IN-DEPTH ANALYSIS

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Research for TRAN Committee - Road enforcement databases: economic feasibility and costs

Transport and Tourism

Policy Department for Structural and Cohesion Policies
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Abstract

This in-depth analysis investigates the economic feasibility and cost of creating national road enforcement databases following the introduction of new smart tachographs (so-called "Generation 2" digital tachographs) into the EU road haulage market. Two scenarios are considered: the first includes building new databases capable of handling new smart tachograph data, and the second mainly relies on upgrading existing databases for this new usage (such as Tachonet, the European Register of Road Transport Undertakings (ERRU), or the Vehicle Information Platform (VIP) based on EUCARIS). Two options are also analysed: the first includes retrofitting the whole fleet of Heavy Goods Vehicles (HGVs) and buses from year 1, and the second is based on a more gradual introduction of new smart tachographs, only for new vehicles.

This document was requested by the European Parliament's Committee on Transport and Tourism.

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The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

CONTENTS

LIST OF ABBREVIATIONS

ACEA	European Automobile Manufacturers' Association
CMS	Content Management System
EA	Enforcement Agency
ERRU	European Register of Road Undertakings
EU	European Union
GSM	Global System for Mobile Communications
HGV	Heavy Goods Vehicle
IETF	Internet Engineering Task Force
IT	Information Technology
LGV	Light Goods Vehicle
MS	Member States
NRRU	National Register of Road Undertakings
TELOS	Technical, Economic, Legal, Operability, Scheduling
RA	Road Administration
WEE	Wider Economic Effects
VIP	Vehicle Information Platform
XML	Extensible Markup Language

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EXECUTIVE SUMMARY

This in-depth analysis focuses on the creation of national road enforcement databases collecting data (via 3G/4G/5G networks) from new smart tachographs. The ultimate goal of new smart tachographs is to reduce the number of infringements, improve enforcement of road transport regulations and create a more competitive and honest internal road transport market. The aim of this analysis is to evaluate the economic feasibility and cost of creating these databases, which, if they are interoperable, will enable the national enforcement agencies to effectively enforce the rules of the road transport market and reduce the number of infringements observed at present. The analysis is performed in different options and scenarios regarding different ways of implementation. Analysis is conducted taking into consideration two options: Option 1 – new smart tachographs are equipped in all HGVs and buses already in operation, and Option 2 – new smart tachographs are installed only in newly registered vehicles each year. Those two options are assessed under two scenarios: Scenario 1 (creation of new databases) and Scenario 2 (utilising existing databases in operation within the EU).

The main component of this feasibility assessment is an economic one, including a cost-benefit analysis. However, due to the severe lack of quantitative data for several of the cost and benefit components, this in-depth analysis combines both quantitative and qualitative methods.

Direct and indirect costs & key findings

Costs associated with the introduction of new smart tachographs include direct and indirect categories. Direct costs are those which can be specifically traced to entities involved in the introduction of new smart tachographs while indirect costs are those applied to all other entities which will incur costs because new smart tachographs were introduced into vehicle fleets.

The main costs associated with new smart tachographs are the direct costs of equipping tachographs into vehicles and creating and maintaining database allowing for collecting, storing and exchanging information collected via tachographs between Member States.

Higher initial (investment) costs are associated with Option 1 rather than with Option 2. But this effect diminishes as the share of new vehicles increases over time. The cost difference between Scenario 1 and Scenario 2 favours Scenario 2 but the scale of the cost difference is not as huge as to completely rule out the setting up of a new system. Besides, there are more than strictly financial issues which have to be addressed here, like the willingness of Member States to use existing systems in a new role or like data protection clauses which might still make setting up of a completely new system attractive.

Direct and indirect benefits & key findings

Benefits associated with the introduction of new smart tachographs include direct and indirect benefits. The main direct benefits identified are an increase in market efficiency, improved administration and better enforcement. Other expected direct benefits of the introduction of new smart tachographs result from improved information and cost savings due to fewer infringements, as well as lessened administrative burden on national road administrations in Member States. Indirect benefits could include spill-over effects and other not monetisable effects. Spill-overs are mostly identified in the IT sector with new order placements on equipment and services from the transport industry.

TELOS assessment & key findings

The feasibility assessment is based on the TELOS methodology of project assessment (Hall 2010), which includes five dimensions of feasibility: technical, economic, legal, operational and scheduling. The

analytical framework for assessing feasibility is based on the identification of stakeholders responsible for specific aspects of feasibility, i.e. financing, regulation, technology supply and enforcement effectiveness. The following institutions and variables influencing feasibility are taken into further consideration: financiers (EU + MS), regulators (EU + MS), technical suppliers (databases technology suppliers), users (road administrations and enforcement agencies). The economic dimension of feasibility includes quantitative assessment (costs and benefits) while other dimensions (technical, legal, operational and scheduling) are analysed as a supplementary assessment, which is based on a qualitative approach. From a regulatory point of view, the legal, organisational and scheduling feasibility is important, including data protection issues. Feasibility for databases technology suppliers is high with the only identified barrier being a legal issue resulting in organisational and scheduling risks. From the user perspective (road administrations and enforcement agencies), technical and organisational feasibility can be assessed as high, especially due to technical and organisational improvements influencing the reduction of infringements.

Conclusions

The comparison of costs and benefits under both options and both scenarios leads to the following final conclusions:

- The replacement of existing EU vehicle fleet (using digital tachographs) with a new fleet (using new smart tachographs) as one time operation (Option 1) is rather expensive costing around 6.2 billion EUR.
- The gradual replacement based on the premise that new smart tachographs are installed only in newly produced vehicles (Option 2) yields a cost of about 343 million EUR yearly.
- The costs associated with Option 2 will however accumulate year by year. For instance, at the end of year 8 of the gradual replacement process, they will amount to around 2.7 billion EUR.
- Under the different variants, the estimates regarding database setup costs are as follows:

  Option1/Scenario1 – 86.7 million EUR;

  Option2/Scenario1 – 59.1 million EUR;

  Option1/Scenario2 – 16.2 million EUR; and

  Option2/Scenario2 – 10.1 million EUR.
- The estimate regarding database maintenance costs under considered variants produces yearly costs as follows:

  Option1/Scenario1 – 29.8 million EUR ;

  Option2/Scenario1 – 20.4 million EUR ;

  Option1/Scenario2 – 4.1 million EUR ; and

  Option2/Scenario2 – 1 million EUR.
- The main benefits are associated with improved enforcement of road transport regulation and in consequence with more honest and competitive road haulage market. Due to the use of new smart tachographs, it is estimated that tachograph-related offences should be reduced from the current annual level of almost 27 thousands to only 2.7 thousands, while driver working hours offences should be reduced from more than 36 thousand cases to just about 2 thousand cases.
- The feasibility of the introduction of new smart tachographs depends on the actor in the transport market but is generally high with regards to technical feasibility, medium for economic and legal components, and medium-to-low for the scheduling part.

1. INTRODUCTION

Background

This in-depth analysis focuses on the economic feasibility and cost of the creation of national road enforcement databases collecting data (via 3G/4G/5G networks) from new smart tachographs.

