

Road charging for cars

What the European Commission should do

May 2017

Summary

Transport will look very different in the coming decades. If we are to tackle growing emissions from the sector, then changes are badly needed. Transport is now the largest contributor of CO₂ emissions in the EU. The upcoming trends of vehicle autonomy and electrification of transport will transform demand patterns and impose additional burdens on infrastructure. Air pollution, noise and other externalities associated with car use are a persistent issue and result in significant health costs and damage every year. Distance-based charges can help address a variety of such issues in one single instrument. This briefing is a summary of T&E's [position paper](#).

The European Commission is set to favour distance-based charging for all road vehicles in the upcoming review of Directive 1992/62/EC (known as the “Eurovignette” Directive), expected on 31 May as part of the new Road Package. Whereas the Directive focused solely on trucks and buses in the past, the upcoming review will extend the scope to both passenger cars and vans.

In order for this Directive to have a real-world impact on reducing emissions, the Commission should:

1. **Promote distance-based road charging that differentiates tolls according to the emissions from vehicles.** Any toll should be differentiated by both the air pollutant and CO₂ emissions from the vehicle being charged. This should be done in a fair and non-discriminatory manner with clear incentives in place for zero-emission vehicles.
2. **Mandate the fitting of the in-car technology to enable tolling in all newly manufactured vehicles.** The fitting of “one box” technology for cars should become mandatory on carmakers. Certifying and fitting this technology as standard would lead to significant cost reductions for road users. “One box” technology would include basic GNSS and communication components necessary for different ITS applications (tolling being one of them). The EU should also ensure that funds are made available from the EU budget for member states to invest in the roadside technologies required to operate tolls.
3. **Allow countries to design their tolls in order to protect ‘exposed’ communities.** The EU should focus their efforts on ensuring the technical harmonisation and cost-effectiveness of tolling systems across borders, as well as a unified method of determining tolls. Member states should be free to amend their tolls in order to account for people in low-income communities or rural areas where no alternative means of transport are available.

Road charging is not a silver bullet to decarbonise transport but it can play an important role in any country's attempt to reduce emissions from the sector. The concept is only useful if it's implemented in a way that promotes clean and sustainable transport behaviour.

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1. Road charging for cars in Europe

1.1. Current situation

Road charging involves vehicle users paying for their use of road infrastructure. The set-up of the scheme can take very different forms as the area covered by the scheme can vary from urban centres or motorways to the entire road network. Pricing can be flat, time-based or distance-based. Furthermore, tolls can be differentiated by the vehicle's characteristics, location and time of day to account for CO₂ emissions, air pollution, noise, and congestion.

In Europe, many of the road charging schemes for cars are time-based (known as “vignettes”). This is the case in eight member statesⁱ that charge for the use of roads for a fixed period of time (common periods of time are 10 days, monthly or annually). Ten member states charge road users based on the distance driven. These types of schemes are usually applied to motorways only, to raise funds for road construction and maintenance (road tolls).

The situation is very different for trucks and buses (so-called “heavy duty vehicles”/“HDVs”)ⁱⁱ. Only four member states have no any road charging scheme in place to charge such vehicles, and those which have time-based systems are shifting gradually to electronic distance-based road charging. Currently, eight member states have electronic network-wide distance-based schemes. The Eurovignette Directive defines how such tolls can be structured. Currently, the toll can be based on infrastructure damage, which is differentiated by vehicle weight, EURO class, and time of day. Additionally, trucks can be charged based on certain external costs; namely air pollution and noise. The maximum amounts are defined in the annex of the Directive.

There is no similar framework for cars (or vans). Currently, the Commission only monitors such schemes and ensures that the Treaty principles of non-discrimination and proportionality are respected. However, the Transport Commissioner Violeta Bulc has voiced support for a standardised Europe-wide road-charging scheme for all road vehicles: HDVs, vans, and cars that is based on distance travelled. The upcoming review of the Eurovignette Directive provides a perfect opportunity to introduce this into law.

1.2 Why should Europe move towards distance-based road charging?

Distance-based charges can play a role in addressing a variety of issues in one single instrument: charging vehicles for every kilometre driven can help tackle CO₂ emissions, pollution and congestion while raising revenue for a country's public budget. Therefore, it's becoming increasingly important to develop an EU-wide framework for distance-based road charging for all cars.

