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COMMISSION STAFF WORKING DOCUMENT

EX-POST EVALUATION

of

Directive 2004/52/EC of the European Parliament and of the Council of 29 April 2004 on the interoperability of electronic road toll systems in the Community and of Commission Decision 2009/750/EC of 6 October 2009 on the definition of the European Electric Toll Service and its technical elements
FINAL REPORT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council on the interoperability of electronic road toll systems and facilitating cross-border exchange of information on the failure to pay road fees in the Union (recast)

{COM(2017) 280 final}
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1. INTRODUCTION

The present *ex post* evaluation assesses the effects of the legislation on the European Electronic Toll Service (EETS)[1] and its implementation over the period of 2004-2014.

The assessment covers Directive 2004/52/EC (EETS Directive)[2] and Decision 2009/750/EC (EETS Decision)[3] which lay down the conditions for the interoperability of electronic road toll systems in the European Union.

The *ex post* evaluation assesses the level and accuracy of implementation of the legal framework, the relevance of the objectives and the effectiveness and efficiency of the individual provisions in achieving stated objectives. It nominally covers the period since the adoption of the EETS Directive in 2004. However, it focuses on the period after the adoption of Decision 2009/750/EC, which defined the EETS and thus allowed its physical deployment.

An EETS is still not available to road users today. The analysis in this *ex post* evaluation will notably help understanding if the existing legal framework was ineffective and why the European Electronic Toll Service was not offered to heavy duty vehicles (HDV) by October 2012 and to other types of vehicles by October 2014, as provided under Directive 2004/52/EC.

The possible market and regulatory failures identified in this *ex post* evaluation could contribute to the problem definition in the impact assessment accompanying a revision of the EETS legislation.

2. BACKGROUND TO THE INITIATIVE

2.1. Description of the initiative and its components

Directive 2004/52/EC mandated the setup of a European Electronic Toll Service (EETS), by which road users only subscribe to a single contract and use a single on-board unit (OBU) to pay electronic tolls all over the EU. The EETS was to be provided to heavy duty vehicles (HDV) by October 2012 and to cars by October 2014. To ensure that different tolling systems are technologically compatible and therefore ready to connect to this single tolling service, the Directive specified that all new electronic toll systems which require the installation of on-board equipment, brought into service after 1 January 2007, shall use one or more of the following three technologies: satellite positioning (GNSS)[4] – recommended; mobile communications (GSM-GPRS); microwave technology (DSRC).

It was expected that, as a result of this technical convergence, standard equipment and back office solutions could be used in all the systems. This would have brought their unit costs down by a mechanism of economies of scale. Road users would not have to equip their vehicles with many scheme-specific on-board units (OBU) any more. It was also expected that the OBU would, with time, be integrated with other devices installed in the vehicle, such as the digital tachograph, to achieve further savings.

[1] Abbreviations and difficult terms are explained in a glossary in annex I to this staff working document.
[2] Directive 2004/52/EC of the European Parliament and of the Council of 29 April 2004 on the interoperability of electronic road toll systems in the Community (Text with EEA relevance), OJ L 166, 30.4.2004, p. 124–143.
[3] Commission Decision of 6 October 2009 on the definition of the European Electronic Toll Service and its technical elements (notified under document C(2009) 7547) (Text with EEA relevance), OJ L 268, 13.10.2009, p. 11–29.
[4] Annex 1 contains a glossary of difficult terms and abbreviations used in this document.

Decision 2009/750/EC defined the EETS and provided for the European Electronic Toll Service to be offered by market players on commercial terms. It split the actors of the EETS between four categories:

- Member States,
- Toll chargers (TC), i.e. managers of the roads for the use of which a toll is levied electronically,
- Clients, i.e. road users, and
- EETS providers, i.e. intermediaries between the clients and the toll chargers.

The Decision stated that 'EETS providers' should negotiate with all toll chargers in the EU the authorisation to provide the EETS on their road networks; then, they should offer the EETS to their clients.

The Decision specified in details the rights and obligation of all actors. Member States should have put in place the necessary regulatory framework to make the provision of EETS possible. They should have notably established independent 'conciliation bodies' to supervise the correct application of the rights and obligations of all partners. Toll chargers should have accepted on a non-discriminatory basis all interested EETS providers and their certified equipment; they had the right to request full co-operation of the EETS providers to guarantee the correct functioning of the service and eventually the correct collection of the toll. EETS providers should have provided their services in all electronic toll domains in the EU within 24 months from their official registration by their Member State of establishment and guarantee the quality and continuity of the EETS, in full co-operation with the toll chargers. Finally, EETS users should have ensured the correctness of all the data provided in the framework of the EETS and complied with the obligation to pay the toll; they had the right to sign contracts with the EETS provider of their choice and pay all their tolls through this channel.

2.2. Baseline and the problems which the initiative was intended to solve

At the time of the adoption of the EETS Directive (2004), nearly all motorway tolls (which existed on a larger scale in Portugal, Spain, France, Italy, Slovenia, Greece, Ireland and Poland) required vehicles to stop before a barrier, which would open after payment of the amount due. Special electronic tolling lanes were reserved for holders of on-board units; the latter allowed remote collection of the toll directly from the account of the user; the vehicle would need to slow down, but not stop, as the barrier would open automatically once the payment confirmed.

The first large scale free-flow system[5] was deployed by Austria in 2004, followed by Germany in 2005. Both systems were only designed for lorries. The Austrian scheme used the DSRC technology (the same as used in the special lanes on toll plazas), while Germany opted for satellite positioning coupled with mobile communications.

[5] Free-flow tolling schemes are those which allow registering and collecting the toll due without requiring the vehicle to stop or slow down.

Relatively early, concessionaires inside different EU countries co-operated to make their individual electronic tolling systems interoperable: in France, the Liber-T system for light vehicles was introduced in 2000 and is still operational today; similar agreements exist in Italy, Spain, Portugal, Ireland and elsewhere.

On the other hand, nearly no interoperability agreements were reached between partners located in different States. It was only made possible to use Swiss OBUs to pay tolls in Austria.

The first interoperability agreements (such as Liber-T) were negotiated bilaterally between toll chargers, but in the second half of the 2000's contracts involving third party toll service providers started to appear. As an example, the French single tolling system for lorries 'TIS-PL', introduced in 2007,[6] is offered by as many as five toll service providers competing for customers and offering access to all tolled road infrastructures in France. Other examples of interoperability involving one or more third party(ies) exist notably in Spain, Portugal and Ireland.

Already in 2004, most electronic tolling systems which required the installation of equipment on-board the vehicle were using technologies compatible with the requirements of the EETS Directive.[7] The only major exception to this rule was the Slovenian HGV toll, which used short range communication in a different frequency band than the DSRC standard. Infrared DSRC and passive RFID were also used in local systems (respectively Westerschelde tunnel in the Netherlands and Warnow tunnel in Rostock, Germany).

Before the adoption of the EETS framework there was no integration between tolling OBUs and other devices installed inside the vehicle, such as the digital tachograph or e-call. There were no examples of OBUs being used for other purposes than tolling. It is important to mention that at that time e-call was not deployed, and the digital tachograph did not contain GNSS and DSRC technologies, which could become the basis for integration with tolling OBUs.

The lack of interoperability agreements between partners in different countries meant that hauliers had to equip their vehicles with as many OBUs as States which their trucks were crossing. Indeed, a truck transporting goods from Berlin to Lisbon needed, just for this trip, 4 OBUs. The price of an OBU depends on the technology of tolling. Back in 2004, the manufacturing costs of a DSRC OBU was 20-30 EUR, and of a GNSS OBU – 180-300 EUR,[8] but the price or deposit paid by the user would on many occasions be much higher. This was notably the case in Germany, where the OBU had to be fixed inside the vehicle by a specialist in a certified workshop.

Hauliers also had to sign separate tolling contracts for each country – often in the local languages of the toll chargers – and pay separate invoices in the currency of each toll charger. The latter however was not considered as an issue before two consecutive enlargements of

[6] ASFA, answer to the targeted consultation for the *ex post* evaluation of EETS policy, 17.07.2015.

[7] It is worth mentioning that one of the dominant technologies in other parts of the world was and still is passive radio frequency identification ('passive RFID'); this technology allows unidirectional data communication from the OBU to the roadside equipment, but not vice-versa. Passive RFID is therefore less sophisticated than semi-active DSRC (which allows, to a certain degree, for bi-directional communication), but the OBUs (stickers similar to the ones which protect cloths and other goods against stealing from shops) are much cheaper (1-2 EUR instead of 9-15 EUR for DSRC).

[8] Estimates based on the assumption that prices fell by 50% over the last ten years, as confirmed notably by ASFA, ASFINAG, Ireland, Germany, Flanders, Poland, Portugal, Toll Collect in their answers to the targeted consultation.

2004 and 2009, as at that time most electronic tolling systems were deployed in Eurozone countries). If we assume that a lorry engaged in international haulage had typically to visit or cross each year at least once Germany, Austria, Switzerland, France, Italy and Spain, then each haulier had to equip his/her vehicles with 6 OBUs each, sign as many local tolling contracts and pay dozens of invoices a year.[9] A truck travelling across all Member States of today's EU (incl. Romania, Bulgaria and Croatia) would had had to be equipped with 11 OBUs (for Portugal, Spain, France, Italy, Germany, Austria, Slovenia, Croatia, Ireland, Greece and the Øresund bridge between Copenhagen and Malmö) and pay countless invoices per year. This would have been source of significant compliance costs and burden inside the companies.

Each electronic tolling system was being developed 'from scratch'. Toll chargers had to support very significant system development costs, which raised initial investment costs to extremely high levels. For example, investment in the development of the system amounted to EUR 750 millions in Austria (2004) and EUR 700 million in Germany (2005).[10] Operation costs were consuming a significant share of the revenues: in Germany, initially they amounted to 18% of the revenues.[11]

These issues have led to a situation where electronic fee collection did not operate in a cost efficient way and the proliferation of technologies and specifications was seen as a potential barrier to the smooth operation of the internal market.

2.3. Objectives of the initiative and expected outcome

The European legislator provided for a European Electronic Toll Service (EETS) to answer the abovementioned problems of road users and toll chargers.

The general objective of the EETS legislation was to improve the functioning of the internal market for electronic fee collection and to remove barriers that hinder the free movement of people and goods and compromise transport policy objectives by offering to road users the European Electronic Toll Service.

In more specific terms, the objectives were to:

(1) reduce for road users the hassle and direct costs of compliance with the requirement to pay tolls, i.e. of installing, updating and handling the on-board equipment and of managing tolling contracts in different Member States;

(2) reduce for toll chargers (i.e. road operators) the costs of setup, operation and administration of electronic fee collection systems.

Finally, in operational terms, the initiative aimed at:

(1) ensuring that the technologies and components provided for in national electronic fee collection systems can be combined with other vehicle components e.g. the digital tachograph and the e-call (emergency call device) or tracking and tracing devices of vehicles, to save money on redundant equipment;

[9] This assumes a monthly invoicing period.
[10] Steer Davies Gleave, *Technology options for the European Electronic Toll Service*, Study performed for the European Parliament, 2014 http://www.europarl.europa.eu/RegData/etudes/STUD/2014/529058/IPOL_STUD(2014)529058_EN.pdf.
[11] Contribution of Toll Collect to the targeted consultation.

and, more importantly,

(2) ensuring the interoperability of electronic tolls at technical, contractual and procedural levels. Interoperability can indeed be defined on three layers:

- first, a certain level of technical harmonisation of the equipment and systems used for electronic tolling must be achieved for the EETS to be feasible at reasonable costs;

- second, it must be possible for users from different countries to sign a contract with one EETS providers, and for the EETS provider to sign contracts with all toll chargers. For this to be achievable, contractual practices across the EU must be approximated;

- third, procedures for calculating and transmitting toll information need to be similar across the schemes, so that the EETS may be operated with similar features in all toll domains.

Figure 2 and Figure 3 in Annex 2 present the intervention logic of the EETS legislation. In summary, the Directive and the Decision were expected to create the appropriate legal framework for the single European electronic toll service to be provided as a commercial service by third party providers playing the role of intermediaries between road users and the toll chargers in different toll domains.

The EETS was expected to facilitate the payment of road use charges for drivers when they go abroad. Users were also expected to accept more easily paying for the use of roads if the payment means were interoperable at European level.

It was also expected that this legal framework would provide the incentives (notably through standardisation work) for gradual technical and operational convergence of electronic tolling in the EU. This in turn would allow industrial economies of scale which would pull the costs of equipment and systems down.

Finally, the interoperability and harmonisation of equipment was expected to bring as a consequence the integration of OBUs with other standardised equipment in the vehicle such as the digital tachograph or e-call.

It should also be mentioned that an original idea of the legislation was to allow future generations of tolling systems to benefit from the high level of performance and of the flexibility of satellite-based tolling, through EGNOS and GALILEO, the European satellite positioning systems.

Had e-tolling become cheaper and interoperable as expected, this would have created the potential for:

- the increased replacement of manual toll collection at toll booths by fully electronic tolling, allowing to cope with the increase of traffic, which in turn would help reducing the problem of recurrent congestion at toll booths;

- easier and more wide-spread application of tolls on the wider network (not only motorways) and to all vehicles (incl. passenger cars), facilitating the generation of

necessary funds for the completion and maintenance of the transport networks. This would allow true application of the 'user pays' and 'polluter pays' principles to road transport, and therefore the creation of a level playing field between transport undertakings in the road sector and between the transport modes.

3. EVALUATION QUESTIONS

3.1. Effectiveness:

(1) Have the provisions of the Directive and of the Decision led to the technical, contractual and procedural interoperability of electronic tolls? What has hindered/contributed to the achievement of this objective?

(2) Have the standards imposed by legislation been sufficient to render e-tolling systems technologically compatible? If not, what is the reason for that?

(3) Has the integration of on-board units with other devices such as e-call or the digital tachograph happened and if so did it allow for reduction of the costs? Is it technically feasible and does it make sense from an economic point of view?

(4) To what extent did toll chargers comply with the requirement to use only three technologies? To what extent did it help achieve interoperability? Has it lead to any unintended effects?

(5) Has the cost of setup and maintenance of electronic toll systems for toll chargers changed? Has the cost and administrative hassle for tolled road users changed? If so, can this be attributed to the effects of the evaluated legislation?

(6) Have the provisions of the Decision led to the setup of the EETS? What has hindered/contributed to the achievement of this objective?

(7) To what extent has the legal framework led to the improvement of the internal market for electronic fee collections? What factors have contributed to or hindered the achievement of this objective?

(8) Has the legal framework led to any unintended effect (negative or positive)?

3.2. Efficiency:

(1) What are the current costs (including opportunity costs of not using another suitable technology) and benefits of the approach limiting to three the number of technologies allowed to be used for electronic tolling? What will be their possible level in the short-to-medium term future? Are the answers different for different types of vehicles (heavy vs. light vehicles)?

(2) Are the costs of the approach involving third party providers (EETS provider)) adopted in the Decision lower than the benefits associated with the EU wide interoperability of the toll? Would the relation between the costs and benefits be better had an alternative approach been chosen (e.g. deployment of EETS through agreement between toll chargers, or as a public service obligation, etc.)?

3.3. Relevance:

(3) To what extent is interoperability of electronic tolls needed by the users? Is the answer different for different types of road users (in particular heavy goods vehicles vs. other users)? Is it likely to change over time?

(4) To what extent the objective of having interoperability at all three different levels (technical, contractual and procedural) is equally needed by the users? Would any of the three levels of interoperability be less relevant?

(5) To what extent does the level of the costs (and hassle) caused by the lack of interoperability justify policy intervention to facilitate interoperability? How has the gradual increase in the length of tolled networks and number of electronic toll systems in the EU affected the relevance of the objectives of reducing costs for users and for toll chargers?

(6) To what extent the coverage of the framework in terms of users and geographical scope is adequate to the needs of the sector? For instance, is interoperability needed for some or all road user types? Is it relevant to cover all toll domains in the EU? Could it cover less, e.g. main transit countries? Or should it cover more, e.g. Switzerland, EEA, Western Balkans, Turkey, Community of Independent States, etc.?

(7) Is there still a need to ensure that the technologies and components provided for in national electronic fee collection systems be combined with other vehicle components?

3.4. European Added Value:

(1) What was the EU added value of the EETS legislation?

3.5. Coherence:

(2) To what extent the legal framework is coherent with the goals and provisions of existing and upcoming EU legislation? In particular, how does this initiative fit in the overall ITS legal framework?

(3) To what extent are the provisions of the Directive and of the Decision coherent and consistent? Are there any incompatibilities or contradictions between individual provisions?

4. METHOD

Work on this *ex post* evaluation started in March 2015. A roadmap for this *ex post* evaluation was published on the Europa website on 14 September 2015.[12]

The evaluation covers the 10-years[13] periods starting from 20 May 2004, when the EETS Directive entered into force, until 31 December 2014. The assessment of the implementation

[12] Evaluation of the legislation on the European Electronic Toll Service (EETS) – Directive 2004/52/EC and Decision 2009/750/EC, http://ec.europa.eu/smart-regulation/roadmaps/docs/2015_move_108_evaluation_eets_en.pdf.

[13] The assessment of the implementation in Bulgaria, Romania and Croatia starts as of the date of their accession to the European Union, respectively 2007 (BG and RO) and 2013 (HR).

of the Decision will cover the period from 13 October 2009, when the Decision was published, until 31 December 2014. However, where there was important evolution between the end of 2014 and the day of the publication of this staff working document (for example regarding the registration of EETS providers), this is also reflected in the text.

4.1. Main tools

A range of methodological tools to gather the necessary quantitative and qualitative evidence for the analysis of the key evaluation issues were used. These are outlined below and the methodology followed is further described in the following sections. Furthermore, the data gathered through these tools were checked for consistency and relevance. The quantitative data were formed into tables and analysed. Since the relevant data was obtained through various methods, triangulation was used to verify the findings.

4.1.1. Desk research

The literature review covered a number of relevant reports and statistics. The purpose of the desk research was to provide an overview of the available information relevant to the evaluation in the literature and to identify the gaps in available data. Sources were primarily selected by the Commission, and supplemented by suggestions from stakeholders.

An important data source of information for this evaluation is the *REETS project*[14]. This regional interoperability project of 7 EU Member States and Switzerland, co-financed by the European Commission, published 12 reports, notably on the following topics:

- contractual framework and risk management
- certification
- key performance indicators
- back office interfaces
- return on experience

The papers report on the obstacles to EETS deployment and provide recommendations on how to solve them. Obstacles are linked to inappropriate provisions in the EU legal framework, the way they have been applied at national level, standardisation issues, etc.

It is important to mention that the REETS project gathered representatives of all the categories of stakeholders involved in EETS deployment, i.e. Member States, toll chargers and toll service providers. Reports are adopted by consensus, and thus reflect a balanced view of tpahe industry on the main obstacles to EETS deployment. REETS reports provided elements for the evaluation of the relevance, effectiveness and efficiency of the legislation in place.

Expert views presented in the study *Expert Review of the EETS Legislative (September 2015)*[15] critically analysed the provisions of the EETS Directive and EETS Decision, indicating regulatory failures which contributed to the lack of success of EETS. The study was performed for the Commission by a consultancy[16] with long experience with electronic tolling systems.

[14] www.reets.eu.
[15] 4icom, Expert Review of the EETS Legislative Acts, 2015, http://ec.europa.eu/transport/modes/road/studies/doc/2015-09-ex-post-evaluation-eets-4icom.pdf .
[16] 4icom.

The study *State of the Art of Electronic Tolling*[17] *(October 2015)* which was performed on behalf of the European Commission upon request from the European Parliament,[18] assesses available tolling technologies and suggests solutions to identified problems. It focuses particularly on the costs and benefits offered by each electronic tolling solution. It thus provides data for evaluating the efficiency of the technological choices in the Directive, and helped answering the questions on relevance of the existing provisions.

