ITS AND THE PRIVATISATION OF ROAD INFRASTRUCTURE
A PROPERTY RIGHTS APPROACH TO A 'PUBLIC' GOOD

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Bijdrage aan het Colloquium Vervoersplanologisch Speurwerk 2004,

25 en 26 november 2004, Zeist

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Samenvatting

In dit paper wordt ingegaan op de privatisering van weginfrastructuur. Om de discussie omtrent dit thema te verfijnen wordt gebruik gemaakt van de inzichten uit de eigendomsrechtenbenadering. Je zou kunnen zeggen dat een weg bestaat uit een bundel van rechten. Het recht op het gebruik (of toegang) van een weg is de moeilijkste om te privatiseren. Nu vrijwel alle wegen vrij toegankelijk, maar de privatisering van dit recht zou betekenen dat er een systeem opgezet wordt met een beperkt aantal private eigendomsrechten die verhandeld kunnen worden: een markt in toegangsrechten. Om dit technisch mogelijk te maken kunnen intelligente transportsystemen een belangrijke rol spelen. Vooral de combinatie van in-car-, infrastructuur-, en informatieapplicaties kan aanzienlijke gevolgen hebben.

Summary

In this paper we deal with the privatisation of road infrastructure. To refine the discussion insights from the property rights approach are used. Learning from that approach, we could say that road infrastructure could be seen as a bundle of rights. The right to use road infrastructure is the most difficult one to privatise. Now many roads are freely accessible, but the privatisation of this right leads would comprise setting up a system where there is a limited number of privately owned access rights that can be traded: a market in access rights. To make this technically possible, intelligent transport systems can be a very important tools. Especially the combination of in-car, infrastructure and information applications can have significant consequences.

1. Introduction

The privatisation of road infrastructure is a recurring topic within academic and professional debates. Some argue that road infrastructure cannot be privatised, because of its non-profitability. Others regard the laying-out of road infrastructure as the moral duty of government, because it exceeds the interest of the individual. The privatisation of infrastructure remains a political choice.

Political willingness is one condition for the privatisation of road infrastructure. In this paper, we do not want to get involved in the political debate; we only want to focus on the other conditions for road privatisation. Other conditions are technological feasibility and a demand for using the road that 'exceeds' the supply. In section 2 and 3 of this paper we use insights from new institutional economics, in particular the property rights approach, to understand what a change from a public road to a private road comprises. This conceptual framework helps us to have a more precise and qualified discussion about the privatisation of road infrastructure. In section 3 we argue that the property rights over a road can be subdivided in the right to transfer, the right to income and the right to have access to that road. The right to access is the most difficult right to privatise because the right does not 'simply' go from a public party to a private. From an open-access good, the road changes in a good with a limited number of privately owned access rights. A practical problem is how to protect this right to access. Some-one only buys or rents this right if he can be (fairly) sure that no-one else can use it.

The privatisation of access rights has to be technically possible. In this paper it is also argued that Intelligent Transport Systems (ITS) already play a successful role in managing infrastructure use and therefore could be a important tool to privatise access rights. In section 4 we will explain what we mean by ITS. Further, in section 4 we will show that ITS systems are already involved in shifts from open access roads to conditioned access rights. Here, we show different cases: the congestion charge in London, Electronic Road Pricing in Singapore and the Ecopoints system in Austria. Next in section 5, we will show how future developments in ITS might assist the privatisation of the use of road infrastructure. Finally (section 6) we have some concluding comments.

2. New institutional economics and the property rights approach

Within new institutional economics the role of institutions and their implications on economic behaviour is essential (see e.g. Eggertsson, 1990). This is an important difference with neo-classical economics that assumes the market to be spontaneous and to be led by what Adam Smith (1776) called the 'invisible hand'. This invisible hand was the best problem-solving device in co-ordinating individual decisions. In 1937, Nobel Prize winner, and founding father of neo-institutional economics, Ronald Coase wrote a classical article named 'The nature of the firm'. In this article, he asked himself the simple question: if the market co-ordinates individual decision-making so efficiently why do firms (and other organisations) exist? According to him because the transactions costs[1], for instance, the costs of market co-ordination are sometimes too high. In these cases hierarchical forms of co-ordination, like firms, but also government organisations, are more cost-efficient (Coase, 1937).

New institutional economics can broadly be divided in three approaches, namely the transaction cost approach, the property rights approach and the principal-agent (or agency) theory. However, this distinction is strictly analytical. In all approaches, property rights and transaction costs play a central role. The principal-agent theory has been applied many times to matters of liberation of government organisations, like railway and electricity companies. These are, however, private exploitations of public infrastructure. In this article we use insights of the property rights approach to see how infrastructure can be privatised.