While not a replacement for effective fuel taxes at national level, road charging can complement fuel taxation and raise revenue while contributing to additional CO₂ emissions reductions. The latter can be achieved by making drivers aware of the true costs of a car trip. Car users tend to overlook incremental or invisible costs (such as maintenance costs) and don't usually take into account other burdens that car use imposes on society, such as CO₂ emissions, air pollution, and congestion. They also create routines around car use which makes it very difficult to change. The use of the car becomes commonplace, leading people to choose driving over other transport modes without considering the full cost, and cars end up being used more than necessary. Road pricing based on distance travelled can link driving decisions to the real costs of driving. This can lower excess driving demand and shift mobility to other modes or means of transport, reducing overall CO₂ and air pollutant emissions.

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1.3. Road charging is fair if correctly implemented

Distance-based charges are considered to be a fairer form of road pricing to the extent that they make road users pay for the costs they impose on the infrastructure (user-pays principle), as well as pay for the externalities they create (polluter-pays principle).

There are some concerns about the distributional effects of distance-based charges. Evidenceⁱⁱⁱ is mixed but it seems road charging is not necessarily regressive. In Stockholm the congestion charging scheme was found to be progressive^{iv}. For nationwide road charging schemes, there is no scheme in place but the Netherlands and Finland have considered the possibility^v. The Finnish study concluded that the new kilometre fee would reduce the tax burden on all income groups compared to the current tax regime. They also note, however, that the abolishment of fixed taxes will make heavier cars cheaper, which will be more beneficial for the wealthier groups. Regarding the Dutch study, Cost-Benefit Analyses have been performed and are overall positive^{vi}.

Whether road pricing is regressive or progressive depends on the circumstances but the use of revenues can ultimately ensure that the scheme is socially fair. Road pricing in itself is progressive since wealthy people tend to drive more in general and therefore would pay more for the use of roads. However, it can also have regressive effects if it prevents the lower-income groups from making as many trips as before or makes them pay more as they tend to live farther away from urban centres and need longer commutes to go to work. Even if this is the case, disadvantaged groups can be compensated through revenue redistribution or discounts and exemptions. The additional revenue raised allows governments to reduce other taxes (such as labour taxes) and economic distortions. Revenue can also be invested in developing public transport, a close substitute of car use. The upcoming proposal for a Directive shall allow member states to implement their tolls in a way that would ensure their social fairness.

The reduction of air pollution also makes road charging more progressive. Air pollution tends to affect the poor more as they live closer to major motorways and roads (where housing is cheaper) and thereby are more exposed to dangerous exposure. By reducing externalities, road pricing is more beneficial to these people. In London, the congestion charging scheme marginally reduced inequalities in air pollution exposure^{vii}.

2. Why is an EU framework necessary?

Following the German case of a national road toll being incompatible with EU law and discriminatory to non-German drivers, it is clear that - in light of vehicle pollution, climate targets, and declining fuel tax revenue - more member states in the future may decide to introduce national road tolls for light-duty vehicles without consideration of EU-wide ramifications. To pre-empt a proliferation of divergent schemes that might distort the single market and be costly, it is imperative that the Commission introduces an (optional) EU-wide framework of key principles to be adhered to in any future road tolling schemes.

Setting up a nationwide scheme requires the implementation of a technology that monitors traffic flows, registers distance driven, applies the charges and controls payments. Failure to reach common standards for communication between cars and back office, and interoperability between technologies at the EU level will create barriers to the operation of the internal market and significantly increase costs of roll-out and operation. If each member state implements its own independent scheme, the mobility of people between EU countries will be considerably hindered.

It will also increase costs for governments, businesses and citizens. Road users would have to own a road charging device for each country they drive through and hold several contracts for every scheme implemented, increasing significantly the burden for users. It will also raise significant challenges for enforcement vis-a-vis foreign cars and increase the risk

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of discriminatory charges. Manufacturers of the technology would also not benefit from wide scale deployment, missing an opportunity for economies of scale and lower production costs.

T&E commissioned a study by TNO^{viii} to assess different technology options for road charging of cars. Several technologies can be used for Electronic Toll Collection (ETC). The system needs to be able to measure road use: it should register distance travelled and, in more advanced systems, identify road type, location and time.

2.1. The best way forward: GNSS-based road charging

TNO conducted an extensive evaluation of the main technologies used for road pricing and concluded that the most appropriate for a nationwide distance-based scheme is an in-car technology based on GNSS (Global Navigation Satellite System). A 2004 study commissioned by the European Parliament^{ix} also supports this conclusion, indicating that the implementation of a scheme on the entire road network for all vehicles requires a more flexible technology such as GNSS-based tolling.

The majority of the member states which have a distance-based scheme in place have opted for the GNSS technology^x. Technically, it would be possible and relatively easy to enlarge these schemes to include cars, by installing OBUs on cars and expanding the operations of the back office. GNSS technology is also compatible with DSRC-based systems, which has the advantage of not making existing DSRC systems obsolete. The opposite does not hold true, which makes GNSS a very interoperable technology.