A 'smart tachograph' is a so-called "Generation 2" digital tachograph, which uses a positioning service based on a satellite navigation system to automatically determine its position. Any references to the so-called "Generation 1" digital tachograph will be referred to as simply 'digital tachograph'.

The assumption is that, if national databases are interoperable or at least fully accessible by road enforcement agencies of other Member States, they will enable the national enforcement agencies to effectively enforce the road transport market rules and reduce the number of infringements observed at present. Current infringement rate accordingly to Euro–Control Route field inspections results is at about 26% with tachograph offences recorded in about 10% of all controlled vehicles (Euro-Control 2017).

This in-depth analysis addresses existing regulatory frameworks within the road transport sector and should be useful in enforcing new legislative proposals, as follows:

- COM(2017) 0277: "Proposal for a regulation of the European Parliament and of the Council amending Regulation (EC) No 561/2006 in regards to the minimum requirements on maximum daily and weekly driving times, minimum breaks and daily and weekly rest periods and Regulation (EU) 165/2014 in regards to the positioning by means of tachographs".
- COM(2017) 0278: "Proposal for a directive of the European Parliament and of the Council amending Directive 2006/22/EC in regards to the enforcement requirements and the laying down of specific rules with respect to Directive 96/71/EC and Directive 2014/67/EU for posting drivers in the road transport sector".
- COM(2017) 0281: "Proposal for a regulation of the European Parliament and of the Council amending Regulation (EC) No 1071/2009 and Regulation (EC) No 1072/2009 with a view to adapting them to developments in the sector".

Aim

The aim of this in-depth analysis is to evaluate the economic feasibility and cost of creating national road enforcement databases. The scope of the in-depth analysis takes into account the taxonomy of regulatory costs, well described in the literature by both economists and lawyers (see e.g. Marneffe and Vereeck 2011). This analysis does not disregard well-known and commonly used studies in the field of economic evaluation of legal regulations. It should be underlined that international organisations have developed guidelines for such evaluations (see e.g. OECD 2014, Coglianese 2012), while at the European Union level, all important legislative proposals are accompanied by impact assessments. In 2012, the European Commission established the REFIT programme (EC 2015) which imposes regulatory fitness and performance to ensure EU law is 'fit for purpose' (EC, 2015b). Strict rules of law-making processes have been developed. Recently, the Commission Staff Working Document: Better Regulation Guidelines (EC 2017) has been published, which is based on earlier studies (e.g. EC 2013).

The framework for the analysis was created on the basis of reviewed literature and existing guidelines. Perspectives of the evaluation include:

- **Stakeholders** involved – EU and Member States, road transport companies and the EU internal market in general.

- **Types of costs / benefits** – cash-flow values and non-monetisable costs / benefits; direct and indirect costs / benefits.
- **Approach** – regulatory administration (process of the system change), behavioural compliance and outcome performance (costs and benefits estimation).

Methodology

In our analysis, two options are taken into consideration:

- **Option 1** - the implementation of a new system of road enforcement databases with the introduction of new smart tachographs in the whole fleet (this is equivalent to Option 2 plus retrofitting of all vehicles with the potential to be used in international transport).
- **Option 2** - the implementation of a new system of road enforcement databases with the introduction of new smart tachographs only in new vehicles.

Option 2 is a key component as it concentrates on the databases and information exchange systems. The impact of retrofitting (Option 1) depends much more on the scale of retrofitting. The main difference between these two options comes from the variable costs linked with vehicle fleet size. Under Option 1, those costs increase gradually as new vehicles equipped with new smart tachographs enter the market, while Option 2 sees radical instant changeover.

For each option, two scenarios are considered:

- **Scenario 1** - new system capable of handling new smart tachograph data is built.
- **Scenario 2** - an existing system (such as Tachonet[1], the European Register of Road Transport Undertakings (ERRU)[2] or the Vehicle Information Platform (VIP)[3]) is upgraded in order to add capability to handle new smart tachograph data.

The main component of this feasibility assessment is an economic one. A cost-benefit analysis was performed for both options. However, due to the severe lack of quantitative data, this in-depth analysis relies mainly on qualitative analysis.

Costs and benefits

The costs and benefits associated with new smart tachographs fall into direct and indirect categories (further developed in Chapters 2 and 3).

Direct costs comprise all setup, maintenance, hassle and enforcement costs on the part of all entities involved in the road transport haulage market and its regulation. Different actors to be considered include: EU institutions, Member States, transport companies and enforcement agencies. Similarly, direct benefits will apply to the same concerned entities. At least some direct costs and benefits can be

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1 Tachonet is a telematics network in operation across the EU which allows an automated exchange of information between Member States. Please see: European Commission - DG Mobility and Transport (DG MOVE) - Tachonet.

2 The European Register of Road Transport Undertakings (ERRU) is a platform that facilitates data exchange between Member States based on the National Registers of Road Transport Undertakings (NRRU). The NRRUs are nationally developed databases storing basic data on entities involved in transport markets.

3 Vehicle Information Platform (VIP) is an EU system allowing for full vehicle information exchange between Member States. The information to be stored and exchanged through this type of system depends on the adopted system architecture (for details on different variants of VIP, please check (EU 2015)).

monetised and represented by cash flows even though the availability of data always poses challenges for their assessment.

Indirect benefits and costs apply to those entities who will be affected as a side effect of the introduction of new smart tachographs and of the enforcement databases. For instance, new smart tachographs might induce change in the IT sector creating opportunities for highly innovative companies. Indirect effects are very difficult to assess. Most fall into what is considered to be wider economic effects[4] and are frequently impossible to decouple from reactionary aftereffects. Thus, indirect elements are only addressed in a qualitative way in our analysis.

The single most important observation is that there is a huge difference in year 1 costs between retrofitting all existing vehicle fleet vs. equipping with new smart tachographs only new vehicles. This cost will however – as time progresses - equalise as more new vehicles are added annually. This process might take as long as 20-25 years. Thus, there is an important political decision to make – whether to make new smart tachographs compulsory, and if yes, than what should be the final year for reequipping vehicles? If retrofitting is enforced in year 1, it will involve the staggering cost of more than 6 billion EUR. Gradual change achieved by adding new smart tachographs only in newly registered vehicles presents a much more affordable outcome (i.e. 343 million EUR per year). Gradual change will mean that for a number of years two systems will have to co-exist with all associated costs.

Interestingly, the cost of building a new databases/IT system as compared to adding smart capacity to existing ones is about 80% more expensive.

TELOS feasibility assessment

The feasibility assessment of both Option 1 and Option 2 is based on the TELOS methodology of project assessment (Hall 2010):

- **T - Technical** - Is the project technically possible?
- **E - Economic** - Can the project be afforded?
- **L - Legal** - Is the project legal? What are the legal determinants / are there any conflicts?
- **O - Operational** - How will the current operations support the change? What is the organisational framework?
- **S - Scheduling** - Can the project be done in time? Estimating how long the system will take to develop. Schedule feasibility is a measure of how reasonable the project timetable is (i.e. a project will fail if it takes too long to be completed before it is useful).