Welfare, or Pigovian, economists would often say that the market will not supply such goods, like road infrastructure. Neo-institutional economists argue that market failures do not exist. When the market does not supply goods like road infrastructure it is the property rights that are incompletely assigned and the transaction costs that are positive. This is based on Cheung's (1990: 11) often cited invariance version of the Coase-theorem (Coase, 1960), which says:

> If property rights are clearly delineated and if all the costs of transactions are zero, then resource use will be the same (and efficient) regardless of who owns the property rights (based on Demsetz, 1967, parenthesis ours).

[1] Transaction costs are all the costs "…associated with the transfer, capture and protection of rights." (Barzel, 1998: 4).

In practice, this optimum almost never occurs: transaction costs are never zero and property rights are never clearly delineated. Therefore, the Coase-theorem has often been characterised as an unrealistic theorem. This is true when it is contemplated in its strict form. But the corollary of the Coase theorem shows its importance and the importance of assigning property rights:

> If information is not perfectly distributed and transaction costs are not zero, then the outcome for any externality (and public good) problem depends on the distribution of property rights (Webster & Lai, 2003: 173, parenthesis ours).

What follows from this is that the way property rights are assigned and distributed is essential in terms of efficiency.

Barzel (1998) has brought the work of Coase on property rights a step further. Barzel argues that externalities and public goods give rise to 'public domain' problems. This is not the same as a public sector problem. What is meant by this is that these problems arise when there are goods or attributes of goods that have a value, but are ill-defined in terms of property rights. Externalities and public goods are goods or attributes of goods that are un-priced, not because they do not have a value, but because of the high costs of assigning property rights, the lack of political willingness and the technological unfeasibility to do so that would make them tradable. The result of this proprietary ambiguity, in a free market, is that these goods remain un-priced and are therefore inefficiently allocated (Webster & Lai, 2003: 108).

Road infrastructure in the Netherlands also lies in the public domain, in the sense that it is open-access (or non-) property, through which no-one is excluded, and using it is often un-priced. The notion of road infrastructure as a public domain good in relation to privatisation is elaborated in the next section.

3. Road infrastructure as a 'public domain' problem

Before we can say more on the privatisation of road infrastructure we must determine which features a privatised good must contain. Figure 1 (based on Webster & Lai, 2003) shows a typology of goods ranging from pure private goods (A) to pure public goods (D). There is no public domain problem with goods of type A. The consumption of these goods is rival. This scarcity leads to a point where the value of these goods exceeds the costs of assigning exclusive property rights. So, these goods can be made exclusionary and captured from the public domain. Type B goods are excludable but non-rival. An example of such a good is a toll road that operates below congestion level. Private parties are less willing to supply such good than goods of type A, because a non-rival good is not scarce, which gives the good little or no value. This deters a private actor from assigning exclusive property rights. Goods of type C are rival but non-excludable. But actually few goods are non-excludable. If they are, the reasons might be institutional (including cultural and political reasons) or technological. It is therefore a transitional category as the diagonal arrow indicates. Category D consists of pure public goods. However, in practice those are rare. As we saw with type C, almost every good is excludable. In addition, many goods that are presumed to be non-rival are rival. For instance, clean air and fresh water, which are traditionally not seen as scarce goods, are becoming scarce.

Figure 1: Dynamic typology of public goods (Webster & Lai, 2003: 136)

	Excludable	Non-excludable
Rival	A	C
Non-rival	B	D

What becomes clear from this, is that if we want to privatise road infrastructure (i.e. a transition to type A goods), it is has to be congested or rival and excludable. Exclusion of people may sound unjust from ideological perspectives as equality and freedom to move, but is essential when the market as an allocating model of co-ordination is applied. Webster & Lai (2003: 123) assert that no market can function without exclusive property rights.

But what or who has to be excluded in the case of road infrastructure? We have to be more precise in what we mean by property rights. Property rights can be laid out in a bundle of rights. Several ways of separating the bundle of rights circulate. An often made (see e.g. De Alessi, 1991), and useful distinction is between *usus* (right to use), *usus fructus* (right to income) and *abusus* (right to transfer). These partial rights are interrelated. For instance, the right to derive income from a good (usus fructus) often only gets value if the right to use can be exploited. The division in the three partial rights is very useful to reveal the change of ownership and rights assignment in the case of the privatisation of road infrastructure (see figure 2). The right to use is in this case equal to the right to have access to a road, and is therefore substituted by 'right to access'.

