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Evaluation of the implementation and effects of EU infrastructure charging policy since 1995

Final Report

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Executive summary

This report was commissioned by DG Mobility and Transport to evaluate transport infrastructure charging policy in the EU. The aim is to identify and analyse the experience of Member States with respect to road user charging.

The EU has been working towards the development of a common framework for the charging of road freight transport for over 40 years. The assessment period for this study starts from 1995, with the publication of the Green Paper "Towards fair and efficient pricing in transport" (COM (95) 691). The paper advocated charging users for the full social costs of their journeys in order to reduce transport problems and make Europe's economy more competitive. After 1999, the primary policy instrument of interest is Directive 1999/96 (the 'Eurovignette' Directive) and its subsequent amendments, as well as the Directive 2004/52 on the European electronic toll service.

This report has two main components:

- An *ex-post* evaluation of previous EU road-user charging policies since 1995, up to and including the effects of Directive 2006/38/EC.
- An *ex-ante* analysis of the impacts of the recent revisions to the Eurovignette Directive as enshrined in Directive 2011/76/EC.

Ex-post evaluation

The ex-post evaluation comprised an assessment against nine key evaluation questions.

Q1: Description of measures taken in Member States in the field of road user charging, including the rates of tolls/charges applied

The majority of Member States have now implemented some form of road user charging

Some form of road charging was in place in 21 EU Member States at the end of 2012: nine countries have vignettes, five have electronic nation-wide tolls and seven have conventional tolls. Six countries still have no form of national policy, but two of these plan to implement vignettes by 2014.

All countries except Germany and those that take part in the Eurovignette agreement include vehicles >3.5t

Inclusion of vehicles over 3.5t by 2012 has largely been achieved[1]. The majority of countries include vehicles over 3.5t, as well as buses and coaches in their charging schemes. Only the Eurovignette countries (Belgium, Denmark, The Netherlands, Luxemburg and Sweden) and Germany restrict their charging to goods vehicles above 12t (excluding buses and coaches). Of the Member states with road charging in place, 15 include vehicles over 3.5t (71%)

Most Member States now differentiate charges by Euro emission class; those that do not are usually those with large networks of concession motorways

Many Member States introduced Euro-differentiation of charges before it became mandatory in 2010. All Member States with network-wide electronic tolls have complied with the requirement. Almost all vignettes are differentiated by Euro class; the only exception is Hungary, which plans to replace the vignette with tolls. In contrast, concession tolls do not typically differentiate according to Euro class and the long contract periods of most concessions suggest that it may be some time before they do so. Of the Member states with road charging in place, 14 differentiate charges by Euro class (67%)

Differentiation in charges according to time of travel remains largely unexplored

Of the Member states with road charging in place, only six apply time-of-day charge differentiation (two apply time-differentiation widely across the network), although it should be noted that countries with vignettes are unable to differentiate charges by time.

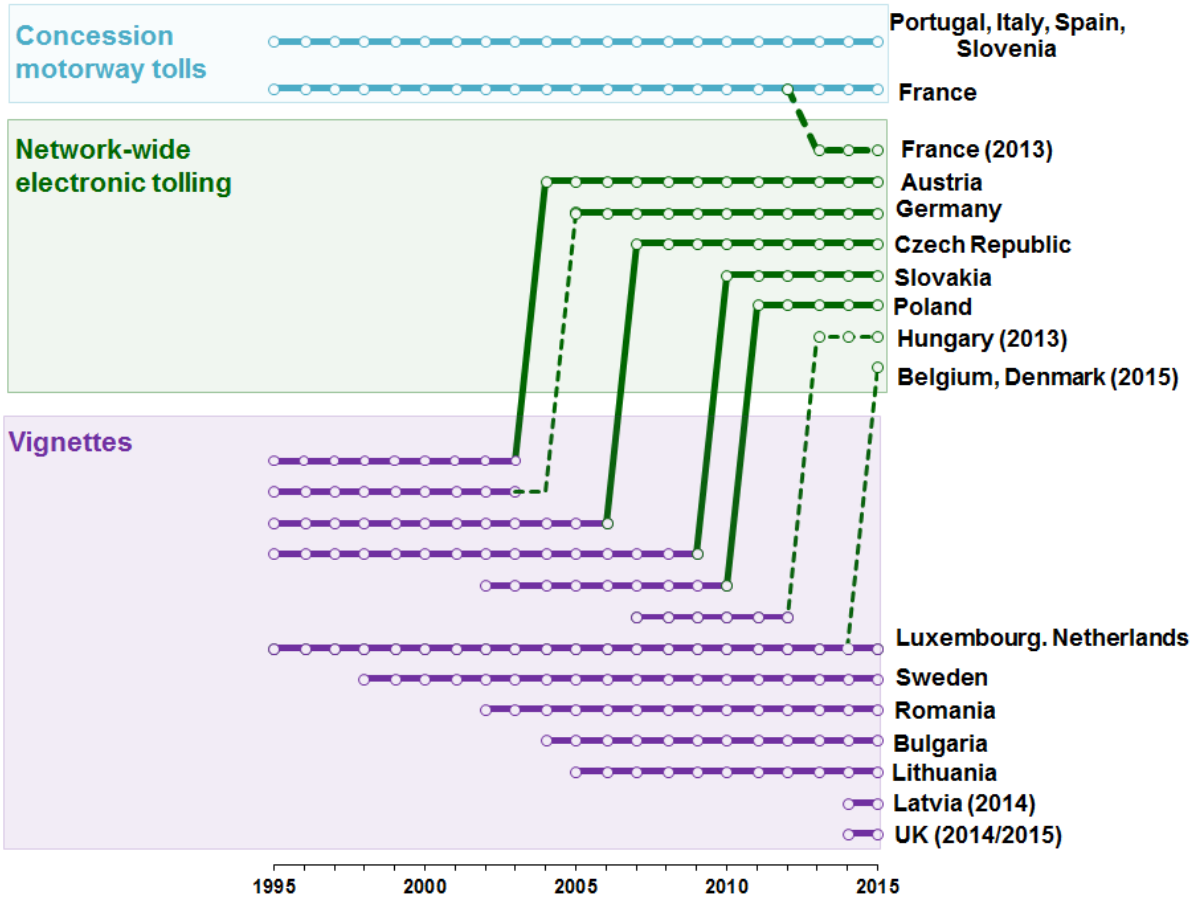
[1] The original Eurovignette Directive 1999/96/EC applied only to commercial vehicles over 12t, whereas the amendment in 2006 extended the scope to those over 3.5t. This requirement became mandatory from 2012, except in exceptional circumstances.

Q2: Progress towards applying charges to road users and ways of gradually harmonising the charging systems that are applied to commercial vehicles

Despite the apparent fragmented nature of road user charging in Europe when viewed as a snapshot, significant progress has been made since 1995.

There is a clear trend towards greater use of electronic network-wide tolling across Europe. Five countries that started with vignette systems have gradually transitioned to electronic network-wide tolls, with France, Hungary and Belgium also planning to implement new tolls in the next few years.

Figure 0.1: Development of infrastructure charging systems in Europe 1995-2015



Evidence from implementation choices in Europe shows that Member States with electronic network-wide tolls are more likely to explore options for differentiating charges by Euro class, time of travel and number of axles compared to Member States using other forms of charging. However, the prevalence of concession motorways in other Member States, typically with long contract periods extending over several decades, is likely to slow any further harmonisation of charging systems in these countries.

Q3: The policies of Member States as regards the use of charging revenues

All Member States, except those belonging to the Eurovignette agreement, earmark revenues from road transport charging at least in part to transport

Despite the voluntary nature of earmarking revenues to transport, most Member States have chosen to do so, although the precise use of the revenues is not clear. For Eurovignette countries, revenues go to the general budget.

Q4: The policies of Member States as regards enforcement and the treatment of occasional users

Violation rates generally appear low and Member States impose penalty fees that are broadly comparable

In all Member States the minimum penalty for non-compliance does not exceed €375. There are two main approaches that are used to ensure compliance:

- The first is to have many compliance checks and a low penalty – this appears to be the favoured option in Member States with electronic network-wide charges.
- The second is to have only occasional compliance checks but penalty levels reaching much higher levels (although starting at comparable levels to those in the former group). This structure is common for concession motorways and national vignettes

The available evidence suggests that non-compliance is almost zero in countries with physical barriers; around 1-3% for electronic tolling and 2-15% for countries with vignettes. Thus in most cases for which data are available, violation rates are very low and enforcement procedures could be considered effective.

Regarding the policies of Member States towards the treatment of occasional users, one of the key aims of the Eurovignette Directive is to prevent competitive distortion through discrimination *"…directly or indirectly, on the grounds of the nationality of the haulier or the origin or destination of the vehicle."*

No evidence of excessive minimum charges for vignettes was found under current schemes

For vignettes, potential discrimination could occur through excessive minimum charges, by either not offering a daily rate, or by charging a rate above the maximum level set out in the Eurovignette Directive (€11).

None of the Member States with tolls in place, except Spain, offer discounts for frequent users beyond the saving in administrative costs

For toll roads, there are likely to be some savings in administrative costs for frequent users over occasional users. Directive 1999/62 did not specify provisions for frequent user rebates, but the amended Directive 2006/38/EC capped them at a maximum of 13%. In most countries with concession motorways, discounts were provided that went beyond the 13% limit; however, all cases have subsequently been resolved with the exception of those in Spain. Thus, only one country currently offers discounts of more than 13%.

Q5: An evaluation of all the existing national electronic toll systems: use of electronic systems to levy and collect infrastructure and external-cost charges and their degree of interoperability pursuant to Directive 2004/52/EC.

There are several successful examples of interoperable systems in Europe.

Currently, interoperable systems exist between France and Norway (with potential to also include Spain, Austria and Slovenia); Germany and Austria; Norway, Sweden and Denmark.

In Member States with electronic tolling systems, user acceptance appears to be high.

In cases where users have a choice of different payment methods, 35-60% of all users chose to use electronic tolling, while uptake for HGVs appears to be higher than average (over three-quarters in France and Italy).

Q6: The effectiveness, completeness and clarity of the provisions on the recovery of infrastructure costs in terms of financing, developing and maintaining the road network and in terms of promoting a harmonised approach.

Most EU Member States have transposed the 1999 Directive and its 2006 amendment. However, only a few Member States have systematically implemented and applied all the provisions of the Directive.

Charging systems	Member States	Transposition of Directive 1999/62 and 2006/38
Network-wide electronic tolls	Austria, the Czech Republic, Germany and Switzerland	Austria, the Czech Republic, Germany are already in line with the application of tolls, as suggested by the Eurovignette Directive.
Concession motorways	France, Spain, Greece, Italy, Slovenia and Portugal	Most have transposed the Directive, with provisions that exempt existing concessions from the scope. Italy exempts existing concessions from the requirement to vary tolls by Euro standards. Spain has not yet implemented the provisions of the Eurovignette Directive in national law. The Portuguese law transposing the Eurovignette Directive contains a provision that leaves concession toll systems entirely outside the scope of the Directive.

Charging systems		Member States	Transposition of Directive 1999/62 and 2006/38
Vignettes	**Eurovignette**	Belgium, Denmark, Luxembourg, the Netherlands and Sweden	Most have transposed the Directive by setting up national acts and decrees for key elements. The Netherlands have proposed some concrete proposals to bring the Eurovignette scheme in line with directive 2006/38/EC especially to use the maximum possible rates under the amendment; this has yet to be agreed with all the Eurovignette countries.
	National vignette	Bulgaria, Romania Hungary, Lithuania, Poland and Slovakia	Most have transposed the Directive by setting up national acts and decrees for key elements. However, all provisions of the Directive are not systematically implemented.
No widespread charging system		Cyprus, Estonia, Finland, Ireland, Latvia, Malta and UK	

Most Member States do not recover full infrastructure costs from road charging due to a lack of methods to relate charges to costs or where charges are set by political decisions.

Germany, and Austria to some extent, are the only two countries that are currently reflecting charges to recover investment and operating costs across the national network. A summary of the experience from the other groups of countries is given below:

- **Member States with vignettes:** The revenue from vignettes only covers a small part of infrastructure costs; the rest is covered by other road and fuel taxes, state subsidy or state budget
- **Member States with concession-based systems** can recover 100% of costs but only for the network covered by them.

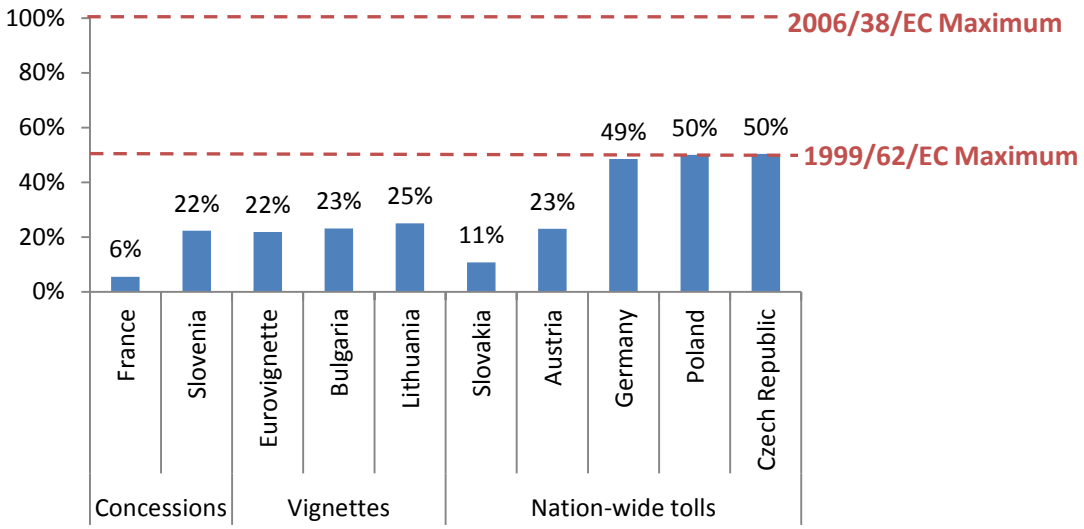
A lack of guidelines to calculate infrastructure costs and the complexity of methods required to recover them in a revenue neutral way were specifically cited as important barriers by some Member States (Italy, Hungary, Slovenia and Denmark).

Q7: The implementation and effect of the variation of infrastructure charges on the reduction of local pollution and congestion.

Most Member States apply charge differentiation by Euro class at levels significantly below the maximum permitted

The maximum differentiation to control air pollution was extended from 50% (Directive 1999/62/EC) to 100% (Directive 2006/38/EC). The range of charge differentiation applied in Member States is between 6% (France) and 50% (Poland and Czech Republic).

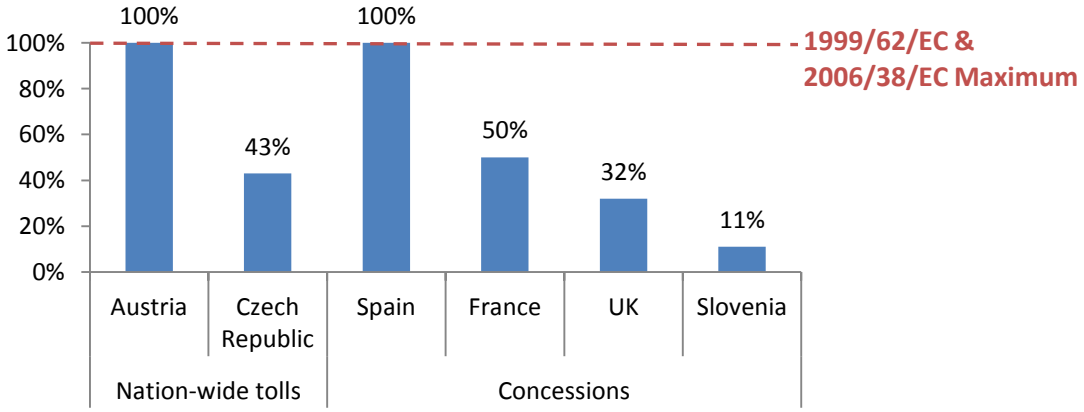
Figure 0.2: Maximum charge differentiation according to Euro class for vehicles in the same category



Only Austria and Spain apply the maximum differentiation of 100% according to time of travel (on a few road stretches), whereas the remaining countries apply variations of 50% or less.

Directive 1999/62/EC and Directive 2006/38/EC allowed a maximum differentiation of 100% according to time of travel. It should also be noted that in most countries the differentiation is only applicable on selected routes, whereas Czech Republic and Slovenia apply them on the network. In addition, Austria and Slovenia apply higher charges at night to control noise emissions, whereas the other Member States apply higher charges during peak hours to control congestion.

Figure 0.3: Maximum differentiation according to time of travel for vehicles >3.5t in the same category



Charge differentiation by Euro class has been found to have an effect on behaviour change only in a few cases of nation-wide tolls.

Network-wide tolls differentiated by Euro class in Germany are thought to have had a significant effect on the use of cleaner vehicles. For other types of road charging, differentiation by Euro class has not been effective - even when the level of a vignette charge is differentiated by vehicle emission categories, it is insufficient to induce changes to the composition of the vehicle fleet. However, an improvement in the fleet composition of trucks engaged in international transport has been observed in countries without Euro-differentiated charges due to spillover effects of tolls in other countries.

Improvements in transport efficiency were found in Germany and Austria (network-wide tolls) soon after the introduction of the charge. However, in the longer term, GDP and fuel prices appear to be the main explanatory factors for changes in loading and empty running.

Table 0-1: Effectiveness of schemes in reducing air pollution and congestion

Main impact	Mechanism	Vignette	Toll (network wide)	Toll (selected roads)
Air pollution	Greater share of higher Euro class vehicles	Low effectiveness	Potential for a strong effect to increase share of travel carried out by cleaner trucks if differentiated by Euro class Smaller effect on fleet renewal rates	Most trucking firms would have little incentive to modify their vehicle fleets if tolls apply only to selected corridors
Air pollution, congestion	Changes in route to avoid charged areas	No effect	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls
Congestion	Changes in travel time to avoid peak periods	Not possible	Some evidence of peak spreading	Some evidence of peak spreading (mostly passenger cars)
Air pollution	Improvement in transport efficiency	No impact expected	Improvements in short-term Long-term effects are uncertain	No impact expected

A small number of countries have introduced time-varying charges to control congestion. Evidence from France and the Czech Republic shows that traffic during the peak times reduced after differentiated charges were implemented. However, just-in-time inventory management and time-sensitive goods (such as express services) can limit the flexibility of freight delivery, meaning that time-of-day elasticities are typically lower for trucks compared to passenger cars.

Q8: The effect to direct users toward the most environmentally friendly and efficient transport solutions (modal shift)

No significant evidence of modal shift was found

Various studies have not found any significant evidence of modal shift, and statistics of vehicle activity did not provide any evidence of modal shift. The lack of modal shift was also confirmed through a number of interviews with Member States.

Q9: The impact of road charging and of the measures of the Directive controlling toll rates on geographically isolated and peripheral Member States

Any negative impacts on peripheral Member States are expected to be small

Several studies have shown that there is potential for cost increases in peripheral regions to be higher compared to those in central regions; however the overall impact on economies is thought to be small. Other factors appear to have a larger impact on the total cost of transport – particularly differences in the wages of drivers.

Ex-ante evaluation

Q1: The effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution and of the variation of infrastructure charges according to Euro classes to reduce pollution

The provisions have not yet been implemented; however, stakeholders expressed some concern over the complexity of the charge structure

The main concern was that further differentiation of tolls (in addition to those already applied) could lead to complex tariffs and a lack of transparency. Furthermore, the calculation method requires highly disaggregated information, some of which is not yet collected.

Several Member States are planning to introduce Euro class differentiation in the next few years, but a significant barrier to wider implementation stems from existing concession contracts

The majority of contracts will not be renewed until after 2025: 60% of contracts in Italy expire after 2025; 75% in Spain; 86% in Portugal and 94% in France. This is likely to delay any implementation of the provisions of the Eurovignette Directive on the conceded network.

Q2: An evaluation of the effect of the variations according to peak time on congestion, of whether the new maximum variation and maximum daily duration of peak periods are sufficient; and of the effectiveness of variations if such differentiated charges are only applied to certain vehicle categories

Most Member States are not currently planning to introduce differentiation of charges by time of day

The reasons for this choice include the following:

- Congestion is viewed as being mostly a problem in urban areas, which are outside of the scope of the Eurovignette Directive
- Ensuring revenue neutrality would require regular revisions to the charges based on changes in demand, which would create additional administrative burdens
- HGVs are already banned at night-time in some countries; adding daytime congestion charges could be viewed as penalising HGVs twice and make stakeholder acceptance more difficult; and
- Congestion charges should apply to all vehicles if they are to be effective

Q3: The effect to direct users toward the most environmentally friendly and efficient transport solutions

The potential for modal shift is generally thought be low

Freight transport is likely to continue to rely on road haulage over short distances even if policies for modal shift are introduced, as other modes cannot compete in terms of speed, flexibility and reliability. There is broad consensus amongst stakeholders that modal shift as a result of road charging has been limited, or negligible.

Q4: The impacts of the provisions of the Directive on the use of revenue

The likely impacts of the new provisions of the Directive on the allocation of revenues are not clear at this point in time.

National competent authorities have indicated that the new provisions will not lead to a clear, straightforward impact, with changes mainly expected in those countries where external-cost charges will be levied. In addition, the proportion of total revenues that will be earmarked to the transport network will vary significantly between Member States.

Recommendations

Based on the ex-post and ex-ante evaluations contained in this report, several recommendations are made as follows:

Recommendation 1: Considering measures to further encourage the shift from vignettes to electronic tolls will help to ensure better recovery of infrastructure costs, as well as improve consistency and compatibility of pricing systems across Europe.

Revenues from vignettes are very low compared to those collected from distance-based charges and therefore do not meet the financial needs for infrastructure investment. While it is recognised that vignettes are useful as a transition measure because of their simplicity, a transition to fair and efficient pricing implies a greater recourse to tolls. Measures to encourage the shift to tolls could include soft measures such as guidance and funding. Stronger legislative measures could also be considered, while recognising that tolls may not be cost-effective for certain Member States (such as those with low traffic density).

Recommendation 2: Consider measures to remove soft barriers to uptake of time-varying charges

The European Commission's White Paper on Transport (2011) predicts that congestion costs will increase by 50% by 2050. Only a few Member States have introduced time-varying charges. One of the key barriers to greater use of time-varying charges was found to be the complexity of complying with the requirement for revenue neutrality. Resolving this issue by supplying guidance or by revising the requirements will encourage greater use of time-varying charges, which will become more important in the future as congestion in Europe grows.

Recommendation 3: Consider measures to encourage Member States to introduce interoperable systems

There is a patchwork of different charging systems that international freight (and to a lesser extent passenger) transport encounters when travelling across the EU. Although the number of Member States introducing electronic tolling systems is increasing, these can be based on several different technologies and systems that are not necessarily interoperable. Some effort has been made in relation to mainly bilateral interoperability agreements, but these cover only a small subset of systems. It could be appropriate to further encourage such efforts.

Recommendation 4: Consider measures to improve the consistency of pricing signals in order to reduce the environmental burdens of transport

This evaluation found a wide variation in the way Member States have chosen to vary road charges according to the emissions of the vehicle. Some Member States do not vary charges at all according to Euro class, whereas in other Member States there are differences in the groups of vehicles subject to each charge level and the amount by which the charges vary. This creates inconsistent price signals for users.

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1 Introduction

1.1 Background

This report was commissioned by DG Mobility and Transport (DG MOVE) to evaluate transport infrastructure charging policy in the EU. The aim is to identify and analyse the experience of Member States with respect to road user charging. Subsequent deliverables of this project will update the external cost handbook and carry out an impact assessment of future legislative proposals in the field of road infrastructure charging policy.

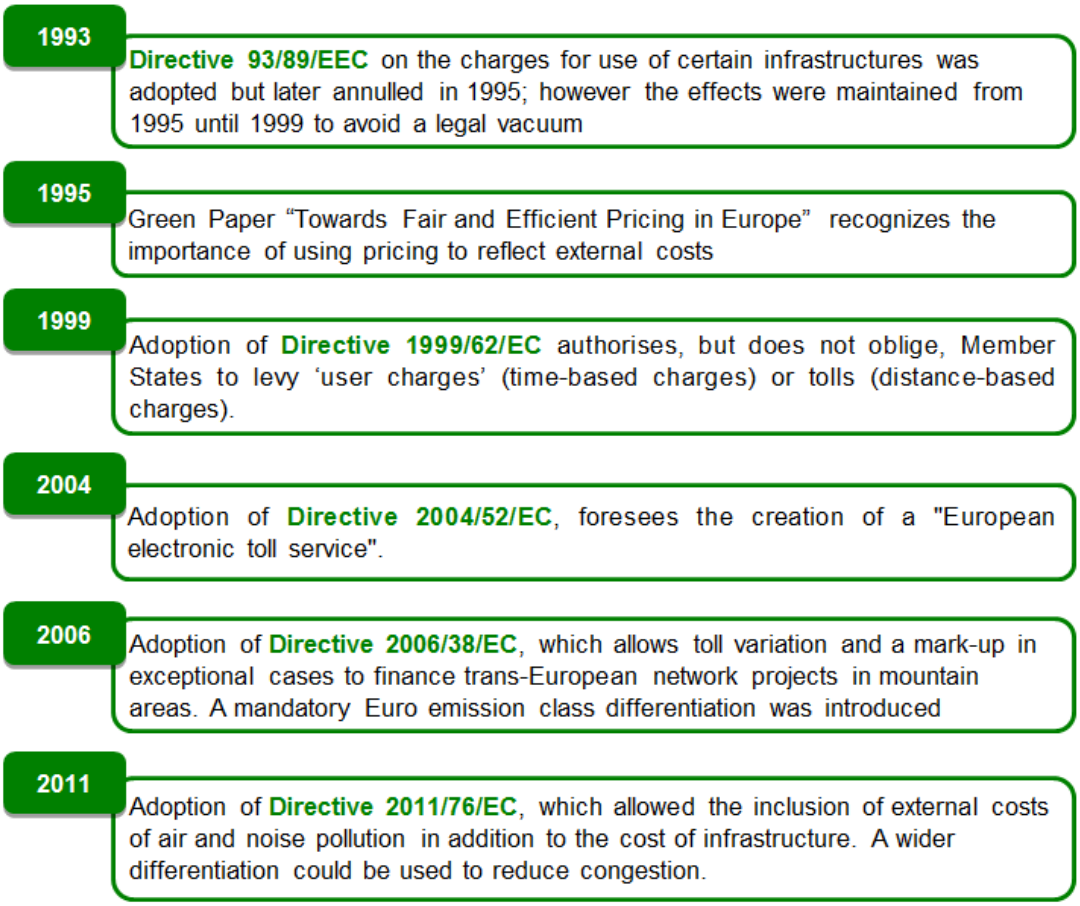
1.2 Overview of EU policies in the field of road infrastructure charging

Transport policy pursues several goals, some of which involve trade-offs. A major aim is to improve efficiency by eliminating discriminatory charges within Europe, in order to remove competitive distortion and promote the free flow of trade. Moreover, transport policy often incorporates social and environmental aspects, such as regional policy objectives and reducing the external costs of pollution and congestion. Investment in infrastructure has been one of the main instruments for improving transport systems; however financing development from outside of the general budget is of critical importance in order to ensure sustainable sources of finance. Road user charging is thought to be a key policy instrument to meet these aims.

The EU has been working towards the development of a common framework for the charging of road freight transport for over 40 years. There have been several important developments in the area of road infrastructure charging policy that are important to understand in the context of this study.

Figure 1.1 shows a timeline of relevant policy in Europe. The assessment period for this study starts from 1995, with the publication of the Green Paper "Towards fair and efficient pricing in transport" (COM (95) 691). The paper advocated charging users for full social costs of their journeys in order to reduce transport problems and make Europe's economy more competitive. After 1999, the primary policy instrument of interest is Directive 1999/96 (the 'Eurovignette Directive) and its subsequent amendments, as well as the Directive 2004/52 on the European electronic toll service.

Figure 1.1: Evolution of road infrastructure charging policy in Europe



The aim of the Eurovignette Directive when it was adopted in 1999 was to preserve the functioning of the internal market and prevent any discriminatory charging by Member States. It set the minimum rates for vehicle taxes to be applied by the Member States, as well as the framework for setting tolls and user charging for vehicles with maximum permissible weight over 12 tonnes.

The Directive does not oblige Member States to introduce user charges, but specifies that in the case user charges are applied, tolls should be related to the cost of constructing, operating and developing infrastructure. The charges were to be limited to the levels required to maintain and replace infrastructure, but could be varied according to the emissions standard of the respective vehicles. Hence, while charges could reflect a vehicle's environmental impact to some extent, the Directive did not allow Member States explicitly to include other external costs, e.g. those associated with climate change, air pollution and noise, in charges.

The Directive 1999/62 has subsequently been amended by Directives 2006/38 and 2011/76 as follows:

- **Directive 2006/38**: introduced greater possibilities to vary tolls away from the average level to achieve policy objectives linked to the environment, congestion and management of traffic flows, albeit with a maximum ceiling on the degree of variation upwards. The scope was extended to cover commercial vehicles over 3.5 tonnes (a requirement that became mandatory from 2012).
- **Directive 2011/76**: allows Member States to levy an external cost charge which is related to air pollution and/or noise pollution from road traffic. It also allows Member States to vary charges for the purpose of reducing congestion and optimising the use of infrastructure.

Additionally, **Directive 2004/52/EC** was adopted with the aim of ensuring the interoperability of electronic road tolling systems within the EU. A review of national electronic toll systems and their degree of interoperability as per Directive 2004/52/EC will be essential to understand pricing technology, design and enforcement. More generally, the European Electronic Tolling System (EETS) should provide cost efficient and reliable charging technologies that minimise transaction costs and enhance the transparency of tariffs.

Table 1-1 compares the scope of Directive 1999/62, Directive 2006/38 and Directive 2011/76. Where the scope refers to "subsidiarity/treaty", Member States may levy charges according to the provisions of the Treaty. This means that the charges on the network must not discriminate and that the instrument must be proportionate.

Table 1-1: Overall scope of the Eurovignette Directive

Scope		1999/62	2006/38	2011/76
Geographical	Motorways	✓	✓ (if TEN-T roads)	✓
	TEN-T roads	✓ (if motorways)	✓	✓
	Parallel roads	Restricted conditions	Subsidiarity/treaty	Subsidiarity/treaty
	Other roads	No	Subsidiarity/treaty	Subsidiarity/treaty
	Urban areas	Subsidiarity/treaty	Subsidiarity/treaty	Subsidiarity/treaty
Vehicles	HGVs >12 tonnes	✓	✓	✓
	HGVs >3.5 tonnes	Subsidiarity/treaty	✓* (only mandatory from 2012)	✓
	Cars and vans	Subsidiarity/treaty	Subsidiarity/treaty	Subsidiarity/treaty
Differentiation of infrastructure charges	Air pollution	Optional, up to 50% according to: • A broad emission class	Up to 100%, according to: • Euro class (mandatory as of 2010)	Mandatory, up to 100% according to: • The Euro class
	Congestion	Up to 100% according to: • Time of day	Up to 100% according to: • Time of day • Type of day • Season	Up to 175% *during peak periods limited to five hours per day,* according to • Time of day • Type of day • Season
Other charges	Mark ups	×	15% or 25% to the average toll in mountainous areas**	15% or 25% but the amount should be deducted from external charges
	Regulatory charges***	The Directive shall not prevent the application of regulatory charges specifically designed to combat: • Time and place-related congestion	This Directive shall not prevent the *non-discriminatory* application of charges specifically designed to combat: • Time and place-related congestion, • Environmental impacts (incl. poor air quality, notably in urban areas)	This Directive shall not prevent the *non-discriminatory* application of charges specifically designed to combat: • Traffic congestion, • Environmental impacts (including poor air quality), on any urban roads
	Separate charges for external costs	×	×	✓ (air pollution and noise pollution)
Rebates	Frequent users	No provisions	A maximum rebate level for frequent users of 13%.	Up to 13% for infrastructure costs. No discount for external cost charges

* Alternatively, Member States may also choose to continue existing schemes or introduce new ones for vehicles over 12 tonnes, but only until 2012.

** However, this is only possible in corridors with a TEN priority project, for which the additional revenues must then be used. If the TEN priority project is a cross-border one, the Member States in question can add a 25% mark-up, otherwise only 15%.

*** Regulatory charges are not part of the Directive, but fall under subsidiarity and can thus be freely designed by Member States. Any such regulatory charges must satisfy the provisions of the Treaty, though, i.e. they may not discriminate and they must be proportional. Examples include the London and Stockholm congestion charges

1.3 Evaluation Approach

1.3.1 Ex-post and ex-ante analysis

This report has two main components:

- An *ex-post* evaluation of previous EU road-user charging policies since 1995, up to and including the effects of Directive 2006/38/EC;
- An *ex-ante* analysis of the impacts of the recent revisions to the Eurovignette Directive as enshrined in Directive 2011/76/EC.

The *ex-post* evaluation will inform the wider study by assessing the impact of existing and previous EU road-user charging policies, to help shape future options for a harmonised system of user charging in Europe. It will also provide insights that can be built on by the Commission when reporting on the effectiveness of the amended Directive.

The *ex-ante* evaluation is equally fundamental to the study and will be used to assess and quantify the likely impacts associated with the new provisions included in Directive 2011/76/EC. However, given that the transposition of Directive 2011/76/EU is expected by 16 October 2013, many countries have not yet implemented measures. In addition, the ex-ante evaluation will inform the baseline of the 'no new policy' scenario for the impact assessment of the proposed policy options for the possible revision of Directive 1999/62/EC.

Therefore the ex-ante evaluation is structured along two steps, respectively taking place in Task A (this report) and Task C (the impact assessment) of the project.

- Task A (this report) focuses on the current intentions of Member States concerning the introduction of the new provisions of Directive 2011/76/EU, in order to identify the most probable future European scenario for road charging, as well as in identifying the potential challenges Member State may face in their implementation. The primary source of information is the Stakeholders survey and the potential impacts are evaluated in light of the most recent information collected from them.
- The outcome of Task A, documented in this report, will contribute to the definition of the baseline scenario for the modelling activities to be performed in Task C (the impact assessment), where a more complete ex-ante assessment will be performed through a quantitative analysis of the potential impacts.

1.3.2 Evaluation approach and information sources

The first step involved obtaining a **comprehensive overview** of the subject of the evaluation, to provide a robust grounding for subsequent research activities. The project team reviewed the relevant Directives and impact assessments undertaken to date.

The second step aimed at precisely defining the issues to be investigated. The targeted **evaluation questions** were developed in the terms of reference (both ex-post and ex-ante). In addition, **evaluation criteria** were developed in order to identify appropriate indicators.

The third step consisted of the **data collection**, which took place through several stages:

- A desk study based on document and data analysis, as well as discussions with DG MOVE and the steering committee;
- A technical survey of Member State competent authorities and other relevant stakeholders;
- Telephone interviews, with targeted questions building on the preliminary findings and hypotheses from desk study.

The last step was dedicated to the **analysis of the data** with a view to constructing answers to the evaluation questions.

1.3.2.1 Evaluation questions

The report covers the answers to specific nine ex-post and four ex-ante evaluation questions specifically requested by the European Commission in the Term of Reference and reported in Table 1-2.

As shown in the table, the *ex-post* and *ex-ante* analyses are related in several cases to the same theme, thus leading to a high risk of overlaps in the two phases of the analysis. In order to ensure a harmonised approach it was necessary to combine the *ex-post* and *ex-ante* evaluations in some cases as shown in Table 1-2..

Table 1-2: Categorisation of the evaluation questions

No.	Ex-post evaluation questions		Category
Q.1	-	Description of measures taken in Member States in the field of road user charging, including the rates of tolls/charges applied	Policies, measures, systems (State of play)
Q.2	Combined with Ex-ante Q.4	The policies of Member States as regards the use of revenue	
Q.3	-	The policies of Member States as regards enforcement and the treatment of occasional users	
Q.4	-	An evaluation of all the existing national electronic toll systems: use of electronic systems to levy and collect infrastructure and external-cost charges and their degree of interoperability pursuant to Directive 2004/52/EC.	
Q.5	-	The effectiveness, completeness and clarity of the provisions on the recovery of infrastructure costs in terms of financing, developing and maintaining the road network and in terms of promoting a harmonised approach.	Transposition process
Q.6	Combined with Ex-ante Q.1 and Q.2	The implementation and effect of the variation of infrastructure charges on the reduction of local pollution and congestion.	Impacts of policies and measures
Q.7	Combined with Ex-ante Q.3	The effect to direct users toward the most environmentally friendly and efficient transport solutions (modal shift)	
Q.8	-	The impact of road charging and of the measures of the Directive controlling toll rates on geographically isolated and peripheral Member States	
Q.9	Combined with Ex-post Q1	Progress towards applying charges to road users and ways of gradually harmonising the charging systems that are applied to commercial vehicles	Harmonisation
No.	**Ex-ante evaluation questions**		**Category**
Q.1	Combined with Ex-post Q.6	The effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution and of the variation of infrastructure charges according to Euro classes to reduce pollution	Policies, measures, systems (state of play)
Q.2	Combined with Ex-post Q.6	An evaluation of the effect of the variations according to peak time on congestion, of whether the new maximum variation and maximum daily duration of peak periods are sufficient; and of the effectiveness of variations if such differentiated charges are only applied to certain vehicle categories	
Q.3	Combined with Ex-post Q.7	The effect to direct users toward the most environmentally friendly and efficient transport solutions	
Q.4	Combined with Ex-post Q.2	The impacts of the provisions of the Directive on the use of revenue	

The evaluation questions addressed the main evaluation criteria (relevance, efficiency, effectiveness, impact and sustainability) of the EC evaluation guidelines and EC added value. These linkages are illustrated in Table 1-3

Table 1-3: Coverage of the main evaluation criteria

	Ex-post evaluation									Ex-ante evaluation			
Topic	**Q.1**	**Q.2**	**Q.3**	**Q.4**	**Q.5**	**Q.6**	**Q.7**	**Q.8**	**Q.9**	**Q.1**	**Q.2**	**Q.3**	**Q.4**
Effectiveness	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Efficiency		✓	✓		✓			✓		✓	✓		✓
Relevance			✓		✓					✓			
Coherence	✓			✓	✓	✓		✓	✓				
Economy		✓			✓	✓		✓			✓		✓
Sustainability	✓				✓	✓	✓			✓	✓	✓	
Utility	✓	✓		✓	✓					✓			
Consistency	✓			✓	✓			✓	✓	✓			
Allocation / distributional effects		✓			✓			✓	✓				✓
Acceptability		✓	✓	✓	✓	✓		✓		✓			

1.3.2.2 Challenges and limitations

The evaluation of European road user charging policy is a complex and wide-ranging task, and its impacts have been contentious and the subject of much research and speculation.

Historical data in particular is scarce and is further complicated by the fact that the approaches used by different Member States have varied over time. For many Member States, the availability of literature that could support the analysis is poor. Moreover, although some relevant data were identified during the interviews, it was considered confidential by Member States and could not be included in this study. This has had a direct impact upon the analyses that could be conducted in this evaluation.

Capturing the additionally of impacts is also difficult because a number of complex factors influence the use of roads, independent of the imposition of tolls. The main factors include:

- The level of economic activity and trade. Freight transport is a support activity and is closely linked to the level of economic growth and trade. This is an important factor to bear in mind given that this evaluation covers a period of recession.
- The individual Member States policies' with regards to investment in other modes of freight transport. This influences the ability and desire of hauliers to shift to other modes.
- The extension of the charged network itself over time. As it expands, it captures traffic and also reduces the diversion options available to hauliers.
- The expectations of hauliers' customers in particular with regards to speed and reliability of delivery which can override cost considerations.

1.4 Outline of the report

Beside this introduction, the report contains two main sections:

- **Section 2**, which provides the answers to the nine ex-post and the four ex-ante evaluation questions identified in the Terms of Reference, as shown in Table 1-4.
- **Section 3** which presents, on the basis of the findings and analysis of Section 2 an overall assessment, and the conclusions of the evaluation.

Table 1-4: Outline of Section 2

Section	Evaluation question	Ex-post	Ex-ante
2.1	Description of measures taken in Member States in the field of road user charging, including the rates of tolls/charges applied	Q1	
	Progress towards applying charges to road users and ways of gradually harmonising the charging systems that are applied to commercial vehicles	Q9	
2.2	The policies of Member States as regards the use of revenue	Q2	
	The impacts of the provisions of the Directive on the use of revenue		Q4
2.3	The policies of Member States as regards enforcement and the treatment of occasional users	Q3	
2.4	An evaluation of all the existing national electronic toll systems: use of electronic systems to levy and collect infrastructure and external-cost charges and their degree of interoperability pursuant to Directive 2004/52/EC.	Q4	
2.5	The effectiveness, completeness and clarity of the provisions on the recovery of infrastructure costs in terms of financing, developing and maintaining the road network and in terms of promoting a harmonised approach.	Q5	
2.6	The implementation and effect of the variation of infrastructure charges on the reduction of local pollution and congestion.	Q6	
	The effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution and of the variation of infrastructure charges according to Euro classes to reduce pollution		Q1
	An evaluation of the effect of the variations according to peak time on congestion, of whether the new maximum variation and maximum daily duration of peak periods are sufficient; and of the effectiveness of variations if such differentiated charges are only applied to certain vehicle categories		Q2
2.7	The effect to direct users toward the most environmentally friendly and efficient transport solutions (modal shift)	Q7	Q3
2.8	The impact of road charging and of the measures of the Directive controlling toll rates on geographically isolated and peripheral Member States	Q8	

2 Assessment

2.1 Description of road user charging measures in Europe

Purpose: To summarise the approaches taken by European Member States in terms of road charging since 1995 and to review progress towards harmonisation

Context: Member States may choose whether or not to adopt tolls and/or user charges. This section presents the options selected by Member States across Europe, providing a historical perspective by looking at changes from the first implementation of road charging in each country to the current day situation.

Main Findings

Road charging in Europe is fragmented

- Some form of road charging is now in place in 21 EU Member States: nine countries have vignettes, five have electronic nation-wide tolls and seven have conventional tolls.
- Six countries still have no form of national policy on road pricing: the UK, Latvia, Estonia, Finland, Malta and Cyprus.

Differentiation of charges is increasingly used by Member States

- All vignette countries except Hungary now apply differentiations according to Euro class. All countries with nation-wide electronic tolls differentiate by Euro class. However, for concession motorways with manual tolls (mostly also offering electronic tolling), Euro class differentiation is only in place for selected tunnels in France and in Slovenia for users paying electronically.
- Time-based differentiation remains relatively rare. Of the nation-wide electronic tolls, only the Czech Republic has introduced time-varying charges, and Slovenia has introduced different charges for day/night. Some concessionaires in Spain and France have introduced time-varying charges, but this is not generally widespread

There has been a gradual shift toward network-wide electronic tolling

- Five countries that started with vignette systems have gradually transitioned to electronic network-wide tolls.
- Large central European countries have typically made the shift to electronic tolls earlier, while most of the countries in the Eurovignette are planning to implement electronic tolls in the near future (a further three countries have plans to introduce nation-wide electronic tolls.)

2.1.1 Overview

The process of implementing road charging is complex and often politically sensitive; this has resulted in a range of different approaches across the Member States. It is also a dynamic process, so these approaches have changed over time. As a result, the complete picture over the assessment period is very complex. This section provides a description of road charging in Europe in terms of:

- Geographic coverage;
- Implementation choices;
- Charge levels across Member States; and
- Development of road user charging in Europe over time.

2.1.1.1 Types of road user charges

The Eurovignette Directive allows two types of payment for the use of road infrastructure as follows:

- **Vignettes:** Also known as time-based charges or user charges. Purchase of a vignette gives the user the right to use the infrastructure for a given period of time (a day, a week, a month or a year)

- **Tolls:** Also known as distance-based charges. Tolls are charged for a vehicle travelling a given distance on the infrastructure, with the amount based on the distance travelled and type of vehicle. They can be network-wide tolls or apply only to selected infrastructure.
    - **Network-wide tolls**: Allow access to the whole network of charged roads, and have electronic charging systems that are common across the network.
    - **Concession motorway tolls:** A concession agreement enables the state to draw upon the private sector in order to finance public infrastructure. These typically use "conventional" toll plazas, although increasingly these may have lanes that allow electronic charging without the vehicle needing to stop.

There are advantages and disadvantages to each system. Vignettes have been widely used as they have relatively low implementation costs and are easy for users to understand. However, as they are a flat time-based fee, the flexibility in terms of charge differentiation is limited. This means that vignettes are not effective instruments for achieving environmental improvements or managing traffic flows.

Due to these limitations, Member States are increasingly opting for tolls, which charge road users in proportion to their actual usage – thereby enabling a fairer implementation of the 'user pays' principle. They offer the potential to internalise external costs (environmental damage, congestion, noise) and the potential for greater revenue generation. However, they can cause traffic diversion to untolled roads and involve a significantly larger initial investment.

More in-depth discussion of the relative advantages and disadvantages of different systems are provided in Section 2.4.2 and Section 2.6.

