Chapter 4

The provincial and urban level: meeting the local needs

Increasingly, cities and regions in developing countries adopt incentive-based transport strategies in order to raise local revenue and alleviate congestion and environmental problems in urban areas. Nevertheless, there is no blue print as to how to successfully manage transport demand on the local level. It should always be borne in mind that sound transport measures based on Economic Instruments:

- **are highly city-specific**, depend on city size, level of development, road networks and transport demand characteristics, cultural and educational factors that determine transport behaviour, flexibility in transport mode choice, public acceptance, institutional capacities to introduce and enforce measures, local institutional and jurisdictional independence from national transport policy frameworks;

- **are most effective if applied as part of a comprehensive transport strategy** as outlined in chapters 1 and 2;

On the regional and local level important Economic Instruments which are implemented in many countries include:

- **Surcharges on national/federal measures** (see section 4.1),

- **Parking fees** (see section 4.2),

- **Urban road and congestion pricing** (see section 4.3).

These measures will be discussed in more detail below.

Surcharges on national/federal measures

Surcharges as a policy instrument

The basic idea

Local charges to better meet the local needs.

Supplementing a national policy. Local conditions are often distinctly different from national conditions. To cater for these differences, in many countries Economic Instruments in transport are set at the national (federal) level to meet the basic national needs, but local governments/authorities are allowed to levy a local/provincial surcharge on these charges.

Local surcharges create local revenues and contribute to local transport demand management.

Creating revenues, managing local transport. Good examples for such surcharges

- are locally differentiated levies on vehicle taxation,
- transport-related surcharges on national/federal income- and company-taxation,
- fuel charges (“pay-at-the-pump charges”) or
- additional local road pricing.

Local surcharges serve two objectives: to create local revenue, and to manage transport demand. Revenues are often fed into the local budget, or they are directly used for new transport investment and maintenance. Often the revenues are assigned to different, well-specified purposes (e.g. maintenance fund, urban roads fund, public transport fund) according to fixed ratios.

Shortcomings

Tax evasion is easier at the local level.

Local surcharges can lead to evasive reactions. If transport users have the opportunity to evade a local surcharge, they will seize it. For example, local surcharges on a national vehicle tax create an incentive for car owners to register their vehicles in the province with the lowest additional levy. Likewise, a surcharge on a national fuel tax creates an incentive to refill in the least expensive province. This evasive action, however, will always involve additional travel, and the risk of evasive behaviour will decrease with the size of a province. Only drivers in the fringe regions may still profit from evasion.

The necessary legal framework is not always in place. To impose local surcharges, the local authorities/governments must have the legal autonomy to levy such charges. National and local legislation does not always provide the legal grounds for such measures.

Local authorities must have the autonomy needed to implement local policy measures.

Conclusions

Local surcharges can help to adapt transport policy more adequately to the needs at the local level. The instrument, however, requires local political autonomy and capacities. It supports but cannot replace purely local transport strategies.

Best practice case: State surcharges on fuel taxation in the United States

Policy background and objectives

Fuel taxation in the United States is based on a two-tier approach, with both a national and a local (State) element. Historically, the State fuel tax was introduced in most US States well before a national/federal tax. The initial purpose of the national/federal fuel tax, which was introduced in 1932, was to reduce the federal budgetary imbalance of that time. Only later on, revenue generation for the transport sector became an issue.

Fuel taxation in the U.S. consists of a national base charge and a local (state) surcharge.

Specifications of the U.S. state surcharges on fuel tax

State surcharges are imposed by the States. There is a lot of variation in State surcharges, with State fuel tax rate ranging from 3.0 to 10.5 US cents per litre gasoline or Diesel (2001 data). Federal, State and final fuel tax rates per litre fuel as of January 2001 are summarised below:

Table 4.1: **Fuel tax surcharges in the United States** Source: International Fuel Tax Association (IFTA), and US Department of Transportation

	Federal Fuel Tax [US cents per litre]	State Fuel Tax (range) [US cents per litre]	Final Fuel Tax [US cents per litre]
Gasoline	4.9	3.0 - 10.5	7.9 - 15.4
Diesel	6.4	3.0 - 10.5	9.4 - 16.9

Federal revenues are earmarked and fed into a special fund, the Highway Trust Fund.

The revenue from the federal fuel tax is fed into the federal Highway Trust Fund which was established in 1956. The revenue of the fund (approximately 28 billion US $ in 1999) is mainly used for construction, resurfacing, restoration and rehabilitation of the interstate highway system (from the so-called Highway Account of the Highway Trust Fund) while about 10 per cent of the revenues are dedicated to the Mass Transit Account to finance public transport improvements. Currently the federal fuel tax amounts to 4.9 US cents per litre gasoline and 6.4 US cents per litre Diesel.

Revenues on state-level are used for construction, maintenance, and management of local streets and roads, the State highway system and for State and local public transport. Most States assign revenues to the various expense categories by using a fixed ratio of distribution. For example, the State of California assigns about 64 per cent of its State fuel tax revenues to the State Highway system. 20 per cent of revenues go to the counties and are distributed according to the counties' shares of vehicle registration and road mileage. The remaining 16 per cent are assigned to the cities of the State, basically in proportion to population.

Further Information. A brief but comprehensive summary of fuel taxation in the U.S. can be found in the "Congressional Research Service Issue Brief for Congress", RL30304 by Louis Allen Talley, which is available at www.cnie.org/nle/trans-24.html. For detailed information about tax levels, Trust Fund revenues etc. see, the U.S Federal Highway Administration (www.fhwa.dot.gov) and the website of the International Fuel Tax Association (www.iftach.org).

