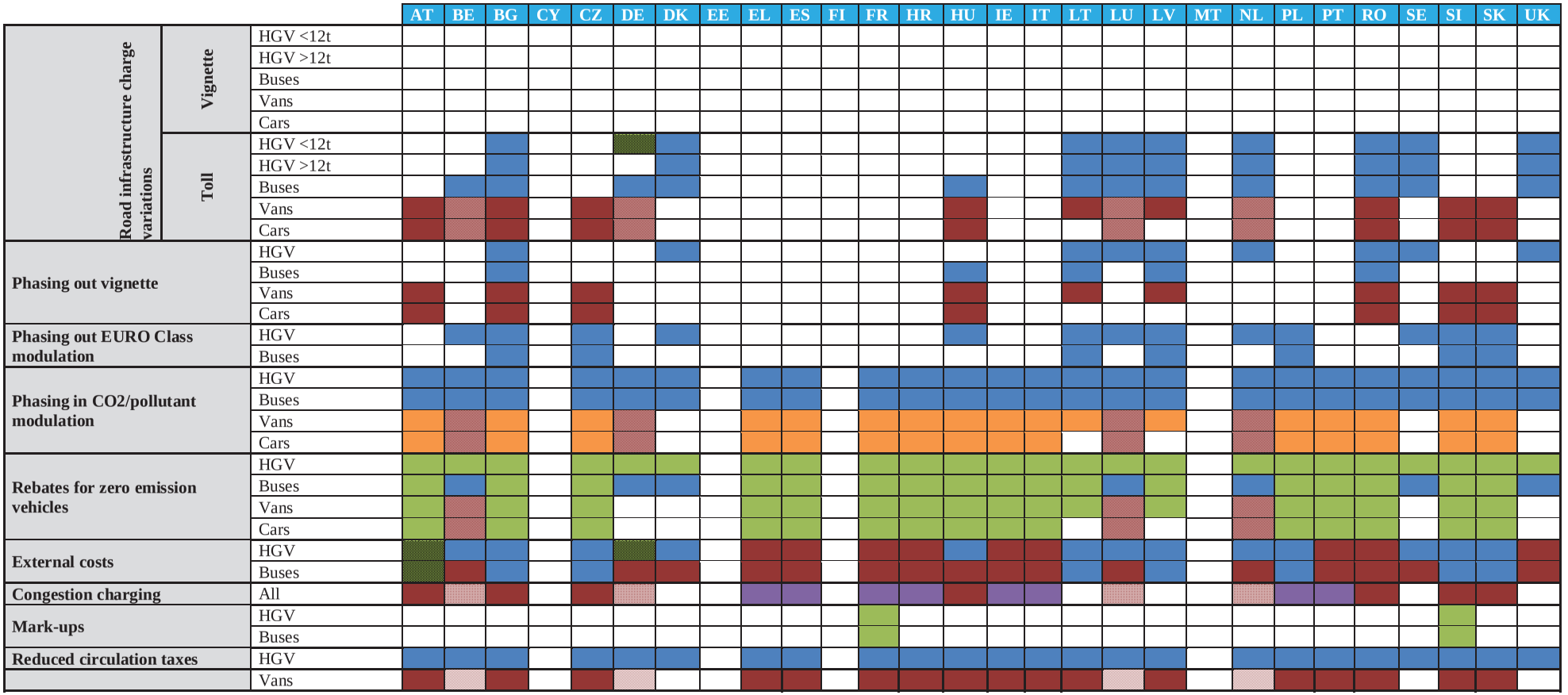
Note: measures included in PO1, PO2, PO3a, PO3b and PO4 are reported in green; measures included in PO2, PO3a, PO3b and PO4 are reported in blue; measures included in PO3a, PO3b and PO4 are provided in purple; measures included in PO3b and PO4 are reported in orange; measures additionally included in PO4 are reported in red.

4.3.7. Policy option 4 – sensitivity case (PO4s)

PO4s builds on PO4 but additionally includes the following modelling assumptions:

- Phase-in of distance-based charges for vans and passenger cars in Belgium, Germany, Luxembourg and Netherlands from 2025 onwards.
- Phase-in of modulation of infrastructure charges according to CO_2/air pollutant emissions for vans and passenger cars starting with 2025 in Belgium, Germany, Luxembourg and Netherlands.
- Rebates for all zero emission vans and passenger cars starting with 2025 in Belgium, Germany, Luxembourg and Netherlands.
- Extension of genuine congestion charging also to Belgium, Germany, Luxembourg and Netherlands.
- Exemption from circulation taxes for vans in Belgium, Germany, Luxembourg and Netherlands from 2025 onwards.

Figure 4-20: Summary of policy measures introduced in PO4s (sensitivity case) relative to the Baseline



Note: measures included in PO1, PO2, PO3a, PO3b, PO4 and PO4s are reported in green; measures included in PO2, PO3a, PO3b, PO4 and PO4s are reported in blue; measures included in PO3a, PO3b, PO4 and PO4s are provided in purple; measures included in PO3b, PO4 and PO4s are reported in orange; measures included in PO4 and PO4s are reported in red; measures additionally included in PO4s are reported in light red.

5. ANNEX 5: ROAD CHARGING SYSTEMS IN THE EU

Figure 5-1: Heavy goods vehicles

Figure 5-2: Light goods vehicles

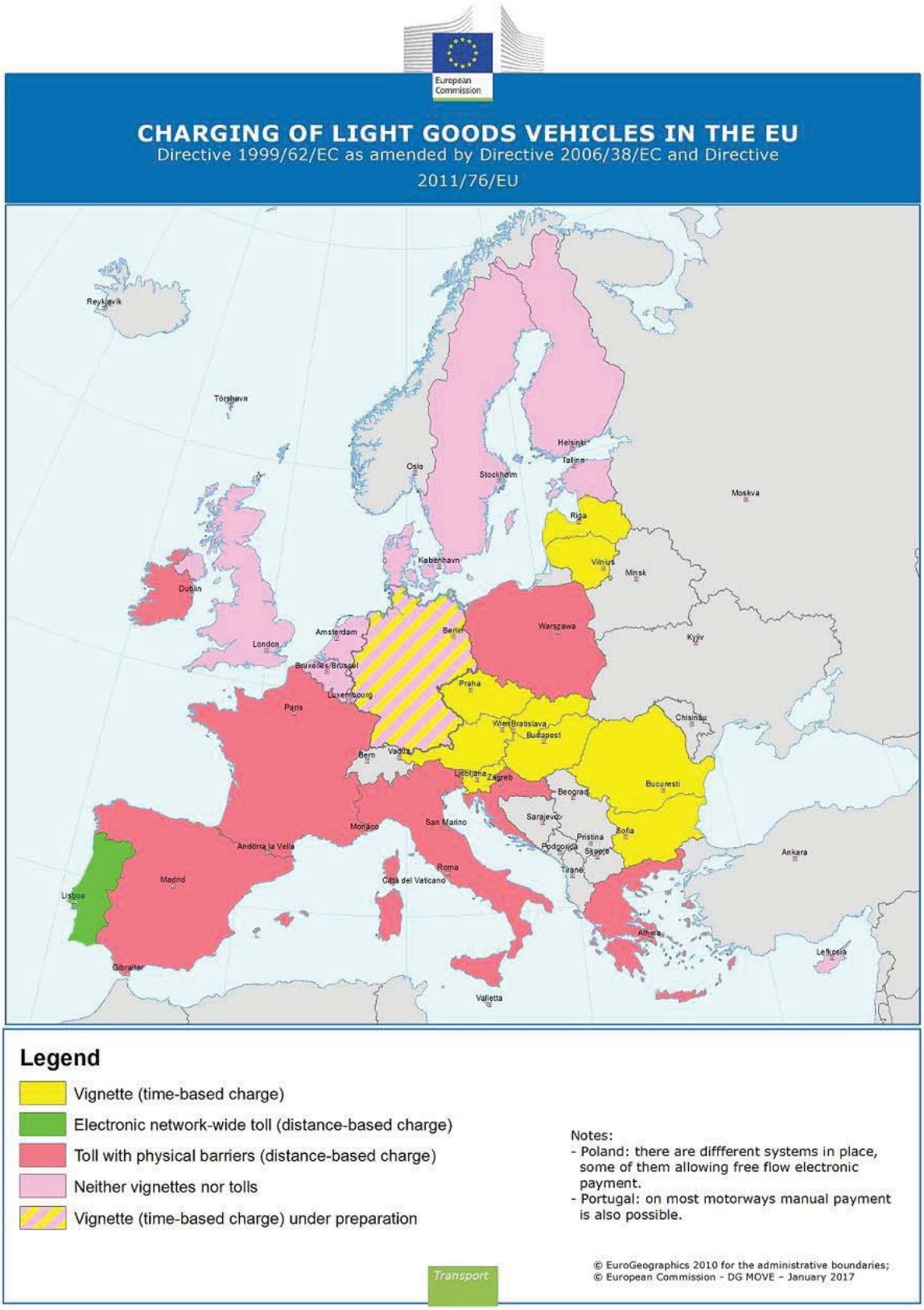


Figure 5-3: Buses and coaches

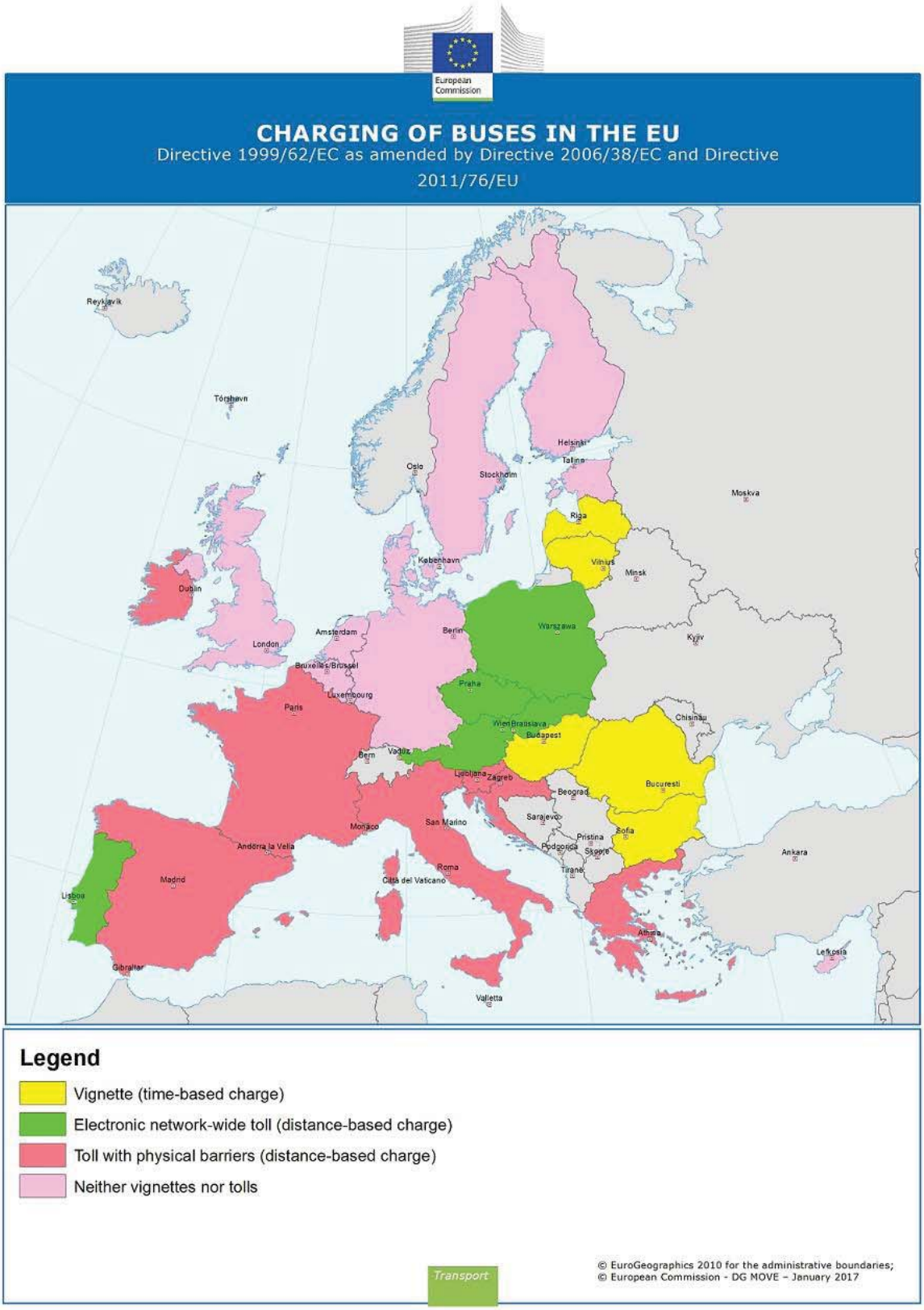


Figure 5-4: Passenger cars

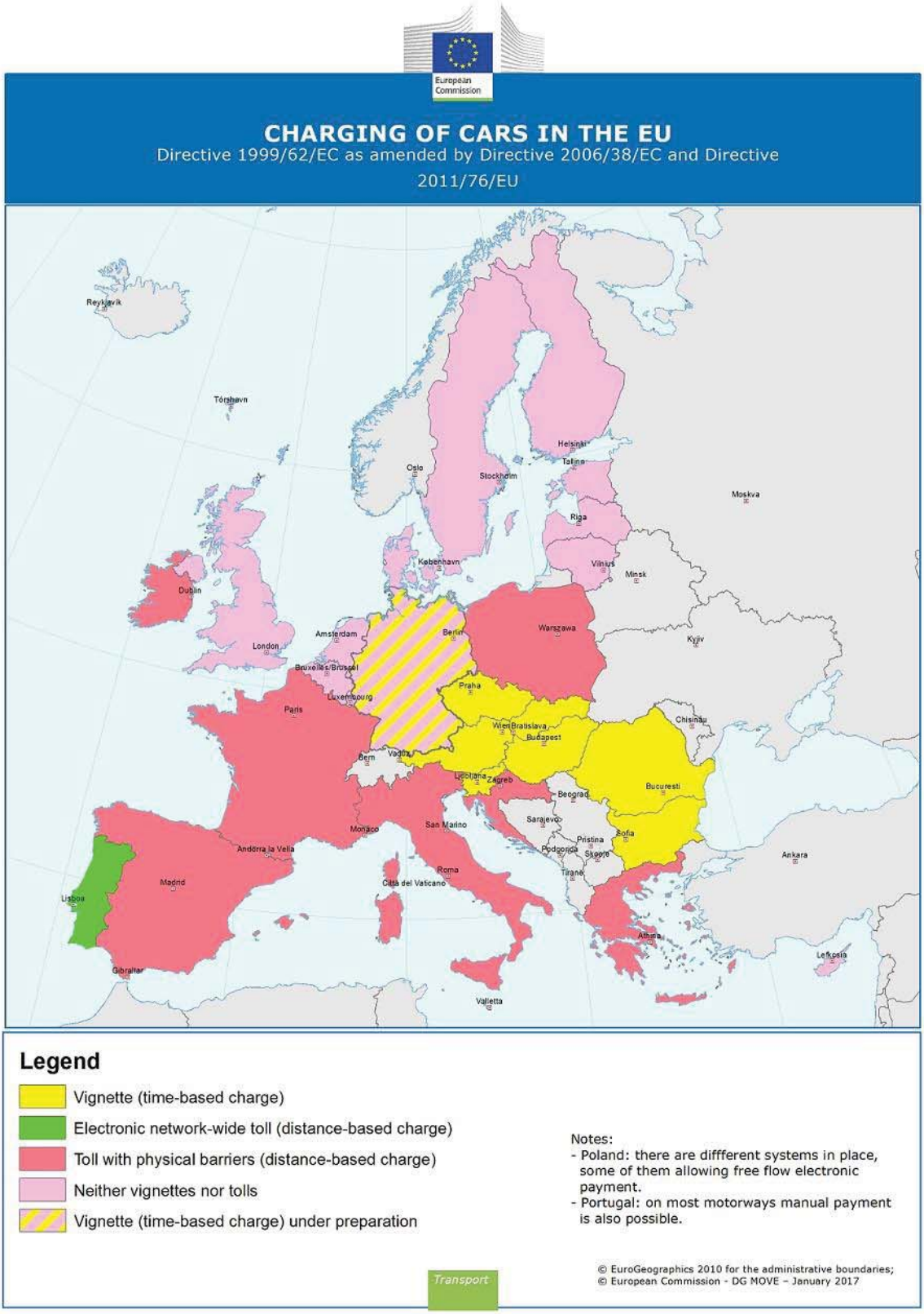


Figure 5-5: HGV external cost charges, covering air pollution costs per kilometre from 1st October 2015, Germany

Emission category	Toll rate [cents], Costs for air pollution
Euro VI	0
EEV 1, Euro V	2.1
Euro IV, Euro III + with particulate reduction class 2	3.2
Euro III, Euro II + with particulate reduction class 1	6.3
Euro II	7.3
Euro I, Euro 0	8.3

Source: (Toll Collect, 2016). These charges are independent of the number of axles of the vehicle and the type of road (BMJV, 2015).

