Specific environmental taxes are minor in relation to fuel excise duty, road tolls and annual taxes on the ownership or use of vehicles, in terms of their cost to transport operators and users (see the OECD environmental tax data base). Although differentiation of general transport taxes on the basis of environmental performance is quite widely used to leverage vehicle purchase decisions, this paper is concerned with the larger and more fundamental potential for influencing patterns of demand for road transport offered by the introduction of road pricing, in the form of electronic kilometre charges and area wide road pricing systems.

Finance and Transport Ministers are considering the introduction of such charges, and/or the wider use of road tolls, in a number of OECD countries. Each government considering reform faces urgent pressures -- altering taxation is always politically sensitive and not something undertaken lightly. The main motivations are:

- Raising additional revenue for investment in transport infrastructure;
- Ensuring foreign trucks contribute adequately to the costs of using roads;
- Managing chronic congestion;
- Improving the natural or urban environment;

More generally, the introduction of electronic kilometre charges for trucks, and possibly for cars, is being considered in some countries as a means to reducing inefficiencies and distortions in transport taxes and charges, aiming at:

- Substituting for fixed charges for owning or using trucks in order to move towards international harmonisation of the fixed charges, as differences in the level of these taxes tend to distort international competition, leading to complaints from national haulage associations to their governments (even if the complaints often misguidedly target fuel tax differences);
- Providing for more predictable relationships between road and rail costs, by substituting for fuel taxes which tend to be somewhat volatile due to oil price instability and political pressure;
- Improving the efficiency of the tax system as a whole by partially substituting for some traditional taxes on labour or capital with taxes on the external costs of pollution, noise and congestion. A number of city and national governments are also considering new taxes on land linked to the increase in land values brought about by major investments in transport infrastructure (such as new metro stations) as an efficient alternative to general tax revenues for financing these investments.

Major reforms of transport taxation for environmental protection or managing congestion tend only to be considered when combinations of other measures, such as parking charges, traffic management systems, infrastructure investments and traffic calming measures, fail to produce the results hoped for. In the case of some urban cordon charge systems, however, road pricing has been used in place of more conventional measures -- more on this below.

The paper is structured as follows, beginning with experience with innovative charging instruments and ending with some comments on policy towards the reform of transport taxation:

1. Electronic truck kilometre charges;
2. Electronic road tolls;
3. Urban road pricing;
4. Road pricing policy directions in Europe.

1. Electronic Truck Kilometre Charges

Switzerland

Switzerland replaced a fixed annual road user fee for trucks with its *Heavy Vehicle Fee (HVF)* electronic kilometre charge in January 2001. The charge applies to all trucks over 3.5 tons and is differentiated by the maximum allowed weight of the truck and its EURO standard environmental emissions class. The charge applies to all roads in Switzerland. It raised around *Euro 450 million* in 2001, roughly the same amount as fuel tax revenues from road haulage.

Hauliers are required to equip their trucks with an on-board unit connected to the vehicles’ tachograph (recording distance driven). This communicates with road side microwave transponders located at all the main border crossing points. The units also have a satellite tracking connection used to deactivate the payment recording system if a truck leaves the country by a route not equipped with road-side beacons. For billing, once a month the user inserts a microchip card into the on-board unit to record the distance driven in Switzerland that month. The card is then mailed to the customs authority or the data on it sent to customs by email. Occasional users of Swiss roads have the option of obtaining an identification card and paying the fee with petrol cards at vending machines located at border crossing stations. Enforcement is through customs checks at borders, roadside checks and checks in the accounts of Swiss haulage companies.

The charge was introduced as part of a package of measures agreed under treaty with the European Union, part of a bilateral trade agreement. Under the agreement, Switzerland was required to remove its 28 ton weight limit on trucks, progressively raising the limit to 40 tons. The HVF was designed to manage the number of trucks crossing the Swiss Alps, rising in steps with the weight limit. The combination has proved highly successful in managing demand (see figure 1). The impacts of the charge on traffic and the economy have been carefully monitored and the positive developments
expected in terms of fleet efficiency and traffic management have materialised (see www.oecd.org/cem/topics/rail/modalshifte.pdf and /cem/topics/env/London04.htm).

Figure 1.

After a strong increase between 1997 and 2000, freight transport mileage was reduced remarkably in the years following introduction of the fee.


Each half of the package is estimated to account for a roughly equal part of the impact on traffic. Raising the weight limit allowed hauliers to carry larger loads per truck. The HVF stimulated hauliers and logistics companies to consolidate loads and find back hauls for empty trucks because the fee has to be paid regardless of whether the truck is running loaded or empty. This has resulted in consolidation in the industry, with larger companies absorbing one-driver operations and with alliances and the use of web-based brokering services greatly increasing load factors. Higher volumes of freight are now moved with fewer vehicles, and the industry has become much more competitive. The HVF was carefully calculated to match the cost advantage achieved through the efficiencies made (see figure 2).

At the same time, determination of the level of the charge was the subject of political negotiation. The average charge level initially proposed was based on the results of a study to estimate the external costs of transiting the Alps. Negotiations with the European Commission significantly reduced the charge, to the level required to stabilize traffic flows. Nevertheless, the charge is subject to periodic review in the light of new studies on the external costs of truck traffic.
Figure 2. Consequences of lifting the weight limit from 28 to 40 tonnes

The overall gain in productivity of 18% in road transport due to the higher weight limit more or less makes up for the effect of the HVF, which increased total costs for heavy goods transport by 19%.

The HVF is seen as a key part of the government’s strategy to internalize external costs and has brought about a reduction in vehicle exhaust emissions. Figure 3 presents the results of projections of CO₂ and NO₂ emissions to 2007 made by the Swiss Agency for Environment. Emissions in 2007 will be about 30% lower with the new regime than they would have been if the old regime (flat fee, no higher weight limit) had been maintained.

Figure 3.

Effects on the environment


Two thirds of the revenues from the HVF are earmarked for rail investments, mainly for two long tunnels through the Alps (Gothard and Lotschberg routes) designed to substantially increase rail
freight productivity and make rail competitive with road freight. Some revenues will also go to high speed passenger rail investments. The other third of the total revenues goes to Cantonal (regional) governments for investment in transport infrastructure. This attribution of revenues was significant in gaining the support of the regional governments and industrial lobbyists for the introduction of the charge. Until the new tunnels enter service the HVF is not expected to result in any significant shift of traffic from road to rail, but in some specialized markets, such as chemical tankers there has been such a shift as the small markets make it difficult for road haulage companies to invest in larger tank trucks to off-set the impact of the HVF. (The one major flaw in the system to have emerged is that projected revenues from the use of the new rail base-tunnels are now expected to be insufficient to cover the infrastructure’s marginal operating and maintenance costs).