Parking fees

Parking fees as a policy instrument

The basic idea

Implementing the "user pays principle". In most countries, parking is provided free of charge or at a subsidised rate. Such subsidies are, for example, provided by companies offering parking space free of charge to their employees, or by municipalities that do not charge for on-street parking. Providing parking facilities, however, involves considerable costs that should be passed on to motorists. Estimates for urban areas in the United States show that costs for the provision of one parking space amounts to US$ 1 to US$ 5 per day.

The use of urban parking space has to be charged.

Generating revenues. Parking fees may create considerable revenues for the local municipality. In many developed cities, fees for public parking are in the range of 1 to 2 US$ per hour. In developing mega cities parking fees may be at similar levels. In Buenos Aires/Argentina, for example, parking fees at private car parks amount to about US$ 2 per hour (and US$ 8-10 per day). Although these private car parks also include a guarding component, it shows that a willingness (and ability) to pay for parking exists.

Parking fees can create local revenues.

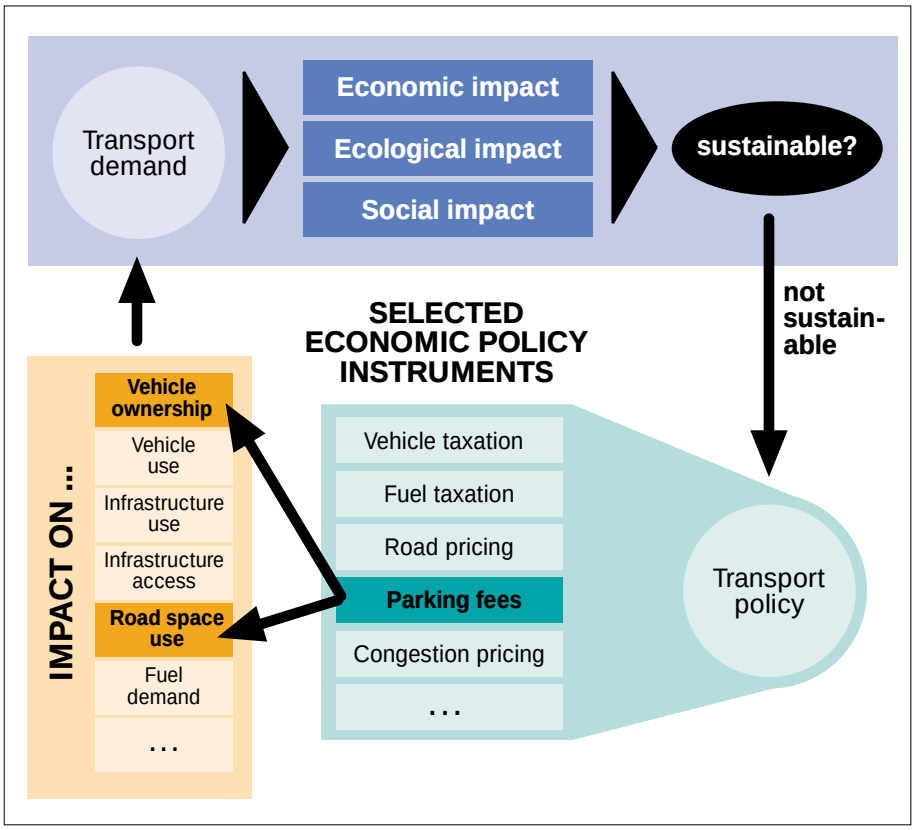
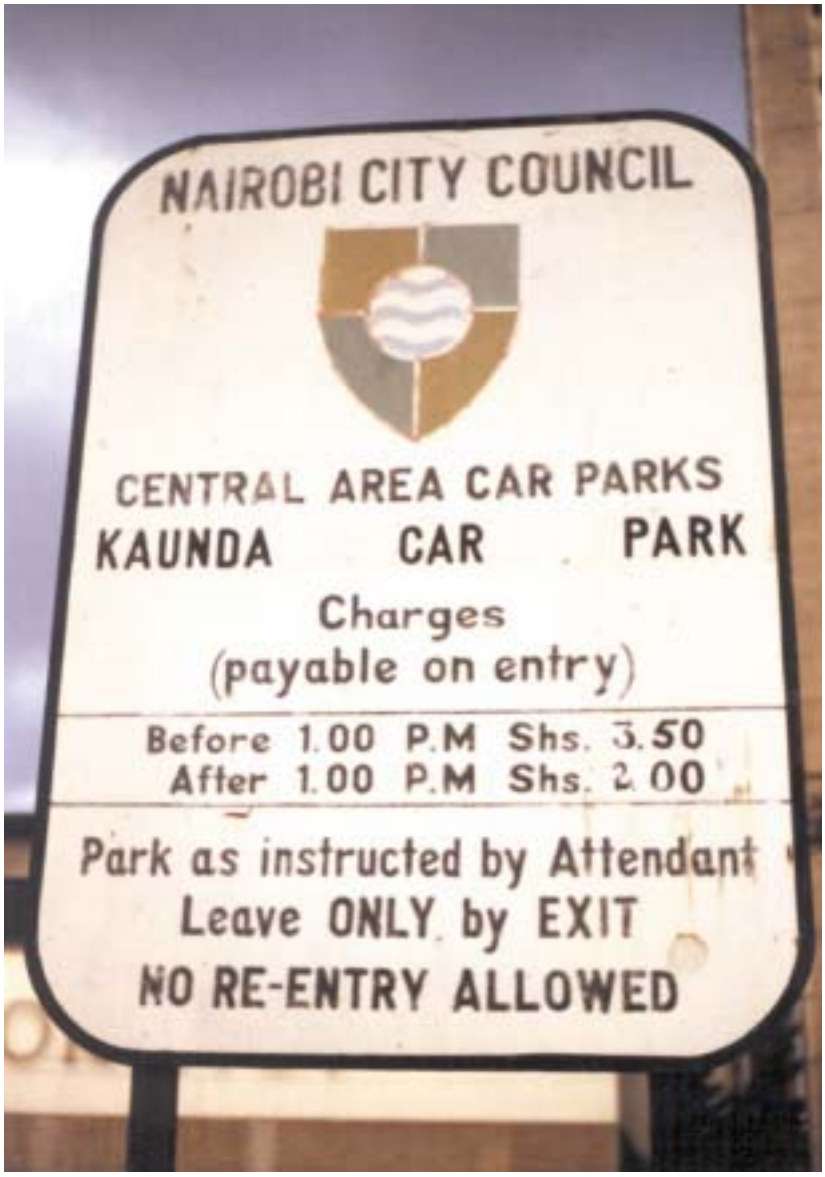