A full list of the literature used is presented in Annex 4.

4.1.2. Targeted questionnaires

On 26 June 2015, separate targeted questionnaires were sent to the main groups of stakeholders in the field of EETS (i.e. Member States and toll chargers; toll service providers; road users, with a distinction between heavy and light vehicles; technology providers and commercial vehicle manufacturers) to collect missing information and data. A summary of the results of this and all other consultation activities are published under the following link: http://ec.europa.eu/transport/modes/road/consultations/2016-eets_en. A shorter review of the results is also presented in the synopsis report of all consultation activities in Annex 3.

Consulted European organisations were invited to disseminate the questionnaire among their members to maximise response rate. During the consultation period, which lasted till September 2015, the Commission received a total of 22 responses.

Targeted questionnaires focussed on information gaps identified during the desk research. Both the answer rate and the average quality of contributions were high, including quantified data.

Type of stakeholder	**Approached**	**Responded**	**% response rate**
Member States and Toll Chargers	33 individual + 3 associations	15	42%
Toll Service providers	1 + 1 association	4	200%
Road users (heavy duty transport)	2 associations	2	100%
Road users (light vehicles)	2 associations	1	50%
TOTAL (surveys)	**42**	**22**	**52%**

4.1.3. Workshop with representatives of standardisation bodies

To complete the knowledge on existing standardisation gaps, a full day seminar involving representatives of 3 notified bodies, the European Committee for Standardisation and two

[17] 4icom. *Study on "State of the Art of Electronic Road Tolling" MOVE/D3/2014-259,* 2015, http://ec.europa.eu/transport/modes/road/road_charging/doc/study-electronic-road-tolling.pdf.

[18] In its Resolution of 11 June 2013 on a "Strategy for an electronic toll service and a vignette system on light private vehicles in Europe", the European Parliament asked the Commission to undertake a review of all available studies on electronic road tolling systems, so as to provide a clear basis for different options for action in both the medium and the long term, including charging for road use via technologies such as GPS/GNSS, in order to prevent and reduce traffic congestion caused by physical barriers.

equipment manufacturers was organised in the framework of a meeting of the Notified Bodies Co-ordination Group (NoBos-CG) on 29 September 2015.

Important input on issues related to standards and technical certification was received as an outcome of the discussion.

The group will keep on working on the subject and is intending to present recommendations to the Commission.

4.1.4. Open public consultation

An open public consultation to validate the results of the *ex post* evaluation was organised back-to-back with the public consultation on the Impact Assessment. It was launched on 8th July 2016 and was open for responses until 2nd October (12 weeks). The objective of the consultation was to give the wide public an opportunity to express their opinion on the big societal choices related to the organisation of electronic toll collection in the EU. A total of 73 responses to the questionnaire were received. There were four main groups of respondents: industry associations (29 out of 73 or 40%), companies (21 out of 73 or 29%), citizens (11 out of 73 or 15%) and public authorities[19] (9 out of 73 or 12%). There were many more respondents from EU-15 (over 50) than from EU-13 (10) or outside the EU (12). A summary of the results of this and all other consultation activities are published under the following link: http://ec.europa.eu/transport/modes/road/consultations/2016-eets_en. A shorter review of the results is also presented in the synopsis report of all consultation activities in Annex 3.

4.2. Limitations – robustness of findings

The community of electronic tolling professionals in the European Union is relatively small and well organised. It was therefore relatively easy to access the relevant stakeholders to collect from them information for the *ex post* evaluation. However, data on costs is considered commercially sensitive, and therefore difficult to obtain. This *ex post* evaluation therefore often had to base the analysis on expert estimations, price ranges or, in the best case scenario, averaged figures.

It was also difficult to obtain reliable data on the demand for- and use of interoperable services by the hauliers and other road users. The road transport market is highly fragmented with a lot of one-truck-one-man companies – according to official statistics, 80% of road freight transport companies in the EU employ less than 10 people.[20] reliable consolidated data is therefore rare and hard to obtain. This makes it nearly impossible to estimate and monetise with sufficient level of precision the potential benefits of interoperability (or, to put it the other way, the current costs of the lack of interoperability). These can only be provided in the form of ranges and made dependent on the assumptions taken. The latter are explained each time figures dependent on assumptions are provided throughout the text. Again, even most conservative assumptions do not change the validity of the conclusions as to the need to further promote tolling interoperability.

[19] Public authorities from the following countries participated in the open public consultation: Czech Republic, Estonia, France, Germany, the Netherlands, Norway, Poland, Slovakia, United Kingdom.

[20] European Commission, *Road Freight Transport Vademecum 2009*, http://ec.europa.eu/transport/sites/transport/files/modes/road/doc/2009_road_freight_vademecum.pdf.

5. IMPLEMENTATION STATE OF PLAY (RESULTS)

5.1. State of implementation

EETS legislation is not fully implemented in the EU Member States, as half of them failed to meet certain requirements set in the EETS legal framework according to the required timetable (as explained in more details below). As a result, the Commission started infringement procedures against eight Member States for non-respect of one or more of these obligations. Five Member States were able to fulfil their obligations in the course of the infringement procedures. It is expected that additional infringements will be opened as result of unsatisfactory exchange of information between the Commission and other Member States on the level of implementation of EETS in their respective countries.

The EETS Directive provided that Member States had to ensure that all electronic tolling systems requiring the installation of an on-board unit and brought into use after 1 January 2007 use one, or a combination of, three technologies: microwave communications, satellite positioning and mobile telecommunications (Art.2). This provision has been largely respected by the Member States. Systems using alternative technologies are rare and have typically been put in place before 2007 (cf. section 2.2 for the details).

The EETS Directive also requires Member State to ensure that the EETS is offered to the users according to a fixed schedule (by October 2012 for heavy duty vehicles and by October 2014 for light vehicles). Given the fact that to date there is no EETS in place, all Member States have failed to meet these obligations.

The EETS Decision put three detailed concrete obligations on the Member States to pave the way for the implementation of the EETS:

- to foresee a registration procedure for candidate EETS providers;
- to keep and make public a national electronic register of the EETS domains within their territory by July 2010. The register had to include 1) all the necessary information for EETS providers wanting to enter their markets and 2) data on EETS providers which were granted registration in a given Member State;
- to set up national conciliation bodies to facilitate mediation between toll chargers and EETS providers.

Half of the Member States (i.e. Belgium, Bulgaria, Croatia, Czech Republic, Germany, Greece, Hungary, Luxemburg, Poland, Portugal, Slovakia, Slovenia, UK) have not correctly and fully implemented these requirements. This, as explained in the beginning of this section, already led to infringement procedures against eight Member States. The most common infringement is the failure to publish complete registers of EETS domains, which creates insurmountable obstacles to the entry of EETS providers on the local markets. Most concerned Member States have not started preparations to publish the register of EETS domains before being recalled of this obligation by the Commission in the framework of the infringement procedure.

The EETS Directive lists in its Annex the technical, procedural and legal items required for the definition and deployment of the European Electronic Toll Service. The list includes notably the operational procedures for the service, its functional specifications, technical

specifications of the equipment, transactional models, procedures for the verification of the technical performance of the equipment, parameters for vehicle classification, rules on protecting fundamental rights of the individuals, harmonising rules related to enforcement and conflict resolution procedures. Although these items have not been further defined in the subsequent Decision, Article 4 of the Directive clearly states that "the European Electronic Toll Service shall be based on [them]". 12 Member State administrations,[21] Norway and Switzerland have been working in the framework of the so-called 'Stockholm Group'[22] on the approximation of these elements; however, the results of this work have hardly been reflected in the implementation of the national systems. In particular:

- The operational procedures for the service are different, and sometimes incompatible between different schemes. One amongst many examples of such difference is the way DSRC OBUs must be attached to the windshield to enable effective reading by the roadside equipment. Depending on whether roadside antennas are installed above or parallel to the road, OBU antennas should – respectively – be in a close to vertical or close to parallel position.[23]

- Functional specifications of the service are defined for each toll domain in abstraction of the key performance indicators imposed in other toll domains.

- Most schemes use established standards to define the technical specifications of the equipment. However, several of the existing standards allow for certain flexibility in the implementation. As an example, the standard for back-office interfaces (EN ISO 12855) allows toll chargers to request additional elements on top of those listed in the standard. Member States have used this flexibility, defining technical specifications of the equipment which are not always compatible between toll domains.

- The EETS legislation does not specify the standard transaction model to be used. Some toll chargers choose the "reseller model", where the toll service provider acts and invoices road users in his/her own name; other toll chargers privilege the "agency model", where the toll service provider is merely the agent of the toll charger – this has a number of negative consequences for the service provider, including the impossibility to issue a single invoice and, in some extreme cases, the obligation to have a banking licence.[24]

- The procedures for the verification of the technical performance of the tolling equipment (OBUs, roadside equipment, interfaces, etc.) are not standardised. The cost of a full test cycle can range from 100,000 (e.g. average cost to test suitability for use in one concession in France) to 200,000 (e.g. cost of testing suitability for use in the single tolling system covering the whole territory of Belgium) EUR per toll domain. Typically, the toll service provider bears the largest part of these costs. The cycle must be repeated as many times as there are toll domains in Europe (more than 140 today). A few tests are done jointly for several toll domains (e.g. French concessionaires run a join test centre, which explains the lower cost per domain), but compatibility to certain domain-specific requirements and end-to-end tests must be checked individually.

[21] Finland, Sweden, Ireland, UK, France, the Netherlands, Denmark, Germany, Poland, Austria, Slovenia and Hungary
[22] The Stockholm Group is the informal platform of national authorities on tolling-related issues. The membership includes 12 EU Member States, Norway and Switzerland.
[23] 4icom, *op.cit. note* 15.
[24] Contribution of AETIS to the targeted consultation.

- The division of vehicles into toll classes is different in each tolling scheme:
  - Most toll domains in Europe classify vehicles according to their number of axles; however, the Belgian HGV tolling scheme introduced in 2016 classifies them according to the maximum permissible laden weight;
  - Similarly, most HGV tolling schemes cover all vehicles above 3.5 tonnes of total permissible laden weight. In Germany, however, this limit is fixed at 7.5 tonnes (previously 12 tonnes);
  - It is mandatory, under the provisions of Directive 1999/62/EC, to differentiate toll rates by the EURO emissions class of the lorry. However, toll domains cluster different EURO norms together (e.g. same toll for EURO norms 0-III); this clustering is different in each toll domain.

- The legislative framework on the protection of personal data is not the same across the EU; this influences the design of the schemes and the interfaces with potential EETS providers. In Germany, requirements of the legislation on data protection were reportedly one of the reasons for choosing a "thick" OBU,[25] while 'thin' OBUs[26] are a more natural solution for EETS providers. The requirements in terms of data storage and computing powers are less demanding in a thin OBU than in a thick OBU, as the thin OBU is no more than a communication interface, but it can potentially raise issues related to the protection of personal data, as information on the exact location of the vehicle is sent to the back office.

- Finally, most toll chargers have not specified, nor harmonised, the contractual arrangements which they want to apply to EETS providers in fields such as financial guarantee requirements, service remuneration, invoicing policy, etc. The publication of such information in the EETS registers is an obligation for the Member States under the provisions of Article 19 and Annex I of the Decision. In the rare cases when the information is published, there requirements are not consistent between toll domains.

All the above issues have been identified in the reports of the REETS project.[27] The latter also provided recommendations on how relevant stakeholders should address these shortcomings. However, to the Commission's knowledge these recommendations have so far largely not been put in practice.

[25] A 'thick' GNSS OBU is an on-board unit which establishes the position of the vehicle, compares it with digital maps stored in its memory, on this basis calculates the toll due and sends only this information to the back office.
[26] A 'thin' OBU is an on-board unit which establishes the position of the vehicle and send the information to the back office. The calculation of the toll due takes place there.
[27] Cf. REETS publications, activities 1-4, http://reets.eu/index.php?option=com_phocadownload&view=categories&Itemid=109

REETS project

In 2013-2015, the Commission co-financed a regional interoperability project REETS involving Member State administrations, toll chargers and toll service providers from 7 EU Member States (Poland, Germany, France, Austria, Spain, Italy, Denmark) and from Switzerland. The project aimed at facilitating deployment of interoperable toll services first among these countries, in which most of the EU transit traffic takes place. The project consisted of two phases. In an analytical phase, which ran from January till September 2014, the partners analysed the framework conditions for the possible deployment of interoperable services in the REETS region: contractual framework and risk management, rules on the certification processes, key performance indicators used in different toll domains, back office interface solutions, and possible ways to manage interoperability. The analytical phase identified problems – including those related to the existing EU legal framework – which delay the achievement of interoperability and which also risked jeopardising the success of the deployment phase. After the analytical phase, the project entered the deployment phase: from the project side, this phase mainly consisted of monitoring and reporting on the ongoing negotiations between service providers and toll chargers for the provision of interoperable tolling services. The deployment phase of the project nominally ended on 31 December 2015. Nevertheless, REETS partners decided to continue monitoring and co-ordinating interoperability negotiations even after the Commission finished co-financing the project. The new co-operation agreement is called the EETS Facilitation Platform (EFP).

Five of the national electronic tolling schemes are not fully EETS compliant because they were designed and now are operated by private partners chosen through public tendering processes before or right after the Directive or the Decision defining the EETS were adopted. This is the case of the Austrian (operational in 2004), German (operational in 2005 and developed before 2003) and Czech (operational since 2007) HGV tolling schemes; the Slovak and Polish HGV tolling schemes (deployed, respectively, in 2010 and 2011) were put in place right after the adoption of the Decision, and hence the tender for the operation of the system could not take its provisions fully into account. Article 5.1 of the EETS Decision requires toll chargers to "assess the problems [of non-compliance] and […] take remedial action in view to ensure EETS interoperability of the toll system". This has so far not been entirely done for all the above schemes except the Austrian one. In particular:

- In Germany, the toll charger is reluctant to open the market to EETS providers on non-discriminatory basis. The current contract with the operator of the system gives to the latter monopoly rights and changing the contract in course could imply for Germany the obligation to compensate the operator for the lost revenues. However, Germany has adapted the system to EETS from a technical point of view, by gradually adding CEN DSRC antennas to enforcement gantries, replacing or adding to the previously used infrared DSRC.

- In the Czech Republic, the DSRC antennas are not fully compatible with the CEN DSRC standard. The toll charger is also reluctant to open the market for the same reasons as evoked for Germany.

- In Poland, new entrants cannot access the market because the legislation has not yet been updated in line with the EETS Decision.[28]

The French 'Écotaxe' HGV national tolling scheme,[29] which was supposed to be deployed in 2013, was expected to be fully EETS-compliant. However, the project was suspended and abolished just before its launch by decision of the government following public demonstrations in different regions of France against the idea of introducing a toll for heavy goods vehicles. Also the Hungarian toll is potentially open to all toll service providers, even though so far only Hungarian players managed to access the scheme.[30] The Belgian HGV toll, deployed in April 2016, initially raised some concerns among prospective EETS providers regarding its EETS readiness. The system has opened to EETS providers *in extremis*, with the EETS provider Axxès signing a contract for the provision of toll collection services on the day preceding the launch of the scheme. Other EETS providers have not managed to enter the Belgian market so far (state of play in January 2017).

In general, it can be said that Member States and toll chargers have so far – with few notable exceptions – given low interest and priority to the objective of cross-border interoperability of electronic tolling schemes. Concession holders in a few Member States (France, Ireland, Spain and Portugal) were the first to re-organise themselves along the EETS model. When the toll chargers are public administrations, the willingness to adapt to the requirements of EETS is generally lower.

To date six companies – AGES (DE), Axxès (FR), Brobizz (DK), Eurotoll (FR), Telepass (IT) and Total (FR) have been officially registered as EETS providers. However – mostly because of the hurdles described above – AGES has since stopped operations in the EETS market, while Brobizz, Eurotoll, Telepass and Total did not make significant progress in terms of market coverage compared to the situation before their registration (although all four are known to be in the process of testing their equipment and negotiating contracts in a few toll domains).

5.2. Current situation

5.2.1. State of play – interoperability of electronic tolls

(1) Light vehicles

As illustrated in Figure 4 in Annex 5, light vehicle (car, van and minibus) users are subject to electronic tolling on significant parts of the road networks in Croatia, France, Greece, Ireland, Italy, Poland, Portugal and Spain. In most of these tolling schemes, users can choose between electronic tolling requiring the presence on board of the vehicle of an OBU and manual payment of the toll (at the toll booths). Systems are largely interoperable inside each State (e.g. the Liber-T agreement allows users to pay tolls on all conceded motorways in France with one OBU and one invoice); cross-border agreements are typically signed between local

[28] This has recently changed, as legislation adopted in the second half of 2016 finally allows the remuneration of EETS providers, and contains other elements necessary for EETS to function. However, no EETS provider has yet tried to enter the Polish market to check if the latter has become entirely open.

[29] The Écotaxe was a planned satellite-based electronic tolling system for HGVs, applied on 15,000 km of national roads in France.

[30] Cf. list of audited Toll Declaration Operators: https://www.hu-go.hu/articles/article/the-list-of-the-first-audited-toll-declaration-operators.

toll chargers on two sides of the border – e.g. the French OBU can also be used in northern Spain.

(2) Heavy duty vehicles

Regarding heavy duty vehicles, electronic tolling with OBUs is (nearly[31]) the only available payment method in eight Member States (Austria, Belgium, Czech Republic, Germany, Hungary, Poland, Portugal, Slovakia). In other countries with electronic tolling system (i.e. Croatia, France, Greece, Ireland, Italy, Slovenia and Spain) both manual and electronic tolling are available.

As in the case of light vehicles, systems are largely interoperable inside each State. The following cross-border interoperability agreements have also been reached:

- One-way technical interoperability agreements between Austria and Germany, and between Austria and Switzerland: Since its launch in 2004, the Austrian HGV tolling system accepted Swiss OBUs as valid toll declaration tool. In 2011, the same became possible with the German OBU. In both cases, interoperability works one way only, and is limited to technical aspects, i.e. the equipment used; separate contracts must still be signed by clients with each toll charger.

- Agreements between toll domains using the DSRC technology: Since 2013, it is possible to pay tolls with one OBU in Norway, Sweden, Denmark and Austria (EasyGo+ agreement). Initially developed on the basis of a pure agreement between toll chargers, the system is now evolving to allow independent toll service providers to offer their services in the area. Thanks to this evolution, providers already active in France, Spain, Portugal and Italy could start negotiating access to the service. If these negotiations are successfully concluded, it will soon be possible to travel on the toll roads of all seven countries – all using the DSRC technology – with one OBU issued by third party toll service providers and a single monthly invoice (if all toll chargers adopt the re-seller transaction model – cf. section 5.1 for details).

- Hungary**:** the electronic tolling system in Hungry is technically ready to connect to third party toll service providers. However, despite the system being operational since 2013, so far no toll service providers from abroad entered the market.

5.2.2. State of play – costs and hassle linked to electronic tolls

(1) Cost of setting up an electronic tolling system

Member States face significant costs for setting up an electronic tolling system. Moreover, from available data (see Table 1 below), it appears that the initial investment needed for the toll charger to set up an electronic tolling system has not significantly changed over the evaluation period, averaging at over 650 million EUR. It seems also that there is no strong correlation between the technology chosen and the network coverage. The notable exception of a low price of the Hungarian system can be explained however by the choice of a completely different architecture compared to other systems (lower accuracy requirements,

[31] In Germany, Hungary and Slovakia it is also possible to buy 'tickets' for a given route, but it is relatively burdensome and not flexible (not possible to divert from the pre-established route).

use of pre-existing equipment, minimum enforcement infrastructure, etc.). This special case will be further analysed and explained in the answers to specific evaluation questions.