The average rate for the HVF, increasing in steps with raising of the weight limit, is as follows:

- 01.01.01: 1.0 Euro cent/tkm, weight limit 34 tonnes (with a quota for 40 tonne trucks paying at the 34 tonne rate – the quota has not been exhausted so far).
- 01.01.05: 1.6 ct/tkm, weight limit 40 tonnes.
- 01.01.07: 1.8 ct/tkm.

The average charge is differentiated according to emissions class of vehicle (example given for the period 2001-2005) as follows:

- Fee category 1 (corresponds to emission class Euro 0): 1.15 Euro cent/tkm
- Fee category 2 (corresponds to Euro 1): 1.0 ct/tkm
- Fee category 3 (corresponds to Euro 2 and better): 0.85ct/tkm

The introduction of the HVF marked a large increase in road user charges for Switzerland, and the country now has by far the highest national average charges (tolls and km charges) per truck-km for road use in Europe. Nevertheless, the charge is lower than the equivalent for crossing the French Alps by the Frejus or Mont Blanc tunnel routes, as figure 4 illustrates’.
Figure 4. Tolls and km-charges for crossing the Alps on alternative routes of similar length

<table>
<thead>
<tr>
<th>Route</th>
<th>2001</th>
<th>2004</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frejus</td>
<td>217</td>
<td>202</td>
<td>228</td>
</tr>
<tr>
<td>Lyon-Sanità (346 km)</td>
<td>63</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Bâle-Chiasso (300 km)</td>
<td>140</td>
<td>125</td>
<td>105</td>
</tr>
<tr>
<td>Wörgl-Verona (335 km)</td>
<td>47</td>
<td>42</td>
<td>31</td>
</tr>
</tbody>
</table>

Note: These figures compare average costs for 40t trucks of making Alpine crossings. Average national motorway tolls (and infrastructure costs) in France are lower than those on the route illustrated. The fall in Swiss HVF between 2001 and 2004 is accounted for by exchange rate fluctuations; in Swiss Francs the level of the charge increased. The figures inside the columns are in Euro cents per vehicle kilometre.


**Austria**

Austria replaced a fixed annual road user charge for trucks with an electronic km charge in January 2004. Revenues are estimated at **Euro 600 million** in 2004. Charge rates are shown in figure 5. All revenues go to the company charged with managing and expanding the motorway system.

Like Switzerland, Austria uses road side transponders and an on-board unit to levy the charge (and Swiss on-board units can be used in Austria) but unlike Switzerland the charge is not differentiated according to the emissions class of the vehicle. Neither do the external costs of transport enter into the calculation of the level of the charge. The charge was introduced in order to increase the recovery of infrastructure investment and maintenance costs, providing for new investments in motorway infrastructure in the face of rising demand. Nevertheless, by replacing a fixed annual charge with a charge levied per km driven, incentives to improve the efficiency of haulage operations and reduce the number of km driven have been created. No analysis of the expected impacts in this direction is as yet available. As Table 1 shows, the average level of the charge is significantly lower.
than the Swiss charge, and of course there has been no accompanying change in the weight limit for trucks in Austria. The impacts are therefore likely to be small in the short term compared with those in Switzerland, and the charge is not expected to increase significantly in the future. Finally it should be noted that the law provides for differentiation of the charge according to pollutant emissions at some point in the future.

Figure 5. Austrian km Charge Tariffs

Table 1. Average Rates for Electronic Truck-km Charges (40 ton truck)

<table>
<thead>
<tr>
<th>Country</th>
<th>Charge</th>
<th>Euro cents per ton* kilometre</th>
<th>Euro cents per kilometre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>January 2004 HVF</td>
<td>1.0</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>January 2005 HVF</td>
<td>1.6</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>January 2008 HVF</td>
<td>1.8</td>
<td>76</td>
</tr>
<tr>
<td>Austria</td>
<td>January 2004 LKW Maut</td>
<td>0.65</td>
<td>27</td>
</tr>
<tr>
<td>Germany</td>
<td>January 2005** LKW Maut</td>
<td>0.3</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes: * Authorised gross laden weight; ** German LKW Maut expected to be introduced by January 2005, probably initially at the rate of 12 cents/km, rising to the planned level of 15 cents/km; The table records only the specified charges and ignores fuel tax, annual vehicle taxes etc. For data on total taxes and charges see the ECMT database http://www1.oecd.org/cem/topics/taxes/AnnexB3e.xls.


Germany

Germany plans to introduce an electronic km charge for trucks over 12 tons by January 2005 and has already abolished its former Eurovignette charge in anticipation of the new toll. It will raise **Euro 3.4 billion** when levied at the full average rate of 15 Euro cents per km, although it will be introduced at a discounted average rate of 12 Euro cents, roughly half the level of the Austrian charge. It will
apply to motorway driving only. The initial rate is one and a half times the previous Eurovignette charge per km and will increase the taxes of motorway driving by 70% compared with current conditions.

The charge is calculated according to the estimated maintenance, upgrading and renewal costs for the motorway system attributable to trucks. The charge is designed to raise revenues to relieve public budgets of this expenditure, and charge all users, including foreign trucks, equally. Revenues will be ring-fenced for use in paying for the costs of collection and investment in transport infrastructure, mainly federal highway construction. The charge will be differentiated according to the number of axles (i.e. the approximate weight of trucks) and on the basis of exhaust emissions class. The charge is also explicitly intended to provide an appropriate financial environment for inter-modal competition for freight between road haulage and the railways. Delay in introducing the charge is currently proving a severe handicap for rail business seeking new business, as reported by independent train operators such as Rail4Chem.

Replacing the time based Eurovignette charge with a km charge, and increasing the level of the charge, should drive rationalisation of the haulage industry and reduce km driven below what would have otherwise been the case. As with Austria, though, the impact can be expected to be much less than in Switzerland.

The most interesting feature of the German system is its reliance on satellite and mobile phone technologies to communicate with on-board units without the need for roadside transponders. The main advantage of satellite based systems is that they can be applied (in Germany’s case at some future point) to the entire road system and differentiated by road type and spatially to a high degree at low cost. Thus routes associated with higher environmental or infrastructure costs could be charged higher rates, varied also by time of day, week and year.