Figure 4.1:
Parking fees as part of transport demand management

A municipality levying parking fees in the range of US$ 4 per day could create annual revenues of about US$ 1 million per 1,000 parking slots under control. Enforcement costs would be significantly below 10 per cent of these revenues so that parking fees may open up a rich financial source for the municipality's budget.

Restricting parking in urban areas helps reduce congestion.

Reducing congestion. By introducing parking fees, car use in urban areas becomes more expensive and thus less attractive to many motorists. This can help reduce inflow traffic and congestion in urban areas. When combined with a consequent policy of limiting parking space, parking fees have also proved successful in stimulating commuters to switch from private cars to the use of public transport. This contributes significantly to the reduction of congestion, as commuting is the main cause of peak time congestion.



A step towards urban road pricing. In many cities, the introduction of parking fees is regarded as a first step towards more sophisticated schemes of pricing urban traffic. Parking fees are rather easy to implement and they gradually make urban road users aware that driving within the city cannot (and will not) be free of charge. It thus helps to create awareness for and acceptance of pricing schemes in general. In the medium- to long-run, road pricing may then be introduced as well, maybe in the form of a cordon around the central business district.

Optional features

Basically, parking fees can be charged on-street (metered on-street parking, ticketed on-street parking), or off-street (public parking space, private car parks). Some criteria for creating differentiation in parking schemes and their corresponding charges are

- area/zone, in order to reduce parking in crowded inner city regions through the use of higher charges;
- time of day, in order to discourage long-term parking by solo commuters through peak parking surcharges;
- calendar day, in order to distinguish between weekday commuter parking and weekends;
- duration of stay, in order to set incentives for short-term parking, and to set incentives for commuters to use certain parking areas designated for long-term parking;
- vehicle type/size, in order to provide disincentives for single-occupant vehicles, etc.

Providing parking space for residents. If residents in the city centres are not provided with adequate parking facilities, there may be an incentive for them to leave the city centres and to seek suburban residential areas. This would create additional commuting traffic. For that reason, parking fee schemes should always include reduced charges for residential use. In many cities, special parking permits are issued to residents.

The needs of residents must not be neglected.

Integrating private parking space into the charging scheme. There is a large share of parking space outside the control of the traffic management authority. These private car parks should be integrated into the public scheme of parking fees. This could, for example, be done by harmonising parking fees with the private sector.

The overall supply of parking space (both public and private) should be integrated into a comprehensive parking policy.

More serious, however, may be the problem of "private non-residential" parking which is offered free of charge by private sector companies to employees and customers. In some developed cities "work place parking levies" have been introduced, with the employer paying a significant charge for each parking lot to the traffic management authority. Ideally, this levy should then be passed on by the employer to the employees in order to make them pay the full costs of their journeys.

Parking charges can also be used to provide incentives for P&R schemes.

Park & Ride Schemes. As part of a comprehensive sustainable transport strategy that aims for a modal split shift toward public transport, parking fees can also be combined with other measures. Restrictive parking regimes in the inner cities with high parking fees and limited parking space can be supplemented by the provision of parking space in the periphery and incentives to access public transport. Park & Ride (P&R) models – as they have been implemented in many OECD countries – combine parking spaces in less congested areas of the periphery and public transport terminals in order to facilitate switching from the vehicle to public transport. P&R schemes provide incentives for modal shifts, however, both their environmental effectiveness and their economic efficiency heavily depend on the specific local circumstances.

Shortcomings

Parking fees may drive motorists out of the cities – with the result of additional traffic.

Parking fees in the central city may stimulate urban sprawl. A restrictive parking policy does only affect trips to the area that is subject to parking control (typically the central cities). This may result in an incentive for business to be set up outside the city. In many developed cities, shopping centres explicitly attract customers with the argument of free-of-charge parking.

Improved traffic flows may attract additional through-traffic in the cities.

Parking fees may increase through-traffic. When trips with a destination within the city centre become less attractive, such trips will decrease in number. However, that will lead to improved traffic flows which may attract additional through-traffic passing through the controlled areas.

Not the complete urban parking is under public control.

