



PERGAMON

Transport Policy 8 (2001) 289–294

TRANSPORT
POLICY

www.elsevier.com/locate/tranpol

Making urban road pricing acceptable and effective: searching for quality and equity in urban mobility

José M. Viegas

CESUR, Instituto Superior Técnico; and TIS.PT, Transportes, Inovação e Sistemas, s.a. Lisboa, Portugal

Received 1 June 2001; revised 1 July 2001; accepted 1 July 2001

Abstract

Urban Road Pricing has been proposed many times as a powerful instrument to fight congestion in urban traffic, but has systematically faced a hostile political environment, due to lack of confidence on its promised (traffic) results and fear of its political consequences. Lack of action in this front is contributing to stable or even growing congestion problems in most large cities.

This paper tries to address the problem with a fresh look at the objectives of road pricing and at the reasons for that political hostility. For managing and developing the urban mobility system, efficiency and equity are normally taken as the basic economic objectives. Sustainability objectives may be integrated in the efficiency objective if we are able to represent adequately the costs of the resources consumed in the process. Political hostility is normally based on having to pay for what was freely available, and on the risk of exclusion for those with little revenue available for the extra cost of driving into the city.

Pursuit of efficiency leads to suggestion of marginal social cost pricing but this is hard to explain to the public and application of this principle is fraught with pitfalls since some components of that cost get smaller as traffic grows (noise related costs for example). Pricing is still a good option but the objective has to be something easier to understand and to serve as a target for mobility managers. That “new” objective is quality of the mobility system, with a meaning similar to that of “level of service” in traffic engineering, and prices should be managed to across space, time and transport modes in such a way that provision of service is made with good quality in all components.

Pursuit of equity leads to some form of rationing, which has often been associated with high transaction costs and abuse by the administrators. But the use of electronic road pricing should allow easy ways to address the rationing process without such high costs. The basic proposition is that all local taxpayers receive as a direct restitution of their tax contribution a certain amount of “mobility rights”, which can be used both for private car driving in the tolled areas and for riding public transport.

These principles are easily applicable with a variety of technical solutions for road pricing, from the simplest cordon pricing to the more sophisticated “pay-as-you-go” schemes. The paper addresses this question of implementation and argues for increasingly sophisticated schemes, as people get accustomed to the principles and finer targeting of demand segments may be needed. © 2001 Elsevier Science Ltd. All rights reserved.

Keywords: Congestion; Efficiency; Road pricing; Acceptability; Equity; Fairness; Rationing

1. Fighting congestion with urban road pricing: from economists' preferences to politicians' fears

Urban road pricing has long been in the list of preferred approaches by economists to solve the urban traffic congestion problem. The introduction of prices to manage demand of private car access to city centre has been recognised by economists as a powerful instrument (Vickrey, 1963; Button, 1995), and numerous research projects and publications have been dedicated to developing models and showing the expected results of such measures on road traffic saturation levels: Even if we cover only EU funded research, we find projects TRANSPRICE, FISCUS, FATIMA, AFFORD, PETS, PATS and CAPRI in the 4th

Framework Program, and PROGRESS and CUPID, just on the first wave of the 5th Framework Program.

At the same time, politicians in many cities have been regularly receiving these suggestions but have systematically considered them as inappropriate and politically not acceptable. This probably means they are seeing dimensions of the problem that the economists are not considering. The only exceptions to this refusal are Singapore and the Norwegian cities of Oslo, Bergen and Trondheim, but on these three this introduction has been motivated by objectives of financing capacity expansion of the transport system, and not demand management per se, although it can be argued that the overall final result of a transport system with better quality was the same.

In the recent past, some cities seem more willing to take the road pricing approach, namely London where the new mayor, Ken Livingston, has put it explicitly in his election manifesto, and several other British cities (Edinburgh, Bristol) which have been taking visible preparatory steps in that direction. In all these cases, the major factor in favour of road pricing seems to be that citizens are no longer willing to face recurrent heavy congestion and believe that all other sensible approaches have been tried without success. So, it comes as a solution of last resort, but without strong support. The question should then be: can it be introduced as a positive approach instead of the least negative one?

2. Objectives in the broad picture: efficiency, effectiveness, acceptability

If we consider the arguments put forward by economists in the discussions about this issue of congestion and road pricing as a measure to fight it, the objective of efficiency always comes forward, in most cases associated with prices based on marginal social costs.

