

# **Charges for Heavy goods vehicles: EU policy and key national developments**

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## **1. Introduction**

Following on from the Green Paper of 1995 (CEC, 1995), the European Commission has sought to achieve a closer relationship between transport prices and the marginal social cost of transport. Because of its importance in European economics, heavy goods vehicle charges have formed a central part of this policy. It is widely recognised that existing charges do not adequately reflect these costs. The Eurovignette currently in force in some European countries is a time-based user charge. A distance-based user charge is generally seen as a better solution to the problem of reflecting the costs, and a number of countries are now seeking to introduce such a system.

This paper first looks at developments in interurban road transport pricing policy in Europe, it then looks into the draft Eurovignette directive which came out in the spring of 2003 (CEC, 2003) and considers the proposal for amending the current directive in various ways. Proposals for revised HGV charges are considered in three European countries; Switzerland where the charge is already in force, Germany where the charge is expected to come into force at the end of 2003 and Britain which hopes to implement the charge by 2006. The charging systems are compared and finally conclusions are drawn as to the extent to which these proposals are consistent with a policy of marginal social cost pricing.

## **2. Developments in European interurban road transport pricing policy**

In interurban road transport, in contrast to urban transport, the treatment of freight transport assumes a particularly great importance. The marginal social costs of freight transport by HGVs depend on several factors: congestion, which varies with traffic volume; road damage, which is sensitive to axle load and road quality; and accident and environmental costs, which vary widely with geographical location.

Existing pricing schemes do not take into account these dependencies. Fuel taxes do not increase with vehicle (and particularly axle) weight. Fixed annual charges fail to charge for distance travelled at the margin. And the current insurance system does not internalise the external accident cost in a proper way.

Currently there are three Europes: Eurovignette countries, countries with tolls on specific roads, and countries with no direct road charging at all.

The Eurovignette system has been adopted in some member countries: Germany and the Benelux countries. The Eurovignette directive (EU, 1996) aimed to limit competition problems within the road freight sector caused by the existence of very different methods and levels of charging for infrastructure use in different countries. For example, vehicles licensed in a country with a low annual licence duty plus supplementary tolls may have an unfair competitive advantage when competing with a vehicle licensed in a country with a high licence duty and no supplementary tolls. Freight vehicles are required to buy a time-related supplementary licence, or 'vignette' in order to use certain defined parts of the European motorway system. The directive was intended to set a limit for the maximum infrastructure access charges payable as a general supplementary licence for heavy goods vehicles, on the basis of average infrastructure costs, with non-discrimination between goods vehicle operators of different nationalities.

However, under current European legislation, the Eurovignette is limited to motorways and is only related to the cost of providing those roads, thus excluding external cost. It is based on time, rather than on the distance travelled.

Regarding the current situation of transport pricing in Europe, the most recent European White Paper (CEC, 2001) on transport policy states (pp. 72-73):

*"[Currently] while transport may be heavily taxed, it is above all badly and unequally taxed. Users are all treated alike, irrespective of the infrastructure damage, bottleneck and pollution the cause. This failure to spread the burden fairly between infrastructure operators, taxpayers and users causes considerable distortion of competition both between transport operators and between modes of transport. For the modes to enjoy a level playing field, taxation should work according to the same principle regardless of mode and ensure a fairer distribution of the burden of transport costs."* The White Paper also emphasises that it is not the overall level of taxes and charges that needs to change significantly, but rather their structure needs to be altered radically.

With the aim to integrate external costs into the price of road transport, the principle of marginal-cost based pricing has come to the forefront in recent years. This principle has been advanced in the EU Commission's White Paper "Fair payment for infrastructure use" (CEC, 1998) and its predecessor Green Paper "Towards fair and efficient pricing in transport" (CEC, 1995) and other related documents. White Paper (2001) adopted a broader, and perhaps more reserved approach to marginal cost pricing.

White paper (2001, p. 75): *"The thrust of Community action should be gradually to replace existing transport system taxes with more effective instruments for integrating infrastructure costs and external costs [in the price of transport]. These instruments are, firstly, charging for infrastructure use, which is a particularly effective means of managing congestion and reducing other environmental impacts, and, secondly, fuel tax, which leads itself well to controlling carbon dioxide emissions. The introduction of these two instruments, which will allow greater differentiation and modulation of taxes and right of use, needs to be coordinated, with the first being backed up by the second."*

However, despite the Commission's (and researchers') efforts, there remains substantial opposition to the marginal cost pricing principle in different members countries. Individual member countries rarely make explicit reference to marginal social cost in the determination of pricing structures and levels; on the contrary, in some countries there are made explicit policy statements arguing against it.