Parking space is only partly under public control. When a significant part of urban parking space is owned by the private sector, a restrictive parking policy may be difficult to implement. However, in some cases co-ordination with the private sector may be feasible. Parking fees should be harmonised and the number of car lots provided by private suppliers should be limited. When companies provide free parking for their employees, the introduction of a "work place parking levy" that has to be paid by the company per parking lot can be helpful. It should

be insured, however, that this levy is passed on to the employees, i.e. to the actual road users. Only then will the levy have an effect on the behaviour of road users.

The enforcement of the parking fee scheme is crucial. The traffic management authority has to be able to effectively enforce a restrictive parking policy, to collect parking fees and to fine offenders. In developing cities, any lack of an adequate institutional setting may result in a major obstacle to parking fees.

Parking fees have to be enforced.

The effectiveness of parking fees will generally be limited, when (a) only a low proportion of car users pay to park (enforcement problem), (b) car travel is through travel, (c) employers subsidise or reimburse employees' parking expenses.

Conclusions

The introduction of parking fees is an important aspect of making motorists pay the full costs of their trips. It reduces urban traffic and thus congestion. Unfortunately, parking schemes are more difficult to implement when considerable private parking space is available. In any case, an effective enforcement of the fee scheme is of utmost importance.

Further Information. For a detailed analysis of the role of parking restriction within a urban transport strategy see e.g. Hartmutt H. Topp, The role of parking in traffic calming, available at http://www.agenda21.ee/english/transport/parking_calming.pdf.

International experience with parking policies

Parking policies are in place in most cities all over the world. The following examples shall reflect some of the variety in these policies and approaches. Some more examples can be found in OECD 2001, pp. 105-107.

Parking fees in San Sebastian, Spain

In San Sebastian, as in many other European cities, parking measures are a central element of urban traffic policy and environmental policy. Major objectives have been noise reduction and pollution reduction. In order to reduce motorised transport in the city, several measures have been introduced. Inner city residents have priority access, while commuters are invited to use Park & Ride facilities in the periphery. High inner city parking fees and zero parking fees at P&R hubs give incentives to use P&R schemes.

In many European cities, parking fee schemes have formed the first element of urban traffic management with other measure (e.g. public transport improvements, promotion of non-motorised transport, etc.) following subsequently.

Private parking charges in Buenos Aires, Argentina

In Buenos Aires, private parking places play an important role. They usually charge on a per hour or per day basis. Inner city parking charges are summarised in Table 4.2.

	Per hour [US$]	Per day [US$]
On-street parking	2 - 2.5	7 - 12
Underground parking	3	10

Table 4.2: **Private parking charges in Buenos Aires, Argentina**

Integrated parking management in Bremen, Germany

Parking policy in Bremen follows an integrated approach. It includes measures to raise public awareness, improvements of public transport, parking management, and town planning. Pricing elements in the parking management strategy include (cf. OECD 2001, p. 105):

- Making sure no free or unregulated parking exists in urban centres,
- having the price and quantity of parking lots be determined by the appropriate demand for short-term and long-term parking (highest prices at most attractive locations),
- ensuring that car use plus parking charges in the city should not cost less than the cost of using public transport.

These measures have contributed to changes in urban transport in Bremen. Recent surveys show that 50 % of all trips to the city centre are made by public transport, and roughly 22 % by bike.

Resident parking permit programme in Seoul, Korea

The Resident Parking Permit Programme (RPPP) manages parking space in Seoul's residential areas. A parking lot is assigned to users who buy a parking permit. Permits are differentiated according to the scheme "all-day" (40,000 Won per day, = 36 US$), "daytime only" (30,000 Won), and "night-time only" (20,000 Won). Price levels may vary according to residential area.

The RPPP has not been fully embraced with open arms. Although community members are given priority in buying permits for parking lots near their residences, public acceptance of payments is low. Currently, charged parking accounts for a mere 15 % of all parking lots in Seoul (cf. OECD 2001, p. 105).

Urban road and congestion pricing

Urban road and congestion pricing as a policy instrument

The basic idea

Road and congestion pricing allows for a fair allocation of costs.

Charging internal and external costs. Road and congestion pricing are used as demand management strategies on local roadways. Urban road pricing generally aims at recovering internal and external costs of urban infrastructure and infrastructure use. Like general road pricing schemes, urban road and congestion pricing measures put a levy on the use of specific parts of the road network, thereby charging every road user. They also generate revenues needed to take anti-congestion measures and alleviate environmental problems.

As road users pay regardless of residency status, road and congestion pricing measures are fair. They are particularly useful, if a large share of non-residents causes traffic. Many big cities have a high proportion of the labour force commuting by car from neighbouring residence cities or independent suburbs.

In order to set incentives to implement local road and congestion pricing measures local institutions must be authorised to design, implement and enforce these measures. In short: Decentralisation of institu-