System	Technology	Network coverage	Year	Cost (EUR)
Austria	DSRC	Motorways only	2004	750 million[32]
Germany	GNSS	Motorways and certain federal roads	2005	700 million[33]
Slovakia	GNSS	Motorways, first and second class roads	2010	800 million[34]
France	GNSS	Certain motorways, national roads and certain regional roads	2013 (but later aborted)	650 million[35]
Hungary	GNSS	Motorways and first class roads	2013	<100 million[36]

Table 1: Initial investment to set up electronic tolling schemes in the EU[37]

(2) Cost of operation

Due to data heterogeneity, it is difficult to establish clear patterns in the cost of operation of different systems, which seem to depend on many factors such as number of vehicles, intensity of traffic, technology, network coverage, etc. The only clear pattern emerging is the decrease of the costs of operation throughout the lifetime of the individual systems.

System	Technology	Network coverage	Initial operating costs (year)	Current operating costs (year)
France	GNSS	Certain motorways, national roads and certain regional roads	224 million EUR/year, 18% of tolls collected (2013) [38]	N/A[39]
Austria	DSRC	Motorways only	10-11% of tolls collected[40] (2004)	4.5%[41] (2015)
Germany	GNSS	Motorways and certain federal roads	18% of tolls collected (2006)[42]	12% (2014)[43]
Hungary	GNSS	Motorways and first class roads	Ca. 40 million EUR/year, 6.5% tolls collected (2013)[44]	Same as initial operating costs

Table 2: Cost of operating different electronic tolling schemes in the EU

[32] Steer Davies Gleave, *op.cit.* note 10
[33] Steer Davies Gleave, *op.cit.* note 10
[34] Steer Davies Gleave, *op.cit.* note 10
[35] 4icom, Steer Davies Gleave, *op. cit. note 17.*
[36] Zoltán Varga, *Introduction of HU-GO, the Hungarian distance based electronic toll system,* 2014 http://ibtta.org/sites/default/files/documents/2014/14Prague/Varga_Zoltan.pdf.
[37] The table contains data for those countries, where the initial investment costs could be clearly established. E.g. for the Belgian system, only the total payment to Satellic, who operates the system, is publicly available 1.6 Billion EUR over 12 years.
[38] 4icom, Steer Davies Gleave, *op. cit. note 17.*
[39] The project was suspended and abolished just before its launch by decision of the government following public demonstrations in different regions of France.
[40] Steer Davies Gleave, *op.cit. note 10.*
[41] ASFINAG
[42] Answer of Toll Collect to the targeted consultation.
[43] Answer of Toll Collect to the targeted consultation.
[44] *op. cit. note* 34.

(3) Cost of equipment

The cost of on-board units, both in the DSRC and in the GNSS technology, fell by half over the evaluation period to respective averages of 8-15 EUR and 90-150 EUR.[45] The cost of ANPR cameras, which are used for enforcement in all the systems, and as primary method of toll collection in few of them, and the cost of gantries over the roads (which would mainly depend on the cost of steel and on the cost of public works to ensure power supply and connection to data networks) have not evolved.[46]

(4) Cost and hassle for users

For light vehicles, the cost and hassle remained at a low level, as confirmed by the contributions of motorists' associations to the targeted public consultation[47]. Car drivers are usually satisfied with the manual tolling alternative, which exists for them on nearly all motorways where they are subject to tolls. Moreover, cars do not often go abroad, and therefore do not need cross-border interoperability as much as the lorries.

For lorries the situation looks different, as illustrated in Table 3. The number of nation-wide schemes has increased by 5 over the evaluation period. Thanks to cross-border interoperability agreements which were signed in the meantime, notably between Portugal, France and Spain, on the one hand, and between Austria and the Nordic countries (EasyGo+) on the other, the number of OBUs needed to travel unhindered across the EU increased only by two. However, the number of most expensive GNSS OBU went from 1 to 4, which explains the rise in the cost of OBUs needed. Also, the introduction of electronic tolling systems in non-Eurozone countries (Poland, Czech Republic, Slovakia, and Hungary) increased the hassle due to the treatment of invoices (and payments) in different currencies.

Year	Number of nationwide schemes + Oresund	Number of DSRC OBUs	Number of GNSS OBUs	Number of invoicing entities	Total cost of OBUs (EUR)[48]
2004	11	9	1	11	162-285
2009	12	10	1	12	170-300
2016	16	9	4	13	432-735

Table 3: Number of schemes and on-board units needed to travel unhindered on all EU roads on international importance[49]

More information on the evolution of costs for users and toll chargers is presented in the answer to evaluation question 5 (part 7.1.5).

[45] Source: 4icom, Steer Davies Gleave, *op. cit. note 17.* Confirmed by ASFA, ASFINAG, Ireland, Germany, Flanders, Poland, Portugal, Toll Collect in their answers to the targeted consultation.
[46] Cf. the answers of Flanders, Ireland to the targeted consultation.
[47] Answers of ADAC and ÖAMTC to the targeted consultation.
[48] Based on the assumption that a DSRC OBU costs 8-15 EUR, and a GNSS OBU costs 90-150 EUR – source: 4icom, Steer Davies Gleave, *op. cit. note 17.*
[49] The numbers in the first four columns are own calculations based on the maps in Annex 5.

6. ANSWERS TO THE EVALUATION QUESTIONS

6.1. Effectiveness

6.1.1. Question 1: Have the provisions of the Directive and of the Decision led to the technical, contractual and procedural interoperability of electronic tolls? What has hindered/contributed to the achievement of this objective?

Apart from national, and a handful of very limited regional interoperability agreements, the implementation of the provisions leading to technical, procedural or contractual interoperability has not been achieved in the EU.

6.1.1.1.Contractual interoperability

Most fuel cards[50] can be used to pay tolls in different Member States. More than just easing the payment, fuel card providers (such as DKV, Shell, Total, OMV, Ressa, UTA, Trafineo)[51] actually act as intermediaries between toll chargers and road users, taking care for the latter of administrative formalities such as registration in the toll charger's database, shipment of the on-board unit and financial brokering including financial guarantees. *De facto,* the customer's main counterpart is thus the fuel card provider and not the toll charger. These services come at a cost which can vary 1 and 4% of the tolls paid,[52] depending on the array of services offered and the geographical coverage. Indeed, none of the fuel card providers offers his/her brokering services in all toll domains in the EU.[53]

Similar services are offered by more profiled companies which specialise in toll payments, such as Eurotoll, LogPay or WAG.

The services of the fuel card/payment services providers therefore partly contribute to the objective of contractual interoperability (as they reduce the administrative burden for users linked to the need to deal with many toll chargers). However, users have a contractual relationship with each toll charger, and the services they receive from their fuel card providers are not available all across the EU. A higher level of contractual interoperability is offered by toll service providers such as Axxès, DKV, Eurotoll, Total, Telepass. Beyond obtaining payment services, like from fuel car providers, the clients of these toll service providers do not need to enter into contractual relations with the toll chargers, the toll service providers being their sole counterparts. The services of these companies are therefore the same as those of EETS providers (and Axxès, Eurotoll, Total and Telepass all recently became registered as EETS providers), but unlike the latter they are active in a handful of Member States only, namely France, Spain, Portugal, Belgium (only Axxès) and Italy (only Telepass).

6.1.1.2. Technical interoperability

The necessary basis for technical interoperability (i.e. the compatibility of equipment used by different parties in different toll domains) has been laid down by, on the one hand side, the provision of Art. 2.1 of the EETS Directive, which listed the technologies allowed to be used

[50] A fuel (fleet) card is a payment card typically issued by an oil company or specialised financial intermediaries and primarily used for the purchase of fuel at gas station. Typically, however, a wider range of products and services can be paid with fleet cards: meals at gas stations, tolls, insurance, etc.
[51] These fuel card providers are members of AETIS. Other providers exist outside this organisation.
[52] 4icom, Steer Davies Gleave, *op. cit. note 17.*
[53] As reported by the IRU in their answer to the targeted consultation.

for electronic tolling in the EU and, on the other hand side, the standardisation work which delivered main standards for electronic tolling such as the EN 15509 on the DSRC communication between the OBU and the roadside equipment, the TS 16331 on the communication between the OBU and the back office of the toll service provider, or finally the EN 12855 on the interfaces between the back offices of the toll charger and of the toll service provider.

In practice, this technical interoperability is however limited. One on-board unit is compatible with the electronic tolling systems in Portugal, France, Spain and Italy. Another one can be used to pay tolls in Austria, Denmark, Sweden and Norway. Finally, a third type of OBU can be used both in Germany and in Austria. Elsewhere a different OBU is needed to pay tolls in each Member State.

6.1.1.3. Procedural interoperability

The EETS Directive identified in its Annex the procedural items essential for the definition and deployment of the European Electronic Toll Service. However, these items have not eventually been harmonised in the EETS Decision. As a result, the procedures adopted by different toll chargers in the different Member States were not always consistent with each other, as explained in details in section 5.1.

The Stockholm Group[54] has been working to develop commonly acceptable solutions, but the results of this work have not always been enforced by the participating Member States. Also standards, developed by European standardisation bodies under mandated from the European Commission, proved so far not to be specific enough to ensure the harmonisation of procedures.

A certain level of procedural interoperability has been achieved inside regional interoperability agreements. Toll chargers participating in EasyGo+ (Austria, Norway, Denmark and Sweden) have developed, for instance, a common interface to exchange information with toll service providers. In France, a big part of the procedure of testing new on-board units is done only once for all the toll domains in the country. Discussions are also taking place inside the REETS/EFP region on the possible approximation of certain procedures in all participating countries. The possible results of these discussions in terms of greater procedural interoperability could materialise in the upcoming years. As an example, AETIS is discussing with the toll chargers partners in REETS the advantages for EETS of choosing the re-seller transaction model over the agency model.

6.1.2. Question 2: Have the standards imposed by legislation been sufficient to render e-tolling systems technologically compatible? If not, what is the reason for that?

To achieve technological compatibility in the world of electronic tolling, it is essential to harmonise two interfaces:

- The interface between the on-board unit (OBU) of the toll service provider and the roadside equipment (RSE) of the toll charger; and

[54] The Stockholm Group is the informal platform of national authorities on tolling-related issues. The membership includes 13 EU Member States and Switzerland.

- The interface between the back offices of the toll charger and of the toll service provider.

For the first interface, two profiled standard have been developed and their use is rendered mandatory by the EETS Directive. These are the standards on DSRC charging transactions: EN 15509, applicable across the EU, and ETSI ES 200674-1, which can be used on Italian territory.

Still in the framework of the first interface, a standard has been developed for real-time compliance check. This standard (ISO 12813) is essential in the framework of GNSS-based schemes, in which communication with roadside equipment is the main enforcement method. However, the standard for real-time compliance check has not been referred to in the EETS legislation.

The interface between the back offices of the toll charger and of the toll service provider has so far not been sufficiently harmonised. The existing standard ISO 12855 is a toolbox (i.e. a standard with many variants). It has been developed mainly with DSRC-based systems in mind, and does not meet the complex data exchange requirements in the framework of GNSS-based systems. So-called Interoperable Application Profiles (IAP) for the ISO 12855 standard (i.e. more precise standards, fitting more specific needs) have recently been adopted under the number CEN/TS 16986 and are reportedly referenced for future inclusion in the relations with EETS providers in the German tolling scheme, but not yet in any other existing system.

Specific test standards are also required for testing the compatibility of equipment and systems with the requirements of the abovementioned standards. Such test standards have been developed for the DSRC-related standards. These are respectively the test standard ISO 15876 for EN 15509, and test standard ISO 13143 for ISO 12813.

The same cannot be said about the interface between back offices. Test standards for the IAP for ISO 12855 are still in the process of being developed.

The clear and good definition of the DSRC standards undeniably contributed to the progress observed in Europe in terms of interoperability of DSRC-based electronic tolling systems (cf. section 5.2.1). On the other hand, the lack of as precise standards for GNSS-based schemes contributes to the delay in achieving interoperability with- and between GNSS-based systems.[55]

6.1.3. Question 3: Has the integration of on-board units with other devices such as e-call or the digital tachograph happened and if so did it allow for reduction of the costs? Is it technically feasible and does it have the potential to reduce costs?

The objective to integrate on-board units with other legally required devices, such as e-call or the digital tachograph, has not been achieved. The implementation of this objective is impeded by the fact that on-board units for each tolling scheme are developed according to the proprietary requirements of each toll charger. Moreover, on-board units evolve all the time in line with changes to particular toll domains, while the specifications of the highly standardised tachograph or e-call remain stable as e.g. the tachograph must be protected

[55] Sources used for answering this question: (1) Presentation of the German Ministry of Transport and Infrastructure "Electronic Fee Collection Standardisation Current status and future activities" given at the meeting of the Toll Committee on 9 November 2015; contributions of Siemens and AETIS to the targeted consultation.

against changes to prevent tampering.[56] Therefore, the integration of OBUs with the digital tachograph or e-call could only be envisaged once OBUs are standardised across the EU, and even in this case would be difficult given the typical frequency of changes to the OBU software.

The question arises as to the actual existence of potential savings resulting from the integration of OBUs with the digital tachograph or e-call. The tachograph and e-call must be protected from malicious interventions to preserve their functions. OBUs, on the other hand, must receive constant software updates to reflect changes in the tolling environment. It would therefore seem that, for security reasons, full integration of the tachograph and e-call with the OBU would not be possible. It could be imagined, however, that the devices share some of the hardware, like the DSRC antenna in the upcoming smart tachograph. The cost of such parts is however extremely low, and the benefits from sharing their use would probably be lower than the costs of ensuring the integrity of the primary functions of the tachograph and e-call.

However, there are examples of integrating the OBU with devices present in the vehicle other than the tachograph or e-call: in Ireland, France or Italy, some of the on-board units can also be used to pay parking fees in non-public parking lots;[57] The Hungarian tolling scheme allows for the use of commercial tracking and tracing equipment instead of dedicated on-board units to declare tolling data; the OBU of Axxès can also be used for fleet management.

Integration of OBUs with other devices is therefore possible as shown by the above examples. However, where commercial devices designed for other use (e.g. tracking and tracing devices in Hungary) are used *instead* of dedicated OBUs, additional efforts must be deployed for enforcement. Indeed, such devices can be turned off at any moment to evade the obligation to pay the toll.

6.1.4. Question 4: To what extent did toll chargers comply with the requirement to use only three technologies? To what extent did it help achieve interoperability? Did it have any unintended effects?

According to information available to the Commission and confirmed by Member States during the consultation for this evaluation, toll chargers have nearly totally (with exception to four cases, to the Commission's knowledge) complied with the requirement to choose among the three technologies provided for in the EETS Directive. For further details see a Section 2.2 and 5.1.

As confirmed notably by the (prospective) EETS providers gathered in the association AETIS and by an equipment manufacturer (Kapsch) during the targeted consultation, this high level of compliance helped achieve the existing interoperability among different DSRC-based tolling schemes – mostly at the national level, but also between some specific countries.

The unintended effects of the requirement to use only three technologies are discussed in the answer to question 8 (part 7.1.8).

[56] Cf. notably the answer of Kapsch to the targeted consultation.
[57] Answer by Transport Infrastructure Ireland to the targeted consultation; road users' contributions.

6.1.5. Question 5: Has the cost of setup and maintenance of electronic toll systems for toll chargers changed? Has the compliance cost and hassle for tolled road users changed? If so, can this be attributed to the effects of the evaluated legislation?

(1) Cost for toll chargers

As mentioned in sections 5.2.2 (1) and (2), available evidence (c.f. Table 1) indicates that the investment needed to setup and launch a network-wide electronic tolling scheme has remained at a similar level over the evaluation period. Similarly, while for a single system operating costs tend to diminish with time, the level of these costs in the first year of operations seems to be the same for systems launched ten years ago and today.

The operating costs diminishing over time in different schemes indicate a high potential of cost reduction through a learning process. It can be safely assumed that this potential could also materialise, from the very beginning, in each new tolling schemes deployed, if there was sufficient exchange of best practices between toll chargers. The fact that setup and operating costs are as high in most recent schemes as they were in schemes introduced ten years ago shows that the EETS legislation failed to put in place effective incentives for toll chargers to exchange best practices and to build upon past experience.

One network-wide electronic tolling scheme stands out from the crowd. It is the Hungarian HGV tolling schemes, the deployment of which cost between 1/8 and 1/6 of the cost of comparable systems in other Member States, and the operation of which costs much less (the scarcity of data does not allow to estimate exactly by how much). The system is said to achieve lower performance levels (notably in terms of enforcement effectiveness) compared to other systems in the EU, nevertheless it meets the objectives of the Hungarian authorities in terms of toll collection and offers similar flexibility as elsewhere in the EU. The fact that Hungary remains the only Member State to date to have opted for such a 'cheap' solution shows that the EETS legislation did not put in place effective incentives for toll chargers to opt for the most economically efficient technical solutions for electronic tolling.

(2) Cost and hassle for tolled road users

According to sections 5.2.2 (3) and (4), the production cost of OBUs fell by half over the evaluation period, but this positive evolution was not entirely reflected in the prices paid by road users. In many schemes OBUs are rented to users against a deposit which typically exceeds the value of the equipment; in Poland, for example, the deposit for a DSRC OBU (manufacturing cost 8-15 EUR) is 30 EUR, and the user's account must be topped up with 30 EUR. These deposits and mandatory top ups of pre-paid accounts, when applied across different toll domains in the EU, amount to important sums which hauliers are obliged to block, and this negatively affects their cash flow.

The reduction in the manufacturing cost of OBUs can be attributed to different factors, depending on the specific category of equipment:

- GNSS on-board units were not in use in the EU before 2005 when the German HGV toll was deployed. At the time, it was a rising technology,[58] and this fact explained the

[58] 4icom, Steer Davies Gleave, *op.cit.* footnote 17.

high costs of equipment. Today, the technology has reached a certain level of maturity – which explains the reduction of prices. It should also be acknowledged that GNSS is one of the technologies allowed by the EETS legislation and this fact could have also contributed to the decrease in prices.

- DSRC, on the other hand, was a relatively mature technology already back in 2004. The division of the price of OBUs by two can therefore be, at least partly, attributed to the impact of standardisation (EN 15509) mandated by the legislation. Moreover, the deployment of many new schemes, some of which cover not only heavy goods vehicles, but also private cars, greatly increased the number of OBUs in use, and therefore allowed further economies of scale in the production.

What can certainly be said is that the evaluated legislation failed to make sure that the falling cost of equipment is reflected in a proportionate reduction of the costs for final users.

Moreover, the number of electronic tolling schemes for lorries and their coverage in Europe has greatly increased over the evaluated period. Before 2004, electronic tolling was only an add-on to manual toll collection at toll plazas on concession motorways in Southern Europe, Ireland and Poland. Therefore, a lorry could drive across the EU without on-board units – the latter could only make paying tolls at barriers quicker and smoother. Nowadays, lorries must be equipped with a good dozen of OBUs to be able to drive unhindered on all tolled roads in the EU. Figure 1 illustrates an extreme scenario of a truck, which would travel to all EU Member States and therefore need most of the OBUs.

Figure 1: A lorry equipped with the different OBUs needed to drive unhindered on EU roads. Source: 4icom, Steer Davies Gleave, op. cit. footnote 17

For light vehicles, the situation today is similar to the one observed in 2004: electronic tolling is mainly an alternative to manual payment at toll plazas. In some electronic tolling schemes (Portugal, Dartford crossing in the UK, London, Stockholm and others), free-flow tolling has been put in place, but it is based on automatic number plate recognition, and therefore does not require equipping the car with an OBU.

Therefore, the costs and hassle for users (in particular lorries) linked to the obligation of paying electronic tolls increased over the evaluation period as new free flow schemes have

been introduced. However, as explained in section 5.2.2(4) several regional interoperability agreements were signed in the meantime and contributed to some reduction of administrative burden. The explicit reference in the EETS Directive to the DSRC standard (EN 15509) facilitated the achievement of interoperability between microwave-based systems and thus the signature of the abovementioned regional agreements.