GNSS-based road charging is also more appropriate for a scheme that covers all roads. Unlike DSRC-based systems, it does not require large investments in roadside equipment and is more flexible, being easily expanded to other roads (only needs software update). The GINA project, sponsored by the European Commission and the GNSS Agency (GSA), concluded that the more complex the road charging scheme is, the less cost-effective are DSRC and ANPR (Automatic Number Plate Recognition) but the costs of GNSS do not rise as rapidly^{xi}. After implementation, GNSS-based road charging generates lower operating costs, which is essential when considering nationwide implementation that includes roads with low traffic volume and thereby low revenue potential.

The fitment of “one box” in-vehicle unit during the car manufacturing process which aggregates all applications based on the same components (GNSS, communication channel, DSRC) can further reduce costs and create a multi-service platform for ITS applications. This should be an open platform to allow different developers to offer services, but at the same time it should ensure car safety and security. The European Parliament’s 2014 study claims that such a box could deliver significant cost reductions, requiring an investment of €100 with operational costs of less than €10/month.

The Commission should not only set interoperability standards but it should also consider mandating the essential capabilities to enable GNSS-based road charging for all new cars. By fitting certified technology as standard the EU could greatly reduce the roll-out and operation costs of road charging schemes at national level. The additional cost for manufacturers would likely be limited since much of the necessary ITS technology is already fitted to most new cars. The main challenge would then be to certify and calibrate this technology to enable its use for tolling.

3. Conclusions and policy recommendations

Transport will greatly transform in the coming decades. Coupled with other measures at EU and national level, distance-based charging is an effective means to positively influence how people move around. Kilometre-based road charging can reduce air pollution, greenhouse gas emissions, congestion, and noise. Furthermore, the reduction of revenues from

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already insufficient fuel taxes that comes as a result of decarbonisation means that countries will need to rethink how they tax transport. Distance-based tolling is an effective means of securing revenue for a country's public budget and is far more efficient than time-based systems.

In its upcoming proposals, the Commission should:

1. **Promote distance-based road charging that differentiates tolls according to vehicle emissions.** Any toll should be differentiated by both the air pollutant and CO2 emissions from the vehicle being charged. This should be done in a fair and non-discriminatory manner with clear incentives in place for zero-emission vehicles.
2. **Mandate the fitting of the in-car technology to enable tolling in all newly manufactured vehicles.** The fitment of "one box" technology for cars should become mandatory on car makers. Certifying and fitting this technology as standard would lead to significant cost reductions for road users. "One box" technology would include basic GNSS and communication components necessary for different ITS applications (tolling being one of them). The EU should also ensure that funds are made available from the EU budget for Member States to invest in the roadside technologies required to operate tolls.
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Further information

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Endnotes

ⁱ See http://ec.europa.eu/transport/modes/road/road_charging/doc/pv_charging.jpg

ⁱⁱ See http://ec.europa.eu/transport/modes/road/road_charging/doc/hgv_charging.jpg

ⁱⁱⁱ Levinson, D., 2010. Equity Effects of Road Pricing: A Review. *Transport Reviews*, 30: 1, 33 — 57.

^{iv} Eliasson, J., 2014. The Stockholm congestion charges: an overview. Working papers in Transport Economics 2014:7, CTS - Centre for Transport Studies Stockholm (KTH and VTI).

^v Plans and studies conducted in the Netherlands (NL), Finland (FI) and Belgium (BE)

NL: Geurs, K., Haaijer, R. and Meurs, H., 2010. The Dutch national kilometre charge: impacts on the Dutch car market and environment; FI: Ministry of Transport and Communications, 2014. Fair and Intelligent Transport. Working Group Final Report; BE: Mayeres, I., 2015. Road charging in Belgium: opportunities and latest state of play. VITO

^{vi} Geurs, K., Haaijer, R. and Meurs, H., 2010. The Dutch national kilometre charge: impacts on the Dutch car market and environment.

^{vii} Pike, E., 2010. Congestion Charging: Challenges and Opportunities. ICCT.

^{viii} TNO, 2015. Technology options for road pricing (Available from T&E).

^{ix} European Parliament, 2014. Technology Options for the European Electronic Toll Service. [http://www.europarl.europa.eu/RegData/etudes/STUD/2014/529058/IPOL_STUD\(2014\)529058_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2014/529058/IPOL_STUD(2014)529058_EN.pdf)

^x Germany, Slovakia, Hungary and Belgium.

^{xi} Geurs, K., Haaijer, R. and Meurs, H., 2010. The Dutch national kilometre charge: impacts on the Dutch car market and environment.