Deployment of the system has experienced severe delays. It was initially due for introduction in mid 2003. Some of the delay can be attributed to technological difficulties, but Switzerland has already demonstrated trouble-free application of satellite tracking as part of its electronic charging system. The real reasons for the problems encountered stem from the award of the concession for developing the German system to a national champion through a deficient competitive tendering process. The European Competition Directorate General ruled the tender anti-competitive, but subsequently approved the winning bid when the French company Cofiroute took a minority share holding in the Deutsch Telekom-Daimler Chrysler consortium. The contract also lacked incentives for the cost-minimisation. The consortium’s natural incentive was to develop high value, high cost systems able to provide increased revenues through additional services rather than concentrating on cost-effectiveness for the client’s basic needs. It failed to deliver the resulting complex system on time, with on-board units unable to communicate satisfactorily with satellites, and was eventually forced to renegotiate terms by the government. A somewhat simplified system is now expected to be introduced by January 2005, with additional services to be provided at a later date.

The United Kingdom

The United Kingdom plans to introduce a satellite based electronic km charge for trucks in 2008 and trials of the technology began in 2004 on the motorways around the city of Leeds. The plans are outlined in successive budget statements from the Minister of Finance, and preparatory work is underway in the Department for Transport. Road infrastructure costs have been closely examined in the UK over many years and the existing fixed annual vehicle tax for trucks is differentiated according to axle weight and type of suspension in order to promote road friendly vehicles. The external costs of road use by different types of vehicles and on different classes of roads are also well understood as a
result of studies sponsored by the Department. This knowledge is expected to be used to differentiate the new electronic km charge to a relatively high degree, and this is the reason for preferring a satellite based system.

In designing charges there is a trade-off to be made between simplicity and potential efficiency. The information on the external costs of transport published in the study *Surface Transport Costs & Charges - Great Britain 1998* shows that these costs vary significantly by time of day, road type and area type. Although a structure of charges that reflects these differences would be efficient, there is little information on how road users might respond to a complex structure of charges and hence how effective a complex system might be.

The British Government therefore proposes to start with a relatively simple structure of charges which succeeds in meeting the main objectives of the policy. These are: to ensure fairness and efficiency, so that all users contribute equally and at a level which reflects the costs they impose on the road network; to deliver environmental and other benefits by setting the rates so as to reflect the environmental performance of the vehicle paying the charge. The charge is expected to vary according to distance travelled, vehicle type and road type.

Varying the charge by distance travelled within the UK ensures that all vehicles contribute equally irrespective of their country of registration or where they last refuelled. Distinguishing by vehicle type ensures that the charge relates both to road damage costs and to environmental costs, with the heaviest vehicles with the fewest axles paying most and vehicles with more environmentally friendly emission standards paying less. The charge will also encourage operators to upgrade their fleets and make better use of their vehicles so as to reduce vehicle kilometres. Variation by road type further reflects the significant differences in costs between modern, high quality roads usually constructed to provide for freight traffic and other roads where road damage, environmental and safety costs are higher.

Using a satellite based system to levy the charge will allow for further variation to be implemented. There is likely to be the potential for varying the charge by time of day, so as to encourage operators to schedule their trips at times when they impose the lowest costs because the inter-urban network is less congested. A further option is a charge that varies by area type, to reflect the higher costs that heavy vehicles typically impose when operating in close proximity to people and their homes in urban areas. Both these options are unlikely to feature in the system when first implemented. The aim is to ensure that it is sufficiently flexible for it to be enhanced later.

The Government does not intend the new charge to increase the overall cost of road freight haulage for domestic operators in the UK. The aim is to reduce other taxes on UK road haulage so as to leave the overall costs broadly unchanged. There is little scope for reducing the annual tax on vehicle ownership (Vehicle Excise Duty) further. It is already highly graduated to encourage the purchase of environmentally friendly vehicles.

While reductions in fuel tax provide a means of offsetting the lorry road user charge, such a reduction would give an unwarranted benefit to the owners of diesel-engined light goods vehicles and cars. There would be significant financial costs to the UK Treasury on account of the loss of fuel duty. In addition, the shift to diesel cars that would result from a large difference between diesel and petrol prices could increase the environmental costs of traffic in urban areas because of the higher pollution costs associated with the use of diesel vehicles, although reduced carbon emissions would in part offset this. So a reduction in the duty paid on diesel fuel was rejected as an option.
The Government concluded that the best way to offset the charge is to repay part of the fuel duty paid by hauliers when they purchase fuel in the UK. Most fuel purchased by goods vehicle operators is either supplied directly to their depots or purchased in the course of a journey by drivers using special fuel cards. In both cases it would be a relatively simple matter for the suppliers of the fuel to claim a rebate from the tax authority and pass this on to the purchaser. There would also need to be arrangements whereby direct purchasers of fuel could claim back the tax against a receipt from an authorised service station.

One final point illustrates the importance of getting these tax adjustments right for competition between road and rail operators, and the environmental implications of resulting changes in modal shares. In the 1990s, the United Kingdom introduced a fuel tax escalator as a means of taxing CO2 emissions. Fuel tax protests, led by truck drivers, brought about a premature ending of the system accompanied by a 50% cut in vehicle excise duty (fixed annual vehicle tax) on trucks, in 2001. The electronic km charge was initially expected to make up for this tax reduction, but introduction is taking longer than initially expected. In the meantime, the Rail Regulator found it necessary to halve the charges paid by freight train operators for using rail infrastructure in order that they remain competitive with road haulage\(^1\). The Regulator also ruled that the government provide the resulting missing income to the infrastructure manager, in full, through direct payments from the budget. The cost is estimated at 500 million pounds (Euro 747 million) over the period 2001-2006. The regulator allocated the infrastructure manager a period of 10 years to gradually reduce its costs and enable the phasing out of this subsidy.

**Other Countries**

The Netherlands, Sweden and the Czech Republic are all looking at the possibility of replacing time based vignettes for the use of roads with electronic km charges for trucks. In early 2004, the French Government proposed introducing an electronic km charge for trucks on urban sections of motorways that are currently un-tolled, as this is where costs, and especially environmental costs are highest. Studies for the Ministry of Transport\(^2\) show a general balance between the costs, including external costs, and revenues associated with truck traffic except in the case of urban areas. The proposal ran into difficulties because of a decision late in the process of development that the revenues from the charge should be earmarked to expanding the budgets of regional government authorities, as part of a plan to increase decentralisation. Regional politicians voted against this means of funding. It remains to be seen if the proposed charge will be re-launched.

Figure 6 illustrates the weights of different economic categories of charges in the basket of taxes levied on road haulage across Europe\(^3\). The categories are organised from the most purely fiscal (national, annual, vehicle taxes), through weakly territorial charges (fuel taxes) and moderately territorial charges (time-based vignettes), to strongly territorial charges (km charges and road tolls). The Swiss electronic km charge clearly stands out in relation to other categories of charge, together with the combination of electronic km charge and tolls in Austria, and motorway tolls in France, Italy and Spain. Note the shares were calculated on the basis of standardised domestic hauls for each country rather than compiled from records of tax payments or budget revenues. This will result in a degree of divergence from the true figures for taxes actually paid per km driven.