Initial interoperability agreements were signed by the toll chargers between themselves. This model renders difficult the achievement of interoperability between more than a few partners (e.g. the *EasyGo* interoperability agreement between Norway, Sweden and Denmark). Larger interoperability schemes require the participation of (a) third party(ies) to negotiate interoperability with each toll charger on a bilateral basis, avoiding the need for complicated multilateral negotiations. This model of interoperability was provided for by the EETS Decision, which defined the rights and obligations of *EETS providers*. It can therefore be said that larger interoperability projects (such as the one currently negotiated on the margins of the REETS project) were facilitated by the EETS legislation. The latter is expected to contribute to the reduction of the costs and hassle for road users.

6.1.6. Question 6: Have the provisions of the Decision led to the setup of the EETS? What has hindered/contributed to the achievement of this objective?

The legislation clearly failed to lead to the setup of a European Electronic Toll Service by the deadlines foreseen in the 'EETS Directive'. The first EETS provider (AGES GmbH) was registered in Germany in 2015, but since then abandoned its plans to expand in the EETS market. The second EETS provider (Axxès) is operating in 5 countries, but only in 4 (Belgium, France, Portugal and Spain) does it operate in all toll domains. The four remaining EETS providers cover even smaller networks.

A short analysis below considers the individual provisions of the Decision which can be held responsible for this failure:

- Article 3 lists the requirements to be fulfilled by companies seeking registration as EETS providers. The experience of AGES in the registration process in Germany gave valuable feedback on the appropriateness of these conditions. It appeared that the lack of precise definition of what constitutes "appropriate financial standing" (letter (d) of the Article) and "global risk management plan" resulted in the authorities asking guarantees, which are disproportionate at the stage of registration. In particular, AGES was asked to show a detailed business plan for EETS operation in a situation where the vast majority of toll chargers, including Germany, have not made public the contractual conditions for relations with EETS providers – making it impossible to foresee future revenues.

- Article 4.1 requests EETS providers to cover all EETS domains in the EU (over 140 domains) within 24 months. Prospective EETS providers commonly agree that this timeline is too short for the conclusion of contracts and accreditation procedures. Moreover, any EETS provider would not have the resources to start negotiations and accreditation with over 140 partners at the same time. Therefore, the requirements of Article 4.1 are seen by potential EETS providers as a barrier to enter the market.[59] The open public consultation show that 37 respondents (51%) felt that the European Union

[59] The point has been often raised by AETIS as a problem, notably at the level of the Electronic Toll Committee.

should leave the EETS providers to decide which toll domains they want to cover by their services. A very large proportion (c.80%) of respondents representing toll chargers or service providers were in favour of allowing EETS providers to decide which domains they should cover. However, only c. 30-35% of respondents from the other interest groups agreed that the regulation should be relaxed; between 50-67% of public authority and 'other' representing respondents suggested an 'other solution', while between c. 45-55% of respondents representing private use and many/other transport modes suggest that the current obligation should be maintained.

- Article 4.10 mentions the need for EETS providers to collaborate with toll chargers in their enforcement effort. However, it does not oblige toll chargers/Member States to collaborate between themselves (identification of the offenders on the basis of their licence plates and exchange of data on vehicle registration). This complicates enforcement of the toll obligation for foreign drivers and thus makes cross-border interoperability/EETS more difficult to achieve. This goes in line with the results of the open public consultation in which a large majority (56, or77%) of respondents were in favour of the EU establishing a mandatory mechanism for the exchange of data on toll offenders to facilitate recovery of unpaid tolls (and only 12% were against). The division of answers by main respondents groups follow the above trend.

- Article 5.3 puts upon Toll Chargers the obligation to "accept on a non-discriminatory basis any EETS provider requesting to provide EETS on [their toll domain]". Furthermore, they must aim at "complet[ing] negotiations within [24 months]". While these provisions are necessary and important, the obligations of toll chargers are not defined in sufficient detail. In particular, the term "non-discriminatory basis" can be subject to interpretation – in two Member States, this term was interpreted initially as forbidding discrimination *between*, rather than *of* EETS providers.[60] Also, it is not clear how it can be verified if the toll charger acts "with the objective to complete negotiations within [24 months]". Normally, this could be clarified by the Conciliation Bodies referred to in the last subparagraph of Article 5.3 and defined in Articles 10 and 11. However, Article 11 does not give the Conciliation Bodies sufficient power to enforce their decisions – they have mainly a consultative role. This issue was underlined by respondents to the open public consultation with 36 of them 50% supporting the replacement of conciliation bodies with strong and independent national entities to supervise the correct functioning of the tolling markets (market regulators). A wider range of views is apparent when considering the interests that the respondents represent. For example, 73% of respondents representing road freight transport agreed that powers of conciliation bodies should be increased to enable enforcement of mediated outcomes, in comparison to 55% of infrastructure operators/solution providers and 30-35% of public authorities and private users.

- Article 7.1 and Annex VI provide rules which must be followed for the determination of vehicle classification parameters. However, Annex VI defines these rules in such a broad manner, that toll chargers may adopt classifications based on various incoherent parameters. This constitutes a problem for interoperability, in particular when incompatible parameters are used in different schemes (e.g. total permissible laden weight in Belgium and number of axles in the rest of the EU).

[60] Exchange of information between the Commission and the concerned Member States.

- Article 8 provides for the mandatory separation of accounts in case an organisation operates both as a toll charger and an EETS provider. The aim of this provision is to make sure that EETS providers compete on a level playing field and that there is no cross-subsidisation of activities. However, EETS providers do not only compete against each other, but also against national toll service providers; indeed, the latter provide exactly the same services as the EETS providers, but are contracted *by default* by the toll chargers, as part of a package including the setup and operation of the electronic tolling system. Examples of such national toll service providers include Toll Collect in Germany, Kapsch in Austria, Czech Republic and Poland, SkyToll in Slovakia or Satellic in Belgium. The effect of Article 8 is therefore limited as it does not also provide for the separation of accounts between the toll charger and toll service providers (which are not EETS providers). This analysis finds indirect confirmation in the results of the open public consultation, where 45 respondents (63%) felt that EU legislation should provide for the separation of accounts between toll charger and toll service provider activities (to avoid negative consequences of vertical integration), with only 15% opposing the measure. No major variations were apparent between interest groups.

- Annex III contains the essential requirements which must be met by EETS components. This should help achieve technical convergence and therefore facilitate interoperability and appearance of EETS. Yet, the Annex contains reference to only two standards (on the communication between the OBU and the roadside infrastructure in a DSRC environment) which is, as explained in section 6.1.2, insufficient.

- Annex IV, finally, describes methods of assessing conformity to specifications and suitability for the use of interoperability constituents. The Annex is based on the general rules provided for in the "New approach" Decision 768/2008/EC[61], which apply to conformity assessment in all sectors from toys to industrial machinery. Typically, there should be presumption of conformity to specifications if equipment respects a number of defined standards. Yet, the lack of reference to standards in Annex III makes such a presumption of conformity difficult to establish. Without a clear reference of what conformity means, it is difficult for a manufacturer or a notified body to actually assess and certify conformity.[62]

Thus, ambiguities and gaps in the provisions of the EETS Decision have largely hindered the setup of the EETS system as a whole. At the same time, certain elements of the EETS have been put in place following the adoption of the framework. The technical harmonisation introduced by the EETS Directive (i.e. the limitative list of three technologies allowed for use in electronic tolling schemes), a relatively mature standardisation framework for DSRC tolling (as compared to GNSS-based tolling) with reference to specific standards in the Decision, and the adequate interoperability architecture which introduced the role of a third party toll service provider, have contributed to the appearance/emergence of cross-border interoperability in certain cases.

[61] Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC (OJ L 218, 13.8.2008, p. 82).
[62] This is one of the main, initial findings, of the workshop on standardisation gaps organised in the framework of the Notified Bodies Co-ordination Group.

6.1.7. *Question 7: To what extent has the legal framework led to the improvement of the internal market for electronic fee collections? What factors have contributed to or hindered the achievement of this objective?*

The question of the improvement of the internal market should be analysed from four angles:

(1) Integration of toll chargers

As explained in section 5.2.2, the development and setup of an electronic tolling system, as well as its operation, has very considerable costs. These costs however are not necessarily proportionate to the size of the tolled network and to the number of tolled vehicles. In other terms, the bigger the network and the greater the number of vehicles subject to the toll obligation, the lower the costs of collecting the toll per vehicle-kilometre. Greater collaboration between toll chargers, which could range from better co-ordination of tolling standards and practices to the development of a common system for two or more networks, could bring significant savings going into hundreds of millions of EUR.

Despite this huge savings potential, the only example of such co-operation so far is the common electronic tolling system developed by the three Belgian regions (in Belgium, regions and not the State are competent for tolling). The EETS legal framework does not provide any incentives for such collaboration. For comparison, the 'Eurovignette' Directive 1999/62/EC indicates in its Article 8b that "Two or more Member States may cooperate in introducing a common system for tolls applicable to their combined territories as a whole."[63]

(2) Technical interoperability

As explained in Evaluation Question 1 (section 6.1.1), some technical interoperability has been achieved in the EU, but not all of it can be attributed to the influence of the European legal framework.

Interoperability between the HGV tolling schemes in France was achieved in 2007 based on the operational model developed in the CESARE projects, which was later adopted in the text of the EETS Decision. Interoperability between tolling systems within other countries (notably Spain and Ireland) are based on the same model. The legislative process at EU level has therefore been instrumental in incentivising the development of technical interoperability in these Member States. The same applies to the several cross-border interoperability projects such as between France, Spain and Portugal, or the EasyGo+ interoperability agreement between Austria, Norway, Sweden and Denmark[64].

On the contrary, bilateral interoperability agreements such as – for HGVs – between Germany and Austria, Switzerland and Austria, or – for passenger cars – between neighbouring regions of France and Spain or of Spain and Portugal, are not built on the EETS model and cannot be attributed to the influence of European legislation.

Finally, the expected long term impacts of REETS on cross-border interoperability have not realised yet. However, the recently observed expansion of EETS providers into new toll

[63] 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), as amended by Directive 2006/22/EC and Directive 2011/76/EU.

[64] EasyGo initially started as an interoperability agreement between toll chargers, but later evolved and today it is possible for third party toll service providers to operate in all involved toll domains.

domains in the REETS region could certainly be partly attributed to the influence of the EETS legislation.

(3) Procedural interoperability

There are some achievements in terms of procedural interoperability (or at least approximation of practices) at EU level which can be attributed to the EU legislation, in particular the relatively harmonised classification of vehicles. However, as discussed under Evaluation Question 6 (cf. section 6.1.6), most of the merit for the current system where toll classes generally follow some common rules in all toll domains could be attributed the 'Eurovignette' Directive. The latter suggests the variation of tolls by the damage done to the infrastructure (the proxy most often used is the number of axles, as heavier vehicles which damage roads most tend to have more axles),[65] and the EURO environmental class of the vehicle.

Other aspects of procedural interoperability, as described in Evaluation Question 1 (cf. section 6.1.1), have hardly progressed. This can be attributed to the insufficient level of standardisation provided by the EETS legislation.

(4) Contractual interoperability

As explained in section 6.1.1, fuel card issuers and similar intermediaries help haulage companies deal with the numerous toll chargers on the roads on which they travel. These services have nevertheless developed independently of the EU legislation.

6.1.8. Question 8: Has the legal framework led to any unintended effect (negative or positive)?

There were two main unintended effects of the legislation. The first one is linked to Art. 2.1 of the EETS Directive, which restricts the list of technologies allowed for use in electronic tolling in the EU and therefore excludes from the market a technical solution very widely used elsewhere in the world, i.e. passive RFID tags. Therefore, the deployment of a cheap potential alternative for free flow tolling of cars and other light vehicles has been hindered. Box 1 contains more information on the passive RFID technology and its use worldwide

[65] The Belgian HGV toll is an exception to this rule, as it varies the toll according to the maximum admissible laden weight, rather than the number of axles.

Box 1: Passive RFID technology

Passive RFID tags are used for tolling in the United States, Canada, Brazil, Argentina, Chile, Columbia, Costa Rica, the Dominican Republic, Turkey, India, Vietnam, Thailand, Brunei, the United Arab Emirates, Israel, South Korea and other countries). In this technology the OBUs (minuscule antennas integrated into stickers glued to the windshield) are not able to communicate information by themselves, but they merely reflect a signal when interrogated by the roadside equipment. This makes them less suitable for complex tolling systems, such HGV tolling or closed motorway tolling systems. However, passive RFID tags are potentially suitable for use in schemes where all the information which needs to be transmitted is the presence of the vehicle, e.g. cordon pricing, open tolling systems or even, under certain conditions, free flow tolling systems for cars. The greatest advantage of these tags is their price – ca. 1 EUR, instead of 8-15 EUR per DSRC OBU – while the cost of the necessary roadside equipment is comparable to the DSRC environment.

The second unintended consequence of the legislation is that, by imposing heavy obligations on EETS providers (cf. notably the answer to evaluation question 6 – section 6.1.6), it created for them considerable obstacles for entering the market. The most problematic provisions are:

- Article 3 of the Decision which lists the requirements which a company must meet before it can be registered as EETS provider;

- Article 4.1 which obliges EETS providers to cover with their services all electronic toll domains in the EU within 24 months;

- Point 1 of Annex I to the Decision, which allows toll charger to ask bank guarantees or equivalent financial instrument up to a level equivalent to "the average monthly toll transaction amount paid by the EETS provider for this toll domain";

- The lack of effective provisions which would prevent the discrimination of EETS providers wanting to enter a new toll domain. Art. 5.3 of the EETS Decision, which provides that "toll chargers shall accept on a non-discriminatory basis any EETS provider requesting to provide EETS on the EETS domain(s) under the toll charger's responsibility" proved not explicit enough, as it has often been interpreted as forbidding discrimination *between* EETS providers, rather than *against* EETS providers.

6.2. Efficiency

6.2.1. Question 9: What are the current costs (including opportunity costs of not using another suitable technology) and benefits of the approach limiting to three the number of technologies allowed to be used for electronic tolling? What will be their possible level in the short-to-medium term future? Are the answers different for different types of vehicles (heavy vs. light vehicles)?

6.2.1.1. Costs

As discussed under Evaluation Question 8 (cf. section 6.1.8), Art. 2.1 of the EETS Directive does not authorise electronic tolling systems using passive RFID**.** This technology cannot be

used in situations where the OBU must register and autonomously communicate data, such as the closed tolling systems (systems where a barrier is installed at each entry and exit point from the motorway) present on many concession motorways across the EU. In principle, the systems could be rearranged so that the tolling system itself registers the point of entry and then compares it to the point of exist. However, this would require considerable investments and a complete re-organisation of the back-offices. RFID could therefore not easily be deployed in many existing closed tolling systems.

RFID tags are much cheaper than DSRC OBUs (1-1.20 EUR instead of 8-15 EUR for DSRC). There are around 25 million OBUs installed in passenger cars today.[66] The value of these OBUs is of is of 200-375 million EUR, and because of the lifetime of a battery, they must be renewed every 5 years (which is not the case for RFID tags, which by definition do not have a battery). In an RFID environment, equipping the same number of vehicles would cost only 25-30 million EUR. The potential savings therefore amount to some 170-250 million EUR every five years. It should be noted however that the operational costs of RFID passive tags can be 10 to 20% higher than in the case of a DSRC-based system (due to increased costs of enforcement).[67] RFID tags are less suitable for use in the HGV tolling systems in the EU, because they cannot handle the complex data exchange requirements.

There are also other technologies excluded from Article 2.1 of the EETS Directive, however their exclusion in the European tolling context do not present any significant costs. In particular:

- Infrared DSRC has similar level of performance and costs to microwave DSRC. Its exclusion from the list of allowed technologies therefore is not linked to any significant opportunity costs.

- The tachograph-based OBUs are relatively cheap, but do not allow for differentiation between tolled and non-tolled roads (each kilometre is counted, independently on where it is driven). Moreover, the system is exposed to fraud, as the signal from the odometer is quite easy to tamper. In order to prevent this, the signal from the odometer must be checked against another source, e.g. GNSS. This however makes the device expensive, as it is the case in Switzerland, where the OBU costs around 350 EUR. Overall, therefore, tachograph/odometer-based tolling schemes are not particularly adapted to the EU context.

- With exception to some pilot operations cell phones have never been used so far in real operations of toll collections. Under this option, the position of the vehicle is established by triangulation of signals received by the phone from different GSM base station. Availability of signal is a critical element, which makes it inappropriate for less populated areas with insufficient coverage. In the future however, when universal coverage of the EU territory is attained, cell phone might also become an alternative tool for tolling, but it is difficult to estimate when/if it will happen.

[66] Own calculation based on statistics of the European Association of tolled motorways, bridges and tunnels concessionaires (ASECAP).
[67] 4icom, Steer Davies Gleave, *op.cit. note 17.*

6.2.1.2. Benefits

The main benefit of limiting to three the number of technologies allowed to be used for electronic tolling is the reduction in the complexity of on-board equipment. Today, an OBU with the three technologies costs 90-150 EUR.[68] The Swiss OBU, which in addition to these technologies also has a link to the odometer, costs 350 EUR a piece. Adding infrared DSRC to the equipment would cost another 8-15 EUR. In addition, such OBUs incorporating all different technologies would need to be updated all the time, which would make the achievement of technical interoperability much more difficult than it is even today.

The main benefit is therefore a reduction in the price of EETS-compatible OBUs (i.e. OBUs which can operate in all toll domains in the EU). This benefit can be estimated at some 200-260 EUR per piece of equipment,[69] and some 1.2–1.56 billion for all lorries engaged in cross-border transport in the EU.[70]

6.2.1.3. Comparison costs-benefits

In monetary terms, and assuming the same rate of replacement for EETS-compatible OBUs as for DSRC units, the net benefits of limiting to three the number of technologies allowed to be used in electronic tolling, compared to a situation where all technologies were allowed, amounts to 950-1,360 million EUR every 5 years.

However, compared to a situation where only one technology (passive RFID) is added to the list, the current imitation could actually be seen as bringing net losses amounting to some 170-250 million EUR every five years. This estimate is however the result of very basic calculations, which does not take into account all characteristics of RFID as a technology and its wide-scale deployment in an EU-context. Its possible inclusion in the list of authorised technologies would require a much deeper analysis in the framework of an impact assessment.

6.2.2. Question 10: Are the costs of the approach involving third party providers (EETS provider) adopted in the Decision lower than the benefits associated with the EU wide interoperability of the toll? Would the relation between the costs and benefits be better had an alternative approach been chosen (e.g. deployment of EETS through agreement between toll chargers, or as a public service obligation, etc.)?

Given the actual state of deployment of the EETS system (of the six registered EETS provider only two of them[71] providing services in 4-5 Member States), currently it is impossible to assess the *actual* level of costs and benefits. Therefore, this evaluation question will discuss the *potential* costs and benefits of the approach given the current state of deployment and expected market developments.

[68] 4icom, Steer Davies Gleave, *op.cit. note 17.*
[69] Difference between the price of today's EETS-compatible OBUs and of the Swiss OBU.
[70] Base on the assumption that there are 6 million lorries engaged in cross-border transport in the EU, source: Impact Assessment accompanying the proposal for a revision of Council Directive 96/53/EC of 25 July 1996 *laying down for certain road vehicles circulating within the Community the maximum authorized dimensions in national and international traffic and the maximum authorized weights in international traffic*.
[71] Axxès and Telepass.