The need for European-wide harmonisation (and standardisation), to promote European integration (cohesion) and competitiveness, has been stressed a primary policy goal. The White Paper (2001) (pp. 72, 76) states: *"The paradox is that transport has too many taxes... Most modes of transport already have infrastructure charging systems... These systems were conceived individually for each mode of transport and for each country, which sometimes leads to anomalous situations that can hamper international transport and even discriminate between operators and modes of transport."*

The White Paper continues (pp. 77-78): *"The Current Community rules... need to be replaced by a modern infrastructure-pricing scheme which encourages advances of ... [distance-based charging] while ensuring fair competition between the different modes of transport and more effective [efficient] pricing. This kind of reform requires equal treatment for operators and between modes of transport. ...the price for using infrastructure should vary in the same manner according to category of infrastructure used, time of day, distance, size and weight of vehicle, and any other factor that affects congestion and damages the infrastructure or the environment. This kind of change will require a root and branch review of accounts in the transport sector, including a close look at all taxes, rates and State aid in each mode of transport as well as external costs."*

Two other major problems to be accounted for in interurban road freight transport are (according to the White Paper 2001): absence of inter-operability of different existing (or under design) charging systems, and absence of harmonisation of fuel taxes. In particular, in relation to the latter the White Paper states (p. 79) that this *"seems increasingly to be an obstacle to the smooth functioning of the internal market."* The White Paper's "Action programme" (presented in Annex) proposes concrete actions in relation to both issues (p. 110): *"In 2002 propose a directive guaranteeing the interoperability of means of payment on the trans-European road network." "Make the tax system more consistent by proposing uniform taxation for commercial road transport fuel by 2003 to round off the internal market."* Harmonisation of fuel tax on commercial vehicles would make it more urgent to find alternative ways of reflecting the variability of costs with location and time.

### **3. The draft Eurovignette Directive**

In 2003, a proposal to amend Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructure was put forward. This will change the earlier Directive in the ways described below.

On average, user charges will be tied to the costs of construction, operation, maintenance and development of the network plus the uncovered costs of accidents. Some of the latter costs are covered by insurance premiums, but road tolls must include the costs that are not covered by insurance. The overall average charge must be equal to infrastructure and uncovered accident cost (i.e. external cost of accidents minus insurance premiums), where infrastructure costs must be allocated to vehicle types on the basis of stipulated equivalence factors and may include the annualised cost of investment going back 15 years only.

A more differentiated charging system will be provided for. Tolls can vary according to a number of factors such as;

- the distance traveled,
- the location, as the probability of accidents differs between different areas (urban and rural), population density and weather conditions,
- infrastructure type and speed as expenditure on maintenance varies from that on a motorway to a trunk road and infrastructure type determines speed which also affects the accident rate,
- the vehicle type which includes characteristics such as axle weight and suspension type which influence infrastructure repairs and maintenance. Engine type, energy source and emission standards influence air pollution levels and vehicle size as larger vehicles make a bigger contribution to congestion,
- the time of day also affects congestion levels as it varies from peak and off-peak times
- tolls may also be differentiated according to specific routes. This will be required from 2008. (CEC, 2003)

The toll will be applied to HGVs weighing over 3.5 tonnes, replacing the previous 12 or more tonnes. Even though the vehicles with lower weight and capacity carry fewer goods, they still contribute to infrastructure damage, congestion and accidents; therefore it is felt their presence on the roads needs to be accounted for.

The earlier Directive will change by being applied to the TEN network and to other roads to which traffic might divert, but permitting application of pricing to other roads as well (the previous directive only covered motorways).

Changes to the use of revenue from fees include ensuring strict enforcement that revenue from the tolls is used for expenditure on roads, other transport networks, transport substitutes or the transport sector as a whole, but not general state expenditure such as spending on health or education. Each state must create an independent transport infrastructure supervisory authority to guarantee that charges are being set and revenue is being used in the required way. In exceptional circumstances a surcharge of up to 25% will be permitted, to fund alternative rail infrastructure.

The proposed new directive may not be fully consistent with the policy of short run marginal cost pricing adopted by the European Commission in the White Paper on Fair Charges for transport infrastructure. The reason is the decision to tie average user charges to the cost of “constructing, operating, maintaining and developing the network”, as well as accidents, limits the extent to which the overall level of tolls can reflect environmental costs and marginal costs of congestion. Moreover, earmarking revenue for spending in the transport sector may prevent it from being used in the most efficient way. There are also constraints on the degree of which tolls may vary by time of day (the highest charge may not be more than 100% above the lowest.)

The importance of this discrepancy depends on two issues; firstly, whether there is any good reason to introduce such constraints on the level and variability of charges and on the use of revenues, and secondly whether the constraints will in fact lead to serious distortion.

On the first point, it is widely recognised (e.g. Verhoef, 2001) that there are many reasons why “pure” short run marginal social cost pricing may not be the optimal policy in the real

world. These reasons include second best responses to immovable distortions elsewhere in the economy, budgetary issues, institutional problems and implementation costs and risks. A rather different barrier to short run marginal cost pricing, but one, which may force compromises to be reached, is political, industry and public acceptability.

Given that the constraints imposed on the level of charging will in some cases (e.g. on severely congested roads such as many in Great Britain) lead to charges that are below marginal social cost, and in other cases where congestion is limited lead to charges above marginal social cost, it is very hard to think of any general second best conditions that could make these constraints sensible. Nor is there any reason to suppose that budgetary problems will cause it to be necessary to exactly recover infrastructure costs from user charges in all countries. Indeed, given the arbitrary conclusion that only capital charges on new infrastructure or that built in the last 15 years may be included, and as it appears that the share attributable to HGVs is to be based on vehicle km rather than on the degree to which they are responsible for the construction of new roads, it seems likely that only a low level of infrastructure capital costs will typically be applicable and that charges under these proposals are more likely to be too low than too high.