Outside of Europe, a number of States in the USA are working on deployment of electronic km charges and on Australia the Government’s Intelligent Access Project\(^4\) experimented with satellite telematics to monitor compliance of vehicles with road access conditions (such as loading limits, speed limits, access for over-dimensioned trailers, driving time). The trucks monitored were exempted from road-side inspections. Some of the State governments are working on introducing operational systems of this sort that include road pricing. In New Zealand the government is examining
introduction of a similar system to provide hauliers with a voluntary alternative to the existing paper-based weight and distance charge. In all these cases governments make use of the commercial satellite tracking systems already employed by trucking companies to manage their operations.

Figure 6. Structure of Road Haulage Taxation for Standard Hauls (40 t Euro I truck), first quarter 2004 (Euros per 400 km trip).

2. Electronic Road Tolls

Conventional road tolls have financed motorway networks in several countries and provided for investments in tunnels, bridges and urban expressways in many more. Much experience relevant to developing more efficient road charges has been accumulated by differentiating some of these tolls to spread peaks in demand. The most technically advanced system operates in San Diego, California, where tolls on a 13 km stretch of the Interstate Route 15 motorway vary on a continuous basis as a function of demand: toll rates can be changed as often as every 6 minutes, with rates displayed prominently ahead of exits that give access to un-tolled, and more congested, lanes. In peak periods, the numbers of vehicles carried per lane of the motorway has been doubled by the application of pricing to prevent traffic jams.

Simpler forms of peak-pricing have been introduced elsewhere in the USA and in Europe (see Annex for complete list). In France, higher tolls apply during some peak hours (on Sundays and national holidays) on the A1 and A14 motorways entering Paris, in order to spread peak demand and avoid construction of additional lanes. Daily peak charging exists on the Artxanda motorway tunnels in Bilbao and is planned for a series of new motorway ring roads around Spanish cities.

The United Kingdom provides the most interesting innovation in Europe, even though the country has no tradition of tolling motorway use. The M6 relief road is a 30 mile stretch of motorway offering an alternative route around the country’s second city, Birmingham, to the existing M6 motorway, which is subject to heavy and chronic congestion. Under the terms of the concession awarded by the Government, the operator of the road is free to set tolls at any level, provided it results in free flowing traffic being maintained on the new link. The only differentiation introduced so far is between day time and night time rates, but the tolls charges are relatively higher for trucks than for cars with the result that cars account for most of the diverted traffic. Congestion has been relieved on the old M6 and a second concession is about to be issued to extend the new route.

Back in the USA, peak pricing on bridge and tunnel tolls plays a significant part in managing demand on New York’s roads. The New Jersey Turnpike and Hudson River Crossings are all subject to variable tolls. More cars cross these bridges and tunnels per day than enter the area of central London subject to the new Congestion Charge.

3. Urban Road Pricing

Singapore

Singapore pioneered a manual version of urban road pricing in 1975 in the form of its Area Licensing Scheme and gradually introduced electronic payment systems until in 1998 it successfully arrived at the world’s first fully automated electronic road pricing scheme. Given Singapore's small size, the demand for car ownership and the number of vehicles using the roads needs to be managed carefully to avoid serious traffic congestion and accompanying pollution and degradation of the urban environment. Two demand management tools have been developed: Electronic Road Pricing (ERP) and a Vehicle Quota System.

The quota system was introduced in 1990 to control the growth of the vehicle population at a sustainable rate. Certificates of Entitlement must be obtained through a process of competitive bidding before a vehicle can be registered. The vehicle quotas are revised annually, taking into account car de-registration patterns and sustainable growth rates. The value of the certificates typically exceeds the cost of new car purchases several times.
The objective of road pricing is to moderate and spread peak vehicle usage for a more optimal use of the infrastructure and a congestion-free road network. Charging applies to a central ‘restricted zone’, to expressways and to some other arterial roads outside the restricted zone (see figure 7). Additional charging gantries are currently being introduced to manage congestion on the city’s main ring road. Charges vary with location, time of day and vehicle type. Currently they change in half-hourly intervals according to levels of congestion.

Figure 7. The Areas Charged: Restricted Zone Entry Gates and the Arterial Roads Charged Outside the RZ (indicated in blue on the map of Singapore island)

Charges are varied to maintain average traffic speeds between appropriate limits (see figure 8). Charge levels are reviewed every three months, and during the main holiday travel periods, and adjusted according to recorded traffic flow rates. Traffic speeds are monitored through the GPS receivers used to manage Singapore’s 7000 taxis. The objective is that the roads should be neither congested nor under-used and in essence driver behaviour determines the rate of the charge. The
purpose of charging is explicitly not to raise revenues, but to manage road use. This is illustrated by a fall in revenues of 60% when electronic charging replaced the old manual system in 1998. The finer tuning of the system to traffic conditions enabled average charge levels to be cut substantially.

Figure 8. Charges are Increased or Decreased Depending on Traffic Flow Speeds

![Figure 8](image)

Source: Land Transport Authority.

The impact on traffic levels has been highly significant. The effects of the old area licence system are displayed in figure 9, showing a 75% reduction in inbound journeys in the morning rush hour at the start of the system. The change over to the more finely tuned electronic system in 1998 resulted in another 16% fall in morning rush-hour traffic, and a 15% fall in overall traffic, even though the basic charge for entering the restricted zone was reduced. Only 5% of drivers switched to other modes or
abandoned their daily journey to the zone. The main effect of the more sophisticated system was to discourage multiple trips crossing the entry points to the zone during the same day, together with some additional spreading of the morning and evening peaks.

Singapore was long viewed as an exceptional case rather than a model for urban charging systems for other cities, due to its isolated geographical position and relatively small area, the strong package of additional tax and regulatory measures limiting the number of cars in circulation and a political system less sensitive to motoring lobbyists than in many other countries. Hong Kong, with some similarities to Singapore, developed an electronic urban road pricing system to the point of introduction in the 1990s but the government finally decided against introduction. The decision had more to do with new institutions flexing their decision-making muscle, however, rather than the value of the scheme itself, as the decision was one of the first to be made by the authority appointed for the handover from British to Chinese sovereignty. The introduction of the London Congestion Charge in 2003 finally demonstrated the feasibility of urban road pricing in a major western city.