6.2.2.1. Costs

The introduction of a third party (EETS provider) in the toll collection chain means for the toll charger – from a technical perspective – that he needs to create in his system an adequate interface for exchange of data with this new partner. When several EETS providers ask access to a given scheme, creating and managing a separate interface for each of them can be burdensome and costly, unless a sufficiently open interface can service all of them. This solution was chosen by the operator of the Austrian HGV toll domain ASFINAG, who want to communicate with EETS providers through the existing 'EasyGo' interface.[72]

For EETS providers, the main cost element relates to the need to obtain technical accreditation (and re-accreditation after any change to the system) of their OBUs and systems to all EETS domains. An expert commissioned on the margins of this evaluation assessed these cost at 14.2 million for all toll domains.[73]

For toll chargers, outsourcing contacts with the clients to the EETS providers can make enforcement and fining more difficult, as the direct link to the client is lost. This problem can be mitigated if good and close co-operation is established between the toll charger and the EETS provider in the field of enforcement.

6.2.2.2. Benefits

The main benefits of delegating toll collection to the EETS provider are obviously savings on equipment. This is particularly true for GNSS-based schemes, where OBUs typically cost more than 100 euros a piece. Furthermore, many toll chargers (ASFA – the association of French motorway concessionaires, Ireland, Italy, Poland, Portugal) pointed in their answers to the targeted consultation to the fact that specialised third parties such as EETS providers have the necessary expertise to collect tolls in a more efficient manner than the toll chargers themselves. In particular, their international presence and activity base makes it easier for them to interface with clients established across the EU. By delegating to EETS providers relations with the clients, toll chargers can focus on their main field of specialisation, i.e. road management. None of the toll chargers who answered the targeted consultation contested that the guarantee of toll payment offered by the EETS providers is a valuable service which should be remunerated.

Another benefit of EETS, mentioned by Germany in its answer to the targeted consultation, is that it makes toll chargers less dependent on the single service provider. Hence, their bargaining power and flexibility in the framework of long term contracts with system operators increase. Finally, with EETS providers operating on the market, the deployment of new electronic schemes becomes much easier, as the toll charger can benefit from a pre-existing large number of registered users and vehicles equipped with OBUs.[74] Still, unless EETS providers are legally obliged to accept all users, the toll charger will need to provide on-board units and services to the 'bad clients'.[75]

[72] Contribution of ASFINAG to the targeted consultation.
[73] 4icom, *op.cit*. note 15.
[74] Cf. Italian contribution to the targeted consultation.
[75] E.g. in the Ecotaxe system, independent service providers were expected to service 600,000 registered users, while Ecomouv' – the operator of the system on behalf of the French State – would have delivered 200,000 OBUs to address the needs or occasional users not registered with other companies (cf. 4icom, Steer Davies Gleave, *op. cit.* footnote 17).

In summary, the benefits of the approach to interoperability which involves third party providers (EETS providers) seem to considerably outweigh the costs. Actually, the fact that third party providers offer their services on commercial terms since many years in France (in the framework of TIS-PL[76]), Spain (VIA-T) or Ireland proves that the approach is commercially viable. The interest of six service providers in entering the EETS business proves that it can also be potentially viable on a European scale.

It is useful to compare the interoperability model which involves EETS providers with one based exclusively on agreements between toll chargers. This alternative model has notably been successfully implemented in the telecoms sector, to allow world-wide roaming. This was mainly possible thanks to the existence of very precise standards (GSM), to which all market players adhere. Furthermore, roaming is – unlike interoperability of electronic tolls – a vital necessity for mobile telecommunications, and demand for interoperable services is huge. Neither is true for electronic tolling, where systems can work in isolation, and demand for interoperability is restricted to the million-or-so lorries engaged on a regular basis in cross-border transport.

In the field of electronic tolling, the cost of passing bilateral agreements between each of the 142 toll chargers (to achieve EU-wide interoperability) would therefore be disproportionate (in the worst case scenario, the cost of certification of equipment of each toll charger for interoperability with all other toll domains would amount to (141+140+139+138+137+136+…)*100,000 = 1,001,100,000 EUR) compared to the significant, yet limited benefits. However, the bilateral approach has proven useful in regional interoperability projects addressing the needs of specific, local users: motorway concessionaires have passed such agreements to allow seamless crossing of borders by people living in neighbouring regions of France and Spain, or Spain and Portugal.[77]

6.3. Relevance:

6.3.1. Question 11: To what extent is interoperability of electronic tolls needed by the users? Is the answer different for different types of road users (in particular heavy goods vehicles vs. other users)? Is it likely to change over time?

As discussed in Section 5.2.1 electronic tolls on motorways and in cities for private cars exist in a number of EU Member States. However, for most of the private users, when occasionally travelling abroad, the hassle of paying manually seems to be at an acceptable level. In their answers to the targeted consultation, organisations representing light vehicle users (Automobile Clubs) have clearly indicated that cross-border interoperability of electronic tolls is not an issue for them.[78] This results from the fact that: (1) electronic tolling requiring the presence of an on-board unit is still not frequent for light vehicles, and manual payment is offered as an alternative in most of the cases and (2) cars do not go abroad on a regular basis (typically once-twice a year for holidays) and even then do not cross many borders. In addition, these representatives of the industry fear that possible costs of interoperability are reflected as an increase in the level of tolls. ASFINAG – single toll charger and main toll service provider in Austria, gave a somewhat less categorical answer, indicating that a market

[76] TIS-PL is the French interoperability system for heavy goods vehicles, allowing the use of all conceded motorways with one OBU and a single contract.
[77] Cf. the answers of ASFA and of Portugal to the targeted consultation.
[78] Answers of ADAC and ÖAMTC to the targeted consultation.

could exist for regional cross border interoperability between two countries with significant cross border movement.[79] Yet ASFINAG confirmed that users of light vehicles would not accept to pay the costs of this interoperability, nor would they accept any interoperability which does not guarantee fully seamless payment of tolls in the other country.

The position of heavy duty vehicle operators is different. As discussed in Evaluation Question 5 (Section 6.1.5) the hassle for tolled road users of having numerous OBUs is high and costs are significant. Moreover, as trucks go abroad on a regular basis, the hassle of using manual payment for HGV in countries where both paying methods are available (i.e. Croatia, France, Greece, Ireland, Italy, Slovenia and Spain) is relatively higher than for occasional private car or van users. In their answer to the targeted consultation, the hauliers' organisation IRU also indicates that almost all EU trucks engaged in cross-border transport would be equipped with at least three to four OBUs. Between one third and half of the road haulage market would be a potential user of the EETS.[80] This last figure however seems exaggerated, as it is commonly assumed that only about one million lorries out of a European population of 6 million are engaged in cross-border transport.[81]

Intermediaries such as fuel card issuers already facilitate toll payment in the EU by allowing road freight transport operators to have to deal with only one invoice. However, according to IRU, none of these intermediaries cover all electronic toll domains across the EU. Whereas they constitute a partial solution to the problem of having to deal with numerous counterparts, it doesn't solve the issue of road users being obliged to handle many OBUs and contracts to seamlessly cross borders in the EU. Road freight transport operators still have to carry as many OBUs and to sign as many contracts as there are toll chargers, with the attached burden, administrative fees and maintenance costs.[82] This is still reported as a big problem by the hauliers' association (as already indicated in section 6.1.5), who therefore call for interoperability of electronic tolls at the three levels defined by the EETS legislation (cf. also answer to question 12 in section 6.3.2)**.**

In conclusion, it appears clearly from expert views that cross-border interoperability of electronic tolls is much more needed by heavy duty vehicles than by cars. This was somehow indirectly contradicted by the results of the open public consultation (to which mainly a non-expert audience participated), where the majority of respondents (45, or 62%) agreed that the EU should continue regulating interoperability between electronic tolls applied to passenger cars. Three times the amount were in favour of this compared to those who believed this matter should be left to Member States. Road users (both professional and private) were most in favour, while public authorities were more split (3 in favour, three against). This result might reflect the fact that the situation might change in the medium-to-long term as barrier-free tolling schemes start to be deployed on a wider scale for light vehicles. As regards heavy duty vehicles, their need of interoperability will become more acute in the near future as the deployment of new schemes is being considered in several countries (c.f. tendering process in Bulgaria for a network-wide tolling scheme, ongoing analyses in Sweden, etc.).

[79] Answer of ASFINAG to the targeted consultation.
[80] Answer of the International Road Union (IRU) to the targeted consultation.
[81] Impact Assessment accompanying the proposal for a revision of Council Directive 96/53/EC of 25 July 1996 *laying down for certain road vehicles circulating within the Community the maximum authorized dimensions in national and international traffic and the maximum authorized weights in international traffic.*
[82] Answer of the International Road Union (IRU) to the targeted consultation.

6.3.2. *Question 12: To what extent the objective of having interoperability at all three different levels (technical, contractual and procedural) is equally needed by the road users? Would any of the three levels of interoperability be less relevant?*

The lack of technical interoperability, i.e. the need to equip vehicles with a separate on-board unit for each electronic tolling scheme, is the most visible aspect of the issue. It means the following problems for the hauliers:

- Financial costs of acquiring, installing and removing on-board units from the vehicle; this can be particularly problematic where the vehicle travels across many Member States, and is therefore to be equipped with many OBUs. Similarly, it is an issue for companies in which the fleet renewal rate is high (if trucks are constantly engaged in long distance international transport, they can be renewed as often as every three years to optimise their performance).
- Installing and removing on-board units is also linked to a loss of time, especially, when the OBU must be installed in a specialised workshop.
- The driver needs to monitor that all his OBUs are working to avoid fines.
- There can be interferences between different OBUs.

Most aspects of the lack of procedural interoperability are not directly relevant for the road users, since they influence the relations between the toll chargers and toll service providers. However, the lack of consistency in the way vehicles are divided into toll classes is a problem for operators wishing to optimise their fleet composition according to the deployed price signals. As an example, it is cheaper – from a tolling point of view – to transport a given shipment with two 7.5 tonne trucks in Germany (since they are not subject to the toll), while in Austria it will make more sense to pack it in a 12 tonne truck.

Finally, the lack of contractual interoperability can cause significant direct compliance costs, especially to smaller hauliers' companies who do not have specialised services dealing with contractual issues. However, the market already has – at least partially – addressed this problem, with fuel cards providers acting as intermediaries between road users and toll chargers. The high cost of such services – between 1 and 4% of the toll due – remains however a problem.

To conclude, for users technical and contractual interoperability are seemingly more important, while procedural interoperability is a secondary objective. However, the latter is very important for the toll service providers, who are in the end responsible for deploying the EETS.

6.3.3. *Question 13: To what extent does the level of the costs (and hassle) caused by the lack of interoperability justify policy intervention to facilitate interoperability? How has the gradual increase in the length of tolled networks and number of electronic toll systems in the EU affected the relevance of the objectives of reducing costs for users and for toll chargers?*

When answering this question, one has to consider costs and hassle for two main categories of stakeholders: the users (in particular heavy duty vehicles) and the toll chargers.

For users – as explained in section 6.1.5 – costs can be quite significant for heavy good vehicles. The gradual extension of the tolled road network in the EU in the last years and the use of more sophisticated tolling technologies (GNSS on-board units) contributed to an increase in the magnitude of initially identified problem.

For light vehicles, the costs and hassle caused by the lack of interoperability seem small[83] and are likely to remain at the same level in the short-to-medium future. Therefore, the coverage of light vehicles by the EETS legislation is less strongly justified by the level of costs and hassle experienced by this category of users, although other reasons (coherence of the internal market, preparing for future wider extension of free flow tolling systems for light vehicles) are also to be considered.

Regarding toll chargers, the costs due to the lack of interoperability are even larger than for the previous stakeholders' group. However, the objective of minimising these costs for this category of stakeholders is less relevant. The vast majority (in terms of network coverage) of electronic tolling schemes put in place since 2004 have been deployed by the States themselves, rather than by private concessionaires. For public authorities, the integrity of toll collection (i.e. reducing the level of unpaid tolls to the minimum) is often more important than the cost of achieving this goal. Therefore, they tend to develop proprietary systems which sure guarantee a better control of the overall toll collection process, but cost much more in investment and operational terms. The same is true for the systems possibly coming up in foreseeable future, namely the ones considered in Sweden and Bulgaria.

This explains why – as presented in section 6.1.5 – new electronic tolling schemes still cost on average more than 600 million EUR to deploy, and are characterised by operating costs which can reach 10-20% of the tolls collected.

6.3.4. *Question 14: To what extent the coverage of the framework in terms of users and geographical scope is adequate to the needs of the sector? For instance, is interoperability needed for some or all road user types? Is it relevant to cover all toll domains in the EU? Could it cover less, e.g. main transit countries? Or should it cover more, e.g. Switzerland, EEA, Western Balkans, Turkey, Community of Independent States, etc.?*

As discussed under Evaluation Question 1 (section 6.3.1), from the users' perspective, cross-border interoperability is much more needed by heavy-duty vehicles than by cars or vans. However, some toll chargers have a different opinion. In its answer to the targeted consultation, Ireland indicated that EETS for light vehicles could convince more of the users to opt for electronic tolling, thus helping to reduce the costs of toll collection. The same could be true in other countries where manual collection exists as an alternative to electronic tolling, such as notably France, Italy, Spain and others.

There is disagreement between the stakeholders on the geographical coverage of EETS. IRU for instance suggests that EETS should be *extended* to EFTA and all neighbouring countries, which have introduced electronic fee collection.[84] Toll chargers and toll service providers tend to agree with IRU that interoperability should not be restricted to the EU, but they believe that this extension should be justified by significant transport flows. Kapsch (one of the main technology provider and operator of electronic tolling schemes in the EU) also

[83] Cf. Answers of ADAC and ÖAMTC to the targeted consultation.
[84] This would cover Switzerland, the Western Balkans, Turkey, Belarus, Russia and Morocco.

agreed that EETS providers should be allowed to enter all the markets where there is demand for interoperable services. These views are challenged by ASECAP, who are one of the leaders of the REETS project. According to their contribution to this evaluation, the need for the EETS system would mainly exist today for centrally located European States, which have a lot of cross-border traffic.[85] The assessment of figures provided by ASFINAG (operator of Austrian motorways and of the Austrian road tolling scheme) does not support this conclusion however. According to these data, there is significant HGV traffic on Austrian territory coming from such peripheral Member States as Lithuania (more than 12,000 toll transactions), Portugal or Greece.[86] Ireland also shows significant volumes of foreign registered vehicles on its territory (24%), including 6.7% from mainland Europe.[87] The optimal scope of EETS will depend, on the one hand, on the costs of including each particular toll domain in the service (these costs include, notably: the certification of the OBU as suitable for use in the toll domain – 100,000 EUR on average; developing the necessary back-office interfaces between the toll charger and the EETS provider; negotiating and maintaining concrete contractual agreements) and, on the other hand, the potential benefits for users and for the toll charger. Obviously, the more cross-border traffic there is in a given toll domain, the greater the chance that it should be covered by the European Electronic Toll Service. Geographical location (central vs. peripheral) should not be seen as the sole factor to take into account, as some peripheral countries are strongly integrated in the European transport chains and business. The results of the open public consultation confirm this view: 37 respondents (51%) felt that the European Union should leave the EETS providers to decide which toll domains they want to cover by their services, while 24% only believed the EU should maintain the obligation for EETS providers to cover all toll domains in the EU. A very large proportion (c.80%) of respondents representing toll chargers or service providers were in favour of allowing EETS providers to decide which domains they should cover. However, only c. 30-35% of respondents from the other interest groups agreed that the regulation should be relaxed; between 50-67% of public authority and 'other' representing respondents suggested an 'other solution', while between c. 45-55% of respondents representing private use and many/other transport modes suggest that the current obligation should be maintained.

Therefore, the geographic coverage is at least partially relevant and might possibly be extended where demand justifies it. As regards the types of users, while covering passenger cars may seem redundant (partly because a number of Member States apply vignettes rather than distance-based tolls), seasonal congestion could be reduced had the EETS been operational and had travellers been equipped with (interoperable) OBUs and therefore not been obliged to stop at toll booths.

6.3.1. Question 15: Is there still a need to ensure that the technologies and components provided for in national electronic fee collection systems be combined with other vehicle components?

The assessment shows that the objective of having OBUs combined with other vehicle components is partially irrelevant in light of the recent legal and technical developments. In its answer to the targeted consultation, Kapsch (one of the main technology provider and operator of electronic tolling schemes in the EU) pointed to two major issues which must be taken into account in the assessment: a) the primary roles of devices serving a specific legal

[85] ASECAP, *Tolling industry – key parameters – a phased approach*, contribution sent to the Commission at the occasion of the targeted consultation.
[86] Contribution of ASFINAG to the targeted consultation.
[87] Answer of Ireland to the targeted consultation.

purpose (digital tachograph, e-call) shall not be jeopardised; and b) requirements on protection of personal data, which don't allow using the data on the location of the vehicle collected for enforcement (tachograph) or safety (e-call) reasons for other purposes, such as tolling. In general, it is technically feasible to share GNSS and DSRC interfaces of these devices when they are external to the latter. If, however, these interfaces are embedded in the tachograph or in e-call, their use can potentially put at danger the personal data protection, and also expose the tachograph to the risk of tampering. Integration of OBUs with commercial tracking and tracing devices is possible as shown by the successful example of Hungarian HGV toll. However, such devices do not guarantee the integrity of toll declaration messages (e.g. they can be turned off at any moment), and their use therefore requires enhanced enforcement efforts to prevent fraud and toll evasion.

In conclusion, the need of ensuring better use of GNSS and DSRC interfaces of the devices installed on board of the vehicle to achieve economies of scale remains relevant to the sector. However such integration should be considered only where it does not pose any threat to the functioning of the legally imposed devices. When it comes to integration with commercial devices such as tracking and tracing boxes, smart phones or satellite navigation tools, the appropriateness of these devices for the specific application of toll collection should be analysed and potential gains should be carefully weighed against the drawbacks.

6.4. European added value

6.4.1. Question 16: What was the EU added value of the EETS legislation?

The EETS legislation was expected to put an end to the proliferation of mutually incompatible national electronic tolling systems, and thus contribute to reducing the costs of e-tolling for users and for toll chargers. Given their divergent objectives, Member States were not expected to have incentives to co-ordinate between themselves the development and operation of their systems. The European legal framework was seen as an instrument to incentivise the coordination of individual schemes and to ensure the further development of common market for e-tolling market.

The potential of the EU added value has largely not been reached because of the low effectiveness of the EETS legislation, as explained in the answers to evaluation questions 1- 8 (sections 6.1.1-6.1.8). It should be noted however that the legislation contributed to a limited technological and procedural convergence of individual e-tolling schemes and to a certain level of cross-border co-operation (e.g. REETS projects). This in its turn resulted in the limited deployment of cross-border interoperability in different parts of the EU, e.g. between France, Spain and Portugal, or between Austria and the Scandinavian countries. Overall, the EU added value of the EETS legislation was therefore low.

6.5. Coherence

6.5.1. Question 17: To what extent the legal framework is coherent with the goals and provisions of existing and upcoming EU legislation? In particular, how does this initiative fit in the overall ITS legal framework?

'User pays' and 'Polluter pays' principles

Electronic tolling is a key enabler for the application of the 'user pays' and 'polluter pays' principles, since it allows seamless collection of 'intelligent' tolls which take into account the individual infrastructure- and external costs related to the use of each vehicle. By aiming to

make electronic tolling cheaper and more user-friendly, the EETS legislation supports the Commission's goals to apply the user and polluter pays principles on a wider scale. These goals have been set in a series of Communications of the Commission, and more recently in the 2011 Transport White Paper.[88] EETS is also instrumental for the success of the goals of the 'Eurovignette' Directive[89] which establishes the framework conditions for charging heavy goods vehicles for the use of certain infrastructure.

Radio frequencies

The use of the 5.8 GHz frequency band for microwave-based tolling is compatible with the Annex to *Decision 2006/771/EC* as amended,[90] which restricts the use of the 5795-5805 MHz frequency band with transmitting power up to 2 W e.i.r.p.[91] to road tolling applications.