The conclusion must be, therefore, that the constraints reflect compromises in order to make the proposals generally acceptable throughout the Union, and/or institutional issues. It is certainly a common finding that user charges are made more acceptable if it is clear that they reflect actual money costs incurred by the authority levying the charges and if the revenue is earmarked to be spent in ways that benefit those paying the charge. Indeed this argument is explicitly cited in the explanatory memorandum. The exclusion of environmental costs from the total costs to be covered appears to be justified on the grounds that these are more uncertain than infrastructure and external accident costs, despite the enormous amount of work the Commission has funded on their measurement and valuation in recent years.

It follows therefore that the constraints on the level and variability of charges and use of revenues of the proposal must be judged in terms of the degree of inefficiency to which it will lead, and in particular the degree to which this will be reduced relative to that caused by the existing Directive.

On the latter point, the proposed Directive represents a clear advance on the existing Directive in a number of respects. It makes it clear that kilometre based charges are a permitted form of user charge, and that they need not be confined to motorways; they may be levied on other competing roads, and indeed all roads in a particular country. It permits user charges on lighter good vehicles (those above 3.5 tonnes gvw rather than solely above 12 tonnes gvw) and increases the degree of differentiation allowed (for instance, allowing differentiation according to the degree of congestion as well as emission factors) and indeed making this compulsory from 2008. (It is doubtful however whether 4 categories of vehicle present enough variety to reflect efficiently the variability of wear and tear with axle loads.) In terms of many of the decisions open to freight vehicle operators (type of vehicle, route, time of day), it is toll differentiation rather than the average level of toll that is the crucial factor. It also permits a surcharge in environmentally sensitive areas, which may be used for rail infrastructure enhancement rather than road.

However, it does appear that the limits on permitted levels of charges may lead to significant degrees of distortion, for instance in Great Britain, charges for articulated goods vehicles related to marginal social cost would exceed charges based on the cost of infrastructure

provision by nearly 150% (Sansom et al, 2001). Judging by the British evidence, the limit on congestion charges that peak charges should not be more than 100% above those for the cheapest times of day looks less of a problem. There is also a question as to whether introducing congestion charges for HGVs without doing so for private cars may be damaging. Latest research suggests that this is not the case. (Nash, Niskanen and Verhoef, 2003). Clearly only charging HGVs congestion costs is enormously less efficient than charging all traffic. But it appears that second best charges for HGVs are actually above those that would be optimal were all traffic charged.

The constraints the Commission suggests on the levels of charge may be a reaction not just to acceptability problems, but also to particular institutional issues. There is good evidence that when the setting of charges is decentralised between governments covering different geographical areas of a single market, individual governments may have incentives to deviate from marginal social cost pricing in order to influence the distribution of revenues and costs. For instance, even if they are precluded from discriminating against foreign hauliers, countries with a high level of transit traffic may have an incentive to impose charges that are inefficiently high (Nash, Niskanen and Verhoef, 2003). This will ensure that transit traffic which uses the country concerned pays more than the marginal social costs. The result of this is not solely inefficient routing of international traffic, but distortions to production and distribution decisions throughout the economy. Thus there may be justification for imposing constraints on the levels of charges at the European level. Ideally these constraints would take the form of checking that charges are correctly based on marginal social cost. This is why the promised framework directive was so important, since it was expected to set out the principles to be applied to charging on all modes of transport, including methods of calculation. In its absence, the constraints in this proposed Directive may be designed to prevent such overcharging, but – as indicated above – they are a very poor substitute in terms of efficiency.

In summary then, this proposed Directive does significantly improve on the existing situation. If it is really the best compromise that could be reached then it can at least be welcomed on those grounds. But it falls a long way short of the aspirations of the 1998 White Paper, and appears certain to perpetuate severe inefficiencies, including requiring charges to be held inefficiently low in much of Europe.

#### **4. Swiss experience**

The Swiss Heavy Vehicle Fee (HVF) came into operation on January 1 2001, after a national referendum in Switzerland had voted for the introduction of a distance based, electronically collected road toll for heavy goods vehicles. The charge was levied on the entire Swiss public road network, applying to both Swiss and foreign vehicles alike. Vehicles weighing over 3.5 tonnes were charged. The Federal Council Minister Moritz Leuenberger (ARE, 2002) believed that the HVF was a key element on the route to sustainable transport policy. The high costs of heavy goods vehicles on the road such as pollution and damage were aimed to be covered by the HVF by the polluters. An aim was to move much of the road freight traffic to the railways. A lot of the income generated by the HVF was proposed to be used to modernise the rail network. It was seen as only fair for HGVs to contribute to the funding as they would benefit from the better transport infrastructures.

Balmer (2003) describes how the charge was implemented. He explained that it took 20 years from the first approaches to introduce the HVF. Distance based HVF were suggested in 1980

but at that time, it was seen as too early for such a solution due to technical reasons. Therefore the first approach was to introduce a flat fee for heavy vehicles in 1984. The initiative for a distance based HVF was refused in 1986, but finally accepted in the 1990's, thus the HVF came into force in 2001.