Figure 5-6: HGV external cost charges, covering air pollution costs per kilometre from 1st January 2017, Austria

Emission category	Toll rate [cents], Costs for air pollution 2 axles	Toll rate [cents], Costs for air pollution 3 axles	Toll rate [cents], Costs for air pollution 4+ axles
Euro VI	---	---	---
EEV, Euro V	1.37	1.92	2.19
Euro IV	2.00	2.80	3.20
Euro 0 - III	4.00	5.60	6.40

Source: (BMVIT, 2016b), *Interview input from BMVIT*

Figure 5-7: HGV external cost charges, covering noise costs per kilometre from 1st January 2017, Austria

Time	Toll rate [cents], Costs for noise 2 axles	Toll rate [cents], Costs for noise 3 axles	Toll rate [cents], Costs for noise 4+ axles
Day	0.07	0.16	0.20
Night	0.11	0.25	0.32

Source: (BMVIT, 2016b), *Interview input from BMVIT*

Figure 5-8: Maximum chargeable air pollution cost according to Directive 1999/62/EC

cent/vehicle.kilometre	Suburban roads (including motorways)	Interurban roads (including motorways)
EURO 0	16,9	12,7
EURO I	11,7	8,5
EURO II	9,6	7,4
EURO III	7,4	6,4
EURO IV	4,3	3,2
EURO V	0	0
after 31 December 2013	3,2	2,2
EURO VI	0	0
after 31 December 2017	2,2	1,1
Less polluting than EURO VI	0	0

Updated on 1.06.2016

Figure 5-9: Maximum chargeable noise cost according to Directive 1999/62/EC

cent/vehicle.kilometre	Day	Night
Suburban roads (including motorways)	1,17	2,12
Interurban roads (including motorways)	0,22	0,32

Updated on 1.06.2016

6. ANNEX 6: IMPORTANCE OF ROAD CHARGES IN HGV OPERATING COSTS IN THE EU

A wide variety of different road charging systems exist in the EU and **only a share of vehicles are charged** (section 2.2.3). **Charging schemes differ** not only in the technology they use[64] but also in terms of pricing (section 2.2.5), which provide contradictory incentives to the user. While differentiated distance-based charging encourages the most efficient transport choice for a given trip, time-based vignettes and vehicle taxes represent sunk costs to the user, and thus do not incentivise travelling shorter distances. As such, vignette systems are convenient for the heaviest road users, while at the same time may discriminate against the occasional user. Vignettes and circulation taxes are by nature very similar instruments, which is a potential concern when Member States replace taxes by vignettes, as this can lead to compensating national users and discrimination against foreign users. The result is an uneven playing field in freight transport.

6.1. Uneven playing field in freight transport

The initial aim of the Eurovignette Directive was to eliminate distortion of competition in the road haulage market through a harmonisation of levy systems and the establishment of fair mechanisms for charging infrastructure costs to hauliers.[65] However, as demonstrated by the evaluations referred to in section 1.3, in spite of the framework provided by the Directive, the patchwork of charging systems (see Annex 5) are causing an uneven playing field. In addition, contradictory price signals stemming from the use of different systems, in particular time-based schemes, cannot ensure truly proportionate pricing.

Another source of inconsistency in road pricing is the diverging level of annual **vehicle taxes** across Europe. While Directive 1999/62/EC sets minimum levels for HGV taxes, there is no upper limit, which can result in differences of over 250% between neighbouring countries[66]. Where annual circulation taxes are meant to be a contribution to the maintenance of the national/local road network, Member States might be reluctant to implement road charging on the top of the taxes or will want to compensate their haulage sector. This can be problematic in the case of introducing a vignette scheme working as an extension of the tax to foreign operators; and raise concerns of discrimination especially in case of one-to-one compensation of nationals (see e.g. the case of the heavy vehicle fee introduced by the UK).

As a result of these variations, road charging and vehicle taxes make up a very different share of operating costs of a HGV in different Member States, as shown in Figure 6-1: Taxes, charges and tolls per standard haul, [Euro per trip]. Differences in road charges to be paid can be over 20 or even 40 euro per trip between neighbouring Member States[67]. Previous evaluation showed that the share of road user charges compared to total HGV operating costs can vary between 1% and 15% between counties applying vignettes and those using distance-based tolls (Figure 6-2). The majority of stakeholders, in particular transport undertakings

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64 I.e. satellite positioning (GNSS) or microwave communication (DSRC)

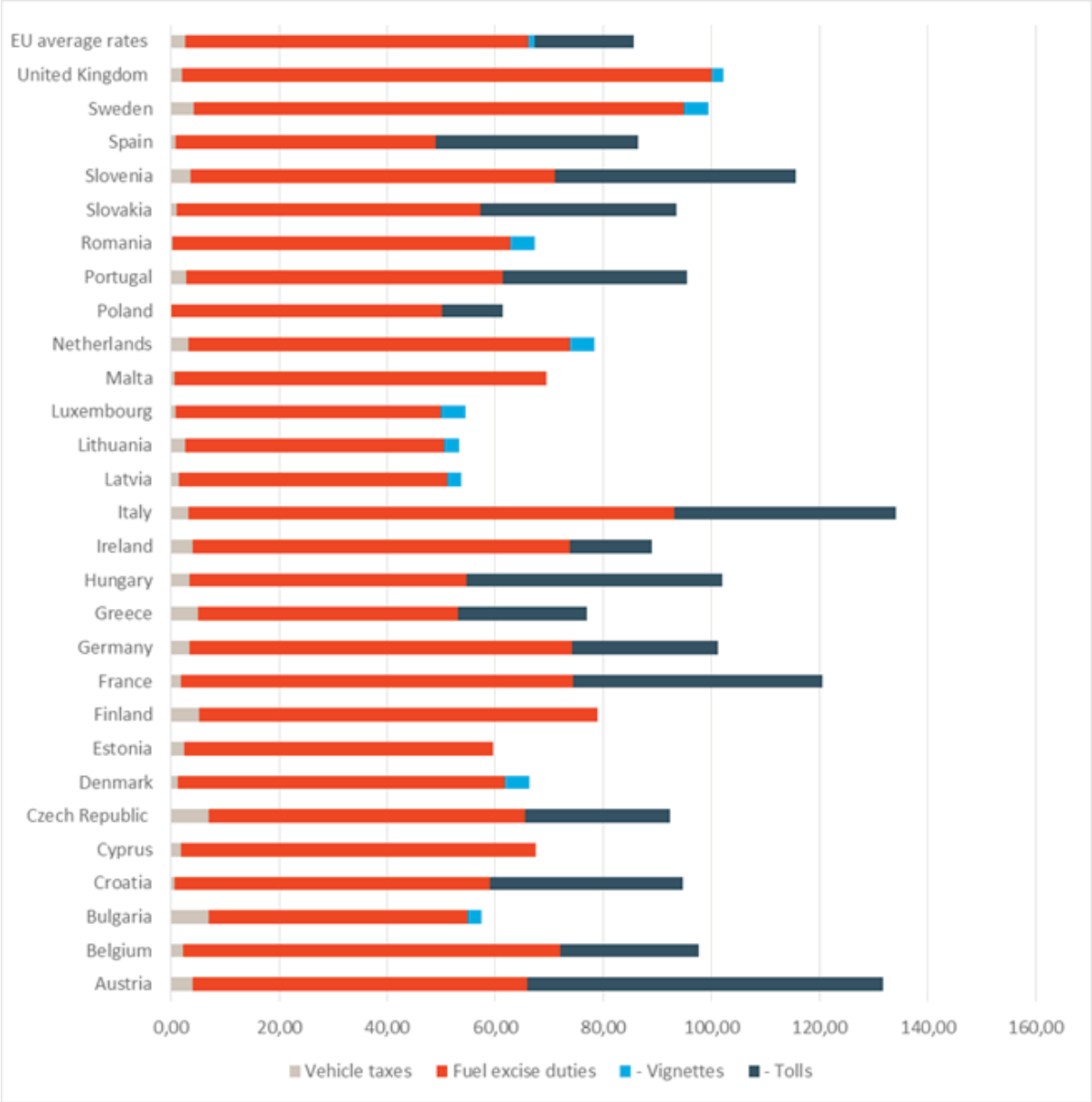
65 Recital 1 of Directive 1999/62/EC

66 Report in accordance with Article 11 (4) of Directive 1999/62/EC, Inventory of measures to internalise external costs, *Summary of measures that internalise or reduce transport externalities*, SWD(2013) 269 final: https://ec.europa.eu/transport/sites/transport/files/themes/sustainable/doc/swd%282013%29269.pdf

67 E.g. between Belgium and the Netherlands, which can lead to distortions and traffic diversion between Belgian and Dutch ports

(82%) felt that different taxes and charge systems cause market distortion, therefore supporting EU harmonisation.

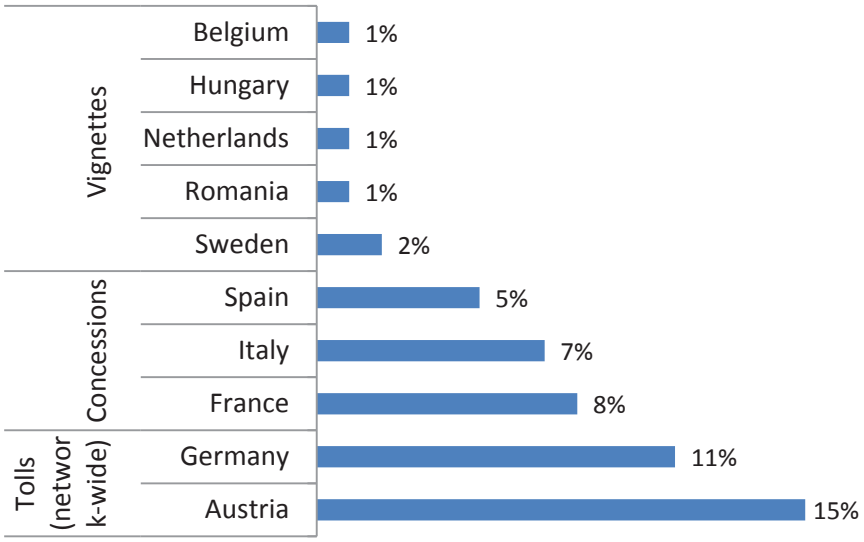
Figure 6-1: Taxes, charges and tolls per standard haul, [Euro per trip][68]



Source: COWI (2016), Assessment of Infrastructure Costs Calculation, Tolls Calculation and Variation for Heavy Goods Vehicles in Member States

[68] assuming a standard haul of 400 km

Figure 6-2: Share of road user charges compared to total HGV operating costs[69]



Source: Ricardo-AEA et al., Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, 2013. Bayliss (red) Report of the High Level Group on the development of the EU road haulage market, 2012.

[69] Note that Belgium and Hungary have introduced network-wide distance-based tolling for HGVs in 2016 and 2013 respectively, which would bring these Member States closer to Germany and Austria, in the lower part of the figure. This also results greater differences in road charges to be paid between neighbouring Member States (Belgium/Netherlands and Hungary/Romania), which can lead to distortions and traffic diversion, e.g. between the ports of Belgian and Dutch ports.