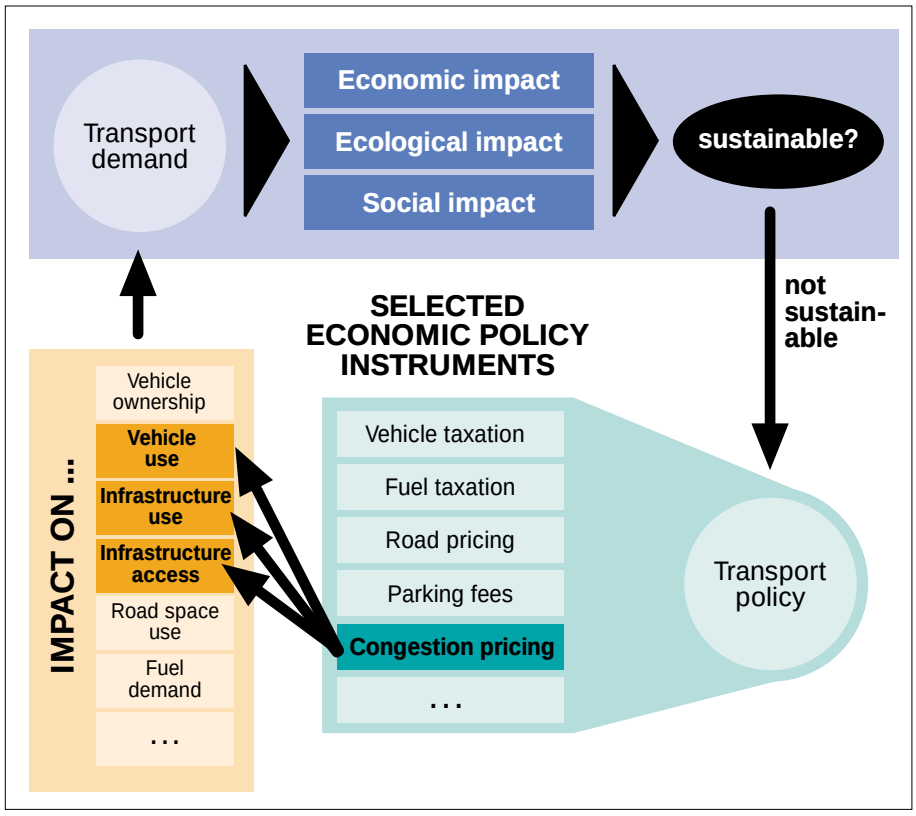


Figure 4.2: **Congestion pricing as part of transport demand management**

tional powers creates incentives for local policy makers to use Economic Instruments, and enables efficient urban road network use.

Congestion pricing specifically addresses the issue of (urban) congestion.

In congestion pricing, the focus for policy-makers is to reduce the overall traffic volume in urban areas in order to reduce or even avoid congestion. When implemented on existing roadways it also reduces the need to add new roadway capacity. The main objectives of road and congestion pricing are thus:

- a **change in the time of travel**: shift of peak to off-peak traffic with a consequent reduction of peak period traffic and a potential reduction of total traffic (e.g. through linked trips: more combination of activities on a single trip);
- a **shift in routes**: to roads without tolls or less tolled roads;
- a **shift towards a more sustainable traffic mode** (transit, carpooling, cycling etc.);
- a **reduction in negative environmental effects**;
- an **improvement in the overall quality of urban life**;
- a **means to generate revenue**.

The implementation of congestion pricing should be gradual.

Success thus is measured in terms of reduced congestion delay, curtailed roadway costs, and other demand management objectives. To actually implement urban congestion pricing the following 4-phase approach may be helpful:

Phase 1: Identification of the need of a local congestion-pricing scheme.

Phase 2: Introduction of a demonstration scheme.

Phase 3: Implementation of a full scheme.

Phase 4: Successive improvements of the congestion-pricing scheme.

According to this approach, congestion pricing should not be too ambitious right from the beginning, as the ideal pricing scheme can hardly be developed right from scratch. Congestion pricing should rather be seen as a gradual process that starts on a pilot scheme basis and then aims at successive extensions and improvements.

There are various options for the actual implementation of road pricing.

The design of road pricing. There are basically two principle forms of road and congestion pricing, namely:

- **Cordon pricing or area licensing**, where motorists are charged for entering a designated area at the defined crossing points of the cordon boundary, or pay a charge for driving within the area that is subject to road pricing;

- **Time-dependent tolling of individual routes**, where motorists are charged for using specific roads or road lanes. In this form, congestion pricing is predominantly applied to major highways or traffic bottlenecks such as tunnels, bridges, etc.

Technically, road and congestion pricing can be implemented in different ways at various levels of technical complexity:

- **Purchase of a paper permit (vignette)**. For each vehicle that is used within the controlled area, a permit has to be purchased and displayed at the windscreen. These permits will then be manually checked. Such permits will normally be valid for a limited period of time, e.g. a day, a week or a month. Such a system is rather inflexible, as it does not allow for time-based differentiation (see below).

- **Manual toll station.** Motorists have to pay a road charge on entering the priced area. Such procedures may be rather time-consuming and may hinder traffic flows. However, toll stations allow the differentiation of charges according to the time of day.

- **Electronic charging systems.** Vehicles are equipped with electronic tags that allow the automatic identification of vehicles at non-stop tolling stations. Charges are then automatically debited against the motorist's account.

Most technological components for congestion pricing have been tested and demonstrated successfully throughout the world. In developing cities, manual toll stations may be the most adequate approach when only a limited number of cordon/area crossing points is needed.

Optional features

Making congestion pricing flexible. In urban road pricing, a flexible system of charges will strengthen the congestion-reducing effect. When charges are higher at peak times (during workdays, at rush hours in the morning or in the evening) and lower at off-peak times (at weekends, mid-day) then drivers may partly shift their travel times to off-peak hours. This levels out peaks and makes the use of transport infrastructure more evenly distributed. With reduced peak-time travel, infrastructure supply – which should cater for peak demand – can be much smaller. In addition, travel may be shifted towards alternative modes such as public transport, thus reducing the overall travel demand as well.

Congestion pricing should be flexible.

Shortcomings

Currently congestion pricing is only an approximation. Ideally, congestion pricing should be based on the actual distance travelled, differentiated by time. At present, however, technical limits only allow a rough approximation; vehicles are only charged on entering a controlled area but the actual amount of driving done within the area is not reflected in the charge.