The charge level of the fee was calculated in three steps. The first step was to calculate the uncovered costs of heavy traffic. This included uncovered road infrastructure costs (most road costs were covered by users through fuel excise duties, but a gap remained of uncovered costs of about 10 million Euros), and external costs caused by heavy vehicles. Damages caused by congestion or the greenhouse effect were not considered. The external costs were found from studies and were divided into three areas that could be given monetary values; air pollution, noise and accidents.

Air pollution includes the external health costs, which amounted to costs of 260 million Euros according to the study, and the costs of damages to buildings, which led to costs of 220 million Euros. The costs of noise were calculated, using the house price depreciation approach. Noise costs due to heavy vehicles came to 160 million Euros. Most accident costs were covered by insurances but a gap of 10 million Euros remained. The external costs totalled to 650 million Euros. To this total, the uncovered road costs (10 million Euros) and the amount to replace the flat fee, which was dropped due to the introduction of the performance related fee (90 million Euros) were added, therefore the total of the uncovered costs caused by HGVs amounted to 750 million Euros.

The second step calculated total transport performance (measured in tonne-kilometres tkm). The corresponding performance for each weight category was calculated and these figures were then multiplied by the average admissible weight in each category. For all classes combined, this gave the figure of 47 billion tonne-kilometres.

The rate was fixed in the third step. The uncovered costs of 750 million Euros (step one) were divided by the total transport performance of 47 billion tonne-kilometres (step two) to give the value of 1.6 cents per tkm. The fee was agreed to be introduced in several steps and in parallel to the increase of the weight limit. The introduction of the HVF in 2001 was at a rate of 1.6 cents/tonne-kilometres and in 2005, at a rate of 2.5 cents/tonne-kilometres.

Balmer explains that the implementation of the fee had two dimensions, political and technical. The Department of Finance was in charge of the technical side and the Department of the Environment, Transport, Energy and Communication were in charge of the political side.

In regard to the technical side, the fee varies according to three factors: distance (kilometres traveled on Swiss territory), weight (admissible weight of vehicle and trailer) and the emissions of the vehicle. Therefore the HVF is calculated by:

$$\text{Rate} \times \text{Distance travelled in Switzerland} \times \text{Weight of vehicle and trailer} \times \text{Emissions}$$

Two systems were developed, one for domestic and one for foreign vehicles, in order to gather the relevant data. Each domestic vehicle has to be fitted with an on board unit (OBU) which is connected with a tachograph, that enables the OBU to register the kilometres driven. The OBU is available free of charge to both domestic and foreign vehicles until the end of 2004, but the installation costs have to be paid by the vehicle owner. The OBU also stores

information such as the admissible weight and the emission category. Each month, the data stored in the OBU has to be transmitted to the Swiss Customs Authority (SCA), which is within the Department of Finance, responsible for the administration and collection of the HVF. The data is checked and forms the basis for the calculation of the fee and the billing. The installation of an OBU is not mandatory for foreign vehicles, but is available on request. For an unequipped vehicle, the fee is registered by using an identification card at the special terminals for HVF clearance. This identification card is provided upon entering Switzerland for the first time and contains the relevant data such as admission weight and emission class. In order to obtain the distance needed for calculating the fee, the driver has to enter on a form the actual mileage on the tachograph when entering and leaving the country. When leaving the country, the fee is paid either by cash, fuel credit cards or through an account with the Customs Authority. Certain types of vehicles such as coaches, mobile homes and caravans are subject to flat fees and therefore do not require OBUs. Also certain types of vehicles such as military, agricultural and public transport vehicles are exempt from the HVF.

Balmer states that three reasons that have been decisive for the political implementation of the HVF are: Firstly, the political deal of introducing the HVF to outbalance the negative effects of the higher weight limit led the project to be on safe political ground. Secondly, the way the revenue of a pricing project is used is important, as learned from the EU project PRIMA (Pricing Measures Acceptance). The project showed that acceptance was good when the revenue was reinvested in transport infrastructure in road and public transport. A large majority of people agreed that up to 2/3 of the revenue from the HVF should be used for projects in public transport. This decision fits well with the strategy of shifting goods from road to rail and helps finance the new railway lines. The remaining 1/3 goes to the cantons where it is used mainly for road purposes. And finally, one of the strongest arguments in favour of the HVF was its link to the polluter pays principle.

When looking at the impacts of the HVF, Balmer believes that it was necessary to consider the following facts; the HVF was applied to the whole road network in Switzerland, HVF led to a change in the average level of the fee as it is five times higher now than it used to be until 1999, and the fee was not introduced in isolation but simultaneously with a change in weight limit. The increasing weight limit raises the productivity of road transport which leads to less heavy vehicle traffic on the roads, but it also more or less balances out the higher competitiveness conferred on railways by the HVF. In terms of competition between road and rail, the average gain in productivity for road transport of 18% due to the higher weight limit more or less balanced out the cost increasing effect of 19% of the HVF.