If we accept dominance of the efficiency objective, this approach is certainly correct in a theoretical world where all prices would be based on marginal social costs, but creates some risks in the real world where many prices are fixed in ways that are far from that principle. If road pricing is to be effective against congestion, some trips will be changed in mode, others in time, some others in space, and possibly some others cancelled altogether. It is assumed that each citizen's change of behaviour will be made considering his best adaptation to the new circumstances, but urban mobility is related to so many activities that, even if we could estimate such direct consequences (on the trips made), it is almost impossible to predict the consequences in terms of business location and reorganisation, employment, overall attractiveness of the city centre, etc.

If road pricing is to be effective, prices have to be real prices, not just tips, i.e. give a signal of shortage and induce behavioural changes. But the complexity of the chain effects of transport implies that great care has to be exercised on the selection of pricing regimes and implementation of road pricing schemes, trying to avoid drastic changes of behavioural patterns that would seriously disrupt existing balances and create strong anxiety in employers and employees in the more affected zones, with the inevitable consequence of suggesting retreat to the politicians who would have had the courage to take the initial steps.

If we try to see the wider picture of the city centre and the pain that is inflicted on it by severe traffic congestion, and if we want to avoid "killing the patient with the cure", we must proceed with caution and consider a richer set of objectives than just economic efficiency. This objective is not to be forgotten, but has to be pursued gradually, whilst considering the more visible objective of effectiveness—

making progress on congestion relief—and the constraint of acceptability—having people believe things are being done properly and fairly, in a way that considers the multiplicity of interests present in that society, and thus keeping trust on their elected representatives.

3. Equity and accountability at centre stage of acceptability

Besides efficiency, equity and sustainability are normally taken as basic objectives in the definition of transport policy. Sustainability objectives may well be integrated in the efficiency objective if we are able to adequately represent the costs of the resources consumed in the process, through internalisation of external costs, and this has been shown in the FISCUS project (FISCUS, 2000) to be possible (with some margin for error) in the urban mobility setting, even if relatively poor data is available.

On the topic of equity, one can discuss whether this is really a case of equity or of distribution of some kind of benefits. Besides the fact that there is a significant body of literature that uses the term "transportation equity" (for instance Federal Transit Administration, 1995; Banister, 1994; Giuliano, 1994; Allen et al., 1994), it is the question of fairness in access to road infrastructure (and on the conditions for that access) that is at stake. So, bearing in mind this possibility of two starting conceptual points (equity or distribution) we keep using the term equity in the remaining of this paper.

Since acceptability is strongly connected with the perception of fairness of the proposed measures, it is useful to start this discussion by invoking Rawls' Theory of Justice (Rawls, 1971) and his first principle, stating that "each person is to have an equal right to the most extensive system of equal basic liberties compatible with a similar system of liberty for all". Even if Rawls' examples of basic liberties are more related to civic areas (liberty of thought and expression, right to integrity of person and to non arbitrary or violent treatment), in most modern societies where congestion is recurrent the argument on the basic right to drive freely to gain access to any part of the territory is often heard. So, even if our problem falls more within Rawls' second principle, dedicated to distribution of income and wealth (and by extension, benefits), we cannot ignore the views that put it in the realm of the first principle.

Even if we want to admit that there is a basic right to drive one's car freely, we must bear in mind that the exercise of this right in dense urban areas is jeopardising other rights, namely the right to a tranquil and safe urban environment, and the right to clean air. And Rawls has admitted constraints to basic rights if they were coming into conflict with other basic rights, provided the resulting rights are equally shared.

Analysis of this issue alone can be rather complex, as several dimensions of equity concerns can be invoked

(PATS, 2000):

- *horizontal equity*, associated with the principle of equality of opportunities, which can be translated in this case to:
- *territorial equity*, associated with the right to mobility, and provision of identical conditions for citizens living in all parts of a certain country;
- *vertical equity*, associated with the protection of those in worst conditions;

as well as another dimension which must be considered since we are dealing with a system that is facing a deterioration of resources available for each consumer:

- *longitudinal equity*, associated with the comparison of conditions between present and past, for each citizen individually, and for social groups (balance of gains and losses).