Stakeholders taken into consideration in our analysis include institutions responsible for financing and regulation (EU and Member States), technology suppliers and users of the system (road administrations and enforcement agencies).

Chapter 4 provides a detailed description of the TELOS feasibility assessment undertaken for this in-depth analysis.

[4] Wider economic effects (WEE) is a term used to describe additional indirect effects occurring as an indirect consequence of development in one field. Typical WEEs are attributed to effects in trade, agglomeration effects, additional tax from the movement to more productive jobs and the benefit from additional business output (ICEU, 2013).

2. DIRECT AND INDIRECT COSTS

KEY FINDINGS

- Main **cost drivers** are: setup of databases, fitting new smart tachographs in vehicles and data transmission.
- Higher costs are associated with **Scenario 1** (creation of new databases) as compared to **Scenario 2** (utilising existing databases).
- Higher initial costs are associated with **Option 1** (refitting all vehicles with new smart tachographs) rather than with **Option 2** (new smart tachographs only mandatory for newly registered vehicles). This effect diminishes as the share of new vehicles increases over time.

2.1 Direct costs

Direct costs include the costs that can be specifically traced to the entities introducing or subjected to the introduction of new smart tachographs. Within our analysis, two options are being considered: Option 1 – new smart tachographs are equipped in all HGVs and buses already in operation, and Option 2 – new smart tachographs are installed only in newly registered vehicles each year. The specific direct costs are grouped as follows:

- Compliance costs: administrative burden and regulatory costs;
- Compliance costs: implementation costs; and
- Maintenance, hassle, monitoring and enforcement costs.

Compliance costs: administrative burden and regulatory costs

There are three cost categories within the administrative and regulatory cost group: costs of data collecting and reporting (data recording), data transmission costs and data input costs. The first and third items should not cause additional costs other than costs already incurred while setting up the entire databases and relevant IT system. Both data recording and input will be automated which should not involve any additional costs beyond initial hardware/software investments.

The data transmission cost however will occur whenever a new smart tachograph in a particular vehicle transmits data to national/central databases. Our analysis assumes that data will be transmitted using the existing GSM network and mobile phones. It is not yet certain whether all new smart tachographs will have a technical capability to directly transmit data but they should, at least, all be equipped with connection slots to allow for pairing with a smartphone. Regardless of these technical issues, in both cases, the cost incurred will result from the data transmission charges levied by mobile network operators.

Table 1 presents the calculation of data transmission costs under the assumption that data packages are not larger than 128kB (it will most likely be even smaller since the data format should follow standard XML file format as currently used in Tachonet). The size of the data package largely depends on the quantity of data exchanged. It is assumed that transmitted data will be the minimal data necessary, ensuring compliance with existing rules (e.g. driver id, location, speed). The fact that the system would communicate back and confirm data reception, etc. also needs to be taken into account. Given the size of one message, 8 text messages would represent 1 MB of data transmitted over a GSM network. In order to arrive at a unit price, per one data operation, the EU roaming charge for data transmission is applied. From 2017, those are domestic charges. Since they vary considerably within the EU and between mobile operators, it is safe to assume that they should not be higher than the EU-

wide cap charge from the previous year (2016), before domestic charging took over, which was 0.05 EUR per 1 MB of data (EC 2016a). Hence, the price per one message transmitted is 0.0125 EUR. It is further assumed that data is transmitted automatically between new smart tachographs and central databases on an hourly basis in order to ensure compliance and reduce the possibility of misuse.

Table 1: Data transmission cost

Option	Cost EUR
Annual cost Option 1 (per each year)	**261 653 000**
Annual cost Option 2 (year 1)	**14 445 000**
Annual cost Option 2 (after 8 years)	**115 558 000**

Source: own estimates

Under the assumption that the currently existing fleets of Heavy Goods Vehicles (HGVs) and buses were fully equipped with new smart tachographs, the annual data transmission costs could reach 261.7 million EUR. The detailed breakdown of costs depending on vehicle fleet per EU Member State is given in Table 2 of the Annex. If new smart tachographs are installed only in newly registered vehicles, this cost in year 1 would be 14.45 million EUR. Assuming linear increase in new registrations, this number will increase year by year. For instance, after 8 years this number would reach 115.6 million EUR.

It is, however, unlikely that stocks of new vehicles in the EU vehicle fleets will follow this linear progression. They are rather sensitive to market demand and other factors (e.g. availability of credit, leasing, etc.). In 2017, there was a relatively small increase in the number of new HGVs and buses observed as companies are still recovering from slowdown of 2008-9. Considering the average age of a truck in the EU is 11.7 years (ACEA 2017), it might be expected that full replacement of the EU fleet with vehicles equipped with new smart tachographs, if left to natural scrappage schemes, would take between 20 and 25 years. This is in contradiction to the Commission's envisaged deadline for replacement of older generation tachographs in use in international transport within 15 years from adoption of the regulation (EC 2016). A full introduction of new smart tachographs is therefore foreseen by early 2030's according to the European Commission. If this date is to be maintained, a mandatory refit at some point will be necessary.

The main difference between Option 1 and Option 2 is that under Option 1 the whole cost of data transmission, for the entire EU heavy vehicle fleet, is applicable on day 1 that the new smart tachographs are made compulsory, while under Option 2 it is a more gradual increase. In addition, it should be noted that these costs are direct costs of hauliers. Costs of intra-EU institutional data transmission are measured under the implementation costs assessment.

Compliance costs: implementation costs

Implementation costs include:

- IT/software;
- New infrastructure to transmit data;
- Making existing information systems capable of handling new types of data or creating independent systems for data exchange;
- Data access for analytical/policy purposes; and
- Staff and staff training for the implementation of new databases.

These costs will vary significantly depending on the implementation decision. Two scenarios are considered in our analysis: Scenario 1 – entirely new systems capable of handling new smart tachograph data is built, and Scenario 2 – new smart tachograph data handling capacity is added to one of the existing systems (e.g. Tachonet or the European Register of Road Transport Undertakings (ERRU) or the Vehicle Information Platform (VIP)).

In addition, while analysing the costs of specific items, it turns out that some of them are independent of the amount of data processed (e.g. number of new smart tachographs in operation) while others vary in response to the amount of data processed. Therefore, as previously discussed, a division by options (Option 1 and Option 2) also applies. For instance, the IT/software costs are composed of end-interface costs (in essence the cost of installing the new smart tachograph) and national databases costs. Only the second component changes depending on whether it is Scenario 1 or Scenario 2, while the first component depends on the option adopted. Under Option 1, it requires installing new smart tachographs in all HGVs and buses currently in use, while under Option 2 only in newly registered vehicles each year.

Table 2 depicts the difference in those initial costs of fitting new smart tachographs into vehicles. New smart tachographs are still a concept under development and their exact budgetary cost is not fully known. It will vary and depend on the technical capabilities of new smart tachographs. Various estimates range from as little as 600 EUR (which is 12% over the current digital tachograph price) to almost 2000 EUR. Based on the review of the market, this in-depth analysis assumes a middle estimate of 800 EUR per new smart tachograph unit and the whole installation procedure from a vehicle workshop is estimated at 90 EUR per one unit (Suchanek 2018).