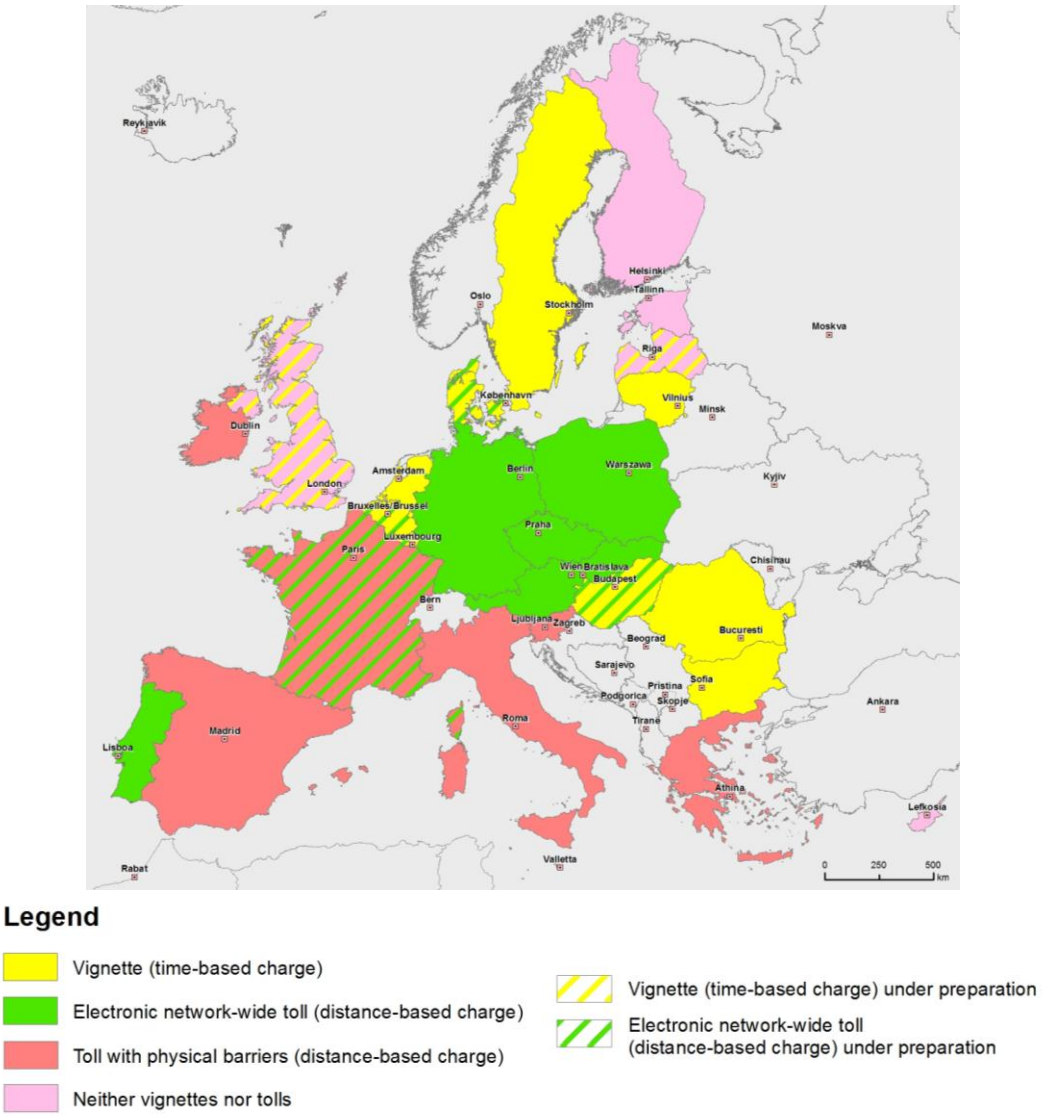
2.1.2 Geographical coverage

The majority of Member States have now implemented some type of road charging. Countries can be grouped into six main categories depending on the type of charging system, as follows:

- **Vignette systems in place:** Bulgaria, Romania, Hungary and Lithuania have national vignette systems for trucks. Sweden, Denmark, the Netherlands, Belgium and Luxembourg operate the shared "Eurovignette".
- **Vignette systems in development**: The UK and Latvia are developing vignette systems for trucks.
- **Electronic network wide tolling systems in place:** Germany, Austria, the Czech Republic, Slovakia, Poland and Portugal.
- **Electronic network wide tolling in development**: Belgium, France and Hungary. France will only be applying the charges to existing untolled state owned motorways, so it will retain its present system of tolls with physical barriers on motorway concessions.
- **Tolls with physical barriers:** Includes Ireland, France, Spain, Italy, Slovenia and Greece. Although other countries have manual tolling on a small number of roads, the scale is not significant. Poland and Portugal also have tolls with physical barriers on part of the network, although they are classified as having electronic network-wide tolling in place.
- **No tolls**: The UK, Latvia, Finland, Estonia, Malta and Cyprus

The map in Figure 2.1 summarises the system of road charging in place in the Member States, as well as developments under way which may affect future policy.

Figure 2.1 Charging of Heavy Goods Vehicles in Europe



Source: European Commission, June 2012 http://ec.europa.eu/transport/modes/road/road_charging/doc/hgv_charging.jpg

It is worth noting that Switzerland has an electronic network wide tolling system for trucks, and Norway has an extensive system of toll bridges across the country. Other non-Member States also have road charging systems in place. For example, Russia is considering a national distance-based charge for HGVs based on its satellite system (GLONASS)[2]. In Belarius, the Austrian toll equipment company Kapsch TrafficCom has reportedly been contracted to implement a national electronic road tolling system for vehicles >3.5t[3]. In Serbia, both cars and HGVs are required to pay tolls for motorway usage[4].

This overall picture is based on the predominant form of road charging in place in each Member States. However, it sometimes hides a more complex situation where some region / area-specific measures may be in place. For instance, most countries with vignette systems also have tolls on selected infrastructure (such as bridges and tunnels), which is permitted under the Eurovignette Directive. A complete overview of implementation in each Member State is provided in the following section.

[2] ITS International new stork, 26 June 2012. http://www.itsinternational.com/categories/charging-tolling/news/russia-plans-satellite-based-mileage-fee-for-trucks/?locale=en
[3] Road Traffic Technology news article, 5 March 2012. http://www.roadtraffic-technology.com/news/newskapsch-trafficcom-secures-toll-system-contract-in-belarus/
[4] ASECAP (2006) Tolling policy in Serbia. http://www.asecap.com/english/documents/SESSION2BTOLLINGSERBIA.pdf

2.1.3 Implementation choices

Across the EU, Member States have adopted different approaches towards the charging of transport, reflecting different national political priorities which have developed over time. The Eurovignette Directive allows for charge variation in order to reflect differences in the environmental performance of different vehicles and the time of day at which a vehicle travels. The rationale behind these provisions is that variation in charges will provide price incentives for a shift to environmentally enhanced vehicles and/or a reduction in congestion levels.

Table 2-1 provides a summary of the road charging systems in place in Europe, and highlights the scope of the charging and whether differentiation was introduced. Countries are grouped according to whether they have vignettes, network-wide tolls or concession motorway tolls.

Table 2-1: Overview of road charging in Europe under Eurovignette Directives

Type	Member State	Dates	Vehicle types					Road type	Differentiation by		
			>12t	>3.5t	<3.5t	Buses & coaches	Car charges		Euro standard	Time	Axles
Vignettes	Belgium	Since 1995	✓	×	×	×	tunnel tolls	Motorway network and certain national roads. (tolls are also in place for all vehicles using the Liefkenshoek tunnel on the R2 ring road around Antwerp.)	✓ (since 2001)	×	✓
	Bulgaria	Since 2004 (joined EU in 2007)	✓	✓	✓	✓	vignette	All inter-urban roads	✓ (since 2008)	×	×
	Denmark	Since 1995	✓	×	×	×	tolls for bridges	Motorway network and certain national roads (tolls are also in place for the E20 motorway and Storebaelt and Oeresund bridges)	✓ (since 2001)	×	✓
	Hungary	Since 2000 (joined EU in 2004)	✓	✓	✓	✓	vignette	Sections of motorways + some highways & primary roads	×	×	×
	Lithuania	2005	✓	✓	x	✓	×	Main roads A1-A18	✓	×	×
	Luxembourg	Since 1995	✓	×	×	×	×	Motorway network and certain national roads	✓ (since 2001)	×	✓
	Netherlands	Since 1995	✓	×	×	×	tunnel tolls	Motorway network and certain national roads (tolls are also in place on the Westerschelde and Kil tunnels.)	✓ (since 2001)	×	✓
	Romania	Since 2002 (joined EU in 2007)	✓	✓ Since 2004	✓ Since 2005	✓	vignette	All inter-urban roads (plus tolls on selected bridges – Giurgiu-Rousse; Giurgeni-Vadu; Fetestic-Cernavoda)	✓	×	✓
	Sweden	Since 1998	✓	×	×	×	tunnel tolls	Motorway network and certain national roads. (tolls also in place on E20 motorway bridge across Øresund and the Svinesund bridge)	✓ (since 2001)	×	✓

Type	Member State	Dates	Vehicle types					Road type	Differentiation by		
			>12t	>3.5t	<3.5t	Buses & coaches	Car charges		Euro standard	Time	Axles
Network-wide tolls	Austria	Since 2004	✓	✓	v	✓	vignette	Motorways + express roads & tunnels. Markups on Brenner, Tauern, Pyhrn, Karawanken and Arlberg	✓ (since 2010)	✓ (Brenner motorway)	✓
	Czech Republic	Since 2007 (vignette 1995-2007)	✓	✓ Since 2010	v	✓	vignette	Motorways + express roads	✓	✓ (since 2010)	✓
	Germany	Since 2005 (vignette 1995-2003)	✓	×	×	×	tunnel and city tolls	Motorways (from 2005) and some national roads to prevent traffic diversion (since 2007)	✓ (since 2005)	×	✓
	Slovakia	Since 2010 (previously vignette)	✓	✓	v	✓	vignette	Highways, expressways and some 1st class roads. The vignette remains in place for all vehicles <3.5t.	✓ (since 2010)	×	✓
	Poland	Since 2011 (vignette 2002- 2011)	✓	✓	v	✓ (all weights)	concession m'ways (excl. national rds)	Highways and roads (national network). Also has 3 concession motorways: the A2 (AWSA, open tolling since 2002/2004); A4 (SAM, open tolling since 2000) and A1 (GTC, closed tolling since 2007/2008) – but CVs exempted from 2005-2011 while the vignette was in place.	✓ (since 2011)	×	✓
Concession tolls	France	Pre-Directive	✓	✓	✓	✓	concession m'ways	Concession motorways, bridges and tunnels. (additional tolls on Fréjus and Mont Blanc tunnels (to Italy), and the Puymorens and Envalira (Andorra) tunnels in the Pyrenees)	✓ (selected tunnels)	✓ (selected roads)	✓
	Greece	Pre-Directive	✓	✓	✓	✓	concession m'ways	Concession motorways	×	×	✓
	Italy	Pre-Directive	✓	✓	✓	✓	concession m'ways & tunnels	Concession motorways. (tolls also on cross-border tunnels: Mont Blanc (to France), Fréjus (to France), Grand St-Bernard (to Switzerland) and Munt la Schera (to Switzerland).	×	×	✓

Type	Member State	Dates	Vehicle types					Road type	Differentiation by		
			>12t	>3.5t	<3.5t	Buses & coaches	Car charges		Euro standard	Time	Axles
	Portugal	Pre-Directive	✓	✓	✓	✓	concession m'ways	Concession motorways (all motorways). Electronic tolling was introduced on previously free motorways in 2010. Portugal is therefore considered to be a concession model, although the motorway network is now fully subject to electronic tolls – in addition, some motorways still have physical barriers.	×	×	✓
	Spain	Pre-Directive	✓	✓	✓	✓	concession m'ways	Concession motorways	×	✓ (selected roads)	✓
	Slovenia	Pre-Directive	✓	✓	v	✓	vignette	All motorways, most expressways and the Karavanken tunnel. Vignettes for private vehicles.	✓ (since 2010)	✓ (day/night)	✓
	Ireland	Pre-Directive	✓	✓	✓	✓	✓	Motorways, national roads, Dublin Port tunnel, Limerick tunnel, East Link toll bridge	×	✓ (Dublin port tunnel, only vehicles <3.5t)	✓

Sources: ACEA tax guide (2012); TRT (2008); Booz&Co (2012) Member State interviews

2.1.3.1 Scope of vehicles subject to road charging

Table 2-1 above shows the scope of road user charging with respect to the vehicle type. The original Eurovignette Directive 1999/96/EC applied only to commercial vehicles with "maximum permissible laden weight" of over 12 tonnes. The amendment to the Directive in 2006 extended the scope to cover commercial vehicles over 3.5 tonnes. This requirement became mandatory from 2012, except in circumstances that would create adverse effects on traffic flow or externalities, or if the administrative costs would amount to over 30% of the additional revenue. Thus, all charges apply at least to goods vehicles over 12t, but there is some flexibility over whether to include vehicles over 3.5t. The situation can be summarised as follows:

- **Vignettes:** The Eurovignette still applies only to goods vehicles over 12t, whereas national vignettes cover all vehicle weights.
- **Network-wide tolling**: With the exception of Germany, network-wide tolls are applied to all vehicles above 3.5t. The Czech Republic included all vehicles over 3.5t from 2010, whereas previously it applied only to those >12t (since the introduction of the scheme in 2007).
- **Concession tolls:** For concession tolls, in most cases all vehicles have been charged from the outset of the tolls. However, in Slovenia, a vignette is in place for vehicles below 3.5t.

Thus, most schemes included all vehicles from the outset. In Romania and the Czech Republic, the schemes started with vehicles over 12t and later extended to include vehicles over 3.5t. Only the Eurovignette countries and Germany do not include vehicles over 3.5t.

In most cases, buses and coaches are included. Only the countries that do not yet include vehicles over 3.5t – that is, the Eurovignette countries and Germany - provide exemptions for these vehicles. On the other hand, Poland extends the charges to buses of all weights.

2.1.3.2 Differentiation according to Euro class

In order to encourage a move to more environmentally friendly vehicles, it is possible to differentiate the charges according to the Euro emission class of the vehicle (the Euro standards set limits on vehicle air pollutant emissions). This option was included in the Directive 1999/96/EC, but the 2006 amendment also allowed greater possibilities, including differentiation by emissions (NO_x and PM) as opposed to Euro standard. This makes it more attractive to retrofit older lorries with emission control equipment such as diesel particulate filters. This option was taken up in Germany, where older lorries can obtain discounted rates if they fit particulate filters (for example, a Euro II lorry would be allowed to pay the Euro III rate). Directive 2006/38/EC also required that Member States introduce Euro-differentiation of tolling systems no later than 2010, of in the case of concessions, when the contract is renewed. The situation regarding charge differentiation according to Euro class is summarised as follows:

- **Vignettes**: The Eurovignette countries differentiate charges according to Euro class, although they do not distinguish between vehicles better than Euro II. Most national vignettes also differentiate according to Euro class – the only exception is Hungary, but there are plans to replace the vignette soon with a toll that will be differentiated by Euro class.
- **Network-wide tolls**: All are differentiated by Euro class. Germany also allowed vehicles that were fitted with particulate filters to benefit from a lower fee band than would have been assigned based on the Euro class of the vehicle.
- **Concession tolls**: Euro class differentiation is only in place for selected tunnels in France and in Slovenia for users paying electronically.

All Member States with electronic network-wide tolls have complied with the requirement to introduce Euro-differentiation no later than 2010. Almost all vignettes are differentiated by Euro class; the only exception is Hungary, which plans to replace the vignette with tolls. In contrast, concession tolls do not typically differentiate according to Euro class. This is likely because the primary aim for concession tolls is to finance the transport network, and environmental goals are not usually considered. However, once the concession contracts come up for renewal, they will be required to introduce this charge differentiation.

2.1.3.3 Differentiation according to time of travel

Time-differentiation can be used for two main aims: firstly, applying higher charges at night discourages travel during periods when noise pollution is a particular issue. Secondly, applying higher charges during peak periods of high demand can help to control congestion.

- **Vignettes**: It is not possible to time-differentiate vignettes.
- **Network-wide tolls**: The Czech Republic introduced time-varying charges to help to control congestion in 2010 – three years after the tolls were first introduced. In Austria, only the Brenner motorway has daytime and night-time tariffs, primarily designed to control noise emissions.
- **Concession tolls**: Some concessionaires in Spain and France have introduced time-varying charges, but this is not generally widespread. Some motorways in France experimented with time-varying charges to control weekend traffic (e.g. A1 motorway); despite success in shifting traffic to off-peak periods, the rates were discontinued. Slovenia has introduced charges that are differentiated according to day and night periods.

Overall, time-varying charges are an emerging area of intervention in terms of road charging. A more detailed analysis of the different approaches to charge differentiation and the impacts on air pollution, congestion and modal shift is provided in Section 2.6. Further detail on the charge structure in Europe, including the level of the charges is also provided in the Annex to this report

2.1.3.4 Mark-ups

In 2006 the possibility of a mark-up to tolls was introduced, allowing Member States to add 15% or 25% to the average toll on roads in mountainous areas. However, this is only possible for corridors with a TEN priority project, for which the additional revenues must then be used. These requirements mean that mark-ups are only possible in a few Member States, hence uptake has been limited. Austria applies mark-ups on some alpine links, due to the special environmental characteristics of these areas crossed by the motorways. These so-called '*Sondermauten*', or 'exceptional tolls', are levied on the Brenner, Tauern, Pyhrn, Karawanken and Arlberg links. Further detail on the charge structure is provided in the Annex to this report.

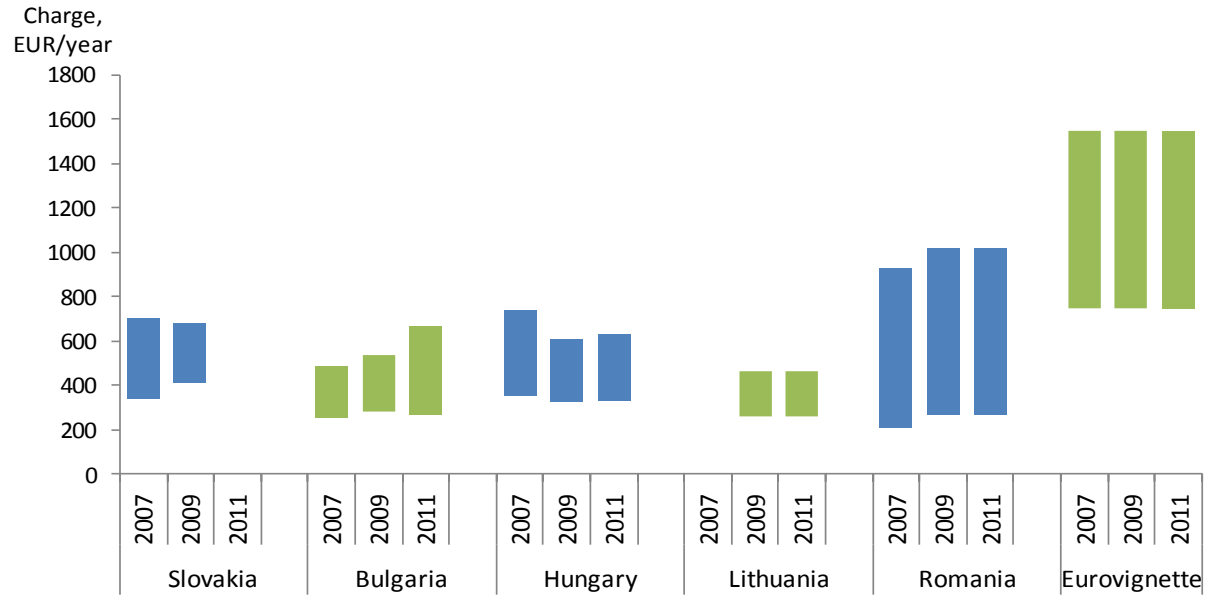
2.1.3.5 Charge levels across Member States

This section provides an overview of the charge levels set by Member States and their development over time. It also considers the principles by which the charges were calculated.

2.1.3.5.1 Vignette charges

The maximum level of vignette charges, including administrative costs, is subject to maximum rates set out in the Eurovignette Directive. Figure 2.2 shows the range of prices for an annual vignette in countries with vignettes in place during in 2007, 2009 and 2011. The range varies due to the different implementation choices as outlined earlier (variation in the level of charge according to parameters including the weight of the vehicle, number of axles, Euro class, time of day etc.).

Figure 2.2: Range of charge levels for vignettes in 2007, 2009 and 2011 (EUR/year)



Notes: Rates exclude purchase taxes, which range from 15% to 25% depending on the country. Note that Bulgaria and Romania joined the EU in 2007, whereas Lithuania, Hungary, and Slovakia joined in 2004.

The Eurovignette agreement (Belgium, Denmark, The Netherlands, Luxemburg and Sweden) stands out compared to the other vignette schemes for two reasons:

1. First, charges are high compared to countries with a national vignette – they are set at the maximum allowable level for annual charges as originally specified (Directive 1999/62/EC Annex II – although these maximum charges have been subsequently revised and raised). This is because the Eurovignette allows access to a much wider road network across the five member countries, as opposed to just a single country.
2. The charges for the Eurovignette have not been updated for some time (since 2001). Member States interviewed about this cited the complexity of obtaining agreement between all of the countries involved as the reason behind this.

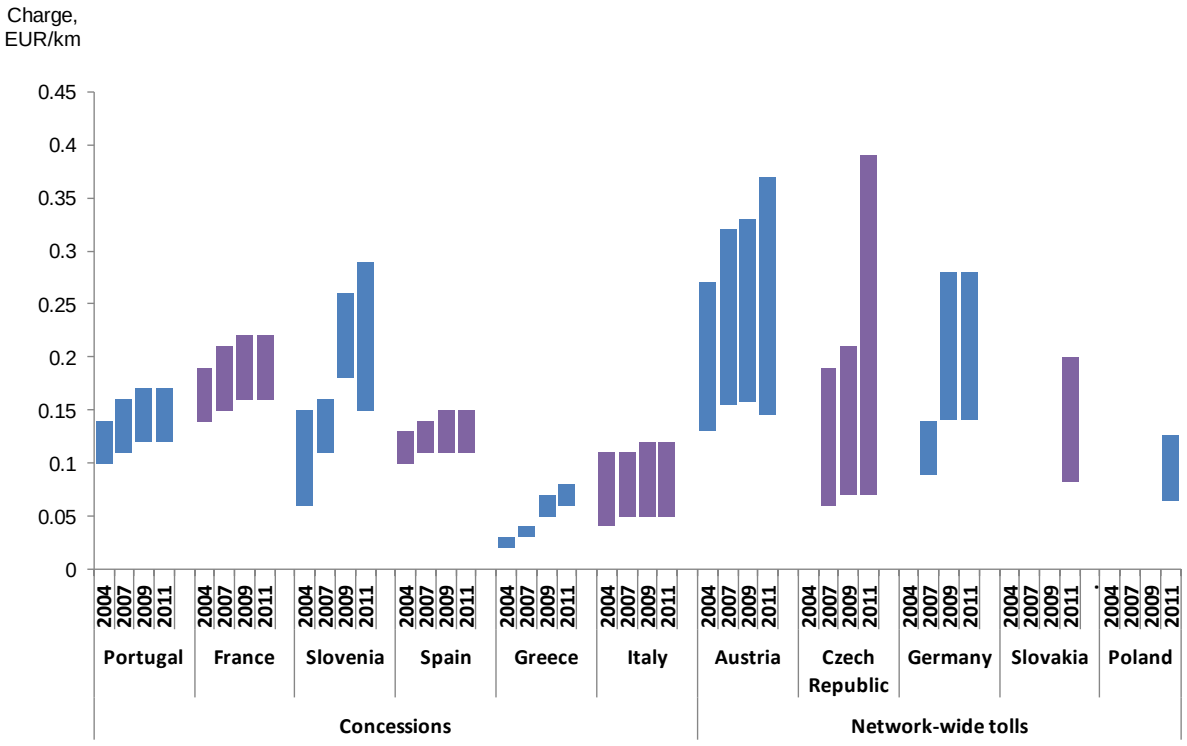
The charges for national vignettes are broadly proportional to the length of motorways in each country. In Romania, the charges are relatively high compared to its modest network of motorways; however, the scope covers the entire national network.

2.1.3.5.2 Toll charges

The level of toll charges Member States can apply is intended to cover the costs related to the infrastructure (namely, investment, operation and management). For motorway concessions, an allowable profit margin is also included.

Figure 2.3 shows the range of charges in place for European countries with distance-based tolls and the evolution over time. Tolls on concession motorways are not usually expressed as a distance-based charge (per km), but rather as a set charge for use of certain motorway stretches; therefore, the charges have been converted to a per-km basis to allow comparisons.

Figure 2.3: Range of charges in 2004, 2007, 2009 and 2011 for HGV (>12t) motorway tolls in Europe (EUR/km)

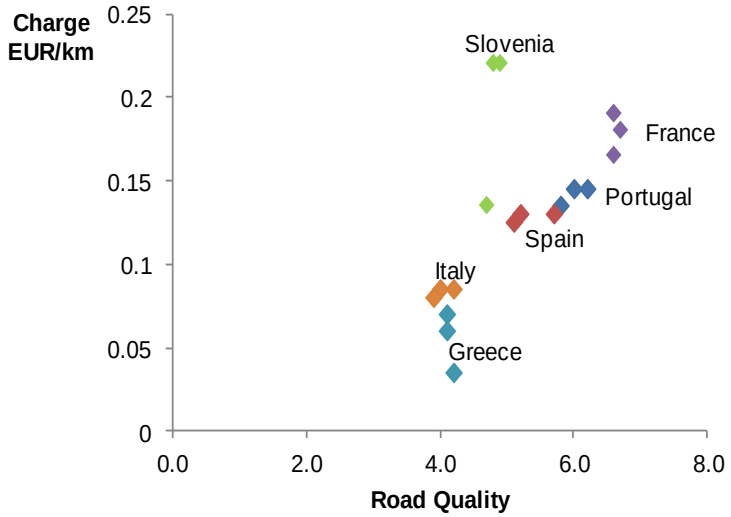


Notes: Rates exclude purchase taxes, which range from 15% to 25% depending on the country; rates are for HGVs (>12t) on motorways; exchange rate from PNL to EUR of 0.24 assumed. Tolls rates obtained from toll operator websites and interviews with Member States

Network-wide electronic tolls have a broader range of charge levels compared to concession tolls due to greater use of charge differentiation in these countries. Under the provisions of the Directive, the weighted average charge is permitted to cover the infrastructure costs; however, ultimately this is often a political decision oriented towards creating acceptance of the scheme and does not necessarily recover the full cost of the infrastructure (see Section 2.5.2.5).

The level of the charge on concession roads is based on contractual agreements aimed at recovery of costs and an allowable profit margin. The charge levels seen in Member States appear to be broadly correlated with the quality of the road infrastructure (as measured by the World Economic Forum) – particularly for Member States that are part of the EU-15, as shown in Figure 2.4

Figure 2.4: Concession road charges (EUR/km) and road quality



Notes: Data points for Member States show charges and road quality in 2011, 2009 and 2007. Indicator for road quality is derived from the World Economic Forum's Executive Opinion Survey.

Slovenia stands out for the relatively high charges compared to the quality of its roads. Greece also has slightly high charges compared to the quality of the roads, although this is much less pronounced. This is likely because traffic in these countries is much lower compared to the other Member States; 75-95% lower in Slovenia compared to other Member States shown and 50-90% lower in Greece. Therefore the fixed costs cannot be spread over as many users. Further detail on the charge structure in each Member State, including the level of the charges and the criteria for differentiation, is included in the Annex to this report.

2.1.4 Progress towards harmonising the charging systems

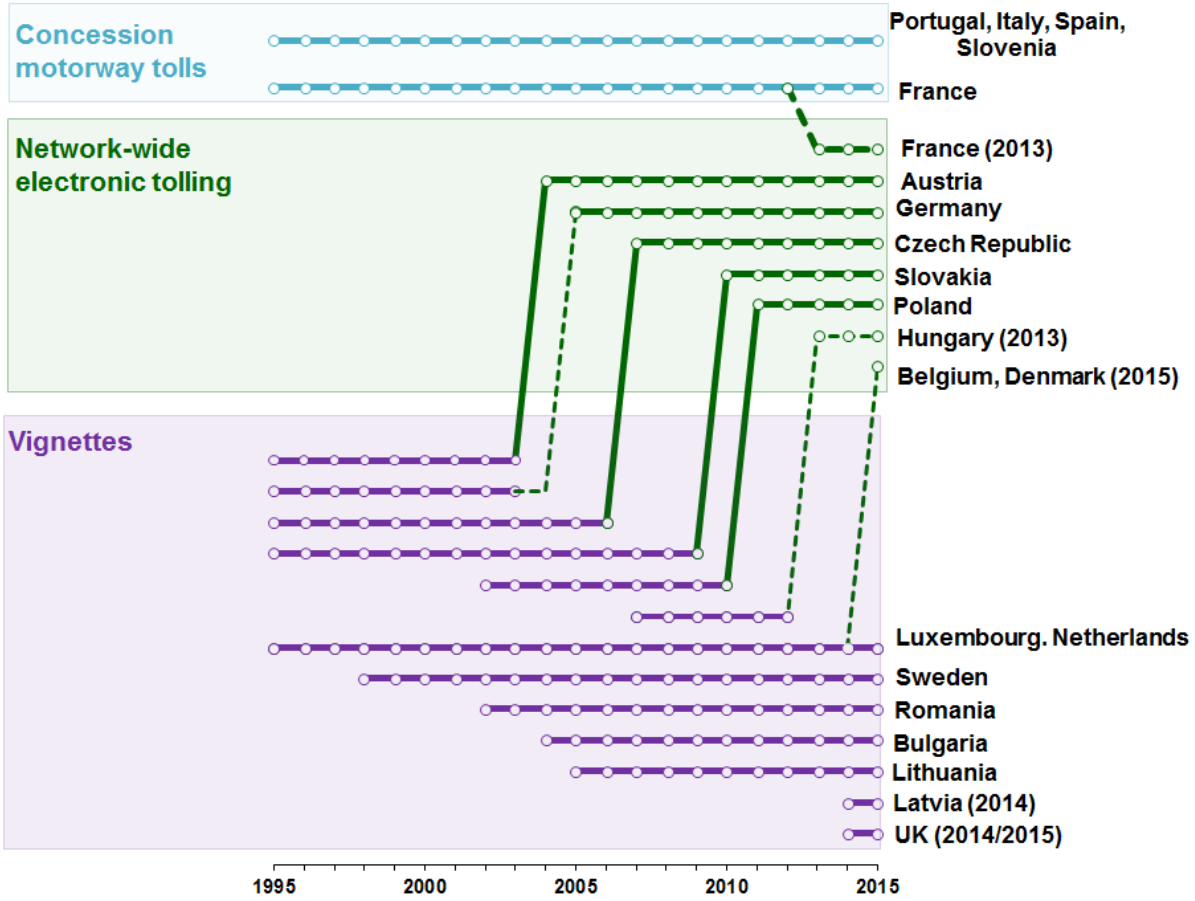
This section reviews the changing landscape of road user charging systems in Europe since 1995 in terms of progress toward applying charges and ways of gradually harmonising the charging systems for commercial vehicles. The trend over time has been for the development of either:

- **Network access charges:** vignettes or network-wide tolls
- **Extensive coverage of conventional tolled motorways:** based on concession motorways

Figure 2.5 shows the development of charging systems in Europe from 1995-2015, considering whether the system is based on concession motorway tolls, network-wide electronic tolling or vignettes. Two clear trends are visible:

- First, there is increasing uptake of road user charging systems in Europe, and no country has abandoned road user charging once it has been implemented (only changed to different schemes). Countries that have implemented their first charging scheme more recently include many of the "new" Member States, whereas those that are yet to implement schemes are typically island economies or sparsely populated countries for which the urgency may be considered lower compared to central European states.
- Second, there is a visible trend for countries to gradually migrate from simple systems (vignettes and manual toll plazas) to more complex electronic tolling systems.

Figure 2.5: Development of infrastructure charging systems in Europe 1995-2015



Notes: Future (planned) implementation dates are based on the most recent available data and could be subject to change. France plans to operate a dual system of concessions and network-wide tolling, starting in 2013.

Source: Ricardo-AEA

Regarding the migration from simple to complex systems, evidence shows that countries that started with vignette systems have tended to gradually transition to electronic network-wide tolls. Large central European countries have typically made the shift to electronic tolls earlier, while most of the countries in the Eurovignette are planning to implement electronic tolls in the near future. The only country with plans to move to electronic network-wide tolls that did not first start with a vignette is France, which is planning to implement tolls on the state-owned network while maintaining existing concession charges. On the other hand, the UK initially investigated tolls but did not implement them given the high cost and public resistance; instead, a vignette is planned as an interim measure, which may be more acceptable to stakeholders. In addition, Latvia intends to implement a vignette as a temporary measure given fierce stakeholder resistance, but hopes to replace this with a toll after an introductory period of five years. It is clear that stakeholder acceptance is a key issue in the stepwise development of road user charging, and it appears that public attitudes are less resistant to vignettes at first, but may eventually become accepting of tolls.

For countries with a long history of concession motorways, particularly in those with many different companies operating the infrastructure, large shifts in approach are uncommon, but there has been a gradual upgrading of the electronic toll collection systems to allow greater use of electronic fee collection (see Section 2.4), as well as introduction of tolls on additional motorways (including those that used to operate under shadow tolls in some cases).

2.1.4.1 Factors that affect harmonisation

Understanding the different approaches to infrastructure funding can shed some light on why road user charges have developed differently across Europe. Maintaining road networks and adding capacity requires large expenditures. To meet these needs, governments have typically opted for two broad infrastructure funding models:

1. Financing infrastructure through the general budget, or

2. Contracting out to concessions.

The most common instrument is funding through the government budget, although several countries have a mixture of the two approaches. The funding models and their linkages to implementation of road user charging systems are explored in more detail below.

2.1.4.1.1 Member States that have historically relied on the general budget to fund infrastructure

Almost all European countries that fund motorway development through general taxation have introduced network access charges (based on vignettes or network-wide electronic tolling). Countries in this group have typically started with vignettes, and many then subsequently transitioned to network-wide tolls. For instance:

- The first truly harmonised charging system in Europe was the Eurovignette system, set up in 1995 by **Belgium, Denmark, Luxembourg the Netherlands and Germany**. Sweden then joined in 1998. Although this operated for many years, almost all of the Members have plans to leave the system in order to set up electronic tolls (**Germany** left in 2003 to set up an electronic toll). Member States interviewed about their experience with the Eurovignette noted that it was politically difficult to agree any changes to the charge structure.
- **Bulgaria, Romania, Hungary, Slovakia, the Czech Republic, Poland and Lithuania** (all EU-12 Member States) developed national vignettes for trucks. However, **the Czech Republic, Poland and Slovakia** have since changed to electronic tolling for trucks, whereas **Hungary** has plans to introduce electronic tolls in 2013.

2.1.4.1.2 Member States that have historically relied on contracting out to concessions

The other group of countries are those with long histories of using concessions (decades before the Eurovignette Directive was adopted), including Spain, France, Italy and Slovenia. The concessionaires rely on toll revenues and in some cases government subsidy for the construction, operation and maintenance of toll roads. In many cases, contracts last for several decades. Thus, these countries have typically developed extensive networks of conventional tolls roads

- **Spain and Italy**: have concessions on elements of the motorway network, which are subject to tolls designed to recover the investment costs. In Spain, infrastructure costs relating to the toll-free road network are covered by the general budget. In Italy, financial public contributions represent exceptions for a limited number of highways with reduced traffic demand.
- **France**: entire sections of the motorway have been devolved to companies with varying degrees of public involvement. At present, plans are in place to introduce tolls on the state-owned network which comprises 10,000 km of main national roads and non-concessionary motorways and 5,000 km of smaller, departmental roads
- **Portugal**: The entire road network is currently under Private Public Partnership (PPP) concession contracts. Previously, around two-thirds were tolled and around a third were “SCUT” motorways subject to a shadow toll, where the government made volume-based payments to the concessionaires in place of the users. However, tolls were introduced in 2010 for all vehicles on the SCUT motorways. Apart from motorways, other national roads are not subject to road pricing schemes and are financed from the general budget.

Where different motorway links are operated by different concessionaires, inter-company remote payment systems have been developed at national levels – Via Verde in Portugal, TELEPASS in Italy and TIS in France. Further details of the situation in each Member State are provided in the following sections.

In addition, there are a number of Member States in which the situation is not as clear cut.

- **Austria** follows the concession funding model, although the system cannot be considered a typical concession, as the entire motorway network has been devolved to ASFINAG, a fully state-owned entity. ASFINAG is responsible for Austria’s primary road network, and receives all of its revenues from a nationwide system of user charges: a network-wide toll is in place for vehicles >3.5t, whereas a vignette is in place for passenger cars. In addition, the Alps crossings at Brenner and Taurem are tolled in order to recover the higher expenses of operating these specific sections. Before ASFINAG was set up, roads were funded from the general budget

- In the **UK** most of the network is funded through general taxation (although a vignette is expected to be introduced), whereas a small number of key infrastructure projects (such as the M6 tolled motorway, Dartford Crossing, Mersey Tunnels, Severn Crossing) are provided by private companies.
- **Slovenia** also follows a concession funding model, the concessionaire being a state-owned motorway company, DARS d.d. Slovenia operates a hybrid system where the state pays the concessionaire regardless of toll revenues (for instance for tasks connected to spatial planning). Slovenia changed from a vignette to a system of manual tolls from trucks in 2010 and plans to introduce free-flowing toll collection in 2015, consistent with the interoperability Directive (2004/52).**Poland** is another hybrid case, as sections of the road network are under PPP concession contracts, whilst the remaining ones are managed by the General Directorate for National Roads and Motorways (GDDKiA). Revenues from tolls are used to cover infrastructure costs. However there are additional financing mechanisms used to cover infrastructure costs: budget resources allocated by the National Road Fund; EU grants; loans (including EIB) for investment costs; and budget resources (other than National Road Fund) for operation and maintenance.

2.1.4.2 Views from stakeholders – sector associations and road hauliers

Overall, it seems that there is a general consensus amongst stakeholders that infrastructure charging schemes across Europe and within Member States are not harmonised, and various stakeholders emphasised the need to improve harmonisation.

Several stakeholders highlighted the significant differences between charging systems in different Member States, although it was noted that the Eurovignette has resulted in some harmonisation (where EU guidelines are followed, such as the methodology to calculate external costs and charges). It was suggested that a Regulation may be better able to achieve harmonisation than a Directive. Another stakeholder considered that there is need of clearer provisions on minimum charges for infrastructure and environmental costs, as well as other external costs. Although infrastructure charging is becoming more harmonised with time, additional provisions and policy support (for example by providing technical assistance) would help the more widespread adoption of road user charging across Europe. Funding could also be made available for developing system architectures, for example to overcome the hurdle of making the transition from vignettes to electronic toll systems.

Regarding the Interoperability Directive, it was noted that offering three different technology choices is not in line with harmonisation, and as a result current systems can be considered a patchwork as recent Commission documents illustrate.

2.1.5 Conclusions

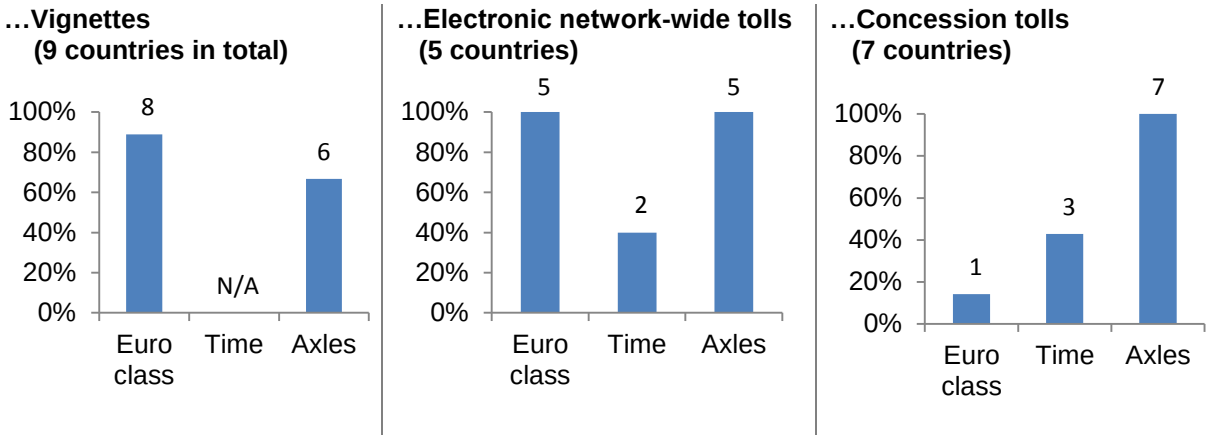
Road charging is now widely implemented throughout Europe, with a range of vignette or toll systems currently in place in 21 countries. This leaves six countries which still have no widespread road pricing: the UK, Latvia, Estonia, Finland, Malta and Cyprus.

The variation in approaches taken by Member States is due to several factors, including: the freedom accorded Member States to choose how they wanted to implement the Directives; the need for each Member States to design approaches which are most acceptable to their stakeholders; legacy issues such as concession contracts dating from before the Eurovignette Directive was in place.

The majority of countries include vehicles over 3.5t, as well as buses and coaches in their charging schemes. Only the Eurovignette countries and Germany restrict their charging to goods vehicles above 12t (excluding buses and coaches).

Most countries have adopted differentiated approaches based on Euro class (14 countries) and axles (18 countries). The only vignette that is not Euro-differentiated is Hungary, which plans to adopt a toll system soon. All network-wide tolls have complied with the requirement to differentiate by Euro class no later than 2010. By contrast, few concessions apply Euro-differentiation. Time-differentiation remains rare but may pick up as a result of the 2011 Directive (this is considered in the ex-ante evaluation in Section 2.6.1).

Figure 2.6: Differentiation of road user charges in Member States



From the outset, it was envisaged that the Eurovignette Directive would lead to gradual harmonisation across Europe. Despite the apparent fragmented nature of road user charging in Europe when viewed as a snapshot, significant progress has been made since 1995. Better technology is allowing more countries to introduce network-wide electronic tolling, which can generate higher revenues and better able to internalise external costs compared to other forms of charging. As a result, there is a clear trend towards greater use of these systems across Europe. The number of Member States with network-wide electronic tolling has grown from zero, before Austria introduced its system in 2004, to five today, with France, Hungary, Belgium and Demark also planning to implement tolls in the next few years. Evidence from implementation choices in Europe shows that Member States with electronic network-wide tolls are more likely to explore options for differentiating charges by Euro class, time of travel and axles compared to Member States using other forms of charging.

The only country with plans to move to electronic network-wide tolls that did not first start with a vignette is France, which is planning to implement tolls on the state-owned network while maintaining existing concession charges. The prevalence of concession motorways in other Member States, typically with long contract periods extending over several decades, is likely to slow any further harmonisation of charging systems in these countries at least until these contracts expire.

2.2 The policies of Member States as regards the use of charging revenues

2.2.1 Current situation – Ex-post evaluation Q.2

Purpose: This section analyses the current use of revenues from road charging by Member States, as a key element of the role and effectiveness of the Directives in improving the transport network and reducing congestion.

Context: The Eurovignette Directive recommends that revenues from road charges should be used to benefit the transport sector and to optimise the entire transport system but there is no obligation on Member States to earmark the revenues. Given that the Directive limits the level of tolls to what is necessary for the recovery of infrastructure costs, even in the absence of mandatory earmarking, the revenues from tolls are compensating for past, present or future infrastructure costs (the share of these costs which is attributable to heavy goods vehicles). However, in the absence of earmarking there is no guarantee that the financing of adequate infrastructure is assured.

Main Findings

Revenues are usually directed, at least in part, toward transport infrastructure investment; however the exact use of this revenue is not transparent.

- In all Member States except for those participating in the electronic Eurovignette, there is a stated desire to use revenues for transport investment.
- This takes various forms: under concessions, revenues are typically used for the construction and maintenance of the tolled roads (with the exception of France, where revenues are also used for other purposes); in other Member States it is also used to invest in the wider transport network, including non-tolled roads.
- In Eurovignette countries (Belgium, Denmark, the Netherlands, Luxemburg, Sweden) revenues contribute to the general state budget and there is no clear link between the Vignette revenues and its use.

2.2.1.1 Member States' stated approach for the use of road charging revenues

The Directive recommends that the revenues should be used to benefit the transport sector and optimise the entire transport system (i.e. not just for roads). However, as these recommendations are not legally binding, Member States may use the revenues at their discretion – they do not need to earmark revenues. The stated approaches in terms of use of revenues in each Member State are presented in Table 2-2 below.

Table 2-2: Member States' stated approach for the use of revenues from road charging

Type	Country	Use of revenue	Ear-Marking
Vignette	Belgium	The revenues from Eurovignette sales are split across the participating countries according to an agreed allocation approach. Eurovignette sales feed into the general revenues collected by the state. Its use then depends on budget decisions taken at national level.	×
	Bulgaria	The vignette revenues are allocated to the operation, current maintenance, repair and reconstruction works, but are not meant for new construction works.	✓
	Denmark	There is no earmarking of vignette revenues for transport investment; it feeds into the general budget. Revenues from the two toll bridges are collected by a state-owned entity which uses them to repay loans incurred during the construction phase, operate the toll and maintain the infrastructure	×

Type	Country	Use of revenue	Ear-Marking
	Hungary	Revenues from the vignette are used for maintenance and construction of the motorway network It also uses a concession system. Concessionaires are required to build, maintain, improve and operate the infrastructure, as well as to adjust or expand the infrastructure according to traffic volume. – income from user charges along with state subsidies was used entirely for the road network both charged and non-charged roads. Profits are taxed (incl. through VAT) and this part feeds into the national budget.	✓
	Lithuania	No information found.	
	Luxemburg	Revenue feeds into general taxation budget	×
	Netherlands	Revenue collected from the Vignette is not earmarked for use in the transport sector.	×
	Romania	The 'vignette was introduced with the aim of raising funds to improve existing infrastructure under the control of the Romanian National Company of Motorways and National Roads (RNCMNR). All revenues from vignette sales are fed into RNCMNR budget.	✓
	Sweden	Sweden uses the Eurovignette road charging system with the revenues collected going to the central government. In addition, these tolls are utilised to finance two cross-border projects to Norway and Denmark.	×
Electronic network-wide tolls	Austria	Revenue is earmarked for reinvestment in the transport sector. 20% of the net toll collected on the A13 from January 2006 is to be used for the Austrian part of the Brenner railway tunnel. Net toll income from motorways in mountain areas are to be given to the Government to finance priority areas of European interest within the same area as the toll was collected in.	✓
	Czech Republic	All revenues from highway and motorway tolls are received by the State Infrastructure Fund, which also collects revenue from the road tax, consumer tax on hydrocarbon fuels, and the transfer of assets from the National Property Fund (privatisation). Revenues are used to finance: • Construction, modernisation, of roads, motorways, railways and inland waterways. • Repair and maintenance of roads, motorways and railways • Safety accessibility to persons with restricted movement and orientation • Construction and maintenance of cycling paths	✓
	Germany	Revenues from toll roads are split as follows: 20% go to the toll operator for charging technology; the remainder is earmarked for improving transport infrastructure. Until July 2011, it was thought to be distributed as follows: 50% for the federal road network, 38% for the federal rail network, and 12% for inland waterways. There is no longer a prescriptive split. From July 2011 onwards after the introduction of Federal Truck Road Act, 100% of revenues (minus expenditure for operation, supervision, enforcement, management and harmonisation) has been earmarked for improving transport infrastructure for federal trunk roads (no longer divided between roads, rail and inland water way).	✓
	Poland	Poland stopped using the vignette system on 1st July 2011, and replaced it with a toll. The revenue is directly transferred to the National Road Fund and reinvested to the road network	✓
Concessions	Slovenia	Motorways are operated by DARS, a company that is 100% owned by the State. The revenues are used to finance motorway management and maintenance, construction of new motorways and repayment of loans.	✓
	France	Revenue raised is used by motorways operators to build, maintain, develop and operate the infrastructure and for high-speed railways. However, they are under no obligation to adapt or expand the infrastructure in accordance with traffic volume, unless this has been specifically mentioned in the original specification	✓

Type	Country	Use of revenue	Ear-Marking
	Greece	Until 2007 the toll system was run by TEO, which is owned by the Government. The revenue was used to finance, maintain and operate the network. Since then, a concession system has been introduced for the majority of tolled roads. Toll charges are used to finance part of the construction, as well as maintenance and improvement of the highways. Their profits are subject to VAT, which goes to the general budget	✓
	Italy	All the revenues currently raised from charging are used by the motorway operators for maintaining and operation. Any future charging revenue is earmarked to the transport sector.	✓
	Portugal	The revenue from tolls is directly assigned to a legally independent entity in charge of financing, building, maintaining, and operating the infrastructure. Profits are also subjected to company taxes and VAT and therefore contribute to the national budget.	✓
	Spain	Concessionaires are responsible for financing, building, maintaining, and operating the infrastructure for Spanish toll motorways. Their profits are subject to VAT, which goes to the general budget.	✓
	Slovakia	Some of the revenue is thought to be earmarked for reinvestment in the transport sector, to fund the construction and maintenance of highways and motorways	✓
	Ireland	Major new road developments in Ireland are funded through Public Private Partnerships. Therefore the toll revenues go both to the private companies who invested in the road as well as the public sector. There is no mention on how the toll revenues that go to the public sector are distributed.	✓□ (private partners only)

As seen above, there are two broad camps when it comes to the use of revenues from road charging:

- **Eurovignette countries**: in these countries, the vignette is treated as any other tax and revenues are added to the general budget. Expenditure will then be decided at national level according to the priorities identified in their spending review. There is therefore no clear linkage between road charging revenues and their use.
- **Other countries**: all other countries assign revenues to transport investment, although to various degrees and through various channels. In the case of concessions, the use of revenues is usually clearly stipulated in the agreement between the concessionaire and the state and covers maintenance and construction of the tolled roads. In some cases, funding may also be used for transport projects beyond the charged roads themselves (e.g. Czech Republic and Austria, while Germany stopped this system in 2011).