7. ANNEX 7: VIGNETTE PRICES FOR LIGHT DUTY VEHICLES

Figure 7-1: Vignette prices for light duty vehicles across Member States, 2017

Member State	Vignette prices [€]		Ratio of average daily price between shortest term and longest term vignette
	Shortest term vignettes (number of days)	Annual vignette (number of days)	
Passenger cars			
Austria	8.9 (10)	86.4 (365)	3.76
Bulgaria	8 (7)	50 (365)	8.34
Czech Republic	11.5 (10)	55.5 (365)	7.54
Germany (planned)	From 2.5 to 20	From 0 to 130	3.65 to 7.3*
Hungary	9.5 (10)	138 (365)	2.53
Romania	3 (7)	28 (365)	5.59
Slovakia	10 (10)	50 (365)	7.30
Slovenia	15 (7)	110 (365)	7.11
Vans			
Austria	8.9 (10)	86.4 (365)	3.76
Bulgaria	8 (7)	50 (365)	8.34
Czech Republic	11.5 (10)	55.5 (365)	7.54
Hungary	19 (10)	138 (365)	5.05
Latvia	6 (1)	300 (365)	7.3**
Latvia	14 (7)	300 (365)	2.43**
Lithuania	6 (1)	304 (365)	7.20**
Lithuania	14 (7)	304 (365)	2.40**
Romania	6 (7)	96 (365)	3.26
Slovakia	9 (10)	47 (365)	7.30
Slovenia	30 (7)	220 (365)	7.11

** Proposal not yet adopted. In the case of the cleanest vehicles, even though the weekly vignette would only cost €2.50, the ratio could be even higher*

*** Ratio of the daily/weekly vignette price (in line with the relative price set in the Directive)*

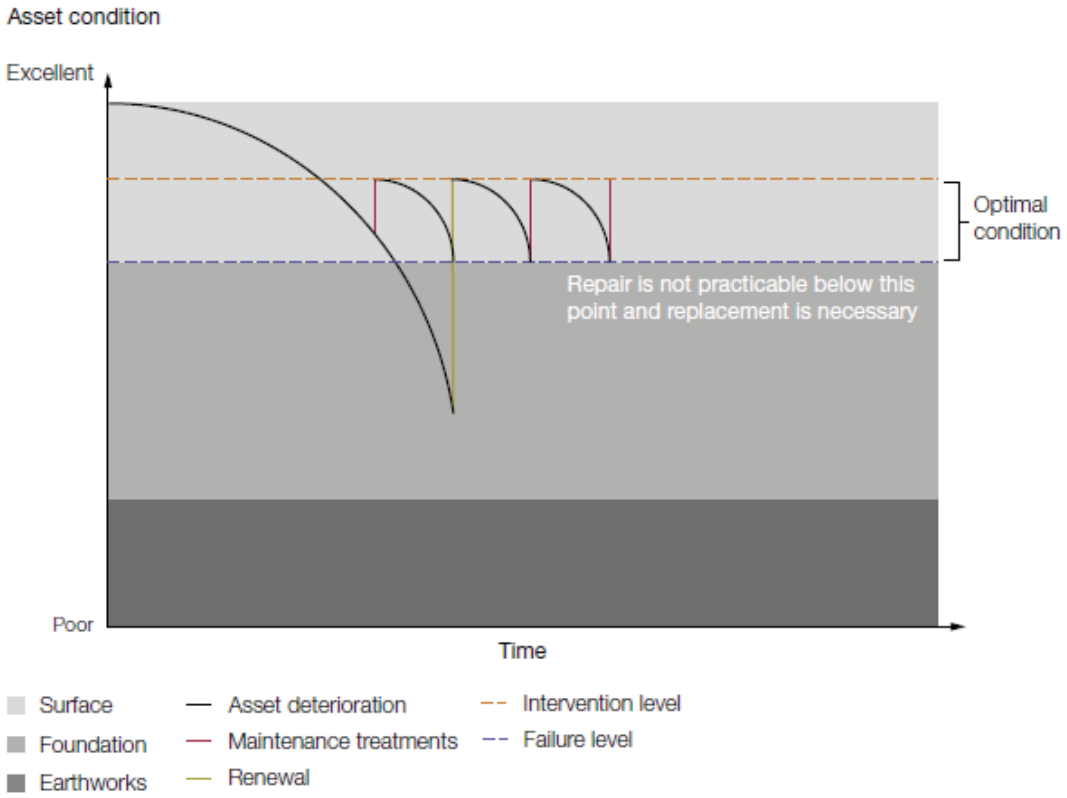
Source: own development based on analysis of data collected for the impact assessment support study

For **vans** (vehicles up to 3.5 tonnes), the picture is slightly different, with 4 Member States applying the same rates as for cars, some applying higher vignette prices than for cars, while Hungary for instance apply double rates for vans compared to cars in the case of weekly and monthly vignettes only and uses the same rate for the yearly vignette. This makes the relative price of short term vignettes for vans much less proportionate than for cars. Only Latvia and Lithuania apply the ratios set in the Eurovignette Directive for heavy goods vehicles.

8. ANNEX 8: ROAD ASSET CONDITION AND MAINTENANCE FUNDING

Figure 8-1 emphasises the point that 'optimal' road condition does not mean 'as new' but rather an acceptable condition that avoids costly replacement at a later date. Road surfaces that remain untreated can deteriorate at a faster rate, with the cost of repairs rising disproportionately – deferring preventative maintenance can therefore lead to substantial increases in repair/rehabilitation costs (European Parliament, 2014). If road condition deteriorates to the point that reconstruction is needed, the costs can be three to four times more than if timely maintenance had been adequately funded[70].

Figure 8-1 Asset Condition Model



Source: NAO, UK (2014)

8.1. Issues with road maintenance funding in Member States

Examples of maintenance backlogs are reported in several Member States – all of which currently have reports of overall good road quality:

- **Germany:** the German Institute for Economic Research (DIW) reports a past investment shortfall of almost €4 billion for the maintenance of the transport infrastructure. Assuming that at least this investment is required in order to maintain the transport

[70] https://www.piarc.org/ressources/publications/8/24531,2016R07EN-Gestion-Patrimoine-Routier-Road-Assets-Management-World-Road-Association-Mondiale-Route.pdf

infrastructure in coming years, and if the cumulative result of years of neglect is also taken into account, the additional annual investment requirement should be at least €6.5 billion (Kunert & Link, 2013)

- **UK**: a figure of €9.6 billion for clearing the maintenance backlog in local road network alone (it tends to be the local road network that has been sacrificed to preserve the strategic network). An estimated of 13 years is needed to clear the maintenance backlog (HMT, UK Treasury, 2015).
- **Ireland:** the National Road Authority has highlighted that maintenance works are most effective when carried out on a continuous basis. The Department for Transport, Leisure and Sport quantify this as an annual cost of €1.6 billion up to 2020, the current forecasted expenditure will lead to a shortfall of over €260 million in road investment. (DTTAS, 2014) (CE Delft, 2016).
- **Netherlands** the annual expenditure should be around €600 to €700 million. In the period 1995-2005, the actual expenditures were generally below the steady state level expenditures, implying an underinvestment in road maintenance. Conversely, in the period 2005-2010, expenditures were significantly above steady state levels, which suggest a recovering of overdue maintenance of national roads (CE Delft, 2016).

Another indication suggesting that the state of road infrastructure is a problem for Member States is that each year more of them realise that there is a gap in their budget for financing its maintenance (let alone development). As an example, following recommendations from the World Bank, Bulgaria plans to replace its time-based road charging scheme (bringing just over €100M/year altogether from heavy and light vehicles) with a distance-based system for HGVs, covering the entire network of roads.[71]

But road maintenance is not only a challenge in Eastern Europe. Belgium replaced its time-based charging scheme (the Eurovignette[72]) with a distance-based road charging system using satellite technology for HGVs above 3.5 tonnes on its main road network in April 2016. Germany is about to expand its distance-based tolling system applied to HGVs to all national roads (in 2018), and intends to introduce a vignette system for light vehicles, to increase the inflow of revenues that could be spend on infrastructure maintenance.

At the same time, motorists associations (FIA) and road transport operators represented by the IRU are arguing that road users already contribute more to national budgets (through taxes and charges) than what is effectively spent on road infrastructure[73, 74]. The issue is that tax revenues are generally allocated to the general budget even if those from fuel tax correspond on average to infrastructure costs (1.3% of GDP).

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[71] According to the Ministry of Regional Development and Public Works, road maintenance in Bulgaria has been severely underfunded for decades. The Bulgarian Road Infrastructure Agency estimates that the annual allocation of about €100M is less than half of the needed budget. It has also been recognized that the vignette system is not flexible enough and is not fair to users – the lion's share of revenues have come from private vehicles that cause little to no damage to the roads, while revenues from HGVs, which are the main cause of damage to the pavement, forms a small share.

[72] The Eurovignette is a road user charge for HGVs with a gross vehicle weight of minimum 12 tonnes that continues to be applied by Denmark, Luxemburg, the Netherlands and Sweden: https://www.eurovignettes.eu/portal/

[73] http://www.fiaregion1.com/en/fia_region_1/news/european-motorists-deserve-a-betterdeal.htm

[74] https://previouswww.iru.org/en_policy_co2_response_transporttax

9. ANNEX 9: SCOPE OF AND REVENUES FROM ROAD CHARGING IN MEMBER STATES

Figure 9-1: Scope of infrastructure charging systems for HGV network – Share of main network that is being tolled

Member State	Total motorway length (km)	Share of motorway that is charged for HGVs*	
		Time OR distance-based	*of which Distance-based (i.e. tolls)*
Austria	2,185	100%	100%
Belgium	1,763	100%	100%
Bulgaria	734	100%	0%
Croatia	1,290	100%	100%
Cyprus	257	0%	0%
Czech Republic	3,404	42%	42%
Denmark	1,216	100%	0%
Estonia	140	0%	0%
Finland	810	0%	0%
France	11,560	79%	79%
Germany	12,949	100%	100%
Greece	1,558	100%	100%
Hungary	1,180	100%	100%
Ireland	897	39%	39%
Italy	6,751	89%	89%
Latvia	1,674	90%	0%
Lithuania	1,948	87%	0%
Luxembourg	152	100%	0%
Malta	163	0%	0%
Netherlands	2,678	100%	1%
Poland	1,552	100%	100%
Portugal	3,065	96%	96%
Romania	683	100%	0%
Slovenia	1,499	40%	40%
Slovakia	1,943	100%	100%
Spain	14,981	23%	23%
Sweden	2,088	100%	1%
United Kingdom	3,760	100%	1%
Total	**82,880**	**76%**	**58%**

*Notes: * some Member States may apply exemptions (e.g. for HGVs below 12t) or base their system on vehicle characteristics other than weight (e.g. number of axles or vehicle height).*
Source: Impact assessment support study

Figure 9-2: Revenues from road charging and their use

Member State	Part of the charged network[1]	Annual Toll revenue / M€, 2014		Use of revenue
		HDV	LDV	
Austria	1	1235	449	Reinvested in construction, operation and safety of highly advanced road network.
Austria	2	155		
Belgium	1	650	N/A	The Flemish minister for mobility has stated that toll will be earmarked for investment in road infrastructure. The rest of the income will go to the general budget and can be spent on whatever the Flemish government so choose. The Wallonia region has not published any plans on how they are to spend the money raised from the toll but it is assumed to be reinvested into road infrastructure due to how the road management is structured there.
Bulgaria	2	102		The vignette revenues are entered in the budget of the country and are allocated to the operation, current maintenance, repair and reconstruction works, but are not meant for new construction works.
Croatia	1	317		Toll collection revenues are used to finance, build, maintain, operate and improve the motorways.
Czech Republic	1	360		All revenues from highway and motorway tolls are received by the State Infrastructure Fund, which also collects revenue from the road tax, consumer tax on hydrocarbon fuels, and the transfer of assets from the National Property Fund (privatisation). Revenues are used to finance: - Construction, modernisation, of roads, motorways, railways and inland waterways. - Repair and maintenance of roads, motorways and railways - Safety accessibility to persons with restricted movement and orientation - Construction and maintenance of cycling paths.
Denmark	2	559		Finance the upgrade of Danish hinterland connections. Toll revenues received from bridges are used to finance the operation and maintenance, as well as repay loans incurred during the construction period.
France	1	9390		Toll revenues are the main financers of the transportations infrastructures. Tolling revenues are collected on the oldest sections in order to finance the most recent ones.

Member State	Part of the charged network[1]	Annual Toll revenue / M€, 2014	Use of revenue
Germany	1	4370	The Bundesfernstraßenmautgesetz (BFStrMG) states that the Federal Government may use the income from the toll to cover the costs of operating and monitoring the toll system and for the administration costs of the Federal Traffic Infrastructure Finance Company (VIFG). In addition, up to EUR 450 million are used to implement Federal programmes aimed at securing jobs and qualifications and at promoting environment-friendliness and safety as regards haulage firms operating on toll routes. There are three programmes: to encourage the purchase of low-emission HGVs, to promote basic and further training, qualification and employment in haulage firms with HGVs, and to promote safety and the environment in haulage firms with HGVs. The remaining toll income will, apart from an annual amount of EUR 150 million, be added to the transport budget and used in its entirety for the sole purpose of improving the infrastructure of the Federal trunk roads.
Greece	1	495	Until 2007 the toll system was run by TEO, which is owned by the Government. The revenue was used to finance, maintain and operate the network. Since then, a concession system has been introduced for the majority of tolled roads. Toll charges are used to finance part of the construction, as well as maintenance and improvement of the highways. Their profits are subject to VAT, which goes to the general budget.
Hungary	1	678	The utilisation of the increased revenue due to the introduction of the HU-GO system is determined by the requirement system of the EU: it can only be used in the public road and traffic sector. Hu-Go states that the toll revenue will ensure financial means for developing, maintaining and operating the road network.
Ireland	2	217	Major new road developments in Ireland are funded through Public Private Partnerships. Therefore, the toll revenues go both to the private companies who invested in the road as well as the public sector. There is no mention on how the toll revenues that go to the public sector are distributed.
Italy	1	5454	There are no specific funds directed toward financing national highway infrastructure in Italy, which is funded by the general revenue. Highway revenue is generated by taxes and tolls, but this revenue is not tied to highway construction. A percentage of revenue generated by tolls goes to the National Autonomous Roads Corporation (Azienda Nazionale Autonoma delle Strade, ANAS) for monitoring highways under

Member State	Part of the charged network[1]	Annual Toll revenue / M€, 2014		Use of revenue
				concession.
Latvia	1	N/A	N/A	Maintenance and development of roads.
Lithuania	1	43	N/A	Financing of the road construction and maintenance, as well as Development Programme of the Republic of Lithuania.
Luxem-bourg	1	3	N/A	Luxembourg applies the principle of the unity of the budget. Revenue feeds into general taxation budget. Therefore, no revenue may be provided with an "earmarking".
Netherlands	2	28		The Netherlands funds state highways through a national Infrastructure Fund, which is fed by express lane fees and regular tolls. Provinces, municipalities, and district water boards may also set tolls on motor vehicles passing through certain tollgates on state-managed roads. Additionally, the government applies one-time and recurrent taxes on registered motor vehicles, and levies fuel taxes and a general VAT of 21%. Whether or not these taxes are applied to road construction and maintenance is unclear.
Poland	2	209 on A2 and A4		Poland stopped using the vignette system on 1st July 2011, and replaced it with a toll. The revenue is directly transferred to the National Road Fund and reinvested to the road network.
Poland	2	284	N/A	
Portugal	1	915 (for 19 toll domains)		The revenue from tolls is directly assigned to a legally independent entity in charge of financing, building, maintaining, and operating the infrastructure. Profits are also subjected to company taxes and VAT and therefore contribute to the national budget.
Romania	1	N/A	N/A	Toll revenues are allocated directly to NCMNR. In addition, NCMNR (Road Administration) collects charges for overloaded vehicles. The total direct income, however, is too low in relation to the full cost of road maintenance for the national road network. Thus, NCMNR is reliant on the State budget, IFIs and/or commercial loans in order to fund the shortfall.
Slovenia	2	350		Motorways are operated by DARS, a company that is 100% owned by the State. The revenues are used to finance motorway management and maintenance, construction of new motorways and repayment of loans.
Slovakia	1	185	119 .6	Construction and maintenance of roads.
Spain	2	1709		Concessionaires are responsible for financing, building, maintaining, and operating the infrastructure for Spanish toll motorways. Their profits are subject to VAT, which goes to the general budget.

