EUROPEAN
COMMISSION

Brussels, 31.5.2017
SWD(2017) 180 final

PART 1/2

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}

GLOSSARY VII

1. INTRODUCTION 1

1.1. Policy context 1

1.2. Legal context 2

1.3. Evaluation of the implementation 3

2. WHAT IS THE PROBLEM AND WHY IS IT A PROBLEM? 3

2.1. What is the nature of the problem? What is the size of the problem? 5

2.1.1. P1: Insufficient contribution of road transport to overall CO_2 emission reduction 5

2.1.2. P2: Degrading quality of road infrastructure 6

2.1.3. P3: Discrimination of occasional / non-resident road users and unfair distribution of costs via road charging 8

2.1.4. P4: High levels of air pollution, noise and congestion 10

2.2. What are the main drivers? 11

2.2.1. D1. Insufficient uptake of vehicles with low CO2 emission 11

2.2.2. D2. Insufficient investment in road maintenance 13

2.2.3. D3. Insufficient uptake and sub-optimal application of road charging 14

2.2.4. D4. No rules on price proportionality of vignettes for passenger cars and vans 15

2.2.5. D5. Lack of clear price signals on pollution and congestion 16

2.3. Who is affected by the problem? What is the EU dimension of the problem? 18

2.4. How is the problem likely to develop without action? 19

2.4.1. Insufficient decrease in CO_2 emissions from road transport 19

2.4.2. Degrading quality of road infrastructure with negative economic, social and environmental impacts 19

2.4.3. Potential discrimination against occasional/non-resident users and unfair distribution of costs via road charging 20

2.4.4. Negative environmental and socioeconomic impacts of road transport 22

3. WHY SHOULD THE EU ACT? 22

3.1. The EU's right to act 22

3.2. Subsidiarity check 23

3.3. EU added value 24

4. OBJECTIVES 25

5. POLICY OPTIONS 26
5.1. Baseline (no additional EU action) 26
5.2. Discarded policy measures 26
5.3. Policy option 1: minimum adjustments with rules for vehicles (including for passenger cars) (PO1) 27
5.4. Policy option 2: rules for all vehicles and progressing on the 'polluter pays' and 'user pays' principles for HDVs (PO2) 29
5.5. Policy option 3: reducing CO_2 and other externalities from all vehicles (PO3) – with two variants (3a and 3b) 30
5.6. Policy option 4: optimisation of tolls for all vehicles (PO4) 31
5.7. Overview of measures and objectives 31
6. ANALYSIS OF IMPACTS 33
6.1. Economic impacts 33
6.1.1. Transport costs 33
6.1.2. Congestion cost 37
6.1.3. Impact on SMEs 38
6.1.4. Member States budgets 39
6.1.5. Compliance costs to road users 42
6.1.6. Road quality 43
6.1.7. Regional distribution of impacts 44
6.1.8. Macroeconomic environment 45
6.1.9. Competitiveness of the EU economy 47
6.1.10. Functioning of the internal market 47
6.1.11. Impact on third countries 48
6.2. Environmental impacts 48
6.2.1. CO_2 emissions 48
6.2.2. Air quality 49
6.2.3. Noise 50
6.2.4. Land use 51
6.3. Social impacts 51
6.3.1. Impacts on employment 51
6.3.2. Public health 52
6.3.3. Social inclusion and distributional impacts 53
6.3.4. Equal treatment of citizens 54
7. HOW DO THE OPTIONS COMPARE? 55

7.1. Key economic, social and environmental impacts 55
7.2. Effectiveness 57
7.3. Efficiency 58
7.4. Coherence 59
7.5. Proportionality 60
7.6. Preferred option 60
7.7. Effectiveness in achieving the objective to reduce regulatory burden (REFIT objective) 61
8. MONITORING AND EVALUATION 62
8.1. Indicators 62
8.2. Operational objectives 63

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*".