Ireland is a hybrid case, with revenues allocated to private partners focusing on the toll road network and revenues allocated to public partners not being earmarked.

The majority of Member States with road charging in place have elected to earmark revenues for transport-related investments. This is an essential tool to improve the political acceptability of road charging. This was highlighted during the public consultation conducted as part of this study, where the vast majority of respondents (over 95%) agreed with the need to secure funds to maintain transport infrastructure.

2.2.1.2 Total revenues

Estimates of revenues from the tolls and vignettes are presented in Table 2-3.

Table 2-3: Revenues from HGVs charging (unless otherwise specified) by country (€m)

Country	Revenues for vehicle types	2004	2005	2006	2007	2008	2009	2010	2011
Vignettes									
Belgium	>12t	97	101	76	80		150	120	64
Bulgaria	All vehicles								95
Denmark	>12t	53	61	61	63	55	57	49	48
Hungary	>3.5t	n/a	n/a	n/a				74	82
Lithuania	Goods vehicles, buses and agricultural vehicles	n/a			26	27			
Luxembourg	>12t	4.6	10.5	8.2	9.0	4.4	19.7	10.2	10.8
Netherlands	>12t	110	111	111	116				150
Sweden	>12t			72	75	78	89		
Electronic network-wide tolls									
Austria	>3.5t	750	775	825	984	1,062	926	1,031	1,062
Czech Republic	>12t before 2010; >3.5t since 2010	n/a	n/a	n/a	219	199	245	222	263
Germany	>12t	n/a	2,593	3,046	3,310	3,490	4,327	4,511	4,475
Concessions									
Slovakia	>3.5t	n/a	n/a	n/a		75	90	88	175
France	HGVs	1,913	2,001	2,101	2,274	2,422	2,668	2,394	2,488
Greece	All	112	117	154	155	171	100	550	565
Italy	All	3,766	3,954	4,071	4,333	4,474	4,534	4,545	4,836
Portugal	All	502	633	640	665	714	723*	738	725
Spain	All	1,565	1,755	1,677	1,822	1,992	1,998	2,004	1,821
Slovenia	>3.5t	120	112	139	152	173	202	238	290

**Of which 144 was from HGVs*

Sources: ASECAP for tolls; OECD, ITF online database; SPF Finances, 2011; Danmark Statistik http://www.dst.dk/da/ *Ministere des Finances du Luxembourg, Rapport d'activites 2006 and Rapport d'activites 2011 ; Member State Replies to the questionnaire; Company annual reports and* http://www.3k.gov.hu/servlet/download?type=doc_field_file&field=file&id=4632

Data on revenues disaggregated by vehicle type is patchy, and despite extensive stakeholder interviews it was not possible to build a complete dataset. From the available evidence, it appears that revenues from HGV vignettes are rather low, reflecting the limited revenue generation potential of vignette systems – this is in part due to caps on the maximum chargeable amount set in the Directive, but several Member States charge rates below the cap in order to ensure affordability. The revenues from network-wide HGV tolls are larger compared to those from HGV vignettes and are usually larger than those from concession motorways (bearing in mind the revenues from concessions include all vehicles in most cases). Figures obtained for concession motorways are rather high because the revenues were not available disaggregated by HGVs in most cases, and therefore cover all vehicle types. In many countries, the recession in Europe has led to revenues that are significantly lower than anticipated in recent years.

2.2.2 Conclusions

In most cases Member States use revenues at least in part for transport; however, the practical implications are less clear as most countries do not have explicit rules or plans on how to allocate these revenues. This takes various forms: under concessions, revenues are used for the construction and maintenance of the tolled roads; in other Member States it is also used to invest in the wider transport network.

In Eurovignette countries (Belgium, Denmark, the Netherlands, Luxemburg, Sweden) revenues contribute to the general state budget and there is no clear link between the Vignette revenues and its use.

Countries with network-wide tolls and concessions have far higher revenue generation potential compared to those with vignettes; however the recent recession has led to much lower revenues than originally anticipated in many countries. Furthermore, the economic crisis and the Stability Pact have put additional constraints on the possibility of financing the maintenance of infrastructure from increased public debt and/or tax payer's money.

The urgency of finding new sources of funding has triggered debates in an increasing number of EU Member States, and at the European level, on the possibility in the future to rely less on tax payers and more on road charging for the financing of transport infrastructure

2.2.3 Future situation – Ex-ante evaluation Q.4

Purpose: An overview of the current use of revenues is already provided in the context of the ex-post analysis performed in the section above. For the ex-ante evaluation, the main focus on the impact of the new provisions included in Directive 2011/76/EU on the use of revenues.

Context: According to the Directive, revenues generated from infrastructure and external-cost charges should be earmarked to support the transport sector with the purpose to optimise the entire system (Article 8b.2). In parallel, the Directive recommends that revenues obtained from mark-ups should be invested in financing the construction of priority projects of European interest that are listed in Annex III to Decision No 661/2010/EU of the European Parliament (Article 7f.1(a)). In exceptional cases concerning infrastructure in mountainous region a mark-up may be added to the infrastructure charge levied on specific road sections which suffer from acute congestion, or the use of which by vehicles in the cause of significant environmental damage (Article 7f.1).

Main Findings

The available evidence from stakeholder interviews suggests that:

- The likely impacts of the new provisions of the Directive on the allocation of revenues are not clear at this point in time. In addition, responses from Member States during the stakeholder interviews showed that an assessment of the impact was not anticipated to be straightforward;
- The proportion of total revenues from infrastructure and external-cost charges that will be earmarked to finance the transport network will vary significantly between Member States;
- Regarding the use of revenues derived from the simultaneous application of mark-ups and infrastructure charges in the context of financing the construction of priority projects of European interest, information of note has been received from Italy and Austria, both of which are currently collecting funds to finance the common project of the Brenner rail base tunnel (part of the transport corridor from Berlin to Verona)

2.2.3.1 Description of relevant provisions in the Eurovignette Directive

The provisions in Directive 1999/62/EC, as amended by Directive 2011/76/EU Article 9.2 state that "*revenues generated from infrastructure and external costs charges, or the equivalent in financial value of these revenues, should be used to benefit the transport sector, and optimise the entire transport system. In particular, revenues generated from external cost charges, or the equivalent in financial value of these revenues, should be used to make transport more sustainable".* Further, the provisions state that "*This paragraph shall be deemed to be applied by Member States, if they have in place and implement fiscal and financial support policies which leverage financial support to the trans-European network and which have an equivalent value of at least 15 % of the revenues generated from infrastructure and external cost charges in each Member State."*

In particular circumstances, a mark-up can be levied in parallel with infrastructure charges to finance priority projects according to Article 7f.1(a) and Annex III to Decision No 661/2010/EU of the European Parliament and of the Council of 7 July 2010.

2.2.3.2 Assessment

The main purpose of the ex-ante evaluation was to investigate whether the new provisions included in Directive 2011/76/EU will have an impact on the use of revenues collected from road infrastructure charging in each Member State. Representatives from Member State competent authorities were sent questionnaires and interviewed on these topics, which provided the following information:

- **Italy and Austria:** stated that they are inclined to earmark external-cost revenues according to the provisions of the Directive, although the share that will be devoted to the transport sector was not mentioned.
- **Poland and Portugal:** indicated that revenues are already fully earmarked for the road transport network.
- **The Czech Republic:** confirmed that the rate of allocation will depend on the specific approach used for levying external-cost charges.
- **The Netherlands:** declared that none of the revenues from road charges will be earmarked in the transport sector.
- **Denmark:** stated that revenues are not currently earmarked due to country's policy on funds. A different approach was foreseen for the revenues to be collected under the tolling system which has been shelved following the decision of the new Danish government. Revenues were expected to be allocated to a wide variety of uses: a proportion of the revenues were supposed to go to an Infrastructure Fund (around 1 billion DKK (M€134) from 2015-2020); another portion to supporting a general reduction in income taxes (about 0.5 billion DKK (M€67); and a portion to improving public transport. Finally, a portion of these revenues would have been destined to the general budget (about 0.5 billion DKK (M€67)) and a portion would have been reserved for administration costs.
- **Latvia:** is expected to raise €15 million from the future vignette in the first year of operation. All the revenues earned though these road charges will be reinvested within the road transport sector (maintenance and investments).
- **Hungary:** after the implementation of the Single Tolling Act in 2013, the revenues will initially be directed into the General State Budget, but will subsequently be re-directed to the transport sector for public-private partnerships and environmental improvements. The Tolling Act lists the preferences for how the revenues should be allocated.
- **France:** estimates from the French Government forecast around 1.2 billion Euros of revenues from the HGV Eco-tax in the base year. Revenues will be allocated to the Agency for Financing Infrastructure in France (AFITF) and local authorities. Part of the proceeds of the tax will be invested in infrastructure development and projects developed under the "Grenelle Environnement" agreement, to protect the environment and promote sustainable development.
- **Finland and Slovenia:** were unable to provide further insights on this theme.
- **Czech Republic and Austria:** stated that allocation of revenues will be modified when the external-cost charges are introduced, while in the **Slovenian** case a partial effect from cross-subsidisation is expected.
- **Italy and Austria[5]:** have indicated that revenues from simultaneous application of infrastructure charges and mark-ups will be used to finance relevant corridor projects as required in the Annex III to Decision No 661/2010/EU. It is also worth noticing that the two countries are currently collecting funds to finance the common project of the Brenner rail base tunnel (part of the transport axis Berlin-Verona).

As far as the other countries are concerned the topic is either not applicable or no comments were provided.

[5] Italian tolls cover both passenger car and freight vehicles. For Austria there is a vignette for passenger cars and a toll for HGVs.

2.3 Policies on enforcement and treatment of occasional users

Purpose: This section explores how different groups of users are treated through the use of discounts, as well as the enforcement methods used in each Member State. It will help determine the impact of the Directives in terms of equity and effectiveness.

Context: Member States must ensure that systems are properly implemented and may establish penalties to achieve this aim. However, these must be effective, proportionate and dissuasive. These are key factors to maximise the effectiveness and efficiency of the measures.

Main Findings

Frequent HGV users are often eligible for discounts

The extra cost placed on occasional users may reflect the comparatively higher administrative burden they place on the system, although it is not clear to what extent this is reflected in the tariff differences. On the other hand, favouring frequent users could be considered to be contrary to the 'user pays' principle which is supposed to underpin the Directives.

- Daily passes for vignette systems are offered in all Member states, at rates in compliance with the €11 maximum.
- Compared to the annual charge for a vehicle in the same category, daily rates are offered at 1-3% of the charge, weekly rates at 3-7% and monthly rates at 10-17% across the countries with vignettes in place.
- Network-wide tolls do not usually offer discounts to frequent users. The exception in the Czech Republic, which offers discounts of up to 13% to frequent users.
- In the case of concession roads, discounts are frequently offered as the tolled routes often compete with untolled roads. Although in most cases the discounts do not exceed the European 13% cap set out in Directive 2006/38, discounts of up to 50% are still offered in Spain and of up to 15% in Greece.

Enforcement is achieved through manual and automated checks, along with penalty fees

- Enforcement is critical to the effectiveness and acceptability of the charges. It tends to be undertaken through a combination of manual and automated checks in most countries.
- Penalties, usually amounting to several hundred Euros, are applied to non-compliant users. In some cases, the fee can be as high as several thousand Euros.

The violation rate appears to be of the order of a few percent in the majority of cases

- Only limited and anecdotal evidence on the effectiveness of enforcement is available. The available evidence suggests that non-compliance is almost zero in countries with physical barriers; around 1-3% for electronic tolling and 2-15% for countries with vignettes.

2.3.1 Treatment of different user categories

Most countries provide a range of discounts and exemptions to various different user categories. In many cases, these discounts reflect actual savings in administrative costs, or allow exemptions for vehicles providing a public service (such as emergency services or armed forces). However, some forms of discounts could discriminate against international traffic. One of the key aims of the Eurovignette Directive is to prevent competitive distortion through discrimination *"..directly or indirectly, on the grounds of the nationality of the haulier or the origin or destination of the vehicle".* Therefore, this section reviews the level of discounts provided in Member States and the possible mechanisms for discrimination.

2.3.1.1 Vignettes

For vignettes, potential discrimination could occur through two main mechanisms:

- Excessive minimum charges:
  - Through excessive rates for daily permits.
  - Through the absence of permits for short time periods (daily or weekly).
- Excessive discounts for vignettes covering longer time periods, e.g. annual vignettes compared to daily charges.

The Eurovignette Directive defines the fair minimum charge as a one day permit (Annex II) of no more than €8 in Directive 1999/62/EC, and was updated to €11 in Directive 2006/38/EC. As shown in Table 2-4, all countries currently comply with these maximum rates (although Hungary charges slightly more than €11 currently, due to fluctuations in exchange rates).

The absence of a daily permit could be considered discriminatory, as it suggests that foreign hauliers must buy a permit for a longer time period, which raises the minimum charge. Hungary, Bulgaria and Romania's vignettes all initially lacked daily rates; therefore the minimum charges were for longer vignettes, at €34 (10 days) for Hungary, €49 (one week) for Bulgaria and €13 (one week) for Romania. However, daily rates have subsequently been introduced in these three countries. Currently, daily vignettes are available under all European HGV vignette schemes, which show that there is only a small minimum charge imposed on foreign vehicles.

Table 2-4 compares the equivalent day rates of weekly, monthly and annual tariffs with actual day rates in Vignette countries, along with the ratio of each charge to the equivalent annual charge. The range of prices reflects various categories based on weight or number of axles, which are not typically available for daily vignettes. The monthly and weekly rates should be in proportion to the duration of the use made of the infrastructure.

Table 2-4 Vignette charges for regular and occasional users (€)

Country	Day charge	Weekly charge (equivalent day rate)	Monthly charge equivalent day rate	Annual charge equivalent day rate
Eurovignette	8	2.9 - 4.7	2.5 – 4.2	2.1- 3.5
As % of annual rate	*1%*	*3%*	*10%*	
Lithuania	11	7	3.8	1.45 – 2.8
As % of annual rate	*1-2%*	*5-7%*	*12-17%*	
Bulgaria	7	2.4-5.4	1.5-3.7	0.7-1.8
As % of annual rate	*1-2%*	*6%*	*17%*	
Hungary	11	4.2-8.0	1.6-3.0	1.2-2.3
As % of annual rate	*1-3%*	*7%*	*11%*	
Romania	4-11	2.9-7.9	1.7-4.8	0.9-3.4
As % of annual rate	*1%*	*6%*	*16%*	

Notes: % of annual rate refers to the rate for vehicles in the same category.

In countries with vignettes in place, regular users can benefit from discounts in the form of cheaper rates for weekly, monthly and annual charges compared to daily charges. No precise criteria were defined in the 1999 Directive to identify what scale of discount is appropriate with respect to the annual rate for vignettes covering different time periods. However, provisions have been introduced in Directive 2011/76/EC (Article 7a), which state that "*The monthly rate shall be no more than 10 % of the annual rate, the weekly rate shall be no more than 5 % of the annual rate and the daily rate shall be no more than 2 % of the annual rate.*" Although these provisions will not have been transposed yet, they can be used here as a guide to the appropriate charge structure.

- Eurovignette countries are the only ones already in compliance with the new limits in Directive 2011/76/EC for all permit periods
- All other countries tend to offer discounts of 1-2 percentage points higher than the new limits in Directive 2011/76/EC for the daily and weekly charges, whereas monthly charges are 1-7 percentage points higher.

This suggests there is some room for improvement, but in most cases any amendments to charge levels would be relatively modest. Following the approval of Directive 2011/76/EU, Romania is already analysing how to modify its current tariffs so that they observe the recommendations.

2.3.1.2 Tolls

Table 2-5 shows current discounts available for frequent users of toll roads. For toll roads, there are likely to be some savings in administrative costs for frequent users over occasional users, and in recognition of this many countries offer a discount to frequent users. Directive 1999/62 did not specify

provisions for frequent user rebates. This resulted in several Member States introducing discounts that were considered to go beyond the savings in administrative costs. Therefore, in the amended Directive 2006/38/EC, rebates were capped at a maximum of 13%; a level considered sufficient to cover the actual savings in administrative costs for the infrastructure operator.

Table 2-5 Treatment of regular users versus occasional users on toll roads

Type	Country	Discounts for regular users
Network-wide tolls	Austria	None found
	Germany	None found
	Czech Republic	Discounts are provided for regular users depending on the level of electronic toll reached. Discounts are as follows: • 100,000CZK earns 5% discount • 150,000CZK earns 8% discount • 250,000CZK earns 11% discount • 400,000CZK earns 13% discount
	Slovakia	None found
	Poland	No Discounts available
Concessions	France	Up to 13% discount for use of automatic payment system.
	Greece	Only a few of concessionaires provide discounts for regular users that have electronic toll passes. For instance, Attikes Diadromes S.A. offer HGVs a monthly subscription programme (~20% discount for 90 crossings) or a pre-paid subscription programme (up to 10% discount). On the TEO network, discounts of 5-15% are provided for regular users that have electronic toll passes
	Italy	There are different percentages of reduction of tolls calculated according to the EURO classes (multiplied by 0.5 for Euro II; 1.5 for Euro III and 2.0 for Euro 4+), and allowed only in levying tolls by deferred billing and with electronic toll system. The resolutions of the years 2006 to 2011 had set in the highest band at percentage reduction of 13%. • from 200,000 to 400,000: 4.33% • from 400,001 to 1,200,000: 6.50% • from 1,200,001 to 2,500,000: 8.67% • from 2,500,001 to 5,000,000: 10.83% • Over 5,000,000: 13%
	Portugal	Previously locals did not pay the first 10 times they used the motorways a month and got 15% off the normal toll charges; however discounts for locals were removed recently and replaced in 2012 by a 10% discount on SCUT motorways during the day and 25% at night.
	Spain	Up to 50% discount found depending on the concessionaire (as of December 2012 on the A7, Alicante – Cartagena)
	Slovenia	For toll road users paying the toll by means of an electronic medium (DARS Card, DARS Transporter Card or ABC electronic tag) for EURO III vehicles and above, a reduced toll is paid.

Sources: Member States interviews; http://www.road-tolls.co.uk

Discounts for frequent users are not in place for most network-wide tolls – only the Czech Republic offer discounts of up to 13% for frequent users, which is within the permissible range specified in the Eurovignette Directive.

Most concession roads offer discounts for frequent users. This is likely because concession motorways often compete to varying extents with untolled routes (which does not occur as frequently for network-wide tolling), and returns on investment depend on traffic volumes. The introduction of a cap of 13% on discounts to frequent users in Directive 2006/38 has led to some changes in Member States with concession roads that previously offered large discounts. These are summarised as follows:

- **France**: There are no common national toll levels, as all of the motorway operators apply different fees. In the past (until 2008), users could be eligible for considerable discounts (up to 30%); however, following a warning from the European Commission in 2006 these discounts are now capped at 13% in accordance with the 2006 amendment to the Directive.
- **Spain**: Users can obtain discounts of up to 50% (still in place as of December 2012). In 2007 the European Commission referred Spain to the Court of Justice for failure to respect the 13% limit (EC, 2007).

- **Italy:** Frequent users used to be eligible for considerable discounts, but these are now capped at 13%.
- **Portugal** previous allowed local residents 10 free trips and 15% of subsequent charges on SCUT motorways (those that used to be free to users under a shadow toll system). However, the EC Directives do not allow discounts based on where a person lives, so they have recently been removed.
- **Greece:** Most concessionaires do not provide discounts; Attikes Diadromes S.A. offer HGVs a monthly subscription program (~20% discount for 90 crossings) and TEO offers discounts of 5-15%. No information on European Commission action was found.

In most countries, discounts were provided that went beyond the 13% limit; however, all cases have subsequently been resolved with the exception of those in Spain and Greece.

2.3.1.3 Other types of discounts

As seen in Table 2-1 most countries apply emissions-based differentiation. This is reflected by lower tariffs for the less polluting vehicles. This is examined in more detail in Section 2.6. Additional discounts in each Member State that were highlighted during the interviews carried out as part of this project include:

- **Lithuania:** there are discounts for agricultural vehicles and special road vehicles (LRA, 2011).
- **Hungary:** Buses >7.5t fall into the category below the one they would belong to based on their total permissible weight.
- **Germany:** Has an additional provision, for vehicles that have retrofitted particle filters, which qualify under the cleaner Euro V and Euro VI classes. This gives an Incentive to operators / owners to retrofit the technology and make the vehicles as clean as some of the new ones available, in terms of air pollution.

Exemptions also exist in most Member States for vehicles delivering a public service (e.g. police, ambulances, fire services, and armed forces) as well as vehicles undertaking necessary works on the road network.

2.3.1.4 Views from stakeholders – sector associations and road hauliers

Several stakeholders expressed doubts over whether discounts for frequent users could change travel behaviour. It was further highlighted that discounts increase the complexity of a scheme and lack transparency. The German particle filter provision was mentioned specifically by one stakeholder, as it could be difficult to apply for foreign users, especially since information seems to be available only in German.

2.3.2 Enforcement of road charging

The Eurovignette Directives place responsibility for the enforcement of road charging at the Member State level. Successful enforcement can lead to reduced loss of revenues, higher acceptance of the system and a more effective road-charging policy, which in turn further encourages compliance. In Directive 2006/38, Member States are required to implement enforcement systems and define "*effective, proportionate and dissuasive*" penalties to discourage users from cheating the system.

Table 2-6 summarises these key aspects of the road charging enforcement system in Europe. There are two broad methods for enforcement available to Member States: manual checks or automated checks. Manual checks rely on tolls barriers and enforcement officers; automatic enforcement stations rely on a combination of technologies including laser scanners, automatic licence plate reading equipment and video cameras. If users are not compliant, they may be liable to pay a penalty charge.

Table 2-6 Enforcement approaches by Member States

Type	Country	Manual checks	Auto checks	Penalty charge	Notes
Vignette	Belgium	✓	✓	Unknown	From 1st of October 2008 the Paper Eurovignette was replaced by an electronic vignette. The authorities can check vehicles in free flow as the payment is registered in a common database.

Type	Country	Manual checks	Auto checks	Penalty charge	Notes
	Bulgaria	✓		€50	The responsibility for enforcement resides with the road police.
	Denmark	✓	✓	Unknown	Eurovignette
	Hungary	✓		€220-280 if paid within 30 days, else €885-1110	Inspections based on stopping vehicles
	Lithuania	✓		€174-€750	Failure to pay the user charge for using roads of the highest category imposes a fine
	Luxemburg	✓	✓		Eurovignette
	Netherlands	✓	✓	€246	Eurovignette. Fine increases up to several thousand Euros for repeat offenders
	Romania	✓	✓	€280-1000	Checkpoints at border crossings, cameras and inspection officers. Electronic vignette since 2010.
	Sweden	✓	✓	€50	Eurovignette
Electronic network-wide tolls	Austria	✓	✓	€220 (non-payment) €110 (partial non-payment)	Approximately 100 gantries are equipped with stationary enforcement systems that record license plates. Also has portable enforcement, involving temporary upgrade of roadside equipment to include enforcement capabilities. Mobile enforcement units also patrol.
	Czech Republic	✓	✓	Unknown	100 stationary gantries, portable, and mobile devices
	Germany	✓	✓	€100-€400	The automated system on autobahn operates via approximately -300 gantries with DSRC and cameras; In addition, there is a mobile fleet of 300 vehicles with DSRC and roadside stationary checks covering approximately10% of journeys.
	Poland	✓	✓	€375-750	32 enforcement gantries, 12 border crossing gantries and mobile enforcement units
Concessions	Slovenia			€300-€800	
	France	✓		€35	Toll gates ensure that almost all payments are made. Video enforcement is prohibited by law.
	Greece	✓	✓	€200	Toll gates aim to ensure that payments are made.. In addition to a fine, the police may revoke the driver's license, and the vehicle plates for 20 days..
	Italy	✓	✓	Up to €6000	The enforcement system is composed by a video camera and Licence Plate Recognition
	Portugal	✓	✓	Ten times the toll payment owed, minimum €25	Regular checks are carried out with the cooperation of the police
	Spain	✓	✓	€90	Toll gates ensure that almost all payments are made.
	Slovakia	✓		€120-1300	6 fixed gantries; 40 mobile control gantries, 30 toll police vehicles. Mobile toll enforcement patrols. The penalty has to be paid in cash immediately, otherwise the driver's licence will be taken away until the payment is made

Sources: European Commission (2006); Member States interviews; toll operator websites

Most countries use a combination of manual and automated checks. In particular:

- **Vignettes:** Countries belonging to the Eurovignette use manual and automated checks, and penalties are in the range of €50-250. National vignettes in Romania and Lithuania appear to have less comprehensive checks, but penalties can reach €750-1,000, although lower fees offered for partial non-compliance (such as registering the incorrect Euro class).
- **Electronic network-wide charging systems:** All countries employ enforcement through stationary and mobile units. The penalty charges are usually several hundred Euros, and less severe offences (such as incorrect usage of the On-Board Unit or partial non-payment) are fined at a lower rate.
- **Concessions:** Most have tolls with physical barriers, which are sufficient to prevent most violations. Penalty charges are usually low, but can be considerably steeper in Italy and Portugal – up to several thousand Euros in Italy and at least 10 times the toll payment owed in Portugal.

The penalty charge structure in most Member States is staged, so that more severe offences, repeat offenders and larger vehicles pay higher rates. As can be seen from Table 2-6, where ranges are indicated, the higher rates are only imposed for more severe offenses. Thus, in all Member States the minimum penalty for non-compliance does not exceed €375.

The aim of compliance activities is that on average a compliant user pays less than a non-compliant one. There are two options that have been adopted in Member States to achieve this target.

- The first is to have many compliance checks and a low penalty – this appears to be the favoured option in Member States with electronic network-wide charges.
- The second is to have only occasional compliance checks but penalty levels reaching much higher levels (although starting at comparable levels to those in the former group). This structure is common for concession motorways and national vignettes.

2.3.2.1 Violation rates

Examining the violation rates for different Member States provides some indication of whether enforcement procedures are effective and dissuasive. However, data on violation rates is rare, as some authorities are reluctant to share this information because it could encourage additional violations (especially where violation rates are already high). From the available information, it appears that violation rates depend on the technology used. Table 2-7 shows typical violation rates depending on the road user charging system in place, along with examples from various Member States.

Table 2-7: Typical violation rates for different types of road user charging systems

Charging system type	Typical violation rate	Examples
Toll plazas with barriers	<1%	Since the barriers prevent access to the motorway without payment, violation rates are typically very low and are mainly due to tailgating. However, they do cause disruption to free flow of traffic. In 2005, the reported violation rate was <0.5% in Greece; 0.1% - 0.2% in Italy; <1% in Spain (European Commission, 2006).
Nation-wide electronic charging	**1-3%**	In Germany, violation rates have been estimated at 3% in 2005 and 1% in 2006 (TUHH, 2008); in Austria it was around 2.5% in 2004 (Czako, 2004) and 1.35% in 2006 (European Commission, 2006); in the Czech Republic it was 2% in the first year of operation (2007). All of these countries use stationary and mobile enforcement devices.
Vignettes	2-15%	Interview responses indicated that the violation rate for the Eurovignette is around 10%. An assessment of vignettes for private vehicles in Romania found that the estimated non-compliance rate for domestic vehicles is 15% (foreign vehicle compliance rate is unknown) (Booz, 2010). The same study found violation rates of 2-3% in Hungary and 3% in Slovenia. Violation rates for freight vehicles were not available but are assumed to be of the same order of magnitude as the enforcement procedures are similar – and may be even less, as the penalty fines tend to be much higher for trucks compared to those for private vehicles.

Thus in most cases for which data were available, violation rates are very low and enforcement procedures could be considered effective.

2.3.2.2 Views from stakeholders – sector associations and road hauliers

One of the stakeholders interviewed as part of this evaluation mentioned the idea of Europe wide enforcements that treat all operators in the same way and highlighted the need for co-operation between Member States and enforcement agencies in order to achieve this. It was thought that there are currently problems in sharing information between enforcement. Police forces (e.g. UK, Dutch, French and German) also face problems in enforcing country laws to all nationalities because of a language barrier with, for example, foreign drivers.

2.3.3 Conclusions

A key aim of the Eurovignette Directive is to prevent competitive distortion through discrimination *"..directly or indirectly, on the grounds of the nationality of the haulier or the origin or destination of the vehicle".* Excessive discounts for local users are considered to be discriminatory, as they would have to be compensated for with higher payments by international users. Therefore, this section reviews the level of discounts provided in Member States and the possible mechanisms for discrimination.

For vignettes, potential discrimination could occur through excessive minimum charges or providing excessive discounts for longer permits. Currently, no Member States were found to be imposing excessive minimum charges: daily passes for vignette systems are offered in all Member states, at rates in compliance with the maximum level of €11. This was not always the case: previously, Hungary, Bulgaria and Romania only offered permits for weekly or 10-day periods, which imposed a higher minimum charge on foreign vehicles.

In terms of discounts for longer permits, regular users benefit from cheaper rates for weekly, monthly and annual charges compared to daily charges in all cases. Compared to the annual charge for HGVs in the same category, daily rates are offered at 1-3% of the charge, weekly rates at 3-7% and monthly rates at 10-17% across the countries with vignettes in place. This suggests there is some room for improvement in future to comply with the new levels set out in Directive 2011/76/EU, but in most cases any amendments to charge levels would be relatively modest.

Discounts on toll roads are capped at 13% under Directive 2006/38/EC to prevent them going beyond the savings in administrative costs.

- **Network-wide tolls:** do not usually provide discounts, with the exception of the Czech Republic where frequent users can save up to 13%.
- **Concessions:** often apply discounts, as the roads frequently compete with untolled routes. Most Member States offered significant discounts in the past, but with the exception of Spain and Greece, all appear to have revised these discounts in order to comply with the 13% cap.

Enforcement is critical to the effectiveness and acceptability of the charges. It tends to be undertaken through a combination of manual and automated checks in most countries. Penalty fees are applied in most cases, usually in the range of several hundred Euros and rising to several thousand Euros depending on the severity of the violation.

There are two main approaches to enforcement that have been adopted in Member States. In countries with electronic network-wide tolling, the approach is usually to have many compliance checks and a low penalty. By contrast, in countries with national vignettes or concession motorways, it is more common to have only occasional compliance checks but penalty levels reaching much higher levels (although starting at comparable levels to those in the former group).

The available evidence on the effectiveness of enforcement suggests that the violation rate is almost zero in countries with physical barriers; around 1-3% for electronic tolling and 2-15% for countries with vignettes. Violation rates typically reduce over time with electronic tolling, as more users install the necessary electronic equipment. Thus in cases for which data were available, enforcement procedures could be considered effective. Since most Member States apply similar enforcement protocols, it can be concluded that there is unlikely to be a problem in this area.

2.4 Evaluation of existing national electronic toll systems: Use of electronic systems to levy and collect infrastructure and external-cost charges and their degree of interoperability pursuant to Directive 2004/52/EC

Purpose: The purpose of the question is to get an insight into the extent to which additional policy measures are required in order to ensure interoperability between national electronic tolling systems.

Context: Directive 2004/52/EC was adopted to ensure interoperability of electronic road tolling systems across Europe. This ex-post evaluation considers interoperability of electronic tolling schemes in Europe, to ascertain whether additional policy measures are needed to ensure that the provisions of the interoperability Directive are met.

Main Findings

Almost half of EU Member States have either adopted electronic tolling systems or are in the process of doing so.

- Currently, interoperable systems exist between France and Norway (with potential to also include Spain, Austria and Slovenia); Germany and Austria; Norway, Sweden and Denmark
- In cases where users have a choice of different payment methods, 35-60% of all users chose to use electronic tolling, while uptake for HGVs appears to be higher than average (over three-quarters in France and Italy)

2.4.1 Policy background

Lack of interoperability between charging systems has a number of negative implications. It creates greater costs for users, particularly international hauliers that often have to equip their vehicles with multiple On-Board Units (OBUs) for different systems. For example, an HGV travelling from Lisbon to Bratislava via Lyon, Milan, Munich and Vienna needs at least seven different contracts with toll operators and seven OBUs, in addition to a digital tachograph and an on-board computer (European Commission Transport White Paper, 2011). In view of the growth of international road traffic and the increasing number of Member States introducing tolling systems under the Eurovignette Directive, the importance of interoperability is clear.

Directive 2004/52/EC and related Decision 2009/750/EC aim to achieve the interoperability of all the electronic road toll systems in the European Union. Therefore, the Directive required that a European Electronic Toll Service (EETS) be established, while Commission Decision 2009/750/EC went on to define EETS. The main objective of the EETS was to reduce administrative burdens and costs by streamlining the process for the payment of tolls.

Any tolls implemented under the Eurovignette Directive that require on-board equipment fall under the scope of Directive 2004/52/EC, except for small, strictly local toll systems for which the costs of compliance would be disproportionate to the benefits.

2.4.1.1 Types of electronic toll systems

Article 2 of the Interoperability Directive identified technical specifications for electronic tolling equipment, which include three types:

- **Satellite positioning:** GPS is the most widely used satellite technology system in use in electronic tolling across Europe. Its accuracy depends on the quality of the GPS receiver, the almanac it contains (describing the movement of the orbiting satellites) and its ability to model atmospheric conditions. There are a number of different technologies that are available to increase its accuracy, which use geostationary satellites to transmit locational information (Clough and Guria, 2008).
- **Mobile communications using the GSM-SPRS standard;** GSM (mobile communication) require an on-board unit (OBU), which is used to identify the vehicle location, and this GPS position data is transmitted by GSM to a central system.

- **5.8GHz microwave technology - Dedicated Short Range Communication (DSRC):** DSRC systems require vehicles to have an OBU that communicates with road side beacons and in doing so the gantry (using DSRC) charges the vehicle.

A third type of system, Automatic Number Plate Recognition (ANPR) is also available but is not considered in this study as it is not included in the EETS. Under ANPR, vehicles are identified at a location by terrestrial based cameras and information is relayed to a central processing unit to match against payment records.

2.4.2 National electronic toll systems

The electronic toll systems that are already in operation use different systems and technologies that are not necessarily compatible. It should be noted that Directive 2004/52/EC does not force Member States to replace existing electronic toll systems with EETS-compliant systems, and in practice EETS will be available alongside existing systems in Member States.

Table 2-8 contains a list of the HGV charging initiatives that are in place in Europe. There are a number of European (CEN) standards on Electronic Fee Collection (EFC). The main standard for DSRC is EN15509: Interoperable application Profile for DSRC (adopted 2007).

Table 2-8: HGV tolling systems in Europe.

	Country	Technology	Detail on standards	% HGVs using electronic tolling
Integrated electronic network-wide toll collection	Austria	DSRC	CEN DSRC (Austrian EFC + EN15509)	100% (all vehicles)
	Czech Republic	DSRC	CEN DSRC ("Czech EFC)	100% (all vehicles)
	Germany	GNSS	GNSS/GSM + IR	90% (estimated)
	Slovakia	GNSS	GNSS/GSM + CEN DSRC	100% (all vehicles)
	Poland	DSRC	CEN DSRC (EN15509)	100% (all vehicles)
	Switzerland	DSRC	CEN DSRC (+ GNSS)	60-85% (2005 estimate)
Distance-based concessions	France	DSRC	CEN DSRC (TIS + EN15509) Introducing GNSS/GSM + CEN DSRC	38% (all vehicles) 77% (HGVs)
	Greece	DSRC	CEN DSRC (A1)	unknown
	Italy	DSRC	UNI DSRC	56% (light vehicles) 87% (HGVs)
	Portugal	DSRC	CEN DSRC (EN15509)	58% (all users)
	Spain	DSRC	CEN DSRC (PISTA + EN15509)	35-40% (all users)

Notes: CEN is a Standards body that is responsible for DSRC related standards. The Italian UNI standard is a national standard that is not compatible with other systems

Source: GMV et al (2009), TRT (2008), http://www.its-australia.com.au/wp-content/uploads/NeTC-2012-Magnus-Westroth-Kapsch.pdf, stakeholder survey responses

The first HGV charging systems that were implemented were based on different principles and technologies to their more recent counterparts. Today, in most countries the electronic tolling technology of the existing systems is compliant with the Interoperability Directive. However, in some countries specific interfaces are required. For example, the German system has an infra-red interface, whereas the Italian DSRC standard (UNI) is not interoperable with other systems.

The Interoperability Directive requires that Member *States 'endeavour to ensure that, by 1 January 2007 at the latest, at least 50% of traffic flow in each toll station can use electronic tolls systems'* (Article 2, Paragraph 5). The stakeholder survey carried out as part of this project requested information about the proportion of vehicles that pay infrastructure charges using electronic toll systems. The figures (both actual and estimates) featured in Table 2-8 indicate that in the majority of cases the target is being met and exceeded. For Member States that were able to provide information on all users and HGVs only, it can be seen that a higher percentage of HGVs prefer to use electronic fee payment.

2.4.2.1 Implementation costs

A comparison of the type of technology used for road charging in different Member States, along with the costs of implementation (where available) is given in the table below.

Table 2-9: Selected charging technology implementation costs

Type	System technology	Country	Year of toll introduction	Investment cost (€m)	Operational cost as % of revenue	Network length
Network-wide tolls	Dedicated Short Range Communications (DSRC)	Austria	2004	750	10-12%	~ 2,000 km Tolled Network; ~ 800 Toll Segments
		Czech Republic	2007	780	10%	~ 2,000 km Road Network, ~ 850 Toll Segments
		Poland	2011	278	17% (as for other systems, this is expected to reduce over time)	Total length 1,130km incl. motorways and expressways. Expected to expand to about 3,000km.
	Global Navigation Satellite Systems	Germany	2005	1240	10.4-20% (High at first, but are thought to have reduced to 11-12% in 2009).	~ 12,000 km Motorway Network; ~ 5,000 Toll Segments
		Slovakia	2010	716	unknown	600km highway (900 segments) and 1,800km first class roads (1,500 segments).
		France	2013 (planned)	600	~20%	10,000km highways and 5,000km secondary roads

Notes: Operation costs as % of revenue are provided as a range, due to the varying figures depending on the year.

Sources: ACEA Tax guide 2012, Mikulski (2010), ViaToll website, Ministry of Infrastructure of the Republic of Poland (assuming exchange rate PNL to EUR of 0.25; ecomouv website; Siemens website

The Interoperability Directive recommended that new electronic toll systems brought into service after its adoption use satellite positioning and mobile communications technologies. However, several countries have investigated satellite systems but did not implement them due to the high upfront costs. For the Netherlands, estimated costs for the system in 2005 were €2.1-3.8 billion, and annual system operating costs were estimated at €0.4- 1.1 billion (European Commission, 2005). In the UK, a distance-based toll for trucks >3.5t was investigated in 2004-2005. Tolls were to be differentiated by type of road, vehicle weight, number of axles, and emissions class, followed later by possible further differentiation by time of day and geographic area. However, it was not implemented due to the high cost of €3-4 billion. More recent schemes in Slovakia and France appear to have lower costs, although no two systems are directly comparable.

The key factor that determines which system is taken up is the road network: for large or complicated networks, satellite systems are preferred, whereas for smaller networks DSRC is most likely the best option. France already has DSRC on its concession motorways; the planned system for charging on non-concession motorways will be based on satellite technology with DSRC used for compliance checks and for charging on the old toll network.

2.4.3 Interoperability

There have been delays in implementing EETS, which are due to a number of factors including:

- Limited number of projects across Europe to introduce electronic tolling;
- Full-scale tolling schemes in Member States tend not to be introduced until successful pilot projects have been completed;
- The costs of equipping vehicles with OBUs; and
- Member States have a reluctance to discard their existing national systems.

However, a number of Member States have successfully worked to make their systems interoperable. The following sections describe the systems in place.

2.4.3.1 Interoperability of France's 'TIS' and Norway's 'AutoPASS'

The French national electronic tolling system, TIS-PL, and Norway's equivalent, AutoPASS, both use the DSRC (5.8GHz) European standard. The readers of both OBUs are compatible with the systems of both countries, and so HGVs can be charged by the same system. This example has been used by the European Toll Collection Committee (2005) to show that tolling systems can be made interoperable if they have the same application system.

In practice France has only permitted use of this interoperable approach nationally, although they state that in addition to similarities with Norway's system, there has been some progress in making it capable of being interoperable with Spain, Austria and Slovenia's systems (GMV *et al,* (2009).

2.4.3.2 Joint service provided by TOLL2GO (Germany) and ASFINAG (Austria)

TOLL2GO is a transnational toll system that is jointly provided by Toll Collect and ASFINAG – the German and Austrian toll operators. Operational since September 2011, it is the first road charging scheme to be based on a combination of DSRC and satellite technologies. A year after its implementation, it is being used by 50,000 HGVs operated by 4,000 transport and logistics companies based in Austria (22% of registered vehicles), Germany (30% of registered vehicles), the Netherlands, Czech Republic, Poland, Hungary and Slovakia (collectively 48% of registered vehicles) (Toll Collect, 2012). The system requires users to pay for road use in both countries via one OBU ('TC OBU'). However, the two toll operators have separate contracting and invoicing services.

The DSRC component is the Austrian toll collection system, which is based on microwave 'GO-Box' technology. The technology used in Germany is the satellite-based element of the system, which supports the microwave-based toll system of Austria.

2.4.3.3 EasyGo service in Norway, Sweden and Denmark

The 'EasyGo' service allows users of Norway's AutoPASS system and Sweden and Denmark's BroBizz system to use the same toll collection systems and OBUs. Only one contract is needed to pay charges. The OBUs are based on the CEN TC278 DSRC standard, and must be able to read data from systems with the specifications of those across the network (EN 15509, AutoPASS, BroBizz and PISTA).

The EasyGo initiative is being extended into Austria in early 2013, and being renamed EasyGo+. Users will need to request a new OBU that has been programmed with the vehicle characteristics. It is being prepared to meet the requirements of the European legislation, and technical procedures are in the process of being refined (EasyGo, 2012).

2.4.3.4 Italian Telepass standard

The Italian Telepass DSRC technologies are not compatible with other systems. However, a dual mode OBU has been developed and is capable of communicating with both Italian Telepass beacons and other European beacons that are compliant with the standard specification. ASECAP (2007) indicate that this has been driven by the EETS activities.

Telepass Spa is a company that offers the Telepass Italia service, the TIS PL service in France, the Via-T service in Spain, the Liefkenshoek tunnel service in Belgium and has introduced an EETS satellite device, Telepass SAT. Telepass has recently signed an agreement with Ressa, the Spanish market leader for payment systems for road users, that will allow Telepass to integrate the Spanish Via-T system into Telepass SAT telebadges (Telepass Spa, 2012). There are other providers that also offer an OBU that can be used both in France and Spain, for instance the Bi-Model replaces the TIS PL in France and the VIA T in Spain.

2.4.3.5 Views from stakeholders – sector associations and road hauliers

Most stakeholders consulted, support the Commission's objective to make the various electronic tolling systems more interoperable. However, it is generally thought that efforts have failed so far and electronic tolling systems need to become more compatible in the future. Several stakeholders highlighted the importance of the integrity and accuracy of the charging system, as a key weakness of electronic tolling is that there is scope for errors that can result in the over / under-pricing of users.

2.4.4 Conclusions

Successful development of cross-border electronic tolling systems requires strong political support and public acceptance. Key barriers to implementation have been due to limited experience, high costs and a reluctance to change existing systems; however there is evidence systems are evolving towards meeting the requirements of the EETS Directive. Currently, interoperable systems exist between France and Norway (with potential to also include Spain, Austria and Slovenia); Germany and Austria; Norway, Sweden and Denmark.

In Member States with electronic tolling systems, user acceptance appears to be high. In most cases participation in electronic fee collections is greater than 50%, while several Member States have achieved close to full participation.

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2.5 The effectiveness, completeness and clarity of the provisions on the recovery of infrastructure costs in terms of financing, developing and maintaining the road network and in terms of promoting an harmonised approach

Purpose: The purpose of the question is to check if the legislation 'is fit for purpose' i.e. whether it allows Member States to easily introduce efficient road charging.

Context: The ex-post evaluation will focus on understanding the effects of all policies in this area up to and including Directive 2006/38/EC. While the Eurovignette Directive sets mandatory minimum rates for vehicle taxes, the approach to user charging is largely voluntary. Hence, Member States may choose whether or not to adopt tolls and/or user charges (but not both at the same time on the same infrastructure).A key aspect of the Eurovignette Directive is the inclusion of provisions that allow tolls and charges to be applied to recover infrastructure costs (maintenance and new investments).