Table 2: Cost of equipping EU vehicle fleets with new smart tachographs

Option	Cost EUR
Option 1 (per year)	**6.2 billion**
Option 2 (in year 1)	**343 million**
Annual cost Option 2 (per year after 8 years)	**2.7 billion**

Source: own estimates

According to our analysis, the retrofitting of all existing HGVs and buses in the EU would cost a staggering 6.2 billion EUR. If gradual replacement is allowed, the annual cost as per newly registered vehicles should be around 343 million EUR, totalling 2.7 billion EUR in year 8. Again, given average vehicle lifetime in the EU, it should be expected that total replacement of all vehicles will be finalised no earlier than in 20-25 years from the starting date unless a mandatory refit date is enforced by regulation. The country split of the costs of fitting vehicles with new smart tachographs is based on ACEA estimate of vehicle fleet size and is provided in Table 1 of the Annex.

On the other hand, the nature of the new smart tachograph design and assumed ability to utilise GSM networks means that there will be no need for additional roadside infrastructure investments. Both Tachonet and the European Register of Transport Undertakings (ERRU), as well as the Vehicle Information Platform (VIP based on EUCARIS[5]), are capable of handling this type of data. In fact,

[5] EUCARIS is the EUropean CAR and driving license Information System. To help fight car theft and registration fraud, EUCARIS is an information exchange system that provides an infrastructure and software to countries in order to share (among others) their car- and driving licence-registration information.

Tachonet has been specifically designed to handle this type of transmitted data. These systems currently in operation require multiple access in real time, however information flows between Member States are only available through single access points. Yet individual Member States can create national systems that gather multiple queries and process them in order to connect to individual single access points. This kind of process can be maintained for new smart tachograph data exchange.

Obviously direct connections between all access points would allow for more information to be processed more quickly. The building of a new centralised (EU sponsored) system and the abandoning of national systems would also be required. Not only is this more expensive, but it would also necessitate the passing of control competences from Member States to the EU. It is also suboptimal because current infrastructure could be reused for new smart tachographs even though it will likely need to be checked for technical system requirements (e.g. server capacity). This is a more technical than economic issue and cannot be fully answered within this in-depth analysis. Even more, the exact specifications of the discussed systems have not yet been detailed. In our analysis, we consulted within the IT industry to determine the cost difference for systems capable of processing new smart tachograph data, for those built anew and adding smart data processing capabilities on top of existing ones.

For the purpose of referencing a utilised system, the currently implemented National Register of Transport Undertakings (NRRU) in Poland, was used. This is mainly, due to the fact, it is the newest national system implemented (2017) and it is considered to have the most up to date infrastructure and, in consequence, closest to the one required by new smart tachographs. The technical complexity of smart databases is not much higher than that of what is currently being used for digital tachographs. The adoption of the European Register of Road Transport Undertakings (ERRU) over Tachonet as a reference base, is triggered by Member States that are reluctant to use Tachonet differently than it is being used now, as recognised by the Vehicle Information Platform Study (DG Move 2014) and the lack of the exact structural breakdown of costs.

A choice needs to be made between Scenario 1 (creating new systems capable of handling new smart tachograph data) and Scenario 2 (upgrading existing systems such as Tachonet, the European Register of Road Transport Undertakings (ERRU) or the Vehicle Information Platform (VIP) in order to add capability of processing new smart tachograph data). The main difference between the two scenarios is the initial databases investment and the maintenance costs.

Setting up of databases capable of handling new smart tachograph data involves the following costs:

- Project of the system;
- Management of project realisation;
- Buildings;
- Servers and network equipment;
- Other internal server connectivity;
- Software;
- Applications for users (control administration, certification bodies, all other users);
- Procurement;
- Technical documentation;
- Training for system administrators; and
- Training for users.

Some of these costs are fixed which means that they will exist regardless of the amount of data processed by the system, while other cost items are directly related to the size of the data flows. Thus, the underlying estimate on the number of new smart tachographs equipped in vehicles is necessary in order to pursue variable costs. For this reason, two already discussed options are considered in our analysis: Option 1 - assumes all vehicles (HGVs and buses) are equipped with new smart tachographs and Option 2 - assumes that only newly registered vehicles (HGVs and buses) are equipped with new smart tachographs.

The difference between reusing existing infrastructure (one based on Tachonet or the European Register of Road Transport Undertakings (ERRU) or the Vehicle Information Platform (VIP)) and creating a new system lies in about 20% higher costs. Server expenses, as well as the internal server connectivity between the main servers and the backups, will cost more in case of a new system by 50% - 100%. The cost of buildings in which the system and its operators are located should fall within the same range for both variants. The software cost will increase by 20% - 30%. The interface for end-users under a new system assumption will be between 15% and 20% more expensive. The technical documentation cost will be higher by 15% - 20% for a new system and the cost to the system procurement will increase by an additional 20%. The training for administrators will increase by 50% to 100%. End-user training costs should not differ between both variants due to the same requirements by end-users.

For all of the estimates a lower band of cost increase has been adopted. It should be noted, there is no new smart tachograph databases in existence therefore all estimates are made on the premise that similar functionalities, as are currently required, with use of digital tachographs are in place. In case a number of additional functionalities are requested, the upper band estimate should be substituted. However, should the change from digital tachographs to new smart tachographs will be rather gradual, it is likely that lower band estimate will be closer to reality.

Investment costs including all abovementioned cost components have been summarised for both options in Table 3 below. The full estimate of investment costs for EU Member States is given in Table 3 of the Annex.

Table 3: Investment costs of different variants of new smart tachograph databases in the EU [unit : millions of EUR]

Option/Scenario	Option 1	Option 2
Scenario 1	**86.7**	**59.1**
Scenario 2	**16.2**	**10.2**

* Estimate excluding BG, CY, MT due to insufficient data
Source: own estimates

Maintenance, hassle, monitoring and enforcement costs

Costs of maintaining databases involve the cost of national databases dedicated to this task plus the cost of maintaining central servers at EU level for the purpose of facilitating smooth data exchange.

Annual maintenance costs estimates include the following items:

- Salaries;
- Hardware servicing;
- Overheads (use of electricity, etc.);
- Security (other than IT);

- Network connections;
- Helpdesk;
- Insurance; and
- Modernisations.

In our analysis, we again conducted estimates for two options and two scenarios previously discussed (please see Table 4 below for summarised figures while detailed breakdown by Member State is provided in Table 4 of the Annex). The change in maintenance costs when considering the difference between upgrading and building new systems from scratch should involve higher staff costs (i.e. employees both directly to manage the systems as well as to service hardware and design). This increase in staff costs is estimated at between 50% and 100%. These staff costs numbers are also sensitive to the number of vehicles serviced, thus there exists a huge difference between Option 1 and Option 2 (i.e. retrofitting the current fleet vs only newly registered cars equipped with new smart tachographs).