For the discussion of urban road pricing the two most pressing dimensions of equity are longitudinal equity—having to pay for what previously was freely available and taken by many as a basic right—and vertical equity—risk of exclusion from access to a wide range of urban functions for those with little revenue available for the extra cost of driving into the city. While some schemes have tried to address the latter, we are not aware of any other author proposing solutions that address the former.

Applied to our case, Rawl's second principle says that inequalities are to be arranged so that all privileges must be open to all under conditions of fair equality of opportunity, and that those inequalities are to the greatest benefit of the least advantaged. The system proposed below in this paper goes in this direction although it might be called “imperfect procedural justice” as it is clear that, while improving efficiency, only partly we can bring more advantage in a payment scheme for those with lower revenues.

Besides the issue of equity, another topic seems to be central in the acceptability discussion, namely the application of the net revenues generated by the road pricing schemes (Goodwin, 1989; Small, 1992), which includes issues of fairness and accountability. In a time when there is growing mistrust of politicians' handling of tax money, and in the presence of a case in which it is obvious that the price paid does not correspond to additional consumption of publicly owned goods or services, most respondents in surveys (PATS, 2000) consider the application of significant parts of the generated revenues into improvements of the mobility system as paramount to for the credibility and acceptability of the whole scheme.

Applying a part of the revenues on improvements of the local roads is logical and effective, as it is known that very often bottlenecks in a few specific points are responsible for widespread congestion, and a regular supply of money can

help achieve a more balanced level of capacity across the network. Besides, this helps fight the notion that road pricing is just another tax in disguise, bringing it closer to the concept of a charge. In any case, the notion that all road capacity problems in urban areas can be solved with additional money (through construction of more roads) has to be dismissed unless we accept that urban landscape and character have very low value against the pressure of the car.

Application of another part of this revenue in the public transport supply has two advantages:

- it reduces the sacrifice (loss of utility) associated with those trips that will be shifted from private car to public transport;
- it benefits the least advantaged—who would ride on public transport anyway—by giving them a better service, wider territorial coverage or both.

and so is generally found to be well accepted both by car drivers and by the rest of the population.

4. Aiming at quality of the mobility system, based on a mix of pricing and rationing

Congestion pricing is easy to explain, and in fact it is widely applied in many sectors of the economy subject to peaks in demand, like hotels in the holiday season, publicity in TV shows, etc. But in these and other cases, we are dealing with free markets, and price setting is guided by considerations that have nothing to do with equity and fairness.

Transport economists have argued time and again that the search for maximum efficiency in the provision of a scarce resource is achieved by application of marginal cost pricing, and this has been the basic recommendation in several policy documents of the European Union (see for instance European Commission, 1998; High Level Group on Transport Infrastructure Charging, 1999).

But marginal social cost pricing is hard (or impossible) to explain to the public and application of this principle is fraught with pitfalls since some components of that cost get smaller as traffic grows (noise related costs for example).

Pricing is still a good option but the objective has to be something which is easier to understand and serve as a target for mobility managers. So, it is wiser to adopt another formulation for the objectives, namely what can be called quality of the mobility system—with a meaning similar to that of “level of service” in traffic engineering—and prices should be managed across space, time and transport modes in such a way that provision of service is made with good quality in all components of the mobility system (Viegas and Macário, 1999). To a large extent, if we were talking only about private cars, this would be equivalent to ensuring that congestion would not go beyond a predefined threshold.

The issue of internalisation of external costs, so crucial when marginal social cost pricing is adopted, can still be

tackled, as part of the total price can be allocated to this item. In urban areas, if we consider the relation of the costs related to the main external effects of traffic (emissions, accidents, infrastructure) with the traffic volume in any link, they are typically linear or less-than-linear (FISCUS, 2000), so their contribution to total transport costs can be charged in average terms, which is easy to understand and allows full recovery of those costs.

The dose-response curves associated to the concentration of toxic gases in the atmosphere are clearly non-linear in many cases, with a strong upwards surge when a (tolerance) threshold is reached, but here we are addressing the case of the marginal effects of a stream of traffic in a pre-existing environment, and for this case the (piece-wise) linear behaviour is a correct description.

Congestion is handled with a separate logic, since its costs are distributed only among those travelling in the same time and space. And that logic is the usual one in market economies: higher prices reduce the quantity of demand, which tends to be diverted to alternative forms of supply (here, other places, times or modes), thus allowing higher quality of service. In parallel, selective application of (part of) the revenues generated can be expected to improve the capacity of some critical components, for which good alternatives were missing.