Main Findings

- Member States with network wide electronic tolls have stronger and more focussed objectives for implementing road charging systems
- Most Member States do not recover full infrastructure costs from road charging. This is due to a lack of methods to relate charges to costs or due to charges that are set by political decisions
- There is mixed evidence on wider stakeholder acceptability of HGV road charging, with positive experiences in Austria and German and high public resistance in the Czech Republic.

2.5.1 Transposition into national legislation in each country, with respect to recovering infrastructure costs

This section presents the main theoretical and legal constraints on the application of road pricing measures, in order to better understand how the Directive was transposed and implemented in Member States. It addresses the following issues:

- Objectives of infrastructure charging policies;
- Experience of transposing the Directive and the legal framework;
- Stakeholder acceptance;
- Revenue neutrality and recovery of infrastructure costs.

The findings from the analysis can broadly be grouped depending on the type of system that was implemented in each Member State, as given in Table 2-10.

Table 2-10: Groups of Member States according to charging systems in place

Charging systems		Member States
Network-wide electronic tolls		Austria, the Czech Republic, Germany, Poland (since 2011), Slovakia (since 2010) and Switzerland
Concession motorways		France, Spain, Greece, Ireland, Italy, Slovenia and Portugal
Vignettes	**Eurovignette**	Belgium, Denmark, Luxembourg, the Netherlands and Sweden
	National vignette	Bulgaria, Romania Hungary, Lithuania, Poland (up to 2011) and Slovakia (up to 2010)
No widespread charging system		Cyprus, Estonia, Finland, Latvia, Malta and UK

The interplay between the various features and provisions of the Directives, differing objectives of Member States and the choice of pricing schemes makes it extremely complex to assess whether the legislation is 'fit for purpose'.

2.5.1.1 Objectives of infrastructure charging policies in Member States

Charging for the use of infrastructure in Europe is not a new concept. However, in recent times the European road charging legislative framework and Member State policy priorities have increased the ability to use infrastructure pricing to reflect the socioeconomic and environmental marginal costs. Hence, Member States have different objectives for implementing road infrastructure charges, such as:

- Recovery of infrastructure costs (including financing, maintenance and operation),
- Reducing transport-related air pollution and road congestion,
- Increasing transport efficiency,
- Influencing modal choice, and
- Creating fairness between domestic and foreign vehicles.

This range of objectives has been reflected in the different approaches to implementation taken in Member States.

Infrastructure financing is the main objective for implementing road user charges in almost all Member States. In the Member States with national vignettes, assisting networks facing difficulties after years of under-investment and speeding up completion of motorways was a key objective. The Member States with network wide electronic tolls can more effectively recover infrastructure costs. The tolls can also take into consideration external costs by differentiating charges according to Euro class and/or time of travel.

Table 2-11: Objectives of road user charging in Member States

	AT	CZ	DE	BE	DK	LU	NL	SE	BG	RO	HU	LT	PL	SK	ES	FR	IT	EL	PT	SI
Financing/speed up of new road infrastructure	✓	✓	✓	pc	pc	pc	pc	pc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reduce the growth rate of freight traffic	✓																			
Apply user pay principle	✓	✓	✓																	
Apply polluter pay principle	✓	✓	✓																	
More efficient use of transport capacity and intermodal competition	✓		✓																	
Provide a common and integrated system (interoperability)	✓			✓	✓	✓	✓	✓												
Address declining share of freight rail	✓								✓	✓	✓	✓	✓	✓						
Improve service quality and maintain market share of road transport									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cope with rising national and international traffic and cost imposed				✓	✓	✓	✓	✓	✓		✓		✓							
Operation and maintenance of networks	✓	✓	✓	pc	pc	pc	pc	pc					✓	✓	✓	✓	✓	✓	✓	✓

pc - partly covered

Nework-wide electronic tolls

Eurovignette

National vignette

Previously vignette, now Network-wide electronic tolls

Concession motorways

Source: T&E (2007), TRT (2008), BMT Transport Solutions (2006), Booz & Co (2010)

2.5.1.2 Experience in transposing the Directive and legal framework

Most Member States have transposed the legislation into national law. However, not all have implemented the provisions of the Directive or are entirely compliant with the Directive 1999/62/EC and its amendment Directive 2006/38/EC.

Table 2-12: Legal framework for road user charging in Member States

Type	Member States	Legal framework and transposition of the directive
Network-wide electronic tolls	Austria	In the mid-1990s the Austrian government introduced a vignette for cars and a toll for heavy vehicles. The parliament approved the requested law in 1996, and amended both the Motor vehicle tax Act 1992 (Legal act: Federal law, number: I no 64/2007; Official Journal: Federal Law Gazette for the Republic of Austria (BGBl.) number: I no 64/2007, publication date: 31/07/2007) and the highways toll Act 2002 and the ASFINAGGesetzes (Legal act: Federal law, number: I no. 82/2007; Official Journal: Federal Law Gazette for the Republic of Austria (BGBl.) number: I no. 82/2007, publication date: 13/11/2007, entry into force: 14/11/2007.
	Czech Republic	The conditions of Eurovignette Directive are continuously transposed into Czech law. A law on electronic fee collection (Government decree N° 481, 19/05/2004) was adopted and is supported by follow-up regulations. Toll rates per km are stipulated by Czech Government Regulation No. 484/2006 Coll. The Road Infrastructure act was amended to allow the implementation of Electronic Fee Collection (EFC) for vehicles over 12 t from January 2007. Operation of the electronic tolling system is also subject to Decree No. 527/2006 Coll. of the Czech Ministry of Transport, Czech Government Regulation No. 484/2006 Coll., and the General Business Terms and Conditions of the Operator of the Electronic tolling system (PreMid website).
	Germany	Germany stepped out of the Eurovignette agreement (with Benelux, Sweden and Denmark) at the end of August 2003, and replaced it with a network-wide electronic toll. Owing to technical problems, the launch of the system was delayed until 1 January 2005.The legal framework of the toll was laid down in a law adopted by the German parliament in 2002. Tolls levied on basis of Federal Road Toll Act (until 18th July 2011, the toll was levied on the basis of the Motorway Toll Act for Heavy Goods Vehicles since April 12, 2002)On 8 June 2007, the German Parliament set out legislation changing the rates of vehicle tax and the toll. Vehicle tax for heavy goods vehicles fell to the EU minimum level (German Transport Ministry, 2007).
Vignettes	Eurovignette countries (Belgium, Luxembourg, Netherlands, Denmark, Sweden)	Netherlands - The user charges are differentiated according to Euro class of the vehicles, according to directive 1999/62/EC guidelines. The differentiation of the Eurovignette scheme is still not in line with the new directive (2006/38/EC). Within the Eurovignette treaty Member States have to come to a unanimous decision if the rate is to be changed. Other than that, the Netherlands have not faced any problems in transposing the Directive. Sweden - Legislation transposing the Eurovignette Directive - Lag (1997:1137) om vägavgift för vissa tunga fordon. Svensk författningssamling (SFS), number: 1997:1137 – came into force in 01/05/2006. Denmark – Legislation transposing the Eurovignette Directive: Legal act: Administrative measures; Official Journal: Administrative measures, Publication date: 01/01/2008, Entry into force: 01/01/2008; Reference: (MNE (2008) 53328) List of charges for commercial vehicles. Legal act: Administrative measures; Official Journal: Administrative measures, Publication date: 01/06/2008, Entry into force: 01/06/2008; Reference: (MNE (2008) 53329)
	Poland	The legal basis is the Road Transport Act of 6 September 2001 (Dz.U. No 125, item 1371) and regulation of the Minister of Infrastructure of 14 December 2001 on the fees charged to transport operators using national roads (Dz.U. No 150, item 1684) (T&E, 2007). Road tolls are collected by the concessionaires, who transfer them into the national road fund, which is used for Motorways and national roads. In July 2011, Poland replaced its national vignette system with a toll.
	Hungary	The legal system, Road User charge / toll related parts from the Act I of 1988 on Roads – has the chapter on the charging issues. Basic rules have been transposed from EU Directive. There are three Ministerial-level Decrees which transpose the Eurovignette Directive into national law: , 37/2007 and 47/2007.
	Romania	Romania has operated a vignette since 2002. The Minister of Transport has set out the legal basis for the cost allocation principles and the calculation of tariffs; tariffs of weighted average tolls and concession fees (depending on the classes of pollutant emissions) and rules for determining tariffs.

Type	Member States	Legal framework and transposition of the directive
	Slovakia	The legal basis for the Slovakian scheme is the Electronic Charging Act passed by parliament. The supervisory authorities are the Ministry of Transportation, Posts and Telecommunications and the National Highway Company.
	Bulgaria	The Government relies on PPP and concessions to co-finance the motorway system development. It should be noted that, according to the commitments taken by Bulgaria within the accession negotiation process, as of January 1, 2007 the scope of the vignette network shall be limited to the roads corresponding to the requirements of EC Directive 1999/62, e.g. no more than 2,500 – 3,000 km. Both the Road Law and the Law for local taxes and fees were amended.
Concession tolls	Spain	Both Directive 1999/62/EC and the 2006 amendment have been exclusively transposed to charge trucks driving on tolling highways that are part of the trans-European network). However, Span has not applied all the provisions of the Eurovignette Directive till date.
	France	The national umbrella organisation of motorway operators is ASFA (Association des Sociétés Françaises d'Autoroutes et d'ouvrages à péage). There is no common national toll level, all the motorway operators applying different fees. Legal act: Decree, number: 2008-411; Official Journal: Official Journal of the French Republic (JORF), Publication date: 30/04/2008, Entry into force: 01/05/2008. Reference: (MNE (2008) 53218).
	Italy	Italy's road infrastructure costing system was already compliant with the Eurovignette directive and did not face any problems for transposing the Eurovignette Directive into national legislation6. Legal act: Legislative Decree, number: 7; Official Journal: Official Journal of the Italian Republic, number: 151, Publication date: 2/9/2010 Entry into force:, 2/9/2010. Existing concessions are exempted by the European legislation and with regard to the variation of tolls depending on the Euro categories of the vehicles. The proposal is to revisit these exemptions during the renewal of concessions or for new toll systems. There is a single decree for each concession.
	Portugal	Ministry of public works, transport and Communications establish the principles that must be followed for setting tolls to be levied on heavy goods vehicles for the use of road infrastructure. Legal act: Government Decree, number: 60/2010; Official Journal: Diary of the Republic I, number: 110, Publication date: 6/8/2010. The Portuguese law transposing the Eurovignette Directive contains a provision that leaves concession toll systems entirely outside the scope of the directive
	Slovenia	Eurovignette Directive has been transposed into national legislation. The legal basis is the 1994 Directive of the National Assembly's infrastructure and environment committee. The Decree on the toll on the use of certain roads has brought the Slovenian system of paying tolls into line with the European Union's Directives (T&E, 2007). The Act on tolls for vehicles with the maximum permissible weight exceeding 3,500 kg specifies the definition of the level of the toll.

Member States were also asked if they faced any challenges when implementing the new external-cost provisions. Member States were aware that the opinions and understanding of how to calculate external costs are extremely diverse and still developing. This seems to be an important challenge. Moreover, the variety of different tariffs throughout a Member State can be a problem for transparency.

2.5.1.3 Revenue neutrality and recovery of infrastructure costs

The Directive requires that the 'weighted average fee' (total revenues divided by total vehicle kilometres) shall in principle not exceed construction costs and the costs of operating, maintaining and developing the network on which tolls are levied, for the share that can be attributed to the charged vehicles.

Member States were asked if the requirement to vary infrastructure charges in a revenue neutral way within two years created any barriers to applying this provision. Most Member States indicated that barriers stemmed from limited experience in applying the charges, as well as the lack of monitoring of

[6] Interview with Italian Competent Authority.

the traffic and income in order to adjust toll differentiation. Responses from Member States on the recovery of infrastructure costs and ensuring revenue neutrality are given in Table 2-13.

Table 2-13 Recovery of infrastructure costs and revenue neutrality

Member States	Recovery of infrastructure costs and revenue neutrality
Austria	Every two years the structure of the differentiation is reconsidered in the light of the share of the different EURO classes in the total vehicle kilometres per year. This is to ensure further positive impacts on the air quality as well as revenue neutrality.
Czech Republic	Prior to introduction of tolls, the cost of road infrastructure was only partially paid by users through motorway vignettes, road tax and excise tax on mineral oils. The revenue of the first two is fully used by the State Fund of Transport Infrastructure to be invested into infrastructure construction and maintenance, the latter only in a small part (9.1%). The rest of infrastructure cost is covered by a state subsidy (Ecorys, 2006).
Germany	The fee is calculated on the basis of infrastructure costs and differentiated according to number of axles and emission categories. Toll revenues in excess of system operating costs provide funding for transportation infrastructure improvements. The government has been investing €600m/year (since 1st January 2009) for the benefit of the German road haulage sector in the form of various measures to reduce the financial burden: Reduction of motor vehicle tax for HGVs (approx. €150m/year) Three financial assistance programmes (approx. €450m/year) Creation of incentive to purchase cleaner HGVs De minimis aid programme Programme for training and skills
Denmark	The revenue from the Eurovignette covers only around 25% of infrastructure costs. The proposed new method (see next steps below) should increase this considerably but it is unlikely to reach 100%. The calculation of infrastructure cost was carried out using the perpetual inventory method. Denmark received support from DG MOVE and the German government to apply this method. However, they indicated that lack of guidelines to calculate infrastructure cost was a key barrier
Spain	Currently, road users pay tolls for only 18.8% of the highways network (less than 1.8% of the whole road network). Concessionaires can apply to charge higher tariffs that comply with the Directive, but these still need to be approved by the government. Since all vehicles are charged aside from ambulances, emergency vehicles, the concessionaries recover 100% of the infrastructure costs (operation and maintenance). The rest of the network is toll-free and therefore infrastructure costs are charged to the general budget. They are able to increase the charge if any new construction is required.
Italy	Currently the charges are applied to recover infrastructure costs including investment and return on investment for the concessionaire. The formula is complicated in its application to vary infrastructure charges in a revenue neutral way. It could also be a possible source of discrimination if a deviation from the correct calculation of the charges is subsequently ascertained. Due to the complexity of these issues Italy is not going to activate the differentiation of road infrastructure charges for reducing congestion because it is too complex.
Slovenia	The Eurovignette directive provides appropriate basis for recovering infrastructure costs. The exact prices related to the toll sections are defined in the Price list of tolls for the use of toll roads and in the Governmental Decision on the level of tolls for vehicles whose maximum permissible weight exceeds 3,500 kg. In recent years tolls have been calculated on the basis of internal calculations and estimations within DARS (national motorway company).
Romania	The total direct income in Romania is too low in relation to the full cost of road maintenance for the national road network. Thus, investment is reliant on the State budget, IFIs and/or commercial loans in order to fund the shortfall (Ecorys, 2006).

Member States	Recovery of infrastructure costs and revenue neutrality
Portugal	From the perspective of the road concessionaires; in 2008 the aggregate revenues/costs ratio was under 90%, a total annual deficit of €400 million. Currently, the remuneration of the real toll concessions in Portugal is based on a toll calculation scheme that does not relate directly the type of vehicle with the damage caused to the infrastructure and the subsequent financial cost. In the framework given by the current Eurovignette provisions (and even more in the near future), if the calculation of tolls includes the external costs caused by the use of the infrastructure, the Portuguese toll calculation schemes will have to adapt rapidly. However, this change would only be applied to new or renegotiated concession contracts, limiting the real expected impact of the "Eurovignette". A national study 'NARI' found that the current HGVs tolls are lower than they could be according to Directive 1999/62/EC, which could mean that other vehicle classes are overcharged, thus leading to a cross-subsidisation between vehicle classes (Crespo & Burnier, 2011)
Bulgaria	Charges are set by political decision, based on annual road maintenance budgets, and are reviewed annually. Taking into account the network's maintenance backlog and the vignette price level (set up based on affordability and not on the needs principle), the revenue raised are far below the real needs. They could cover the operation and maintenance costs, but the State Budget and loans and grants from EU and other financing institutions will be needed to finance major repair and reconstruction works. Additionally, the State Budget and Infrastructure Finance Institutions (IFIs) need to be used to finance the new construction (Ecorys, 2006).
Hungary	Revenues from the vignette are used for maintenance and construction of the motorway network. However, these revenues are not enough to cover the required expenditure. Hungary finds it very difficult to impose charges to recover infrastructure costs due to lack of data. Information on the actual percentage of the vehicle fleet by Euro class and the vehicle kilometres travelled by vehicles is required for both international and local traffic. The Single Tolling Act will in the future be based on 100% cost recovery.

2.5.1.4 Stakeholder acceptance

There is some evidence from Austria, the Czech Republic and Germany on wider stakeholder acceptance of heavy goods vehicle charging in Europe.

Table 2-14: Stakeholder acceptance

Member State	Stakeholder acceptance
Austria	The perception of the Austrian toll scheme by the public is fairly positive. Despite strong opposition at the outset by the Austrian Federal Economic Chamber over the possibility to introducing a dual system (manual and electronic control), a survey in Austria found that 94% of users of the HGV toll and light vehicle vignette were either satisfied or very satisfied with the toll collection system (ASFINAG, 2005). T&E (2007) point out the following experiences: • The toll was successfully implemented despite strong opposition at the outset; • The scheme had high acceptance among users; • The scheme was based on well understood, simple and reliable technology (99,9% correct transactions); and • The equipment was cheap to purchase (€5 for a "Go-Box") and free to install.
Czech Republic	a Motorway charging has generally found a high public resistance in the Czech Republic. This is thought to be due to a combination of factors (T&E, 2007): • Road charging was a relatively new concept; • The public has a lower income level compared to the EU15; • Motorised mobility costs (fuel, insurance, registration, maintenance) are generally perceived to be high already compared with current GDP per capita. Users felt they were "taxed double" when road charges are added on top of the already existing taxation. The issue of low acceptability is further compounded by the fact that, as shown by quality of service indicators, the "value for money" is very poor.

Member State	Stakeholder acceptance
Germany	Public opinion on road tolls is divided in Germany. On the one hand, the high density of HGV on German motorways leads to a relatively high acceptance of the HGV toll by private users. On the other hand, private consumers fear a negative impact on overall price levels. The German Federal Office for Goods Transport states that the new system (apart from some expected teething troubles) has been accepted by the industry. The number of on-board units (OBUs) has been constantly increasing. By April 2006, there were over 500,000 OBUs and their number continues to grow at regular pace. By earmarking the revenues generated by the toll for improving transport infrastructure (especially road infrastructure), the acceptance of the charging scheme has increased.
United Kingdom	The DfT (2012) consultation regarding the use of a vignette system for HGVs revealed fairly divided views: 56% of respondents agreed that foreign hauliers should pay the vignette, 36% disagreed that this was the best way to introduce charges. Suggestions included; drivers paying to enter the UK, the use of the European Vignette System and a combination of vehicle exercise duty and tolls as a means of taxation, as alternatives.

2.5.1.5 Views from other stakeholders – NGOs, sector associations and road hauliers

Key responses are summarised below:

Clarity of provisions

One stakeholder noted that many Member States had not made use of the opportunities the Directive provides, when transposing it into national law. Some countries, like Austria, have made full use of opportunities, whilst others haven't, such as the UK. Although the consultee considered the provisions of the Directive to be clear in allocating tolls/charges to the relevant infrastructure costs, there is the political problem of whether to allocate the full cost or a proportion of the infrastructure costs. Only one or two countries allocate full infrastructure costs.

Feasibility of implementation

One stakeholder pointed out that there may be different authorities developing road charging policy to those that implement charges. This may create challenges in; implementation, and justification of the charges to users (including the use of additional revenue collected).

Another stakeholder felt that infrastructure user charges had not made the transport system more transparent, resulting in double charging.

Recovery of infrastructure costs

Several stakeholders felt that the lack of mandatory earmarking and the lack of transparency in the use of revenues were problems in Europe.

Harmonisation

Several stakeholders felt that harmonisation could not be achieved as the Directive does not oblige Member States to implement uniform charging; however, if more binding rules were established there could be progress.

2.5.2 Comparative analysis with rail

Directive 2001/14/EC established rules for the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure. This section provides a comparison between the infrastructure charging strategies in the rail and road sectors. The analysis covers the following topics:

- Level of harmonisation;
- Level of charges;
- Network coverage;
- Internalisation of external costs;
- Level of cost recovery; and
- Effects of the level of infrastructure charges upon users.

2.5.2.1 Level of harmonisation

The level of harmonisation of the structure of access charges is inconsistent across EU countries in both the rail and the road sectors.

In the rail sector, infrastructure access charges are applied in all countries. There are a wide variety of structures with varying degrees of complexity. For example, Finland applies a simple charge structure based only on gross ton-km and train type, whereas in Austria the charge structure is based on many more variables. Table 2-15 below shows the variables included in the infrastructure access charges in each Member State.

Table 2-15: Comparison of charge structures of rail usage charges: charge base (2012)

Country	Infrastructure Manager	Gross ton-km	Train-km	Line or section category	Time	Train type
Austria	ÖBB Infrastruktur AG	✓	✓	✓	✓	✓
Belgium	Infrabel	✓	✓	✓	✓	
Bulgaria	National Railway Infrastructure company	✓	✓			
Czech Republic	SZDC	✓	✓	✓		✓
Denmark	Banedanmark- Rail Net Denmark	✓	✓			
Estonia	EVR	✓	✓			
Finland	Finnish Transport Agency	✓				✓
France	RFF		✓	✓	✓	✓
Germany	DB-Netz	✓	✓	✓	✓	✓
Greece	OSE		✓	✓	✓	✓
Hungary	VPE	✓	✓	✓		✓
Ireland	Department for transport	✓				
Italy	RFI		✓	✓	✓	✓
Latvia	Latvian Railway LDZ		✓			
Lithuania	JSC Lithuanian Railways	✓	✓			✓
Luxembourg	ACF	✓	✓	✓		✓
Netherlands	Prorail	✓	✓	✓		✓
Poland	PLK	✓	✓	✓		
Portugal	REFER		✓	✓		✓
Romania	CFR	✓	✓	✓		
Slovakia	ZSR	✓	✓	✓		✓
Slovenia	AZP		✓	✓		✓
Spain	ADIF		✓	✓	✓	✓
Sweden	Trafikverket	✓	✓	✓		✓
United Kingdom	Network Rail	✓	✓	✓		✓
	HS1		✓		✓	✓
	Eurotunnel				✓	✓

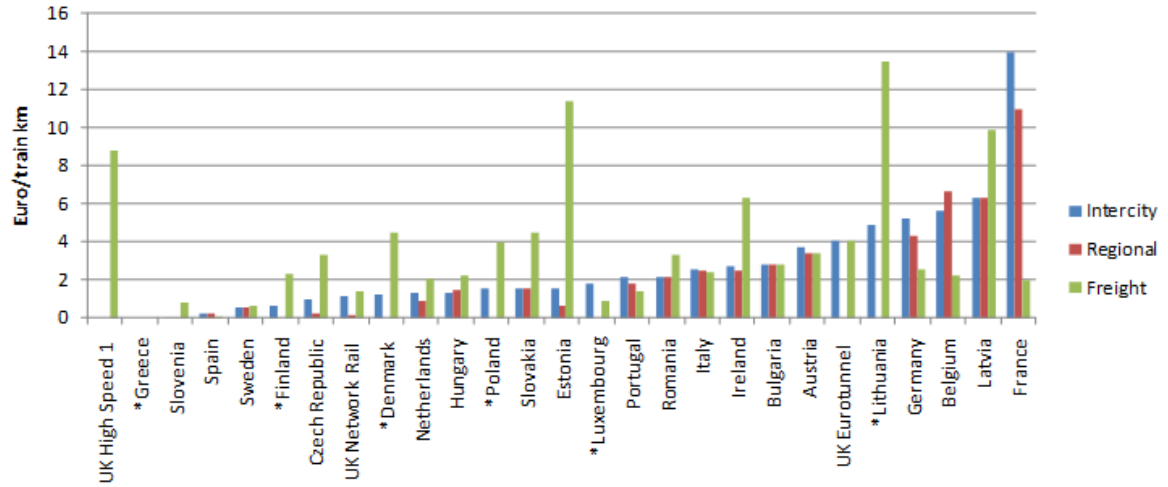
Source: van Essen et al, (2012)

For road transport infrastructure, the charges types are less varied and can be categorised as either distance-based charges (tolls) or time based charges (vignettes). Tolls are correlated with the usage of each vehicle, and can therefore be linked more closely with external and infrastructure costs. While vignettes can generate a steady income for the infrastructure operator (mostly the state) at low operational costs, the charge less correlated with the external and infrastructure costs because it is independent of usage. The charge structures are quite different across Member States (see Table 2-1). Variables included in the charge structure include: vehicle type (including the dimensions, number of axles, and weight of the vehicle, the Euro class), section of the network, travelling time. Even the vehicle classification differs per country.

2.5.2.2 Level of charges

The average level of rail infrastructure access charges varies across countries. Figure 2.7 summarises the average charge levels by train type levied in each Member State (where available). Charges are generally below €2/km, but in some cases can be as high as €14/km.

Figure 2.7: Average level rail usage charge per train typology (Euro/train-km)



Notes:
Greece data not available
Regional figures for Denmark, Finland, Lithuania, Luxembourg and Poland are not available
UK High Speed 1 and Eurotunnel do not provide regional services.
Source: van Essen et al, (2012)

The differences are due to both specific features of national networks, their usage and of the pricing principles adopted, as well as policies adopted in each Member State. In particular, the mix and density of traffic varies greatly between countries. This affects costs, as renewal and maintenance costs strongly depend on these aspects. Furthermore labour costs and technology applied (automation and labour saving) are quite diverse.

For the road sector, only tolls can be expressed in terms of a charge per unit of distance, as vignettes are based on a period of time. In Member States with tolls the following evidence emerge (Van Essen et al.2012):

- Rates for a 100 km-trip made by representative heavy goods vehicles (HGV) vary between € 10 and € 30 (see Table 2-16 which reports equivalent rate per km);
- For passenger vehicles, the charge for a 100 km-trip is between approximately €5 and €10.

Table 2-16: Infrastructure charge per km (equivalent) for HGV[7]

Country	Toll/km (€)	Country	Toll/km (€)
Austria	0.30	Italy	0.16
Czech Republic	0.17	Poland	0.06
France	0.21	Slovak Republic	0.19
Germany	0.16	Slovenia	0.25
Greece	0.09	Spain	0.29

Source: van Essen et al, (2012)

While the rates for road access are usually significantly lower per km compared to those for trains, it must be remembered that the carrying capacity of trains (both in terms of cargo and passengers) is significantly large than those possible for road vehicles.

2.5.2.3 Network coverage

A summary of the length of rail and road network charged per country is reported in Table 2-17. Figures relating to the rail network mostly refer to the network managed by national rail infrastructure

[7] Van Essen et al. (2012) considered heavy duty vehicles with the following features: Gross Vehicle Weight (GVW): 40,000 kg; Tractor Weight: 14,000 kg; Axle configuration: 2 axles (tractor) + 3 axles (semi-trailer); Air suspension; 400 HP, 298 kW, 6000 cc engine size; EURO V; Purchase price: € 120,000. Representative light vehicles with specific characteristics have been considered in order to allow comparisons between countries: for small cars, a Peugeot 207 1.4; for medium cars a Volkswagen Golf 1.5; for large cars: a Ford Mondeo 2.0

managers (which cover the longest part of the total national rail network). Data on road network mainly refers to the network charged through tolls, except from Bulgaria and Hungary which indicates the kilometres charged through vignette, Slovakia and Slovenia which include the network charged through both tolls and vignette.

Table 2-17: Length of the road and rail networks charged per EU country

Country	Charged network (km)	
	Road	Rail network
Austria	2,178[3]	10,143
Belgium	3,996[3]	3,587
Bulgaria	19,267[1]	6,938
Cyprus	n/a	No Railways
Czech Republic	1,376[3]	9,487
Denmark	1,100[3]	2,132
Estonia	n/a	787
Finland	n/a	5,919
France	8,887[2]	29,213
Germany	12,812[2]	33,707
Greece	1,659[2]	2,552
Hungary	1,640[2]	7,609
Ireland	304[3]	2,400
Italy	5,773[3]	16,734
Latvia	n/a	1,936
Lithuania	1,742[3]	1,767.6
Luxembourg	93[3]	279.1
Malta	n/a	No Railways
Netherlands	2,631[3]	2,886
Poland	2,368[3]	19,702
Portugal	1,700[3]	14,808
Romania	16,500[3]	20,210
Slovakia	1,957[3]	3,617.7
Slovenia	545[3]	1,541
Spain	3,362[3]	13,945
Sweden	4,000[3]	11,149
United Kingdom	42[3]	17,284

Notes:
[1] 466 km of motorway charged
[2] ASECAP
[3] EC SWD(2013) 1 final

Source: van Essen et al, (2012); ASECAP; EC SWD(2013) 1 final

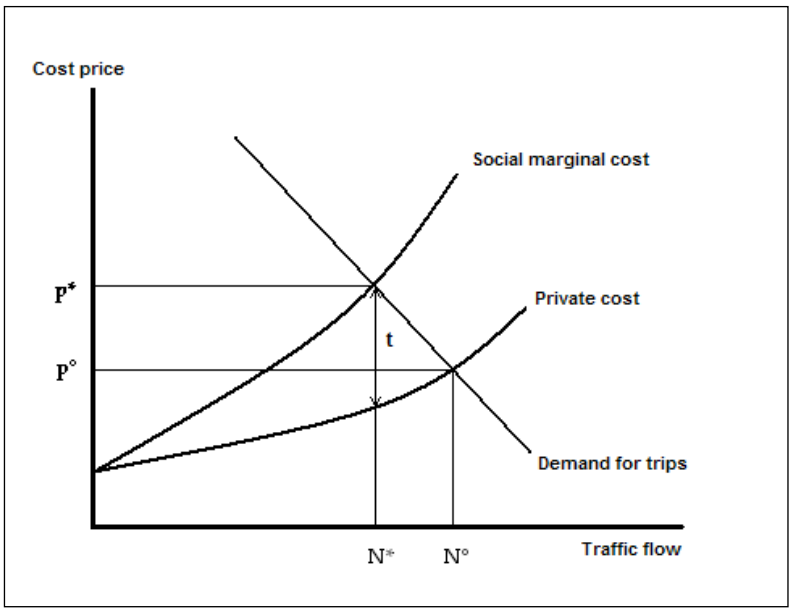
2.5.2.4 Level of internalisation

The internalisation of external costs in infrastructure charges finds its justifications in established principles of the welfare economics. Welfare economics looks upon price as a method of resource allocation, which maximises social welfare rather than simply the welfare of the supplier. The maximisation of social welfare is achieved when the price is set equal to the Marginal Social Cost (MSC).

Figure 2.8 shows how external costs can lead to deviations from the optimal level of traffic flow. Equilibrium is established in *N°* where the demand curve meets the private cost curve (perceived cost). Since the social marginal costs generated by traffic flow are higher than perceived costs, the social optimum corresponds to *N*.* The optimal charge which would guarantee the optimal mobility is *t.*

After imposition of the optimal *t* charge, users between *N** and *N°*– whose infrastructure usage is excessive from a social perspective – are discouraged to use the infrastructure since the benefits derived from its use fall short of the sum of the private cost *c* plus the price charge *t*.

Figure 2.8: Marginal costs-current and efficient



Source: TRT

In the case of transport infrastructure, the costs that could be included in the definition of the optimal tariffs are: congestion and scarcity costs[8], infrastructure wear and tear, part of accident externalities and emissions.

However, there are some conditions that should be met in order to validate the MSC pricing, and in reality these conditions are not always met. Second-best policies are considered when it is not possible to set prices equal to MSC due to the presence of constraints within the transport sector or distortions elsewhere in the economy. Over the last decades a vast technical literature addressing various types of second-best pricing, and considering questions towards the optimal design of second-best pricing schemes and towards the relative efficiency of these schemes has emerged[9].

As far as rail infrastructure pricing is concerned, ECMT (2005) distinguishes four approaches that the European governments have tended to follow:

- **MC:** The social marginal cost pricing, requiring government compensation for the difference between marginal cost and financial cost.
- **MC+:** Marginal cost with a mark-up to reduce (or eliminate) government compensation and the gap between marginal cost and financial cost.
- **FC:** The full cost recovery
- **FC--:** The full cost recovery after receipt of grants, setting access charges to collect the difference between government contribution and full financial cost.

It is important to remark that MC and MC+ approaches require an accurate knowledge of the rail marginal costs and of social costs associated with the rail operations, whereas in the FC- approach government contribution are (in principle) known quantities. Nearly the half of the European countries apply the marginal cost pricing approach with or without mark up, while the other half adopt the full cost recovery approach (FC) (as in Latvia, Hungary, Romania, Poland) and the full cost recovery

[8] Scarcity is significant in the rail and aviation sectors. It happens when demand exceeds capacity. Possible solutions for allocating scarce capacity are slot trading and auctioning: when selling slots on a spot market, scarcity value is the cost of pushing another service off the tracks or into an inferior slot. In the rail sector congestion costs incur when one train delays another. This can happen when rail lines are highly used and the presence of an additional train on the tracks may lead to additional delays to other trains by reducing the ability of the system to recover from delays (ECMT, 2005)

[9] Much of this literature is reviewed in Lindsey and Verhoef, 2001 and in Rouwendal et al. 2002

approach after receipt of grants (FC-), meaning that the infrastructure manager acts as a commercial organisation needing to recover their costs (this is the case of Belgium, Estonia, Germany and Italy).

Table 2-18: Charging principles in EU countries for rail infrastructure

Country	Pricing principle
Austria	MC+
Belgium	FC-
Bulgaria	MC+
Czech Republic	MC+
Denmark	MC+
Estonia	FC-
Finland	MC+
France	MC+
Germany	FC-
Hungary	FC
Italy	FC-
Latvia	FC
Netherlands	MC
Poland	FC
Portugal	MC+
Romania	FC
Sweden	MC+
United Kingdom	MC+

Source: ECMT, 2005

The external costs internalised in the infrastructure access charge differ across countries. All Member States charge for wear and tear (although at different levels), some apply access charges including scarcity and/or congestion costs, and only few charge for power, environmental and accident costs.

Table 2-19: Cost categories included in rail usage charges

					Environmental		
Country		**Wear and tear**	**Power**	**Scarcity/ Congestion**	**Noise**	**Air pollution**	**Accident**
Austria		✓		✓			
Belgium		✓		✓			
Bulgaria		✓					
Czech Republic		✓			✓ (1)	✓	
Denmark		✓		✓			
Estonia		✓					
Finland		✓				✓	✓
France		✓		✓			
Germany		✓		✓	✓ (2)		
Greece		✓	✓	✓			
Hungary		✓					
Ireland		✓		✓			
Italy		✓		✓			
Latvia		✓					✓
Lithuania		✓	✓				
Luxembourg		✓	✓	✓			
Netherlands		✓			✓(3)		
Poland		✓					
Portugal		✓					
Romania		✓					
Slovakia		✓					
Slovenia		✓					
Spain		✓		✓			
Sweden		✓		✓		✓	✓
United Kingdom	**Network Rail**	✓	✓	✓			
	HS1	✓	✓	✓		✓	
	Eurotunnel	✓					

Notes:
(1) A noise factor will be introduced in 2013.
(2) A noise related component in the access charge for freight traffic and a bonus system will be introduced in December 2012.
(3) Bonuses for trains with silent wagons are currently provided

Source: van Essen et al, (2012)

In the road sector, multiple internalisation targets can be achieved with tolls, including:

- Infrastructure costs: particularly when charges are differentiated by axle load;
- Air pollution costs: particularly when charges are differentiated by fuel type and Euro class;
- Noise costs: ideally charges should be differentiated by noise emission class and by time period (day/night); however in practice such a differentiation is not yet sufficiently well developed.
- Congestion costs: this requires charges that are differentiated by road sections and time of the day (or ideally by considering the actual congestion level).

Vignettes are not a suitable instrument to internalise external costs. In fact once the charge is paid, the access and use of infrastructure is unlimited. Differentiation can be made on the basis of designed parameters (such as CO_2 emission factor or fuel efficiency, Euro class, fuel type, engine size/power, vehicle size, configuration and weight, vehicle age, value and purchase price), but only at the moment of purchase of the vignette.

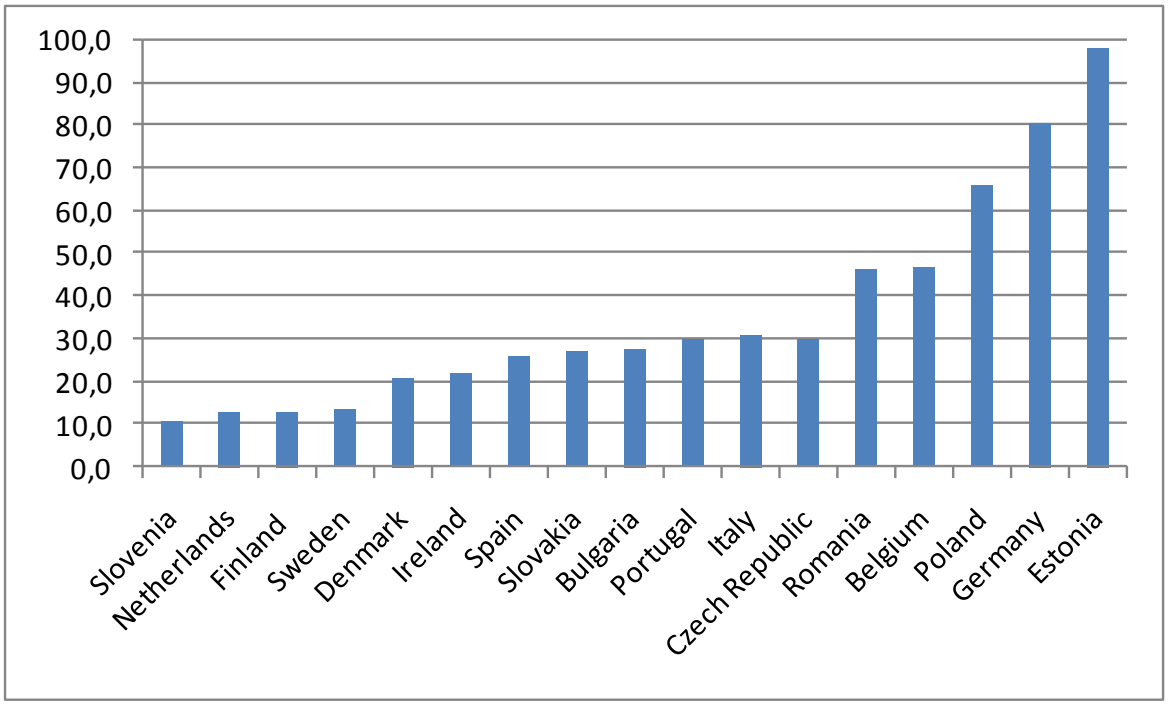
Apart from infrastructure charges, other taxes can partially and indirectly have the effect of reducing external costs, including:

- Fuel taxes serve many purposes: they are intended to cover strategic issues regarding security of supply, production processes as well as externalities of fuel consumption. They are also an important source of revenue for public budgets.
- Vehicle taxes which can be distinguished in:
    - Registration taxes, which are applied in many of the EU countries. Through the registration tax the government can promote or discourage certain vehicle types. The tax varies according to Euro/EURO class, fuel type, level of local pollutants such as NOx and PM.
    - Ownership and circulation taxes, which are levied in all Member States. Contrary to registration taxes, heavy duty vehicles are subject to this form of taxation in nearly all countries. Parameters which determine the tax level are: engine size/power and CO_2 emissions for passenger cars; and gross vehicle weight (GVW) for heavy goods vehicles, in many cases also combined with the vehicle's axle configuration and suspension type. The system which determines the tax level depends on the year of first registration, with newer vehicles benefitting from modern technologies and the lower ratio CO_2/engine size this provides them with.
- Insurance for accidents can be seen as a measure to internalise accident costs.
- VAT exemptions and discounts applied on road transport services like bus transport, taxis etc.
- Other measures such as benefit in kind that is attributed to company cars used for private trips by employees, purchase premiums to support environmentally friendly vehicles and local congestion charging scheme as applied in several European cities.

2.5.2.5 Level of cost recovery

In the railway sector, there exists a high variability between countries: the percentage of costs covered by infrastructure charges ranges from 10.6% in Slovenia and 98.4 % in Estonia.

Figure 2.9: Percentage of total rail infrastructure cost covered by infrastructure charges



Source: van Essen et al, (2012)

As far as the road sector is concerned, no specific data on infrastructure costs coverage is available; a general overview of cost coverage ratios has been provided in van Essen et al (2012). It considers:

- Total revenues deriving from all road transport related taxes and charges (i.e. registration taxes, ownership taxes, infrastructure charges, insurance taxes and fuel taxes);
- Total external costs (van Essen et al 2011[10]) per member state (i.e. accident, air pollution, climate change, emissions from fuel production, biodiversity losses, nature and landscape, soil and water pollution, urban effects);
- Indicative road transport external costs and infrastructure costs (the latter from IMPACT Deliverable 2[11]).

It should be noted that these ratios should be treated with some care as there is quite some uncertainty in the infrastructure cost estimates as explained in the notes to the following Table.

Table 2-20: Indicative cost coverage ratios for road transport

Member State	Total revenues	Total external costs	Infrastructure & External costs road transport (indicative)		Cost coverage (indicative)	
	mln Euro per year	mln Euro per year	excl. fixed infra mln Euro per year	incl. fixed infra mln Euro per year	excl. fixed infra	incl. fixed infra
Austria	€ 8,059	€ 13,037	€ 14,261	€ 18,529	57%	43%
Belgium	€ 6,341	€ 12,238	€ 14,362	€ 21,413	44%	30%
Bulgaria	€ 1,124	€ 4,330	€ 4,468	€ 4,927	25%	23%
Czech Republic	€ 3,722	€ 8,233	€ 9,273	€ 12,759	40%	29%
Denmark	€ 5,632	€ 5,177	€ 5,503	€ 6,464	102%	87%
Estonia	€ 316	€ 669	€ 1,157	€ 2,787	27%	11%
Finland	€ 4,285	€ 5,706	€ 6,735	€ 10,273	64%	42%

[10] van Essen et al (2011), External costs of transport in Europe, Update study 2008, September 2011
[11] van Essen , H., Doll, C. (2008), Road infrastructure costs and revenue in Europe, Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT), Deliverable 2, April 2008.

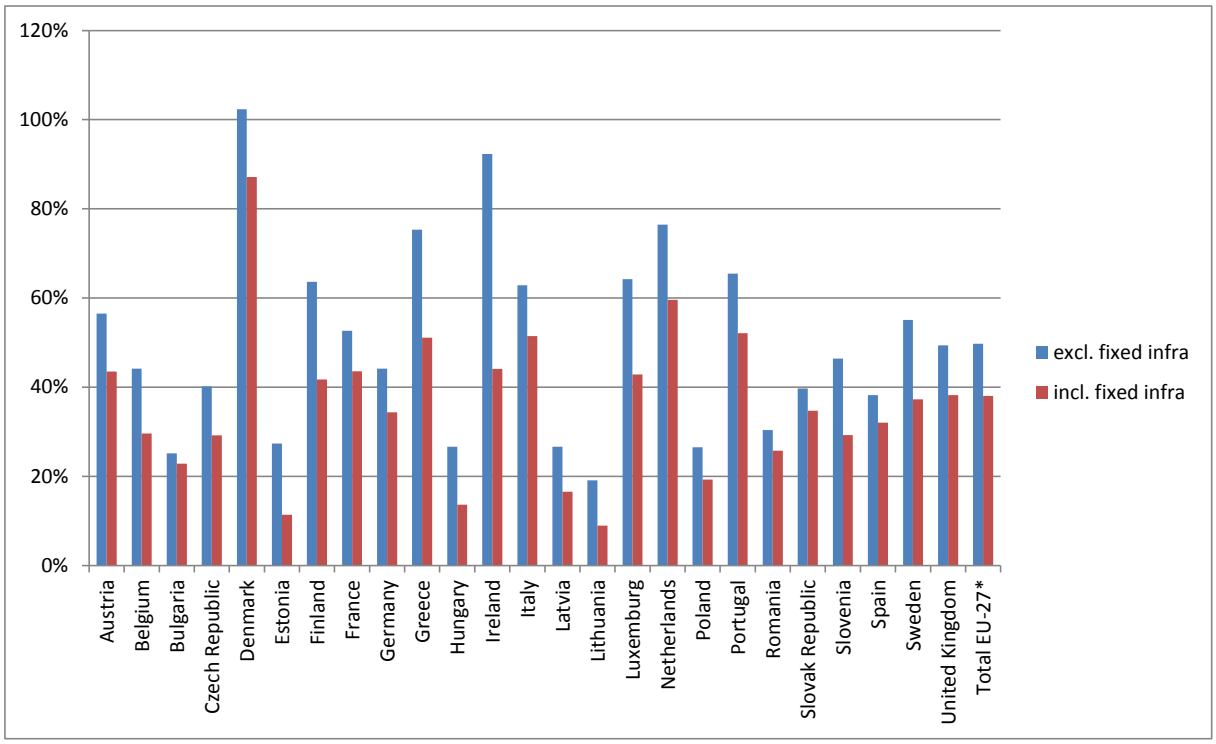
Member State	Total revenues	Total external costs	Infrastructure & External costs road transport (indicative)		Cost coverage (indicative)	
	mln Euro per year	mln Euro per year	excl. fixed infra mln Euro per year	incl. fixed infra mln Euro per year	excl. fixed infra	incl. fixed infra
France	€ 35,062	€ 62,285	€ 66,575	€ 80,517	53%	44%
Germany	€ 48,738	€ 101,551	€ 110,403	€ 141,789	44%	34%
Greece	€ 6,333	€ 7,215	€ 8,408	€ 12,396	75%	51%
Hungary	€ 2,432	€ 6,516	€ 9,123	€ 17,820	27%	14%
Ireland	€ 3,926	€ 2,857	€ 4,253	€ 8,900	92%	44%
Italy	€ 35,490	€ 52,318	€ 56,474	€ 68,944	63%	51%
Latvia	€ 431	€ 1,332	€ 1,616	€ 2,604	27%	17%
Lithuania	€ 550	€ 1,926	€ 2,887	€ 6,148	19%	9%
Luxemburg	€ 983	€ 1,302	€ 1,531	€ 2,294	64%	43%
Netherlands	€ 14,579	€ 17,487	€ 19,070	€ 24,459	76%	60%
Poland	€ 6,390	€ 21,420	€ 24,119	€ 33,169	26%	19%
Portugal	€ 4,831	€ 6,833	€ 7,381	€ 9,270	65%	52%
Romania	€ 2,323	€ 7,234	€ 7,641	€ 9,014	30%	26%
Slovak Republic	€ 1,598	€ 3,850	€ 4,024	€ 4,607	40%	35%
Slovenia	€ 1,400	€ 2,488	€ 3,017	€ 4,786	46%	29%
Spain	€ 16,104	€ 39,796	€ 42,165	€ 50,223	38%	32%
Sweden	€ 5,922	€ 8,432	€ 10,752	€ 15,895	55%	37%
United Kingdom	€ 36,677	€ 67,802	€ 74,314	€ 95,948	49%	38%
Total EU-25*	**€ 253,248**	**€ 462,033**	**€ 509,514**	**€ 665,935**	**50%**	**38%**

Notes:
**Malta and Cyprus are not included since these are not included in the external costs dataset.*
Infrastructure costs are based on very rough estimates directly taken from IMPACT Deliverable 2 (for the year 2005). Given the large uncertainty and indicative character of these numbers no correction has been made for translating them from 2005 to 2008 prices.
Using high climate cost estimates were based on a CO2 price of €146 per ton of CO2.
Subsidies not included (e.g. for company cars, business & commuting travel, bus transport).