**London**

London’s Congestion Charge was introduced on 17 February 2003 with the aims of reducing congestion, improving bus services, improving journey time reliability and improving the efficiency of freight distribution and other services. Drivers entering the centre of the city (see figure 10) during working hours must pay a flat, once-a-day fee. It is an electronic road pricing system but unlike Singapore operates without road-side transponders or on-board units. Vehicles are tracked entering the charged area by video-surveillance cameras, using automatic number plate recognition technology. This technology is employed for enforcement in other urban and truck charging systems. Drivers entering the charged area between 7 am and 6:30 pm Monday to Friday must pay 5 pounds (Euro 7), in advance or before the end of the day. Over half a million payments are made each week. Payments may be made by internet, mobile phone SMS messages or at some petrol stations and shops. On payment, the vehicle’s registration number is entered onto a computerised list and cross-checked against the video camera records. Fines are sent out to drivers of cars entering the zone without payment. Persistent non-payers are identified and their vehicles clamped, or in a few extreme cases their vehicles have been crushed.

The impacts of the system have been carefully monitored\(^{15}\). The main results reported after the first complete year of operation are as follows, and closely in line with the results of the modelling on which the system was designed:

- Congestion within the zone has reduced by 30%, and the volume of traffic within the zone has reduced by 15%;
- Public transport is successfully accommodating displaced car users;
- There have been significant improvements to bus services in the zone and more widely throughout London;
- Comparative analysis of the many influences on the central London economy suggest that the direct impact of congestion charging on business activity has been small;
- Road traffic emissions and fossil fuel consumption in the zone have been reduced.
Traffic entering the charging zone during charging hours has been reduced by 18%, and traffic circulating within the zone has been reduced by 15% (vehicles with four or more wheels). As predicted, there have been small increases in traffic on the inner ring road, just outside the charging zone, but this is being managed without significant additional congestion. There are no indications of significant increases in traffic outside the charging zone. Of the 65 to 70 thousand car trips per day during charging hours no longer made, 50 to 60 percent have transferred to public transport, 20 to 30 percent now divert around the charging zone and 15 to 25 percent have made other adaptations, such as changing the timing of trips.

Improvements to the bus network made in conjunction with the charging scheme have seen increased ridership both inside the charging zone and more widely. Reduced congestion on the roads has enabled more busses to be run with much more reliable journey times. Ridership has increased 38%, and half of this is estimated to be due to charging. Service provision has been increased 23%. Average bus occupancy has increased but over-crowding has been avoided. Most of the net revenues generated by the charge are being invested in bus services.
Net revenues have been significantly below the projected 130 million pounds, expected to be 68 million pounds in 2003/4, due to a number of factors. The reduction in traffic has been at the very top end of the modeled effects of the scheme, many more vehicles have been granted discounts than originally foreseen and levels of evasion have been higher than expected. Part of the problem may have been that the contract with the system operator did not provide incentives for minimizing the number of drivers failing to pay. The contract’s performance regime has since been adjusted to improve things and revenues of 80 to 100 million pounds (Euro 120-150 million) are expected in future years.

By reducing overall volumes of traffic within the charging zone, and smoothing traffic flows, charging is estimated to be directly responsible for an approximate 12% reduction in emissions of both NOx and fine particles (PM$_{10}$) from road traffic. Only very small changes in emissions have been recorded on the ring road (± 2%). The reduction in CO$_2$ emissions from traffic is estimated to be 19%. No significant changes in noise levels have been recorded.

Generally the congestion charge has been accepted by the public and by business, and the London Mayor, responsible for introducing the charge, was returned to power in the June 2004 mayoral election. Some retail businesses blame the charge for falling sales in their central London stores, but the majority reports no significant impact on their businesses. The most serious public concern is perhaps with inappropriate enforcement practices. There have been a number of high profile cases of insensitive handling, albeit relatively small in number. In some cases, drivers living far from London have received penalty notices, ignored them because they have never driven in London, and been perused in the courts for payment of large fines. Administrative mistakes and erroneous monitoring are sometimes at fault. In other cases, criminals using false number plates are responsible, and in these cases the police services are authorized access to the monitoring system. Except in the case of persistent offenders, all records from the monitoring system are destroyed, a procedure that has avoided public concerns over invasion of privacy.

The success of the charge has resulted in the Mayor proposing to extend the charged area to cover all of central London (see figure 10). The charging system and level of charge would stay the same and be applied to a single zone roughly double the size of the present charging area. Extension is projected to result in a 5 to 10 percent reduction in traffic in the new area, and a 10 to 20 percent reduction in congestion there, with a further reduction in congestion of 1 to 2 percent in the zone already charged. The extension could be in operation by 2006 subject to the result of ongoing consultation with stakeholders.

**Rome**

In 1989 the Government of Rome designated a limited traffic zone in the centre of the city, covering the network of narrow streets in the heart of the city, most of the important architectural and archeological sites and most ministries and major government buildings (see figure 11). From 1998, annual permits for entry into the area were made available at cost of Euro 340, with residents permitted free of charge. Enforcement, through police officers posted at entry points, proved difficult until an electronic monitoring system was introduced to control entry, in 2001. Illegal entry fell dramatically.

The charging zone (areas A to F in figure 11) covers 4.6 km$^2$ and entry is controlled on weekdays from 6:30 to 18:00 and Saturdays from 14:00 to 18:00. Vehicles entering the zone must be equipped with an on-board unit and are monitored by road-side transponders and video cameras (figure 12). Public vehicles, handicapped drivers and resident businesses are all exempt: only 19% of vehicles entering the zone pay the charge.
Figure 11. Rome's Limited Traffic Zone


Figure 12. Monitoring Entry to the Zone

The aims of the limiting entry to the area are to reduce congestion, pollution and noise, favour public transport, reduce accidents and protect public health and archeological buildings. The road charging system has reduced traffic in the controlled zone by 20% overall with a 15% cut in peak traffic. Significant reductions in pollutant emissions have also been recorded. Revenues are estimated by the author to be around **Euro 10 million** per year. Compared to London, the Rome system is very small, and traffic diversion to the inner ring road has been significant. Strong growth in motorcycle and scooter use, vehicles exempt from the charge, is also evident. Possible extension of the system has been studied but there are no current plans to do this.

**Stockholm**

In June 2003, the Stockholm Municipal Council accepted a majority proposal to introduce congestion charges on a trial basis. Stockholm plans to introduce a charging system using similar technology to Rome in June 2005, with a referendum to be held on whether to continue or end charging one year later in conjunction with the 2006 elections. The size of the area for charging is intermediate between Rome and London.

The objectives of the trial are as follows:

- to reduce traffic volume by 10-15 percent on the most heavily used routes during morning and afternoon hours;
- to improve accessibility for buses and cars in the inner city;
- to cut emissions of carbon dioxide, nitrogen oxides and airborne particles in the inner city;
- to improve the environment for people in the inner city at the street level.