Figure 2: A publicly and privately owned road

	public road	**private road**
right to transfer	state	private party
right to income	state	private party
right to access	open-access (every car-driver)	private party (individual car-driver)

For identifying the owner of a right, we use Bromley's (1991) (see also Needham, 2004) distinction in private, common, state and open-access (or non-) property (see figure 2). When a road is publicly owned, we mean that the right to transfer and the right to income are held by the state. The right to access is open to everyone and is therefore actually non-property. Once a road has been privatised, both the right to transfer and income have gone from the state to some private party. In order to exploit the road (profitably) the right to access also needs to be privatised. A good only gets a value if it is delineated by certain rights. An open-access good is changed in a good with a limited number of privately owned access rights. What occurs is that a market in access rights is created.

Webster & Lai (2003) say that markets can only be formed when the right institutional, demand and technological conditions are there. The first conditions holds requirements like a good administration, political will and public support. The demand condition has already been discussed when we were talking about rival or non-rival goods. There has to be congestion, before a good can be privatised. The last condition is the technological condition. A right over something is only a right if it is protected by the collective, or in this case the private party that exploits the road:

> "A right is the capacity to call upon the collective (in this case the private party that sells or lets the access rights) to stand behind one's claim to benefit stream (in this case the benefit of having access to the road)" (Bromley, 1991: 15, parentheses ours).

To ensure that one has a full claim to an access right, it has to be technologically possible to demarcate that right in a way that only the holder of the right can use it, while others (the non-owners) are excluded. Technological innovation has turned many publicly organised goods into more competitive markets. Take for example the electricity, water and gas supply. Within the field of transport there are many innovations, often share under the abbreviation ITS. Many of the innovation are meant to increase traffic safety or solving congestion problems. But there are also applications that can be used to create markets in access rights.

4. Intelligent Transport Systems

ITS can be described as "systems consisting of electronics, communications or information processing used singly or integrated to improve the efficiency or safety of surface transportation" (Tindemans et al., 2003: 2). This description encompasses a wide variety of applications (see e.g. Bishop, 2000, Ertico, 2002). These systems can influence several parts of the transportation network on different levels. This means ITS sometimes includes infrastructure applications, vehicle applications or a combination of both.

ITS covers[2], among others, systems that support the driver in controlling his vehicle (Advanced Driver Assistance Systems: ADAS), systems that support the traveller in finding an optimal mode and route, (Advance Traveller Information Systems: ATIS) and systems that are concerned with a more efficient organisation of traffic flows on the existing road infrastructure network (Advanced Transport and Traffic Management Systems: ATMS).

Examples of ADAS are Intelligent Speed Adaptation (ISA) and Adaptive Cruise Control (ACC). ISA is an in-car system that assists or controls a vehicles speed limit. If a car is equipped with ISA and enters for instance an 80 km/h road, the car slows down and adjusts its speed to what is permitted, either by getting a signal from infrastructural devices or by using the digital map in the vehicle on which maximum posted speed have been pre-programmed. Large safety potentials are expected when ISA would be used at large scale.

ATIS are for example systems that inform drivers or passengers about the trip. Examples of such systems are Variable Message Signs (VMS) and Personal Intelligent Travel Assistant (PITA). VMS are traffic control panels used to deliver real-time information to motorists. VMS can range from simple one- or two-line manually changed message signs to sophisticated, fully economic models that can include graphic displays (Ertico, 2002). The type of information can include for example information on accidents, route diversions and congestion, travel time estimation and information on events. Although the benefits of such a system are not considered to be impressive, they do contribute to a more efficient traffic flow

[2] For a more specific and complete overview on the nature of different ITS applications see for example publications by Ertico (2002) and publications of Bishop (2000).

in usage of variable roads. PITA is a GSM system that gives real-time route information to passengers on arrival and departure of different public transport systems. In case of delay for example, alternative route information is provided.

ATMS systems mainly focus at improving operational transport and traffic management. Examples are ramp metering and Automatic Vehicle Location (AVL). Ramp metering regulates input of cars on motorways by allowing one car per time interval, for example every three seconds. The system prevents instant pressures which could lead to a network overload. AVL enables the continuous monitoring of a vehicle position within a road network (e.g. using GPS), enabling improvements in among others service scheduling and vehicle usage efficiency in public transport and freight transport.