Sources:
van Essen et al, (2012); External Costs of Transport in Europe – Update study 2008, CE Delft, INFRAS and Fraunhofer-ISI, 2011; Road infrastructure cost and revenue in Europe - Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT) – Deliverable 2, CE Delft and Fraunhofer-ISI, 2008.

Below, the relevant graph including and excluding fixed infrastructure costs is reported.

Figure 2.10: Indicative cost coverage ratios for road transport



Sources: van Essen et al, (2012)

2.5.2.6 Effects: infrastructure charges and users' reactions

As far as the effects of the level of infrastructure charges upon the choice of transport mode is concerned there is relatively little literature relating to the impacts of access charging in the rail sector.

Although no relevant data can be provided, case studies with considerations on the effects of changes of rail access charges on rail service and considerations on road transport elasticities have been discussed in the literature.

2.5.2.6.1 Rail

As for the rail sector, the DIFFERENT project investigated on the rail infrastructure charges and users' reaction with major focus on the rail freight market, the latter being more sensitive to infrastructure charges than the rail passenger market. This is due to several factors, including:

- The freight rail sector tends to be privately operated,
- There can be severe competition from the road market in certain circumstances - especially for certain commodities and on short-medium distances (however rail is generally considered more economical for bulk transport over long distances);
- There is greater open access competition in freight than in passenger transport and
- The freight rail sector receives less government financial support than passenger services.

Data on rail freight is scarce, but some case studies are available:

2.5.2.6.1.1 UK

It has been observed that rail freight growth started in 1995 (the year of introduction of charges) and that no disruptive increases have been registered since 2001, when charges were halved. The impact of this variation of infrastructure charges is unclear, considering other changes in the market have simultaneously occurred. Other factors that could explain the growth since 1995 include: increased road congestion, increased costs for road freight arising out of the fuel duty escalator, an increase in coal imports, improved quality of services for rail freight and investment on rail freight facilities.

An attempt to quantitatively describe the responsiveness of rail traffic to different access regimes has been implemented in Britain through the Leeds Freight Transport Model (LEFT). The study revealed that by removing access charges, rail t-km increase by 9%, reducing road traffic by almost 2 billion t-km, just 1%. This underlines the lack of competitiveness of rail in key freight markets, because of high captivity to road transport given the short distance involved and the lack of suitable rail infrastructure.

2.5.2.6.1.2 France

Rail infrastructure charges in France have experienced several changes for both charging structure and levels since they were first introduced in 1997. While freight infrastructure charges increased, freight traffic was on a downward trend from the end of the 1990's. However, the linkage between charges and traffic remains unclear and it is probably low. In fact a notable decrease of freight traffic occurred when reservation fees were implemented and led to the suppression of "facultative" paths that were unused. In addition the charge level represents a low share in operators' costs, especially for SNCF (around 8%), whereas the evolution of traffic showed important shocks that seem to be much more related to the changes in SNCF's freight strategy. In addition, other factors occurred over the period, such as reorganisation plans, railway strikes and economic globalisation. All these events have had an impact on traffic to a much larger degree than the (relatively small) infrastructure charge..

2.5.2.6.1.3 Sweden

By international comparison, Swedish rail infrastructure charges are low and the government has decided to raise these charges. In the Swedish transport authorities' "Proposed National Plan for the Transport System 2010-2021" Swedish rail infrastructure charges are estimated to rise from about SEK 600 million per year to an average of SEK 1.3 billion per year (which implies that charges will increase by more than double).

Table 2-20shows estimated rail volume changes in passenger and freight in 2015 and 2020 compared to 2009, caused by the increase in charges. Assuming that the entire increase in charges imposed by the operator can be passed on to the customer in the form of higher prices for the transport, increased rail infrastructure charges in 2015 and 2020 would lead to reductions in transport mileage by about 2% in 2015 and about 4% in 2020. Major reductions for freight transport are expected.

Table 2-21: Changed transport mileage compared to 2009 for freight and passenger transport

Transport	Change in transport mileage in 2015	%	Change in transport mileage in 2020	%
Passenger	-260 million p-km	-1,8%	-519 million p-km	-3.5%
Freight	-552 million t-km	-2.2%	-1214 million t-km	-4.6%

Source: Ljungberg A., (2012), Impacts of increased rail infrastructure charges in Sweden, Research in Transportation Economics, ELSEVIER

Finally, studies for Europe provide estimates for cross-price elasticity of rail demand on a European-wide scale, via the projects SCENES and EXPEDITE (as quoted in Significance, 2010). According to SCENES, the transport cost (per t-km) elasticity of rail tonnage is estimated to be 1.6 and of rail t-km of 2.4. The latter is considerably more sensitive because long distance transport is more affected compared to short distance transport. EXPEDITE found that the t-km price elasticities are between 1.1 and 1.7 for the effect on rail t-km on journeys over 500km.

2.5.2.6.2 Road

As for road sector, a recent research study carried out by CE Delft on the price sensitivity of European road freight transport[12] provides important information on road freight transport price elasticities. The analysis is based on a review of a wide range of research.

There are a wide range of elasticity values which are justified by differences between countries (large differences in the competitiveness of rail transport or inland waterways transport between countries distance classes and commodity types, etc.). The main conclusions from the literature review on road price elasticities have been summarised below, along with the best-guess values of road freight transport price elasticities (Significance, 2010).

[12] CE DELFT (2010), Price sensitivity of European freight transport – towards a better understanding of existing results, A report for Transport & Environment , June 2010.

Table 2-22: Results from the literature review on road price elasticities (best guess estimate)

Price change	Impact on	
	V-km	**T-km**
Vehicle kilometre price	-0.1 to -0.8 (-0.9)	-0.1 to -0.5 (-0.6)
Ton kilometre price		-0.6 to -1.5 (-1.0)

Source: Significance (2010)

The vehicle price elasticities consist of three effects: changes in mode (-0.3), changes in transport demand (-0.3) and changes in transport efficiency (-0.3). For the ton kilometre price elasticity two effects can be distinguished: change in mode (-0.4) and change in transport demand (-0.6).

2.6 Impacts on local pollution and congestion

Purpose: To explore the implementation of charge differentiation in Member States for the purposes of controlling air pollution and/or congestion, and the impact of these provisions.

Context: The Eurovignette Directive states that rates can be differentiated to combat local air pollution and congestion problems, but that any differentiation must be "proportionate to the objective pursued and revenue neutral". Variations in tolls and/or user charges can be applied to reflect differences in the environmental performance of vehicles (to combat air pollution), and the time of day (to combat congestion).

Main Findings

Reducing air pollution has been achieved by Euro-differentiation of network-wide tolls. Other types of charges (vignettes and tolls that are not Euro-differentiated) have had little effect.

- Fleet renewal due to tolls differentiated by Euro class has been found to be significant in Germany, where the effects of the road pricing were reinforced by government incentives to purchase Euro V trucks.
- The Eurovignette has had less impact compared to tolls. However, there are still some effects on fleet composition due to spill over effects from foreign road user charges.
- In countries with tolls differentiated by Euro class, the share of vehicle-kilometres is proportionately higher for cleaner trucks compared to the fleet composition. Generally, the "mileage is cleaner than the fleet", i.e. newer trucks tend to be used more, but this effect appears to be lower in countries with vignettes (CTS, 2012). Euro-differentiated tolls also encourage greater use of cleaner vehicles engaged in international transport from non-tolled countries.

Additional measures can mitigate route shifting to uncharged routes, which would otherwise undermine the effectiveness of user charges

- Route shifting occurs where alternative routes of high quality were available; however, introducing charging, vehicle restrictions or speed limits on these routes was sufficient to counteract this effect

There is some evidence of improvements to transport efficiency due to tolls, whereas vignettes have had no discernible effect

- The introduction of the tolls in Germany and Austria coincided with a decrease in the average distance travelled by trucks.
- After 2007, it becomes very difficult to isolate the impacts of road user charging because the economic crisis had severe impacts on indicators of transport efficiency.

There is limited use of congestion pricing, but where it has been introduced, it has proved an effective instrument to reduce congestion.

- Opposition to the use of congestion charges is linked to distributional effects; groups with a high valuation of time gain at the expense of groups with low valuation of time, even with supporting policies to increase investment in alternative modes.
- In the Czech Republic, time-varying charges on the network-wide toll led to a reduction in peak traffic of 15%. For vehicles with three or more axles the increase in toll rate was 50% and for vehicles with two axles the increase was 25%.
- In France, increasing toll rates during the weekend rush hour on several motorway sections resulted in a transfer to off-peak periods of 8-12%. These charges include passenger cars, which are thought to be able to adjust travel times more easily compared to freight

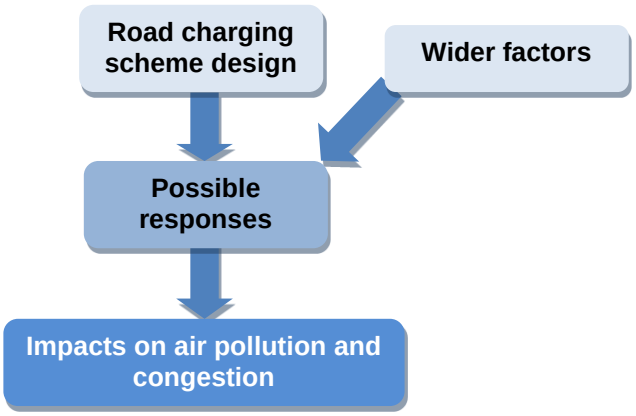
2.6.1 Ex-post assessment: Approach to assessment of impacts on air pollution and congestion

The effects of road user charging must be evaluated while taking into account other factors that could affect the outcomes. A stepwise approach to understanding the interactions between different factors is described in this section. The steps involved are to:

1. Determine the possible responses to road user charging;

2. Identify how different designs of road user charging create incentives to take up each possible response;
3. Determine how each possible response affects air pollution and congestion;
4. Identify interactions with wider factors; and
5. Analyse the most important responses created by road user charging in terms of their impacts on air pollution and congestion.

Figure 2.11: Overview of approach



The possible responses to road user charging represent the behavioural responses of road users. These result in changes in the fleet characteristics, traffic flows and traffic volumes that can be measured and observed. Next, the effectiveness of road user charging to simulate each possible response is considered, as this determines the measurable responses that should be quantified. The most important responses in terms of their impacts on air quality and congestion are then identified. Finally, wider factors are considered, as any response analysed should be the result of the road user charging and not other issues.

2.6.1.1 Determine the possible responses to road user charging

The possible responses to road user charging are the starting point for this analysis because they represent the impacts of road user charging that can be **observed and measured**.

These responses are very broad, and cover all of the different ways in which users can change their behaviour. They can be summarised as follows:

Box 2-1: Possible responses to road user charging

Changes in fleet composition
In cases where this is incentivised through differentiation according to Euro class, the savings on road charges may offset the additional purchase cost. Greater usage of higher Euro class vehicles can be achieved through:

- Higher uptake of cleaner vehicles
- Greater usage of cleaner vehicles within the fleet

Improvements to transport efficiency
This can be achieved through optimising usage of the fleet, including:

- Optimising allocation and loading of vehicles
- Consolidating shipments
- Increasing shipment size
- Reducing empty runs

Changes to trip planning
For geographically or time-limited schemes, road users may be able to avoid the charges by:

- Changing routes to circumvent the charged area
- Changing travel time (for time-differentiated schemes)
- Changing start/end points

Other reduction in road transport demand
This includes options to reduce road transport demand overall (in terms of tonnes lifted), as opposed to simply on the charged route (as for changes to trip planning):

- Shifting to non-road modes
- Changing choice of supplier/receiver
- Reducing demand for the product

2.6.1.2 Effectiveness of road pricing policies on encouraging each response

The potential for each response varies considerably with the ownership structure of the fleet, the type of goods transported and the transport distance; however the general trends are consistent. The decision-makers involved at each step of the supply chain have an impact on the order of the responses typically observed. Thus it is first necessary to identify the participating stakeholders and understand the basic types of contracts through which they interact. Transactions start when a firm requiring goods to be transported (the "shipper") contracts with a motor carrier (the "haulier"). Hauliers may in turn hire company drivers to operate their own fleet or may subcontract with self-employed owner-operators. The shipping rate is often negotiated based on the distance, duration, weight, volume, or number of shipments.

A summary of the options available to avoid or reduce the costs are as follows:

Table 2-23: Possible responses to an increase in transport costs

Possible responses	Examples	Decision-maker(s)			Impact on unit of transport		
		Haulier	Shipper	Consumer	Tonnes lifted	T-km	Veh-km
Greater share of higher Euro class vehicles	Switching to higher Euro standards (for charges differentiated by Euro class)	✓					
	Increased usage of higher Euro classes within existing fleet	✓					
Improve transport efficiency	Optimising load factors	✓	(✓)				✓
	Reducing empty runs	✓				✓	✓
Trip planning	Change in route to circumvent charged area	✓				✓	
	Change in time of day (for time-differentiated charges)	✓	✓				
Other reduction in road transport demand	Modal shift away from road		✓		✓	✓	✓
	Reduce demand for product			✓	✓	✓	✓

Source: Adapted from Significance (2010)

Road charges impact directly on the haulier, who can respond by passing the cost through to the shipper, absorbing the cost, or avoiding the cost. The shipper only receives price signals if the haulier passes the costs through. The potential for cost pass-through is determined by factors such as the type of cargo and the equipment needed to transport it (Significance, 2010). In general, road freight transport is very competitive, which makes it more difficult to fully pass costs through; therefore responses that can be chosen by the haulier are usually observed first as they try to mitigate the cost increases.

This means that usually the first response to road user pricing is to increase transport efficiency, and only once these options have been exhausted are other effects seen. Typically, other reductions in road transport volumes (through modal shift and reducing demand) appear last because the decision maker is furthest up the supply chain.

2.6.1.3 Vignettes or tolls

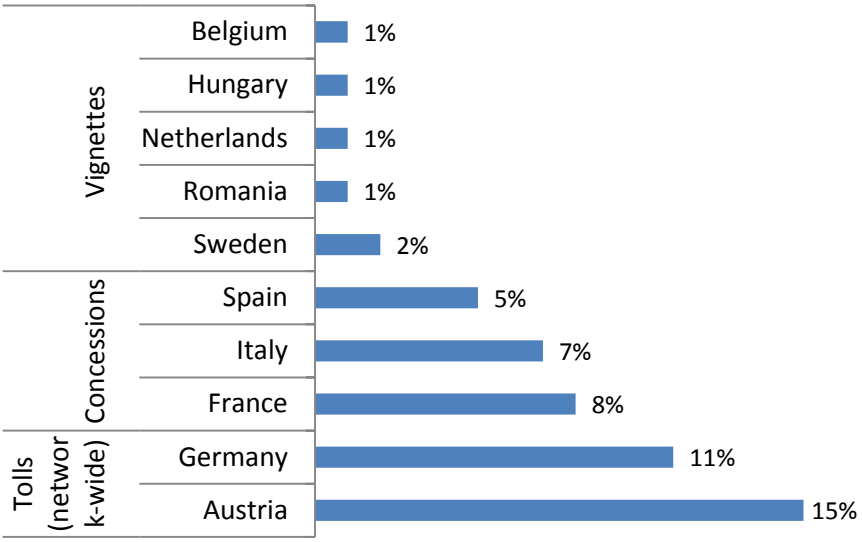
The external costs of air pollution and congestion correlate much more closely with distances (vehicle-km) rather than t-km or tonnes lifted. Charges that vary by distance (tolls) have a greater influence on the mileage driven, and therefore have a greater impact on air pollution (and to a lesser extent on congestion). Fixed charges such as annual or one-time charges (vignettes) which are tied to the vehicle do not affect the mileage.

It is possible to differentiate road charges according to environmental characteristics in order to encourage a shift to these vehicles (and hence improve air quality). Again, this impact is stronger for tolls compared to vignettes because the overall differentiation can be much greater.

Congestion is directly targeted only through time differentiation of road charging, which is only possible with tolls.

In addition, tolls provide much higher price incentives that are directly linked to usage. For network-wide schemes, they represent over 11-15% of total operation costs compared to just 1-2% for vignettes. A comparison of the share of road user charges in total truck operating costs is provided in the figure below.

Figure 2.12: Share of road user charges compared to total truck operating costs



Source: Bayliss (2012); VTI (2010)

2.6.1.3.1 Impact of each response on air quality and congestion

As noted before, air pollution is directly targeted through encouraging a greater shift to higher Euro class vehicles (either through changing the fleet composition or incentivising greater usage of cleaner vehicles within the fleet). It can also be improved by increasing the efficiency of transport, as this could reduce the distance travelled (e.g. by consolidating loads). Congestion is only directly targeted by encouraging time shifting away from peak periods. Reductions in congestion and air pollutant can also be achieved indirectly by factors that reduce overall traffic on the roads, although the effects are less well-targeted. Route shifting could improve local congestion and air pollution on the charged route, but could move the problem elsewhere, so the overall effect is uncertain.

The effect of each of these possible responses to road pricing on air pollution and congestion are shown in Table 2-24.

Table 2-24: Impact of different responses to road user charging on air pollution and congestion

Key: **+** = *direct positive impact;* **-** = *direct negative impact;*
● = *indirect or weak impact* *? = impact could be positive or negative*

Impact on externality	Greater share of higher Euro class	Trip planning		Improve efficiency		Other reduction in road transport demand	
		Route shift	Time shift	Reduce veh-km	Reduce t-km	Modal shift away from road	Reduce demand for product
Air pollution	+	?		+	●	?	●
Congestion		?	+	●		●	●

Source: Ricardo-AEA

Notes: veh-km = vehicle-kilometres; t-km = tonne-kilometres

Tolls and road prices introduce a higher charge for users, providing a financial incentive to change behaviour in the ways described above. However, road user charges are only one component of the total operating cost of road hauliers. Isolating the impacts of road user charging is challenging, as any observed effects could be the result of other factors. Other policy instruments such as vehicle

taxation, vehicle emission standards and fuel taxation have also been implemented across Europe. Wider economic factors such as GDP and the oil price also have a significant bearing.

This creates a complex environment in which the "real world impacts" must be assessed. In particular, the possible responses to road pricing are also closely linked with GDP and wider economic policies. It is important to consider the wider determinants of fright transport demand.

2.6.1.4 Interaction with wider factors

Other policies that have a direct impact on the share of higher Euro class vehicles (and hence air pollution) are direct regulations that requires uptake of Euro standards for new vehicles after a certain date, and economic incentives for ownership of higher Euro classes through tax reductions or subsidies. Direct regulation of Euro standards has been implemented across Europe, so the different impacts across Member States depends on the fleet renewal rates and relative usage of newer vehicles. Economic incentives have been used to varying degrees in Member States – this is discussed in more detail later in this chapter. The impact of route shifting on air pollution is unclear, as it depends on the change in emissions due to the new route. Similarly, the impact from modal shift is overall not clear as the lower network density of rail and inland waterways can lead to an increase in distance travelled; however in most cases it is expected that air pollution will reduce because the emissions per km of rail and water freight are significantly lower than for road haulage.

Congestion is directly targeted only through time differentiation of road charging, which aims to establish allocative efficiency by charging higher prices during peak periods. Reductions in congestion can also be achieved indirectly by factors that reduce overall traffic on the roads.

2.6.1.5 Summary

In summary, the key issues to note are:

- **Impacts on air pollution are most strongly determined by responses that change the share of Euro standards in fleet ownership/usage and improvements in transport efficiency – particularly reductions in veh-km.**
- **Impacts on congestion are most strongly determined by factors that lead to time shifts away from peak periods.**
- **Vignettes exert only weak effects on possible responses to reduce air pollution and/or congestion. This is due to the low price incentive that is achieved through these types of scheme (as discussed earlier).**
- **Tolls may have strong effects on possible responses to reduce air pollution and/or congestion, depending on the design and coverage of the scheme**
- **The strongest effects on air pollution arising from non-road pricing policies relate to:**
  - **Policies on Euro standards (direct regulation and vehicle ownership costs) and**
  - **Relative investment in road and non-road infrastructure**
- **Road pricing policies have only weak impacts on overall road transport demand (in terms of tonnes lifted) compared to wider factors such as GDP (i.e. demand for freight) and fuel prices (which make up a far larger proportion of operating costs compared to road charges).**

2.6.2 Impacts on air quality

2.6.2.1 Overview of charging groups according to Euro class

For countries with tolls, it can be noted that Austria, Germany and Poland have differentiated charges according to four groups of emission classes, whilst the Czech Republic, Slovakia and Slovenia differentiate charges using three groups and a different situation emerges for the Frejus and Mont Blanc tunnels where the number of groups is lower due to restrictions on the types of vehicles allowed to use the tunnels.

In almost all countries with tolls, the group for which the highest charges apply (Group 1) includes Euro 0 to Euro II. The exception is Austria, where Group 1 includes all emission classes from Euro 0 to Euro III.

Table 2-25: Comparison of EURO emission groups across EU member states

	Country	Euro 0	Euro I	Euro II	Euro III	Euro IV	Euro V	EEV	Euro VI
Vignette	**Belgium, Denmark, Luxemburg, Netherlands Sweden**	**Group1**	**Group 2**	Group3					
	Bulgaria	**Group1**			**Group2**				
	Lithuania	**Group1**			**Group2**				
Toll	**Austria**	**Group1**				**Group2**		Group 3	Group4
	Germany	**Group1**			**Group 2**	Group3	Group4		
	Poland	**Group1**			**Group 2**	Group3	Group4		
	Czech Republic	**Group1**			**Group 2**		Group3		
	Slovakia	**Group1**			**Group 2**	Group3			
	Slovenia	**Group1**			**Group 2**	Group3			
	France/Italy Frejus tunnel	Not allowed	**Group1**		**Group2**				
	France/Italy Mont Blanc tunnel	Not allowed			**Group1**				

In the case of vignettes, it can be observed that Bulgaria and Lithuania have two different levels of tariffs according to emission class, while the Eurovignette countries have three tariff levels

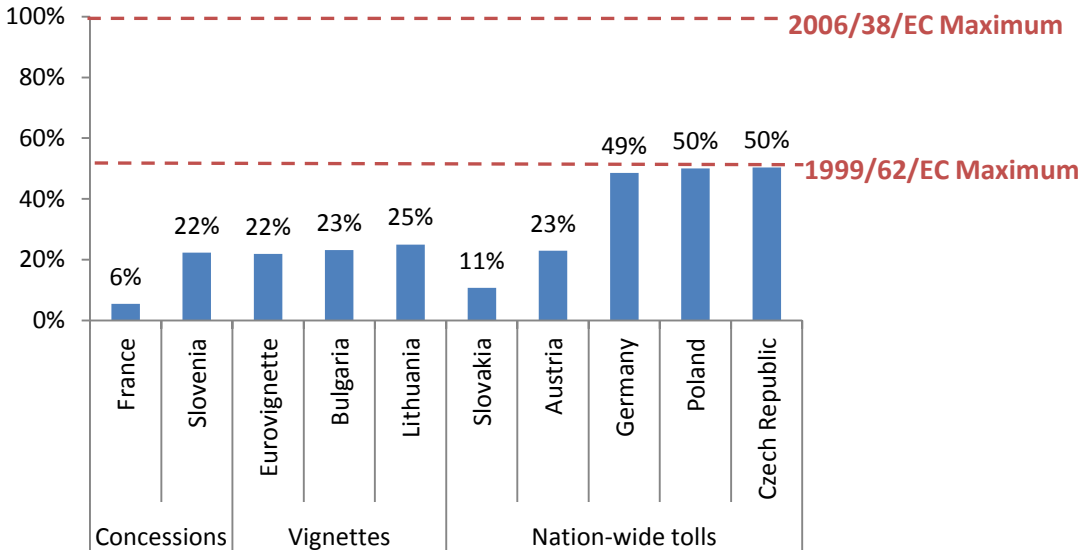
Despite the common methodology for calculating infrastructure costs introduced by the Eurovignette Directive, the rates following the differentiation by Euro classes vary considerably between Member States, as the underlying costs vary due to differences in, for instance, maintenance and operational costs as well as due to differences in the composition of the vehicle fleets at country level.

2.6.2.2 Analysis of maximum charge differentiation applied

The Eurovignette Directive has always allowed some degree of charge differentiation in relation to the environmental performance of vehicles, in order to encourage a shift to less polluting vehicles. Most Member States already have this measure in place. An important issue to note is the revision of the Directive in 2006. This introduced more options to vary tolls according to environmental performance. The maximum differentiation to control air pollution was extended from 50% to 100%.

Figure 2.13 shows the maximum charge differentiation according to Euro class for vehicles in the same category. It ranges from 6% to 50%. Thus, even after the maximum level was raised to 100%, all Member States still apply charge differentiation significantly lower than this level.

Figure 2.13: Maximum charge differentiation according to Euro class for vehicles in the same category



2.6.2.3 Analysis of impacts on air quality

Improvements in air quality can be realised through several responses as described in Section 2.6.1.1. It is clear that the greatest improvements in air quality are realised through achieving greater shares of higher Euro class vehicles and improving transport efficiency. Improvements are also possible through reduction in demand for freight transport overall.

To analyse the impacts on air quality, each possible response to road user charging is assessed in turn. The following sections examine the impacts on air quality as achieved through:

- Encouraging a greater share of higher Euro class vehicles; and
- Increasing transport efficiency.

As described in the previous section, tolls provide much higher price incentives that are directly linked to usage. For network-wide schemes, they represent over 11-15% of total operation costs compared to just 1-2% for vignettes.

2.6.2.3.1 Greater share of higher Euro Class vehicles

Key: **+** ***= direct positive impact;*** **-** ***= direct negative impact;***
● ***= indirect or weak impact*** ***? = impact could be positive or negative***

Overview: Greater share of higher Euro class vehicles		
Mechanisms		Switching to higher Euro standards (for charges differentiated by Euro class)
		Increased usage of higher Euro classes within existing fleet
Road charging characteristics to increase effect	●	**Time-based** charge differentiation by Euro class.
	+	**Distance-based** charge differentiation by Euro class.
Impact on air quality	+	Air quality can be improved in the long-run by changing the fleet composition, and in the short run by increasing usage of higher Euro classes in the existing fleet
Impact on congestion		No impact
Interactions with other policies	+	Various policy instruments (fuel taxes, differentiated vehicle taxes, direct regulation of tailpipe emissions) help to increase the market share of higher Euro class vehicles.
Interaction with wider economic factors	●	Some linkages to general GDP growth, which may create demand for new vehicles (capacity), which must conform to higher Euro standards.

Encouraging greater share of high Euro class vehicles is only achieved through road user charging by differentiating the charges by Euro class. Even so, the effectiveness of time-based charging in terms of encouraging environmental improvements is very weak (INFRAS, 2000). The effectiveness of distance-based schemes is much higher because the charges are directly linked to the usage of the vehicle. Therefore, the strongest evidence of improvements in air pollutants is found under toll (distance-based) schemes differentiated by Euro class.

There are two mechanisms for achieving a greater share of higher Euro class vehicles:

- Switching to higher Euro standards (through faster fleet turnover); and
- Increased usage of higher Euro class vehicle within the existing fleet

The most important policy instrument to consider is direct regulation of air quality pollutants from HDVs. These are regulated under the Euro standards, which have been successively tightened over the years. Due to the technologies needed to control emissions there can be a trade-off between fuel efficiency and air pollutant emissions control. Since the heavy truck fleet has a relatively high sensitivity to fuel consumption (which comprises a significant proportion of operational costs), the Euro standards have typically been adopted much closer to the deadline (i.e. as late as possible) for the majority of truck models (AEA, 2012).

2.6.2.3.1.1 Switching to higher Euro standards

Since purchasing and leasing decisions for new vehicles arise relatively infrequently (every four to five years), the impacts on fleet renewal can take many years to become evident.

Impacts of tolls differentiated by Euro class have been found to be significant, whereas flat tolls have not encouraged fleet renewal.

- In **Germany** the fleet was significantly modernised after the introduction of the toll, and new registrations of vehicles with lower Euro standards reduced disproportionately. Today almost 40% of trucks >12t are Euro V compliant compared to 20% for trucks 2.5-12t (CTS, 2012). The downgrading of Euro IV vehicles from the beginning of 2006 resulted in a stronger interest in Euro V vehicles, although it should be noted that environmental steering effects are also caused by government incentives (Hall & Hesse, 2012). From 1 September 2007 to 30 September 2008 and from 1 February 2009 to 30 September 2009 the German government subsidised the purchase of new trucks over 12 tonnes with Euro V or better performance. Non-refundable grants of about €2550 per truck (for large companies) up to €4250 per truck (for small companies) were paid, which corresponds to about 50% of the price difference between Euro IV and V vehicles (CTS, 2012). In February 2010 the German government started to subsidise Euro VI trucks over 12t; the subsidy was €2500 to €3000 per truck. Since March 2012 small firms can get a subsidy of €6050, medium-sized firms of €4950 and large firms of about €3850 per Euro VI truck (CTS, 2012). This has led to the German fleet being composed of only a small portion of Euro IV trucks, as hauliers purchased Euro V instead.
- **Austria** introduced differentiation by Euro standard in 2010. Is it too early to tell the impacts of this change on fleet renewal; however, studies have shown there were no impacts on fleet renewable from the previous toll that was not differentiated by Euro class (CTS, 2012).

The Eurovignette charge is differentiated by Euro class, but there are currently no different fees for Euro II-VI. The environmental steering effects have been found to be lower compared to tolls. Although there are still some observed effects on fleet composition in Eurovignette countries, this is thought to be because of spillover effects from international road user charges.

- In **Sweden**, Larger vehicles are generally cleaner compared to smaller vehicles. In 2011, the share of Euro V trucks over 12t was 27% compared to 13% for 3.5-12t. However, at least in part this effect is due to road user charges internationally – as international transport accounts for a greater proportion of mileage of more environmentally friendly trucks (CTS, 2012).

Member State responses to questionnaires

- **Slovenia:** It was noted that Slovenia does not currently monitor the impact of differentiation by Euro class.
- **Denmark:** The answers to the questionnaire circulated at the end of 2012 showed some plans to introduce monitoring of traffic volumes for each Euro class following the adoption of the new road charging scheme. Nevertheless in the first months of 2013 the new Danish government decided to abandon the introduction of distance-based tolls..

- **Poland:** Euro V increased their share of v-km. Euro V increased by four percentage points from 28% to 32% of v-km between 2011 and 2012; Euro IV remained unchanged; Euro III decreased from 36% to 35% of v-km; Euro II decreased from 15% to 13% of v-km and Euro I decreased from 2% to 1% of v-km. However, it is not clear how much of this change is due to natural fleet renewal as these statistics were not available.
- **Czech Republic**: Mentioned that transport performance by Euro class is monitored, but did not provide further information
- **Spain**: Traffic information is not monitored. It was pointed out that infrastructure charges are applied only to a small portion of the highway network (18.8%) and as a result air pollution is not considered.
- **Italy:** In cases where Euro-differentiation is introduced, environmental monitoring systems must be developed in accordance with the relevant technical Agencies, including those of the local Authorities: ISPRA (Institute for Protection and Environmental Research), ARPA and APPA . However, no further information was provided.
- **In the Netherlands**, where a time-based system is in place and the differentiation of tariffs between EURO classes doesn't encourage the usage of cleaner vehicles (being EURO II vehicles charged as EURO V ones) only a small effect on investment strategies of operators has been declared.
- **Portugal:** No monitoring

2.6.2.3.1.2 Greater use of cleaner vehicles

In most cases, an incentive is created for a greater share of higher Euro class vehicles in terms of numbers, whereas only toll differentiation by Euro class creates an incentive for a greater share in terms of mileage.

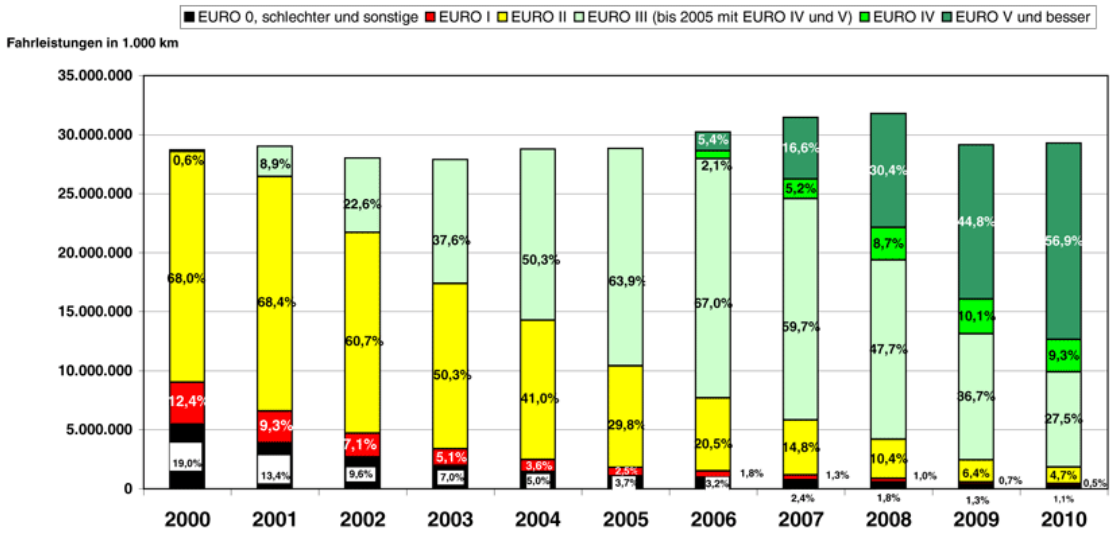
An indication that greater use of cleaner vehicles is being incentivised is if the share of vehicle-kilometres (veh-km) is proportionately higher for cleaner trucks compared to the fleet composition. Compared to the impact on fleet renewal, this effect can be observed much more quickly as hauliers may preferentially deploy the cleanest vehicles in their existing fleet.

- **Germany:** After the introduction of the toll (MAUT), a rapid decline in vehicle-km covered by Euro I and II HGVs was observed, accompanied by a disproportionate increase in mileage covered by Euro V HGVs (Hall & Hesse, 2012). In general, cleaner trucks are used to perform longer trips and account for a higher proportion of mileage compared to their share in the fleet. Around 70% of total mileage in 2011 was carried out by Euro V trucks compared to their share of 40% in the fleet (CTS, 2012).

Statistics collected by BGL Bundesverband Güterkraftverkehr Logistik und Entsorgung (the Association for road haulage, logistics and disposal in Germany) show the evolution of total kilometres travelled by German trucks per emission classes from 2000 to 2010. It covers all German trucks (and therefore also vehicle with a permissible total weight lower than 12 t) and the whole German network (and therefore also the non-tolled roads).

The graph below shows the changes in travelled mileage according to vehicle Euro class from 2000 to 2010. From 2000 to 2003 Germany was still a member of the Eurovignette, thus adopting a time-based road charge for trucks over 12 t differentiated by emission class. During the period 2003-2005, when the suspension of the vignette occurred and the toll had not yet been introduced, the renewal of the vehicle fleet followed a "normal course". After the toll was introduced, there is a clear trend toward the replacement of EURO III vehicles with EURO IV and higher. Comparable trends are shown on the mileage travelled on total network and on the tolled network.

Figure 2.14: Performance of German lorries per emission classes from 2000 to 2010



Source: BGL statistics http://www.bgl-ev.de/web/daten/emissionen_fahrleistungen.htm

- **Austria:** Following the Ecopoints system (see box below), the LKW-Maut is in place on Austrian road network since January 1st 2004 and applies to all passengers and freight vehicles with a maximum admissible gross weight of more than 3.5 tonnes. The scheme developed consists of a distance based toll levied both on motorways and selected expressways[13] and it is based on an end-to-end, open, multilane free-flow configuration that makes possible to collect the charges from moving motor vehicles in unhindered conditions.

Box 2-2: The Ecopoints system

The protection of sensitive areas from the negative impacts of freight transport was an issue of primary relevance to improve the quality of the environment. Under this view, a licensing system of Ecopoints (Ökopunkte) was introduced in 1994 as a part of the transit agreement between Austria and EU. NOx emissions were targeted in order to encourage the use of increasingly cleaner trucks.

The aims of the project were:

- to reduce the NO_x emissions from transit transport through Austria by 60% over the period 1991-2003;
- to limit the transit journeys to a maximum of 8% above of level of 1991.

Good vehicles above 7.5 tonnes transiting through Austria were needed to carry an Ecocard, corresponding to an amount of points based on the payment done. The number of Ecopoints available was also depended on the pollution rate of the vehicle. The system was extended until 2006 and its operations stopped in 2007. Part of the revenues was used to finance the project of the Brenner railway tunnel.

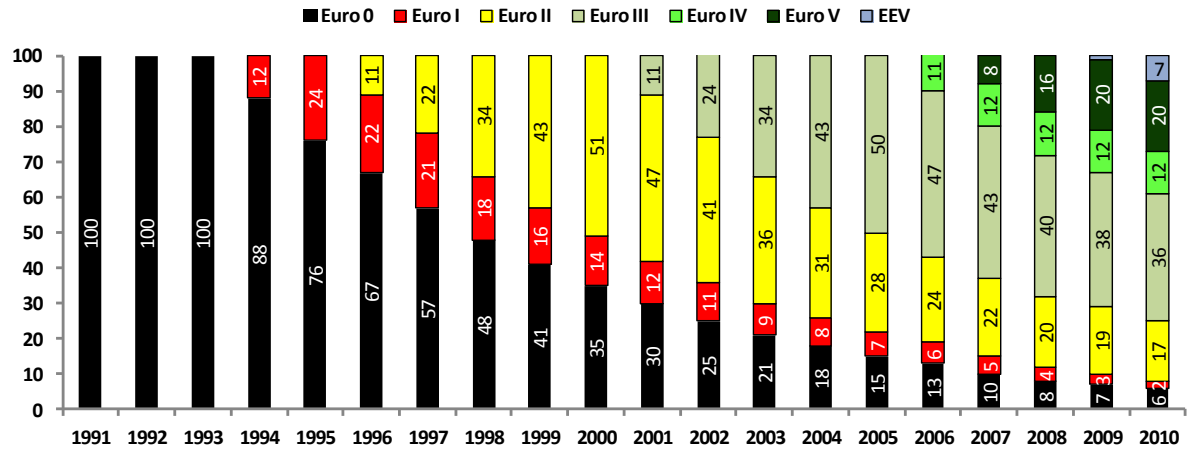
The requirement of 60% decrease of NO_x was almost met in 2001 (57.5%). Moreover, the result achieved was of hundreds of millions EURO's of investments in cleaner and less noisy lorries by international road haulage.

The quota of ECO-Points reduced from 11.4 million in 1994 to 9.3 million in 2003. These figures were reached by using EURO II engines. In 2008 EURO V engines cut down NO_x emissions with another 70%.

Differentiation of infrastructure charges accordingly to Euro emission classes was introduced in Austria only in 2010. Therefore no time series data are available concerning the evolution of the performance by emission classes on the tolled network. Nevertheless some consideration can be made when analysing some data on the evolution of HGV vehicle fleet in Austria and especially when comparing this data with the similar information collected for Germany.

Figure 2.15 shows that the renewal of vehicle fleet in Austria follows similar patterns as already evidenced from Germany, with a reduction of the share of EURO III vehicles and a parallel increase of lower pollutant classes EURO IV and V since 2006.Even though the Ecopoints system (in place from 2004 to 2007) is considered to have had an impact in accelerating the technology shift of international hauliers, the whole impact on the national composition fleet can be considered very low since trucks travelling to or from points in the country were not subject to the payment. Given the absence of any other differentiation of tariffs by pollution classes until 2010, it might be concluded that the trend is mainly determined by the normal renewal of the vehicle fleet.

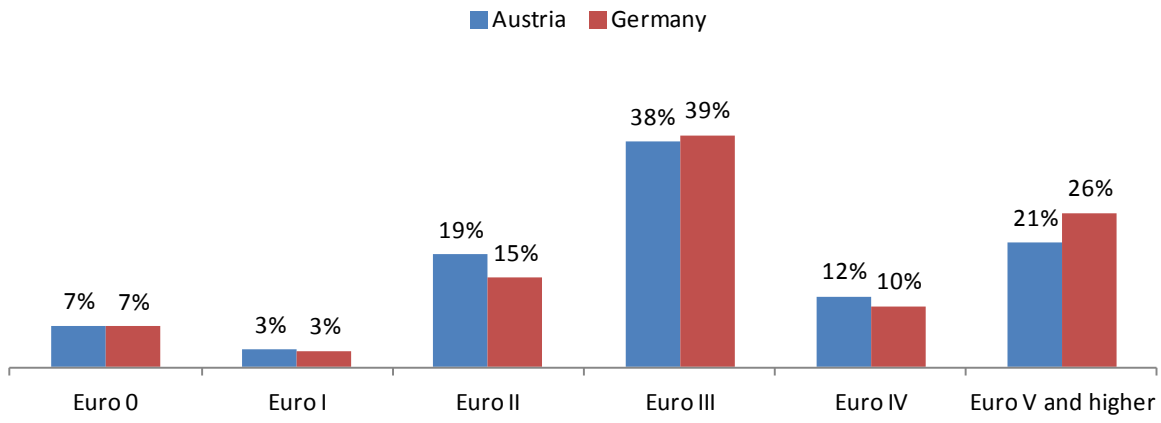
Figure 2.15: Evolution of HGV fleet composition in Austria from 1991 – 2010, as % of fleet



Source: EURO-Klassen-Zuordnung des Fahrzeugbestands Schwere Nutzfahrzeuge (LKW, Busse)> 3,5 t hzG (May 2010)

The figure below provides a comparison of the German and Austrian vehicle fleet composition in 2009, showing the higher adoption of Euro III and V vehicles in Germany (Euro IV was not adopted in Germany due to government incentives).

Figure 2.16: Comparison of German and Austrian vehicle fleet composition in 2009, as % of fleet



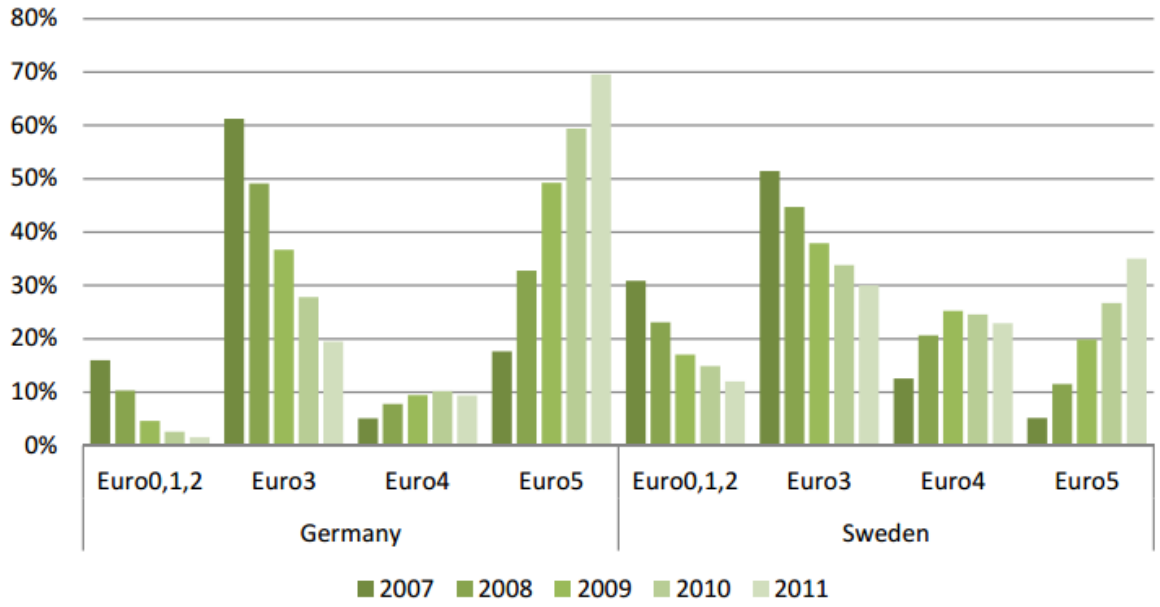
The Eurovignette charge is differentiated by Euro class, and has a similar effect in encouraging higher use of cleaner vehicles:

- In **Sweden**, more than 90% of veh-km in 2005 were carried out by Euro 0-III trucks; this had reduced to 43% by 2011. Generally, the "mileage" is cleaner than the fleet – that is, cleaner vehicles carry out proportionally more veh-km compared to their share in the fleet (CTS, 2012). Overall NO_x emissions from vehicles >12t decreased by 30% between 2005 and 2011, and PM emissions reduced by 46% (CTS, 2012).

The difference in share of mileage carried out by cleaner trucks between Germany and Sweden is striking. In Germany, the distance-based toll has led to Euro V trucks being used for the vast majority of mileage (70%) whereas in Sweden it is just half this level. This difference is due to a combination of

factors (CTS, 2012). Firstly, the German toll is much higher than the Eurovignette for all journeys, meaning that hauliers have a much higher incentive to use cleaner trucks on German motorways. The Euro IV category was downgraded to a higher charge for the German toll in 2006. In addition, the German government incentivises the purchase of Euro V trucks, which reinforces the toll levels and explains the lack of Euro IV in the German fleet.

Figure 2.17: Mileage by emission class of trucks > 12 tonnes in Germany (motorways by German and foreign trucks) and Sweden (on all roads by Swedish and foreign trucks)



Source: CTS, 2012

Main findings

Tolls differentiated by Euro class may have had a significant effect on the use of cleaner vehicles in Germany. This has been achieved through both increased purchase of cleaner vehicles, as well as greater usage of cleaner vehicles. In Germany, the Euro-differentiated fees have been reinforced with government incentives for cleaner trucks, so that today almost 40% of trucks above 12 tonnes Gross Vehicle Weight are compliant with the Euro V emission standard. The Euro V trucks are used for the vast majority of mileage (70%), which is far greater than their share of the fleet (40%). Compared to Austria, which introduced Euro class differentiation more recently in 2010 (another transit country with a high share of international transport) the share of clean vehicles in Germany is higher.