Congestion pricing does not impose the exact full costs to drivers.

Political opposition can be fierce. The main challenge to the implementation of congestion pricing is opposition from groups who consider themselves worse off once pricing is established. As with other char-

Public opposition may be expected.

ges on transport, congestion pricing may be rather unpopular. Users generally accept congestion pricing on a single lane that was not previously available if other lanes are free. Where all previously free lanes are tolled, there is often opposition because the toll is perceived as double taxation and because of hardship on less affluent people.

One of the key lessons learned from many congestion pricing projects is that the rational behind congestion pricing has to be communicated well to the public in order to ensure the necessary acceptance. When the system of congestion pricing is transparent, and when its advantages are apparent to all road users, then public support may be high.

Congestion pricing requires an adequate legal framework – both at national and local level.

The necessary legal framework is not always in place. To implement congestion pricing in urban areas, municipalities must be in the legal position to directly charge for road use. National and local legislation does not always provide the legal grounds for such measures. In addition, legal procedures must exist for the identification, tracing and fining of offenders.

Strong and competent planning institutions are needed for the implementation of road pricing.

Congestion pricing needs strong planning institutions. Congestion pricing is a rather complex issue that needs the competent backing of a well-organised transport planning authority. That agency needs professional skills to address a wide range of issues such as political issues, public awareness and transparency, transport planning, technical implementation, operational management, financial management and various other aspects. In many developing cities the creation of such an agency may be a major bottleneck to the introduction of road pricing.

Conclusions

Congestion pricing is an efficient way to address urban congestion. Although charges can only be approximations for actual road use and external costs (such as congestion), it is an adequate way to provide incentives for not using the car in congested areas or at congested times. The implementation, however, requires both a strong political commitment and competent planning / regulatory authorities.

Further information on urban road and congestion pricing and additional case studies can be found on www.path.berkeley.edu/~leap/TTM/Demand_Manage/pricing.html and in OECD 2001, chapter 5, and in Cracknell 2000. Congestion charging also is a key element of many recent urban transport proposals, e.g. “The Mayor’s Transport Strategy” for the City of London. For details see www.london.gov.uk/mayor/strategies/transport.

Best practice case: City toll ring in Trondheim, Norway

Policy background and objectives

In quite a few European cities, considerations are under way to introduce urban road pricing schemes. The overall aim is to implement an efficient instrument to reduce urban traffic. In most cases, road pricing constitutes only one element in a more comprehensive strategy for Transport Demand Management (TDM) which in general aims at reducing the total volume of traffic and at promoting shifts to more environmentally sound modes of transport.

In many European Cities road pricing is considered as one important element of Transport Demand Management (TDM).

Seven of these European cities have formed the EUROPRICE Group in order to investigate road pricing policy issues. These cities are: Belfast, Bristol, Edinburgh, Copenhagen, Genoa, Rome and Trondheim. Within the EUROPRICE Group only Trondheim has already introduced a comprehensive road pricing scheme and is currently working on its continuous improvement. All other cities are currently introducing demonstration schemes in order to explore technical, legal and operational issues and, in particular, to gradually stimulate and promote social and political acceptance.

The Case of Trondheim. In 1991 the Trondheim road-pricing scheme was introduced in the form of a toll ring around the city centre. The main objective was to generate revenues for investment regarding the "Trondheim Package", an integrated investment package of infrastructure facilities for car users, public transport, pedestrians, and bike users. Demand management was of secondary importance. However, environmental benefits and increased quality of life were considered as the main long-term benefits.

The City of Trondheim is well advanced in the development of urban road pricing.

Although urban road pricing had been introduced in other Norwegian cities before (Bergen in 1986, Oslo in 1990), the Trondheim scheme was unique in two aspects: first, it was a fully electronic system with non-stop toll lanes at all stations, and, second, charges were time-differentiated. The introduction of the Trondheim toll ring was the result of a six year long process of planning and decision-making. Major decisions that had to be taken included: the principle of road pricing, the design of the toll ring, the design of charges, the use of revenues, and the operational and institutional design. All this was supplemented by comprehensive information campaigns to increase public acceptance.

Specifications of the city toll system

Toll structure. All motorists entering the city centre are charged. The charges are differentiated by time and vehicle type as follows:

Table 4.3:
Tolls in Trondheim

	Average charges per inbound crossing		
	Weekdays, 6.00 a.m. until 10.00 a.m.	Weekdays, 10.00 a.m. until 6.00 p.m.	Weekdays, 6.00 p.m. until 6.00 a.m. and weekends
Passenger cars, light vehicles	1.04 US$	0.86 US$	no charge
Heavy vehicles (3.5+ tonnes)	2.07 US$	1.62 US$	no charge

For heavy vehicles (>3.5 tonnes) twice the charge is levied. Cars are registered with the operator of the pricing scheme and equipped with an electronic tag that enables a detection machine to identify the car when passing a non-stop subscription lane at a tolling plaza.

Zoning. Originally, the Trondheim road-pricing scheme was based on a single cordon around the central business district. Now, however, a further improvement of the scheme is aiming at the development of a zone-based system that will be even more efficient at charging and managing transport demand.

Operating institutions. The road pricing scheme is operated by the "Tøndelong Toll Road Company", owned by public authorities (2/3) and local commercial organisations (1/3). Tolling infrastructure is owned by the Public Road Administration, while electronic tolling tags are issued by the tolling company. The costs of the tolling company amount to about 10 per cent of revenues. The remaining 90 per cent of revenues are fed into the Trondheim Package of infrastructure investment.