Besides the expected gains from future and more radical integrations between ATIS, ATMS and ADAS, it is clear that ITS systems that combine some categories can be useful tools in tackling congestion problems. An important issue in this is that ITS in that sense is used to increase the level of control and managing traffic flows. Two examples that are interesting in our search for ITS as a tool to create and protect access rights, are Electronic Road Pricing (EPR) in Singapore and the Congestion Charging Sheme (CCS) in London. These systems are regarded as a combination of in-vehicle applications and infrastructure based ATMS for a more efficient organisation of traffic flow. The main difference between the London and Singapore cases with respect to the more common toll roads is that the main policy goal in both these cases is solving congestion problems and its side effects by exclusion of car drivers, whereas conventional toll policies was to tax the use of infrastructure to finance for instance maintenance. Although a price must be paid to get access to a road in these two systems, it is not exactly what we call a privately owned access right. It is somewhere between it and open-access. It is not completely open-access, because a price has to be paid for accessing the road and it is not complete private in the way that there is not a *limited* number of privately owned access rights (everyone who pays has access). In both cases, the right to access cannot be traded from one car driver to another. Therefore, after we have dealt briefly with the Singapore and London example, we will discuss the case of (semi-) transferable permits (Raux, 2004).

The London case

The London case regards the implementation of the so-called congestion charging scheme which is an electronic payment zone in the city centre of London and operates at the traffic flow market using dynamic traffic management and electronic payment as ITS tools (ATMS).

This was introduced on 17 February 2003. The primary aim of the scheme is to reduce traffic congestion in and around the charging zone and to promote the use of public transport. More specifically, the scheme is intended to contribute to reduce congestion in the city centre of London, to make radical improvements in bus services, to improve journey time reliability for car users and to make the distribution of goods and services more reliable, sustainable and efficient (Transportforlondon, 2004). The scheme also aims to generate net revenues to improve transport in London. There are two reasons why there was no major public rejection towards the scheme (Rye, Ison & Santos, 2003). At first, traffic levels in London had reached unacceptable levels and Londoners felt some radical measure was needed. Further, many London residents felt that congestion charging was a good way to raise money to improve public transport in London.

The congestion charge is a £5 daily for driving or parking a vehicle on public roads within the congestion charging zone between 07:00 and 18:30 hour, Monday to Friday, excluding weekends and public holidays. The central London congestion zone covers 22 square kilometres in the heart of London, including centres of government, law, business, finance business and leisure activities. The inner Ring Road forms the boundary of the congestion zone, and no charge applies to vehicles using that route. Not every car is charged: for example taxis and emergency services do not need to pay. Discount is granted to elderly as well as residents in the charging zone.

There are no tollbooths or barriers around the congestion charging zone and no physical tickets or passes. Instead, drivers pay to register their vehicles' number plates on a database for their journeys within the charging zone. Enforcement of the scheme is via 700 video cameras, which are able to scan the rear number-plate of the vehicles entering or circulating or just parked in the area during the times the scheme applies (Rye, Ison & Santos, 2003). Cameras read their number plates whereas they are inside the zone and check them with the database. It is predicted that every vehicle in the charging zone, will pass an average of five cameras within the 11½ hours that the charge is in operation each day. Payment can be made in various ways. The payment is checked more than once and finally at midnight, the computer keeps registration numbers of violators, who are then issued a Penalty Charge notice of £80. If the offender pays within 14 days the fine falls to £40 and if he does not pay within four weeks, it rises to £120. The scheme's largest contractor is Capita Business Services. They provide management services for the Congestion Charging Scheme. This includes: Sale channels, discount processing and finance processing, validation of driver details against images, customer service and data storage, technology to underpin enforcement operations and the Penalty Charge Notice (PCN) system and Automatic Number Plate Recognition (ANPR) system and storage of images for cross-checking/appeals.

The reductions in both traffic and congestion that have been observed in the charging zone are around 30 percent. Emerging findings relating to public transport were that the additional bus capacity put in place was successfully accommodating the net increase of those who have transferred to public transport. The reliability of buses in and around the charging zone has also improved, both as a result of better traffic conditions and other measures (Transportforlondon, 2004).