So, we can still be in pursuit of higher efficiency, but the objective is translated into terms that are more understandable to the public, and progress towards that objective made easier to measure through commonly accepted engineering performance indicators. And pricing levels can be adjusted progressively, as we move from chronic congestion to more satisfactory levels of fluidity, giving time to all agents in the urban fabric to review their strategies. Each city will have to find its preferred levels of congestion, corresponding pricing, and transition path.

For dealing with equity, the introduction of subsidy to poorer drivers has sometimes been suggested (see for instance a review of this issue in Richardson and Bae, 1998) to avoid exclusion through transport prices, but this only addresses the issue of horizontal equity, not that of longitudinal equity.

For this we should recur to another instrument, largely used to handle scarceness problems: rationing (by which all relevant citizens receive a free ration of the scarce good). Such schemes are often associated with high transaction costs and abuse by the administrators, but the use of electronic road pricing clearly suggests easy ways to address the rationing process without such high costs. A free mobility ration for all residents is easier to manage and more acceptable than allocating discounts to particular social groups, since the correct delimitation of these groups always raises susceptibility and is prone with risks of administrative abuse.

Rationing has often been used when the main purpose is equity, pricing being the dominant instrument when efficiency is the main concern, and the suggestion made

here is to associate these two types of instruments (Viegas, 1996; Jones, 1998). The basic proposition is that all local taxpayers receive monthly, as a direct partial restitution (in kind) of their tax contribution, a certain amount of “mobility rights”, which can be used both for private car driving in the tolled area and for riding public transport. Any consumption of mobility above this threshold would be subject to payment, as it would from the outset for any non resident.

Counting of mobility units can be made in many different ways, either through passing of cordons or by length of drive, measured in time or in distance. It is even possible, without additional hardware, to differentiate consumption of driving time and of parking time (Viegas, 1994). And, in line with marginal cost pricing, each unit of mobility (for instance one vehicle.km) should have a higher price in peak periods than off-peak, higher in heavily congested areas (or links) than in moderately congested ones (Viegas, 1998)

Free allocation of “Mobility rights” may seem strange, but we have to remember that we start from a position in which car drivers enjoy an unlimited quantity of such rights, against taxes paid, partly in a fixed amount (registration and annual circulation), partly in a variable amount (gas duty). So, this “free ration” is only a reduction of current rights, but not their total extinction. And in fact, the gas duty paid for those “free” trips still makes them subject to similar charges to the present situation.

Extension of these rights to the use of public transport (also in a limited manner) is primarily intended to serve as an incentive to shift to public transport, but also as an instrument to put these measures to the benefit of the least advantaged, who do not own a car or drive it everyday.

The alternative of giving the equivalent amount of money to those least advantaged would have two major disadvantages:

- effective filtering of the candidates would have high transaction costs and a high risk of fraud;
- the money could go out of the mobility system, instead of staying within and help improve its quality. The cost structure of public transport is such that it is the level of provision (territorial coverage and frequency of service), not the occupancy of the vehicles, that determine the cost level, so there is a much lower marginal cost of transporting those passengers than the utility for them being transported.

The well known risks associated with bimetalism¹ do not seem to apply here (as they do not in bonus air miles for instance) as long as there is no publicly assured possibility

¹ Bimetalism is a policy based on the existence of two standards for money, namely gold and silver, as was in existence at the end of the 19th century in many countries. Expectation of (as well as speculation towards) revaluation of one of the standards against the other lead to situations of great instability.

of conversion, i.e. no conversion of mobility rights to normal currency. And mobility rights are even more volatile than bonus miles, as they would normally lose their validity at the end of each calendar month.

This ration should be attributed to individuals, not to vehicles, for two types of arguments:

- since it is usable for driving and for riding public transport, it must be directed to individuals;
- attributing the ration to individuals instead of vehicles prevents “abuse” of the system by those rich enough to own more than one car.

Naturally this means that the (vehicle) on-board unit over which the counting of mobility units is made must be fitted with a slot for an individual smart-card, but such a specification is very common, even if also for other reasons.