Even when the level of a vignette charge is differentiated by vehicle emission categories, it is thought to be insufficient to induce changes to the composition of the vehicle fleet and thus significantly reduce emissions. Although some effect in these countries has been observed, this is thought to be due to spillover effects from countries with Euro-differentiated tolls, as the majority of these cleaner vehicles are engaged in international transport

2.6.3 Improving transport efficiency

Key: ***+ = direct positive impact; - = direct negative impact;***

● = indirect or weak impact ? = impact could be positive or negative

Overview: Improving transport efficiency		
Mechanisms		Optimising load factors
		Reducing empty runs
Road charging characteristics to increase effect		**Vignette**s have limited effect as they are not directly linked to vehicle usage
	+	**Toll**s provide a much greater incentive to improve transport efficiency compared to time-based systems
Impact on air quality	+	Air quality can be improved by reducing fuel consumption overall
Impact on congestion	●	Some impact if overall traffic is reduced
Interactions with other policies	+	Any policy instruments that involve variable charges that increase the cost of transport usage will also have an impact, e.g. fuel taxes
Interaction with wider economic factors	+	Oil-price increases (that raise the cost of fuel) and greater competitiveness in the freight sector can encourage better transport efficiency. Higher demand for flexible just-in-time delivery may reduce transport efficiency if customers place a greater value on speed of service, as it may not be possible to optimise loading.

There is mixed evidence that tolls have resulted first in greater transport efficiency for distance-based schemes:

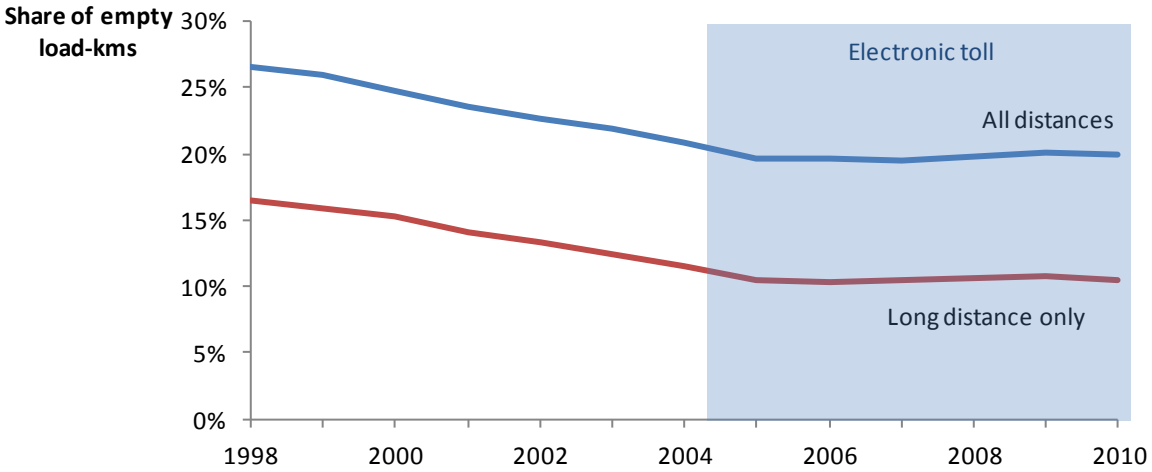
- **Germany:** According to a report of the German federal agency of freight transport, empty trips decreased in 2005 and 2006 after introduction of the toll, but not at a higher pace than before (Significance, 2010). The proportion of empty runs in Germany decreased more for long-haul goods traffic on average compared to short-haul routes. However, the economic crisis of 2009 had a greater effect on the proportion of empty runs than the road toll (Hall & Hesse, 2012).
- **Austria:** During the period 2004-2006, a decrease in average distance travelled per tonne is seen, of about 3% per year, while the tonnes transported remained constant (T&E, 2010). However, this trend reversed in 2007 when a km-charge was introduced on Czech motorways; therefore some of the effect could have been due to traffic diversion.

Statistics on freight transport in Germany and Austria show that the introduction of the tolls coincided with a decrease in the average distance travelled by trucks. After 2007, it becomes very difficult to isolate the impacts of road user charging because the economic crisis had severe impacts on indicators of transport efficiency. Average vehicle loads fell in 2008 – it is thought this is due to a fall in construction activity and a faster decline in total international transport (which typically has higher load factors and lower empty runs) (De Angelis, 2011). However, comparing statistics of empty running in Germany and the UK (which does not have tolls except on the M6) shows that the recession did not appear to cause empty running to increase in Germany on the same scale as for the UK (MTRU, 2010).

Furthermore, the potential for additional improvements in transport efficiency (e.g. consolidation and increases in load factors) in the future is likely to be limited, as increasing fuel prices and greater competition in the road freight sector will force hauliers to improve transport efficiency. In addition, it is not possible to obtain a return load for every journey, and much empty running is due to imbalances in freight traffic flows. This applies particularly to the construction industry where materials will be transported from a quarry with the vehicle (De Angelis, 2011).

The evolution of the share of empty-load kilometres for German trucks from 1998 to 2010 is shown below. Since 1998 a reduction of empty load shares occurred for all distance bands, probably due to optimisation of the logistics system in order to reduce transport costs. The share of empty-load kilometres on long distance bands decreased from 16.5% in 1998 to 10.5% in 2005, the year of introduction of the MAUT. Furthermore, since 2005 the trend remains almost stable with some fluctuations around the threshold of 10.5%, which probably corresponds to a “physiological” minimum of the system optimisation.

Figure 2.18: Evolution of share of empty kilometres shares for German trucks from 1998 to 2010



Source: BGL statistics http://www.bgl-ev.de/web/daten/leerfahrten_kilometer.htm

Main findings

There is some evidence that road pricing has resulted in better transport efficiency soon after the introduction of the charge. Statistics on freight transport in Germany and Austria show that the introduction of the tolls coincided with a decrease in the average distance travelled by trucks. However, rising fuel prices would also have been a significant factor and longer-term trends are less clear.

After 2007, it becomes very difficult to isolate the impacts of road user charging because the economic crisis had severe impacts on indicators of transport efficiency.

2.6.4 Impacts on congestion

2.6.4.1 Current differentiation of charges by time of travel

Table 2-26 summarises the current differentiation of road tariffs by time period in EU27 Member States. A more detailed description of the differentiation that applies in each country is reported below.

Table 2-26: Summary table of current differentiation of road charges by time periods in EU27

Country	Vehicle type		Motorways	Differentiation
	Car	Trucks		
Austria	No	Yes[1]	Brennero Motorway	Day/Night time (22:00 – 5:00)
Czech Republic	No	Yes[2]	All motorway sections	Higher rates on Fridays (15:00-21:00)
France	Yes	Yes	A1 Lille Paris	Time of the day, week-end days, holidays
		Yes	A-14: La Défense-Orgeval	
		No	Viaduc de Millau	
		Not allowed	Tunnel Duplex A86 Rueil Malmaison- Vélizy/Versailles	
		Yes	Prado Carenage Tunnel	
Ireland	Yes	Toll-free[3]	Dublin port tunnel	Time of the day, working/week-end days
Spain	Yes		Several motorways sections	Time of the day, week-ends days, day/night time, holidays, low/high seasons
United Kingdom	Yes		Section of the M6 motorway between junction 4 and junction 11A	Day/Night time, working days/week-ends

Country	Vehicle type		Motorways	Differentiation
	Car	Trucks		
Slovenia	Yes		All motorway sections	Day/Night time (22:00 – 6:00)

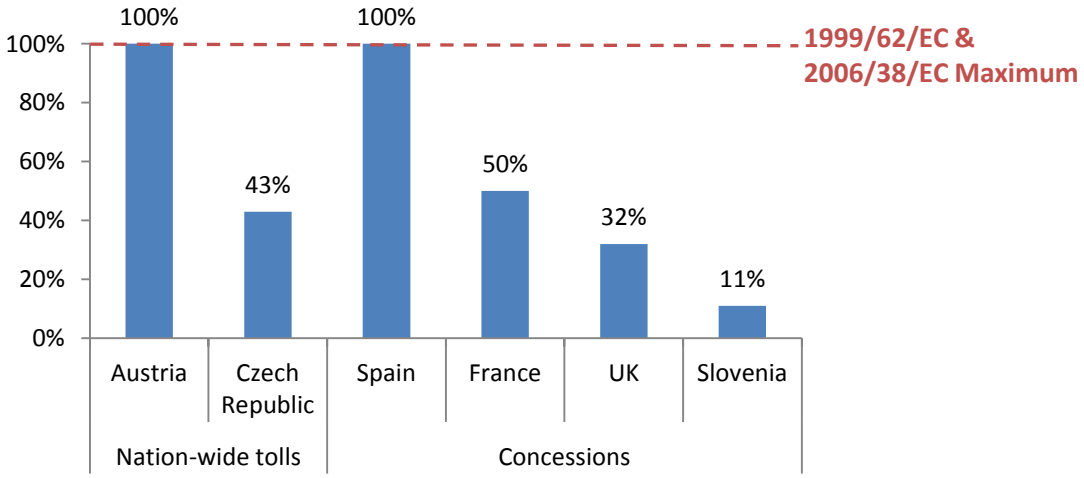
[1] Charge applied to trucks of more than 3.5 t and with more than 4 axles
[2] Trucks >3.5 t
[3] Trucks >3.5 t are exempted

In response to the stakeholder interviews, some Member States (Austria, Hungary) mentioned that congestion was not usually a problem outside of cities, and therefore time-differentiated charges were not necessary.

2.6.4.2 Analysis of maximum charge differentiation according to time of travel

Directive 1999/62/EC allowed a maximum differentiation of 100% according to time of travel. This upper limit was retained in Directive 2006/38/EC. Figure 2.19 shows the maximum differentiation in each Member State compared to the maximum allowed. Only Austria and Spain apply the maximum differentiation of 100%, whereas the remaining countries apply variations of 50% or less. It should also be noted that in most countries the differentiation is only applicable on selected routes, whereas Czech Republic and Slovenia apply them on the network.

Figure 2.19: Differentiation according to time of travel for vehicles >3.5t in the same category



2.6.4.3 Impacts on congestion: change in trip planning

Key: **+ = *direct positive impact;*** **- = *direct negative impact;***
● = *indirect or weak impact* **? = *impact could be positive or negative***

Overview: Trip planning		
Relevant mechanisms		Change in route to circumvent charged area
		Change in time of day (for time-differentiated charges)
Road charging characteristics to increase effect		**Vignette**s have no impact on trip planning
	+	**Tolls** provide a much greater incentive to change trip planning. **Time-differentiated** fees can be designed to control congestion
Impact on air quality	?	Overall impact is not certain, as it depends on the overall changes and proximity to damage receptors
Impact on congestion	+	Direct improvements are expected if charges are **differentiated by time of day** to control congestion. Route shifting may improve congestion on the charged roads but could create congestion elsewhere.

Overview: Trip planning		
Interactions with other policies		There is limited interaction with other policies
Interaction with wider economic factors	-	Contractual agreements between haulier and shipper could reduce options for trip planning. Punctuality in contractual performance may be extremely important, particularly for "just-in-time" delivery schedules, where the cost of non-performance is particularly high (Universitat Pompeu Fabra, 2004).

2.6.4.3.1.1 Changes in route to avoid charged areas

Changes to routes in order to avoid the charged area are relevant for tolls that do not cover the entire road network (as in most cases). Route shifting could improve local congestion and air pollution on the charged route, but could move the problem elsewhere. For example, if route shifting occurs this could cause trucks to travel on roads that were not designed to handle heavy vehicles and therefore make the congestion, wear and tear and air pollution effects worse. This effect is most pronounced where a dense secondary network of good quality roads adjacent to the motorways exists and where such a secondary network is not already congested (TRT, 2008). The problem has been solved by introducing speed limits, extending the charging scheme to include them, or by banning HGVs from secondary roads. Vignettes do not create the same incentive for route shifting within a country, and no evidence has been found of route shifting to avoid countries with vignettes.

In most cases, concerns that traffic would divert to other roads to avoid the charge were not borne out.

- **Germany:** In the early days of the toll a number of lorries were diverting to untolled routes. In January 2007 the toll was extended to mitigate this effect, and in April 2011, another 1,000km of federal highway were added to the tolled network. Overall, toll evasion is thought to account for less than 10% of the federal highway network and does not vary with the level of charges (Deutscher Bunestag, 2009).
- **Austria**: Since only motorways and certain expressways are covered under the charge, rerouting impacts were observed. Soon after the introduction of the charge in 2004 it was found that the average diversion of trucks from highways and express roads was about 2.8 % of the total freight transport of highway and express roads (TRT, 2008), reducing to 2.4% after the introduction of lorry bans in certain areas. In 2007, there was a substantial increase in the average distance travelled per tonne, which is thought to be the result of the introduction of the Czech toll (Significance, 2010).
- **Czech Republic**: There was likely to have been some diversion into neighbouring countries after the introduction of the charge in 2007, particularly Slovakia, which then introduced its own charges in 2010 (T&E, 2010).
- **Slovenia**: In response to the questionnaire, it was noted that occasionally traffic will divert to parallel roads to avoid tolls. No further information was provided.
- **Poland**: In response to the questionnaire, it was noted that unpublished data showed the level of diversion varies depending on region, length of tolled road and accessibility of alternative non-tolled roads.
- **Spain**: The questionnaire response indicated that freight traffic frequently used alternative non-tolled roads. According to Abertis (which owns 59% of toll roads in Spain by length), Spanish toll roads have greater exposure to competition from untolled roads than similar roads in France or Italy.
- **Italy**: The questionnaire response stated that no significant diversion had been observed, as the greatest cost factor for freight operators was fuel.

There is some evidence of route shifting to neighbouring countries in order to avoid tolls. The most significant reported incident was diversion of lorry traffic in the Alsace region of France, where motorways run along the border with Germany. As a result, in 2006 the French transport law was modified to introduce a charge of 0.1-0.15 €/km on sections of the motorway (BMT, 2006).

2.6.4.3.1.2 Changes in time of day (congestion impacts)

The most important aspect for congestion reduction is time-differentiation of charges. This has been implemented in a number of schemes and the effects are usually positive.

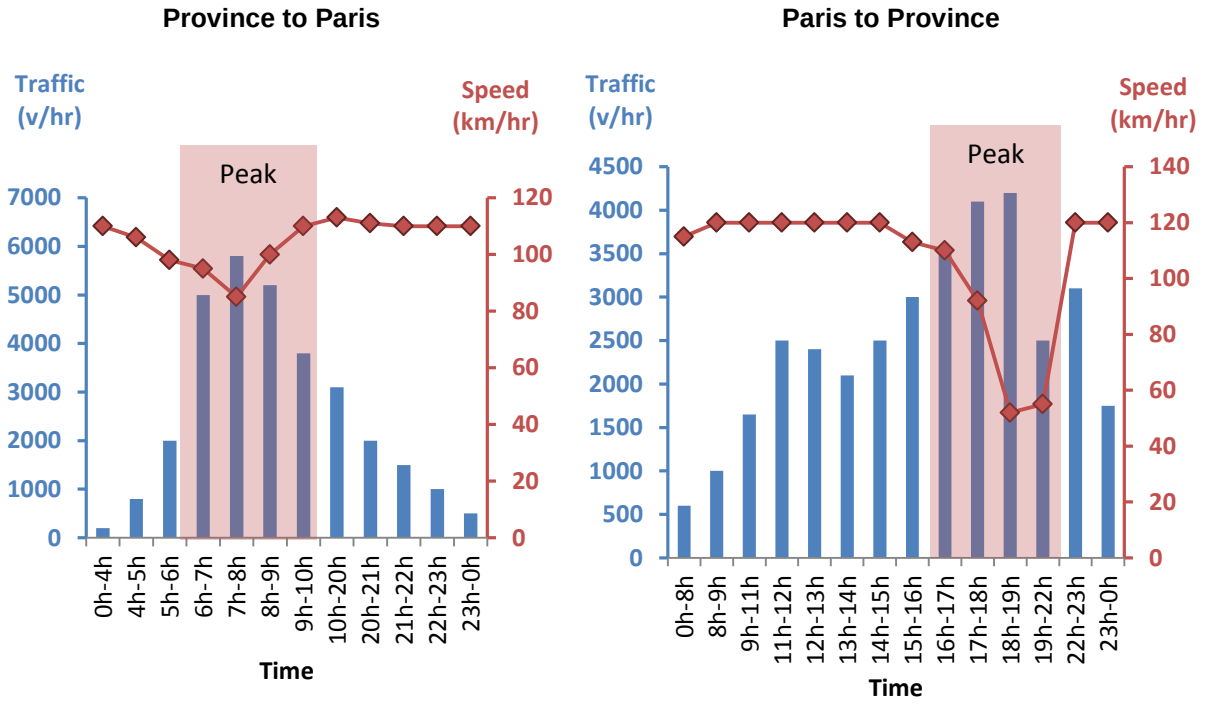
- **Czech Republic:** Since 2010 truck charges have been increased between 15.00 and 21.00 on Fridays. For vehicles with three or more axles the increase in toll rate was 50% and for vehicles

with two axles the increase was 25%. In response to this change the number of vehicles decreased by 15% during the peak period (Fiax, 2010).

- **Spain:** The congestion tolling in Spain is an unusual situation, as the tolled motorway links compete with parallel untolled roads. It is also difficult for users to move from the free to the toll highway once they are caught in a traffic jam. This means that there are several examples in Spain of underused tolled motorway sections while the alternative free road is severely congested (including those around Madrid)[14]. The variation of tolls during peak periods is set at the maximum level of 100% on some links; however in such cases, decreasing the toll may improve traffic allocation.
- **UK:** The M6 tolled motorway opened in 2003 and runs parallel to the original untolled M6 motorway. It was intended to relieve congestion on the busiest section of the M6 by providing an alternative route for traffic. However, most HGVs (over 90%) use the original untolled route. HGVs make up between 9% and 13% of vehicles on the M6 Toll, but comprise up to a third of vehicles on the M6. Despite this, most journeys that were particularly likely to suffer delays are now more reliable[15].
- **France A1 motorway:** Increasing toll rates on the A1 on Sunday evenings (weekend rush hour) by 25% and reducing off-peak rates by 25% resulted in a 10% transfer of traffic to off-peak times. The impact on route shifting was fairly negligible on the non-tolled network nearby Paris, where the consequences of the congestion were even more significant.
- **France A10-A11 motorway:** Increasing toll rates (March to November 1996) on Sunday evenings resulted in a transfer to off-peak periods of 8-12%. However, it should be noted that these charges included passenger cars, which are thought to be able to adjust travel times more easily compared to freight (Le Coffre, 2003).
- **France A1-A26 and A5-A6:** Achieved around 10% shift by rerouting outward and returning holiday and weekend traffic onto alternative roads subject to toll reductions, and increasing the toll on the saturated motorway.

On the **A14 in France**, users were charged between 44% and 38% more to travel during peak periods (see Annex). Despite this variation in tariffs, the highest traffic levels are still found in the time bands where the highest toll charges apply, as shown by data reported below. No counterfactual scenario was available; however it could be expected that congestion would be even worse without the peak rates.

Figure 2.20: Average vehicle flows and speeds on the A14, France – working days



[14] ftp://ftp.hsrc.unc.edu/pub/TRB2011/data/papers/11-1929.pdf
[15] http://www.bettertransport.org.uk/system/files/M6-Toll-Report-Aug-10.pdf

Source: Société des Autoroutes Paris-Normandie (SAPN)

Opposition to the use of congestion charges is linked to distributional effects; groups with a high valuation of time profit at the expense of groups with low valuation of time.

In response to the questionnaire asking whether the impact on congestion had been studied, all Member States replied either that there were no studies available on this issue (Portugal, Italy, Hungary, Spain, Slovenia) or left the question unanswered.

Main findings

Changing routes to avoid charges is only possible for tolls. In most cases, route shifting was observed, but this has been effectively controlled through the use of speed limits, introduction of charges on the evasion routes, or by banning HGVs from secondary roads.

Charges that vary by time of day to control congestion are only possible for tolls. Although they have not been widely implemented, the few examples available have been successful. In the case of the Czech Republic, increasing the charge by 25-50% during peak periods has resulted in a 15% decrease in traffic during peak times. In France, increasing toll rates during weekend rush hours resulted in a 10% transfer to off-peak times. However, in cases where a parallel untolled road is available (e.g. Spain, the UK), congestion pricing is less successful, as the availability of a parallel route tends to result in underutilised capacity on the tolled road and congestion on the untolled road.

2.6.5 Discussion and lessons learned

Attempts to increase environmental effectiveness by differentiating tolls according to Euro class have shown some success in the implementing country. Evidence suggests that the main impacts are due to greater use of cleaner vehicles, as share of travel carried out by clear trucks is disproportionately larger than their share of the fleet. Even when the level of a vignette charge is structured by vehicle emission categories, it is thought to be insufficient to induce changes to the composition of the vehicle fleet and thus significantly reduce emissions. However, an improvement in the fleet composition of trucks engaged in international transport has been observed in countries without Euro-differentiated charges, and is thought to be in part due to spillover effects of tolls in other countries (CTS, 2012). However, some operators believe that any impacts that charge differentiation by Euro class may have on the rate of vehicle fleet renewal can only be effective for around five years due to natural fleet renewal. Technology improvements and mandatory requirements for new vehicles entering the market are considered to be the main driving forces behind the evolution of the vehicle fleet.

Route shifting was examined because if trucks travel on roads that were not designed to handle heavy vehicles this could make the congestion and air pollution effects worse. In a small number of cases neighbouring countries experienced increased diversion traffic from trucks avoiding charged roads, although this could be remedied by applying counterbalancing charges.

A small number of countries have introduced time-varying charges to control congestion. Evidence from France and Czech Republic show that traffic during the peak times reduced after the differentiated charges were implemented. However, just-in-time inventory management and time-sensitive goods (such as express services) can limit the flexibility of freight delivery, meaning that time-of-day elasticities are typically lower for trucks compared to passenger cars.

Improvements in transport efficiency were found in Germany and Austria (network-wide tolls) soon after the introduction of the charge. However, in the longer term, GDP and fuel prices appear to be the main explanatory factors for changes in loading and empty running.

Table 2-27: Effectiveness of schemes in reducing air pollution and congestion

Main impact	Mechanism	Vignette	Toll (network wide)	Toll (selected roads)
Air pollution	Greater share of higher Euro class vehicles	Low effectiveness	Strong effect to increase share of travel carried out by cleaner trucks if differentiated by Euro class Smaller effect on fleet renewal	Most trucking firms would have little incentive to modify their vehicle fleets tolls apply only to selected corridors
Air pollution, congestion	Changes in route to avoid charged areas	No effect	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls
Congestion	Changes in travel time to avoid peak periods	Not possible	Some evidence of peak spreading	Some evidence of peak spreading (mostly passenger cars)
Air pollution	Improvement in transport efficiency	No impact expected	Improvements in short-term Long-term effects are uncertain	No impact expected

2.6.6 Future situation – Ex-ante evaluation Q.1

The effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution and of the variation of infrastructure charges according to Euro classes to reduce pollution

The first ex-ante evaluation question underlies two different elements introduced by the Eurovignette Directive and specifically the possibility to:

a) Recover costs related to traffic based air and noise pollution through the introduction of additional external-cost charges

b) Vary infrastructure charges according to EURO classes to reduce pollution.

In the next sections the two elements are analysed separately.

2.6.6.1 Effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution

Purpose: Assess the impact of new provisions added to Directive 1999/62/EC by Directive 2011/76/EU on the recovery of traffic based air and noise pollution costs.

Context: One of the core changes made in Directive 2011/76/EC is to allow tolls to be composed of an infrastructure charge and/or an external cost charge for the purpose of recovering external costs related to traffic-based air pollution and traffic-based noise pollution. External costs should be charged through a measure of the damage caused by air and noise pollution, accordingly to the methodology proposed by the Directive in Annex IIIa. Nevertheless, Member States may apply scientifically proven alternative methods to calculate the value of air and noise air pollution costs. The external-cost charges have maximum chargeable costs, as indicated in Annex IIIb.

Main Findings

Stakeholder views on completeness and clarity

- The main concern was that further differentiation of tolls (in addition to those already applies) could lead to complex tariffs and a lack of transparency

- Furthermore, the calculation method requires highly disaggregated information, some of which is not already collected.

Effectiveness

- Countries that intend to introduce the measures highlight that studies are currently in progress and it is not currently possible to provide an overview of the monitoring plan.
- Only Denmark provided sufficient information to evaluate the effectiveness. It was found that the maximum charges set by the Directive would allow full recover of the external costs of air pollution, but would not allow for the full recovery of external costs for noise pollution

2.6.6.2 Description of relevant provisions in the Eurovignette Directive

Previous versions of the Eurovignette Directive (1999 and 2006) allowed infrastructure charges to be reduced to encourage cleaner transport, although doing so would reduce overall revenues. Therefore, the tolls could not fully reflect both the costs of the infrastructure concerned and the external environmental costs.

One of the core changes made in Directive 2011/76/EC is to allow tolls to be composed of an infrastructure charge and/or an external cost charge for the purpose of recovering external costs related to traffic-based air pollution and traffic-based noise pollution (Article 2b). This aims to allow incentives for reduction of harmful externalities to be made more effective and explicit.

Directive 2011/76/EC sets out a number of rules relating to the calculation of these external costs. The key changes are summarised as follows:

Provision of a calculation methodology for external costs: External costs should be charged through a measure of the damage caused by air and noise pollution, according to the methodology proposed by the Directive in Annex IIIa. Nevertheless, Member States may apply scientifically proven alternative methods to calculate the value of air and noise air pollution costs

Maximum chargeable costs are set for the external costs, as indicated in ANNEX IIIb. The maximum values may be multiplied by a factor of up to 2 in mountain areas. External-costs charges shall relate to the network or the part of the network on which external-cost charges are levied and to the vehicles that are subject thereto. Member States may choose to recover only a percentage of those costs (Article 7c).

Infrastructure charge differentiation according to EURO emission classes is mandatory: although not applicable if an external cost charge is applied. Member States may derogate from the requirement of varying infrastructure charges in the case of existing concession contracts (until the contract is renewed) or in other specific situations covered by Article 7g Paragraph 1

The variation of infrastructure charges according to Euro emission classes should be "revenue neutral" and thus should not generate any additional revenue (Article 2).

Greater variation of peak-period charges is permitted: The new provisions introduced by Directive 2011/76/EU have increased the upper limits of the charge during the peak-period up to 175% of the weighted average infrastructure charge. Additionally the Directive also specifies the duration of the peak-period for congestion charges which should not exceed the five hours per day. Similarly to the case of the variation of the infrastructure charges according to Euro emission classes, the variation of tolls should be revenue neutral and not generate any additional toll revenues (Article 7b(3))

This section aims to evaluate the effectiveness, completeness and clarity of the new provisions from the point of view of key stakeholders.

2.6.6.3 Assessment

2.6.6.3.1 Evaluation of completeness and clarity

Evaluating completeness and clarity in this context mainly relates to the ease of implementation of the provisions. Member States may be reluctant to introduce the new provisions if they could lead to additional complexity and administrative burdens without generating significant additional revenue

- Additional complexity could stem from the freedom provided to Member States to use dedicated methodologies (although the Directive proposed a methodology that could also be used).

- Administrative burdens could arise due to the requirement to notify users of the amount of external cost charge separately from the infrastructure cost charges.
- Additional revenue could be limited due to the caps placed on allowable charges.

As part of this project, a questionnaire was sent to all Member States regarding the new provisions. The answers provide an overview of perceptions of the ease of the implementation, summarised as follows:

- Most charges are already differentiated to some extent (e.g. by Euro class) - it is thought that further differentiation of tolls could lead to complex tariffs and a lack of transparency
- Applying the calculation method could be difficult, as highly disaggregated information is required. Estimation from different data sources, each providing a piece of relevant information is therefore necessary.
- Other potential difficulties relate to:
  - The maximum charges set by the Directive could lead to lower recovery of total external-costs - especially in the case of noise costs.
  - In those countries where no electronic toll systems are in place, there could be reduced possibilities to introduce road charges on the basis of vehicle classes.
  - It is politically challenging to increase the cost of transportation, especially in the period of the Eurozone downturn.

At this stage, it appears that many Member States anticipate that the new provisions will be rather complex to implement. It is not clear whether implementation will become easier as Member States' experience with the new provisions grows. In addition, several Member States indicated that the introduction of the new measures is not currently envisaged in their country.

2.6.6.3.2 Evaluation of effectiveness

Only Denmark and Austria provided relevant responses to questions on these matters.

Denmark

During the preparatory activities for the distance-based tolling system, which was suspended at the beginning of 2013, a research study on the marginal external cost for lorries was carried out. The findings showed that:

- The calculation of total external costs has required some effort in estimating the performance on different types of roads by different types of vehicles, since no statistics with this level of detail are generally available.
- **For air pollution:** comparison between the external costs and the maximum chargeable levels provided by the Directive showed that the threshold set by the Directive could in principle allow for a full recovery of total external costs.
  - Nevertheless, Denmark would have not implemented a differentiation of external costs charges based on the different types of roads (suburban and interurban) as suggested by the Directive, and would have introduced only three level of tariffs per EURO emission classes. This implied that Denmark would have adopt lower values for external-costs charges.
  - The adoption of the lower of the two values (EU max value or calculated Danish value) for rural roads would have implied an incomplete recovery of total external costs
  - The comparison between the planned maximum permissible infrastructure charge (23€Cent/km) and the air external-cost charges seems to suggest that external-cost tariffs could have been effective in providing the right price signals to users: in the case of most pollutant vehicle class (EURO 0-EURO III) air pollution charges (€cent/km 4.24) was supposed to amount to 18% of infrastructure charges.
- **For noise pollution:** Comparing the results of noise external-costs with the upper limits for the noise cost component provided in Annex IIIb2 in the EU Directive, it emerged that the calculated noise cost values were higher compared to the upper limits from the Directive in all sub categories.
  - The calculation has shown that the Danish costs of noise for the other roads (non-motorways) in rural areas are in line with the upper limits provided by the Directive for the interurban roads
  - The estimation by the Danish Road Directorate on noise costs for urban roads are far higher than the upper limits set by in the Directive for suburban roads

- In the case of Denmark, the adoption of the maximum chargeable noise costs set by Directive 2011/76/EU would have implied the not complete recovery of total external costs for traffic related noise pollution

Austria

Austria is currently exploring the possibility to introduce external cost charges for both air and noise traffic related pollution on the whole network which is currently charged through the electronic toll collection system.

- The government is planning to adopt the calculation methodology suggested by the Directive and not to develop an alternative method.
- Despite the intention to introduce the new charges by October 2013, the study of the possible tariffs and their differentiation is still at an early stage and no values are currently available. Therefore it is currently not possible to indicate the percentage of total external costs that will be recovered from external-cost charges neither to make any comparison with the infrastructure cost charges.

2.6.6.3.3 Monitoring the impacts

Monitoring the impacts is highly relevant to the successful implementation of the new measures on external-cost charges since the Directive includes the possibility to adjust these charges every two years following the observed changes in transport supply and demand. Therefore the survey explored how Member States plan to the monitor the effectiveness of the charging scheme in reducing environmental damage arising from road transport. The answers collected from countries that intend to introduce the measure highlighted that studies are currently in progress and, even though there are clear intentions to monitor the impact on air and noise pollution as requested by the Directive, it is still not possible to provide an overview of the monitoring plan.

Information obtained from Denmark on the shelved tolling arrangement suggests the hypothesis that monitoring of the impacts could have been generally limited to collecting statistics on traffic volumes for each vehicle class. In this case it could have been difficult to isolate the impacts of external-cost charging from those related to the differentiation of infrastructure charging according to EURO emission classes, thereby making it difficult to assess the effectiveness of the new provisions.

2.6.6.4 Effectiveness, completeness and clarity of the provisions on the variation of infrastructure charges according to Euro class to reduce pollution

Purpose: Assess the impact of infrastructure charges differentiation according to **Euro classes** on reduced air pollution

Context: The other significant variation introduced in Directive 2011/76/EU is the mandatory nature of infrastructure charges differentiation according to Euro emission classes (not applicable if an external cost charge is applied). The variation of infrastructure charges according to Euro emission classes should be “revenue neutral”. However, Member States may derogate from this requirement in the case of existing concession contracts (until the contract is renewed) or in other specific situations covered by Article 7g Paragraph 1.

Main Findings

Future implementation

- Hungary plan to move away from the current vignette system to distance-based road charging system with fees differentiated by Euro class. The expected implementation date is mid-2013. At the beginning of 2013.Denmark has shelved the plans for the distance-based tolling system originally foreseen to be operational from.
- In Slovenia the differentiation of tolls by EURO class is expected to be implemented in January 2015.
- Latvia is planning to introduce a time based vignette (daily, weekly, monthly or yearly) and the charges will be levied on HGVs of more than 3.5t, but not on buses.
- From July 2013, France intends to introduce the HGV Eco-tax differentiated by EURO classes for all goods vehicles weighing more than 3.5 tons that travel on France's national and departmental non-concession road network.
- The evidence collected so far highlights that the main reason for any derogations in

implementing this provision of the Directive is due to the presence of existing concession contracts.

Completeness and clarity

- Most Member States already differentiate charges according to Euro class., as well as other criteria (number of axles, weight or a combination of both).
- Despite the common methodology for calculating infrastructure costs introduced by the Eurovignette Directive, the rates that apply based on differentiation by Euro class vary considerably between Member States. This is because the underlying costs differ due to differences in (for example) maintenance costs, operational costs and the composition of the vehicle fleet.

Effectiveness

- In all the countries where charge differentiation is in place there is a monitoring system based on the collection of statistics on transport activity according to Euro emission classes. This is to ensure further positive impacts on air quality as well as revenue neutrality.
- The potential impact of such measures on the behaviour of freight transport operators is highly dependent on the specific charge structure and the extent to which it promotes the uptake of cleaner vehicles.
- In the case of tolls, differentiation of tariffs is thought to have some impact on the behaviour of freight operators, especially on the decision to purchase cleaner vehicles in order to pay the lowest charges.
- However, other factors are considered more important such as vehicle prices, financial standing of the company, access to credit resources/leasing, market situation, availability of compensation schemes, impact on fuel efficiency, etc.

2.6.6.5 Assessment

2.6.6.5.1 Future implementation

In order to conduct an ex-ante evaluation of potential impacts of the new provisions in Directive 2011/76/EC, it is important to understand whether, how and when will the new provisions of the Directive be transposed into national legislation in each country.

It should be noted that the requirements of the Directive are mandatory (although not applicable if an external cost charge is already applied), but Member States may derogate from the requirement in the case of existing concession contracts (until the contract is renewed) or in other specific situations covered by Article 7g Paragraph 1 of the Directive.

Table 2-28 summarises the plans for future implementation of the Eurovignette Directive in Member States. Information is collected both from interviews with authorities from Member States conducted as part of this project, as well as from desk-based research[16].

Table 2-28: Overview of plans for future road user charging schemes in Europe

Member State	Vehicle type	Roads	Details
Denmark (foreseen at 2015, but suspended by the new government))	HGVs >12t	3,800 km (including 1.080 km of motorways and 2.700 km of trunk roads).	Expected to use in-vehicle GPS units. In this way the fee can be calculated per kilometre driven and, possibly also, be differentiated with respect to time and place. Such a system has not yet been introduced in any other country. The Danish tariff scheme encompassed three groups of emission classes: Euro 0 – Euro III Retrofitted Euro III, Euro IV, Euro V and EEV Euro VI The method for calculating the charge was similar to the one used in Germany. .

[16] Information for Netherlands, Belgium, Bulgaria, Romania, Slovakia and United Kingdom are collected from desk research.

Member State	Vehicle type	Roads	Details
Hungary (2013)	>3.5t (excluding passenger vehicles)	6,500 km, including motorways and other state roads	Plans to move from the current vignette system to an electronic toll collection (ETC) distance-based system. Charges will vary depending on the number of axles, type of road and Euro class.
Slovenia (2015)		All motorways, most expressways	Differentiation of tolls according to Euro emission class is expected to be implemented from 1st January 2015. Since January 2010 it has been possible to pay reduced toll rates for vehicles compliant with Euro III, Euro IV and further improved emission classes by adopting the DARS (Motorway Company) electronic payment media (ABC electronic tags or DARS swipe cards). It seems that the main problematic area is defining the methodology related to internalisation of external cost (definition of external costs, link between external costs and pricing etc)
Latvia (2014)	>3.5t (excluding passenger vehicles)	Nine main roads, covering approximately 800-900km.	The proposed user charge will be a time based vignette (daily, weekly, monthly or yearly). A method based on a quantitative analysis (e.g. simulation exercises) was not carried out to calculate the charges. Their amounts were tailored through a sort of benchmark analysis, namely assuming half of the maximum values of the Eurovignette scheme already in place.
France (2013)	>3.5t (excluding passenger vehicles)	10,000 km of main national roads and non-concessionary motorways and 5,000 km of departmental roads	All vehicles must be equipped with a GPS device (On Board Unit (OBU)), which is designed to be interoperable with other toll systems, both national and international. • Base rates depend on static vehicle characteristics: ○ For vehicles with two axles under 12 tonnes: 8 cents/km; ○ For vehicles with two axles over 12 tonnes and for vehicles with three axles: 10 cents/km; ○ For vehicles with four axles or more: 14 cents/km. • Geographically-based discounts: ○ peripheral regions: -25%; ○ peripheral region without concession highways: - 40%; • Euro classes charge variations: ○ depends on categories; ○ 0% for class IV; ○ globally between – 30% and + 50 %; • Possibility for charge to vary depending on congestion
Netherlands (unknown)	All		The cabinet approved a road pricing scheme in 2009, and it was expected be introduced in 2012 (for freight) and fully implemented for all vehicles by 2017. However, the scheme is not currently in place and no evidence of its future adoption has been obtained from the stakeholder survey. The Dutch road pricing proposal would include both a per-kilometre price and a peak surcharge for busy areas and times. The per-kilometre charge was designed to be dependent on vehicle type, weight, CO2 emissions and emission class, reflecting the structure of current vehicle taxation.
Belgium	>3.5t	To the Eurovignette network. In addition, each region can add extra roads.	The Eurovignette time based user charge will be replaced by a kilometre-based user charge. The system will be developed in order to allow a possible technical extension to light vehicles. The specific tariff rates have not yet been decided. A possibility will be to vary the tariffs according to EURO emission class and the number of axles per vehicle.
Bulgaria			• Replacement of the existing vignette system that uses vignette stickers for vehicles with maximum permissible loading capacity below 12 tonnes with an electronic vignette system that will continue to be time-based; • Replacement of the existing vignette system for vehicles with technically permissible loading capacity of 12 tonnes and above with a distance-based electronic toll-collection system based on modern satellite technologies.

Member State	Vehicle type	Roads	Details
Romania	>3.5t		Romania is analysing the opportunity for the modification of the current tariffs, so that they observe the recommendations of the Directive (i.e. a monthly tariff with a maximum value of 10% of the yearly tariff; a weekly tariff with a maximum value of 5% of the yearly tariff; and a daily tariff of 11 Euros or that has a maximum value of 2% of the yearly tariff).
Slovakia (2013)		Expansion of the proportion of the primary road network subject to tolls	The revised scheme is aimed at ensuring the increased use of environmentally friendly vehicles (charges will be differentiated by emission class) and at optimising traffic flows, thereby improving safety and streamlining traffic flows (via the use of charge rates that vary by time of day).
United Kingdom (2014)	>12t		The Government is committing to introducing charging in April 2014, subject to Parliamentary approval and the necessary procurement being completed successfully on a faster timescale than originally planned. This is earlier than the date of March 2015 for foreign hauliers envisaged in the consultation document. Foreign hauliers will pay up to £10 a day, or £1,000 a year to use UK roads (DfT, 2012).
Sweden (unknown)			The kilometre charge concept was developed in cooperation with public authorities, road users and industry. Work is ongoing. An important part of the discussion in Sweden centres on the possibility of refunding part of the diesel tax, or charging a lower rate to vehicles affected by the km-charge.
Italy			As of now Italy is not planning to include external costs in the pricing structure.

Member States were also asked about the level of charges that were planned, as this has important implications for the analysis of expected impacts. However, information was available only in a limited number of cases. In addition, it is important to note that the level of charges that are actually implemented are subject to change, and may therefore differ from the values quoted here. Nevertheless, the information obtained provides a useful guide as to the level of charges that are anticipated.

Denmark

The Danish Government investigated several possible strategies for furthering the use of road pricing in Denmark. In the past years the implementation of a distance-based tolling system replacing the current Eurovignette was extensively analysed. The tariff was supposed to be set as a calculation of: infrastructure costs per km + administration costs per km + environmental costs per km. The maximum infrastructure costs and external costs were calculated in line with the Eurovignette Directive.. The total maximum allowable average km-charge in the Danish scheme would have been 2.03 DKK per km (approximately 0,27 Euro per km). However, it was expected that the average charge in the planned system would have been lower than the maximum charge.

.71 DKK per km, (approximately 0,23 Euro/km) was calculated. The method for calculating the charge was similar to the one used in Germany. Nevertheless, at the beginning of 2013 the new Danish government decided to suspend the implementation of the system.

Hungary

The Hungarian government planned to move from the current vignette system to an electronic toll collection (ETC) distance-based system for all goods vehicles above 3.5 tonnes by mid-2013. The proposed tariffs, computed on the basis of the information gathered in the stakeholder consultation, are reported in the table below.

Table 2-29 Proposed level of tariffs for distance-based charging in Hungary (€cent/km)

Emission class	2 axles		3 axles		>= 4 axles	
	Motorways	Trunk Roads	Motorways	Trunk Roads	Motorways	Trunk Roads
Euro 0	15.8	6.7	22.2	11.6	35.8	22.4
Euro I	15.8	6.7	22.2	11.6	35.8	22.4

Emission class	2 axles		3 axles		>= 4 axles	
	Motorways	Trunk Roads	Motorways	Trunk Roads	Motorways	Trunk Roads
Euro II	13.8	5.9	19.3	10.1	29.9	18.6
Euro III	11.7	5.0	16.4	8.6	23.9	14.9
Euro IV	11.7	5.0	16.4	8.6	23.9	14.9
Euro V	11.7	5.0	16.4	8.6	23.9	14.9
Euro VI	11.7	5.0	16.4	8.6	23.9	14.9

Latvia

The time based system is considered to be a first stage of the new road charging policy that will be followed in years to come by a distance-based system. The vignette system is expected to last five years (the specific time span will depend on the period required to revise the bilateral agreements and on how the new system will be accepted by Latvian road hauliers). The Latvian Road haulage association has already stated its opposition to the new provisions, since national companies will be faced with additional costs. So far, neither external costs, nor congestion are expected to be internalised in the distance based system.

A method based on a quantitative analysis (e.g. simulation exercises) was not carried out to calculate the charges. Their amounts were chosen using benchmarking analysis, namely assuming half of the maximum values of the Eurovignette scheme already in place.

Road freight traffic in Latvia is mostly domestic (80-90%) while the majority of the remainder is traffic in transit. The main expected impact of the charging policy on the latter traffic component could be the diversion of maritime traffic to ports in countries where road charging is not in place (e.g. Estonia).

France

France intends to introduce the HGV Eco-tax for all goods vehicles weighing more than 3.5 tonnes (both French and foreign), which travel within France's national and departmental road network (15,000 km in length). In particular, the charged network comprises 10,000 km of main national roads and non-concessionary motorways and 5,000 km of departmental roads. The tax will be applied from July 2013[17] following an experimental taxation period in Alsace (commenced April 2012).

The aim of this scheme is based on the “user pays” principle and the main purposes are:

- Reducing the environmental impact of road-based freight haulage by influencing the choices of transport companies;
- Rationalising road freight transport over short and medium distances (by reducing the number of empty trips and increasing load factors) to optimise the production processes of goods and reduce freight traffic;
- Providing resources to finance new infrastructure needed for the implementation of a sustainable transport policy, with a multimodal approach.

Furthermore, amongst the purposes of the Eco-tax is a target of a 25% reduction in journeys within three regions (namely, Brittany, Aquitaine, Midi-Pyrenees).

Estimates from the French Government forecast 800,000 taxable vehicles (550,000 domestic and 250,000 foreign), in the base year. Assuming an average distance travelled of 45 km and a weighted average rate of 12 cent/km, revenues are expected to be around 1.2 billion Euros. The revenue earned will be allocated to the Agency for Financing Infrastructure in France (AFITF) and local authorities. Part of the proceeds of the tax will be invested in infrastructure development and projects developed under the “Grenelle Environnement” agreement, to protect the environment and promote sustainable development.

A number of vehicles, as designated by the French state, will be exempt from the Eco-Tax. These include vehicles providing services of public interest[18] as well as military vehicles and those used to transport agricultural goods. Public transport and other vehicles used to transport people are also exempt from payment.

17 Six months before launch, vehicles registration process will be open on the Ecomouv' website.

[18] According to Article R. 311-1 of the French Road Code.

United Kingdom

The maximum daily rate is subject to EU rules about maximum charges and may need to be changed at a later point, depending on changes to EU legislation and the exchange rate. (The maximum daily charge in the Directive is €11, but this will be uprated due to inflation and rounded up to €12 before charging starts.)

Table 2-30: Proposed charge structure for UK vignette, for rigid (non-articulated) vehicles without trailers (or with trailers of less than 4,000 kg), and articulated vehicles (€)

Band	Day	Week	Month	6 -Month	Annual
A	1.97	4.93	9.86	59.16	98.60
B	2.44	6.09	12.18	73.08	121.80
C	5.57	13.92	27.84	167.04	278.40
D	8.12	20.30	40.60	243.60	406.00
E	11.60	37.12	74.24	445.44	742.40
F	11.60	46.98	93.96	563.76	939.60
G	11.60	58.00	116.00	696.00	1160.00

Notes: Exchange rate assumed 1.16

Source: DfT (2012)

For UK vehicles, the charge band (A-G) is the same as the current VED band. For foreign vehicles, the proposed banding is shown in the table below.