According to Balmer, introduction of the HVF led to remarkable changes within road transport. There was a change in fleet composition because in the year before the introduction of the HVF, sales of heavy goods vehicles increased by 45%. Truck owners saved money as new vehicles belong to the lowest and therefore cheapest emission class and the admissible weight of the trucks in the fleet could be better matched to the actual needs of the market. The HVF system led to a concentration in the hauler industry, either through mergers or close of smaller firms. Larger firms were able to manage their vehicles more efficiently and avoid empty runs as empty vehicles cost as much as fully loaded vehicles. In terms of road performance, nationally there was a change to the growth trend as annual increases of vehicles on motorways were replaced by a fall after the change from a flat fee to a performance related fee. In transit traffic across the Alps, the higher weight limit led to an increase in articulated lorries, which was almost outbalanced by a decrease in lighter lorries. This meant that the total number of lorries crossing the Swiss Alps in 2001 was stable and is

currently about equal to the level before the HVF. Balmer found that no significant impact could be measured so far on the performance of rail transport. This may have been due to fact that the competitiveness of rail due to the HVF was outbalanced by increased productivity in road transport because of the higher weight limit. Railways had to improve their productivity as well to gain a higher market share.

Gross annual revenue generated by the HVF in 2002 was 600 million Euros and the average implementation costs were roughly 8% of gross annual revenue at 45 million Euros. The net revenue of the HVF was 525 million Euros which was distributed in the following amounts; 5 million Euros for reimbursement to cantons for their operational costs, 10 million Euros for reimbursement for additional enforcement, 175 million Euros for share cantons, and 335 million Euros for the share federation which is used mainly for rail projects.

The Swiss pricing reform in heavy goods transport may thus be considered a success. Successful implementation was due to the solid scientific work to define the level of the fee, and the separation of political and technical implementation. For political implementation, it was necessary to set out clear and understandable targets such as the Polluter Pays Principle, the shift from road to rail and the use of the revenue. For technical implementation, it was necessary to have a simple system, high competence of the authority in charge and cooperation with transport lobbies.

#### **4. German experience**

The German HGV charge is proposed to be introduced in late 2003, after the act came into force in April 2002. It will be levied based on distance travelled and will be differentiated by the number of axles, pollutant emission categories, and there is the possible potential to differentiate by place and time of use later. The toll will apply to all lorries (including both domestic and foreign) weighing 12 or more tonnes using German motorways and the regulator sets the toll rate.

Rothengatter (2002) explains that the objectives of the study into the HGV charge were to derive fair and efficient user charges for the different vehicle categories using the federal roads and to ensure that charges for infrastructure costs recovered all costs including capital costs and took into account future re-investment cycles, new investment and current expenditures. It was necessary that all users should bear exactly the costs that they were responsible for.

As mentioned above, European law (Directive 1999/62/EC of 17.6.99) required that the toll rate had to be based on actual infrastructure costs: 'The weighted average tolls shall be related to the costs of constructing, operating and developing the infrastructure network concerned.' Therefore the average toll rate of 15 cents/km was determined, but at present it is fixed at an average rate of 12.4 cents/km and will eventually be raised to the original 15 cents/km depending on the date of effect and the scope of any harmonisation measures. External costs were not included. The vehicle category charge had to be based on the category's average infrastructure cost. It was possible to differentiate the charge by the time of day (peak/off-peak) and by environmental performance (emission category). The German government decided to only differentiate according to environmental performance.

By introducing the HGV toll system, the German government believes that it may lead to many advantages. There will be more rigorous application of the 'user pays principle' to

domestic and foreign users. HGVs are responsible for much of the costs of construction, maintenance and operation of motorways, and a distance-based HGV toll will allow HGVs to make a contribution towards infrastructure costs. It was suggested that more efficient use would be made of transport infrastructure capacity due to the tolls.

The HGV toll was understood to lead to fairer conditions of competition for road and rail modes. There is the potential to shift freight traffic from the roads to the railways and inland waterways. Hahn (2002) stated that one of the goals of the German tolling system was to double railway freight transport. Environmental objectives will be promoted by the differentiation of toll rates by vehicle axles and emission category. Rothengatter (2002) found that around one third of HGVs mileage on German motorways was produced by foreign trucks. The proposed HGV charge, which applies to both domestic and foreign vehicles alike, was important for providing fair and non-discriminatory competition for the road haulage business. Therefore distortions of competition to the detriment of German hauliers may be alleviated.

Additional revenue generated from the toll will be vital for the maintenance and upgrading of transport infrastructure. The revenue generated by the toll minus the expenditure for the operation, supervision and enforcement of the toll will go to the transport budget and will be earmarked for improving transport infrastructure, especially federal trunk roads. Revenue is proposed to be spent on several projects such as the 'anti-congestion scheme', which has the objective to reduce capacity bottlenecks and to secure the capacities of individual modes of transport. Revenue will also be used to eliminate bottlenecks on rail and inland waterway networks to relieve the burden on roads, and also spending on closing the gaps and widening motorways to six lanes to allow traffic to move more freely and smoothly.

The German government decided to allow a private sector operator to run the system of upgrading, maintenance, operation and financing, in order to ensure cost effectiveness and consumer friendly behaviour. The idea was to have a combination of tolling and public-private-partnership models and the operator has to pre-finance the system. This allows the private operator to receive a share of the tolls collected on a stretch of motorway. There was additional relief for public budgets by switching from tax funded to user funded infrastructure.