Other elements in which a cost increase is expected are overheads (50% - 100%), network connections (100% - 200%) and insurance (about 10%). For the remaining maintenance cost categories, there should be no difference between Scenario 1 and Scenario 2. However, some cost categories may be sensitive to the number of new smart tachographs in use thus additional cost variation may be observed between Option 1 and Option 2 in regard to overheads, salaries, hardware servicing and network connections.

Table 4: Annual maintenance costs of different options of new smart tachograph databases in the EU* [unit : millions of EUR]

Option/Scenario	Option 1	Option 2
Scenario 1	**29.8**	**20.4**
Scenario 2	**4.1**	**1.0**

* Estimate excluding BG, CY, MT due to insufficient data
Source: own estimates

As illustrated in Table 4 above, the annual maintenance costs for the variant of a fully retrofitted fleet and setting up of new databases (Option 1/Scenario 1) is estimated at almost 30 million EUR, while a fully retrofitted fleet that utilises existing databases infrastructure allows a reduction of those costs to a little more than 4.1 million EUR (Option 1/Scenario 2). When the two same scenarios are applied to the situation when only new vehicles are equipped with new smart tachographs (Option 2), in year 1 they yield 20.4 million EUR for Scenario 1 and 1 million EUR for Scenario 2. Obviously under Option 2, year by year maintenance costs will increase because the number of new vehicles equipped with new smart tachographs will increase each year to the point where the whole fleet is replaced. One should also bear in mind that Scenario 2 costs represent only additional cost on top of the cost of currently used system.

In regard to hassle costs, they comprise all costs on the part of system users resulting from the need to adjust to the new requirements. Since most of the procedures for data reporting/compliance, etc. are either automated or very similarly associated to the ones currently in use, these costs should be minimal.

The only item which might raise the question is translation costs needed to make users from all Member States capable of using the new system. The system architecture could be designed in such a way as to support full language independence. The input forms both for reporting and queries should be standardised. As such, there will be a number of identical fields regardless of the end-user. The questions/data will be inserted into the user forms which will have labels, in specific languages, in which input fields will use matching codes. In this way, language independence can be achieved by the use of codes (which can be translated nationally) in place of textual values. The additional cost of this should be minimal as software will operate on identical values (codes) and only the end-user interface will be translated (and this will be done only once, while producing specific user forms).

The existing systems in the road sector e.g. Tachonet (EC, 2011) operate on this premise. Also, the planned VIP platform is supposed to follow this pattern (EU 2015). Similarly, national databases should be connected allowing for vehicle/driver information exchange. The model format for this could be either Tachonet or ERRU. This means that there is no need for a central database, but there is a need for a common access interface, in the form of a website, available in all languages. Again, the format of the page should be the same and the need for translation will only arise with regards to labels while all operational fields should use codes.

In a properly designed system, internationalisation (translations) can be integrated without problems. Each text displayed to the end-user in the system is represented by a key, and translations will have key-values paired to provide independent language codes (for example using the language identifier RFC 3066 standard[6]: en-GB, de-DE, it-CH, etc.).

The cost of translations can be calculated as the amount of text to be translated multiplied by price per word. Maintenance cost of translations is very low, as it is only providing/fixing a translation for a specified key in a content management system (CMS)[7].

2.2 Indirect costs

Indirect costs due to the switch to new smart tachographs in road transport are effects that are observed outside of the transport market and will mostly be associated with the IT industry. These costs may arise due to reduced competition. Currently, there are hundreds of digital tachograph producers. New smart tachographs are much more sophisticated, leaving the potential danger that only a limited number of companies will be able to design and service them.

It is unlikely that these costs will be significant for the software producers since changes in programming are not necessarily extensive as compared to designing current software solutions applicable in traditional digital tachographs.

The effects on competitiveness of the IT sector largely depend on the specifications of new smart tachograph legislation.

There also might be an additional increase in operational costs of companies cooperating with transport companies resulting in delayed services due to the need to manage fleets of vehicles equipped with and without new smart tachographs (this is under Option 2 – where only new vehicles are equipped with new smart tachographs).

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[6] RFC 3066 document sets standard for language tags used to indicate the language of text or other items in HTML and XML defined by the Internet Engineering Task Force (IETF).

[7] To illustrate the minimal cost involved with this procedure, a review of commercial applications can be conducted. For instance, here: https://webtranslateit.com/en

3. DIRECT AND INDIRECT BENEFITS

KEY FINDINGS

- Key benefits result from **better compliance**.
- Main positive effects are on **fairer and better competition** in transport markets.
- There is a **limited effect on the reduction of enforcement costs**.

3.1. Direct benefits

Direct benefits include the benefits that can be specifically traced to the entities introducing or subjected to the introduction of new smart tachographs. Within our analysis, two options are considered: Option 1 – new smart tachographs are equipped in all HGVs and buses already in operation, and Option 2 – new smart tachographs are installed only in newly registered vehicles each year. The main direct benefits identified are an increase in market efficiency, improved administration and better enforcement. Other expected direct benefits of the introduction of new smart tachographs could include improved information and cost savings due to fewer infringements, as well as less administrative burden.

The estimate of those perceived benefits is based on the assumption that new smart tachographs will actually fulfil their planned role and reduce infringements to 5% - 10% of their current level as identified through Euro-Control Route field inspections.

The monetary value of benefits could not be precisely estimated within our analysis. In order to calculate this, a number of factors would be needed but they are not reported on. These include the cost of infringements (such as the impact on competition) and the cost of accidents caused by drivers working over hours. The benefits, therefore, could only be measured indirectly in our analysis – by assessing change in the rate of compliance.

According to Euro-Control Route, 242 758 vehicles were stopped for roadside controls in 2017 under the Coordinated Checks Procedure (Euro-Control 2017). Out of this number 53 960 (22.23%) were found to have at least one infringement. Out of those, 11 133 (20.63%) had infringements deemed sufficiently serious to immobilise the vehicles.

It could be assumed that with the introduction of new smart tachographs, the infringements which could be directly controllable through the new system will be diminished to 5% - 10% of its current figure.

Tachograph offences (26 891 cases recorded in 2017) should also be reduced to 5% - 10% of their previous number since new smart tachographs are technically more difficult to manipulate due to the use of a new cryptography system and an enhanced security seal. In addition, frequent data transmission between the new smart tachographs and the databases would ensure that there is a very small window of opportunity to clock the device. For the same reason, driver working hour offences should almost be completely eliminated. There are however groups of offences which are not likely to be reduced. For instance, technical offences will be reduced only minimally (it is assumed that the reduction will be between 0% - 10%). If new smart tachographs were connected to different electronic control mechanisms in the truck, this could change. However, it requires both reworking the concept of new smart tachographs and making many mechanical and module-based modifications for the truck's technical communication capability. For similar reasons, it is not expected that the majority of overloading offences could be eliminated with the use of new smart tachographs. For this to happen, an internal module for weighting loads would need to be installed in the truck and connected to the

new smart tachograph, which, in turn, has to be able to connect to the truck weighting module respectively.

Table 5 provides the number of infringements and their possible reduction rate under the assumption that all trucks are equipped with new smart tachographs (Option 1).