---

[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

---

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

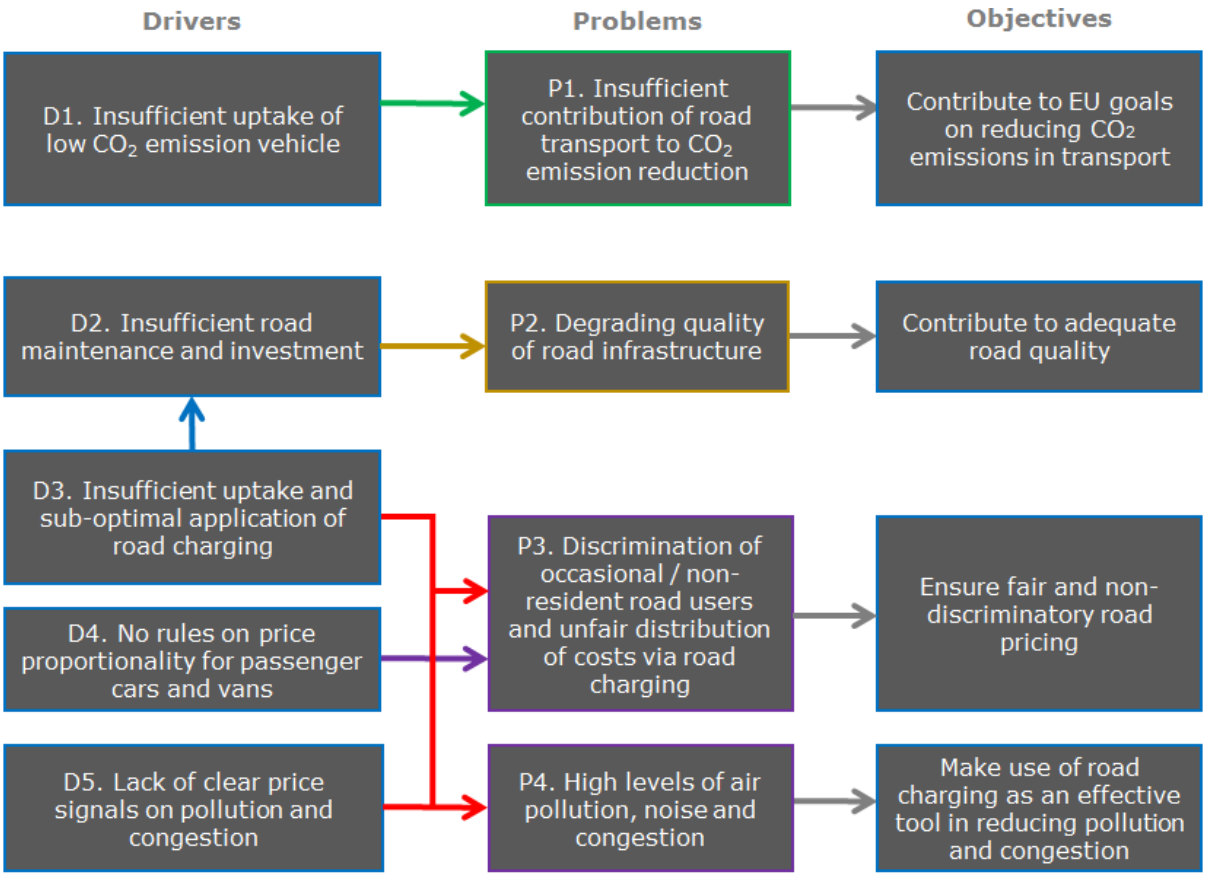
[13] Cf. Annex 10

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.

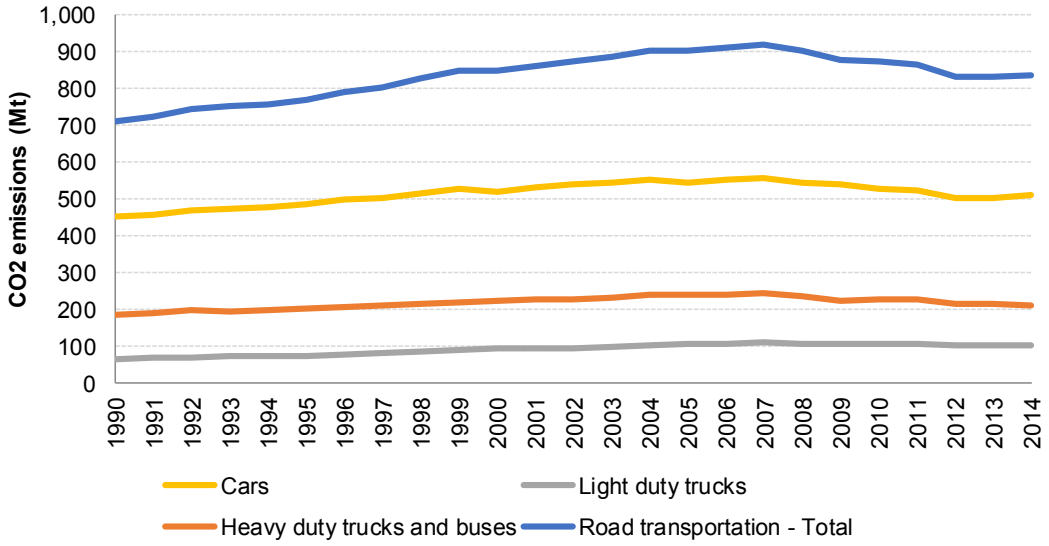
[15] i.e. transport, buildings, agriculture, small industry and waste