The charge is expected to cut traffic 20% in the city centre in the morning rush hour, and reduce traffic crossing the system boundary 33% during the morning peak.

The system will have an outer boundary at a ring of toll gates around the inner city (see figure 13). Tolls will be levied on passage into and out of the inner city on weekdays during the day. The proposed schedule of charges is given in table 2. Commercial road users and private vehicles will be offered the option of paying a maximum charge per day and vehicle of 60 SEK.

<table>
<thead>
<tr>
<th>Period</th>
<th>6.30-7.00</th>
<th>7.00-7.30</th>
<th>7.30-8.30</th>
<th>8.30-9.00</th>
<th>9.00-15.30</th>
<th>15.30-16.00</th>
<th>16.00-17.30</th>
<th>17.30-18.00</th>
<th>18.00-18.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krona</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>15</td>
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</tr>
<tr>
<td>Euro</td>
<td>1.09</td>
<td>1.63</td>
<td>2.18</td>
<td>1.63</td>
<td>1.09</td>
<td>1.63</td>
<td>2.18</td>
<td>1.63</td>
<td>1.09</td>
</tr>
</tbody>
</table>


The following categories of traffic will probably be exempt from charges. Emergency vehicles, vehicles with disability permits, vehicles generally exempt from taxation, buses on scheduled routes, environmental vehicles as defined by Stockholm Municipality (e.g. ethanol and biogas), taxis, transport services for the disabled, school buses and motor cycles. Revenues from the charge will be for investment in public transit and infrastructure associated with the trial. The revenue is not intended to reduce Stockholm’s level of other government funding for infrastructure.
Other Cities

Six Norwegian cities operate electronic toll rings. Oslo was the first to introduce charges, in 1990. The technology used is basically the same as the Telepass system used in Rome. The Norwegian systems differ from other urban road pricing systems in that they were introduced to raise revenues for new infrastructure investments, mainly road tunnels, rather than to manage traffic. They do nevertheless affect traffic levels and the possibility of differentiating charges to enhance traffic management is under examination in some of the cities.

A number of towns in Italy (Milan, Bologna) and Britain (Edinburgh, Bristol) are developing electronic urban road pricing systems for introduction is local populations and politicians agree. Experiments are underway, or recently completed, in Bristol, Copenhagen, Gothenburg, London, Atlanta, Minneapolis and Seattle to apply satellite monitoring systems to cars in urban areas to price road use more directly in proportion to costs. Copenhagen recently completed successful trials tracking cars by satellite, yielding a wealth of detailed information on traffic and congestion, but has no plans to introduce road pricing. Bristol has been working to resolve difficulties in ensuring continuity of monitoring by satellite in areas with high rise buildings, tunnels and fly-overs. The system being developed is designed for implementation. Achieving political agreement to go ahead is
complicated by the frequency of council elections in the United Kingdom, with a proportion of councillors being replaced every year.

Also in the United Kingdom it is worth noting the impacts of introducing a very small road charging scheme in the city of Durham. Durham is a small town with a historic centre on top of a steep hill. The main shopping area is a narrow street running through the mediaeval centre that was chronically jammed with cars and delivery vehicles blocking pedestrian access to the shops. Vehicles that wish to use this street now have to pay the modest fee of two pounds (three Euros) with the revenues used to support a frequent bus service up and down the hill to the city from outlying car parks. The buses can be used for multiple trips at a charge of fifty pence (Euro 0.72) a day. Traffic in the street has fallen 85% and sales in the shops increased since charging began.

4. Road Pricing Policy Directions in Europe

The electronic truck charges and urban road pricing systems reviewed in this paper demonstrate the increasingly central place for road pricing in transport policy in Europe. For efficiency and to reduce environmental costs, road users should be charged according to the costs they impose on the infrastructure manager and the wider community. This principle is increasingly, if not universally accepted by transport as well as environment Ministers. It is subscribed to in two resolutions of the European Conference of Ministers of Transport. These promote a stepwise reform of charges and taxes to improve the efficiency of transport, avoid discrimination and distortion of competition and provide incentives to reduce the environmental impacts of transport and manage congestion. They recommend gradually shifting the structure of taxation to increase the share of more territorially based charges, such as tolls, electronic kilometre charges and urban road pricing. In 2003, the Conference published a report, Reforming Transport Taxes, that concluded the ultimate aim is to introduce charges at a level in line with that for other goods and services in a market economy; that is close to marginal costs (including external costs). This is also the conclusion of the European Commission in its 1998 green paper Fair Payment for Infrastructure Use and subsequent white papers.

The Swiss Heavy Vehicle Fee has been very influential in shaping policy at the level of the European Union. The model of charging for the use of roads on the basis of estimated marginal social costs and using the revenues raised to support rail freight and public transport investments was adopted in the 2001 White Paper European Transport Policy for 2010. The paper proposed a framework Directive on pricing for the use of transport infrastructure in all modes and a regulation setting out methodologies for estimating marginal costs. In the end, neither of these were produced. The plan was then to prepare “daughter directives” for each of the modes, equivalent to the Directive on charges for the use of rail infrastructure, 2001/14/EC, already in force and which does take marginal costs as the basis for charging. The Commission has also sponsored a large body of research into the pricing relevant costs of transport and the implementation and acceptability of pricing reforms.

These principles for charging have been put to the test in European legislation on heavy goods vehicles, the so-called Eurovignette Directive. The Directive sets minimum levels of annual vehicle taxes, in order to limit tax competition (that is attracting companies to change location through lower rates of tax), and upper limits for road tolls and road use charges. These are capped at a level calculated according to the costs of constructing the infrastructure being charged for. The 1998 White Paper and the ECMT reports argue that this is not the appropriate reference point for charges. It will on average result in higher than optimal charges, but used as an upper limit prevents charges rising as high as they ought to where environmental costs are high and, especially, in order to manage congestion effectively. Deviation from the recommendations of the 1998 White Paper was required in order to get political agreement on the Directive. Ministers found the expenditure criterion to have a
simpler logic than relating charges to marginal costs and thought it a more practical target for enforcement.

Nevertheless, work began almost immediately on revising the Directive to bring it closer in line with the principles for efficient charging. Initial drafts of the amendments proposed basing charges on a common methodology to calculate social marginal costs. However, this time the Commission itself found it difficult to agree on this approach and believed political agreement would be unlikely. The amendments issued in March 2004 therefore retained a formula for maximum charge rates based on estimates of expenditure. It did, however, introduce much greater differentiation of charges, in relation to truck emissions class and in relation to congestion, and allowed for mark-ups in sensitive areas (areas of high population density or environmental sensitivity). This would be a significant step in the right direction, even if the scope for differentiation in relation to congestion (a ratio of 1:2 between highest and lowest charges) is far too restricted to be effective in managing traffic.