Table 5: Expected reduction in infringements due to the introduction of new smart tachographs in the EU

Infringement type	Number of cases in 2017	Expected rate of reduction	Estimated number of infringements with new smart tachographs in operation
Tachograph offences	26 891	90%	2 689
Driver hours offences	36 365	95%	1 818
Tachograph	1 503	90%	150
Technical offences	24 686	10%	22 217
Overweights <12 t	3 649	0%	3 649
Overweights >12 t	2 935	0%	2 935
Insecure loads	1 776	0%	1 776

Source: own estimates

These reductions have economic value because they will strengthen fair competition and improve competitiveness of honest hauliers. This effect cannot be however directly estimated quantitatively since there is no relevant data on the economic value of losses incurred from dishonest competition in the sector.

As for the reduction of administrative burden, on the part of the enforcement bodies, it is unlikely that significant savings will occur due to more selective controls or by way of reduction of number of inspections. Under Option 2, where only new vehicles are equipped with new smart tachographs, it is very likely that control quotas will remain the same, although enforcement authorities might be more inclined to control older vehicles without new smart tachographs more frequently than newer ones. On the other hand, the majority of roadside inspections happen because there is something visibly wrong with a given truck, thus the main reason to stop the vehicle for roadside inspection is most often technical, with other infringements (which are controllable by new smart tachographs) being uncovered only as a side effect. Savings should be attributed to making the whole control process much faster by reducing personal hassle on control officers who would be equipped with terminals to allow them to instantly check working hours and tachograph readings of the vehicle.

3.2. Indirect benefits

Indirect benefits of the introduction of new smart tachographs into the EU road transport will result from: indirect compliance spill-over effects and other not monetisable effects. Spill-overs could be found in the IT sector with new order placements on equipment and services from the transport industry. The most notable effects are expected under Option 1 where all vehicles will have to be

equipped with new smart tachographs immediately. Obviously, the scale of new orders placed in the IT industry will be much higher than under Option 2, envisaging only a gradual change. Not only hardware producers will benefit but also software developers, as new smart tachographs will require reengineering of existing software solutions applicable to digital tachographs.

Other intangible effects include improved conditions of work for drivers who under the new system will not be pressed by employers to risk driving over time limits. A general increase in awareness of social rules might be expected among drivers and other market participants. Dependent on the capabilities of new smart tachographs, there might be additional positive environmental effects – e.g. if new smart tachographs can measure fuel consumption, it should allow companies to train drivers in more efficient driving techniques.

4. FEASIBILITY ASSESSMENT BY TELOS METHODOLOGY

KEY FINDINGS

- Feasibility of road databases for **financiers** is analysed quantitatively within this in-depth analysis and results are presented in Section 1 and 2.
- From a **regulatory** point of view, the legal, organisational and scheduling feasibility is important, including data protection issues.
- Feasibility for **databases technology suppliers** is high with the only identified barrier being a legal issue resulting in organisational and scheduling risks.
- From the **user** perspective (road administrations and enforcement agencies), technical and organisational feasibility can be assessed as high, especially due to technical and organisational improvements influencing the reduction of infringements.

Our general approach to feasibility assessment is based on the TELOS methodology of project assessment (Hall 2010), which includes:

- **T - Technical** - Is the project technically possible?
- **E - Economic** - Can the project be afforded?
- **L - Legal** - Is the project legal? What are the legal determinants / are there any conflicts?
- **O - Operational** - How will the current operations support the change? What is the organisational framework?
- **S - Scheduling** - Can the project be done in time? Estimating how long the system will take to develop. Schedule feasibility is a measure of how reasonable the project timetable is (i.e. a project will fail if it takes too long to be completed before it is useful).

Stakeholders taken into consideration in our analysis include institutions responsible for financing and regulation (EU and Member States), technology suppliers and users of the system (road administrations and enforcement agencies).

Feasibility dimensions are analysed in this in-depth analysis as a supplementary assessment which is based on a qualitative approach. Five dimensions are technical, economic, legal, organisational and scheduling. The economic dimension includes quantitative assessment presented in Chapters 2 and 3 (costs and benefits).

The analytical framework for assessing feasibility is based on the identification of stakeholders responsible for specific aspects of feasibility, i.e. financing, regulation, technology supply and enforcement effectiveness. The following institutions and variables influencing feasibility are taken into further consideration:

- Financiers: EU + MS;
- Regulators: EU + MS;
- Technical suppliers: databases technology suppliers; and
- Users: road administrations and enforcement agencies.

In order to assess the feasibility, specific variables have been explored (please see Table 6 below). The evaluation of these variables is based on qualitative experts' score ranging from none (not feasible) to high (highly feasible).

Table 6: Analytical framework for feasibility assessment

Stakeholders (1st level)	Stakeholders (2nd level)	Variable	Questions / problems
Financiers	EU + Member States	Revenue	What are the costs of the databases implementation? (Chapter 2) What are the benefits of the databases? (Chapter 3) What are the sources of financing?
		Cost	
Regulators	EU + Member States	Legal constraints	Is the regulatory framework simple enough to allow straightforward implementation? What are the legal constraints at EU level? What are the legal constraints at Member States level? What specific barriers can be identified? Are there any problems of compliance with current legislation framework? Are there any partnership agreements required? Are the intellectual property rights a problem? Is this implementation risky in the context of sensitive and personal data?
		National legal divergence	
		Other regulatory barriers	
Technology suppliers	Databases technology supplier	Technology requirements	What is the technical requirement for the user/road administration? What is the technical requirement for the user/enforcement agency? Are the databases based on a mature technology? Are there any specific requirements of a national character? Are there any technical problems of translating the adopted system into all EU official languages?
		Specificity	
Users	Road administrations	Impact	What are the impacts for road administrations? What are the impacts for enforcement agencies? Are there any impacts for road transport companies and drivers? What are the external impacts of this system for the overall road transport market?
	Enforcement agencies		

Source: authors

Feasibility of road databases for financiers is analysed quantitatively within this in-depth analysis and results are presented in Chapters 2 and 3. From the EU and Member States' point of view, there is the question about investment expenditures and expected benefits of the system. Though benefits can be treated not only from the financial perspective (which can sometimes be difficult to estimate), one can assume that overall financial feasibility is high for the EU and medium for the Member States – where some budget shifts are necessary. It has to be added, in the case of the implementation of the combination Scenario 1/Option 1 of a new system of road enforcement databases and new tachographs (replacement of the whole fleet), that financial feasibility will decrease due to the high costs of retrofitting.

From the regulatory point of view, the legal, organisational and scheduling feasibility is important. Concerning the legal conditions at EU level, the 2017 Mobility Package is already a good base for further change, as well as road databases implementation. Moreover, databases storing and distributing current information from existing digital tachographs have already been very carefully secured according to the Regulation (EU) No 165/2014 (EU 2014)[8]. This security ensures data integrity and authentication of the recording and control equipment. It also safeguards 'fair competition in the development of applications related to the tachograph, intellectual property rights and patents related to the transmission of data in or out of the tachograph as they should be available to all on a royalty-free basis'. This statement concerns only transmission data.