[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

---

[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.

---

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

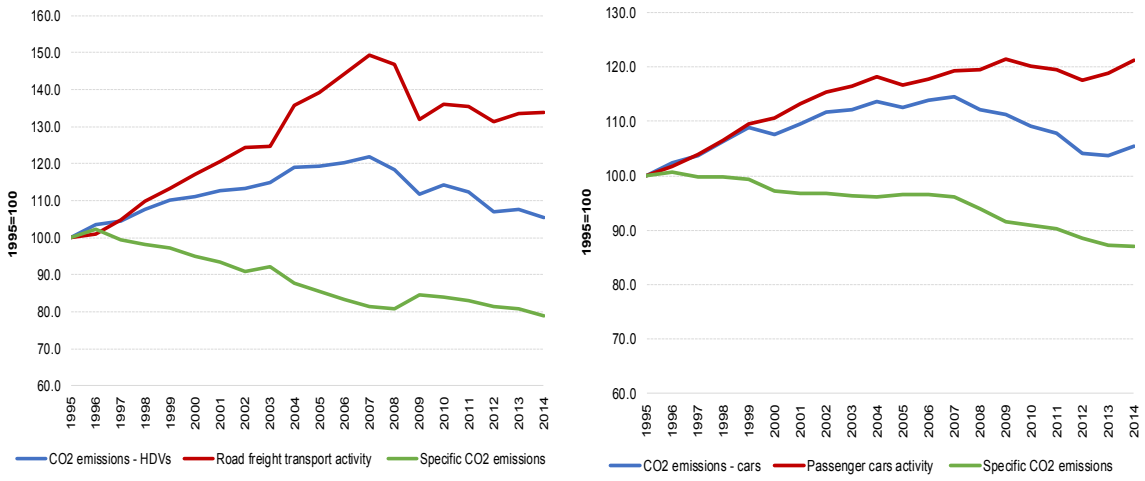
45 Fuel costs represent around a third of the costs of operation and their minimization is among the objectives of the HGV fleet operators.

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.

[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]

---

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.

[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.