DSRC tolling in the 5.8 GHz frequency band is however under risk of interferences (i.e. mutual blurring of signals) coming from two sources. First, a neighbouring band (5.9 GHz) is designated for intelligent transport systems (ITS) applications: the 5855-5875 MHz band is designated within the European Postal and Telecommunications Committee (CEPT) for non-safety-related ITS applications, while the 5875-5905 MHz band is reserved under the provisions of Commission Decision 2008/671/EC to safety-related ITS.

The proximity of tolling and ITS bands has, for a long time, not caused any problem because development of ITS applications was very slow. Today, however, co-operative ITS (C-ITS, i.e. data sharing between vehicles, and between vehicles and the infrastructure) are expected to take up very quickly, with the support of the European Commission and main vehicle manufacturers. Many of the expected applications are safety related, and some are human safety critical (such as collision avoidance, ramp access, grade crossings, platooning, etc.). Signal interference between tolling and ITS can therefore not only cause revenue losses to toll chargers, but also put human life in danger. The organisations representing the two industries – ASECAP for the tolling sector and CAR 2 CAR Communication Consortium for C-ITS – have negotiated inside ETSI to find a solution for interference-free co-existence of the two kinds of applications, but the testing of the efficiency of the solutions proposed are not yet finished. Some players actually suggest a migration of microwave-based tolling to the 5.9 GHz band, but this would require deep analysis and a very long transition period.

The other threat to microwave-based tolling comes from the fact that rapidly expanding RLAN[92] applications require an extension of the spectrum they can use. Mandated by the European Commission, CEPT is currently evaluating if band sharing is possible between WiFi and existing applications amongst others in the 5-6 GHz band. Tolling is particularly threatened by this expansion as – unlike the 5.9 GHz band for ITS applications – the 5.8 GHz band is attributed to tolling on a non-protected basis.

[88] White Paper, *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, COM(2011) 144 final.
[89] Directive 1999/62/EC, as amended by Directive 2006/38/EC and Directive 2011/76/EU.
[90] Commission Decision of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices, OJ L 312, 11.11.2006, p.66.
[91] Stands for "equivalent isotropically radiated power".
[92] Stands for 'Radio LAN', i.e. wireless internet.

6.5.2. *Question 18: To what extent are the provisions of the Directive and of the Decision coherent and consistent? Are there any incompatibilities or contradictions between individual provisions?*

There are two main inconsistencies between the provisions of the Directive and the Decision. First, in its Article 3 (4), the Directive puts the responsibility of setting up the EETS on Member States insofar as "they shall ensure that operators and/or issuers offer the European electronic toll service to their customers in accordance with [a given] timetable". This theoretical responsibility is not further specified in the Decision. To the contrary, the Decision actually transfers the responsibility for the provision of the European Electronic Toll Service to EETS providers, while Member States merely have to ensure that "EETS [is] provided to EETS users as a single continuous service" (Art. 12 of the Decision).

Secondly, the Annex to the Directive mentions a long list of items required for the definition and deployment of EETS, including notably detailed technical and procedural harmonisation on the basis of adequate standards. However, the Decision does not constitute an adequate follow-up to the provisions of the Annex. Most notably, it specifies only one standard (for communication between the OBUs and roadside equipment in a DSRC environment), which falls largely short of what would be necessary for harmonising the systems in the EU according to the needs of EETS. This has hindered the achievement of interoperability as explained in the answer to evaluation question 1 (cf. section 6.1.1).

7. CONCLUSIONS

7.1. Effectiveness

The legislation failed to deliver on most of the objectives: costs of electronic tolling have hardly decreased for toll chargers and for road users, an EETS has not been set up (and interoperability hardly progressed) and OBUs have not – with few exceptions – been integrated with other devices.

As a result, while six EETS providers have been registered so far, only one of them has made significant progress in terms of service coverage since registration.

Interoperability of electronic tolls exists today mainly at national level, and in some countries it is established on the EETS model (involving a third party toll service provider). A few, limited cross-border agreement also appeared – mostly between DSRC systems, where interoperability is easier to achieve. The regional interoperability project REETS, supported by the European Commission, and its follow-up EETS Facilitation Platform and involving tolling actors from seven centrally located Member States and from Switzerland have achieved significant progress, but also shown the limits of what they can achieve in terms of overcoming legal problems and the lack of commitment of crucial decision makers.

Even if the price of tolling equipment has fallen by some 50% since 2004, this has not translated into a significant reduction of the cost of electronic tolling for toll chargers and road users. In particular, system setup and operation costs for toll chargers have remained at a same very high level over the evaluation period. Users have also not benefited from the fall in the price of equipment because toll chargers impose high margins on the on-board units which they put at the users' disposal. The overall costs and burden linked to the toll payment obligation have in fact increased, as many new schemes are now deployed in Member States, where electronic tolling did not exist previously.

One of the objectives of the EETS legislation was to make possible the integration of OBUs with other devices inside the vehicle using the same technologies (DSRC, satellite positioning and mobile communications). To date, this has happened in Hungary, where commercial tracking and tracing devices are used for toll declaration instead of dedicated on-board units. Some toll service providers, such as Axxès, ViaVerde and others also provide value added services on top of toll collection using the same equipment. In France and Ireland (and possibly also in other countries, where electronic tolling is offered to users of concession motorways) it is also typically possible to pay for non-public parking using the same OBU as the one used for toll collection.

A number of factors could be identified as contributing to this non-achievement of objectives:

Interoperability on a wider scale has been blocked by the lack of commitment and – in the worst case scenario – resistance of some Member States to opening their markets to new entrants. However, contractual interoperability, i.e. the possibility to interface with only one counterpart for paying tolls across the EU, has developed independently from the EETS framework as a commercial offer from, mainly, fleet card providers. This did however not allow reducing the number of on-board units which must be installed on-board of the vehicle or the number of contracts to be signed by the haulier. Moreover, certain provisions of the Directive and the Decision also contributed to the *status quo*. First of all, the two pieces of legislation create confusion as to who exactly is responsible for the deployment of interoperable services. Furthermore, the Decision fails to mandate a sufficiently detailed standardisation framework to support the needed harmonisation of electronic tolling systems in the EU. Third, the evaluation shows that the market rules defined in the Decision are biased to the detriment of the EETS providers. Finally, the lack of effective provisions allowing for a cross-border enforcement of offenses to the toll obligation reinforces the reluctance of toll chargers to give away even a part of the control over the toll collection process.

It has to be admitted that the standardisation requirements provided for in the legislation have contributed to the reduction of the price of DSRC equipment. Nevertheless, the reduction of the costs of other devices does not result from the EU rules. The other aspects of the EETS legislation, which actually help interoperability, are the restriction in the number of technologies which are allowed to be used in the EU for toll collection, and the creation of the role of EETS provider, responsible for offering interoperability on the market.

7.2. Efficiency

The intervention has not attained its objectives in reducing costs to transport operators and toll chargers (see section 8.1). However, it should be admitted that the legislation has overall not led to any important opportunity costs for commercial operators, of restricting the number of technologies for electronic tolling in the EU. The only notable exception is the passive RFID technology, which could provide a cheap alternative to DSRC for tolling in specific contexts (light vehicles, urban tolling…). Indeed, other potential technologies used for e-tolling are not suitable for the European context because of the complexity of the tolling operations for heavy duty vehicles which the technology needs to facilitate, or simply would not bring any added value compared to those technologies which are allowed by the EETS Directive.

Finally, given the actual state of deployment of the EETS system (only a handful of countries in which even the most advanced EETS provider offers its services) currently it is impossible to assess the actual level of costs and benefits.

7.3. Relevance

The legislation is only partially relevant in terms of its scope, as the mandatory coverage by EETS of all types of vehicles and all toll domains in Europe is considered an excessive requirement. There is (under present circumstances) no strong need of interoperable tolling for users of light vehicles, as the frequency of cross-border trips for this group of drivers is normally limited (e.g. during the holidays) compared to the HGVs. In specific cases (two bordering regions), interoperability for light vehicles can be achieved through local agreements between toll chargers. On the other hand, the need of cross-border interoperability of electronic tolls for heavy goods vehicles is confirmed by the stakeholders. Moreover, the need for EETS for HGVs will further increase with each new GNSS-based system deployed in Europe.

As regards the geographical scope, EETS providers should offer their services everywhere where significant demand exists. This could mean excluding some remotely located domains with little link to other parts of the EU, but could also mean including countries outside the EU and EEA.

The objective of having three layers of interoperability – procedural, contractual and technical – is still relevant given the latest technological and market developments translated into an important increase in number of toll domains around the Europe. All three layers are still equally important for the road usurers, toll chargers and providers.

Finally, the objective of integrating OBUs with other devices is not fully relevant given the current state of technologies. Indeed, a better use of GNSS and DSRC interfaces of other devices (such as the digital tachograph) installed on board of the vehicle could potentially help in reducing costs through economies of scale, but their integration with the OBUs is not always technically feasible as it may pose a threat to the functioning of the legally imposed devices or violate the rules on access to personal data.

7.4. European added value

The potential level of EU-added value of the EETS legislation is high, as it is shown by experience that voluntary co-operation agreements between Member States would not contribute to a substantial EETS coverage of the internal market.

The existing legal framework also failed to fully reach its potential of EU-added value due to the low level of its effectiveness. It should be admitted however that the legislation contributed to a limited technological and procedural convergence of individual e-tolling schemes and to a certain level of cross-border co-operation. This in its turn resulted in a limited deployment of cross-border interoperability in different parts of the EU.

7.5. Coherence

The objectives of the EETS legislation are fully coherent with the Commission's overarching goal of applying on a wider scale the 'user pays' and 'polluter pays' principles.

Recently, the problem of interferences between DSRC-based electronic tolling and other applications (co-operative ITS and WiFi) started to gain in importance. The fact that the 5.8 GHz band is reserved for tolling on a non-protected basis makes the schemes using microwave communications vulnerable to possible expansions of the two mentioned type of applications (and potentially also other applications in the future).

Internal coherence of the EETS Directive and Decision is not fully preserved due to divergent requirements in two legal acts on the (group of) actors responsible for the deployment of EETS. The Directive lays the Member States and the toll chargers being responsible, while the Decision clearly put the responsibility on EETS providers.

8. ANNEXES

8.1. Annex 1: Glossary

AETIS: Association of electronic toll and interoperable service (association of (prospective) EETS providers)

ANPR: Automatic number plate recognition

ASECAP: European Association of tolled motorways, bridges and tunnels concessionaires

ASFA: Association of French Motorway Companies

CEN: Comité Européen de Normalisation (European Standardisation Committee):

CESARE: Common Electronic Fee Collection System for an ASECAP Road Tolling European Service - project set up by ASECAP with the intention of specifying, designing, developing, promoting and implementing a common interoperable Electronic Fee Collection System (EFC) on European toll roads.

DSRC: **Dedicated short range communication** - two-way short- to- medium-range wireless communications capability that permits very high data transmission critical in communications-based active safety applications.

EasyGo: interoperability agreement between Norway, Sweden and Denmark.

EasyGo+: interoperability agreement between Norway, Sweden, Denmark and Austria.

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.

E-call: EU initiative to bring rapid assistance to motorists involved in a collision anywhere in the European Union. In case of a crash, an e-Call-equipped car automatically calls the nearest emergency centre. E-call is mandatory equipment in all HGV and will become mandatory in cars as of April 2018.

ETSI: European Telecommunications Standards Institute

GNSS: Global Navigation Satellite System: satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world.

GPRS: General packet radio service: packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). By extension, the term GPRS will be used – unless specified otherwise – to design its successors under 3G, 4G and 5G.

GSM (Global System for Mobile Communications): standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones. By extension, the terms GSM will be used – unless specified otherwise – to design its successors (3G, 4G and 5G)

HDV: Heavy Duty Vehicles; the term covers two categories of vehicles: heavy goods vehicles (HGV), i.e. freight vehicles with a total permissible laden weight exceeding 3.5t, and buses/coaches, i.e. vehicles designed and used for the transport of more than nine passengers including the driver.

HGV: Heavy Goods Vehicle, i.e. freight vehicles with a total permissible laden weight exceeding 3.5t.

Interoperability: the capacity of different equipment and systems to work together.

Interoperability constituents: physical (e.g. OBU, roadside equipment) and non-physical (e.g. back office) elements which have an importance for achieving interoperability in the field of electronic toll collection.

IRU: International Road Union

KPI: Key Performance Indicator

OBU: on-board unit – a device installed on-board the vehicle, communicating with roadside infrastructure or with a back office to communicate data necessary to calculate the toll due.

RFID: **Radio Frequency Identification –** wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. **Passive RFID tags** collect energy from the interrogating radio waves and act as a passive transponder.

REETS: Regional European Electronic Toll Service – project co-financed by the European Commission aiming at deploying EETS compliant services in a cross-border regional project. The Project shall cover the electronically toll network of 7 Member States (Austria, Denmark, France, Germany, Italy, Poland and Spain) and Switzerland.

Single service provider: the national provider of toll services in the absence of EETS providers, designated by the toll charger. The single service provider is often integrated with the provider of technical solutions for the operation of the tolling system contracted by the toll charger.

Tachograph: device fitted to a vehicle that automatically records its speed and distance, together with the driver's activity selected from a choice of modes. With certain exceptions, all lorries >3.5t and buses carrying >9 people in the EU must be equipped with a tachograph.

Thick OBU: A 'thick' GNSS OBU is an on-board unit which establishes the position of the vehicle, compares it with digital maps stored in its memory, on this basis calculates the toll due and sends only this information to the back office.

Thin OBU: A 'thin' OBU is an on-board unit which establishes the position of the vehicle and send the information to the back office. The calculation of the toll due takes place there.

Toll charger: the one who perceives the toll. Typically the owner or operator of the road; two main categories of toll chargers exist: the State (or a State agency) on publically managed roads, and the concessionaire on conceded roads/motorways.

8.2. Annex 2: Intervention logic

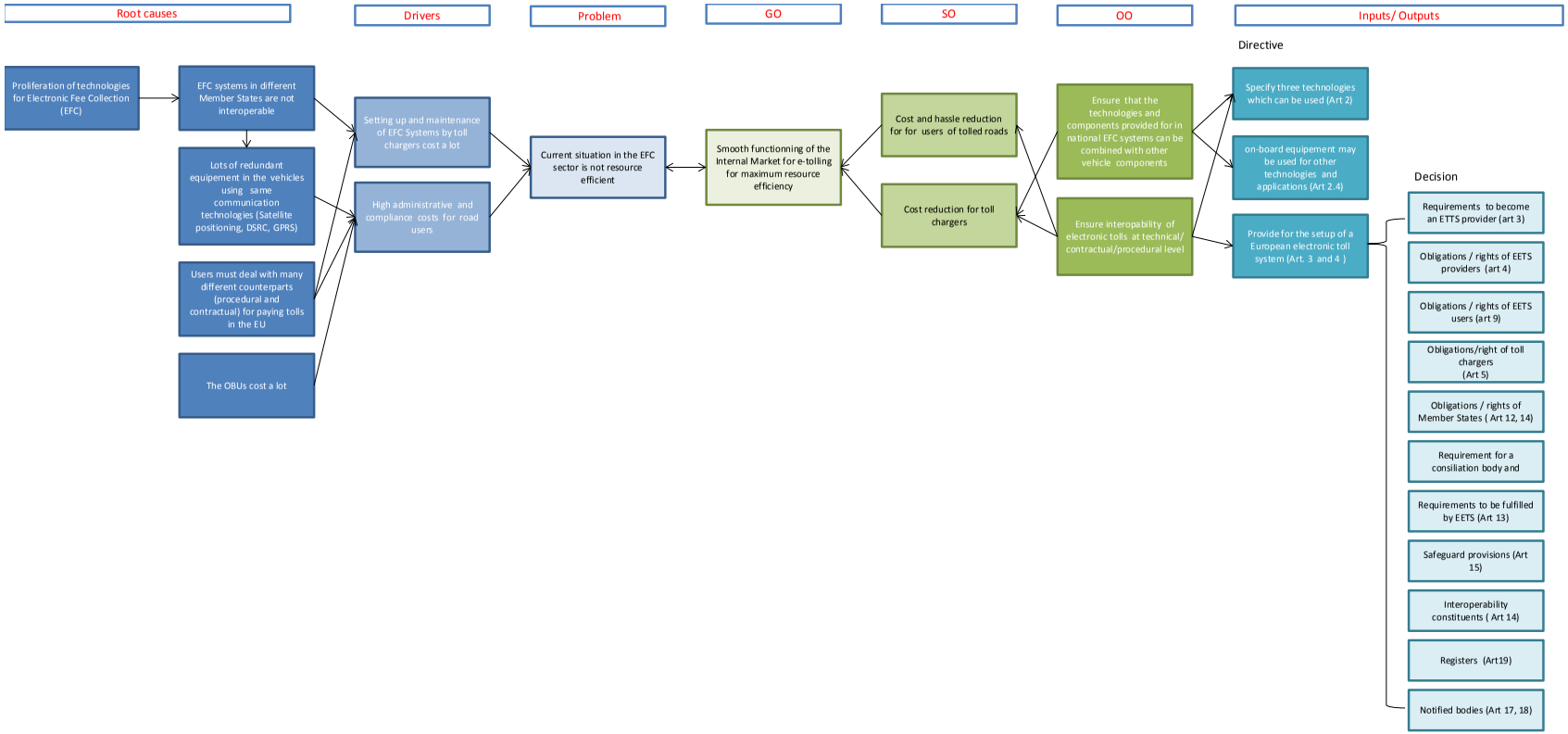

Figure 2: Intervention logic part I: problems and outputs.

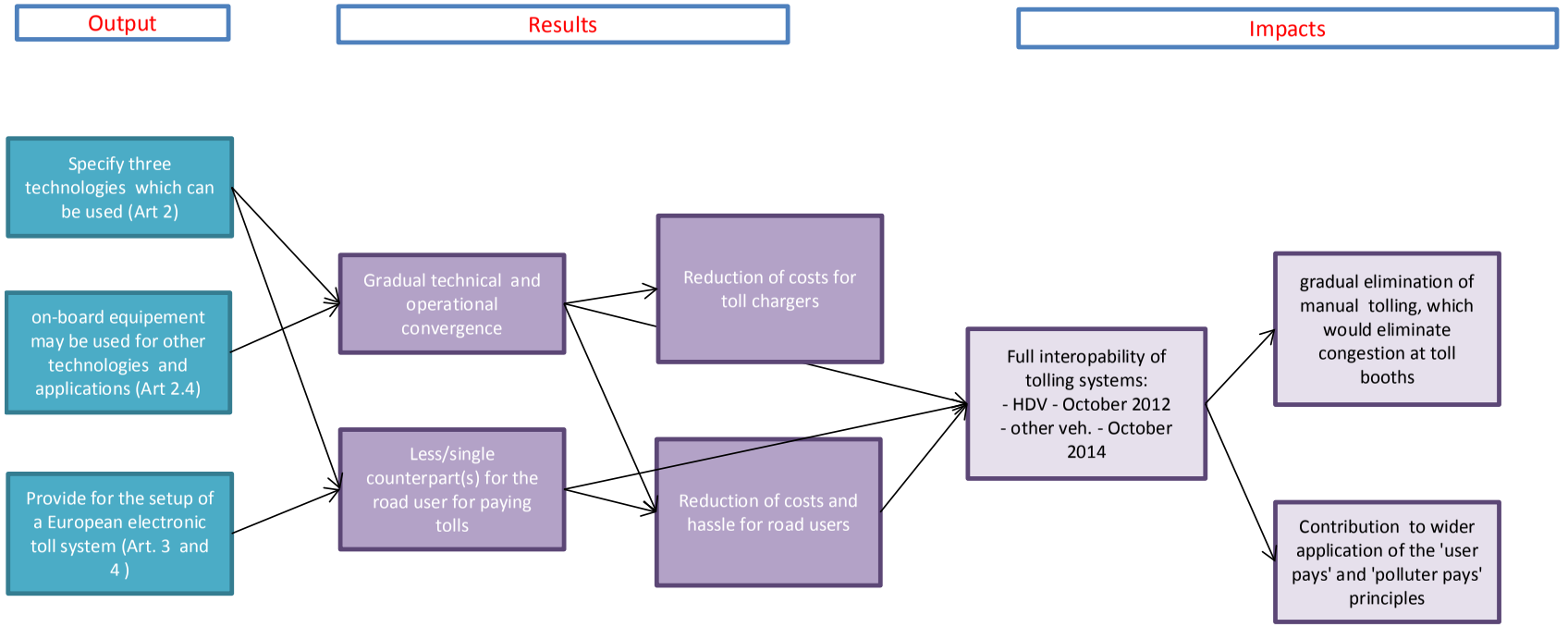

Figure 3: Intervention logic: outputs and impacts.