The EU’s Transport Council was unable to come to agreement on the amendments during the term of the Commission that left office in July 2004. One of the main problems was a requirement for all revenues raised to be earmarked for expenditure in the transport sector – not always the most efficient use for road pricing revenues. Estimating relevant expenditures was also found to be far from simple. The amendments will have to be revised and re-submitted under the new Commission and may change substantially.

Establishing an upper limit to charges will continue to be the most difficult of the issues to be solved in reaching an agreement. Some peripheral countries fear that their trade and transport industries might be damaged if more central countries require a greater share of costs must be paid by users. They are wary of user charges in central parts of Europe based either on recuperating all the expenditure on roads or on the full costs of using roads (including costs related to congestion, accidents and the environment).

Countries where congestion is widespread can expect either of these two approaches to raise similar revenues. The political issue in these countries is how far interest groups will accept the substitution of user charges for general taxation as the means of funding infrastructure development. The economic concern is that although average charge levels might be similar whichever approach is followed, the distribution and differentiation of charges is very different; the traffic management benefits and environmental incentives available to road pricing systems are lost if charges are not based on the actual costs of use, or not sufficiently differentiated in time and space.

These dilemmas may contain the seeds for a resolution. Pressure from electorates to restrain user charges nationally might be relied upon to limit charges to acceptable levels without the need for a cap agreed internationally, freeing governments to base charges on the costs they perceive as most important in their current situation. Moreover, should a cap be found desirable to promote integration of peripheral countries (in place of more direct forms of regional development support) only the level of charges need be the subject of restriction, not the way in which charges are formulated.

The existing directive is certainly out of date and needs to be replaced. As time moves on, marginal costs are likely to prove the durable reference point for pricing as they are based on economic theory. Although superficially attractive, the alternative approach of basing charges on the average costs of providing infrastructure has proved little easier to accept than charging according to social marginal costs.

The European Commission has not attempted to regulate road pricing for passenger cars, leaving this to the competence of local and national governments in the interests of subsidiarity. For freight,
creation of the single market over-rides issues of subsidiarity. The Environment Commissioner has issued a communication on passenger car taxation\textsuperscript{23}, in September 2002, but restricted herself to recommending changes to registration taxes, calling for differentiation according to specific vehicle CO\textsubscript{2} emissions or their replacement with annual road taxes and fuel taxes.

The most far reaching developments for Europe in relation to road pricing for cars are taking place in the United Kingdom. The success of the London Congestion Charge, and the re-election of the Mayor following such a major fiscal reform, have greatly increased interest in urban road pricing in local governments around the world. It has also encouraged the national government of the United Kingdom to review the possibility of introducing road pricing for cars across the country. The results of a feasibility study\textsuperscript{24}, produced by a steering group including most of the important stakeholders (automobile associations, freight and general industry representatives, local government and academics), were published by the Department for Transport on 20 July 2004.

The study concludes that national road pricing is becoming feasible, and it could meet the objectives that the Government has set for managing road traffic and developing the national road network. A national scheme is at least 10 years away. In the meantime, a number of congestion charging schemes at the more local level, and charging on new strategic road capacity (the government is currently considering more roads like the M6 toll relief motorway), would amount to a trajectory towards a national road pricing system, leaving open until the appropriate future moment choices either of principle or method that would have to be made along the way.

A number of recommendations are made for next steps and these are endorsed in the Government’s new transport policy\textsuperscript{25}, also published in July 2004. The policy paper commits the government to the following actions.

- To inform the public on what road pricing is and how it might work and undertake the research recommended by the feasibility study.
- To lead a debate on what would make such pricing acceptable to motorists.
- To seek to build a public consensus around the objectives of road pricing, and on how to use the revenues it produces.
- To work alongside forward-looking local authorities to help them put in place packages of measures which tackle local congestion problems. Resources from a new Transport Innovation Fund will be able to support packages that combine road pricing, modal shift and better bus services.
- To begin a process leading to international standards for in-car equipment, taking account of current, market-led developments.

A fuller response to the feasibility study is promised, but it is clear that the British government is heading gradually towards the introduction of national road pricing for all vehicles and will engage with the European Union and Europe’s transport ministers to develop a coherent international approach.

Finally, the most recent statement of policy from European transport ministers towards road pricing\textsuperscript{26} was agreed by ECMT’s 43 Ministers at the meeting of their Council in Ljubljana in May 2004. The recommendations agreed to are attached below in Annex 1.
ANNEX 1: RECOMMENDATIONS FROM THE 2004 E.C.M.T. COUNCIL POLICY NOTE ON CHARGING FOR THE USE OF INFRASTRUCTURE

Ministers agreed to:

NOTE the successful implementation of electronic road pricing systems for urban traffic management and interurban freight haulage in a number of Member and Associate countries, and in particular that:

- the systems implemented have been effective in delivering results;
- negative side-effects have been minor;
- charging systems can be adjusted rapidly in case of need, in contrast to investments in infrastructure which are largely irreversible.

CONSIDER promoting the introduction of electronic charges for the use of roads and providing powers and incentives for local government to introduce charges to manage urban traffic, especially where other measures have not been effective and where serious problems exist with respect to:

- congestion;
- and improving the urban or natural environment.

CONFIRM their attachment to the principles for the reform of transport charges and taxes agreed in previous decisions:

- Non-discrimination, in relation to nationality in the level of charges applied;
- Efficiency, to drive economic benefits and make economies more competitive;
- Interoperability for electronic charging systems;
- Consistency, ensuring all transport tax changes move in the right direction;
- Fairness;
- The polluter pays.

PURSUE interoperability for electronic charging systems and support the efforts underway in the European Union to this end, ensuring national industrial interests are not put before the common economic interest;

NOTE the value of understanding the costs to which charges are related, particularly in regard to road haulage, and that there may be benefits to following a common international approach to charging in this sector;

NOTE, nevertheless, that for efficiency charges must be related to the local costs of infrastructure use and therefore a certain degree of freedom for national and local governments to set prices is appropriate;

REVIEWS all bilateral exemptions to road user charges, as following a common international approach implies ending such inherently discriminatory arrangements;

NOTE that pricing reform will alter the type, location and magnitude of infrastructure investments required. Project assessments and long term infrastructure plans must take full account of changes in the transport pricing environment.
## ANNEX 2: DIFFERENTIATED TOLLS, CORDON CHARGES AND ELECTRONIC KILOMETRE CHARGES WORLDWIDE