Table 2-31: Vehicle banding for UK vignette (foreign vehicles)

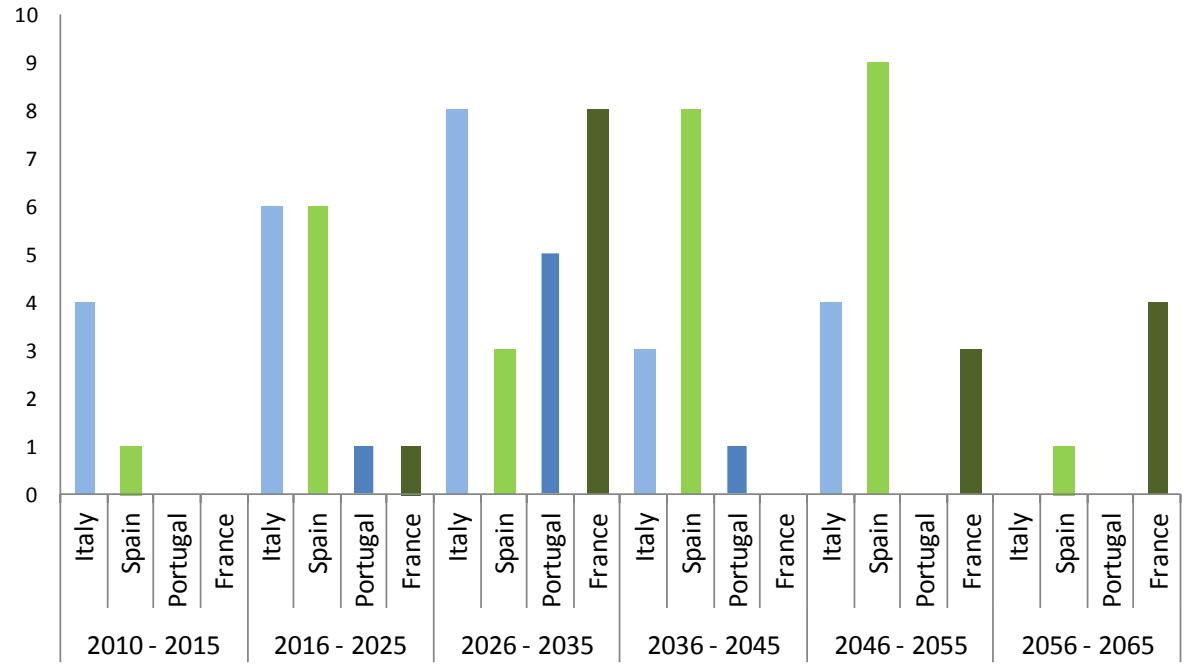
Weight (kgs)		Axles		
More than	Not more than	2	3	4 or more
11,999	15,000	B	B	B
15,000	21,000	D	B	B
21,000	23,000	—	C	B
23,000	25,000	—	D	C
25,000	27,000	—	D	D
27,000	44,000	—	—	E

Source: DfT (2012)

2.6.6.6 Barriers

The questionnaire also explored barriers to the introduction of the planned measures. In particular, it aimed to explore other reasons for the non-application of the provision besides those already considered by the Directive. The evidence collected highlights that the main reason for the derogation is the presence of existing concession contracts, which can last for a number of decades. Figure 2.21 shows the number of concession contracts expiring in each period out to 2065.

Figure 2.21: Number of concessions expiring in each time period



Sources: Concessionaire websites, author analysis

In general the existing concessions will not be renewed for a long time. The majority of contracts will not be renewed until after 2025: 60% of contracts in Italy expire after 2025; 75% in Spain; 86% in Portugal and 94% in France. This is likely to delay any implementation of the provisions of the Eurovignette Directive on the conceded network.

Other barriers highlighted in the interviews included:

- **Stakeholder acceptance:** the situation in Latvia highlights the importance of stakeholder acceptance. The introduction of the new charging system depends on the process of amending the existing bilateral agreements on road transport with neighbouring countries, namely the Russian Federation and Belarus. The government of Latvia is considering with caution this aspect given that in the past, Lithuania decided to introduce a road charging policy without holding discussions with Belarus to avoid distortionary effects, and this decision affected the level of competitiveness of freight road transport in this region. The amendments on bilateral agreements are currently on-going but it appears that introduction of road charge could be postponed.
- **Potential for low cost effectiveness in sparsely populated countries, or those with low traffic flow:** Some studies conducted in Finland during the early 1990s concluded that the cost of implementing charging policies would outweigh the revenue brought in. This is because the road network of the country is very long 700,000 km of which 500-600 km are motorways), whereas the population is relatively small (and the traffic density is fairly low.

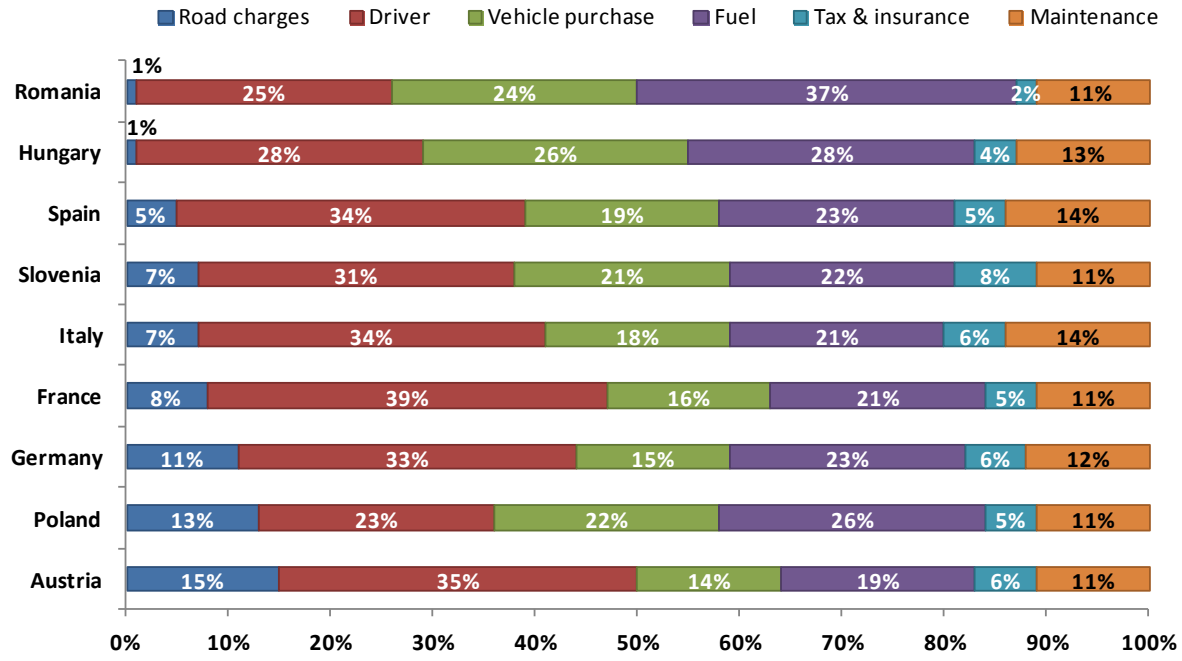
2.6.6.6.1 Evaluation of effectiveness

The assessment of the effectiveness of such differentiation by EURO classes can be approached both through an ex-post assessment as well as through an ex-ante assessment of planned differentiation. The ex-post analysis has already been presented in Section 2.6. Additional insights on the effectiveness of this measure can be obtained by analysing its potential impact on the behaviour of freight transport operators through each of the mechanisms outlined in Table 2-23, namely: changes in fleet composition, improvements in transport efficiency, and changes to trip planning.

Although evidence in the ex-post evaluation has shown that tolls can be effective in encouraging greater use of cleaner vehicles, other factors are as also important. These include: prices of the vehicles, financial standing of the company, access to credit recourses/leasing, market situation, availability of compensation schemes, improving fuel saving etc.

This point of view is clear when considering the overall operational cost of road freight, as shown in Figure 2.22 . The most important cost components by far are the driver's wages and fuel, followed by vehicle purchase costs. Road charges account for only a minor fraction of operating costs – up to 15% in countries with network-wide tolls and as little as 1% in countries with vignettes.

Figure 2.22: Percentage of operating costs per hour in selected Member States



Notes: Driver costs indicate wages; maintenance includes general vehicle maintenance and tyre replacement

Source: Bayliss (2012)

2.6.6.7 Views from other stakeholders – sector associations and road hauliers

Overall, stakeholders felt that differentiation of charges by Euro standard encourages cleaner vehicles, but that the capacity of operators to respond to the price incentives might be limited given the investment costs. In the current economic climate, operators may be likely to continue using their existing vehicle fleets until there is no other choice but to renew them. Thus, government incentives for professional fleet renewal are considered to be important supporting policy measures. In terms of reducing air pollution through increasing efficiency, the consensus was that operators already have an economic incentive to do so. Another stakeholder noted that air pollution is a local problem and thus needs to be treated at a local level.

2.6.7 Future situation – Ex-ante evaluation Q.2

An evaluation of the effect of the variations according to peak time on congestion, of whether the new maximum variation and maximum daily duration of peak periods are sufficient, and of the effectiveness of variations if differentiated charges are only applied to certain vehicle categories

Purpose: To analyse whether and to what extent the differentiation of infrastructure charges by **time period** offers an effective tool to manage congestion.

Context: The new provisions introduced by Directive 2011/76/EU have increased the upper limits of the charge during the peak-period up to 175% of the weighted average infrastructure charge. Additionally the Directive specifies also the duration of the peak-period for congestion charges which should not exceed the five hours per day. It has to be explored whether these new limits are effective in giving a clear and meaningful price signal to road users to modify their behaviour and to avoid congested road sections during peak periods.

Main Findings

The introduction of new differentiated tariffs for the purpose to reduce congestion on motorways and

primary roads is currently almost unexplored in the most Member Sates

The reasons for this choice include:

- That congestion is perceived mostly as a problem in urban areas
- That ensuring revenue neutrality would require regular revisions to the charges based on changes in demand
- That HGVs are already banned at night-time in some countries; therefore adding daytime congestion charges would penalise HGVs twice
- That congestion charges should apply to all vehicles

Potential effectiveness on congestion

The expected behaviour changes are thought to be "time shift" and the "optimisation of logistic behaviour". However, empirical evidence is scarce.

The extent of these behaviour changes is not clear - freight operators are thought to have limited flexibility, as usage strongly depends on the requests of the customer and access restrictions to loading and unloading areas. Often, there are also traffic bans for freight transport during less congested periods such as during night time that limit further the possibility to travel during off-peak hours.

Effectiveness of new limits

- The general opinion of survey respondents is that the new limit of 175% of the weighted average infrastructure charge during peak period is sufficient to give users the right price signals and to have an impact on congestion.
- Opinion was more divided on the "revenue neutrality" principle. Some Member States anticipated difficulties whereas others did not. In this response, it is interesting to note the answer of Czech Republic (whose motorways are charged more during Fridays afternoons) which has declared no barrier in achieving revenue neutrality.

Application to passenger transport

There is some interest in the implementation of such kind of measure in the case of passenger transport, nevertheless it emerged that no Member State has yet taken any concrete actions to introduce it at a broad level.

2.6.7.1 Assessment

2.6.7.1.1 Future implementation

Introduction of new differentiated tariffs for the purpose to reduce congestion on motorways and primary roads is currently almost unexplored in the most Member States. The reasons for this include:

- Congestion is not a widespread problem on motorways and primary road networks, as it is mainly concentrated on urban roads;
- The complexity in implementing the measure whilst ensuring revenue neutrality means that periodic modifications to tariff structures on the basis of the changes in demand will be required
- Several Member States apply night-time motorway bans for HGVs (albeit with some exceptions) which consequently means that freight haulage operators have to concentrate the use of vehicles during the day time, rather than being able to spread journey times over a 24 hour period. With further measures to control congestion, hauliers could be penalised twice;
- Additionally, consultees believe that the measure will not be effective if it is applied only to HGVs, which they believe often suffer the effects of congestion due to the high numbers of light duty vehicles on the roads.

As Member States do not generally seem to be planning to introduce this measure in the near future, no impacts on congestion from the implementation of this policy can be expected, at least in the short term.

2.6.7.1.2 Effectiveness of the new variation

In order to evaluate the effectiveness of the new limits introduced by Directive 2011/76/EU the study team investigated national competent authorities' opinion on this aspect (see Annex VIII).

- The general opinion of respondents is that the new limit of 175% of the weighted average infrastructure charge during peak period is sufficient to give users the right price signals and to have an impact on congestion. Other respondents have no particular views on this topic, while it is interesting to notice the opinion of a Spanish respondent who believes that this value is too low and suggests that a 300% increase would be more appropriate.
- Opinion on the "revenue neutrality" principle of this differentiation appears to be less clear-cut amongst stakeholders, with some Member States envisaging a barrier to its introduction and others not expecting any major complexities in implementing this measure.
- It is interesting to note that the response received from the Czech Republic (whose motorways are charged more during Fridays afternoons) which indicated that there are no barriers to achieving revenue neutrality.

2.6.7.1.3 Effectiveness on congestion

Member States were asked about the potential effects of time-of-day charge variations on the behaviour of road users. The responses from national competent authorities identify time shift and optimisation of logistic behaviour as the most likely impacts.

Nevertheless, no empirical evidence has been provided by stakeholders to support their views on expected or observed impacts. The limited empirical evidence reviewed in the ex-post evaluation indicates that time-varying charges have had positive impacts on reducing congestion where they have been implemented.

Moreover, it is believed that freight operators have limited flexibility as to when they use the road, since the strongest determinants are the specific requests of the customer and access restrictions to loading and unloading areas. Often, there are also traffic bans for freight transport during less congested periods (such as during night time) that further limit the possibility to travel during off-peak hours.

Additionally, Member States were asked whether the differentiation of tolls by time period is applied to passenger cars in their country or whether they have any plans to do so. The responses obtained so far seem to suggest a certain interest in implementing this type of measure in the case of passenger transport. Nevertheless, it emerged that no Member States have yet taken any concrete actions to introduce such a measure at a broad level.

2.7 The effect to direct users toward the most environmentally friendly and efficient transport solutions (modal shift)

2.7.1 Current situation – Ex-post evaluation Q.7

Purpose: The main purpose is to investigate the effectiveness of road pricing to encourage modal shifts of freight from road to rail or inland waterways.

Context: By applying tolls and/or user charges to heavy goods vehicles that operate on EU motorway networks, the costs of providing transport services will have increased. In some cases, these increases may have led to some level of modal shift from road freight to alternatives such as rail freight.

Main Findings

No significant evidence of modal shift was found.

Germany and Austria were investigated as case studies, as both countries have good availability of high quality non-road modes, and included modal shift as one of the aims of their road pricing policies. There is no conclusive evidence of modal shift in Germany due to the introduction of the MAUT. A minor shift from road to rail occurred in Austria; however it is difficult to isolate the impact of the toll from the various other support measures that were also introduced and therefore no significant changes can be attributed to the road charging scheme.

Given that the German and Austrian tolls represent the highest road charges in Europe as a percentage of total operating costs, it can be expected that impacts on modal shift in other countries (if any) would be even smaller.

2.7.1.1 Description

By applying tolls and/or user charges to heavy goods vehicles that operate on EU motorway networks, the costs of providing transport services will have increased. In some cases, these increases may have led to some level of modal shift from road freight to alternatives such as rail freight. Other important factors specific to the choice of mode include:

- Reliability
- Speed
- Frequency
- Network density
- Network capability
- Convenience
- Flexibility
- Customer demands.

Relatively few investigations are available concerning the assessment of the importance of individual factors influencing the choice of mode of transport, and these factors can vary in importance depending on the type of freight (ETC/ACC, 2008).

Rail freight is the most commonly available alternative, yet its characteristics inherently limit the type of road freight services it can substitute for.

- Rail and waterborne modes have comparative advantages in carrying bulk commodities, which have lost relative share
- Rail and waterway networks are much less dense than the road network, which can reduce the directness of the route
- There has been growing demand for quick response deliveries, for which the flexibility of road freight is better suited.

Table 2-32: Main choice of mode for different goods

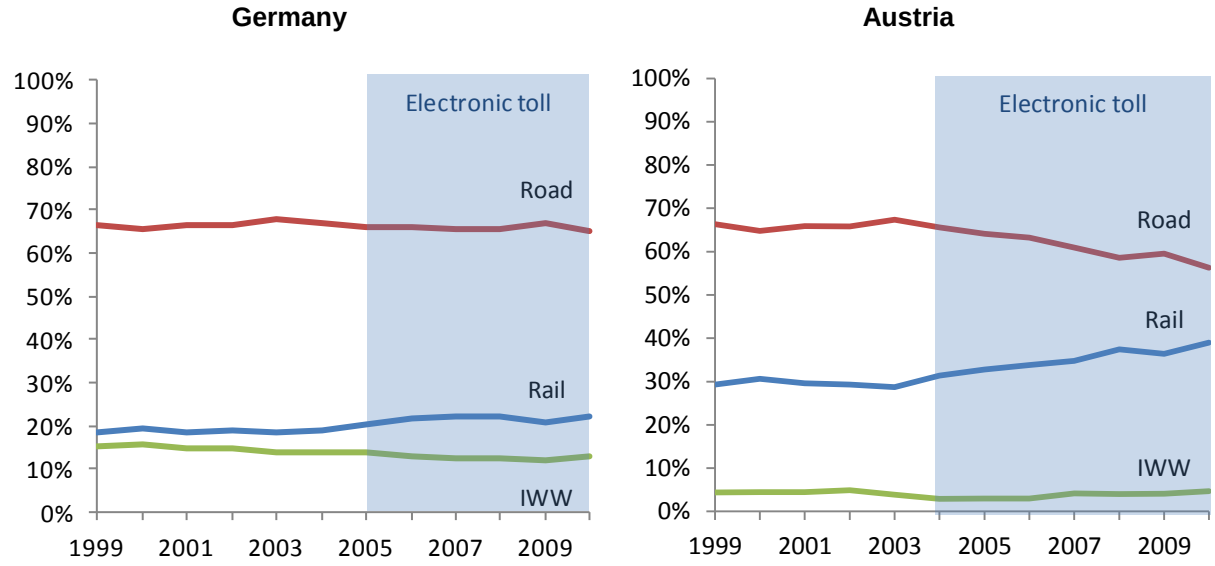
	Heavy load / large quantities	Small size / quantities
High value goods	Mainly by rail	Road
Low value goods	By rail or inland waterways	Minor part by rail

2.7.1.2 Evidence of modal shift

Due to the difficulty in isolating the impact of road user charging on modal choices, the analysis in this section consists of case studies. The two countries with the highest road user charges are analysed in detail, as the higher charges translate into a stronger incentive overall for modal shift.

Germany and Austria have introduced the highest charges as a percentage of total operating costs (at 11% and 15% respectively). Eurostat statistics on German modal split show a slight increase of the share of traffic by rail from 2003 to 2008 and an almost stable share for road after the electronic toll was introduced in the time span 2005 - 2008. In Austria, the share of road transport shows a reduction from 65% to 56% after the toll was introduced within the time span 2004-2010, an average reduction of 1.6% per year. On the other hand, Eurostat figures indicate an increase of the rail transport share from 31.4% to 39%, (1.3% per year on average)[19].

Figure 2.23: Trend of the modal split share in Germany and Austria (% total inland freight t-km)



Notes: IWW = inland water ways

Source: Eurostat database. Table tran_hv_frmod

Germany

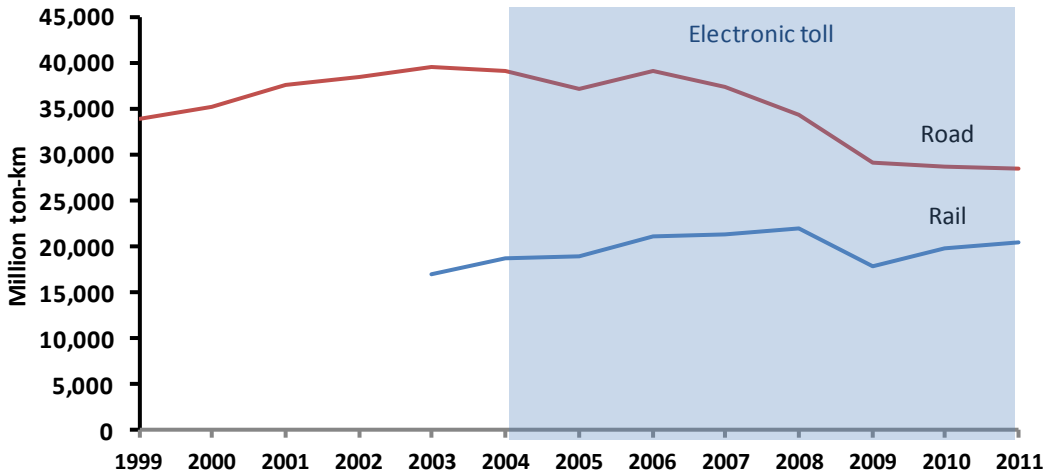
Several studies of the German toll system over the years have concluded that there has been no impact on modal shift, despite the availability of high-quality rail network. The Ministry of Transport concluded in 2001 that the quantity of goods carried by road would fall by 1.4-2% at most due to a charge of DM0.25 to 0.35 per km. TransCare AG (2006) found that the maximum incentive for modal shift created by pricing of 1€ per truck-km would be 1.2%. This potential applies to goods for which transport constitutes a high proportion of the total supply-chain costs, and assumes that the cost of road freight is increased overall. However, Deutsche Bahn AG (the national railway company) increased their fees on their core segments at the same time as the toll system was implemented in 2005. The recommendation of the study is that road tolling is not a tool to influence modal split since the required fee level is so high and the potential so low. A more recent study in 2009 reaffirmed the failure of the road toll to stimulate modal shift (Deutscher Bundestag, 2009).

[19] According to a similar research carried out by Transport & Environment (2010) the effect on the modal share is particularly evident and relevant for the national transport.

Austria

The new modal split in Austria is due to the reduction of the ton-km measured on the Austrian road network and an increase in rail ton-km as shown Figure 2.24 below

Figure 2.24: Trend of road ton-km by road and rail in Austria (Million t-km)



Source: Eurostat database. Tables road_go_ta_tott and rail_go_typeall

It should be noted that the increase of rail freight traffic in Austria could have affected by measures introduced by the Austrian government to support combined transport including[20]:

- Financial support (investment aid, financing the terminal infrastructure, compensation for public service)
- Fiscal measures (incentives for motor vehicle tax),
- Regulatory framework for the promotion of combined transport (e.g. liberalisation, exemptions from temporary bans for pre-and post),
- Infrastructure (for rail transport and combined transport).

Most of the support measures contributed to reducing the total cost of intermodal chains of transport. In view of this, there is no evidence that significant changes in modal split can be attributed to the road charging scheme (TRT, 2008).

Other Member States

In response to the questionnaire, no Member States identified instances of modal shift away from road freight. In most cases, the preferred response of freight operators appeared to be route shifting to un-tolled roads (Slovenia, Poland, Spain, Italy and Hungary).

Main findings

No evidence of modal shift was found.

Germany and Austria were investigated as case studies, as both countries operate network-wide tolls (which represent 13-15% of total operating costs for trucks compared to just 1-2% for vignettes), both have good availability of high quality non-road modes, and included modal shift as one of the aims of their road pricing policies. There is no conclusive evidence of modal shift in Germany due to the introduction of the MAUT. A minor shift from road to rail occurred in Austria; however it is difficult to isolate the impact of the toll from the various other support measures that were also introduced and therefore no significant changes can be attributed to the road charging scheme.

Given that the German and Austrian tolls represent the highest road charges in Europe as a percentage of total operating costs, it can be expected that impacts on modal shift in other countries (if any) would be even smaller.

[20] http://www.bmvit.gv.at/verkehr/gesamtverkehr/kombiverkehr/foerderung.html

2.7.2 Future situation – Ex-ante evaluation Q.3

Purpose: To analyse whether and to what extent the provisions of Directive 2011/76/EU might influence users' behaviour

Context: To evaluate whether and to what extent the new provisions of the Directive 2011/76/EU are effective in influencing modal shift

Main Findings

The analysis of the potential impacts has already been provided in the section above. The ex-ante analysis found that the potential for modal shift is generally low.

Non road-pricing policies to encourage shifting road freight to rail and waterborne transport generally focus on reducing administrative barriers, investing in infrastructure, Freight is likely to continue to rely on road haulage over short distances even if policies for modal shift are introduced, as other modes cannot compete in terms of speed, flexibility and reliability. However, the possibilities of shifting to rail transport over longer distances are much greater if problems concerning interoperability and national fragmentation are resolved.

Various studies confirm the potential for modal shift is rather low.

- The Hop! Project (2008) aimed to assess the impact of high oil prices on the European economy and transport sector – since fuel is a significant factor in truck operating costs, yet only a minor factor for rail freight, this has the effect of simulating a relative price increase for road transport. However, with an oil price three times higher than in the reference scenario, the share of rail would merely increase from 15 to 16% in the year 2050.
- According to Significance (2010), if both road and rail transport were charged for infrastructure use and their marginal external costs, the overall relative price increase of road transport would be in the range of 8 to 25%. This would result in a modal shift of between 2 and 8% of road transport volume.
- Studies in Germany and France suggest that of the total theoretical road freight that is suitable to shift to rail from a technical perspective, only 30% is suitable when evaluated from a real-world perspective (ETC/ACC, 2008). These considerations include the additional costs for pre-runs and onward carriage required for rail freight; the lack of suitable time windows and the lack of specific quality demands such as temperature control and intermediate off-loading points. Overall in the 27 EU Member States (excluding Malta), around 4.5% of the total volume of goods transported by road (measured in tonnes) could be shifted to rail (ETC/ACC, 2008). In order to achieve this shift, expansion of rail infrastructure would be required.

A large range of price elasticities for the effect of changes in prices per t-km on the modal split (in t-km) is found in the literature, ranging from -0.2 to -1.3 (Significance, 2010). The range is due to differences in the availability of non-road modes. Estimates for Belgium are high, while estimates for Italy, Sweden and Denmark are comparatively low. The t-km price elasticities measured in tonnes are significantly lower compared to those measured in t-km, indicating that long distance transport is the main candidate for modal shift.

2.7.2.1 Views from other stakeholders – sector associations and road hauliers

There is broad consensus amongst stakeholders that modal shift as a result of road charging has been limited, even negligible. It was noted that even in countries where tolling has been used to try to discourage the use of the road, modal shift has been extremely limited.

In order to choose between the different modes of transport (or combinations), the associated costs are considered, as well as other criteria, like flexibility, quality, time, service etc. Thus, adding charges does not necessarily make professional operators change their behaviour. On the contrary, if rail transport were to be made more efficient, flexible and service-oriented, then operators could be more likely to choose rail. In addition, small operators are primarily active in road transport, and not in rail and maritime transport, whilst bigger businesses are active in all three modes.

The ability of operators to pass through costs depends on whether the transport operator can negotiate the contract with his customer. In most cases any cost increases due to toll or user charges are partly or completely absorbed by the transport operator. There are countries that have national laws on cost pass-through. In France, for example, there are discussions on how the additional costs of the new eco-tax can be passed on to shippers and end users. However, such legislation is exceptional, as in many countries this would not be in line with competition policy.

2.8 The impact on geographically isolated and peripheral Member States

Purpose: To ascertain whether the application of tolls and/or charges in such Member States may have discouraged international haulage operators from travelling through geographically isolated and peripheral Member States, or increased the cost of goods delivered to these countries.

Context: The ex-post evaluation question was set to support an understanding of the impact that the Directive has had on traffic to and from peripheral Member States, and the cost of goods in these countries. There is a concern that the application of tolls and/or charges in such Member States may have discouraged international haulage operators from travelling through such countries or may have disproportionately affected the costs of goods delivered to such countries. However, it is perfectly possible that, with an economic efficiency objective, the toll or user charge should be lower in peripheral regions. In fact, article 7.1a of the Eurovignette Directive gives a Member State the possibility to exempt a part of the trans-European road network from tolls or user charges as long as it does not result in any distortions against international traffic.

Main Findings

Any negative impacts on peripheral Member States are expected to be small

Several studies have shown that there is potential for cost increases in peripheral regions to be higher compared to those in central regions; however the overall impact on economies is thought to be small. Other factors appear to have a larger impact on the total cost of transport – particularly differences in the wages of drivers.

The Eurovignette Directive recognises the potential for uniform road user charging to disadvantage peripheral areas, and so has a provision that enables such regions to apply a lower charge. This is justified on the grounds of promoting economic development and accessibility.

A number of Member States are adopting this provision in their policies. For example in France it has been announced that a discount of 25% will apply to journeys made to three 'peripheral regions' – Brittany, Aquitaine and Midi-Pyrenees – under the national HGV road user charge that is currently being developed. The justification for this reduction is to promote regional development (Ecomouv, 2012).

This section reflects on the impact of the Directive on freight vehicle traffic to and from peripheral Member States. It also identifies whether there has been an economic impact on these regions, and if there has then whether it has been positive or negative.

2.8.1 Road user charging in geographically isolated and peripheral Member States

There has been much debate about the link between 'geographical isolation' and 'peripherality' and regional disparities. The focus of such research has largely been on economic impacts, with findings generally indicating that there is a correlation between the two. This is often attributed to the fact that geographically isolated and peripheral regions have less access to large markets and that they can have low or falling levels of population density, which can constrain business activity compared to more central regions (Davies and Michie, 2011).

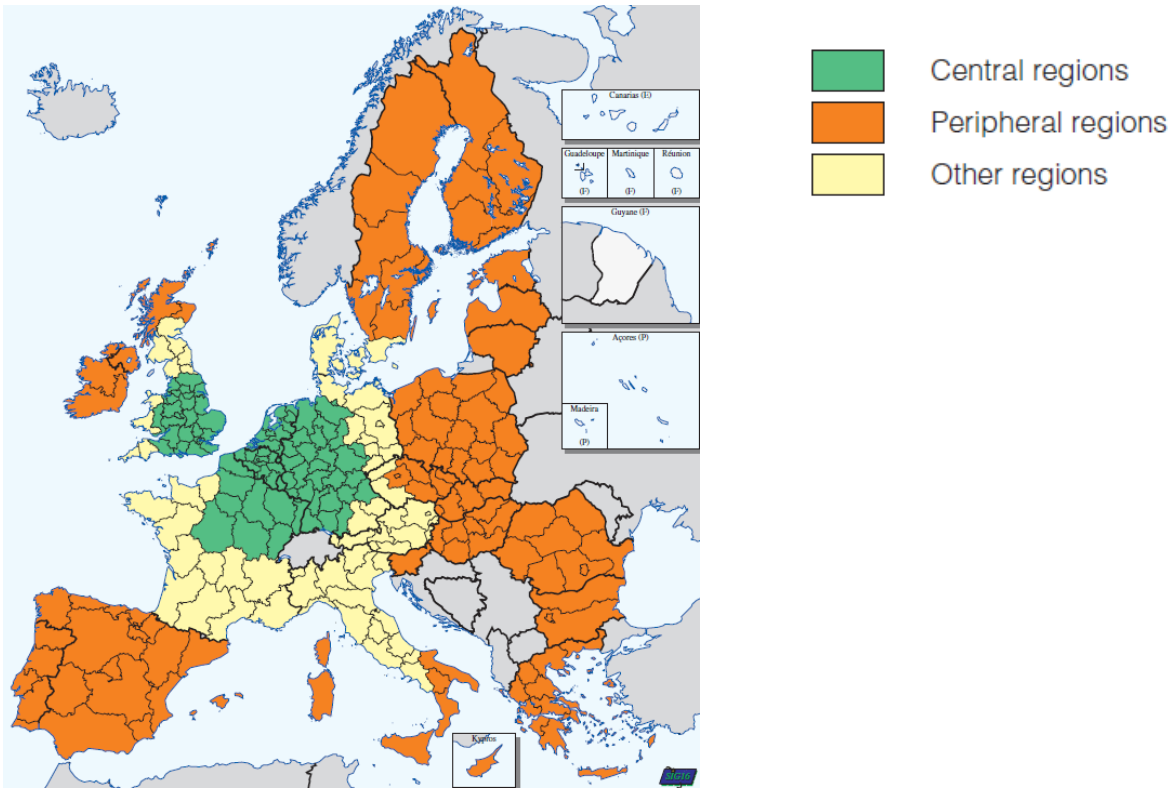
There is not a fixed definition of peripheral Member States, which is partly owing to the desire to treat countries as being 'equal.' However, according to The Institute of Spatial Planning at Dortmund University of Technology (IRPUD), the most important peripherality indices are:

- Population by car (to represent *accessibility* – relative closeness to agglomerations - and the perspective of service firms and consumers with respect to how many opportunities such as clients, markets or tourist facilities can be reached)
- GDP in Euros by HGV (to represent the perspective of producers on potential markets).

The regions identified as being 'peripheral' are similar whichever of the two indices are used. However, the definition based on GDP in Euros by HGV has been used in this report as it highlights the link between peripherality and economic impact, as well as the volumes (and value) of freight

traffic. Figure 2.25 shows a map of the peripheral Member States. The classification was developed using data from before the Eurovignette Directive entered into force and so the regions identified as being peripheral will not have been distorted by any HGV road user charging.

Figure 2.25: Central and peripheral regions based on the peripherality index to GDP by lorry (IRPUD-DGREGIO).



Source: IRPUD-DGREGIO (2001).

According to this definition of peripheral Member States, all of the "new" Member States (the EU-12) are considered peripheral, along with Portual, Spain, Sweden, Finland and Greece. One point to note is that almost all of the Member States with no national charging system in place (i.e. excluding the UK) are considered to be peripheral. The remaining peripheral Member States operate all three types of road user charging between them (vignettes, network-wide electronic tolls and concession motorways).

2.8.1.1 Impacts on peripheral areas

Road user charges increase the generalised cost of transport, and therefore regions where transport costs are the highest will experience disproportionately large impacts. The geographical location of peripheral regions means that they are likely to suffer from this regional imbalance in costs with any inequality between peripheral and core regions enhanced as the accessibility of the former is effectively reduced.

The 1998 White Paper (CEC) proposed a phased approach to a common transport infrastructure charging framework for the EU, based on an assessment that indicated that such policy would be beneficial to all regions including peripheral Member States. This is because:

- 'Consumption' of transport is generally progressive, with wealthier regions or companies spending a greater proportion of their income on transport, so a charge could have a positive distribution effect
- There is less infrastructure and congestion in peripheral regions, so any charges that internalise congestion costs would have a disproportionately positive impact on peripheral areas
- Efficiency improvements driven by road-user charges will benefit all regions (with the exception of hauliers who do not adjust their behaviour in response to charges).

However, it also noted that in short-term, the impact on producers could be negative if they were:

- Located in peripheral regions
- Dependent on a single mode of transport
- Selling over long distances
- In competition with more centrally located producers.

Several studies have been carried out on existing road user charging schemes in Europe. For example, transport prices in Germany increased by between 5 and 7% when the HGV road user charge was introduced. In the more peripheral Sweden and Hungary, however, it is estimated that transport prices will increase by between 6 and 10% as a result of their distance-based HGV charges (Tánczos and Mészáros, 2008).

Other studies on the German toll found it had a negative impact on peripheral regions, with the competitive position of companies that are situated in these regions suffering as a result (Gustafsson *et al,* 2006 and Källström, 2007). This was attributed to the need for companies located in these regions to cover the costs of a greater share of empty runs, although it was not believed that the impact would be great enough to lead to any companies moving location or any facilities closing down. Studies that have been conducted into the impact of Switzerland's HGV charging scheme have come to the same conclusions (Källström, 2007). It has been estimated that the average cost per employee in transport regulated businesses in peripheral regions of Switzerland is 50% higher than in more central regions of the country. Furthermore, it was found that the peripheral and mountainous regions of Switzerland have experienced a greater impact than the more central regions, although the effect was not significant (Karlsson, 2010). The same is true in Austria, where the northern part of the country has been the most affected by the country's distance based road user charge.

The results of a modelling exercise, which sought to identify the impacts of internalising externalities from HGVs across Europe through road user charging, showed considerable variation in the impact of charges across regions (Schneekloth and Brocker, 2003). It found that charging HGVs for the cost of their marginal social cost led to a reduction in GDP and economic welfare, and that in this respect peripheral regions suffer disproportionately compared to core regions. A second modelling scenario looked at the potential impacts if TEN-T proposals were implemented to increase the accessibility of peripheral areas at an accelerated rate. The results showed that there would still be a negative impact on GDP and that the periphery would be more negatively impacted than the core areas.

On the other hand, road user charging can increase the efficiency of freight operations, through better logistics management, shortened journey length and better utilisation of capacities (Tánczos and Mészáros, 2008). Indeed, the average load factor appears to be higher the longer the distances are. Thus, hauliers from peripheral countries such as Spain, Cyprus, Finland and Greece appear to have the highest load factors in international transport operations. The increase in efficiency that can result could compensate for higher operational costs as a result of road user charging and reduce the cost of transport in the supply chain. However, the extent to which this efficiency gain can be stimulated through road pricing (as opposed to other factors such as fuel prices and competition from other firms) is debatable.

2.8.1.2 Views from other stakeholders – sector associations and road hauliers

Overall, stakeholders were of the opinion that peripheral Member States could be disadvantaged by the Directive. For example, Spain and Portugal argue over whether the Eurovignette Directive is fair, because their operators need to pay charges for all countries they drive through / to, whilst businesses / operators based in other countries only have to pay tolls in Spain or Portugal if they actually deliver in those countries. Hence, such countries receive less income from road charging because they have less transit traffic.

One stakeholder noted that it seems that the three biggest opposers, Portugal, Finland and Spain, are moving towards installing tolls/user charges on geographically isolated/peripheral areas. Another stakeholder noted that when considering the cost of transport, other costs are more important than road charges, such as labour costs.

2.8.2 Conclusions

Several studies have shown that there is potential for cost increases in peripheral regions to be higher compared to those in central regions; however the overall impact on economies is thought to be small. Other factors appear to have a larger impact on the total cost of transport – particularly differences in the wages of drivers. For example, a Romanian lorry driver may earn less than a quarter of a German lorry driver's salary (European Commission, 2011).

Nevertheless, some stakeholders have expressed concern over potential disadvantages to peripheral Member States. It is possible to mitigate any disproportionately negative impacts in peripheral regions by compensating affected stakeholders or by reducing the charges. For example, in Switzerland peripheral regions are compensated through the regional distribution of tax revenues (Källström, 2007; Karlsson, 2010). Källström (2007) suggests that an HGV kilometre tax that allows for differentiation according to road type and region would be a way of avoiding these distortions being experienced. Another way of avoiding undesirable regional effects could be to impose revenue caps to avoid overcharging peripheral countries. The White Paper (1998) recommended that peripheral regions should promote the competitive positions of any negatively impacted producers, for example by helping them to adapt their production structures, and improving the quality and diversity of transport systems. However, it was noted that a more gradual introduction of the charging principles in cohesion regions may be needed even though studies into the effects of such a charging system on peripheral regions (as well as on the economy, industry and consumers) showed that the impact would be positive.

3 Conclusions

3.1 Ex-post evaluation

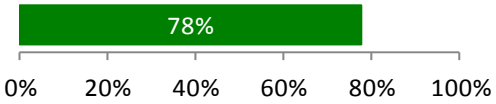
The ex-post evaluation comprised an assessment against nine key evaluation questions.

Q1: Description of measures taken in Member States in the field of road user charging, including the rates of tolls/charges applied

The majority of Member States have now implemented some form of road user charging

Some form of road charging was in place in 21 EU Member States at the end of 2012: nine countries have vignettes, five have electronic nation-wide tolls and seven have conventional tolls. Six countries still have no form of national policy, but two of these plan to implement vignettes by 2014.

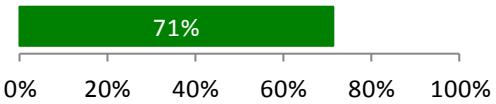
Road charging implemented:



All countries except Germany and those that take part in the Eurovignette agreement include vehicles >3.5t

Inclusion of vehicles over 3.5t by 2012 has largely been achieved[21]. The majority of countries include vehicles over 3.5t, as well as buses and coaches in their charging schemes. Only the Eurovignette countries (Belgium, Denmark, The Netherlands, Luxemburg and Sweden) and Germany restrict their charging to goods vehicles above 12t (excluding buses and coaches). Of the Member states with road charging in place, 15 include vehicles over 3.5t (71%)

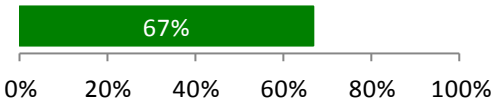
Inclusion of vehicles >3.5t



Most Member States now differentiate charges by Euro emission class; those that do not are usually those with large networks of concession motorways

Many Member States introduced Euro-differentiation of charges before it became mandatory no later than 2010. All Member States with network-wide tolls have complied with the requirement. Almost all vignettes are differentiated by Euro class; the only exception is Hungary, which plans to replace the vignette with tolls. In contrast, concession tolls do not typically differentiate according to Euro class and the long contract periods of most concessions suggest that it may be some time before they do so. Of the Member states with road charging in place, 14 differentiate charges by Euro class (67%)

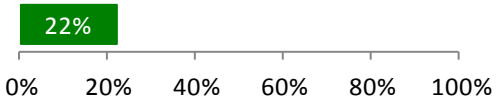
Differentiation of charges by Euro class



Differentiation in charges according to time of travel remains largely unexplored

Of the Member states with road charging in place, only six apply time-of-day charge differentiation (only two apply time-differentiation widely across the network), although it should be noted that countries with vignettes are unable to differentiate charges by time.

Time-differentiation of charges



[21] The original Eurovignette Directive 1999/96/EC applied only to commercial vehicles over 12t, whereas the amendment in 2006 extended the scope to those over 3.5t. This requirement became mandatory from 2012, except in exceptional circumstances.

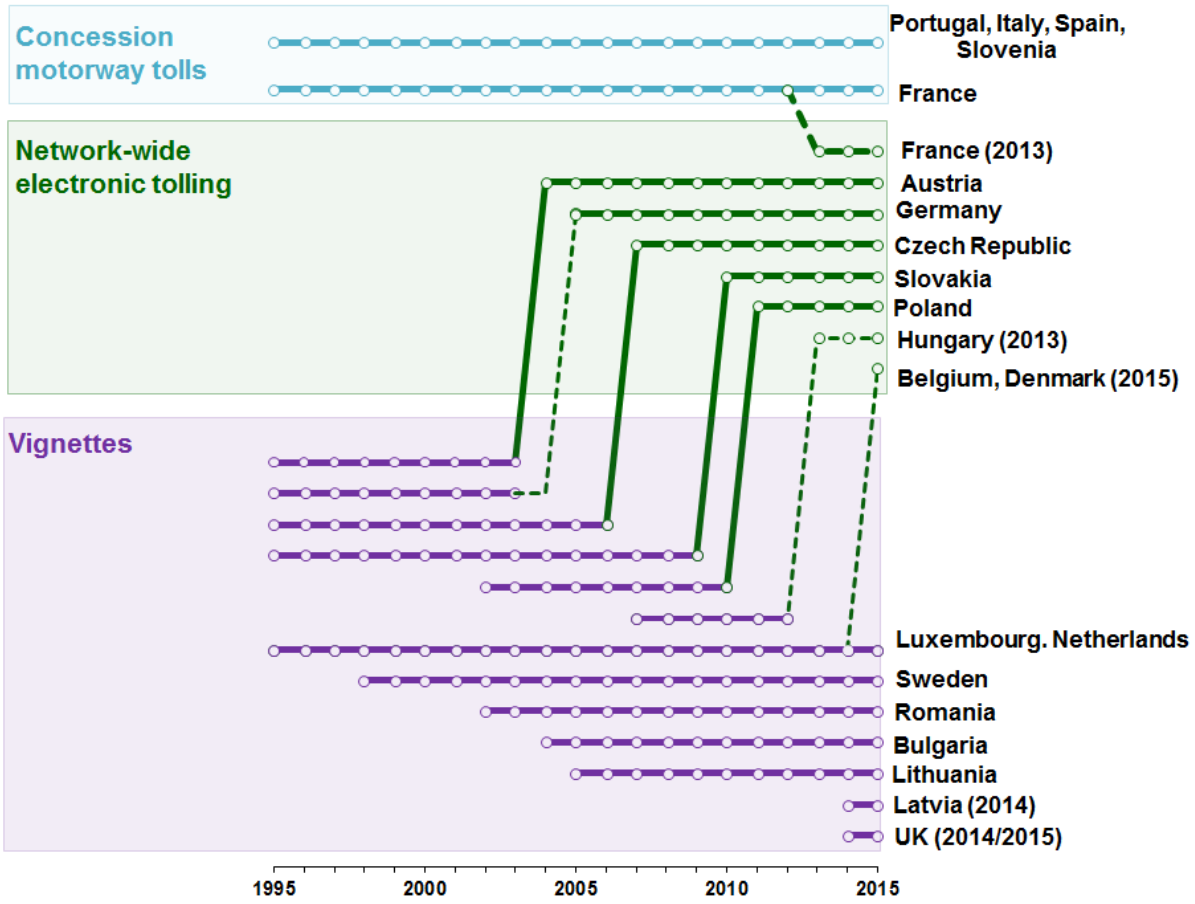
Comparison of annual charges for vignettes shows that charges are broadly proportional to the length of motorways that are included in the charge. The Eurovignette agreement remains the most expensive vignette; however, it has not been updated since 2001 and consequently falls well below the maximum allowable charges today. Comparison of toll charges shows that network-wide tolls have a broader range of charge levels compared to concession tolls due to greater use of charge differentiation in these countries

Q2: Progress towards applying charges to road users and ways of gradually harmonising the charging systems that are applied to commercial vehicles

Despite the apparent fragmented nature of road user charging in Europe when viewed as a snapshot, significant progress has been made since 1995.

There is a clear trend towards greater use of electronic network-wide tolling across Europe. Five countries that started with vignette systems have gradually transitioned to electronic network-wide tolls, with France, Hungary, Belgium and Demark also planning to implement tolls in the next few years.

Figure 3.1: Development of infrastructure charging systems in Europe 1995-2015



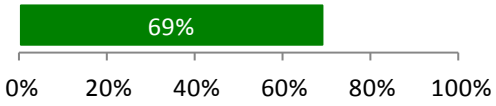
Evidence from implementation choices in Europe shows that Member States with electronic network-wide tolls are more likely to explore options for differentiating charges by Euro class, time of travel and number of axles compared to Member States using other forms of charging. However, the prevalence of concession motorways in other Member States, typically with long contract periods extending over several decades, is likely to slow any further harmonisation of charging systems in these countries.

Q3: The policies of Member States as regards the use of charging revenues

All Member States, except those belonging to the Eurovignette agreement, earmark revenues at least in part to transport

Despite the voluntary nature of earmarking revenues to transport, most Member States have chosen to do so, although the precise use of the revenues is not clear. For Eurovignette countries, revenues go to the general budget.