8.3. Annex 3: Synopsis report on back-to-back public consultation activities (covering both the *ex post* evaluation and the impact assessment)

Synopsis report

Revision of Directive 2004/52/EC and Decision 2009/750/EC) (legislative framework on the European Electronic Toll Service)

Directive 2004/52/EC lays down the conditions for the interoperability of electronic road toll systems in the European Union. The Directive requires that all new electronic toll systems brought into service shall use one or more of the following technologies: satellite positioning (GNSS); mobile communications (GSM-GPRS); microwave technology (DSRC).

The Directive also sets up a European Electronic Toll Service (EETS), by which road users only subscribe to a single contract with an EETS provider in order to pay the charges related to any charging scheme requiring on-board equipment. The detailed definition required by Directive 2004/52/EC regarding technical, procedural and legal issues, has been finalised by the European Commission in Decision 2009/750/EC.

The ex post evaluation assesses the effects of the legislation on the European Electronic Toll Service (EETS) and its implementation over the period of 2004-2014. The Impact Assessment compares different policy options for addressing the problems identified by the ex post evaluation.

Consultation activities

In the context of the preparation of a back-to-back ex-post evaluation and impact assessment, the Commission performed five main consultation activities. The purpose of these activities was:

- Providing to the wide public and stakeholders an opportunity to express their opinion on the main issues related to electronic tolling and the way it is regulated at the EU level, as well as to express their position on the possible/desirable changes to the regulatory framework.
- Gathering specialised input (data and information, expert views) on specific aspects of the legislation (e.g. pros and cons of certain technologies, standards, legal questions, etc.) from tolling stakeholders, with the aim of filling the data and information gaps in view of the preparation of the ex-post evaluation, the impact assessment and the legislative proposal.

While specialized consultation targeted infrastructure providers (i.e. governments, concessionaires), users (hauliers, professional drivers, citizens, etc.), equipment providers (car manufacturers, on-board unit manufacturers, etc.), tolling service providers, standardisation experts in the field of electronic tolling and certification specialists, the citizens and undertaking were provided with opportunity to express their views in the course of the open public consultation (OPC) .

The stakeholders' views do not represent the official position of the Commission and its services and thus do not bind the Commission. The input gathered corresponds to the objective of the consultation in both assessing the performance of the regulatory framework to date and also providing insights about possible challenges.

1) An open public consultation (OPC) in the form of an on-line questionnaire

The open public consultation was open between 8 July and 2 October (12 weeks). The questionnaire contained questions mainly relevant for the general public, giving the citizen a chance to express their views on electronic tolling without going into technical details. It gave however respondents who wished to provide a more comprehensive opinion the opportunity

to expand on their views in several open questions, as well as to upload position papers and other documents as part of their contributions.

For the Commission, the aim of this consultation activity was to test broad policy choices (both in the current legislation and considered in the framework of the legislative review) with the general public. This aim was reached. The relatively low response rate (73 answers) could be due to a very technical nature of the initiative for regular citizens on one hand and reflect the interest of stakeholders professionally engaged in EETS in answering more specialized consultation activities on the other hand. The table below indicates the profile of respondents.

Stakeholder category	Number of responses	% of responses
On behalf of an industry association or a non-governmental organisation (NGO)	29	40%
On behalf of a company	21	29%
As a citizen	11	15%
On behalf of a public authority[93]	9	12%
Other[94]	3	4%
Grand Total	**73**	**100%**

Views presented in the consultation were to a large degree concurrent; however, there was a number of outliers.

2) A call for written contributions publicly addressed to all stakeholders

Stakeholders were given the opportunity to send spontaneously their contributions to the ex-post evaluation and impact assessment exercises. The invitation to do so was published on the consultation web page, as well as announced at conferences, events, etc. As mentioned above, respondents to the open public consultation were also explicitly invited to send written contributions in the form of free text documents.

In the call for position papers, contributors were explicitly invited to express their views on the problem(s) to be tackled, the issue of subsidiarity and the EU dimension of the problem, the policy options and their impacts. Contributors were also invited to evaluate the effectiveness, efficiency relevance and coherence of the existing legislation, as well as the added value of EU legislation so far, taking as the starting point the published evaluation roadmap.

The quality of the contributions was very unequal, ranging from very general statements with little use to opinions on specific point of the legislation. The latter gave the Commission a first indication on the position of some of the main stakeholders (including in particular the 4 public authorities – cf. table below).

No deadline for submitting written contributions was given. A total of 22 relevant contributions were received so far. The table below indicates the profile of respondents.

Stakeholder Category	Number of responses
Tolling/motorway operators	9

[93] Public authorities from the following countries participated in the open public consultation: Czech Republic, Estonia, France, Germany, the Netherlands, Norway, Poland, Slovakia, United Kingdom.

[94] One "company and citizen", one employee of a ministry which did not choose "on behalf of public authority" and the European Employers' Association.

Transport undertakings	9
Public authorities[95]	4

3) A restricted consultation of professional stakeholders on issues related to the ex-post evaluation in the form of several tailored questionnaires with open questions addressed at different professional groups

The targeted stakeholder consultation as part of the ex-post evaluation for the EETS Directive 2004/52/EC and Decision 2009/750/EC was launched on 26th June 2015 and was open for responses until 1st September 2015 (10 weeks). The main objective of this consultation activity was to gather information and data to fill the Commission's knowledge gaps in the preparation of the ex post evaluation.

The questionnaires were sent to the following groups of stakeholders (a separate questionnaire to each group of stakeholders):

- Member States and toll chargers
- Toll service providers
- Commercial road users
- Private road users/automobile clubs

A total of 22 responses to four separate questionnaires aimed at different EETS stakeholder groups were received from the European Commission, as shown in the table below. It must be mentioned that consultees were invited to spread the questionnaire with other known interested parties – this explains that in some cases the number of answers exceeds the number of originally consulted parties). Due to the relatively low number of important stakeholders and good organisation of the sector, it seems reasonable to assume that a very representative body of stakeholders was reached in the frame of this exercise.

Stakeholder category	Number of stakeholders approached	Number of responses (% response rate)	% of responses
Member States and toll chargers	36	15 (42%)	68.2%
Toll Service providers	2	4 (200%)	18.2%
Heavy-duty vehicle electronic toll users	2	2 (100%)	9.1%
Light-duty vehicle electronic toll users	2	1 (50%)	4.5%
Grand Total	**42**	**22**	**100%**

[95] Finland, France, Germany, Ireland.

Besides the questionnaire, addressees were also provided with copies of the evaluation roadmap, and some of them decided to react to the preliminary assessment presented in the document.

The quality of the contributions was unequal, but roughly half of the answers provided hard data and ample information which fed into the evaluation Staff Working Document of the Commission. The other half contained mainly opinions and positions, which helped the Commission to understand the stakeholders' position about the effectiveness and efficiency of the currently applicable legislation.

4) A restricted consultation of professional stakeholders on issues related to the upcoming proposal on the revision of the EETS legislative framework.

The targeted stakeholder consultation for the Impact Assessment on the revision of the EETS legislative framework was launched on 5th October 2016 and was open for responses until 13th November 2016 (six weeks). Respondents were also given the opportunity to provide any further comments at the end of the questionnaire. To ensure the widest possible coverage, a call for expression of interest was published on the Commission's consultation website for stakeholders wanting to be consulted in the framework of this exercise (in addition to the distribution of the questionnaire with the established list of contacts of the Commission).

The main objective of this consultation activity was to gather information and data to fill the Commission's knowledge gaps in the preparation of the problem definition part of the Impact Assessment, but also to test with the stakeholder community the possible policy option and measures which could become part of the Commission's proposal.

A total of **35 responses** to the questionnaire were received. The number of responses was therefore considerably higher than in the framework of the similar consultation for the ex post evaluation, and the average quality of the contributions was also higher. A number of excellent contributions were received containing deep analysis of the problems, statistics and other figures, and recommendations for concrete policy solutions, and they contributed to considerably strengthen the evidence base for the impact assessment and for the drafting of an initial list of potential policy measures.

The table below indicates the profile of respondents.

Stakeholder category	Number of responses	% of responses
Public authority/administration	8	23%
Toll Service Provider	6	17%
Industry Association	5	14%
Toll Charger	5	14%
Represent more than one stakeholder category	4	11.5%
Toll system operator	4	11.5%
Consultancy	2	6%
Road users	1	3%

Grand Total	**35**	**100%**

5) Reactions to the evaluation roadmap and the inception impact assessment

Stakeholders were given the opportunity to react to the published evaluation roadmap and the inception impact assessment. No contributions were however provided.

Conclusive remarks

While the absolute numbers of responses to each of the consultation activities are relatively low, they must be seen in the particular context of the electronic tolling market: a relatively small and specialised market with a limited number of well organised stakeholders. Many stakeholders did not decided to answer individually, but rather contributed to the drafting of co-ordinated positions of industry representative bodies.

Obviously there were differences in the positions expressed in individual contributions, but a general consensus emerged as to the assessment of the current situation and the changes to be made to the legislation. This is particularly visible in the answers to the open public consultation, where a clear majority opted for the same or similar answers to each question. This consensus is less clearly visible – at first sight – in the other consultation activities, but this is mostly because they implied free text answers. Detailed analysis of the latter confirmed however the trend of answers converging to common positions of all stakeholder groups. This convergence is certainly the result of a high degree of organisation of the industry around the REETS consortium[96] in which the main categories of stakeholders (Member States, toll chargers, EETS providers) have been working together for the last 4 years to develop commonly agreed answers to the identified problems.

Remaining information gaps after the public consultation were filled with the help of consultancies hired by the Commission to assist it in the preparation of the ex post evaluation and of the Impact Assessment. The consultants performed further interviews of the most important stakeholders to extract additional data, evidence and opinions. These interviews will be reported upon in the final report of the consultant due for mid-March 2017, which will be published on the Commission's website. The Commission has also held a large number of individual meetings with stakeholders, including some of those who did not decide to contribute to the public consultation in writing. These meetings typically covered many issues, and it is difficult to extract and report upon just the parts of them related to EETS. Finally, to cover the very specific aspects of standardisation of interoperability constituents in electronic toll collection, the Commission held a full day seminar involving representatives of 3 notified bodies, the European Committee for Standardisation and two equipment manufacturers in the framework of a meeting of the Notified Bodies Co-ordination Group (NoBos-CG) on 29 September 2015. This meeting was organised in the framework of one of the regular meetings of the NoBos-CG. Minutes from this meeting are not publicly available. The consultants reached out to some of the participants to this meeting to further discuss some of the topics touched upon during the seminar.

Results of consultation activities

1) Open public consultation

Passenger cars

The majority of respondents (62%) agreed that the EU should continue regulating interoperability between electronic tolls applied to passenger cars. Three times the amount

[96] www.reets.eu

were in favour of this compared to those who believed this matter should be left to Member States. The question received a relatively mixed response when categorised into representing interests. Responses representing 'other' interests showed the strongest agreement with the need for EU regulation (100%), whilst other significant interest groups (several of which represent road users, e.g. the road freight transport and private road user categories) were approximately 50-80% in favour, illustrating the desire of road users in particular to have strong rules in place to enforce European interoperability of electronic tolling for cars. Toll chargers/service providers were most strongly in favour of leaving the matter to Member States (43%),

60% of respondents were in agreement that the EETS scope should be extended to automatic number plate recognition (ANPR) systems, which are widely used for the enforcement of free flow tolling systems for passenger cars such as electronic vignettes (e.g. Hungary) or urban congestion charging (e.g. London, Stockholm).

When disaggregated into representing interest, differences were most apparent between road users (road freight transport operators, users, etc.) and toll chargers/service providers, with c. 60-80% of respondents agreeing that the scope of EETS should be extended to include ANPR technologies, compared to just 16-48% respectively.

Cross border enforcement

A large majority (77%) of respondents were in favour of the EU establishing a mandatory mechanism for the exchange of data on toll offenders to facilitate recovery of unpaid tolls (and only 12% were against). When categorised into representing interest, strong consensus was also observed, with only road freight transport respondents exhibiting any significant desire to remain with the status quo (27%).

Enhancing market conditions of EETS providers

51% of respondents felt that the European Union should leave the EETS providers to decide which toll domains they want to cover by their services, while 24% only believed the EU should maintain the obligation for EETS providers to cover all toll domains in the EU. A broader set of views was observed when representing interests are taken into account. Unsurprisingly, given the significant complexity, costs and risk of covering all EU domains within 24 months of launch, a very large proportion (c.80%) of respondents representing toll chargers or service providers were in favour of allowing EETS providers to decide which domains they should cover. However, only c. 30-35% of respondents from the other interest groups agreed that the regulation should be relaxed; between 50-67% of public authority and 'other' representing respondents suggested an 'other solution' as described above, while between c. 45-55% of respondents representing private use and many/other transport modes suggest that the current obligation should be maintained.

Over three quarters of stakeholders thought the Commission should harmonise accrediting procedures of EETS providers to different toll domains, with only 21% being against it. When disaggregated by representing interest, opinions were more mixed. Almost all road user respondents (i.e. between 87-100%) agreed with harmonisation of accreditation activities, whereas toll infrastructure operators / stakeholders had more mixed views, in particular public authorities, with 67% of respondents not in favour of harmonisation.

Ensuring fairness and non-discrimination

There was also strong support for making sure that EETS providers are offered fair conditions when entering national markets. More specifically, 63% felt that EU legislation should provide for the separation of accounts between toll charger and toll service provider activities (to avoid negative consequences of vertical integration), with only 15% opposing the

measure. When disaggregated by representing interest, no major variations were apparent between interest group.

62% of the respondents were even in favour of giving the Commission the right to scrutinise national tender plans before they are published, to prevent the creation of legally protected monopolies. The opinion between different groups of representing interests was mixed. Respondents representing road users (i.e. transport, private car/motorbike use and many/other transport mode(s)) were in strong favour of the Commission being able to be involved in new electronic tolling systems (between 73-80%), whereas respondents representing toll infrastructure operators/service providers (i.e. public authorities and infrastructure operators and solution providers) were strongly against this being adopted (between 40-83%).

50% of respondents also supported the creation of strong and independent national entities to supervise the correct functioning of the tolling markets (market regulators). A wider range of views is apparent when considering the interests that the respondents represent. For example, 73% of respondents representing road freight transport agreed that powers of conciliation bodies should be increased to enable enforcement of mediated outcomes, in comparison to 55% of infrastructure operators/solution providers and 30-35% of public authorities and private users.

2) Spontaneous written contributions

Given that the spontaneous contributions did not follow any specific structure, the sub-sections included below relate to the most important discussion points raised.

The need for EETS is centred on the benefits of interoperability. It was argued that those benefits could be larger for heavy goods vehicles in regions with highest concentration of cross-border traffic, rather than for light vehicles and in peripheral regions. In any case, while Member States are capable of creating cross-border agreements, an EU-wide agreement is too complex for Member States without an EU-level legislative framework.

Regarding LDVs, a motorway operator suggested however that the EU should introduce legislation to achieve interoperability for passenger cars. An employers' association argued that it was essential to establish a common and harmonised EETS system which should also be expanded to cars. These views were however not given by any other respondents.

The positive impacts presented in the contributions received centre on interoperability, and the resulting shift to free flow tolling solutions which have social, economic and environmental advantages.

The contributions raised a number of existing challenges that must be overcome before EETS can be realised. Most of these focused on the barriers facing EETS providers in entering the market and meeting the requirements set in the Directive, and called for more legislation to open market and correction of the current regulatory obstacles including the excessive requirements for EETS providers. The importance of stable regulations across multiple markets for the success of EETS was underlined by many respondents (in particular (potential) EETS providers), just like the fact that expansion of EETS is currently blocked by too high costs and uncertainty on the market, both linked to the heterogeneous and complex processes of accreditation EETS providers to individual toll domains.

Regarding technologies, there was overwhelming opposition to extending too hastily the list of technologies allowed, as this could hamper the objective of interoperability. Yet, the importance of keeping an eye on the potential of other technologies, and possibly extending some provisions of the directive to technologies currently permitted by the EETS Directive, but not covered by its provisions, was also underlined by several respondents.

3) Restricted consultation of professional stakeholders on issues related to the ex-post evaluation

Due to the very different questions targeted at each stakeholder group and the free-text nature of the responses, the analysis below is split by stakeholder group.

a) Member States and Toll Chargers

According to the responses received, the overall message is that EETS has the potential to provide many benefits including reduced costs for all stakeholders involved (financial, time and administrative). However, barriers to implementation remain, making widespread deployment of EETS unrealistic in the short-medium term. Reasons for this are varied and include:

- Ensuring interoperability with all existing toll schemes requires significant investment and effort to manage the technical and commercial requirements for pan-EU interoperability.
- Increased technical complexity and costs to interface with multiple parties and back-office systems.
- Difficulties in establishing robust toll collection and recovery processes to avoid toll evasion.

Most stakeholder responses received agreed that many benefits arise from outsourcing relations with the clients to specialised companies; however the motorway operators also discussed some disadvantages. A summary of the main discussion is presented below.

According to national administrations and motorway operators EETS providers maintain relations with the road user, and toll chargers do not have to deal with customers relations, which can save costs and hassle for them. The administrative burden and costs for collecting tolls are lowered. They can economise on manpower (including reducing headcount, staff training and other related overheads) and investments in dedicated back office equipment without jeopardising high quality standards. They can concentrate on their core business e.g. building/maintenance of infrastructure and traffic management, whilst the management of individual customers is kept at arm's length. For open road tolling systems, EETS can drive up compliance and collection levels, particularly for foreign traffic. Road users can also benefit as they are able to choose their contractual partner and the relationship can be processed in the client's national language. They also only require one business relationship for any number of toll systems. Due to increased competition, service providers have the potential to extend the range of services they offer which may be favourable for the users, including the possibility of being charged a more reasonable price. However, this depends on whether the service provider is able to make the administration more effective, thus reducing administrative costs and leading to lower costs for the customers.

When introducing a new charging scheme, existing OBUs and customer base of the EETS providers can be used by toll chargers, thereby reducing the amount of initial investment. More generally, EETS could lead to systematically adopted electronic tolling infrastructure (which is cheaper to invest and operate than traditional tolling plazas).

Respondents offered a more diverse range of opinions with regards to enforcement, and some responses can be categorised into benefits and disadvantages. Benefits of EETS with respect to enforcement include reduced (cross border) enforcement effort, reduced risks of fraud/foreign defaulters and reduced need for enforcement and improved communication between Member States to identify offenders and recover fines. Disadvantages of EETS with respect to enforcement notably include more comprehensive and complicated enforcement, as competition between EETS providers and relatively open standards could lead to multiple system design.

Some **national administrations** suggested that costs and compatibility issues would arise from the use of different interfaces, and operating and monitoring with multiple EETS

partners would lead to more technical, operational and legal burdens – and therefore higher costs.