With regards to intellectual property rights of databases, it is also an issue for the area of information and network security. The question of whether the intellectual property will be owned by any (one or more) public institutions is a political issue and decision. Legal solutions are crucial, therefore, feasibility from an EU perspective can be assessed as medium, including in the context of organisational and scheduling issues. As far as Member States are concerned, organisational and scheduling feasibility is assessed as low, due to different organisational arrangements in specific countries and possible risk of extended adjustment processes.

The underlying statement is that information in the databases will have to be protected due to the importance of personal and sensitive data, as well as intellectual property rights (e.g. vehicle manufacturer owners). Another dimension is the importance of legal feasibility within the context of data access, in view of sensitive and personal data regulations. The concept of both personal and sensitive data is addressed by the EU in Regulation (EU) No 2016/679 (EU 2016)[9]. In order to use data stored in databases for other purposes, an effective measure to decouple personal data from general statistical data has to be implemented in the databases. Moreover, regardless of the EU regulation, the perception of sensitive data varies in different Member States. The EReg study (EReg 2014), aimed at gathering the position of Member States on processing mileage data, reveals different attitudes and problem solving techniques by national authorities. The same attitudes will certainly apply to the possible decision of making new smart tachograph data publicly available (e.g. Member States' positions on whether the data can only be kept by a public authority or whether there is a right of the vehicle owner/driver to correct and consult data).

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[8] *Regulation (EU) No 165/2014 of The European Parliament and of the Council of 4 February 2014 on tachographs in road transport, repealing Council Regulation (EEC) No 3821/85 on recording equipment in road transport and amending Regulation (EC) No 561/2006 of the European Parliament and of the Council on the harmonisation of certain social legislation relating to road transport.* OJ L 60/1, 28.02.2014.

[9] *Regulation (EU) No 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data.* OJ L 119/1, 4.05.2016.

With regards to databases technology suppliers, the technical feasibility is high. One key issue could be identified as a legal barrier, resulting in some organisational and scheduling risks. Legal barriers can appear when the specification of the databases is not clear and causes problems of data protection. Additionally, specific legal systems existing in Member States could limit the smooth and on-time implementation processes.

From the user perspective, technical and organisational feasibility can be assessed as high. The databases would be easier to use and much more effective in reducing the number of infringements. It concerns both road administrations and enforcement agencies, especially due to technical and organisational improvements.

The summarised results of feasibility assessment are presented in Table 7.

Table 7: Analytical feasibility assessment of the creation of the road enforcement databases

Stakeholders /Dimensions	Financier		Regulator		Database technology supplier	User	
	EU	MS	EU	MS		RA	EA
Technical	n/a	n/a	n/a	n/a	HIGH	HIGH	HIGH
Economic	HIGH	MEDIUM	n/a	n/a	MEDIUM	MEDIUM	MEDIUM
Legal	n/a	n/a	MEDIUM	MEDIUM	LOW	MEDIUM	MEDIUM
Organisational	n/a	n/a	MEDIUM	LOW	MEDIUM	HIGH	MEDIUM
Scheduling	n/a	n/a	MEDIUM	LOW	MEDIUM	n/a	n/a

RA - Road administration
EA - Enforcement agencies
none-low-medium-high - ranges of feasibility
Source: authors

5. CONCLUSIONS

KEY FINDINGS

- New smart tachographs costs are **significantly higher if the retrofitting of all existing vehicles is required,** while if only newly registered vehicles are equipped with new smart tachographs the replacement process in the whole EU fleet may last about 20-25 years.
- The setting up of an entirely new databases system for new smart tachographs is more expensive than building upon an existing digital tachograph databases system. Indeed, the **cost divergence is much higher under "Option 1" - a compulsory retrofit scenario** (87 million EUR for a new database system vs. 16 million EUR for an existing database system) than under "Option 2" - equipping only new vehicles with new smart tachographs (59 million EUR for a new database system vs. 10 million EUR for an existing database system).
- Main **benefits** come out of improved competition in the road haulage sector, while savings on enforcement are rather limited because enforcement personnel is maintained to deal with all range of infringements in transport sector other than tachograph offences.
- **Qualitative analysis** proves that from the perspective of databases technology suppliers and users (road administrations and enforcement agencies), feasibility can be assessed as high. The only important risks would be from a regulatory point of view, as well as the legal, organisational and scheduling risks (including data protection issues).

This in-depth analysis aims to evaluate the economics feasibility and cost of creating national road enforcement databases. The summary of the different costs and benefits resulting from the adoption of new smart tachographs is given in Tables 8 and 9 below.

Table 8: Matrix of evaluation of the feasibility and cost of creating national road enforcement databases – identification of costs

Type of costs		COSTS	
		Option 1 = Option 2 + the following:	Option 2
DIRECT			
Compliance	Administrative burden / regulatory costs	• Cost of adjustment to the new system	• Collecting data and reporting • Data transmission cost • Cost of data input
	Implementation costs	• Cost of new smart tachographs in newly registered vehicles (per year) • Cost of replacement in whole vehicle fleet (one time) • Staff cost and training – new smart tachographs use	• IT / software costs • Cost of new infrastructure to transmit data • Cost of making existing information systems capable of handling this type of data (use of Tachonet or ERRU or VIP) • Cost of creating an independent system for data exchange (based on car-pass like system) • Cost of data access for analytical/policy purposes • Staff cost and training – implementation of new databases
Hassle costs		• Drivers' and companies' "irritation" costs	• Companies' adjustments (familiarising with new obligations) • Costs of administrative delays due to bureaucratic complexity
Monitoring. maintenance and enforcement costs		• Inspection cost – new smart tachograph enforcement	• Monitoring costs of new databases
INDIRECT			
Indirect compliance cost		• Additional costs for consumers (increase of prices) resulting from new smart tachographs installation	• Additional costs for consumers (increase of prices) resulting from organisational change
Other indirect cost		• Effects for businesses (current systems providers of digital tachographs) • Reduced competition between providers of new smart tachographs • Reduced innovation (only one type of new smart tachograph)	• Effects for businesses (current databases systems providers) • Reduced competition between databases providers • Reduced innovation (only one type of databases)

Source: authors

Table 9: Matrix of evaluation of the feasibility and cost of creating national road enforcement databases – identification of benefits

Type of benefits		BENEFITS	
		Option 1 = Option 2 + the following:	Option 2
DIRECT			
Market efficiency	Improved information	• Higher effectiveness in terms of improved compliance (tachograph)	• Uniform data on monitoring and compliance check • Easier compilations of reports • Higher effectiveness in terms of improved compliance (legal)
Market efficiency	Cost savings	• Benefits to undertakings and drivers (lower fines and better driver retention)	• Access to real-time information on vehicle's and driver's status, leading to cost-savings
Administration		• No additional benefits	• Better administration cooperation - comparability of enforcement data between countries • Better use of data in risk-rating systems
Better enforcement		• Reduction of infringements	• Improving the effectiveness of enforcement of the working time provisions (use of trust-based enforcement – focus on checking operators that present a higher risk and minimalizing burdens on law-abiding companies)
INDIRECT			
Indirect compliance benefits (spill-over)		• Safe driving – enhancing of road safety • Fair competition between operators	• Use of modern information technologies – increase of innovation (IT sector, big data sector)
Other non-monetisable benefits		• No additional benefits	• Improvement of working conditions • Raising awareness of the social rules among customers of transport operators • Reduced distortion of competition (reduced market imperfections) • Overall benefits for citizens (health, safety, environment)