Tolls will largely be collected automatically and this innovative system will not interrupt the free flow of traffic on the motorway. The contract for the toll collection system was awarded to the ETC Consortium on September 2002. There are two systems for toll collection; an automatic system and a manual system. The automatic system is for frequent users and billing information is collected through an OBU. The OBU allows vehicles to be located by GPS signals and vehicle sensors, against a digital map. When passing through 'virtual toll' plazas, the corresponding toll is deducted from the tariff table. When a predefined threshold (credit) is reached, the billing information is transmitted through GSM to the ETC accounting centre. There are more than 1800 stations in Germany for installing OBUs. The schedule for OBU fitting was estimated to be 150,000 before opening and 350,000 after one year. The manual system is for occasional users where trips are reserved and payment is made before travel through the Internet, point of sale or a call centre which all link to a central computer. This system is open to all and is non-discriminatory. Information such as date of future trip, trip route (start, via, end), identification of vehicle (license plate number, class) is stored in the database for further checks at enforcement sites.

Hahn (2002) states that the objective of enforcement was to guarantee an optimum amount of toll revenue and to ensure the fairness of duties. There are four types of enforcement checks: automatic enforcement which is supported by video and identifies the classification and license plate of the vehicle, stationary enforcement consists of stoppage of the vehicles by police, mobile enforcement consists of police vehicles in the traffic flow, and enforcement checks in the transport operator's companies. Vehicles that have not paid the tolls could be fined up to 20,000 Euros.

There was the worry that the toll would encourage HGVs to make detours and use federal highways and regional roads instead of motorways. However this may not be the case as the advantages of using the motorways in terms of time efficiency far outweigh the advantages of using other roads. But it has to be considered that the use of alternative roads varies from place to place, and in certain places, more HGV motorway traffic may shift to these roads. Therefore the toll may be extended to some federal highways when it becomes obvious that detours these roads are being made.

At the time of writing, some technical problems have been experienced, leading full implementation to be postponed to early 2004.

## **5. British proposals**

The British government proposed to introduce a lorry road user charge in the UK as it strongly believed that all road users, regardless of their nationality, should contribute on a fairer and more equal basis towards the costs that they impose when using UK roads. (HM, 2003)

The government's consultation document (HM, November 2001) sought stakeholder's views on the different options for lorry road user charges. They could be either time-based or distance-based charges. In order to decide which of these options to take forward, the government had to assess the fairness and efficiency of each option, the impact of each option on the government's environment and transport policy objectives and the potential to offer wider business benefits and reduce administrative costs.

A distance-based UK road user charge for lorries was announced in April 2002. The charge was proposed to be implemented in 2006 and it was agreed that there should be simultaneous offsetting tax cuts for the haulage industry along with the introduction. This was due to the fact that the government recognised that the UK haulage industry already contributed towards the costs imposed in the UK and the charge should not increase the tax burden. The government has decided that these tax cuts will be in the form of reduced fuel duty for lorries liable to the charge. (HM, 2003)

The distance-based charge was chosen over the time-based charge after the government took into account the responses of the consultation document and further analysis. The main reason for deciding upon this type of charge was that it corresponded more closely to the costs imposed. In principle, the charge could be improved in terms of its relation with costs by varying the charge according to road type, lorry type, and maybe have the potential to vary according to the time of day.

The objectives of the lorry road user charge are to promote fairness and efficiency by ensuring that all users of UK roads contribute at a level that reflects the costs they impose,

and to achieve positive impacts on transport and the environment, as the charge should reflect the costs of climate change, local air quality, road maintenance, safety, traffic congestion and noise.

The proposed charge applies to all lorry operators regardless of their nationality with vehicles over 3.5 tonnes. The government recognises that to immediately apply the charge to this huge number of vehicles would be difficult and it may be sensible to phase in the charge by initially applying it to only larger vehicles and allowing them fuel duty reductions. The charge will vary by lorry type, as different types of lorries impose different levels of costs in terms of road maintenance and environmental costs on the UK roads. This would mean that heavier and more polluting vehicles pay more, as they will be charged at a higher rate per kilometre.

There has been a tendency in Europe of charging for the use of motorways, but if the UK charge was restricted to only motorways, there would be severe problems of diversions onto smaller routes which could not handle the traffic and cause more congestion and pollution. Therefore the charge will apply on all UK roads, with the potential to have a different rate for motorways.

Full details of how the charge will be technically implemented are not finalised yet but many suggestions have been made. The government has suggested a model to implement the charge. The model is based on three schemes; main scheme, occasional user scheme and offsetting fuel-duty reduction scheme. The main scheme is for frequent road users. Lorries will be fitted with OBUs which will record the distance travelled on UK roads and the data will be transmitted automatically to a central database. The occasional user scheme is for infrequent users of UK roads and who do not have OBUs. The government is developing an occasional user scheme similar to the one proposed for Germany. Tickets will have to be bought for lorries in advance of the journey, via the Internet or electronic terminals. The driver will be charged to drive on the selected route, and if the driver's intended journey changes, he/she will have to amend the route description via telephone or online. The system will be subject to enforcement checks to ensure journeys are booked in advance. The government's scheme for offsetting fuel-duty reductions has to be monitored efficiently to ensure that only vehicles paying the lorry road user charges are subject to the reductions. It has to prevent fraudsters from buying cheaper fuel to use in non-chargeable vehicles and thus undercutting legitimate trade. Ways to eliminate this issue may be to develop a new chemically marked fuel, which is illegal for use in non-chargeable vehicles and a repayment scheme where hauliers declare the amount of fuel used in their chargeable vehicle and they are refunded some of their fuel duty.