Of course, if several individuals travel together (a family or a group in a car-pool) they should decide among themselves which card should be used in each trip, just like they do for sharing other costs like gas, parking, etc. Road pricing charges are per vehicle, but mobility rights are issued by person (local tax payer)

Rationing without pricing has been applied in several cities, for instance Athens since the early eighties with odd-and-even number-plate access restrictions (apart from exceptions, each car has free access on 50% of the working days, and is forbidden on the remaining 50%) and several Brazilian cities with restrictions for two final number-plate digits on each working day (apart from exceptions, each car has free access on 80% of the working days and is forbidden on the other 20%).

These access prohibitions have led to increase multiple car ownership and average fleet age, and after some years they lose effectiveness. It is important to note that, once a person buys a car, he has no choice over which day(s) of the week he can or cannot drive into the city (in some cases only to the centre), which is seen by most opponents as a severe restriction of the right to self-organisation and flexibility.

After two years of full-day prohibition, the city of São Paulo, one of the worlds largest and most congested, changed it in 1999 (Estado de São Paulo, 1999) to a peak-hour limitation (7–10 am plus 17–20 pm), still only on 20% of the days for each car. This has been received favourably, and after 2 years it has reduced peak hour traffic volumes by 14% (Estado de São Paulo, 2001). The difference between the 20% limitation and the 14% impact is due to the presence of vehicles to which the limitation does not apply, like motorcycles, taxis, ambulances, transport of perishable goods and gas-powered vehicles. Still, as the title of the news of January 2001 suggests, traffic is still chaotic.

Of course, these constraints are not connected to prices and induce escape through purchase of a second car with a different final digit on the number plate as 25% of the drivers under limitation use a second car (Estado de São Paulo, 2001).

In our suggested scheme, the level of free ration and the unit price of mobility are clearly related if we want to keep congestion in the system under control: the higher the dimension of the free ration, the more expensive the additional mobility has to be. This has to be managed properly, but (based on the Brazilian experience) reasonable levels of congestion relief can probably be achieved (avoiding outrageous prices for additional consumption) if a free ration of between one half and two thirds of average current consumption is established, without imposing any rigid limitations on specific days or periods, just different levels of mobility units for the same trip, according to the congestion level.

Another important point in this proposal is that of transferability of the ration: for each citizen, this transferability is embedded at the outset between private transport and public transport (naturally with a lower unit price for public transport), which constitutes an incentive to use public transport instead of the private car, whenever the advantages of the latter are perceived as small. This could lead to many people deciding to use public transport as their basic transport choice, but keeping the option of using their private car once or twice a week, probably in association with more complex trip chains. Adoption of this type of behaviour would be very facilitated by more flexible ticketing schemes in public transport, where “frequent user” cards typically assume use of public transport on all working days of each month (Viegas and Macário, 1999)

But it would also be positive if these rations were freely tradable among citizens, thus bringing some revenue to those who are less mobile or organise their mobility in ways that are less voracious of common resources, and increasing the overall efficiency of the scheme.

As mentioned above, these principles are easily applicable with a variety of technical solutions for road pricing, from the simplest cordon pricing to the more sophisticated “pay-as-you-go” schemes. In fact, it is possibly preferable to envisage a progressive approach to road pricing, in which relatively simple schemes are used in the initial implementation, and more sophisticated methods are used as the targets where heavy congestion still has to be fought become increasingly narrow. This progressive approach would facilitate acceptability by separating the questions of purpose and of technical handling: if there is a strong leap to be given on the principle, it is better to use a technically simple solution, that creates no additional fears of mishandling; once the principle is accepted and people are familiar with the handling, increasing sophistication can be easily brought in. Many examples of this approach can be found around us in all walks of modern life.

5. Conclusions

We have argued that there has been a great divide between economists and politicians about road pricing

because the former have adopted a much more restricted set of the objectives than the latter, giving too much emphasis to the issues of efficiency, which are hard to understand and convey to the population, and paying less attention to the more visible aspects of effectiveness of congestion relief and equity.

We propose a wider objective of quality in all dimensions of the mobility system, with a richer perspective of equity, covering both horizontal and longitudinal equity dimensions. Accountability on the application of revenues becomes an integral part of the approach, as it contributes to the gradual improvement of capacity of the various critical components.

The economic composition of this approach is a mix of rationing and pricing, with the free mobility ration being usable in private and in public transport, as well as tradable among citizens. For all modes of transport, unit prices vary in line with marginal social costs, but are not necessarily equal to those costs, as the main driver of the process of fine tuning of prices is the quality of service across the whole mobility system.