Member State	Part of the charged network[1]	Annual Toll revenue / M€, 2014		Use of revenue
Sweden	1	N/A	N/A	Concerning bridges between Sweden/Denmark and Sweden/ Norway, the fees are meant to cover the cost of building and maintaining the infrastructure. At Öresundsbron, Sweden and Denmark divide the toll revenues 50/50. At Svinesundsförbindelsen, Sweden collects tolls from vehicles entering Norway.
United Kingdom	1	49.28	N/A	The revenue raised from the HGV levy goes into general government funds.
United Kingdom	2	102		Any revenue generated from tolls goes to the highway authority and must be used for the road network or related transportation measures.

[1] *1= network-wide (or large parts), 2=specific parts of the network (e.g. specific bridges, tunnels etc.)*

10. ANNEX 10: LEVELS AND DIFFERENTIATION OF ROAD CHARGES

Figure 10-1: Average user charge per km on toll roads across EU Member States (freight transport)

Member State	Charging system and average charge per vehicle category in Cent/Km					
	HGV > 12t	Charge /tolled km	HGV < 12t	Charge / tolled km	Vans < 3.5t	Charge/ tolled km
Austria	Distance-based	46.7	Distance-based	32	Time-based	-
Slovenia	Distance-based	27	Distance-based	21.4	Time-based	2.3
France	Distance-based	26.5	Distance-based	21.5	Distance-based	13
Spain	Distance-based	22.4	Distance-based	20.8	Distance-based	11.7
Ireland	Distance-based	20	Distance-based	18	Distance-based	12.2
Croatia	Distance-based	20	Distance-based	16	Distance-based	11
Hungary	Distance-based	19	Distance-based	11.7	Time-based	2.5
Portugal	Distance-based	18.5	Distance-based	15	Distance-based	13
Belgium	Distance-based	18.4	Distance-based	12.5	N/A	0
Czech Republic	Distance-based	18.2	Distance-based	11.5	Time-based	1.3
Slovakia	Distance-based	17.7	Distance-based	7.7	Time-based	1.3
Germany	Distance Based	16.2	Distance-based (only above 7.5t)	3.5	N/A	0
Italy	Distance-based	13.2	Distance-based	10	Distance-based	7
Greece	Distance-based	11.1	Distance-based	9.2	Distance-based	3.4
Poland	Distance-based	10.6	Distance-based	7.8	Distance-based	10
Romania	Time-based	3.3	Time-based	1.1	Time-based	3.1
Sweden	Time-based *	3	N/A	0	N/A	0
Denmark	Time-based *	2.8	N/A	0	N/A	0
Latvia	Time-based	2.4	Time-based	1.5	Time-based[75]	-
Luxem-bourg	Time-based *	2.3	N/A	0	N/A	0
Lithuania	Time-based	2.2	Time-based	1.6	Time-based	-
Bulgaria	Time-based	2	Time-based	1.2	Time-based	2.1
Netherlands	Time-based *	1.9	N/A	0	N/A	0

[75] Since 1 January 2017 for vehicles with a total permissible weight of more than 3 tonnes

United Kingdom	Time-based [76]	1.3	N/A	0	N/A	0
Cyprus	No charging	0	No charging	0	No charging	0
Estonia	No charging	0	No charging	0	No charging	0
Finland	No charging	0	No charging	0	No charging	0
Malta	No charging	0	No charging	0	No charging	0

Figure 10-2: Comparison of EURO emission groups across EU Member States (where applied)[77].

	COUNTRY	EURO 0	EURO I	EURO II	EURO III	EURO IV	EURO V	EEV	EURO VI
Time-based	**Denmark, Luxemburg, Netherlands, Sweden**	**Group1**	**Group2**	Group3					
	Bulgaria	**Group1**				**Group2**			
	Lithuania	**Group1**				**Group2**			
Distance-based	**Austria**	**Group1**				**Group2**		Group3	Group4
	Germany	**Group1**			**Group 2**	Group3	Group4		
	Poland	**Group1**			**Group 2**	Group3	Group4		
	Czech Republic	**Group1**			**Group 2**		Group3		
	Slovakia	**Group1**			**Group 2**	Group3			
	Slovenia	**Group1**			**Group 2**	Group3			
	France/Italy Frejus tunnel	Not allowed	**Group1**		**Group2**				
	France/Italy Mont Blanc tunnel	Not allowed			**Group1**				

Source: Ricardo-AEA et al., Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, 2013

[76] HGV Levy is applied to 11 vehicle categories depending on the weight (always > 12 t) and the number of axles. For most UK-registered HGVs, vehicle excise duty (VED) was reduced by the same amount as the levy, and is conveniently paid alongside VED to keep administrative costs to a minimum. As with VED the levy can be paid either annually or six-monthly. The tax disc will display the total duty paid (combined vehicle tax and levy). Vehicles registered abroad must make levy payments before entering the UK. The levy can be paid by day, week, month or year and discounts are available for longer levy periods.

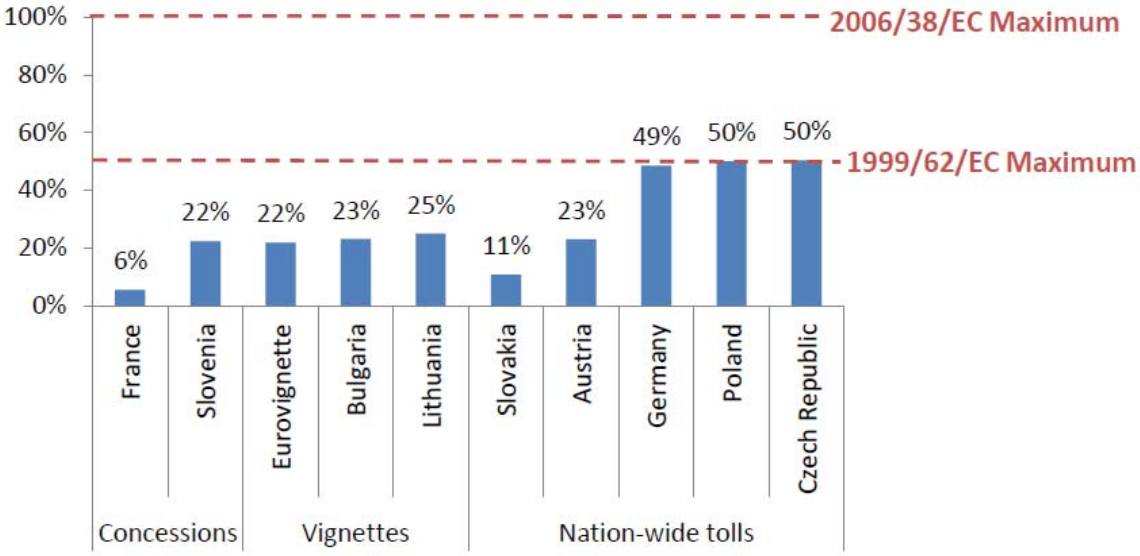
[77] Existing concession contracts are exempted from this requirement until the contract is renewed (article 7g (1) of Directive 1999/62/EC, as amended).

Figure 10-3: Differentiation by EURO class for vehicles >12t.

Member state	Date of toll introduction	Date of first differentiation by Euro class	Dates valid	Vehicles	Saving compared to Euro I				
					Euro II	Euro III	Euro IV	Euro V	Euro VI
Germany	2005		2005	>12t	15%	15%	30%	30%	n/a
			2006-2008	>12t	0	17%	17%	30%	n/a
Czech Republic	2007		2007-2010	>12t	0	17%	17%	30%	n/a
			2012	>3.5t	0	21%	21%	50%	50%
Austria	2004	2010	2010	>3.5t	0	0	13%	13%	18%
Poland	2011		2011		0	13%	30%	50%	50%
Slovakia	2010		2010		0				
			2012 (highways)	>12t	0	5%	30%	30%	30%
			2012 (1st class roads)	>12t	0	7%	7%	7%	7%
			2012 (highways)	3.5-12t	0	8%	11%	11%	11%
			2012 (1st class roads)	3.5-12t	0	10%	10%	10%	10%

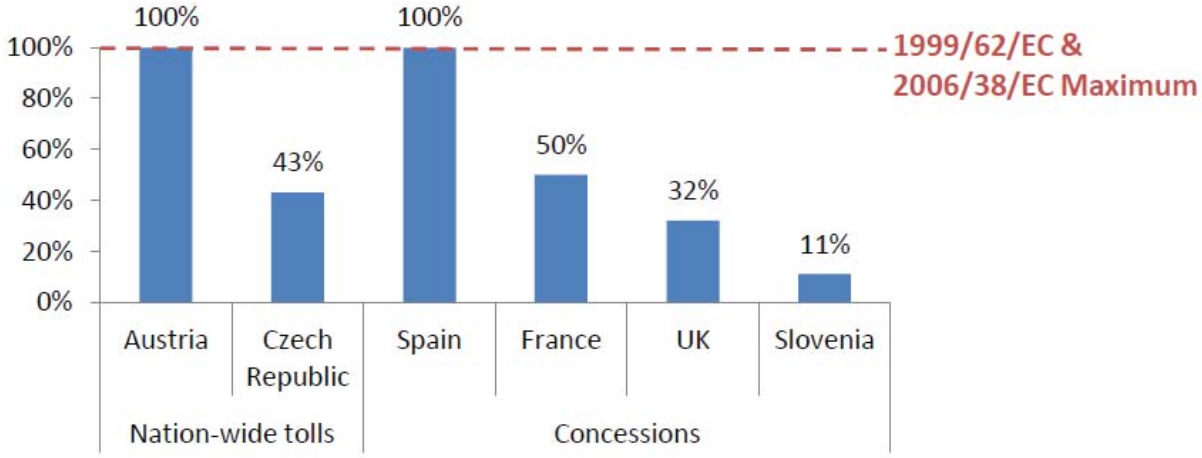
Source: Ricardo-AEA et al., Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, 2013

Figure 10-4: Maximum charge differentiation according to Euro class for vehicles in the same category



Source: Ricardo-AEA et al., Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, 2013

Figure 10-5: Maximum differentiation according to time of travel for vehicles >3.5t in the same category[78]



Source: Ricardo-AEA et al., Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, 2013

[78] It should also be noted that in most countries the differentiation is only applicable on selected routes, whereas Czech Republic and Slovenia apply them on the network. In addition, Austria and Slovenia apply higher charges at night to control noise emissions, whereas the other Member States apply higher charges during peak hours to control congestion.

11. ANNEX 11: PRE-SELECTION OF POLICY MEASURE AND PACKAGING OF OPTIONS

The packaging of measures is done in a way to ensure that all options address the identified problem, at least to some extent. The minimal solution to each problem is PO1. Some of the measures can address more than one problem.

11.1. Rationale behind retained measures

To contribute to the goals of low-emission mobility:

- *Promoting zero-emission vehicles through allowing reduced toll rates (for both HDVs and LDVs):* this is a measure, which is very easy to implement while providing a direct price signal to users; it does not require emission values to be measured and is technology neutral. Since the total cost of ownership of a zero-emission HDV is still 2 to 3 times that of a conventional diesel, even complete exemption from charges could be justified for these vehicles. The situation is different for LDVs, where the total cost of ownership is already very close (see section 4.2.10 of the impact assessment support study) and even a more limited reduction of road charges could provide incentives for the uptake of clean vehicles.
- *Mandatory differentiation of infrastructure charges according to CO_2 emissions for HDVs (HGVs + buses/coaches) from 2020*: Once vehicle certification data on CO_2 emissions becomes available for new vehicles[79], it will be possible to differentiate charges between the more and less fuel-efficient trucks. Distinction could be made between i) Euro 0-VI vehicles, ii) low-CO_2 (new or retrofitted) vehicles. Since the certification data will only be available in the future, the precise method for differentiating charges would be defined by the Commission in a delegated act. In order to provide a coherent price signal and have noticeable impact, Member States would be required to differentiate tolls accordingly. Differentiation between Euro 0-VI and new low-emission vehicles should be simple (in any case much simpler than the current differentiation according to Euro classes applied by Member States) remain revenue-neutral, in recognition of the fact that the cost of CO_2 emissions are in practice internalised through fuel taxation (even if excise duties are not necessarily collected with this goal in mind). A possible way in which such modulation could take place is described in Annex 4 (Figure 4-9).
- *Mandatory differentiation of tolls and user charges (i.e. both distance- and time-based) for LDVs (Vans and passenger cars) from 2020*: Distinction would be made into 3 or 4 emission classes based on WLTP[80] according to CO_2 and pollutant emissions, complemented by RDE tests for NO_X. In order to provide a coherent price signal and have noticeable impact, Member States would be required to differentiate tolls accordingly.

  Compared to LDVs with a gasoline engine, diesel LDVs generally have lower emissions of CO_2 but higher emissions of air pollutants. Therefore, incentivising only

[79] VECTO – Vehicle Energy consumption Calculation Tool developed by DG CLIMA and the JRC – will be ready to provide this information for HGVs above 7.5 t as from 2019.

[80] World harmonised Light vehicle Test Procedure

the most fuel-efficient LDVs without taking account of pollutant emissions would promote diesel driven vehicles entailing higher emissions of air pollutants and also exacerbate the problem of diesel/gasoline imbalance.

Differentiation of road charges for LDVs could be based on the forthcoming UNECE World harmonized Light vehicle Test Procedures (WLTP) complemented by on-road tests, which are better reflecting real driving emissions (RDE[81]) and allowing better comparison between petrol and diesel cars. A possible way of such modulation of charges is described in Annex 4, section 4.3.5.

To contribute to adequate road quality

- *Monitoring and reporting of toll revenues and expenditures* on maintenance/operation of roads will ensure transparency and raise the awareness of Member States' authorities of potential financing gaps. As an extension of current reporting requirements on tolls (every four years, including information on the levels and variation of charges, revenues from charges and any action related to their use recommended by the Directive), Member States would be required to publish annual reports in a more systematic way, including information on

    - total revenues from road charging (also for time-based systems) as well as congestion charging;
    - the use of revenues;
    - the state of roads based on objective indicators (to be harmonised in a subsequent step, cf. measure below): and
    - the level of congestion on the tolled network.

    The measure received the support of over 2/3 of the respondents to the public consultation. Because of the administrative implications, Member States are generally less supportive. It has nevertheless maintained as an alternative to the provision of earmarking of toll revenues in general, which is even less supported by Member States, and to improve the current – insufficient reporting practices. It is also worth noting that Regulation No 1108/70 already requires Member States to report on infrastructure spending but this is not coherently practiced by them (see also section 12.2.3 in Annex 12).

- *Introduction of common quality indicators* will ensure that the manager of a toll road will maintain the given road section in sufficiently good/safe condition. Such indicators are already used by most Member States. However, the information is not strictly

[81] For their approval, new models of vehicles are currently subject to laboratory tests of their emissions. However, analysis has shown that light vehicles produced in line with existing Euro standards generate substantially higher emissions on the road than in laboratory conditions. This problem was detected in particular in relation to emissions of diesel vehicles of the pollutant substance nitrogen-oxides (NOx). That is why new procedures to measure emissions in real driving conditions are needed. Until at least 2021, so called conformity factors will be applied to allow manufacturers adapt to RDE tests. See e.g. http://www.consilium.europa.eu/en/press/press-releases/2016/02/12-vehicle-emissions-in-real-driving-conditions-2nd-package/

comparable since different methodologies are used. A harmonised definition based on current national practices in monitoring road characteristics could be adopted by the Commission through an implementing act.