Outcomes and results

Prior to implementation, there was concern that road pricing in the city centre may reduce the attractiveness of the central business district and may drive trade and business out of the city. Detailed studies, however, have shown that this has not happened. In fact, trade and commerce were able to keep their growth levels.

Lessons learned

In order to implement local road pricing, adequate national legislation had to be in place. The relevant Norwegian Road Law allows user charges on public roads for the purpose of fund raising. With current legislation, charges are not seen as a demand management device. However, the Road Law is currently under revision to allow for the explicit application of road pricing for demand management purposes.

Further Information. Trondheim's toll ring – as a pioneer case – is widely discussed in the transport literature. See, for instance, an ICLEI-report by C. Erdmenger and S. Schreckenberger (1998). See also the website of the EUROPRICE Group of European cities investigating road pricing issues (www.europrice-network.org).

Best practice case: Congestion pricing in Seoul, Republic of Korea

Policy background and objectives

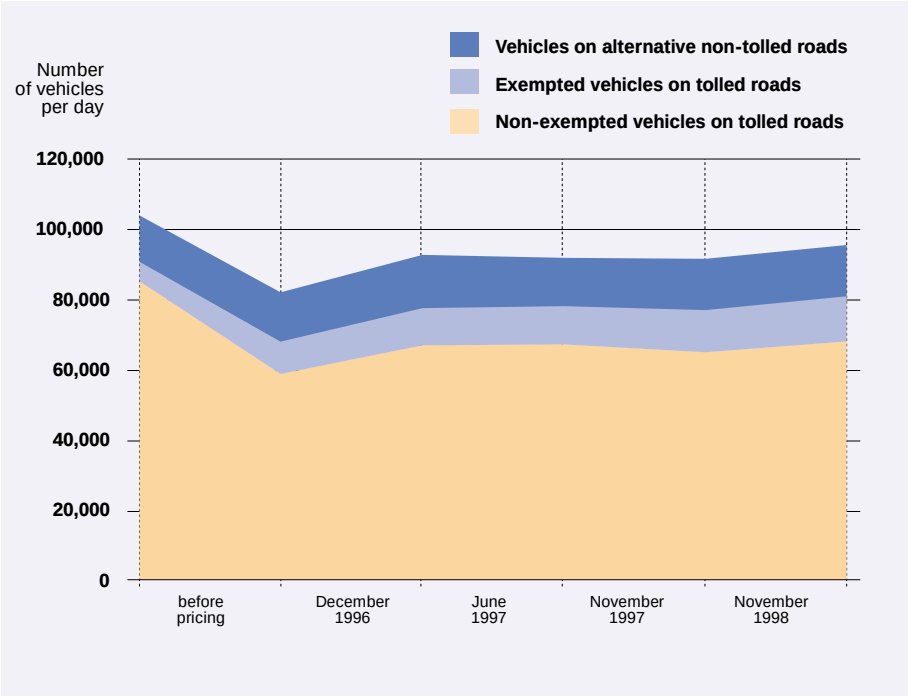
Urban transport policy in Seoul is based on a policy mix including different Economic Instruments.

After several decades of rapid growth in population and car use, Seoul faced increasing traffic congestion problems in the 1980s and 1990s. As part of a push-and-pull-strategy the Seoul City Government has taken several measures to reduce congestion in the inner city and to change the modal split in favour of public transport. These measures are based on a policy mix that also include Economic Instruments (*).

- Expansion of road and railway networks,
- Encouraging public transport demand by
  - Vehicle-related taxation* (local registration and license taxes),
  - Congestion pricing*,
  - Parking fees* and
  - Private car use restraints.

From these measures, congestion pricing plays a major role for controlling traffic volume and speed.

Figure 4.3: **Traffic volume on toll charged and alternative roads**
Data source: Shon 2000



Specifications of Seoul's congestion pricing approach

Congestion pricing measures in Seoul only apply to two major arterial roads linking the southern part of the city to Central Business District. These two corridors had been extremely congested before the system was introduced in 1996, and single occupied cars accounted for the majority of cars. Road pricing charges are levied only on private cars with two or less occupants. Toll booths for cash collection are used.

Charges are 2,000 Won (1.7 USD) for both directions per entry. They are collected between 7:00 am until 9:00 pm during weekdays, and from 7:00 to 3:00 pm on Saturdays. Sundays, national holidays, taxis, public transport, trucks and private cars with three and more people are free of charge.

Outcomes and results

Figure 4.3 depicts the development of traffic volume and speed on toll-charged and alternative routes. All in all, traffic conditions have improved significantly and only slight increases on alternative routes occured. Traffic speeds have increased in the entire system. At the same time use of toll-free vehicles such as bus, taxi, and private cars with more than three occupants has increased significantly.

Lessons learned

The Seoul case allows for several conclusions:

- It is possible to influence transport demand using tolls; they can effectively level off peak demand and induce substitution towards trips in off-periods and other transport modes.
- Despite selective road pricing on few arterial roads it is possible to reduce traffic volumes on the entire road network.
- Using tollbooths to collect tolls does not increase travel time when average traffic speed is increased due to less congestion.
- As part of an integrated transport policy strategy (as outlined above) road tolls do not harm urban economic growth and development.

For further information about the Seoul case see Shon 2000 and the literature cited in that paper.

Best practice case: Mobility concept of the Land Transport Authority in Singapore

Policy background and objectives

In Singapore, a highly restrictive transport policy has been able to keep urban traffic at acceptable levels.