The Singapore case

The second case is the Singapore Electronic Road Pricing system that is operational for some years now. It is operational at motorways and uses in-vehicle applications and infrastructure based ATMS for electronic payment to manage traffic more effectively. The system's main characteristics are comparable to London, with the main difference that the London scheme aims at reducing inner city congestion and Singapore aims especially at reducing peaks at motorways. Singapore has always tried to reduce congestion by charging road use as the government recognizes that driving creates social costs. As such, the government levies a high premium for the right to own and drive vehicles. Thus, as long as motorists are prepared to pay full social costs of their driving, they can drive as much as they want. The ERP system is generally seen as a rigorous technical mechanism for imposing regulatory road charges (Goh, 2002). As a follow up of various measures like Area Licensing Scheme (ALS), Road Pricing Scheme (RPS), Off-peak Car Scheme and Vehicle Quota System (VQS), the Electronic Road Pricing (ERP) system is more successful due to the use of an electronic monitor that tracks only vehicles entering a restricted zone to ensure a smooth traffic flow. In short, it seeks to control the flow of inbound traffic into a restricted zone. The system is capable of automatically imposing a charge on every vehicle without requiring them to slow down or stop when the congestion level in the restricted zone exceeds a preferred threshold level (Goh, 2002).

The ERP system is based on a relatively simple dashboard-mounted device. It works much like miniature version of the electronic turnstiles at mass-transit rail stations. Motorists insert a cash card into the In-vehicle Unit (IU) when they get on the road. As the car passes overhead gantries set up along the road, the card-reader is activated by a microwave signal. There is a beep and the toll is deducted from a CashCard, which is a pre-paid smart card that can be bought at all local post offices, banks, petrol kiosks or automated teller machines.

Cameras mounted on the gantries will record the vehicle's plate number and transmit the information to the traffic police headquarters. Entry into the restricted zone without an appropriate IU or Cash Card leads to an automatic fine of about € 40,- for illegal entry. Computers at the traffic police headquarters will match it against government records, and a traffic ticket will be issued to the registered vehicle owner. Put simply, this ERP technology uses a complicated combination of radio frequencies, imaging and smart card technologies, optical detection, and cameras and computers working in unison (Goh, 2002).

(Semi-) Transferable permits

Another third case is described by Raux (2004). He describes a case of transferable permits; he discusses the Zero Emission Vehicle (ZEV) program in California. The case is concerned with the use of the Ecopoint program which has the purpose to limit pollution and noise from truck traffic passing through Austria. It are quotas that are not (yet) completely transferable, although "allowing the quotas to be transferred among hauliers on a market basis would reduce the total costs of the scheme" (Raux, 2004: 191).

This system also uses technologies that are comparable with electronic payment systems and can be considered as ATMS. An ecopoint corresponds to the emission of 1g of NO_x per kilowatt hour (kWh). For example, a vehicle normally emitting 10 g of NO_x per kilowatt hour will have to use 10 Ecopoints to cross Austria. Ecopoint quotas are distributed annually by the European Commission among Member States according to an allocation schedule established in the regulations and periodically revised by the Commission. Countries redistribute their Ecopoints which are valid for a year among their hauliers. The allocation schedule among states was based on their share of the traffic between the Community and Austria in 1991. In practice, Italy and Germany use two-third of the Ecopoints, while the third largest user is Austria itself (15%). Ecopointsare not transferred through a market in Ecopoints. Ecopoints are assigned to states and unused Ecopoints are reallocated through an administrative process involving all participating states. This is what makes them semi-transferable. They are not transferred from one haulier to another.

Ecopoints can be issued in paper format or electronically. The former requires a border stop. The electronic system detects the vehicle with the aid of an onboard device. To minimize the cost of installing equipment, the device that must be purchased by the haulier has a simple design. The onboard electronic transponder (Ecotag) identifies the haulier and the vehicle and contains details of its Conformity Of Production (COP) document. The Ecotag detects the passage of the truck across the border. Some 169 border crossings are equipped with overhead electronic readers. Information of the date, time and point of entry into Austria are recorded. These data permit inspection by mobile control units within the country. Upon leaving the country, the central system reads the Ecotag, debits the Ecopoints, transmits an electronic invoice to the haulier's country and notifies the authorities of any trip not covered by sufficient Ecopoints.

5. A plausible future case

We have showed that the development intelligent electronics has resulted in traffic management systems that are relatively new. They are both new from a technological point of view as well as from a more policy political point of view. The three examples show some of the possibilities of ITS for traffic management in the present day. Although they are already a step towards the privatisation of access rights, it has not been achieved yet. Our next question is: what could happen in the future? Based on a future perspective of ITS-based traffic management Van der Heijden & Marchau (2002) argue that ITS systems might trigger an even more advanced system. That system would privatise the use of heavily used (i.e. rival) infrastructure, at least during certain times.