To ensure that road pricing treats occasional / non-resident motorists fairly:

- *Removing the possibility to exempt HGVs above 12 tonnes* after a period of 5 years will ensure that all HGVs are subject to proportionate treatment thereby contributing to levelling the playing field in road freight transport. Currently these vehicles are exempted from road charging in the Member States applying the so called 'Eurovignette' (Denmark, Luxembourg, the Netherlands and Sweden) and in the UK, while Estonia also intended to introduce its upcoming charging scheme only to vehicles above 12 tonnes. Germany applies tolls to vehicles above 7.5 tonnes. The stakeholder consultation indicated general support to this measure and finally Estonia has also decided to charge vehicles between 3.5 and 12 tonnes. Germany has also such plans.
- *Inclusion of buses and coaches designed to carry at least 16 passengers (with a maximum weight above 3.5 tonnes)* in the scope of the Directive and applying the same principles as to HGVs: these vehicles cause similar damage to the infrastructure and the environment as HGVs (a number of Member States already apply similar if not the same charges for all HDVs). These buses are typically used for long distance services, and regular interurban services could be further liberalised by revising Regulation (EU) 1073/2009. Since long-distance coach services compete with rail transport, it appears justified that they also pay for the use of the infrastructure and for environmental damage in a coherent way across the EU. The measure was also explicitly supported by some stakeholders saying that coaches should be the next vehicle category to be covered by common rules (to be followed by light goods vehicles and passenger cars). As in the case of extension of rules to HGVs below 12 tonnes, this measure would affect the four 'Eurovignette' countries, the UK, Germany, and Estonia, after having introduced charging for HGVs (cf. Figure 5-3 in Annex 5).
- *Introducing non-discrimination and proportionality requirements for light vehicles*: the goal is to ensure non-discriminatory pricing for short-term vignettes – mainly purchased by occasional users thus most often by foreign nationals – by clarifying the rules on proportionality in the case of light vehicles, taking account of different use pattern of private vehicles[82], and the rules concerning the possible compensation of nationals.

  Since short-term vignettes are mainly purchased by holidaymakers and the price of a daily vignette would have to be very low even to the point of generating a higher administrative cost than revenue brought, it would seem justified to require the provision of at least two different type of short-term vignettes: monthly (valid for 1 or 2 months) vignettes, 10-day vignettes instead of weekly vignettes (one week vignettes often oblige holidaymakers to buy two vignettes to cover the inbound and outbound trip). Most Member States already offer 10-day vignettes, while 4-day vignettes (if

[82] Private vehicles, if used regularly, are used on shorter distances than HGVs; at the same time, when they use the motorway network less frequently, the average length of the trip increases. This, and the fact administrative costs are proportionately higher in the case of light vehicles justifies somewhat higher relative price for the short-term vignettes in the case of these vehicles, compared to HGVs (for which the Directive currently limits the prices of short-term vignettes: the monthly rate at 10%, the weekly rate at 5%, and the daily rate at 2% of the annual rate – these correspond to price ratios of 1.2, 2.6 and 7.3 respectively).

available) could offer a proportionate and thus fair price for very limited use of toll roads.

Based on a dedicated study[83] using survey data from the UK, the only Member State having relevant data, the following vignette types and price ratios would be considered proportionate:

- Two-month vignette: max. 25-30% of that of the annual vignette (ratio of up to 1.8);
- Monthly vignette: max. 15-18% of that of the annual vignette (ratio of up to 2.2);
- 10-day vignette: max. 7-8% of that of the annual vignette (ratio of up to 2.9);
- 4-day vignette is max 4-6% of that of the annual vignette (ratio of up to 5.5).

The percentages are derived from the assumed quantity of trips that the holder of vignette type makes and the average km per trip, according to the assumptions of the Booz&Co. study, that is:

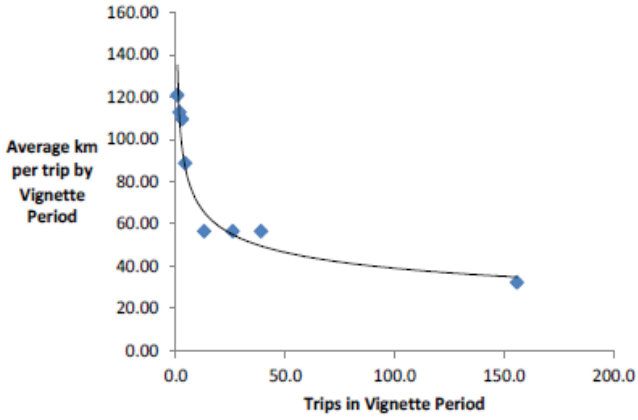
- The longer the vignette duration, the less frequently the motorist uses it (by time);

  and

- The more frequent the usage, the shorter the trip (by distance).

Figure 11-1: Average trip and distance assumptions

Vignette price by duration (€)	Trips in period assumption	Km per trip
Annual	156.0	32.2
Month	13.0	56.4
Week	3.0	109.5



Source: Booz&Co. (2012).

To reflect their more intensive use of the roads, vans and minibuses could be charged at a higher rate than private cars.

[83] Booz&Co. (2012). *Study on Impacts of Application of the Vignette Systems to Private Vehicles.* http://ec.europa.eu/transport/sites/transport/files/modes/road/studies/doc/2012-02-03-impacts-application-vignette-private-vehicles.pdf

The measure would primarily affect those Member States, which operate time-based vignette systems to charge passenger cars (cf. Figure 5-4 in Annex 5), and received overwhelming support from consumers/citizens, while some Member States are reluctant about it.

- *Phasing out vignettes for HDVs (HGVs + buses/coaches) after 5 years (by 2023)* – only distance based charging would be allowed for these vehicles. Member States would remain free to decide whether or not to introduce road charging on their territory and on which roads. However, once they decide to do so, the method of distance-based tolling would be obligatory on the roads which are charged. A 5-year implementation period would give Member States ample time to implement distance-based tolls. The common argument of Member States saying that systems costs of distance-based tolls are prohibitive would be addressed by the parallel revision of the EETS legislation, which would lead to lower system costs[84]. The measure would affect the nine Member States currently operating vignette systems for HGVs and 12 applying vignettes or no charging to buses/coaches (cf. Figure 5-1 and Figure 5-3 in Annex 5). While some Member States that currently apply vignette schemes are not in favour, the majority of stakeholders agree that this is a necessary next step in the harmonisation of charges.
- *Removing minimum levels of vehicle circulation taxes for HGVs above 12 tonnes* (Chapter II of the Directive) would allow Member States reduction or complete abolishing of the tax in case of the application of distance-based charging on TEN-T network. Those Member States which are introducing new systems are interested in being able to compensate the haulage sector through the reduction of vehicle taxes, as the parallel application of an annual vehicle tax and road charging can be perceived as double taxation. Many stakeholders also stressed that any increase in costs as a result of increased charges should be compensated for by reductions in other transport-related taxes.
- *Phasing out vignettes for vans* – only distance based charging would be allowed for these vehicles: since light goods vehicles (vans) are more and more engaged in international transport[85] and compete with HGVs, it can be argued that these vehicles should also be required to pay tolls according to the actual use of the roads (instead of the relatively cheap time-based charges). This would further the creation of a level-playing field in freight transport. The measure would affect nine Member States currently applying vignettes for these vehicles (cf. Figure 5-2 in Annex 5). While road transport operators and environmental organisations are in favour of the measure, Member States are less inclined to agree with it. It would nevertheless be a logical future step in the application of the *polluter pays* and *user pays* principles.

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[84] It is possible already now for Member States to implement distance-based solutions that are not prohibitively costly. For example the Hungarian system introduced in 2013 allows the use of third party devices, including existing fleet management equipment, as on-board units (OBUs) necessary for keeping track of the kilometres covered by the vehicle

[85] See e.g. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/514912/road-use-statistics.pdf or the results of the consultations carried out in the framework of the impact assessment on the revision of Regulation (EC) No 1071/2009 and Regulation (EC) No 1072/2009, where stakeholders representing the EU road haulage industry (IRU) and national level (France, Germany, and Denmark) referred to an increasing presence of foreign registered LCVs in hire-and-reward traffic

- *Phasing out time-based vignettes for cars*: distance-based pricing is the most proportionate way to charge user for the costs of road use. It can be modulated according to the environmental performance of vehicles as well as location and the time of travel, and minimises the possibility of discrimination on the basis of travel frequency (discounts may still be offered by toll chargers on a commercial basis). The measure would affect the seven Member States currently applying vignettes for passenger cars, plus Germany, which plans to introduce such a system (cf. Figure 5-4 in Annex 5). As for vans, there is a distinct difference in stakeholder views concerning this measure. However, a number of Member States would be against it as the measure affects private cars, which makes it much more sensitive. It should be part of a medium-term strategy (as already put forward in the 2011 White Paper), but in the short run, it should be treated with care.

To contribute to reduction of air pollution and congestion:

- *Simplification of the requirements for external cost charging*: merging the charging of noise costs (which are very low on their own) with the cost of air pollution and the waiver of the notification requirement, in case the values set in the Directive are applied, will make it significantly easier for Member States to apply external cost charging. The revised Directive could offer a set of reference values for external cost charges to be applied to different HGV and bus/coach categories depending on their weight or number of axles. These values would better reflect the actual amount of external costs generated by heavy duty vehicles and Member States would not need to make any calculation unless they intend to apply higher charges than the new reference values.
- *Extending the possibility to use mark-ups beyond mountain regions* (up to 15% on top of average infrastructure charge, and up to 25% in case of cross-border sections) to contribute to the financing of removing bottlenecks on the TEN-T network, while keeping the condition of acute congestion or significant environment damage generated by vehicles. The measure would apply to HGVs and buses/coaches.

  Member States would not be allowed to apply a mark-up on roads on which a congestion charge is already applied. Mark-ups could be used for example where no genuine congestion charging is possible (e.g. because cars are not subject to distance-based charging).

- *Phasing out differentiation of infrastructure charges for HGVs according to Euro emission classes* (simplification) – with external cost charging remaining optional. The removal of a redundant measure could incentivise Member States to make use of the other, now simplified, possibility of using external cost charging to protect their local environment from pollution caused by older vehicles. In any case, differentiation according to Euro emission class is losing its relevance and effectiveness over time as the vehicle fleet is replaced and without a Euro VII standard in sight. The share of Euro VI vehicles on German toll roads increase by about 16% each year and stands already at 47% overall and 51% among vehicles registered in Germany, representing a replacement rate of just over 6 years. Thus, the share of Euro 0-IV is barely 6% and decreasing every year. The tendency is similar in other countries operating network-wide distance-based tolls; e.g. in Hungary the share of toll paid by Euro VI trucks

increased from 12 to 21% between 2015 and 2016, with the share of Euro V standing at 50%. The pace of the change is at least partly due to the fact that Hungary does not differentiate between Euro III, IV, V and VI, which also explains that the share of tolls paid by Euro II-III trucks was still 20% in 2016 (but dropped from 28% in 2015). These trends, together with the fact that Member States with long-term concession contracts have been exempted from this differentiation indicate that in just a couple of years the measure will have no impact, apart from hindering genuine external cost charging.

- *Allowing genuine congestion charging on top of the infrastructure charge on congested parts of the network, for all vehicles (LDVs + HDVs)*: such a congestion charge, should Member States decide to implement it, would apply to all vehicles (LDVs and HDVs), which is the fairest way to charge as they are all contributing to congestion. Congestion charging is only possible in a distance-based scheme. Therefore, where private cars are not subject to tolls (when they either use the roads freely or are subject to a vignette scheme), genuine congestion charging cannot be applied.

  It would be up to the Member State to choose whether to make use of this possibility or not. The Directive could require the revenues generated by congestion charging to be invested in the maintenance/development of the road in question or alternative solutions. This could raise the level of acceptability of an extra charge.

  While Member States generally want to keep the decision on the use of toll revenues for themselves; however, they did agree to the requirement of allocating revenues from specific additional charges to transport in the case of mark-ups (plus external cost charges if applied in combination). Since congestion charging would also only cover limited stretches of the network only at specific hours of the day or days of the year, the collected amounts would be limited compared to overall toll revenues. The measure might have therefore better chances of success than the obligation of generalised earmarking.

  In the case of congestion charging many fear that this would become an additional burden on those who are already stuck in congestion. Allocating the revenues to projects addressing the problem can improve acceptability as it could render the charge progressive. As described in the impact assessment support study, whether congestion pricing has progressive or regressive effects depend on the design of the system and on initial travel patterns – and most crucially, on the use of revenues[86].

  Member States are likely to face opposition to introduction of congestion charges if the scheme is perceived to be inequitable. The revenues can be used to counteract any regressive impact, which is a key factor in the acceptability of the systems – hence it is likely that any new congestion charge introduced under the policy options will be (perceived as) equitable, otherwise they will be rejected by the public.[87]

[86] Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

[87] Ibid.

- *Making external cost charging mandatory on the tolled TEN-T network for all heavy-duty vehicles*: with the phasing out of differentiation according to Euro class, it can be argued that the pollutant emissions of vehicles would have to be factored in the road charge if Member States are still to incentivise (not only more efficient) but also cleaner HDVs. In practice, where HDVs are charged, the toll would have to include an external cost charge. Member States would still have the possibility to charge only a percentage of the reference values to be provided in the Directive.

11.2. Discarded policy options (measures)

Some of the specific measures of a full internalisation scenario were considered during the public consultation but have not been retained:

- **Making distance-based charging mandatory on the TEN-T network for HGVs / all goods vehicles** – not retained due to extensive implementation costs (at least in the short term) and proportionality considerations. Road charging is a very sensitive issue for Member States, especially when it comes to passenger cars. While this would probably be the most effective solution to the identified problems, it is not achievable at this stage. In addition, in sparsely populated areas it may not be the most efficient solution (due to the relative importance of costs compared to traffic volumes).

  The consultation results clearly indicate negative sentiments about such a restrictive measure among those Member States which have no distance-based charging in place. Even other stakeholders, which are in favour of such a measure to be applied on the TEN-T network as the ultimate long-term goal, indicated that this needed to be phased in gradually.

  For heavy goods vehicles, all Member States (except Estonia, Finland, Cyprus and Malta) already have charges in place (either tolls or vignettes). The impact of mandatory charging would therefore be limited, while creating strong political opposition. Considering that most countries have charging in place, it would be more effective to require Member States to abandon time-based charging and apply tolls.