Most **national administration** respondents focussed on the benefits of greater acceptance of tolling by road users due to EETS. They believed that EETS could lead to a shift in public awareness and perception, helping tolling to be correctly viewed as a mainstream payment for a service.

b) Toll service providers

The overall message was that while there is a market for interoperable tolling services for HDVs, it was difficult to assess its size, but that there was only limited demand for such services for LVs. Fees paid to fuel card issuers were generally considered to be very low, but it was noted that fuel cards should not be seen to be a distinct means of payment. Toll service providers perform many different services to their customers, and to toll chargers, but transport companies will not be willing to pay more for EETS. While a lack of harmonisation was considered to constitute an obstacle to providing interoperable services, it was argued that this should be addressed through the harmonisation of the application of existing standards, rather than through the development of new standards.

Regarding demand for services, toll chargers indicated there is a significant demand for interoperable toll collection service from heavy goods vehicles. There is no clear distinction between central and peripheral States, or between EU and neighbouring countries, as traffic flows (and therefore demand) do not always follow such artificial divisions. The overall message is that EETS coverage should be based on customer demand rather than by any imposed geographical boundaries.

Toll system providers agree that the lack of harmonisation can constitute an important obstacle. However, technical harmonisation is not just a case of developing and applying standards; it is also about the way in which the standards are applied, interpreted and managed in detail. Rather than developing new standards, it would be better to harmonise the way in which they are used, with a particular focus on satellite technology.

From the perspective of toll service providers, allowing additional technologies in the short-term would create additional obstacles, but should not necessarily be ruled out in the longer-term. Currently, with the three technologies allowed today, this is still no viable technical solution that can be used on all networks and that is EETS-compliant. Allowing more technologies would require additional rules, bringing more constraints on IT interfaces and requiring new OBUs, and so would not speed up the implementation of EETS.

However, all of the technologies allowed by the Directive could now be considered to be mature technologies. If a new technology provides added value compared to the currently allowed technologies in terms of costs and technical performance, its introduction should be allowed after a transition period.

c) Road users

The association IRU representing hauliers pointed to the fact that foreign hauliers would represent up to 36% of the total road user charge revenues in the EU, exceed 50% in France, and increase from 25% to 40% in Germany. This indicates that the potential market size for interoperable HDV tolling services is set to increase, and they consider between a third and a half of the EU road haulage market to be potential EETS users. With almost all EU trucks being equipped with at least three or four on-board units (OBUs) and some with more than a dozen, considerable administrative burdens and costs exist for operators.

For EETS to be successful, EETS providers should continue to be required to provide one single financial guarantee covering the whole EU, however toll chargers must open up existing contracts and not limit contracts to national markets, and technical harmonisation of

national e-tolling systems must be guaranteed. Provided that EU interoperability can be achieved, IRU expects it would be welcomed as a minimum by EFTA countries where the EU has agreements covering the road freight transport market and with all neighbouring countries operating e-toll systems.

Another hauliers' association UETR states that theoretically there is a business case for EETS, but this has not been clearly developed in the Directive or Decision. They propose that a national charging system could be based on a single EU-wide OBU that is installed to all trucks during manufacturing, and the Galileo satellite system could be used for this, registering tolled kilometres in each Member State. Data processing could then be left to the single service providers. They feel that policy makers need to take into consideration cost and user friendliness of the chosen system when determining the technology chosen for tolls, and therefore one single device to register and pay tolls in different Member States is the way forward - economies of scale can be realised and hardware costs reduced.

The key message from the light vehicle users (only one respondent – ADAC) was that there is no need for EETS for light duty vehicle users. As long as the tolling systems in place are in accordance with EU law and do not discriminate any Member States, different systems between toll domains aren't seen as a barrier. The "hassle and costs of compliance with the requirement to pay road tolls" cited in the European Commission's 'evaluation and fitness check roadmap' are considered overstated, and the view that "users would be more ready to accept to pay for using roads if the payment means are interoperable at EU level" cannot be supported.

4) Restricted consultation of professional stakeholders on issues related to the upcoming proposal on the revision of the EETS legislative framework.

Out of all respondents asked, a strong majority (77%) felt that the requirement for EETS providers to **cover all domains within 24 months** is a problem, while 12% stated it didn't particularly affect them and 11% didn't answer. Unsurprisingly, the only respondents that felt the problem of full EU coverage within 24 months did not affect them represented toll infrastructure operators/chargers and industry associations. Almost half (45%) agreed with the solution to completely remove the requirement to cover all EETS domains within 24 months. 21% felt that replacing the requirement with one to cover certain regional EETS domains whilst allowing the coverage to be completed through partnerships with other EETS providers would be the best, whereas the least preferred solution was to replace the requirement to provide the service in the country of registration and all neighbouring countries, where only 5% of respondents agreed.

Regarding the issue of **unfair contract conditions** for EETS providers, the following examples were provided:

- In Italy, where the national service provider gained an unfair advantage due to the technical standards used, as the norm used was too vague to be the sole source of knowledge. It took a long time to gain access to the full documentation.
- In Austria, the remuneration for service providers is almost similar to those for card issuers, whose 'only' role is to commercialise the OBU of the national service provider. The costs of interoperability (including adaptation of OBU and interfaces) are therefore not taken into account.
- In Belgium, the remuneration as a service provider is only slightly higher than the one given by the national service provider to card issuers who are commercialising their OBU. Once again, the benefits of having various service providers is undervalued.
- In Poland on the A4, an OBU is offered by a toll service provider, whereas the acceptance of additional OBUs has been refused, as the system was not yet ready to accept other OBUs.

- Is it not yet defined if and what kind of remuneration will be paid in Germany and Belgium.

The most preferred solution (26% of total responses) for solving the problem of unfair EETS markets was to have a strict separation of accounts between the toll charger and toll service provider. This was followed by the option defining in the legislation the services for which EETS providers should be remunerated by the toll charger (16% of total responses). The solution that was least supported was strict separation between the shareholders of toll chargers and service providers.

A number of examples were provided that increased the set up and/or operational cost of schemes, including:

- That the level of remuneration for GNSS-based e-tolling systems is not higher than that for DSRC technology, so it does not reflect the higher level of responsibilities and risks that are placed on service providers by GNSS-based e-tolling systems.
- The substantial bank guarantees that have to be issued by the service provider to each concessionaire, e.g. in France.
- OBU certification and back-office platform development are costly.
- The 'agent model' limits the opportunity for the EETS provider to offer their own services in conjunction with EETS, e.g. fuel and drivers' expenses made by credit card, VAT services, etc. This model also sometimes requires the toll service providers to obtain a financial institution licence in order to operate.
- Accreditation procedures that are specific to toll domains and are often unpredictable, can increase costs.
- The complexity of VAT rules in some countries.
- Lack of adherence to standards, e.g. on roadside equipment.
- In Italy, which uses UNI1 DSRC technology, its many small concessionaries are not ready for processing the certification of OBUs from various service providers.

The most preferred solutions (% of total response) for solving the problem of high costs related to electronic tolling and EETS were both extending the standardisation effort by developing more profiled standards and thus harmonising tolling schemes to a greater degree and harmonising the procedure of 'accreditation' of the EETS provider to a toll domain. The least supported solution was putting upon toll chargers additional obligations in their relations with EETS providers, such as the obligation to provide electronic maps in GNSS -based schemes, or to support the handling of EETS providers through a harmonised application profile.

There was strong agreement with regards to negative costs arising due to a lack of interoperability, in and particular emphasis was put on the fact that the absence of interoperability has, from the point of view of transport companies, increased costs in terms of multiplication of OBUs, invoices, service fees and fines.

Regarding the problem of cross-border enforcement of tolls, the following statistics and information were provided:

- In Poland, 38% of identified infringements in relation to toll collection concerned foreign-registered vehicles.
- In Portugal, in 2015 25% of toll evasion was by foreign-registered vehicles, with 78% of these coming from Spain and 62% of these being heavy duty vehicles.
- In Italy, it was considered that in general toll avoidance was intentional, but no data on the level of avoidance was provided.

- In France, the proportion of toll evasion by non-domestic vehicles is 40%, which increases to 60% for some toll domains that are particularly vulnerable to cross-border traffic. The proportion of foreign-registered vehicles has increased recently, as a result of legislation that has reduced the number of toll evasion cases by domestic vehicles by nearly 80%.
- In Sweden, it is considered that the vast majority of foreign-registered vehicles pay the tolls.
- In Austria in 2015, there were 108,000 tolling offences by foreign-registered vehicles under the HDV toll, which was 89% of the total number of tolling offences that year. For the light-duty vignette, 117,000 cases – 63% of the total – were attributed to foreign vehicles.
- In Slovenia, it has been observed for the vignette tolling that there are more violations amongst foreign-registered vehicles than amongst locally-registered vehicles, whereas there is no noticeable difference in toll evasion between foreign-registered and local HDVs. It is considered that the main reason for not paying is an attempt to avoid payment, as a result of expectations of an inability to enforce toll recovery across borders.

Respondents generally agreed that the exchange of information between Member States on the identity of toll offenders should be mandated by EU law irrespective of the type of toll or vehicle, rather than being left to bilateral agreements. It was also suggested that the EU should also negotiate suitable arrangements with neighbouring countries. Various respondents agreed that the approach taken by the cross border data exchange relating to road safety offences was a good model, or at least a good starting point, for developing a system for the enforcement of toll evasion.

46% (11 respondents) felt that differing national laws relating to the protection of personal data impedes the cross-border enforcements of toll payments. 16% of respondents did not think this was the case, 17% could not answer due to lack of knowledge, and 21% did not directly answer. 28% (five respondents) agreed that current differing national data protection regimes give rise to difficulties in EETS providers' system designs, whereas 28% also believed this not to be the case. An additional 22% (four respondents) could not answer and another 22% did not directly answer but provided additional comments.

Regarding new technologies, ANPR systems were mentioned by a number of respondents as having the potential to be used as a toll collection technology or as an additional technology to enforce toll collection. Some argued that EU legislation was not necessary at this stage as such systems did not raise interoperability issues in the way that electronic toll collection does, while others argued that EU legislation should cover ANPR in the longer-term. RFID was also seen as a potentially promising technology that EU legislation could cover in the longer-term. One respondent said that RFID sticker tag technology would be appropriate for tolling light duty vehicles, while embedded electronic technology, such as DSRC, linked to an account that can be managed through a smart phone, might also be considered for such vehicles. The same respondent believed that "high-end technology", such as GNSS based OBUs, have the potential to provide multiple benefits for heavy duty vehicle. It was also suggested that fleet management systems could be used for tolling, while video technology capabilities were also improving fast. Additionally, a number of respondents stated that the question of a dedicated bandwidth for DSRC toll systems needed to be clarified.

Regarding the differences between heavy duty and light duty vehicles, a strong majority (64%) felt that instead of removing light vehicles from the EETS scope altogether, having a number of specific rules for different vehicle types was the better option to solve the issues between different vehicles and requirements. The different treatments proposed for LDVs

included there being no requirements for a GNSS OBU for these vehicles, and instead allowing ANPR-based systems and RFID. The rules, processes and even timelines that would apply to light duty vehicles could also be different to those applying to HDVs.

Use of consultation results

The results of the restricted consultation of professional stakeholders on issues related to the ex-post evaluation were heavily used as a source of information and statistics for drafting the ex post evaluation of the EETS legislation. They were widely referred to in the evaluation staff working document.

In a similar manner, the results of the restricted consultation of professional stakeholders on issues related to the upcoming proposal on the revision of the EETS legislative framework was used to feed the impact assessment. Many of the policy measures included for analysis as part of policy options in the impact assessment directly reflect the suggestions made by stakeholders in this consultation activity and in the position papers sent spontaneously to the Commission. Actually, the policy options were drafted only once the results of the restricted stakeholder consultation were available. The contributions to the stakeholder consultation (both open public consultation and the two restricted consultations) as well as the spontaneous positions of the stakeholders were shared with the consultants who worked on the IA support study.

Finally, the results of the open public consultation overwhelmingly confirmed the Commission's initial views and approach to the ex post analysis and to the Impact Assessment.

8.4. Annex 4: Bibliography

4icom, *Expert Review of the EETS Legislative Acts***, 2015**

4icom, Steer Davies Gleave, *Study on "State of the Art of Electronic Road Tolling" MOVE/D3/2014-259***, 2015**

European Commission, *White Paper, Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final***.**

Steer Davies Gleave, *Technology options for the European Electronic Toll Service, Study performed for the European Parliament,* **2014**

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8.5. Annex 5: Overview of tolling systems in the EU

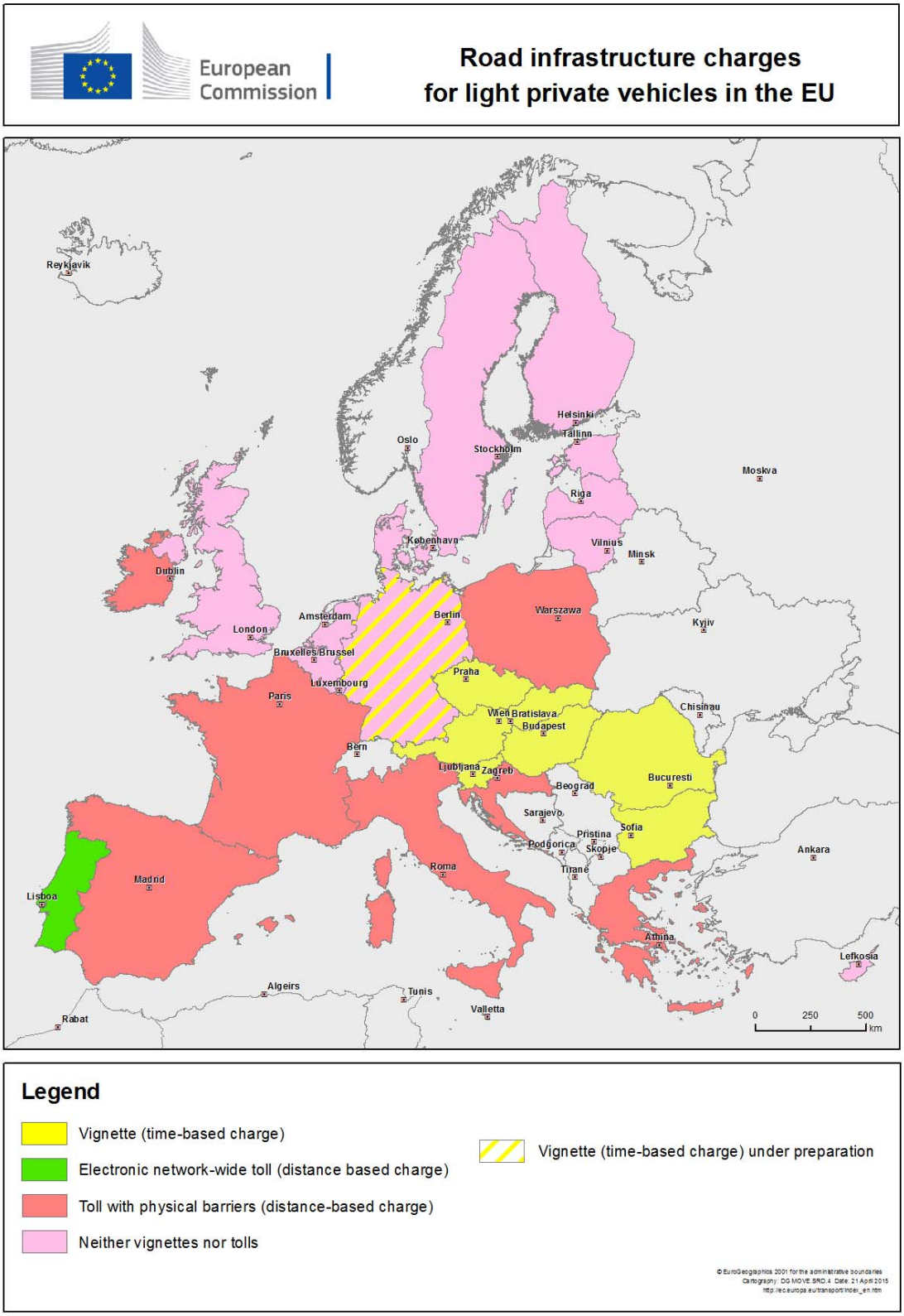

Figure 4: Overview of the road charging systems applying to light vehicles in the EU.

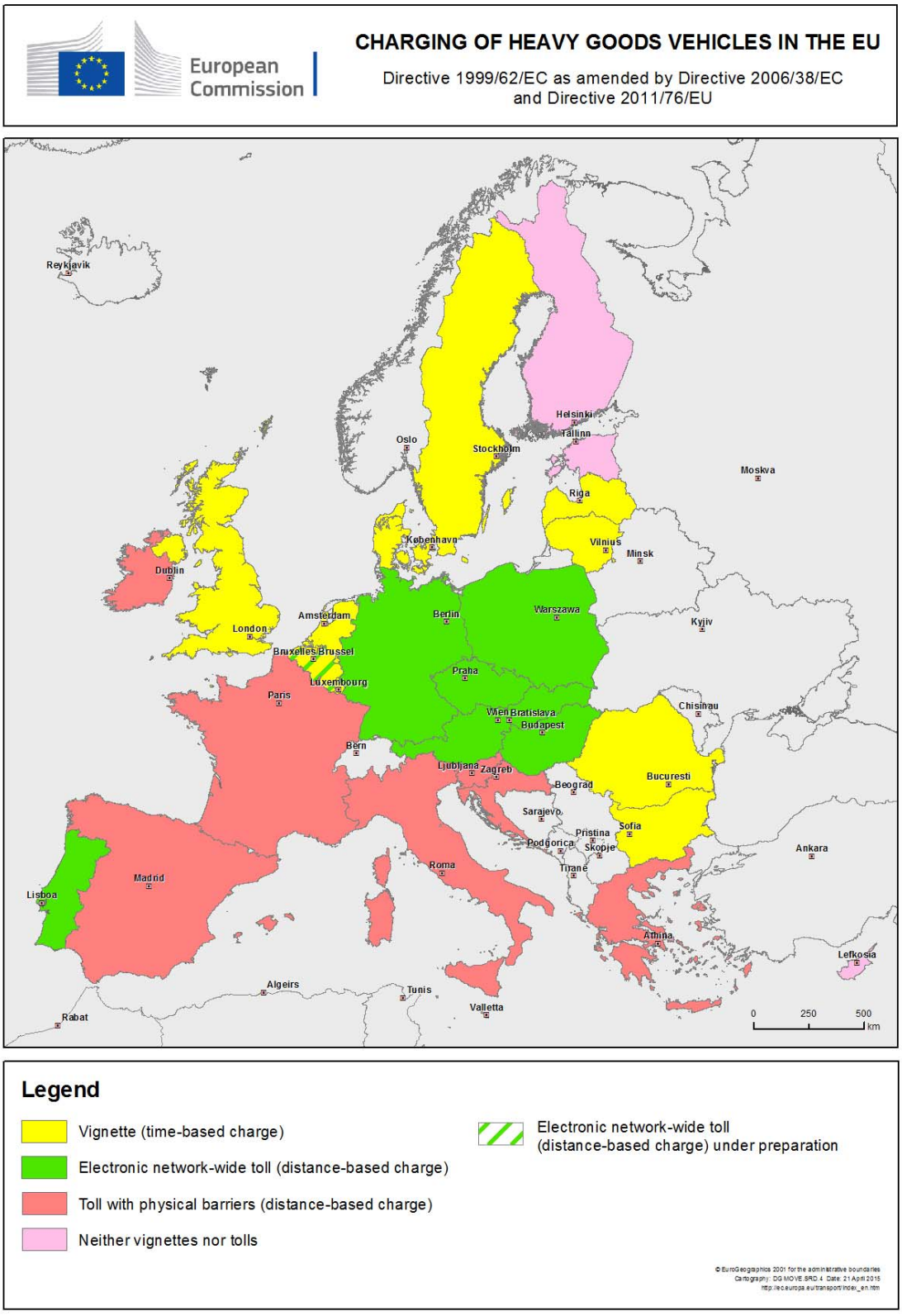

Figure 5: Overview of the road charging systems applying to heavy goods vehicles in the EU