Focussing on the motorway network, the next objective of traffic management relates to the strategy for assigning road capacity to road users. This technology is deduced from the aviation sector, where 'slotmanagement' is used to assign airport capacity to airline companies. The base rule is that all users can ask for capacity at every place in the network at any time, except for some dedicated lanes for freight trucks, buses or carpooling. Moreover, in a growing number of situations local access depends upon payment. Apart from these exceptions, for non-dedicated parts of the road network, payment might not be a sufficient instrument to match demand with the scarce road capacity: congestion is still a reality, although less than before.

The advantage of such an active capacity assignment approach is that control of the flow on the motorway can be improved. Regulation of reservations can be made by price differentiation: (certain) reservations for a long period in advance (e.g. by commuters) for certain access times with high prices versus (uncertain) last minute reservations with low prices. An auction system might even be considered. Another advantage is that in case of upcoming traffic jams, no reservations can be made and no access is allowed. Since this information is given to the driver in time (e.g. 10 to 15 minutes before the preferred entry), the driver might choose an alternative route or travel mode with a minimum loss of time.

Overall, a better trip quality can be guaranteed to motorway users in terms of (average) speed and steady flow. Incidents might still occur, generating traffic jams. In those cases where the promised quality cannot be delivered, repayment could be considered.

An interesting option for the future is to combine payment with a more active assignment strategy of road capacity, enabled by advanced information and telecommunication technology (ATIS). Given the future use of on-board computers or a Personal Intelligent Travel Assistant (PITA) in the car, a strategy based on slot-reservations system could be considered. A capacity assignment based on slot-allocation within the margins of available capacity is basically accepted for air traffic. A prerequisite is the general introduction of electronic vehicle identification, similar to what is described in the Singapore case. The unique code for each vehicle is matched at the on-ramp with the reservations to avoid or allow entry to the motorway and to assure electronic payment (including payment for no-shows).

Users would no longer have random access to the freeway network if slot reservation were implemented completely; instead they would have to reserve a *slot* in advance (Koolstra, 1999: 1). In this context, a slot is the permission to use the freeway system on one particular route with one particular entrance time or time frame. An important element of a successful slot management system is a smooth booking system. Booking means that a consumer can ensure his access to a facility. The purpose is twofold. First, under system capacity limitation, it can protect the rights of the individual car driver. The inconvenience due to uncertainty can then be avoided. Second, operators and managers can benefit from the system due to better control of the operation. Thereby, service quality can be improved, efficiency enhanced, and system capacity attained. Mobile telephones could be very practical devices for booking slots in advance. But also internet applications are becoming more popular and easier operational for the use of a booking system.

6. Concluding comments

Development of ITS technology might assist the transition of infrastructure from public to private. If we confine ourselves to the right to have access to a road, or slots, ITS can help to define these rights and make sure that they are protected. In addition, information can be provided about the availability of the slots as well as about changes, for instance due to accidents, in the infrastructure network. This is yet another example where new technologies make it possible to change institutions.

This way to exploit infrastructure privately might have certain benefits. “For private enterprise, the system may help to create profit. For public enterprise, it can produce social welfare maximisation” (Wong, 1997: 109). Besides these possible economic or financial benefits, there might be other benefits as well. Wong (1997) states that the main reason for an advanced booking system at highways is that it is the only concept that promotes sustainable travel patterns in overloaded traffic systems.

The privatisation of the right to access does not necessarily have to lead to the privatisation of the rights to income and the right to transfer. The state might decide to exploit the road by privatising the right to access. This enhances the possibilities to manage and control traffic. The state then decides how many rights (or slots) are sold, which might reduce congestion. Slots can also be assigned from an environmental point of view. To keep emission levels down, the responsible government agency can decide to sell only a limited number of slots.

There are obviously also negative effects of the privatisation of rights. As we have already said, as soon as a market in rights is created, people get excluded. This is a negative side-effect that has to be considered. Therefore, privatisation remains a political decision. We have tried to qualify the discussion slightly by using concepts form the property rights approach. We should not talk about the road as a non-separable good, but approach it as a bundle of rights: the right to use, the right to income and the right to transfer. We have confined ourselves to the right to use or the rights to access. What we have tried to show in this paper is that if one considers the privatisation of road infrastructure, in particular the right to access, that there are some conditions that need to be taken into account. The use of a road has to be rival, i.e. it has to be congested, and it must be possible to delineate and protect to these rights as to exclude others who do not own that right. ITS is pivotal to make the creation of a market in access rights possible.

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