- **Inclusion of the external costs of accidents not already covered by insurance schemes** (supported by the European Parliament) – not retained because accident costs are best internalised through pay-as-you-drive insurances and taxes thereon; road charging would not be the fairest and could only be the second best instrument. The consultation did not show practically any support for including accident; on the contrary, a number of respondents mentioned insurance schemes as a better instrument.
- **Mandatory application of genuine congestion charging on congested parts of the network in peak hours for HGVs / all vehicles** – not retained due to extensive costs as it would require setting up tolling systems to cover the relevant parts of the network to facilitate such charging, and imposing it on Member States would raise subsidiarity considerations. The consultation did not show support for this measure, even among those who generally supported congestion charging, instead saying that the decision should be left with Member States.

The option of full internalisation would also mean that Member States would have to apply generalised distance-based charging for passenger cars. Even though with the evolution of intelligent transport solutions (in-car and roadside) pay as you drive schemes will no doubt gain relevance, making it mandatory at this stage would face strong opposition. The use of such systems has to be made easier and more attractive to the user first on a voluntary basis to raise public acceptance.

Other considered and discarded measures:

- **Awarding discounts for the use of specific fuel-saving equipment, such as low-resistance tyres of aerodynamic devices** in order to incentivise more efficient operations (also applicable to the existing vehicle fleet) – not retained due to difficulties in monitoring and enforcement – the presence of the given equipment would have to be tracked via the on-board unit of the vehicle either automatically or with manual intervention from the driver.
- **Promotion of specific low carbon fuel** technologies – not retained because it would require complex calculations of specific emissions attributed to the different technologies to ensure a technology neutral approach. Over time, this will be possible with the use of the VECTO tool (PO2), while the promotion of zero emission vehicles does not require such a methodology and is foreseen already in PO1.
- **Introduction of rules on the liability of the keeper of a toll road to maintain the given road section in sufficiently good/safe condition**. Even though the measure received almost as much support from respondents to the on-line public consultation as the monitoring and reporting requirements, it would effectively introduce a legal obligation to ensure that the objective of achieving fair road quality is met. The option has been discarded as it was considered not to respect subsidiarity requirements. Stakeholders that were interviewed did not support attempting to improve road maintenance by way of rules relating to the potential liabilities. They suggested that liability issues are best dealt with at Member State level and that setting out some general indicators focused on minimum standards at EU level was more appropriate.
- **Making it possible to apply genuine congestion charging (i.e. on top of infrastructure charges) on congested parts of the network in peak hours for <u>HGVs only</u>** – not retained because this solution would unfairly treat freight transport and would not be the most effective since about 80% of road congestion can be attributed to light vehicles.
- **Mandatory earmarking (ring-fencing) of revenues from road charging** – as indicated in Figure 9-2 in Annex 9, Member States already allocate at least part of the revenues from road charging to transport (in some cases specifically to road maintenance). However, they want to keep the decision on the use of revenues from road charging in general at their own discretion. The measure has already been proposed but was rejected by Member States and based on the consultation results, even though road users would welcome such a provision, the majority of Member States would still reject it. It is therefore not currently achievable.
- **Requiring Member States to prepare national plans on the maintenance and upgrade of their road networks** (as an alternative to mandatory earmarking, which has already been proposed twice by the Commission but which failed for reason of subsidiarity) – not retained due to proportionality considerations; discarded in favour of a

similar reporting measure that would be less burdensome on Member States (i.e. the option to monitor and report toll revenues and expenditures).

12. ANNEX 12: ASSESSMENT OF MEASURES AIMED IMPROVING ROAD QUALITY

The two retained measures following the first screening of options are A) Monitoring and reporting by Member States through **regular infrastructure reports,** and B) Introduction of **quality indicators** for tolled roads. The measures were analysed individually and in combination, and can be applied together with any of the policy options identified in section 5. The main impacts are described below while a full assessment can be found in the impact assessment support study.

12.1. Impacts on road quality

The main intended impact of both measures A and B is to improve road quality. This is the key impact as all other impacts will depend on the extent to which road quality may change as a result of applying any of the two measures.

Measure A – **monitoring and reporting on revenues and expenditures** – works through *(1)* greater transparency allowing increased public awareness of the costs of road maintenance and acceptance of road tolls, the uptake of such schemes and thus potentially increased revenues. Reporting will improve understanding and help Member States *(2)* identify financing gaps before the problem exacerbates and ensure that the necessary resources are in effect allocated to maintenance.

(1) Previous experience following the introduction of road pricing in various countries show that transparency about the use of revenues increases the public acceptability of charging systems, especially when revenues are ring-fenced and reinvested in the transport system. At the same time, allocating revenues to the general budget is least well received by users[88]. This is also confirmed by the result of the public consultation where 82% of stakeholders agreed that the revenues generated from taxes and charges should be reinvested into the maintenance, repair and upgrade of the road network, ensuring transparency of the process to the public.

(2) Identifying any maintenance gap sooner will help improve road quality in Member States where the lack of information is the underlying issue. This appears to be the case in a number of Member States (BE, CY, DK, DE, GR, HU, MT, PT and RO) (European Parliament (2014)).

Overall, measure A is likely to have a positive effect on road quality by creating enabling conditions that improve public acceptance and contribute to better understanding of potential expenditure issues. At the same time, it is also likely that the measure on its own will not be adequate to ensure good road quality in all Member States and so it should be implemented as part of a wider package of measures.

Measure B – the introduction of a set of common **quality indicators** – on the other hand would contribute to setting minimum standards at EU level. Road infrastructure represents the largest assets in most countries and there are different well-established national approaches/indicators to assess road quality. Even where Member States apply similar

[88] Cf. various studies referred to in the detailed annex of the Impact assessment support study, including CEDR

techniques, data is often compiled and reported differently, even though the principles and core information needs are the same.

Measure B would introduce tools that can improve the effectiveness of road quality monitoring in Member States, which do not have well established procedure. The measures is likely to have a positive impact by improving the quality and comparability of information on road condition.

12.2. Main economic impacts

12.2.1. Transport costs

To the extent that measures A and B can improve road quality, they are expected to have indirect positive impact on reducing the vehicle operating costs described in section 2.1.2. According to World Bank studies, every dollar saved on road maintenance increases vehicle operating costs by 2 to 3 dollars. Overall, although it is not possible to estimate the direct effect of measures A or B on road quality, it is likely that greater improvements in road quality will result in greater benefits. Hence, it is expected that the impact of **both measures together would be stronger** due their potentially greater combined impact.

12.2.2. Impacts on SMEs

Any road transport undertaking would benefit from reduced operational costs, with micro enterprises being relatively more positively impacted than large companies due to their smaller turnover. Since 90% of the road haulage sector is composed of enterprises with fewer than 10 employees[89], most of them would feel the difference in their daily running costs. A UK study, estimated the **savings linked to vehicle operations** at EUR 16.000 per year. It is not by accident that the representatives of such undertakings are most vocal when it comes to supporting the earmarking of revenues to road maintenance (as opposed to cross-financing of other modes of transport).

12.2.3. Administrative costs

According to a regulation from 1970[90], Member States have to report road infrastructure spending, so **measure A** is not expected to generate any additional costs. In effect, that regulation has extremely cumbersome reporting requirements, which may result in its repeal, while measure A would just require a very limited and focussed set of figures, thereby resulting in a **reduced level of administrative burden** to Member States compared to the status quo.

Measure B may require additional equipment and time to monitor e.g. road surface, which in the case of sophisticated systems could entail high costs; however, recent technological development has significantly reduced the cost of measurement (Forslöf & Jones, 2015). Overall, for **measure B**, it is expected that Member States that already practice advanced

[89] Eurostat. (2017). Goods road transport enterprises, by number of employees. road_ec_entemp

[90] Regulation (EEC) No 1108/70 of the Council of 4 June 1970 introducing an accounting system for expenditure on infrastructure in respect of transport by rail, road and inland waterway

techniques will incur little or no additional costs, whereas there may be costs associated with equipment and staff time for countries that need to adopt new approaches.

At the same time, it is possible to offset any additional administrative/operational costs with benefits from improved road maintenance. It is expected that improved monitoring data would allow Member States to better control contracting works for maintenance, leading to cost savings in the longer run. As indicated in the problem definition, preventive maintenace helps to reduce long-run costs (see also Annex 8: Road asset condition). **Both measures** could contribute to helping Member States more effectively identify and address maintenance gaps, and hence it can be expected that they will reduce maintenance costs in the longer term, thereby offsetting any additional administrative costs.

12.2.4. Macroeconomic environment

As indicated in section 2.1.2, improvements in road quality have positive impacts on the wider economy. First order effects include direct employment in construction and materials supplying industries, while second order effects occur in the production sector in response to the demand for additional inputs required by construction materials supplying industries. According to the studies referred to earlier, the value of these first and second round of effects for investments in transport infrastructure have a total multiplier effect of around €2.4 (range from €2.2 to 2.8) for each €1 invested.

12.2.5. Competitiveness of EU economy

Investments in improving the quality of roads are likely to have an overall positive impact on economic performance due to increased connectivity, accessibility and connections for international trade (European Commission, 2011). Connectivity is a key criterion in decisions related to the localisation of a new business or factory. Better road quality is associated with competitiveness improvements due to the lower operational costs for road users and better connections, which will improve the efficiency of transport and contribute to a more competitive economy.

12.3. Main environmental impacts

The impacts on climate change, air pollution and noise (issues identified in the problem definition, section 2) would be positive in the case of both policy measures to the extent to which they can influence increased investment in road maintenance and thus improve the quality of roads. The impact assessment support study (Annex C) has further details on the related literature.

12.4. Main social impacts

12.4.1. Safety (risk of accidents)

Similarly to the case of environmental impacts, as described in the problem definition and noted under the analysis of congestion, poor road condition can increase accident rates. To the extent that the policy measures encourage better planning of road maintenance and higher road quality, they could be expected to decrease the risk of accidents.

12.4.2. Equal treatment of EU citizens

Measure A would have a positive effect on equal treatment because it aims to ensure that there is transparency both with the setting of toll levels and the use of revenues. The former could improve the acceptance of some charges and would help to protect user rights by enabling them to scrutinise the rationale. Clearly stating the components of such charges could facilitate a wider debate about what such charges should or should not cover and enable user groups, or others, to apply political pressure where this was appropriate to change the way in which charges are estimated.

Measure B would also benefit equal treatment of EU citizens, by ensuring that approaches to monitoring road quality are similarly implemented across Europe, and helping to harmonise the divergent practices seen today.

12.5. Comparison of options to improve road quality

12.5.1. Effectiveness

With regard to the goal of ensuring adequate road quality, the main policy packages, including measures to increase the uptake of road tolls, which can generate additional revenues, would be more effective if combined with specific measures targeting road quality. Since monitoring road quality and reporting on toll revenues and expenditures are not mutually exclusive but are rather complementary, the most effective option is to use these measures in concert.

12.5.2. Efficiency (cost-effectiveness)

In the case of **Measure A**, the requirements call for reporting of information that is already collected by Member States. Hence the additional costs are low. At the same time, the obligations to act on the available information are also limited. This option can therefore be seen as creating enabling conditions that can smooth the way for better road quality through providing more information/transparency, without any guarantee of this outcome.

Conversely, **Measure B** would require greater changes for at least some Member States in the form of changes to monitoring practices and/or equipment. This is more administratively intensive and will likely involve some amount of additional cost for implementation, especially if expensive equipment is needed. The cost can be mitigated through use of innovative measurement approaches. The introduction of best practice indicators under Measure B may also help to improve contracting of maintenance works. Measure B can help to identify problems of road quality as part of an overall asset management system, whereas Measure A can help to improve information flows that could identify maintenance expenditure gaps. Both measures could therefore contribute to cost savings due to preventative maintenance.

12.5.3. Coherence

The findings of the impact assessment support study suggest that if Measure A was introduced, it would be useful to further support the ongoing actions being taken at the

international level by the OECD/ITF to increase standardisation of definitions, thereby ensuring coherence with existing initiatives.

12.6. Overall conclusion / preferred option

On the basis of the analysis, it is clear that combining measures A and B is preferred, and it is recommended to introduce them in concert with the preferred main policy package.

13. ANNEX 13: IMPACT OF CONGESTION CHARGING ON LOCAL COMPETITIVENESS[91]

13.1. Approach

Congestion charging can have broad economic impacts on the profile and competitiveness of the region in which it takes place. Transport infrastructure plays a key role in the location of economic activity and individuals, in the efficient operation of the economy and in shaping the fabric of cities and towns. Altering the cost of using one part of the system can have knock-on effects on the geographical distribution of economic activities and their competitiveness by changing the area's comparative advantage as a place to live, do business and visit. There are opposite effects at play: on the one hand the charge can make an area more costly and less attractive to some businesses; on the other, the improved traffic conditions boost its competitiveness. These drivers are likely to affect different businesses differently and could result in shifts in the mix of economic activities in some areas.

An extensive search of the literature has not provided information on the economic effects of local charges. At the same, time dealing with this issue using the same modelling tools used for the analysis of the packages of options would be extremely complex, full of arbitrary assumptions and would therefore not yield any meaningful results. Thus, a simplified approach has been developed to analyse the regional impacts of congestion charges.

The approach presented here is based on the relationship between accessibility and local/regional impacts. This relationship is explored in the literature, although in theoretical terms rather than providing empirical quantifications (also because disentangling the effect of accessibility to other local drivers is complex). However, at least one model exists which use accessibility changes to derive regional economic impact (Spiekermann and Wegener, 2006).

A congestion charge increases travel cost on some roads -> given the higher cost, some traffic is diverted to other roads or modes -> given the lower traffic speed is improved on charged roads -> the generalised cost to travel is therefore modified because of higher cost but lower travel time -> a different generalised cost means a different accessibility -> a different accessibility has an impact on the regional economy.

In order to capture the range of possible impacts of congestion charging on regional economies, several types of regions need to be considered:

a) Regions that are considered to be "attractive" (i.e. in this case productive) areas.

b) Regions that experience various levels of congestion.

c) The effect of a congestion charge on demand depends on many local factors. For instance, the impact of the charge on traffic is heavily dependent on the overall level of congestion on the network, the available alternatives to charged corridors and so on. It is however impossible to consider local conditions at the required level of detail for the analysis. Instead, some parameters can be used to reflect the elasticity of demand and test what happens if different levels of elasticity are assumed.

[91] Source: Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

Therefore, the approach uses an estimation based on parametric assumptions for some sample regions. Given the importance of local conditions in determining the results, the quantitative outcome of the approach is provided as range of values for the potential effect. It is also accompanied by notes to highlight the elements that should be considered on a case by case basis to assess whether the impact would be likely to fall closer to the lower or the higher threshold.