References

- Allen, J., Hwang, R., Kelly, J., 1994. An Equity Analysis of "Pay-As-You-Drive" Automobile Insurance in California. Union of Concerned Scientists.
- Banister, D., 1994. "Equity and Acceptability Questions in Internalising the Social Costs of Transport," in *Internalising the Social Costs of Transport*. OECD, Paris.
- Button, K., 1995. Road pricing as an instrument in traffic management. In: Johansson, B., Mattsson, L.G. (Eds.). *Road Pricing: Theory, Empirical Assessment and Policy*. Kluwer Academic Publishers: Boston, MA.
- Estado de São Paulo, 1999. "A utilidade do rodízio", in the daily edition of 28.4.99 (read at <http://www.estado.estadao.com.br/edicao/pano/99/04/27/NOT2TIT.HTM> on 2.3.01).
- Estado de São Paulo, 2000. "Nem rodízio reduz o caos no trânsito", in the daily edition of 13.1.01 (read at <http://www.jt.estadao.com.br/editorias/2001/01/13/ger744.html> on 2.3.01).
- European Commission, 1998. Fair payment for infrastructure use: a phased approach to a common transport infrastructure charging framework in the EU—White Paper COM(98) 466 final.
- Federal Transit Administration, 1995. Transportation: Environmental Justice and Social Equity Conference Proceedings, Federal Transit Administration, Office of Policy (Washington DC), FTA-DC-26-6025-95-1.
- FISCUS, 2000. Cost evaluation and Financing Schemes for Urban Transport Systems, European Union Transport Research Fourth Framework Programme, Urban Transport. Project co-ordinator: TIS.PT, Consultores em Transportes Inovação e Sistemas s.a., Lisbon, Portugal.
- Giuliano, G., 1994. Equity and fairness considerations of congestion pricing. *Curbing Gridlock*, TRB. National Academy Press, Washington DC, pp. 250–279.
- Goodwin, P.B., 1989. The rule of three: a possible solution to the political problem of competing objectives for road pricing. *Traffic Engineering and Control* 29, 495–497.
- High Level Group on Transport Infrastructure Charging, 1999. Final report on options for charging users directly for transport infrastructure operating costs, Brussels.
- Jones, P., 1998. Urban road pricing: public acceptability and barriers to implementation. In: Button, K.J., Verhoef, E.T. (Eds.). *Road Pricing, Traffic Congestion and the Environment*. Edward Elgar Publishing: Cheltenham, UK.
- PATS (Pricing acceptability in the transport systems), 2000. European Union Transport Research Fourth Framework Programme, Urban Transport. Project co-ordinator: TIS.PT, Consultores em Transportes Inovação e Sistemas a.c.e., Lisbon, Portugal.
- Rawls, J., 1971. *A Theory of Justice*. Harvard University Press: Cambridge, MA.
- Richardson, H.W., Bae, C.C., 1999. The equity impacts of road congestion pricing. In: Button, K.J., Verhoef, E.T. (Eds.). *Road Pricing, Traffic Congestion and the Environment*. Edward Elgar Publishing: Cheltenham, UK.
- Small, K.A., 1992. Using the revenues from congestion pricing. *Transportation* 19, 359–381.
- Vickrey, W.S., 1963. Pricing in urban and suburban transport. *American Economic Review, Papers and Proceedings* 53, 452–465.
- Viegas, J., 1994. Integrating parking with circulation pricing without additional hardware. In *Proceedings of Seventh IFAC Symposium on Control in Transportation Systems*, Tianjin, China.
- Viegas, J., 1996. Turn of the century, survival of the compact city, revival of public transport. In: Meersman, H. (Ed.). *Bottlenecks in Transportation and the Port Industry*.
- Viegas, J., 1998. Acceptability and Efficiency of Urban Road Pricing: Main ingredients for a successful implementation. In *Proceedings RENCONTRES JACQUES CARTIER—'L'avenir des déplacements en ville'*, LET
- Viegas, J., Macário, R., 1999. Upgrading quality in Urban Mobility Systems: Service integration and market segmentation". Presented at the UITP Conference on International Conference on Organisation of Transport and Quality of Service, Florence. International Federation of Automation and Control, Laxenburg, Austria.