Earmarking to transport



Q4: The policies of Member States as regards enforcement and the treatment of occasional users

Violation rates generally appear low and Member States impose penalty fees that are broadly comparable

In all Member States the minimum penalty for non-compliance does not exceed €375. There are two main approaches that are used to ensure compliance:

- The first is to have many compliance checks and a low penalty – this appears to be the favoured option in Member States with electronic network-wide charges.
- The second is to have only occasional compliance checks but penalty levels reaching much higher levels (although starting at comparable levels to those in the former group). This structure is common for concession motorways and national vignettes

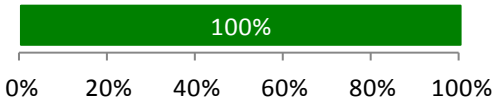
Only limited and anecdotal evidence on the effectiveness of enforcement is available. The available evidence suggests that it is almost zero in countries with physical barriers; around 1-3% for electronic tolling and 2-15% for countries with vignettes. Thus in most cases for which data are available, violation rates are very low and enforcement procedures could be considered effective.

Regarding the policies of Member States towards the treatment of occasional users, one of the key aims of the Eurovignette Directive is to prevent competitive distortion through discrimination *"..directly or indirectly, on the grounds of the nationality of the haulier or the origin or destination of the vehicle."*

No evidence of excessive minimum charges for vignettes was found under current schemes

For vignettes, potential discrimination could occur through excessive minimum charges, by either not offering a daily rate, or by charging a rate above the maximum level set out in the Eurovignette Directive (€11).

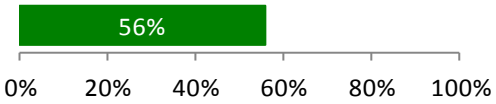
Provision of daily vignettes <= €11



The current level of discounts for longer vignettes could be considered discriminatory in most countries with national vignettes

A further means of possible discrimination under vignettes is by providing excessive discounts for vignettes covering longer time periods. No precise criteria were defined in the 1999 Directive to identify what scale of discount is appropriate with respect to the annual rate for vignettes covering different time periods. However, provisions have been introduced in Directive 2011/76/EC (Article 7a), which state that "*The monthly rate shall be no more than 10 % of the annual rate, the weekly rate shall be no more than 5 % of the annual rate and the daily rate shall be no more than 2 % of the annual rate.*" These can be used as a guide to assess whether the level of discount provided could be considered discriminatory. Currently only the Eurovignette countries (five countries out of nine with vignettes) are in compliance with the new allowable discount rates.

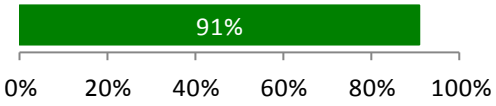
Discounts in line with Directive 2011/76



None of the Member States with tolls in place, except Spain, offer discounts for frequent users beyond the saving in administrative costs

For toll roads, there are likely to be some savings in administrative costs for frequent users over occasional users. Directive 1999/62 did not specify provisions for frequent user rebates, but the amended Directive 2006/38/EC capped them at a maximum of 13%. In most countries with concession motorways, discounts were provided that went beyond the 13% limit; however, all cases have subsequently been resolved with the exception of those in Spain. Thus, only one country currently offers discounts of more than 13%.

Discounts for tolls <13%



Q5: An evaluation of all the existing national electronic toll systems: use of electronic systems to levy and collect infrastructure and external-cost charges and their degree of interoperability pursuant to Directive 2004/52/EC.

There are several successful examples of interoperable systems in Europe.

Currently, interoperable systems exist between France and Norway (with potential to also include Spain, Austria and Slovenia); Germany and Austria; Norway, Sweden and Denmark.

In Member States with electronic tolling systems, user acceptance appears to be high.

In cases where users have a choice of different payment methods, 35-60% of all users chose to use electronic tolling, while uptake for HGVs appears to be higher than average (over three-quarters in France and Italy).

Q6: The effectiveness, completeness and clarity of the provisions on the recovery of infrastructure costs in terms of financing, developing and maintaining the road network and in terms of promoting a harmonised approach.

Most EU Member States have transposed the 1999 Directive and its amendment in 2006. However, only a few Member States have systematically implemented and applied all the provisions of the Directive.

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Charging systems		Member States	Transposition of Directive 1999/62 and 2006/38
Network-wide electronic tolls		Austria, the Czech Republic, Germany and Switzerland	Austria, the Czech Republic, Germany and Switzerland are already in line with the application of tolls, as suggested by the Eurovignette Directive.
Concession motorways		France, Spain, Greece, Italy, Slovenia and Portugal	Most have transposed the Directive, with provisions that exempt existing concessions from the scope. Italy exempts existing concessions from the requirement to vary tolls by Euro standards. Spain has not yet implemented the provisions of the Eurovignette Directive in national law. The Portuguese law transposing the Eurovignette Directive contains a provision that leaves concession toll systems entirely outside the scope of the directive.
Vignettes	**Eurovignette**	Belgium, Denmark, Luxembourg, the Netherlands and Sweden	Most have transposed the Directive by setting up national acts and decrees for key elements. The Netherlands have proposed some concrete proposals to bring the Eurovignette scheme in line with directive 2006/38/EC especially to use the maximum possible rates under the amendment; this has yet to be agreed with all the Eurovignette countries.
	National vignette	Bulgaria, Romania Hungary, Lithuania, Poland and Slovakia	Most have transposed the Directive by setting up national acts and decrees for key elements. However, all provisions of the Directive are not systematically implemented.
No widespread charging system		Cyprus, Estonia, Finland, Ireland, Latvia, Malta and UK	

Member States with network wide electronic tolls have stronger and more focussed objectives for implementing road charging systems

Infrastructure financing is the main objective for implementing road user charges in almost all Member States. In the Member States with national vignettes, assisting networks facing difficulties after years of under-investment and speeding up completion of motorways was a key objective. The Member States with network wide electronic tolls have considered tolls as the most suitable way to apply the "user pays" and "polluter pays" principles.

	AT	CZ	DE	BE	DK	LU	NL	SE	BG	RO	HU	LT	PL	SK	ES	FR	IT	EL	PT	SI
Financing/speed up of new road infrastructure	✓	✓	✓	pc	pc	pc	pc	pc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reduce the growth rate of freight traffic	✓																			
Apply user pay principle	✓	✓	✓																	
Apply polluter pay principle	✓	✓	✓																	
More efficient use of transport capacity and intermodal competition	✓		✓																	
Provide a common and integrated system (interoperability)	✓			✓	✓	✓	✓	✓												
Address declining share of freight rail									✓	✓	✓	✓	✓	✓						
Improve service quality and maintain market share									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cope with rising national and international traffice and cost imposed				✓	✓	✓	✓	✓	✓		✓		✓							
Operation and maintenance of networks	✓	✓	✓	pc	pc	pc	pc	pc							✓	✓	✓	✓	✓	✓

pc - partly covered
Nework-wide electronic tolls
Eurovignette
National vignette
Concession motorways

Most Member States do not recover full infrastructure costs from road charging due to lack of methods to relate charges to costs or where charges are set by political decisions.

Germany and Austria to some extent are the only two countries that are currently reflecting charges to recover investment and operating costs across the national network. A summary of the experience from the other groups of countries is given below:

- **Member States with vignettes:** The revenue from road charges is a small part of infrastructure cost; the rest is covered by other road and fuel taxes, state subsidy or state budget
- **Member States with concession-based systems:** can recover 100% of costs but only for the network covered by them.

A lack of guidelines to calculate infrastructure costs and recover them in a revenue neutral way was cited as an important barrier by some Member States.

There is limited evidence on wider stakeholder acceptability of HGV road charging with positive experience in Austria and German and high public resistance in the Czech Republic.

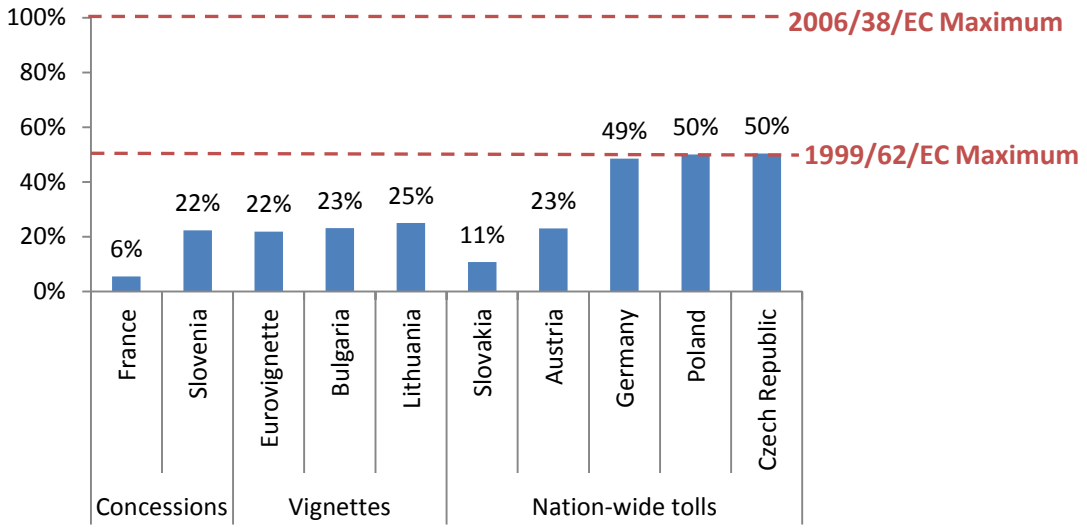
In Austria, the HGV charging scheme has high levels of acceptance among users. The scheme is based on well known and simple technology which makes it reliable (99.9% correct transactions). It is also simple and readily understandable for users and causes them only low equipment costs (5 Euro for a "Go-Box, free to install in vehicle). In Germany, views were split with a relatively high acceptance of the HGV toll by private users, whereas on the other hand, private consumers feared a negative impact on overall price levels. In Czech Republic, users felt they were "taxed double" when road charges are added on top of the already existing taxation in addition to poor 'value for money'.

Q7: The implementation and effect of the variation of infrastructure charges on the reduction of local pollution and congestion.

Most Member States apply charge differentiation by Euro class at levels significantly below the maximum permitted

The maximum differentiation to control air pollution was extended from 50% (Directive 1999/62/EC) to 100% (Directive 2006/38/EC). The range of charge differentiation applied in Member States is between 6% (France) and 50% (Poland and Czech Republic).

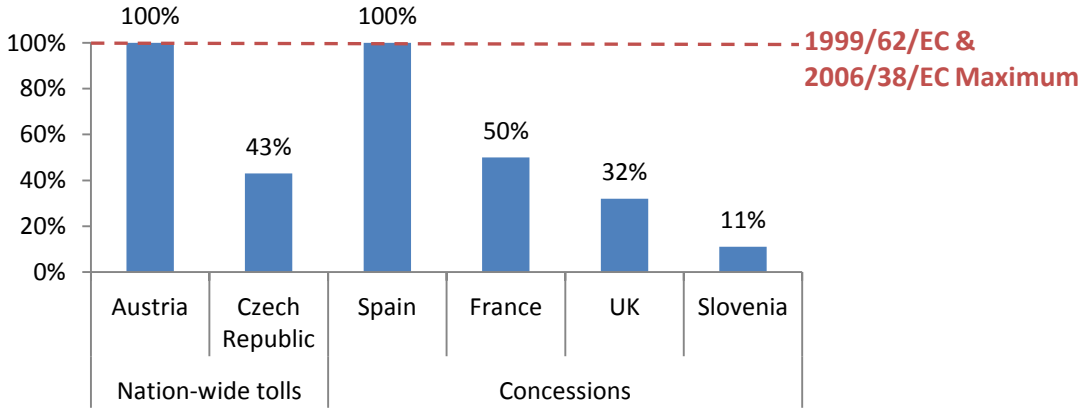
Figure 3.2: Maximum charge differentiation according to Euro class for vehicles in the same category



Only Austria and Spain apply the maximum differentiation of 100% according to time of travel, whereas the remaining countries apply variations of 50% or less.

Directive 1999/62/EC and Directive 2006/38/EC allowed a maximum differentiation of 100% according to time of travel. It should also be noted that in most countries the differentiation is only applicable on selected routes, whereas Czech Republic and Slovenia apply them on the network. In addition, Austria and Slovenia apply higher charges at night to control noise emissions, whereas the other Member States apply higher charges during peak hours to control congestion.

Figure 3.3: Maximum differentiation according to time of travel for vehicles >3.5t in the same category



Charge differentiation by Euro class has been found to have an effect on behaviour change only in the case of nation-wide tolls.

Network-wide tolls differentiated by Euro class have had a significant effect on the use of cleaner vehicles. Even when the level of a vignette charge is differentiated by vehicle emission categories, it is insufficient to induce changes to the composition of the vehicle fleet. However, an improvement in the fleet composition of trucks engaged in international transport has been observed in countries without Euro-differentiated charges due to spillover effects of tolls in other countries.

Improvements in transport efficiency were found in Germany and Austria (network-wide tolls) soon after the introduction of the charge. However, in the longer term, GDP and fuel prices appear to be the main explanatory factors for changes in loading and empty running.

Table 3-1: Effectiveness of schemes in reducing air pollution and congestion

Main impact	Mechanism	Vignette	Toll (network wide)	Toll (selected roads)
Air pollution	Greater share of higher Euro class vehicles	Low effectiveness	Strong effect to increase share of travel carried out by cleaner trucks if differentiated by Euro class Smaller effect on fleet renewal rates	Most trucking firms would have little incentive to modify their vehicle fleets if tolls apply only to selected corridors
Air pollution, congestion	Changes in route to avoid charged areas	No effect	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls	Diversion in cases where alternative non-tolled roads of high quality are available – can be remedied by applying speed restrictions or additional tolls
Congestion	Changes in travel time to avoid peak periods	Not possible	Some evidence of peak spreading	Some evidence of peak spreading (mostly passenger cars)
Air pollution	Improvement in transport efficiency	No impact expected	Improvements in short-term Long-term effects are uncertain	No impact expected

A small number of countries have introduced time-varying charges to control congestion. Evidence from France and the Czech Republic shows that traffic during the peak times reduced after differentiated charges were implemented. However, just-in-time inventory management and time-sensitive goods (such as express services) can limit the flexibility of freight delivery, meaning that time-of-day elasticities are typically lower for trucks compared to passenger cars.

Q8: The effect to direct users toward the most environmentally friendly and efficient transport solutions (modal shift)

No significant evidence of modal shift was found.

This was confirmed through a number of interviews, where Member States did not indicate any evidence of modal shift

Q9: The impact of road charging and of the measures of the Directive controlling toll rates on geographically isolated and peripheral Member States

Any negative impacts on peripheral Member States are expected to be small.

Several studies have shown that there is potential for cost increases in peripheral regions to be higher compared to those in central regions; however the overall impact on economies is thought to be small. Other factors appear to have a larger impact on the total cost of transport – particularly differences in the wages of drivers. For example, a Romanian lorry driver may earn less than a quarter of a German lorry driver's salary (European Commission, 2011).

3.2 Ex-ante evaluation

Q1: The effectiveness, completeness and clarity of the provisions on the recovery of the costs related to traffic based pollution and of the variation of infrastructure charges according to Euro classes to reduce pollution

The provisions have not yet been implemented; however, stakeholders expressed some concern over the complexity of the charge structure

The main concern was that further differentiation of tolls (in addition to those already applied) could lead to complex tariffs and a lack of transparency. Furthermore, the calculation method requires highly disaggregated information, some of which is not already collected.

Several Member States are planning to introduce Euro class differentiation in the next few years, but a significant barrier to wider implementation stems from existing concession contracts

The majority of contracts will not be renewed until after 2025: 60% of contracts in Italy expire after 2025; 75% in Spain; 86% in Portugal and 94% in France. This is likely to delay any implementation of the provisions of the Eurovignette Directive on the conceded network.

Q2: An evaluation of the effect of the variations according to peak time on congestion, of whether the new maximum variation and maximum daily duration of peak periods are sufficient; and of the effectiveness of variations if such differentiated charges are only applied to certain vehicle categories

Most Member States are not currently planning to introduce differentiation of charges by time of day

The reasons for this choice include the following:

- Congestion is viewed as being mostly a problem in urban areas, which are outside of the scope of the Eurovignette Directive
- Ensuring revenue neutrality would require regular revisions to the charges based on changes in demand, which would create additional administrative burdens
- HGVs are already banned at night-time in some countries; adding daytime congestion charges could be viewed as penalising HGVs twice and make stakeholder acceptance more difficult; and
- Congestion charges should apply to all vehicles if they are to be effective

Q3: The effect to direct users toward the most environmentally friendly and efficient transport solutions

The potential for modal shift is generally thought be low

Freight transport is likely to continue to rely on road haulage over short distances even if policies for modal shift are introduced, as other modes cannot compete in terms of speed, flexibility and reliability. There is broad consensus amongst stakeholders that modal shift as a result of road charging has been limited, or negligible.

Q4: The impacts of the provisions of the Directive on the use of revenue

The likely impacts of the new provisions of the Directive on the allocation of revenues are not clear at this point in time.

National Competent authorities have indicated that the new provisions will not lead to a clear, straightforward impact, with changes mainly expected in those countries where external-cost charges will be levied. In addition, the proportion of total revenues that will be earmarked to the transport network will vary significantly between Member States.

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Appendix A - Current road user charge structure in Member States

Differentiation according to Euro emission classes

Table A-1 summarises the current level of charge differentiation for vignettes. Currently (at the end of 2012), the Eurovignette (Denmark, Sweden, the Netherlands, Belgium and Luxembourg) is differentiated by Euro emission class for annual passes, but if the Eurovignette is paid daily (which is possible for foreign trucks) it is not differentiated by EURO class at all.

Table A-1: Charge differentiation according to Euro class for vignettes

			Annual fee (€ per year)			
	Country	Euro class	<=3 axles	>= 4 axles	3.5 – 12 tons	>= 12 tons
Vignettes	Belgium Denmark Luxemburg Netherlands Sweden (VAT not applied)	EURO 0	960	1.550	-	-
		EURO I	850	1.400	-	-
		EURO II	750	1.250	-	-
		EURO III	750	1.250	-	-
		EURO IV	750	1.250	-	-
		EURO V	750	1.250	-	-
		EURO VI	750	1.250	-	-
	Bulgaria (VAT not applied)	EURO 0	-	-	348	665
		EURO I	-	-	348	665
		EURO II	-	-	348	665
		EURO III	-	-	268	511
		EURO IV	-	-	268	511
		EURO V	-	-	268	511
		EURO VI	-	-	268	511
	Lithuania (VAT not applied)	EURO 0	-	-	696	1.000
		EURO I	-	-	696	1.000
		EURO II	-	-	696	1.000
		EURO III	-	-	522	754
		EURO IV	-	-	522	754
		EURO V	-	-	522	754
		EURO VI	-	-	522	754

Table A-2 presents an overview of current tariffs for tolls. Charges are commonly differentiated according to different criteria in different countries. Most now differentiate by Euro class. Some countries differentiate charges on the basis of the number of axles (France, Italy, Czech Republic, Austria, Germany and Slovenia), while others apply the differentiation in charges by vehicle weight (Poland) or by combining both (Slovakia). Furthermore, there are also differences in the way charges have been applied to different Euro emission classes in the different Member States.

Table A-2: Charge differentiation according to Euro class for tolls

Country	Euro class	2 axles and Height > 3 m	>=3 axles and Height > 3 m	2 axles and Height > 3 m	>=3 axles and Height > 3 m
		€ per one way trip		€ per round trip	
France/Italy Frejus tunnel (VAT 21% included)	EURO 0	Not allowed since October 2002			
	EURO I	151.3	304.0	235.5	477.5
	EURO II	151.3	304.0	235.5	477.5
	EURO III	143.0	287.3	222.5	451.3
	EURO IV	143.0	287.3	222.5	451.3
	EURO V	143.0	287.3	222.5	451.3
France/Italy Mont Blanc	EURO 0	Not allowed			
	EURO I	Not allowed			

tunnel (VAT 19.60% included)	EURO II	Not allowed since November 2012					
	EURO III	141.3	284.0	220.0	446.1		
	EURO IV	141.3	284.0	220.0	446.1		
	EURO V	141.3	284.0	220.0	446.1		
		€cent/km					
		2 axles		**3 axles**		**>= 4 axles**	
		Highways	**Roads**	**Highways**	**Roads**	**Highways**	**Roads**
Czech Republic (VAT not applied)	None	13.1	6.2	22.2	10.7	32.2	15.3
	EURO I	13.1	6.2	22.2	10.7	32.2	15.3
	EURO II	13.1	6.2	22.2	10.7	32.2	15.3
	EURO III	10.2	4.8	17.4	8.4	25.2	12.0
	EURO IV	10.2	4.8	17.4	8.4	25.2	12.0
	EURO V and higher	6.5	3.1	11.1	5.4	16.1	7.7
		2 axles		**3 axles**		**>= 4 axles**	
Austria (VAT 20 % excluded)	None	18.7		26.2		39.3	
	EURO I	18.7		26.2		39.3	
	EURO II	18.7		26.2		39.3	
	EURO III	18.7		26.2		39.3	
	EURO IV	16.5		23.1		34.6	
	EURO V	16.5		23.1		34.6	
	EEV	15.0		21.0		31.5	
	EURO VI	14.5		20.3		30.4	
		<= 3 axles			> =4 axles		
Germany[22] (VAT not applied)	None	27.4			28.8		
	EURO I	27.4			28.8		
	EURO II	27.4	19.0*		28.8	20.4*	
	EURO III	19.0	16.9*		20.4	18.3*	
	EURO IV	16.9			18.3		
	EURO V	14.1			15.5		
	EEV	14.1			15.5		
		3.5-12 tons			>= 12 tons		
		Highways	Roads		Highways	Roads	
Poland (VAT not applied)	None	9.6	7.7		12.8	10.1	
	EURO I	9.6	7.7		12.8	10.1	
	EURO II	9.6	7.7		12.8	10.1	
	EURO III	8.4	6.7		11.1	8.9	
	EURO IV	6.7	5.3		8.9	7.0	
	EURO V and higher	4.8	3.9		6.5	5.1	

		3.5-12 tons		>= 12 tons							
				2 axles		3 axles		4 axles		5 axles	
		H'ways	Rds	H'ways	Rds	H'ways	Rds	H'ways	Rds	H'ways	Rds
Slovakia (VAT 19% excluded)	EURO 0	9.3	7.0	19.3	14.6	20.2	15.3	20.9	15.6	20.6	15.3
	EURO I	9.3	7.0	19.3	14.6	20.2	15.3	20.9	15.6	20.6	15.3
	EURO II	9.3	7.0	19.3	14.6	20.2	15.3	20.9	15.6	20.6	15.3
	EURO III	8.6	6.3	18.3	13.6	19.3	14.6	19.9	14.9	19.3	14.6
	EURO IV	8.3	6.3	17.9	13.6	18.9	14.3	19.6	14.6	18.9	14.3

[22] The toll is a public-sector levy and is therefore not subject to Value Added Tax. However, if a transport company inv28.7oices his customers for the cost of the toll, the amount invoiced is subject to Value Added Tax.

	EURO V	8.3	6.3	17.9	13.6	18.9	14.3	19.6	14.6	18.9	14.3
	EEV	8.3	6.3	17.9	13.6	18.9	14.3	19.6	14.6	18.9	14.3
		<=3 axles					> = 4 axles				
Slovenia**		19.8***					28.7***				
	EURO I	19.8***					28.7***				
	EURO II	19.8***					28.7***				
	EURO III	17.3					25.1				
	EURO IV	15.4					22.3				
	EURO V	15.4					22.3				
	EEV	15.4					22.3				

* With PMK filters
** Only for users paying by electronic media
*** Day period toll 6-22

Differentiation of road tariffs by time period

Congestion has typically been a problem mainly in urban areas and on strategic interurban routes. However the continued dominance of road freight is contributing to growing congestion levels in Europe. Applying higher charges during peak hours is permitted as a means to provide incentives for drivers to travel during less congested periods. One of the key changes in the 2006 revision of the Directive was that more flexibility to vary the level of charge differentiation to control congestion was allowed depending on the *type* of day and season.

Austria

In Austria only the A13 Brenner motorway has time-varying charges. Trucks above 3.5 tonnes and with more than four axles are required to pay double the day tariff for travelling at night. In this case the differentiation of tariffs is related to the reduction of traffic based noise pollution.

Table A-3: Toll rates (€cent/km) on the A13 Brennero motorway (35 km)

Euro class	Time Period	2 axles [€cent/km]	3 axles [€cent/km]	+4 and more axles [€cent/km]
EURO 0 – EURO III	Day rate	81.03	113.43	170.17
	Night rate	81.03	113.43	340.34
	Variation%	**-**	**-**	**+100%**
EURO IV – EURO IV	Day rate	71.63	100.29	150.43
	Night rate	71.63	100.29	300.86
	Variation%	**-**	**-**	**+100%**
EURO EEV	Day rate	65.11	91.17	136.74
	Night rate	65.11	91.17	273.49
	Variation%	**-**	**-**	**+100%**
EURO IV	Day rate	62.94	88.11	132.17
	Night rate	0.00	0.00	264.34
	Variation%	**-**	**-**	**+100%**

Source: Authors' elaboration on the basis of toll rates available at http://www.asfinag.at/rates

Czech Republic

Of the Member States operating integrated network-wide toll collection systems, the Czech Republic is the only one that applies time differentiation across the network.

Congestion charges apply to all motorways sections for trucks with a weight of more than 3.5 tons: higher rates are applied on Fridays between 3.00 pm and 9.00 pm. These Friday afternoon toll rates are 27% higher than the regular toll rates that applied during the rest of the week for trucks with two axles and 43% higher for trucks with three or more axles.

Table A-4: Toll rates on the Czech Republic motorways

Euro class	Time period	€cent/km					
		2 axles		3 axles		>= 4 axles	
		Highways	Roads	Highways	Roads	Highways	Roads
EURO 0 – EURO II	Weekdays	13.1	6.2	22.2	10.7	32.2	15.3
	Friday 15.00 – 21.00	16.6	7.8	31.7	15.3	46.0	21.9
	Variation%	**+27%**	**+27%**	**+43%**	**+43%**	**+43%**	**+43%**
EURO III – EURO IV	Weekdays	10.2	4.8	17.4	8.4	25.2	12.0
	Friday 15.00 – 21.00	12.9	6.1	24.8	12.0	35.9	17.1
	Variation%	**+27%**	**+27%**	**+43%**	**+43%**	**+43%**	**+43%**
EURO V and higher	Weekdays	6.5	3.1	11.1	5.4	16.1	7.7
	Friday 15.00 – 21.00	8.3	3.9	15.9	7.7	23.0	11.0
	Variation%	**+27%**	**+27%**	**+43%**	**+43%**	**+43%**	**+43%**

Source: Authors' elaboration on the basis of toll rates available at http://www.premid.cz/index.php?id=2551&L=51

France

SANEF, one of the concessionaires in France, introduced a time differentiation in April 1992 on motorway **A1 Paris-Lille**. On Sunday, Monday and some Tuesday (whether working days), south of the A1 motorway and for the vehicles Paris-bound, Users travelling between 14:30 and 16:30, and between 20:30 and 23:30 are eligible for a discount equal to 25% (. Otherwise, travelling between 16:30 and 20:30, when traffic is more congested, the toll charged is increased by 25%. The reduction is applied from Lille to Paris at toll booth on exits 8, 9, 10 and at the barrier placed in Chamant (Senlis); moreover the discount is restricted to vehicles of categories 1 and 2.

Table A-5: Toll rates on A1 Paris-Lille Motorway (211 km)

Vehicle class	Time period	€cent/km	Vehicle class	Time period	€cent/km
1 	Base period	7.3	4 	Base period	21.5
	Off-Peak period	5.5		Off-Peak period	16.1
	Peak period	9.1		Peak period	20.1
	Variation%	**-25% +25%**		**Variation%**	**-25% +25%**
2 	Base period	10.7	5 	Base period	4.3
	Off-Peak period	8.0		Off-Peak period	3.2
	Peak period	13.3		Peak period	5.4
	Variation%	**-25% +25%**		**Variation%**	**-25% +25%**
3 	Base period	16.1			
	Off-Peak period	12.0			
	Peak period	20.1			
	Variation%	**-25% +25%**			

Notes: off-peak: Sunday, Monday and some Tuesday 14:30-16:30 and 20:30-23:30; peak: Sunday, Monday and some Tuesday 16:30-20:30

On the **A-14 Orgeval – Paris/La Defense** tariffs have been set according to vehicle weight and time of day since 1998. The table below sets out the tolls currently in force on this route.

Table A-6: Toll rates on A 14 Orgeval – Paris/La Defense motorway (15.6 km)

Class	Time period	€cent/km	Class	Time period	€cent/km
1 	Off-Peak period	37.2	4 	Off-Peak period	178.8
	Peak period	51.3		Peak period	242.3
	Variation%	**+38%**		**Variation%**	**+35%**
2 	Off-Peak period	74.4	5 	Off-Peak period	19.2
	Peak period	101.9		Peak period	25.6
	Variation%	**+37%**		**Variation%**	**+33%**
3 	Off-Peak period	132.1			
	Peak period	182.1			
	Variation%	**+38%**			

Notes: Off-peak: 10.00 - 16.00 and 21.00 - 6.00 (except week-end days and holidays); peak: 6.00 - 10-00 and 16.00 - 21.00 (during week-end days and holidays)

For the **Viaduc de Millau,** higher tariffs are imposed in summer time only for class 1 and class 2 vehicles, with a percentage variation of 27% and 28% respectively. The toll rates on the Millau Viaduct are updated every year using a revision formula stipulated in the concession agreement and taking into account the consumer price index for October of the previous year. These new rates are submitted for approval by the Finance Ministry and the French Office of Fair Trading.

Table A-7: Toll rates on the Viaduc de Millau motorway (2.5 km)

Class	Time period	€cent/km	Class	Time period	€cent/km
1 	Off-Peak period	268.0	4 	Off-Peak period	1248.0
	Peak period	344.0		Peak period	1248.0
	Variation%	**+28%**		**Variation%**	**-**
2 	Off-Peak period	404.0	5 	Off-Peak period	172.0
	Peak period	512.0		Peak period	172.0
	Variation%	**27%**		**Variation%**	**-**
3 	Off-Peak period	940.0			
	Peak period	940.0			
	Variation%	**-**			

Notes: off-peak: 1 September - 30 June; peak: 1 July - 31 August

Tariffs applied for the use of the **Tunnel de Duplex** vary according to time bands and working days/holidays. Rates are regulated and approved by the State. Vehicles exceeding a height of two meters, LPG vehicles and motorcycles are not allowed to access the tunnel.

Table A-8: Toll rates on the A-86 Tunnel Duplex Ruel Malmaison- Vélizy Versailles (10 km)

Time period	€cent/km						
	00:00 - 06:00	**06:00 - 07:00**	**07:00 - 10:00**	**10:00 - 15:00**	**15:00 - 16:00**	**16:00 - 22:00**	**22:00 - 00:00**
Off-Peak period	20.0	65.0	65.0	65.0	65.0	65.0	25.0
Peak period	20.0	70.0	90.0	65.0	70.0	90.0	25.0
Variation%	**-**	**+8%**	**+38%**	**-**	**+8%**	**+38%**	**-**

Notes: off-peak: Saturdays, Sundays, holidays, August ; peak: Monday-Friday

Due to the relatively recent completion of the project, extensive data on time and fuel savings are not yet available, but one estimate suggests a 32% decrease in fuel consumption in comparison to the surface-based route (SAFE, 2012)

Vehicles accessing the **Prado Carenage** tunnel are also charged differently according to time bands. The toll rates that apply for the use of this tunnel are set out in the table below.

Table A-9: Toll rates on Prado Carenage tunnel (2.5 km)

Time period	€cent/km
Off-Peak period	96.0
Peak period	108.0
Variation%	**+13%**

Notes: off-peak: 20:00 – 07:00; peak: 07:00 – 20:00

Users of the Prado Carenge tunnel have stated that their average travel times have been reduced by more than twenty minutes per traveller. Based on this figure, a simple calculation indicates that in total, travel time has been reduced by 15,000 hours per day.[23]

Ireland

In Ireland the only motorway section charged according to time period is the Dublin port tunnel. A considerable surcharge is applied between defined time bands according to different directions. Note that **goods vehicles with over 3.5t are exempt from these tolls**.

Direction	Time Period	€	Direction	Time Period	€
Southbound	Off-Peak period[1]	3.00	Northbound	Off-Peak period[1]	3.00
	Peak period[2]	10.00		Peak period[3]	10.00
	Variation%	**233%**		**Variation%**	**233%**

Notes: off-peakAll other times
Peak southbound: 6:00 – 10:00 Monday to Friday; peak northboung: 16:00 – 19:00 Monday to Friday
Source: http://www.nra.ie/GeneralTollingInformation/TollCharges/

Spain

Spain is the country which reports the highest number of motorway sections with toll rates that vary according to time period. **Error! Reference source not found.** summarises the motorway sections ith toll rate variations by time period.

Table A-10: Motorway sections charged per time period, Spain

Motorway sections	Length (km)	Overview of toll rate variations
AP-71 Leon - Astorga	37,68	Night /day tariff
Tuneles de Artxanda	3	Working days/holidays/night[1]
Tunel de Vallvidrera	16,65	Off peak/peak periods[2]
C-16 San Cugat-Terrassa-Manresa	41,8	Working days/holidays
AP-7 Circunvalacìon de Alicante	33,2	Off peak/peak hours
AP-7 Alicante- Cartagena	76,6	Off/peak seasons
AP-7 Cartagena-Vera	114	Off peak/peak hours
AP-7 Malaga- Estepona	82,66	Off/peak seasons
AP-7 Estepona -Guadiaro	20	Off/peak seasons
R-4/AP-36 Madrid-La Roda	n.a.	Off/medium/peak seasons
R-2 Guadalajara Madrid (motorway section out of M-50)	46,43	Night/day tariff
R-2 Guadalajara Madrid (motorway section within M-50)	10,57	Off peak/ peak hours
M12	9,4	Night/day tariff
R-3 Madrid - Arganda	33,9	Off peak/peak hours
R-5 Madrid Navalcarnero	28,3	Off peak/peak hours
AP-41 Madrid Toledo	71,5	Working days/holidays
AP-61 Segovia-San Rafael	27,68	Off peak/normal/peak hours
AP-51 Villacastìn Avila	23,1	Off peak/normal/peak hours
AP-46 Gualdalmedina	24,5	Off/peak seasons

[1] No tolls are applied in the night

[23] Société Marseillaise du Tunnel Prado Carenge. Rapport annuel 2011. http://www.tunnelprado.com/Finances/Documentations/Rapports

[2] Lower charges are applied also on weekends and holidays

Some detailed examples of toll schemes in Spain that have toll rates differentiated by time period are reported below.

In the Artxanda tunnel, the tariffs that apply during holidays are lower compared to the tariffs that apply on working days. No charges are applied for travelling at night

Table A-11: Toll rates on the Tuneles de Artxanda (3 km)

Time period	€cent/km			
	Cars and motorcycles	Industrial vehicles, 2-axle / 4-wheel	Minibuses and 2-axle buses	Buses with more than 2 axles and lorries (exceptionally)
Off-Peak period[1]	20.0	20.0	21.7	23.3
Peak period[2]	33.3	33.3	33.3	33.3
Variation %	**67%**	**67%**	**53%**	**43%**
Night period[3]	0.0	0.0	0.0	0.0

1 Saturday 15.00 – 00.00; Sundays and public holidays 06.00 – 00.00
2 Weekdays 06.00 – 00.00; Saturday 06.00 – 15.00
3 Every day 00.00 - 06.00
Source: Authors' elaboration on data available at http://www.tunelesdeartxanda.com/ingles/tarifas.htm

In the **Tunel de Vallvidrera,** the tariffs applied during peak hours are on average 12% higher compared to tariffs applied for off-peak hours, weekends and holidays.

Table A-12: Toll rates on the Tunel de Vallvidrera (16.5 km)

CLASS[24]	Time period	€cent/km	CLASS	Time period	€cent/km
Category 1	Off-Peak periods	16.94	Category 3	Off-Peak periods	34.17
	Peak periods	19.04		Peak periods	38.38
	Variation%	**+12%**		**Variation%**	**+12%**
Category 2	Off-Peak periods	21.74	Category 4	Off-Peak periods	45.35
	Peak periods	24.44		Peak periods	50.99
	Variation%	**+12%**		**Variation%**	**+12%**

Notes: off-peak: Week days 12:00-7:30; 10:30- 7:00; 21:00– 0:00; peak: Week days 7:30–10:30; 17:00-21:00
Source: Authors' elaboration on data available at http://www.tunelsdevallvidrera.com/upload/files/OR%20Tarifes%20Tabasa%202012.pdf

On the motorway section **C-16 Sant Cugat - Manresa**, the toll rates to be paid on weekends and holidays are about 82% higher with respect to week days tolls.

[24] Category 1: motorcycles with or without sidecar
Category 2: cars and vanes with a maximum of 9 seats, with 2 axles an four wheels, with or without trailer of one axle without tween weel. Trucks, vans and other autogrues vehicles with two axles and four wheels with or without trailer of one axle without tween wheel. With a maximum weight of 3,500 kg.
Category 3: Trucks, buses and other vehicles with two axles and four wheels.
Category 4: cars and vans with a maximum of 9 seats, 2 axles and four wheels with a trailer of one axle and double wheel of two axles. Trucks and vans, autogrues and other vehicles with two axles and four wheels, with trailer of one axle and double wheel or with two axles. Trucks, coaches and autogrues of two axles and four wheels.
Coaches of two axles with trailer. Coaches with three axles and with a maximum weight of 20 t.

Table A-13: Toll rates on the C-16 Sant Cugat - Terrassa- Manresa (41,8 km)

		€			
Direction	**Time period**	**Category 1**	**Category 2**	**Category 3**	**Category 4**
Barrera de Manresa	Off-Peak period	2.06	4.11	6.17	7.0
	Peak period	3.74	7.48	11.22	13.09
	Variation%	**+82%**	**+82%**	**+82%**	**+82%**
Barrera St. Vicenç Montserrat	Off-Peak period	1.03	2.07	3.10	3.62
	Peak period	1.88	3.76	5.63	6.57
	Variation%	**+83%**	**+82%**	**+82%**	**+81%**
Barrera de Les Fonts	Off-Peak period	0.67	1.35	1.96	2.97
	Peak period	1.22	2.45	3.56	5.40
	Variation%	**+82%**	**+81%**	**+82%**	**+82%**

Notes: off-peak: Monday-Friday; peak: Week-ends and holidays
Source: Authors' elaboration on data available at http://www.autema.com/tarifes-i-descomptes/tarifes/

Different tariffs are applied on the **R2 Gadalajara-Madrid** according vehicle category and peak/off-peak hours. The percentage variation in toll rates between peak and off-peak periods differs by vehicle category. In order to access to the motorway section during peak hours, Class 1 vehicles have to pay double the rate of the base tariff, Class 2 vehicles are charged with a tariff that is 35% higher than the base tariff, while Class 3 vehicles are required to pay a toll that is 94% higher than the base tariff for these types for vehicles. It is interesting to note also that the duration of the peak periods varies according to the direction of travel.

Table A-14: Toll rates on the R2 Gadalajara-Madrid (10.5 km section within M2)

Time period	**Category 1[25] [€cent/km]**	**Category 2 [€cent/km]**	**Category 3 [€cent/km]**
Off-Peak period	4,73	8,04	8,04
Peak period	9,46	10,88	15,61
Variation%	**+100%**	**+35%**	**+94%**

Notes: Peak period 6:30 am-10:30 am; 4:30 pm-8.30 pm Monday-Thursday; 7:00 am-11:00 am; 6:00 pm-10:00 pm on Friday (Madrid only) 10:00 am- 2:00 pm; 5:00 pm- 9:00 pm Saturdays, Sundays and holidays
Source: Authors' elaboration on data available at http://www.radial2.com/cms/upload/archivos/tarifas_r2.pdf

United Kingdom

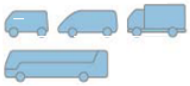
The M6 Toll is a tolled motorway operated by a private concessionaire which runs between Birmingham and Wolverhampton (43 km) and is connected to the standard non-tolled M6. Drivers can choose whether to use the main non-tolled M6 route (which suffers from high levels of congestion) or whether to pay the relevant toll charge and use the M6 Toll road.

Charges differ by vehicle class, by day of the week and by time of day. Furthermore, charges paid at main toll plazas are higher than charges paid at local toll plazas and "Tag"[26] customers receive a 5% discount per trip. The tariffs charged at main toll plazas during day-time for most vehicles are approximately 15% higher on week days compared to at weekends. The highest percentage variation in charges is between the day-time and night-time tariffs on working days, especially for Class 1 and Class 3 vehicles. Lower, but still significant variations in tariffs apply at weekend for day-time compared to night-time journeys.

[25] Category 1 (light):motorcycles with or without trailer. Trucks and vans with two axles and four wheels. Minibuses with two axles and four wheels. Trucks with two axles and with a trailer of one axle. Trucks of three axles. Passenger vans and minibuses (with two axles, four wheels,) with a trailer with one axle and double wheel. Vehicles without or with trailer without double wheel.
Category 2 (weight 1): coaches with two axles, with two axles and with a single axle trailer, coaches with three axles.
Category 3 (weight 2): Trucks, with or without trailer with 4+ axles. Vans and minibuses (4 axles and four wheels), with a 2+ axle trailer, one axle with double wheels. Coach with or without trailer, with 4+ axles .

[26] Tags are the M6toll's electronic pre-payment system

Table A-15: M6 motorway toll rates on main plaza and on the local toll plaza (in brackets)

Class	Day: 06:00-23:00 (£)		Night: 23:00-06:00	% variation		
	Mon-Fri	Sat-Sun		Working days vs weekend	Day vs night on working days	Days vs night on weekends
1 	3.00 (2.00)	2.80 (1.80)	1.80 (1.30)	**7% (11%)**	**67% (54%)**	**56% (38%)**
2 	5.50 (4.00)	4.80 (3.80)	3.80 (2.80)	**15% (5%)**	**45% (43%)**	**26% (36%)**
3 	10.00 (7.00)	8.60 (6.60)	6.60 (4.60)	**16% (6%)**	**52% (52%)**	**30% (43%)**
4 	11.00 (10.00)	9.60 (8.60)	8.60 (7.60)	**15% (16%)**	**28% (32%)**	**12% (13%)**
5 	11.00 (10.00)	9.60 (8.60)	8.60 (7.60)	**15% (16%)**	**28% (32%)**	**12% (13%)**
6 	11.00 (10.00)	9.60 (8.60)	8.60 (7.60)	**15% (16%)**	**28% (32%)**	**12% (13%)**

Notes: Main toll plazas: Weeford Park (between T4 & T3) or Great Wyrley (between T6 & T7); Local toll plazas: Langley Mill (T3), Weeford Junction (T4), Shenstone (T5) or Burntwood (T6)
Source: Authors' elaboration on data available at http://www.m6toll.co.uk/pricing/pricing-guide/

Slovenia

Slovenia also differentiates tolls according to time of the day, applying a lower toll rate during the night with a difference of 11% between the off-peak and peak toll rates.

Table A-16: Toll rate differentiations in Slovenia

CLASS	<= 3 axles [€cent/km]	>= 4 axles [€cent/km]
Off-peak period	17.8	25.8
Peak period	19.8	28.7
Variation%	**+11%**	**+11%**

Notes: peak period 22:00 – 06:00; off-peak periods 06:00 – 22:00

The table below reports the driving restrictions for heavy vehicles applied in EU countries in 2012.

Most of these refer to vehicles with a legal maximum weight of more than 7.5 tons (see France, Germany, Hungary, Italy) and apply to the entire national road network. In some countries, driving restrictions cover just capital city area as in the case of London and Copenhagen.

Restrictions are mostly applied during week-end days and holidays in different time bands

Table A-17: Driving restrictions for heavy vehicles in EU countries, 2012

Country	Driving restrictions for heavy vehicles		
	Vehicles weight/type	Time restriction	Road section
Austria	vehicles with a legal weight of > 3.5 tons + trailers, tractors and machines weighting >7.5 tons(1)	Saturdays between 15:00 and midnight Sundays and weekends between 00:00 and 22:00, at night (22.00-05.00) for vehicles >7.5 tons	entire national road network
Denmark	trucks with legal maximum weight of >3.5 tons	night (19.00-07.00)	Copenhagen
France	trucks with legal maximum weight of >7.5 tons	on weekends (from Saturday 22:00 till Sunday 22:00), during all public holidays, and day prior to a public holiday from 22:00 till 22:00 accordingly	entire national road network
Germany	vehicles with a legal maximum weight of > 7.5 tons and semitrailers(2)	Sundays and public holidays (00.00-22.00)	entire national road network
Hungary	trucks with legal maximum weight of >7.5 tons	1 September – 14 June on Sundays (08:00 -22:00) 15 June – 31 August from Saturdays 08:00 till 22:00 Sundays, holidays (08:00 - 22:00)	national road sections
Italy	vehicles weighting >7.5 tons with or without trailer	Sundays: from January to April/from November to December (08:00 - 20:00) from May to September (07:00 - 00:00)	entire national road network
Luxembourg	vehicles weighting >7.5 tones intended for the transport of goods from Belgium or Germany to France	from Saturday 21:30 to Sunday 21:45, all public holidays and day prior to a public holiday from 21:30 to 21:45 accordingly	public roads
Spain	hazardous goods transport	Sundays and public holidays (08:00 - 00.00) On the day prior to a public holiday (13:00 - 00.00)	national road network(3)
United Kingdom	trucks with a legal maximum weight of > 16.5 tons	Monday to Friday (21:00 – 07:00) Weekends (from Saturday 13:00 till Monday 07:00)	greater London area

Notes:
(1) These restrictions do not apply to road services and Federal Army vehicles, and low-noise motor vehicles (with confirmation from the truck manufacturer and certificate of control every 2 years) with the L-sign next to the front plate attached
(2)The restriction does not apply to vehicles carrying:

- *Intermodal road/rail transports from the shipper to the nearest suitable loading rail station to the consignee, but only up to a distance of 200 km.*
- *Intermodal transports in ports between the loading/unloading stations, but only up to a distance of 150 km.*
- *Transportation of:*
  - *fresh milk and fresh dairy products,*
  - *fresh meal and fresh meat products,*
  - *fresh fish and fresh fish products,*
  - *perishable fruit and vegetables.*
- *Transports of empty vehicles for the carriage of products (see previous item).*
- *Transports of vehicles, which are used for the federal authorities. Such vehicles should be accompanied with the permission documents that are to be shown to the authorities on request*

(3) On connector roads to and from Madrid and Barcelona there are special traffic restrictions on Sundays and holidays
Source: http://www.transsib-logistics.de/en/drivingbans

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