13.2. Methodology

The methodology to model regional economic impacts involved the following steps:

a) For each region a potential accessibility indicator is calculated with reference to the NUTS3 regions within a distance of 300 km. It is assumed that beyond this threshold the effect on local economy is negligible. A potential accessibility indicator is calculated as:

$PAi = \Sigma_j (GDP_j * \exp(-0.075* \text{Generalised Cost}_{ij}))$

Generalised cost is defined as the monetary cost plus the monetary equivalent of travel time[92].

b) A congestion charge is assumed to be applied on paths connecting Origin-Destination pairs where, according to the modelled speed, some congestion occurs[93]. The application of the charge has two effects. First, it increases the travel cost on the O/D pair. Second, it improve speed on the O/D pair by reducing some of the traffic flow. Both these two effects depend on local conditions (see section 3 below). This defines range that encompasses the potential for a low and a high impact.

c) By considering combinations of the low and high impact on travel cost and the low and high impact on travel speed, four scenarios are defined (low effect on cost and low effect on speed, high effect on cost and low effect on speed, etc.). For each scenario the accessibility indicator is recalculated.

d) From the data reported in Spiekermann and Wegener (2006), the elasticity of regional GDP to a change of accessibility is estimated to be 0.25 (i.e. a percentage point improvement of the accessibility[94] gives rise to a 0.25% increment of regional GDP).

e) The elasticity is applied to the accessibility change in each scenario with respect to the reference case. Four different values are obtained from which minimum and maximum effect can be identified.

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[92] A value of travel time of 15 Euros/hour has been used to compute the generalized travel cost. Value of travel time depends on local conditions. Representative values for road transport in European countries (Victoria Transport Policy Institute, 2010) range from 4 Euros/hour for non-working trips to 6 Euros/hour for commuting trips, 21 Euros/hour for business trips to 45 Euros/hour for trucks. The chosen value of 15 Euros/hour is representative of all types of traffic (passenger and freight) taking into account that congestion charge should be applied in peak time where commuting trips are a large share of car trips.

[93] Speeds are drawn from the TRUST model. It should be noted that the approach is based on the identification of origin-destination pairs where speed is below ideal free-flow speed. It is unimportant to detect exactly on which links congestion occurs.

[94] In the study used to estimate the elasticity, the accessibility indicator is a potential one, so the methodology is consistent. Furthermore, data related to the impact of a road charging scenario has been considered.

As discussed above, the approach is a parametric one, adopting a low and high threshold for the assumed impact of congestion charging on travel cost and travel speed. In order to understand if in a specific region one should expect lower or higher elasticities, there are several elements to be considered as discussed in Figure 13-1.

Figure 13-1: Main factors affecting elasticity of travel demand

Impact of congestion charge on travel cost	Impact of congestion charge on travel time
The size of the charge. The larger the charge applied, the greater the increase in travel cost.	***Availability of alternative routes***. When some links are charged, spill over effect on other links can occur. This is more likely when different options are available. If alternative routes are lacking either because the infrastructures are poor or because the whole network is congested (as it often is the case around metropolitan areas), the elasticity of demand will be lower. It should be also considered that if one road is congested and other roads on the same corridor are not, most likely the level of service (i.e. speed) on the alternative routes is anyway lower than on the most used link (otherwise as soon as congestion arises some vehicles would switch on alternative road). Therefore even when alternatives exist and some traffic is diverted onto them, the overall effect on average speed of trips is hardly large.
The length of the charged network. The relevant travel cost is for origin-destination pairs. If a congestion charge is applied to some links, the travel cost will be affected more when these links represent a larger portion of the overall trip distance. Even large charges will not affect the total cost very much if they are only applied on a small number of short road stretches.	***The localisation of the charged links***. The availability of alternatives can depend on the position of congested links. Often congested links are close to large attractors (e.g. a metropolitan area, an industrial zone) where many trip are destined to. In this situation it is hard to find alternative routes. In some cases interurban corridors become congested because traffic related to several different O/D pairs sharing part of their route converge to the same infrastructure. This second case is generally more favourable to find alternatives.
The initial travel cost. The same charge level can have a different impact depending on the initial cost. Especially making reference to perceived costs, a given charge will raise car travel cost more than truck travel cost.	***Availability of alternative modes.*** Another reaction to road charging can be mode shift. This is more likely when good alternative services (e.g. rail connections) exist along the corridor.
	The length of the charged network. As already mentioned for travel cost, if travel time is referred to the whole trip, the effect of a congestion charge depends on the share of route charged. If the policy is applied to only a minor part of the route, even in case demand reacts significantly, the overall effect on the average travel speed for the trip will be small.
	Flexibility of departure time. If a congestion charge is applied only in peak hours, travellers who can move their departure time before or after the charged period can avoid paying the charge (and at the same time traffic in peak time is reduced). The larger the share of demand with a flexible travel time and the larger the effect on travel speed.
	Average income. Demand of higher income groups is usually less elastic than lower income groups'. If the congestion charge is based on an estimation of marginal cost of congestion and, in turn, such an estimation is based on some demand curve, the average level of income will be reflected in the level of the charge (as the demand curve will be more or less steep). However if an average value e.g. by country is applied in region with significantly different levels of income the response of demand can be diverse.

13.3. Model results

The results summarised in Figure 13-2 were obtained, assuming elasticities within a reasonable range as defined above.

Figure 13-2: Impact of congestion charge on regional economies –results

Zone Type	Region	Effect on regional GDP
1	A region located at medium distance from a large economic pole and with a few congestion spots along its connections (e.g. Essex CC (UK))	Min -0.6% Max 0.5%
2	A region located in the middle of a large productive area where congestion is significant especially on short/medium distance (e.g. Milan (IT))	Min -0.7% Max 0.4%
3	A region which is the main economic pole in a large area where congestion is significant (e.g. Warsaw (PL))	Min -0.5% Max 1.0%
4	A region located in an area where GDP is evenly distributed congestion is limited to some spots (e.g. Oporto (PT))	Min -0.3% Max 0.3%
5	A region located at medium/long distance from main economic poles and in an area with widespread congestion (e.g. Harz (DE))	Min -1.1% Max 0.7%
6	A region located at medium/long distance from an economic pole and with some congestion along its connections (e.g. Maine et Loire (FR))	Min -0.3% Max 0.2%

The main findings from the calculations are:

- The effect of congestion charges on regional economies are expected to be limited. This seems reasonable, since congestion charge should be limited in space and time. Furthermore, even if the charge can improve travel speed it will also increase travel cost, so the impact on accessibility is not necessarily positive in all circumstances.
- The effects are larger where the effect on speed is assumed to be bigger and the effect on cost is assumed to be smaller.
- The effect is larger where there is more congestion (even if in more congested areas, demand has probably fewer alternatives and so the more optimistic scenario based on higher elasticity of speed is unlikely).
- The impact is different across regions not only because of different levels of congestion, but also because congestion is "located" at diverse distances from the economic poles. Where charged (i.e. more congested) links are those connections to the main economic poles, the impact on the economy is larger. Again this is not surprising. One message behind this result is that if congestion exists on a corridor because of poor infrastructure (i.e. even if surrounding regions do not generate much traffic, demand is forced to use the only road available) a congestion charge is not effective.

In summary, the main purpose of congestion charging can be the internalisation of congestion cost or to disincentive drivers to use congested roads and improve the level of service. Congestion charges can have indirect effects including those on local economies; however these indirect effects are probably not large and do not represent a major factor that will determine the overall success of the charge.

14. ANNEX 14: SME TEST[95]

14.1. Consultation with SME representatives

Consultation with SMEs took place throughout the following processes:

- The open public consultation (12 weeks from 8th July 2016) gave SMEs the opportunity to respond directly to the questionnaire:
    - Seven SMEs in the road haulage sector (from Spain, Austria, Hungary, Poland and Portugal) responded to the consultation.
    - Representatives of SMEs (UETR and UEAPME) responded to the public consultation via answers to the survey or through submission of a position paper.
- Interviews were carried out with two SMEs, who requested to be remain anonymous. The questions covered potential impacts on SMEs of different policy measures.
- Interviews with all stakeholders included questions that invited interviewees to think specifically about the potential impacts on SMEs and whether they might be disproportionate.

As can be seen above, direct feedback from SMEs via the survey and interviews was limited and so their responses cannot be considered representative. Where we were able to speak directly with two individual SMEs in the interviews, their responses were broadly supportive of the changes in terms of reducing the environmental impact of goods vehicles and congestion, as well as re-investing revenues into road infrastructure. The position of UEAPME was to support the proportional pricing of vignettes and phasing out of vignettes for HGVs (with optional distance-based charging). They did not support the inclusion of freight vehicles in congestion charges given that cars are the primary cause of congestion. Nor did they support the inclusion of CO_2 emissions in the Eurovignette Directive since CO_2 emissions are generally internalised through fuel taxation and thus this type of charging (if applied on top of existing charges) could lead to double taxation.

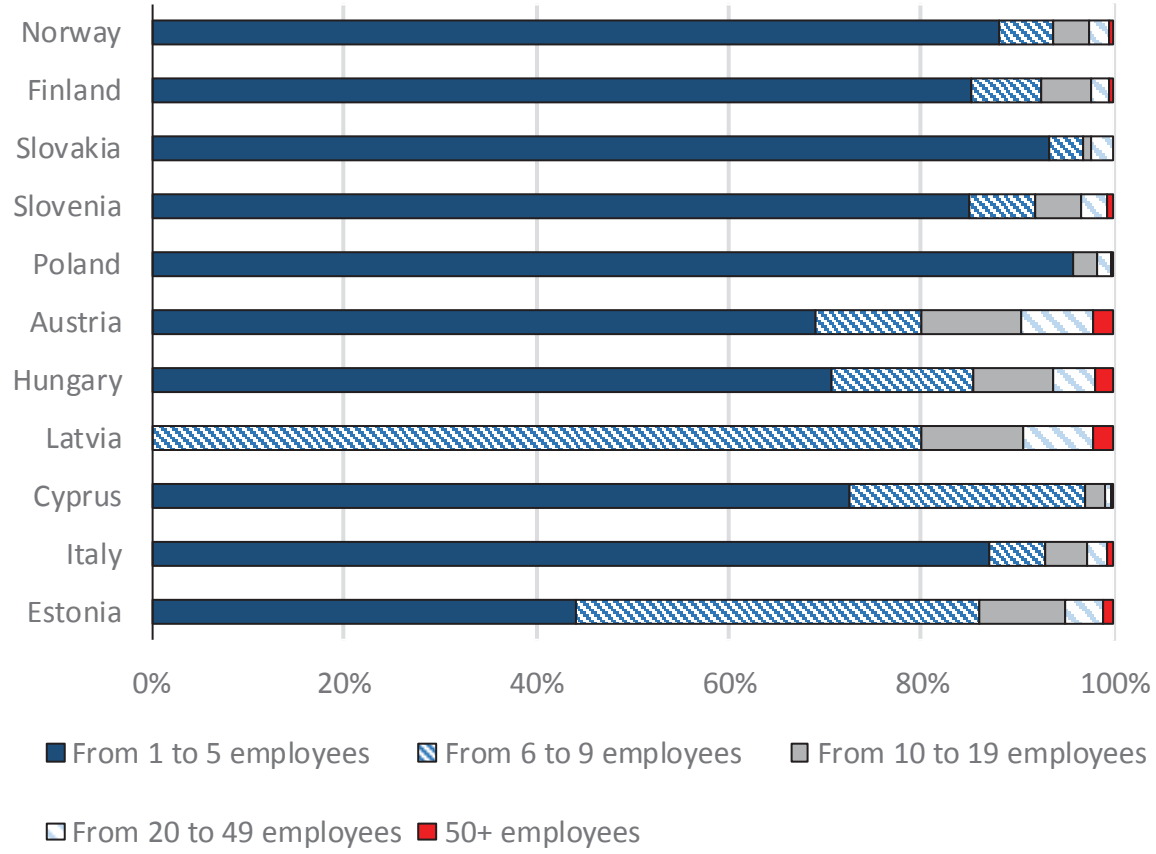
More generally, all interviewed stakeholders were invited to provide their perspective on possible impacts on SMEs; however most did not have an opinion or did not respond to this question. Of the few responses received, one hauliers association (PL) believed that SMEs would find the policy measures more challenging, as these firms had fewer resources to invest in cleaner vehicles, new equipment or pay higher road charges. An interviewee from an EU-15 national authority highlighted the costs of investing in new equipment - such as on-board systems- would have a disproportionate impact on SMEs, particularly for occasional road users. Conversely, another EU-15 National ministry (who requested to remain anonymous) responded that they did not foresee any particular costs burdens for SMEs.

[95] Source: Ricardo et al. (2017), Support Study for the Impact Assessment Accompanying the Revision of Directive 1999/62/EC.

14.2. Assessment of businesses likely to be affected

SMEs play a significant role in the road haulage industry. The market structure is characterised by having a small number of large, pan-European logistic companies providing complex services at the top, which dominate the largest contracts but subcontract a significant proportion of their work to SMEs (AECOM, 2014). This is illustrated in the data from Eurostat on company size (Figure 14-1). For the countries where data is available, SMEs with less than 50 employees represent 97-100% of all road haulier enterprises in 2012 (the latest year for which data are available). The vast majority (80-97%) are micro-SMEs, i.e. companies with fewer than 10 employees. At the EU level, 90% of enterprises in the sector have fewer than 10 employees and account for close to 30% of turnover (including self-employed) (Eurostat, 2017).

Figure 14-1; Size of enterprises in the Haulage Industry in 2012



Source: (Eurostat, 2017) - *Adapted from road_ec_entemp*

The haulage industry is highly competitive and operators are forced to operate on low profit margins (AECOM, 2014). Cost pressures for logistics providers mean that many heavily rely on subcontracting less profitable operations to smaller enterprises and owner-operators (AECOM, 2014). This presents a risk that additional road charges could push some players out of the market, especially among smaller firms that tend to compete mainly on price (WTO, 2010). The risk of such impacts is examined further below.

14.3. Measurements of the impacts on SMEs

The proposed policy measures will likely lead to **increases in the costs of transport**. SMEs may be disproportionately affected by these increases, since a large firm may be better able to absorb increased costs of road pricing compared to a smaller firm (Mahendra, 2010). As shown in the modelling results, small increases in the cost of transport are foreseen for all options due to the introduction of new road tolls in certain Member States and the greater use of external cost charges (and to a lesser extent, mark-ups in mountainous regions).

The capacity to offset additional costs from road user charging may differ depending on the size and competitive position of firms. It could be argued that SMEs may have lower capacity to optimise their operations, and hence would be most affected by road charges. Evidence from Germany and Switzerland suggests that road hauliers were able to offset higher road charges through reducing empty runs or increasing loading factors (BMT Transport Solutions, 2006); (CEDR, 2009). SMEs with smaller vehicles and fleets, or a lower density customer network, could lack the scale needed to enhance efficiency according to these mechanisms. A qualitative study of the effect of the UK HGV levy on Irish hauliers also suggested that the costs would be borne by industry, due to their *"low bargaining power to push the road charge on to freight forwarders and exporters*" (Vega & Eversa, 2016). In addition, extending the Directive to HGVs <12 tonnes could potentially have a greater impact on SMEs since, according to one interviewed stakeholder (UK authority), SMEs typically operate smaller vehicles.