<table>
<thead>
<tr>
<th>Location and Name</th>
<th>Rate Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austria</strong></td>
<td>LKW Maut</td>
<td>Undifferentiated truck km charge based on roadside microwave transponders. Entered service January 2004.</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>Toronto, Highway 407</td>
<td>Peak and off-peak toll.</td>
</tr>
<tr>
<td></td>
<td>A14</td>
<td>Peak and off-peak tolls</td>
</tr>
<tr>
<td></td>
<td>Marseille, Prado-Carénage Tunnel</td>
<td>Day toll and night toll</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td>Copenhagen</td>
<td>Trials with road pricing for cars based on satellite monitoring completed in 2003, no current intent to introduce full scale system.</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>LKW Maut</td>
<td>Electronic truck km charge based on satellite tracking. Introduction delayed from August 2003, expected in 2004/5.</td>
</tr>
<tr>
<td></td>
<td>Genoa</td>
<td>Cordon charge to enter 2.5 km² city centre, based on automatic number plate recognition technology.</td>
</tr>
<tr>
<td></td>
<td>Bologna, Milan, Sorrento</td>
<td>Cordon pricing experiments near ready for full scale application</td>
</tr>
<tr>
<td><strong>Korea</strong></td>
<td>Seoul, Namsan #1 and #3 Tunnels</td>
<td>Day toll, nights and Sundays free</td>
</tr>
<tr>
<td><strong>Norway</strong></td>
<td>Trondheim, Toll Ring around city</td>
<td>Peak toll, off-peak toll, and free at night, road-side transponder based cordon charge.</td>
</tr>
<tr>
<td></td>
<td>Bergen, Toll ring around city</td>
<td>Toll during day, free at night, road-side DSRC based cordon charge</td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>Electronic Road Pricing</td>
<td>Multiple peak-period pricing rates, based on road-side transponders.</td>
</tr>
<tr>
<td>Country</td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sweden</td>
<td>Stockholm</td>
<td>Road side transponder based cordon charge to enter city to be introduced in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mid 2005 with peak and off peak charges. Referendum to be held after first</td>
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<tr>
<td></td>
<td></td>
<td>year of operation.</td>
</tr>
<tr>
<td></td>
<td>Gothenburg</td>
<td>Trials with road pricing for cars based on satellite monitoring completed in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2003. No intent to go to full scale system.</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Heavy Vehicle Fee</td>
<td>Electronic truck km charge based on road side transponder system linked to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tachograph, with satellite tracking back-up.</td>
</tr>
<tr>
<td>United</td>
<td>Birmingham, M6 Motorway</td>
<td>Day toll and night toll, electronic toll option.</td>
</tr>
<tr>
<td>Kingdom</td>
<td>relief road</td>
<td>Flat rate charge for daytime travel anywhere in central London (20.5 km²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>area). System based on automatic number plate recognition.</td>
</tr>
<tr>
<td></td>
<td>Dartford-Thurrock Crossing</td>
<td>Reduced night time fee for trucks. Optional electronic tolling.</td>
</tr>
<tr>
<td></td>
<td>Crossing (Thames crossing</td>
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<td></td>
<td>on M25 London orbital road)</td>
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</tr>
<tr>
<td></td>
<td>Durham, Saddler Street</td>
<td>Daytime fee for use of road through historic centre of town, Monday</td>
</tr>
<tr>
<td></td>
<td>and Market Place</td>
<td>through Saturday.</td>
</tr>
<tr>
<td>USA</td>
<td>Florida, Cape Coral and</td>
<td>Regular toll and shoulder period toll discounts</td>
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<tr>
<td></td>
<td>Midpoint Bridges</td>
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</tr>
<tr>
<td></td>
<td>California, SR-91</td>
<td>Variable toll with HOV discount</td>
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<tr>
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<tr>
<td>California</td>
<td>San Joaquin, Foothill,</td>
<td>Peak-period, peak-direction premium</td>
</tr>
<tr>
<td></td>
<td>and Eastern Toll Roads</td>
<td></td>
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<td></td>
<td>Houston, I-10 (Katy</td>
<td>HOT lane with toll during the peak</td>
</tr>
<tr>
<td></td>
<td>Freeway)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Houston, US-290</td>
<td>HOT lane with toll during the peak</td>
</tr>
<tr>
<td>Missouri,</td>
<td>Lake of the Ozarks Bridge</td>
<td>Summer and winter rates</td>
</tr>
<tr>
<td></td>
<td>New Jersey Turnpike</td>
<td>Cash toll, off-peak toll, peak toll, and weekend toll</td>
</tr>
<tr>
<td>Authority</td>
<td>Authority Roads (except</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garden State Parkway)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Port Authority of New</td>
<td>Cash toll, peak toll, off-peak toll, night toll and a HOV discount</td>
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<td>York and</td>
<td>York and New Jersey</td>
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<td></td>
<td>Crossings</td>
<td></td>
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<tr>
<td></td>
<td>New York, Tappan Zee</td>
<td>Peak period surcharges for trucks, HOV (3+) discounts;</td>
</tr>
<tr>
<td></td>
<td>Bridge</td>
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<tr>
<td></td>
<td>Spring Valley Toll Barrier</td>
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<td>San Diego, I-15</td>
<td>HOT lane with variable toll rate</td>
</tr>
<tr>
<td></td>
<td>Virginia, Dulles Greenway</td>
<td>Cash toll, ETC toll, and weekend discount</td>
</tr>
</tbody>
</table>

Primary source: Mark Burris, Assistant Professor Texas A&M University completed by ECMT.
Notes and References

1 The author would like to acknowledge the work of contributors to ECMT Conference on Managing Transport Demand through User Charges, held in London with TfL in January 2004 on which this paper draws (see http://www1.oecd.org/cem/topics/env/London04.htm).

2 The views expressed in this paper are the author’s own and do not necessarily reflect official positions of the European Conference of Ministers of Transport.


5 See the ECMT Road Haulage Taxation Database on the web at http://www1.oecd.org/cem/topics/taxes/taxpub.htm#annexB3.

6 The window of opportunity, Paper prepared for the OECD by U. Balmer, Federal Office for Spatial Development.

7 Fair and Efficient, the Swiss heavy vehicle fee, Federal Office of Spatial Development, Berne 2002.


9 See presentation to be posted on the following conference web site http://www.eimrail.org/press_and_news_frameset.htm.asp?htmcat1_id=2


13 See the analysis set out in Reforming Transport Taxes, ECMT Paris 2003 and the data available in the ECMT Road Haulage Taxation Data Base, http://www1.oecd.org/cem/topics/taxes/taxpub.htm#annexB3


16 See Progress website for details http://www.progress-project.org/.


19 Fair Payment for Infrastructure Use: a phased approach to a common transport infrastructure charging framework in the EU, COM(1998)466; see also the 1995 Green Paper, Towards Fair and Efficient