## 6. A Comparison of the HGV tolls

Table 1 seeks to compare the HGV charges in the three European countries with the proposed EU Directive. It should be remembered that the German system has to comply with the current Directive, whilst the others do not. The Directives do not of course apply to Switzerland as a non-EU member.

Table 1  
A comparison of the HGV toll characteristics

	<b>Switzerland</b>	<b>Germany</b>	<b>Britain</b>	<b>Proposed EU Directive</b>
<b>Implementation dates</b>	1998: Act Jan 2001: Came into force	2002: Act Nov 2003: Comes into force	2002: Act 2006: Comes into force	?
<b>Roads to which the charge is applied to</b>	All Swiss road network	Mainly covers motorways, but potential to cover highways	All UK roads	Motorways and competing main roads, but all roads permitted
<b>Lorry Weight Charged</b>	Over 3.5 tonnes	Over 12 tonnes	Over 3.5 tonnes	Over 3.5 tonnes
<b>Vehicles Charged</b>	Domestic and foreign	Domestic and foreign	Domestic and foreign	Domestic and foreign
<b>Cost categories included in calculation</b>	Uncovered costs of heavy traffic including external costs such as air pollution, noise and accidents.	Actual infrastructure costs, capital costs taking into account investment and current expenditure.	No explicit methodology, based on existing levels of charges	Infrastructure and external accident costs
<b>Type of charge (Time or distance based)</b>	Distanced based	Distanced based	Distanced based	Distance based
<b>Factors by which charge rates are varied</b>	Environment. HVF takes into account distance, weight and emissions.	Environment (number of axles, emission category)	Environment (number of axles, emission category). Potential for a different charge rate by location and time of day	Vehicle type, location, time of day, environmental costs, infrastructure type and speed
<b>Revenue use</b>	Operational costs, enforcement costs, projects to modernise the rail network	Infrastructure projects for roads, railways and waterways	Transport sector (specific details are not finalised yet)	Road infrastructure projects and transport sector as a whole
<b>Other policies alongside tolls to ease implementation</b>	Increase in permitted gross vehicle weight of lorries on Swiss roads	Toll rebate scheme, lowering HGV motor-vehicle tax and HGV innovation programme	Off-setting tax cuts in the form of a reduction in fuel duty	Reduction in annual vehicle tax, independent infrastructure supervision authority
<b>Technical implementation and collection of billing data</b>	Vehicles are fitted with OBUs which register the kilometres travelled. Foreign vehicles may use OBUs or ID card to register the fee and manually state distance	Frequent user vehicles are fitted with OBUs. Occasional user vehicles book trips via a manual system.	Frequent user vehicles are fitted with OBUs. Occasional user vehicles book trips via a manual system.	

Both Switzerland and Britain apply their charge on the entire road network. Germany's toll is mainly for the use of motorways, but in cases of motorway traffic diverting to highways where traffic becomes unmanageable with high levels of congestion and accidents, there is potential to charge the usage of those roads. This is in line with the proposed EU directive, which covers motorways and competing main roads.

The weight of the vehicles charged is over 3.5 tonnes for both Switzerland and Britain. Germany proposes to charge only heavier vehicles, weighing over 12 tonnes. The proposed EU directive replaces the previous directive's 12 tonne minimum with the new 3.5 tonne minimum weight. All the systems apply their charges to both domestic and foreign vehicles.

In determining the cost categories used for calculating the charges, it was found that Switzerland considered the uncovered costs of heavy traffic including external costs such as air pollution, noise and accidents. Damage by congestion and the greenhouse effect were not considered. Germany based their costs on actual infrastructure costs and capital costs taking into account investment and current expenditure. The proposed EU directive bases charges on infrastructure costs and external accident costs, so neither the Swiss nor German system is exactly consistent with this. Details of how the costs for Britain's charges will be calculated have yet to be finalised.

The type of charge applied by the three countries is distance based which takes into account kilometres travelled. It is believed this method is more efficient to capture and account for the infrastructure and environmental costs imposed by HGVs, rather than a time-based system as with the Eurovignette where HGVs are charged per period for road use. The more the HGV travels, the more costs it imposes and the more it has to pay with a distance-based charging system.

Charge rates are varied by the environment in all three countries, taking into account the number of axles and emission category. The British system has the potential to vary the charge rate according to the location and time of day. This may not be the case with the HGV charge's initial introduction, but given time the charges may have the potential for further variation. The proposed EU directive looks to differentiate charges by vehicle type, location, time of day, environmental costs, infrastructure type and speed.

The proposed EU directive seeks to use revenue for road infrastructure projects and the transport sector as a whole; all three countries' system are consistent with this principle

In order to ease the implementation of HGV charges, Switzerland simultaneously increased permitted gross vehicle weight of lorries on the roads. Germany proposes to introduce a toll rebate scheme if proof of mineral oil tax paid was produced, lowering motor-vehicle tax for HGVs to the minimum level admissible under EU law and a HGV innovation programme where an investment subsidy is given for purchasing HGVs with lower emission classes. Britain proposes to implement the charge alongside off-setting tax cuts in the form of a reduction in fuel duty. The proposed EU directive put forward a reduction in annual vehicle tax and an independent infrastructure supervision authority.