Source: authors

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ANNEX

Table 1: Estimated number of new smart tachographs in EU vehicle fleets

Member State	No of HGVs	No of Buses	Total	Retrofitting cost in EUR (total vehicle fleet)	Cost per year in EUR (new registrations only)
AT	68 860	9 679	78 539	69 899 710	8 039 370
BE	143 697	15 926	159 623	142 064 470	10 150 450
HR	45 757	n/a	45 757	40 723 730	26 397 400
CZ	196 816	19 966	216 782	192 935 980	1 341 230
DK	41 457	8 832	50 289	44 757 210	11 448 070
EE	35 455	4 787	40 242	35 815 380	4 952 850
FI	95 233	12 455	107 688	95 842 320	933 610
FR	567 000	90 000	657 000	584 730 000	3 406 920
DE	902 718	78 345	981 063	873 146 070	48 727 500
GR	233 159	25 007	258 166	229 767 740	88 225 700
HU	86 831	17 254	104 085	92 635 650	377 360
IE	30 932	18 086	49 018	43 626 020	5 268 800
IT	918 258	97 991	1 016 249	904 461 610	3 126 570
LV	32 908	n/a	32 908	29 288 120	21 184 670
LT	50 089	7 147	57 236	50 940 040	1 574 410
LU	11 384	1 778	13 162	11 714 180	5 577 630
NE	149 588	9 385	158 973	141 485 970	1 320 760
PL	980 201	109 844	1 090 045	970 140 050	14 738 400
PT	119 000	14 700	133 700	118 993 000	24 651 220
RO	218 728	21 123	239 851	213 467 390	4 385 030
SK	94 611	n/a	94 611	84 203 790	8 139 050
SI	32 445	n/a	32 445	28 876 050	14 310 310
ES	526 559	60 352	586 911	522 350 790	2 296 200
SE	80 046	14 114	94 160	83 802 400	25 049 940
UK	581 645	88 186	669 831	596 149 590	6 986 500
EU-Totals	6 243 377	724 957	6 968 334	6201 817 260	342 609 950

Source: own estimates based on the total number of HGVs and buses in EU vehicle fleets (ACEA 2014), new registrations (ACEA 2017).

Table 2: Estimated data transmission costs as per vehicle fleet size

Member State	No of working days	Yearly cost as per Option 1 (in EUR)	Yearly cost as per Option 2 in EUR (in year 1)	Yearly cost as per Option 2 in EUR (after 8 years)
AT	249.0	2 933 432	78 539	69 899 710
BE	248.0	5 937 976	159 623	142 064 470
HR	249.0	1 709 024	45 757	40 723 730
CZ	251.0	8 161 842	216 782	192 935 980
DK	250.0	1 885 838	50 289	44 757 210
EE	252.0	1 521 148	40 242	35 815 380
FI	252.0	4 070 606	107 688	95 842 320
FR	251.0	24 736 050	657 000	584 730 000
DE	253.4	37 290 205	981 063	873 146 070
GR	249.0	9 642 461	258 166	229 767 740
HU	251.0	3 918 800	104 085	92 635 650
IE	251.7	1 850 675	49 018	43 626 020
IT	251.0	38 261 775	1 016 249	904 461 610
LV	251.0	1 238 986	32 908	29 288 120
LT	251.0	2 154 935	57 236	50 940 040
LU	249.0	491 601	13 162	11 714 180
NE	248.0	5 913 796	158 973	141 485 970
PL	249.0	40 713 181	1 090 045	970 140 050
PT	248.0	4 973 640	133 700	118 993 000
RO	251.0	9 030 390	239 851	213 467 390
SK	251.0	3 562 104	94 611	84 203 790
SI	249.0	1 211 821	32 445	28 876 050
ES	251.0	22 097 199	586 911	522 350 790
SE	252.0	3 559 248	94 160	83 802 400
UK	250.0	25 122 657	669 831	596 149 590
EU-Totals	250.3	261 652 806	6 968 334	6201 817 260

Source: own estimates based on the total number of HGVs and buses in EU vehicle fleets (ACEA 2014), new registrations (ACEA 2017), average number of working days (Eurostat 2018)

Table 3: Estimated breakdown of databases and system investment cost (in EUR)

Component cost	Scenario 1 Option 1	Scenario 1 Option 2	Scenario 2 Option 1	Scenario 2 Option 2
Fixed cost components (independent of number of vehicles)				
Project of the system	2 526 529	421 088	2 526 529	421 088
Management of project realisation	1 443 731	240 622	1 443 731	240 622
Buildings	5 714 766	0	5 714 766	0
Software	21 655 959	3 609 326	21 655 959	3 609 326
Procurement	18 046 632	3 007 772	18 046 632	3 007 772
Technical documentation	1 323 420	120 311	1 323 420	120 311
Variable cost components (dependent on number of vehicles)				
Servers and Network equipment	17 305 014	5 768 338	959 158	319 719
Server connectivity	1 153 668	384 556	63 944	21 315
Applications for users (control administration, certification bodies, all other users)	2 538 069	230 734	140 677	12 789
Training for system administrators	7 101 140	2 367 047	7 101 140	2 367 047
Training for users	7 890 156	0	132 012	0
Total	86 699 084	16 149 794	59 107 968	10 119 989

Note: Scenario 2 are additional costs over existing system costs.

Source: own estimates

Table 4: Estimated breakdown of databases and system yearly maintenance cost (in EUR)

Component cost	Scenario 1 Option 1	Scenario 1 Option 2	Scenario 2 Option 1	Scenario 2 Option 2
Salaries	6 423 442	2 141 147	2 260 320	753 440
Hardware servicing	3 006 343	1 002 114	190 097	63 366
Overheads	692 201	230 734	38 366	12 789
Security (other than IT)	1 804 663	0	1 804 663	
Network connections	1 845 868	615 289	102 310	34 103
Helpdesk	7 218 653	0	7 218 653	
Insurance	1 588 104	144 373	1 588 104	144 373
Modernisations	7 218 653	0	7 218 653	
Total	29 797 927	4 133 658	20 421 167	1 008 071

Note: Scenario 2 are additional costs over existing system costs. For Option 2 cost in year 1

Source: own estimates

This in-depth analysis investigates the economic feasibility and cost of creating national road enforcement databases following the introduction of new smart tachographs (so-called "Generation 2" digital tachographs) into the EU road haulage market. Two scenarios are considered: the first includes building new databases capable of handling new smart tachograph data, and the second mainly relies on upgrading existing databases for this new usage (such as Tachonet, the European Register of Road Transport Undertakings (ERRU), or the Vehicle Information Platform (VIP) based on EUCARIS). Two options are also analysed: the first includes retrofitting the whole fleet of Heavy Goods Vehicles (HGVs) and buses from year 1, and the second is based on a more gradual introduction of new smart tachographs, only for new vehicles.

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