That said, it is generally assumed that 100% of cost increases due to road tolls are passed through, consistent with experience in several European countries. For instance, in Germany, Austria and Switzerland, the cost increases after introduction of tolls were passed to customers (BMT Transport Solutions, 2006); (Ruehl et al, 2015). Although these studies did not specify whether the results applied specifically to SMEs, since the haulage industry is made up almost entirely of SMEs it seems reasonable to assume that the outcome of passing through most (if not all) of the additional costs is representative. As such, it is expected that increased transport costs in PO1-4 will not have significant disproportionate impacts on SMEs.

Introducing **congestion charging** will also likely impact SMEs, since they have lower flexibility in their operations (as described above). SMEs with operations based primarily in affected areas (e.g. that often travel through congested road networks), or that have fewer resources available to be flexible in the timing of operations (e.g. from a shift to off-peak operations) would be disproportionally affected by increased charges. In particular, small firms may have no choice but to drive in peak hours because they have to maximise utilisation of their vehicles (Mahendra, 2010).

Interview feedback from a pan-European logistics company was that congestion charging is particularly challenging for trucks, as deliveries are often dependent on the demand of customers. This is demonstrated by the introduction of the congestion charge in London, where the number of goods vehicles remained almost unchanged, indicating that hauliers did not change behaviour in order to avoid the charges (CEDR, 2009). In their position paper, UEAPME noted that transport companies are already motivated to avoid congestion and

driving in peak times would be because they have no alternative choices, and suggested that freight vehicles should be exempted from congestion charges.

At the same time, the same firms would likely benefit from lower congestion, which would result in time savings and an effective increase in the catchment area for the business. If the congestion charge is effective, it will improve the reliability and speed of deliveries along the supply chain. Given the limited real-world experience with inter-urban congestion charging, it is difficult to say what the net impacts would be – however, evaluations of the London congestion charge found no discernible impact on businesses (TfL, 2008), suggesting that more limited, targeted interurban congestion charging foreseen in the policy options would not have significant impacts (positive or negative).

Finally, the proposed measures to **promote zero-emission vehicles (included in PO1-4) through allowing lower road user charges** could have different impacts on SMEs compared to larger firms. In general, the impact on firms from this measure is expected to be positive, since the lower per-km road charges will contribute to lower running costs overall (in addition to other fiscal incentives, such as tax breaks and lower prices for alternative fuels). Over time, these lower running costs should more than outweigh the additional purchase costs of zero-emission light vehicles compared to a diesel equivalent (EEA, 2016b); (Energy Saving Trust, 2017). Taking subsidies into account, the total cost of ownership of a commercially-owned electric van is lower than a conventionally-fuelled van in most Member States – with larger savings if annual mileage is higher (Schimeczek et al, 2015).

SMEs in particular may face more difficulties in making the upfront investment for the more expensive vehicle. For example, Nissan e-NV200 electric van is 47% more expensive to purchase and lease compared to its diesel equivalent, the NV200 (Low Carbon Vehicle Partnership, 2016). For HDVs the differences in purchase costs compared to conventional vehicles is even larger, with retail costs of electric trucks being between 170% and 280% higher than a conventional equivalent (CE Delft, 2013).

If SMEs are less able to purchase or lease zero-emission vehicles, they will *initially* benefit less from the measure compared to a larger firm – both in terms of have less potential to access the lower rates for road user charges, as well as the co-benefits of owning zero emission vehicles in the form of lower fuel costs etc. There are, however, two reasons that the impact may not be a concern in the longer term:

- Firstly, the difference in investment costs between zero-emission vehicles and conventional vehicles is largely due to the powertrain costs (i.e. the battery). It is widely predicted that the cost of batteries will decrease significantly between 2015 and 2030 (Wolfram & Lutsey, 2016) - meaning that upfront investment will be less of an issue than today.
- Secondly, SMEs typically buy their vehicles on the second-hand market (BCA, 2012). If the measure stimulates additional first-hand purchases of zero-emission vehicles, these will eventually reach the second-hand market and SMEs will benefit from having access to zero-emission vehicles that they would otherwise not have been able to purchase.

14.4. Assess alternative options and mitigating measures

The analysis shows that the initiative might result in a slight disproportionate increase in costs for SMEs, but this is generally found to be small and likely to be passed on to customers. Experience from existing HGV road user charges (a sector primarily made up of SMEs) in countries such as Germany, Switzerland and Austria found that increases in costs were generally small and passed on to customers (Ruehl et al, 2015). Impacts from interurban congestion charging are expected to be limited. Consequently, there is no indication of a need for SME-specific measures in order to ensure compliance with the proportionality principle.

15. ANNEX 15: THE ROAD INITIATIVES – THE 'BIG PICTURE'

15.1. Introduction

The Road Initiatives, which are all REFIT Initiatives, are fully inscribed in the overall priorities of the Juncker Commission notably under the 'A deeper and fairer Internal Market' and the 'Climate and Energy Union'.

The Communications from the Commission on 'Upgrading the Single Market: more opportunities for people and business' and on 'A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy' explicitly refer to the Road Initiatives.

The table below presents the link between the Juncker priorities, the Impact Assessments prepared for the Road Initiatives and the related legislative acts.

Priorities	IAs	Legislation
A deeper and fairer Internal Market	Hired vehicles	Directive 2006/1
	Access to the haulage market and to the Profession	Regulation 1071/2009 & 1072/2009
	Social aspects: Driving/rest time, working time and enforcement measures (tachograph), Posting of workers and enforcement measures	Regulation 561/2006 and Regulation 165/2014
		Directive 96/71, Directive 2014/67, Directive 2002/15 and Directive 2006/22
	Access to the market of buses and coaches	Regulation 1073/2009
Climate and Energy Union	Eurovignette	Directive 1999/62
	European Electronic Toll Service (EETS)	Directive 2004/52
		Commission decision 2009/750

Moreover, the transport strategy of the Commission as laid down in the White Paper "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system" adopted on 28 March 2011, included references to the road initiatives[96].

15.2. The EU road transport market

Road transport is the most prominent mode of transport. In 2014, almost three quarters (72%) of all inland freight transport activities in the EU were by road. On the passenger side, the relative importance of road as mode of transport is even greater: on land, road accounts for more than 90% of all passenger-kilometres: 83% for passenger cars and almost 9% for buses and coaches.

Almost half of the 10.6 million people employed in the transport and storage sector in the EU are active in carrying goods or passengers by road. Road freight transport services for hire and reward employs around 3 million people, while the road passenger transport sector (buses, coaches and taxis) adds another 2 million employed persons (a third of which are taxi drivers). This corresponds to more than 2.2% of total employment in the economy and does

[96] More specifically in the Annex under points 6, 11 and 39

not include own account transport which in road freight transport alone provides employment for 500,000 to 1 million additional people.

There are about 600,000 companies in the EU whose main business is the provision of road freight transport services for hire and reward. Every year, they generate a total turnover of roughly €300 billion, around a third of which is value added by the sector (the rest being spent on goods and services from other sectors of the economy). The provision of road freight transport services for hire and reward is hence an important economic sector in its own right, generating almost 1% of GDP.

In road passenger transport, there are about 50,000 (mostly) bus and coach operators (of which 12,000 provide urban and suburban services, (some including tram and underground)) and around 290,000 taxi companies in the EU. Together, they generate a turnover of €110 billion. Without taxis, total turnover of the sector is around €90 billion per year, of which some €50 billion is value added.

15.3. Why is there a need for action?

Road transport is for a large part international (around 34%[97]) and this share is increasing, which explains the need for a common EU legal framework to ensure efficient, fair and sustainable road transport. The framework covers the following aspects:

- Internal market rules governing access for operators to the markets of freight and passengers
- Social rules on driving/rest time and working time to ensure road safety and respect of working conditions and fair competition
- Rules implementing the user and polluter pays principles in the context of road charging
- Digital technologies to enable interoperable tolling services in the EU and to enforcement EU rules (e.g. the tachograph)

It is clear that current rules are no longer fit for purpose. Member States are increasingly adopting own national rules to fight "social dumping" while acknowledging that their actions have adverse effects on the internal market. Moreover, public consultations have shown a strong support for EU action to solve current issues in road transport. For example:

- Severe competition in the road transport sector has led many operators to establish in low-wage countries without necessarily having any business activity in these countries. There is a lack a clear criteria and enforcement mechanisms to ensure that such establishment practises are genuine, and that there is a level playing for operators.
- Measures on Posting of Workers implemented in 4 Member States (DE, FR, AT and IT) are all different and obviously from other Member States which have not implemented any measure to implement the minimum wage to road transport on their territory. Stakeholders ask for a common set of (simplified) enforcement rules.

[97] Statistical Pocketbook 2016, EU Transport in figures

- CO2 emissions from road transport represent a large share of total emission and the share is set to rise in the absence of common action (at EU 28 level), which is needed to contribute substantially to the commitment under the Paris Agreement and to the 2030 goals.

- Due to the increasingly more and more hyper-mobile nature of the sector, there is a need for common and enforceable rules for workers. All workers should benefit from the same level of protection in all Member States to avoid social dumping and unfair competition between hauliers. This is currently not the case.

15.4. What are the main problems?

The Internal market for road transport is not complete. It is our assessment that the current situation does not allow to exploit the full potential of transport services

- e.g. current rules on bus/coach services or the rules on hired vehicles are still very restrictive. Some Member States have decided to unilaterally open their market, which has led to a fragmentation of the EU internal market.

Many rules are unclear, therefore leading to different level of implementation by Member States and problems of enforcement:

- e.g. on cabotage where all stakeholders agree that current rules are unenforceable

There are allegations of 'social dumping' and unfair competition in the road transport sector. This has led to a division between East and West in Europe. As a consequence, several Member States have decided to take national measures, which might jeopardize the unity of the EU market for road transport:

- E.g. minimum wage rules in DE, FR, IT and AT coupled with disproportionate administrative requirements ; prohibition of drivers taking the weekly rest in the cabin of vehicles in FR and BE

Environmentally, we have made good progress on reducing pollutants from Heavy Good Vehicles but our legal framework currently does not address the issue of climate change (CO_2). At the same time, the infrastructure quality is degrading in the EU despite that fact that user charges and tolls are levied on most TEN-T and motorways.

Electronic tolling systems in the EU are, despite the primary objective of the EU legislation of "one contract/one on-board unit/one invoice" for the users, far being interoperable. More generally, the benefits of digitalisation are still under-exploited in road transport, in particular to improve control of EU legislation (e.g. many Member States do not currently the use of electronic waybills).

15.5. Options and main impacts

To achieve these objectives, all IAs will consider a range of different options, which ultimately should improve the efficiency, fairness and sustainability of road transport.

The IA on Hired Vehicles will assess options aiming at removing outdated restrictions on the use of hired goods vehicles and thus at opening up new possibilities for operators and leasing/hiring companies alike. More flexibility for the hiring of vehicles should lead to more efficient operations, higher productivity and less negative environmental impacts as fleet renewal will be promoted.

The IA on Access to the haulage market and to the Profession will study various options to ensure effective and consistent monitoring and enforcement of the existing rules in Member States and to ensure coherent interpretation and application of the rules. Three broad groups of potential measures will be assessed, namely measures liable to improve enforcement, measures ensuring simplification and clarification of current rules and measures reinforcing the cooperation between Member States.

The IA on Access to the market of buses and coaches will assess options aiming at improving the performance of coach and bus services vis-a-vis other transport modes, especially private car and further developing the internal market for coach and bus services. This should lead to a reduction of the adverse environmental and climate effects connected with mobility. Various policy options will be considered for creating more uniform business conditions and also a level playing field for access to terminals.

The IA on Social aspects of road transport will study options aiming at ensuring the effectiveness of the original system put in place and therefore contributing to the original policy objectives, i.e.: (1) to ensure a level playing field for drivers and operators, (2) to improve and harmonise working conditions and (3) to improve the road safety level. An additional objective, in the context of the implementation and enforcement of the provisions on posting of workers, is to ensure the right balance between the freedom to provide cross-border transport services and the protection of the rights of highly mobile road transport workers. In this perspective, three broad groups of measures will be analysed: 1. Simplification, update and clarification of existing rules, 2. More efficient enforcement and cooperation between Member States and 3. Improved working conditions of drivers and fair competition between operators.

The IA on the Eurovignette will assess options to promote financially and environmentally sustainable and socially equitable (road) transport through wider application of the 'user pays' and 'polluter pays' principles. A number of different measures and their variants aiming at correcting price signals in freight and passenger transport will be considered in order to address the issues identified. The policy options range from minimum adjustments to the Directive required for improving its coherence and addressing all policy objectives, through the promotion of low carbon (fuel efficient) vehicles and the phasing out of time-based charging schemes (vignettes) for trucks to the optimisation of tolls for all vehicles.

The IA on EETS (European Electronic Tolling Service) will study options aiming at reducing the cost and the burden linked to the collection of the electronic tolls in the EU – for the users and for the society at large. It will equally seek to improve the framework conditions for the faster and more widely provision of an interoperable European Electronic Toll Service. Different policy options will be considered, including a non-legislative approach (facilitating exchange of best practice, co-financing EETS-related projects) and a legislative review.

These policy options and their impacts will be presented and assessed in detail in the respective IAs.

15.6. Expected synergies of the package

The different initiatives constitute a coherent set of measures which will jointly contribute to an efficient, environmentally and socially sustainable road transport sector. It is expected that the impacts will be more than the addition of the impacts of each initiative, meaning that the initiatives are complementary. Some examples of such synergies are provided below.

- Current restrictions on cabotage are unclear and therefore lead to illegal cabotage. These illegal activities are closely linked with the fact that transport operators established in low-wage countries exert unfair competition via 'social dumping' and not respecting the rights of workers, who often are staying in their trucks abroad for longer periods. This illustrates the clear link connection between compliance of internal market rules and social/fair competition aspects of road transport, which are all addressed by the road initiatives and which cannot be dealt with separately.

- When assessing the laws applying a national minimum wage to road transport, Member States explained the Commission that one of the reasons for adopting these national measures is to fight the phenomenon of fake establishments and “letter box” companies in low-wage countries. Tackling the issue of posting of workers in road transport goes therefore hand in hand with the issue establishment of road hauliers transport operators, which again illustrates the link connection between internal market and social aspects of road transport.

- Promoting interoperability of electronic tolls systems will lead to lowering the implementation costs of such systems by Member States. We can expect that this will incentivise Member States to put in place distance-based tolls, which better reflect the user and polluter pays principles use of infrastructure. This shows the close link between the Eurovignette and EETS initiatives.

- Seeking to improve the performance of coach and bus services vis-a-vis other transport modes will inevitably lead discussion on a level playing between road and rail services. Current EU legislation provides that rail users shall pay for the use of infrastructure, while it is not currently the case for buses and coaches which are outside the scope of the Eurovignette directive. The inclusion of buses and coaches in the Eurovignette initiative to ensure that they pay a fair price for using the road infrastructure is therefore essential and will ensure endure overall coherence.

- The initiatives on hired vehicles is in particular related to the initiatives on the access to the market and to the profession, all having the aim of establishing clear and common rules for a well-functioning and efficient Internal Market for road haulage: some of them by ensuring a good functioning of the market of transport services, others by ensuring the best use of the fleet of vehicles.

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