The technical implementation of the charge was very similar in all three countries. In Switzerland, domestic and some foreign vehicles used OBUs to register the distance travelled. Usage of OBUs was not mandatory for foreign vehicles and ID cards could be used

to register the fee. German and the Britain propose to have two schemes; frequent and occasional user schemes. Frequent users would use the OBU to register the billing data whilst occasional users will book trips by a manual system and make payments online, through a call centre or point of sale.

## **7. Conclusion**

In this paper we have critically examined the proposed revisions to the Eurovignette Directive, and the existing or proposed systems of HGVs charging in Switzerland, Germany and Great Britain. The first conclusion to be drawn is that none of these proposals really implement the EC's stated policy of marginal social cost pricing. In each case they rely on some sort of allocation of total cost to determine the average level of toll. The proposed Directive ties charges to average infrastructure and external accident costs. In Switzerland, these costs include environmental costs but not congestion. In Germany, as in the proposed Directive, neither environmental nor congestion costs are taken into account in the overall level of charges, but charges are differentiated according to the pollution category of the vehicle. In Britain, there is no explicit method of calculating the level of the charge, but it will be differentiated by vehicle type (including environmental characteristics) and offset by a reduction in fuel tax, thus maintaining the current overall level of charge. In all cases the use of revenue is tied to the transport sector.

The emerging systems offer the potential for charging which reflects the costs of road use much more accurately, by permitting a charge directly related to kilometres travelled, and which may be differentiated by vehicle type and in time and space. They were very much in line with the proposed new Directive on HGV charging. The two main criticisms of this Directive are thus the constraints on the overall levels of charge and the earmarking of revenue to the transport sector. The reasons for these constraints appear to be largely concerned with acceptability, although also perhaps a desire to prevent individual governments from responding to incentives they may have to over charge HGVs. On balance, it appears likely that all these developments will significantly improve the efficiency with which HGVs are charged for their costs, and thus give better incentives in terms of the types of vehicles used, the times and locations of their use and the competitive conditions between vehicles registered in different countries. But considerable inefficiencies may remain in terms of the overall level and degree of variability of charges and in terms of the way the revenue is used.

## **References**

ARE, DETEC (2002) *Fair and efficient: The distance-related heavy vehicle fee (HVF) in Switzerland*, Federal office for spatial development (ARE), Department of the environment, transport, energy and communications (DETEC)

Balmer, U. (2003) *Practice and experience with implementing transport pricing reform in heavy goods transport in Switzerland*, IMPRINT

Commission of the European Communities. (1995) *Green paper: Towards fair and efficient pricing in transport policy - options for internalizing the external cost of transport in the European Union*

Commission of the European Communities. (1998) White paper: *Fair payment for infrastructure use: a phased approach to a common transport infrastructure charging framework in the European Union*

Commission of the European Communities. (2001) White paper: *European transport policy for 2010: time to decide*

Commission of the European Communities. (2003) *Proposal for a directive of the European parliament and of the council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures*

European Parliament and Council (1999): *Directive 1999/62/EC of the European Parliament and of the Council of 17 June 1999 on the charging of heavy goods vehicles for the use of certain infrastructures*

European Federation for Transport and the Environment. (1999) *Electronic kilometre charging for heavy goods vehicles in Europe*

German Federal Ministry of Transport (2000) *Information on time-related motorway-user charges for heavy goods vehicles*

German Federal Ministry of Transport, Building and Housing (2003) *Facts about the toll system for heavy goods vehicles (HGVs)*, Available at the website: <http://www.bmvt.de>

Hahn, W (2002) *Implementing transport pricing reform in Germany*, Federal Ministry of Transport Building and Housing, IMPRINT

HM Treasury Public consultation paper (27 November 2001) *Modernising the taxation of the haulage industry*

HM Treasury, HM Customs and Exercise, and DTLR publication (25 April 2002) *Modernising the taxation of the haulage industry – Progress Report One*

HM Treasury, HM Customs and Exercise, and DfT publication (6 May 2003) *Modernising the taxation of the haulage industry – Progress Report Two*

IMPRINT EUROPE (2002) *Implementing Pricing Reform in Transport – Effective Use of Research on Pricing in Europe - Deliverable Three, Constraints and solutions: learning from best practice*, European Commission

Nash, C, E. Niskanen and E. Verhoef (2003) *Policy conclusions from MC-ICAM*

Rothengatter, W (2002) *Charging systems for the use of transportation infrastructure*, Institute for Economic Policy Research (IWW)

Sansom T., Nash C., Mackie P., Shires J. & Watkiss P. (2001) *Surface Transport Costs and Charges*, Institute for Transport Studies, University of Leeds

Swiss Customs Authority (2000) *HVF – in concrete terms*

Verhoef, E (2001) *Marginal cost based pricing in transport: key implementation issues from the economic perspective*. Paper presented at the first Imprint-Europe seminar, Brussels