---

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

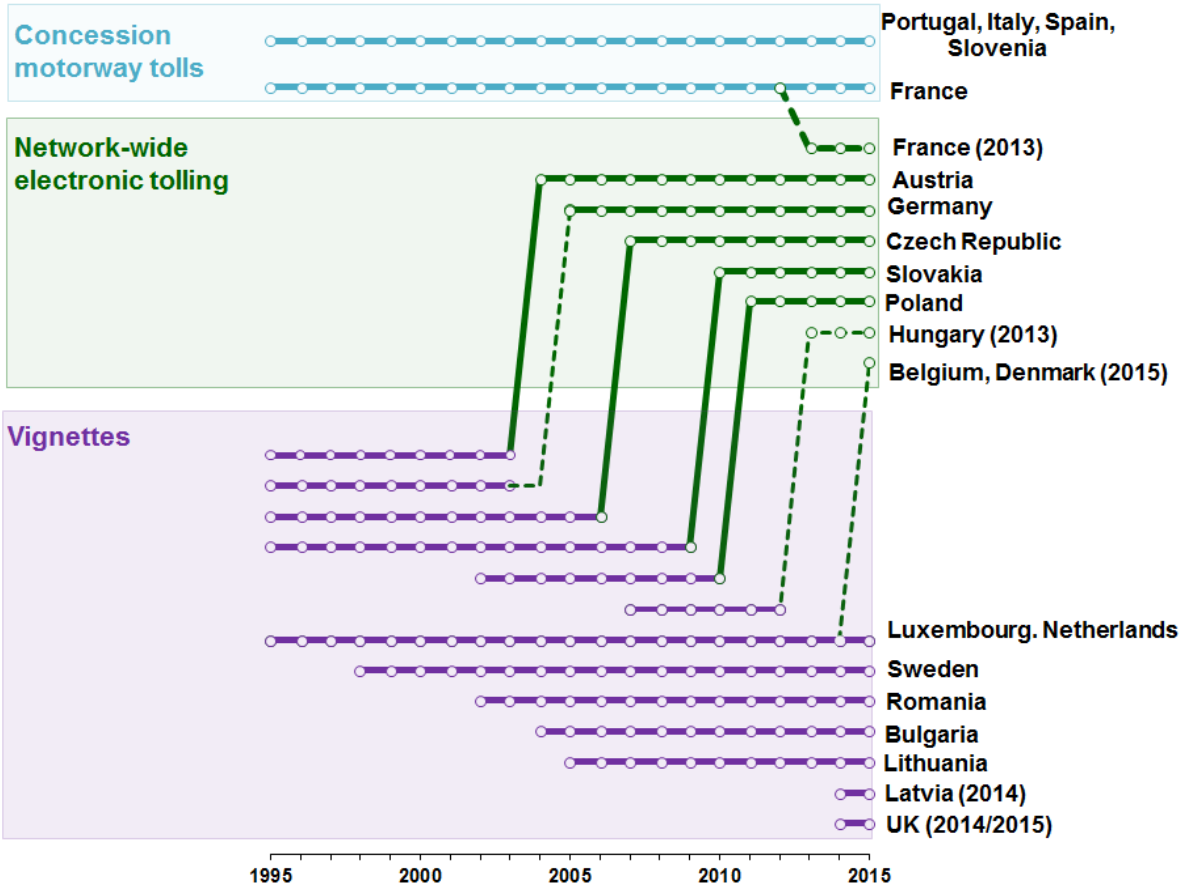
[71] Even though their share in total car sales is still limited, in the Netherlands and Denmark it reached 12% and 8% respectively in 2015. http://www.eea.europa.eu/highlights/reported-co2-emissions-from-new

[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.

---

[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.

---

[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.

[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.

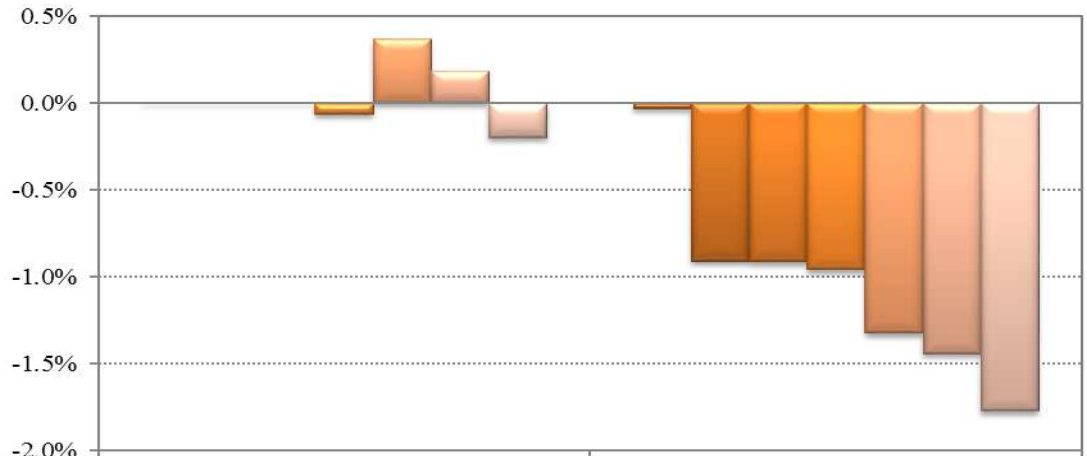
Figure 6-13: Potential economic benefits (in case of 30% and 100% earmarking to transport investments) – in 2030 compared to the Baseline

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.

---

[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