Singapore experienced unprecedented growth in the 1970s and 1980s, which led to a large increase in the vehicle population. To secure future growth prospects, continually attract foreign direct investment, and avoid widespread vehicular congestion and pollution, as can be experienced in other cities of the region, Singapore proactively implemented Economic Instruments for demand side transport management. Demand

Traffic congestion is believed to be bad for business
Source: http://news6.thdo.bbc.co.uk/hi/english/world/asia-pacific/ new-sid_78000/78172.stm

side measures, including Economic Instruments, have been in effect since the 1970s. In 1995, however, the Land Transport Authority was formed to establish a comprehensive transport system that guarantees, controls and manages mobility in the city-state. Since then, Singapore has provided a best-practice example of how Economic Instruments can be implemented as part of a comprehensive management and planning strategy in urban transport.

Singapore's transport policy approach, as outlined by the Land Transport Authority (LTA), since 1995 has followed three basic tenets:

- to deliver an effective land transport network that is integrated, efficient, cost-effective and sustainable;
- to plan, develop and manage Singapore's land transport system to meet the nation's needs, i.e. enable growth, inclusion of the poor, etc.;

- to develop and implement policies to encourage commuters to choose the most appropriate mode of transport.

The basic idea behind these goals is to establish an approach that integrates supply and demand side management strategies and delivers a "World-Class Land Transport System". This top-down approach guarantees that all relevant aspects of transportation are considered, that synergies of supply and demand side measures can be reaped, and that long-term planning is facilitated. Therefore, the goals are broken down into the main strategy elements:

- Integrate land use, town, and transport planning by forming the Land Transport Authority as through the merger of four public sector entities: registry of vehicles, Mass Rapid Transit Corporation, Roads and Transport Division of the Public Works Department, and the Land Transport Division of the then Ministry of Communications;

- develop a comprehensive and efficient road network;

- improve public transport through rapid transit projects, commuter and traffic facilities;

- manage the demand for road space through vehicle ownership and usage measures; these include electronic road pricing schemes, vehicle registration and licensing, differentiated vehicle taxation, vehicle entry permits and toll payments.

Among these key elements of the Singaporean transport strategy, Economic Instruments play a central role in demand side management. Basically, there are three major instruments: Electronic Road Pricing (ERP), Vehicle Quota System (VQS), and Vehicle Entry Permits and Tolls. Additionally, Singapore has levied an annual vehicle tax. It is differentiated according to engine capacity, fuel type and type of vehicle (car, motorcycle).

Specifications of ERP and VQS measures in Singapore's mobility concept

Electronic Road Pricing (ERP) is aimed at managing transport demand through road pricing. The ERP system was introduced in 1998 after extensive trials and preparations. It replaced the Area Licensing Scheme, introduced in the mid-1970s, which required cars entering a designated

Electronic road pricing is one of the key elements in Singapore.

area in Central Area to display an area license. This road-pricing scheme had already been rather effective.

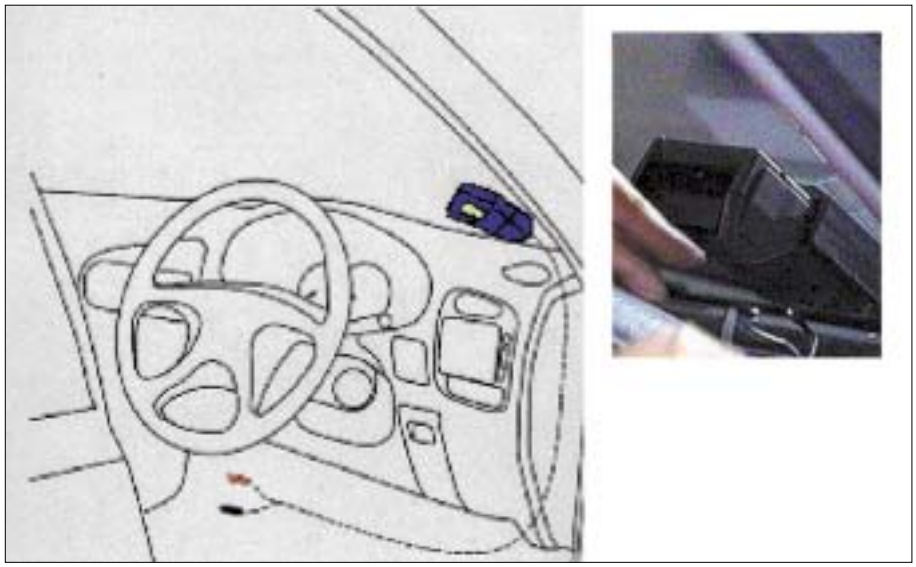


Figure 4.4:
In-vehicle Unit of Singapore's ERP system
Sources: http://its-hongkong.com (left) and http://news6.thdo.bbc. o.uk (right)

ERP, however, allows for more fine tuning. Today, major city axes, arterial roads and expressways use ERP to regulate traffic flow and congestion through differentiated pricing measures. In order to maintain traffic flow, there are neither toll booths or lane dividers, nor is there a need to slow down for detection. The ERP systems consists of two elements that allow for automated payment: Every car is equipped with an ERP in-vehicle unit (IU, see Figure 4.4), i.e. an electronic device installed in the vehicle that accepts a stored value cash-card (their value can be topped up at the automatic teller machines available at most banks, post offices and petrol stations). Vehicles simply pass under gantries and the system automatically identifies the vehicle and deducts the appropriate amount from the user (see Figure 4.5). Enforcement is by way of cameras installed on the same ERP gantries.

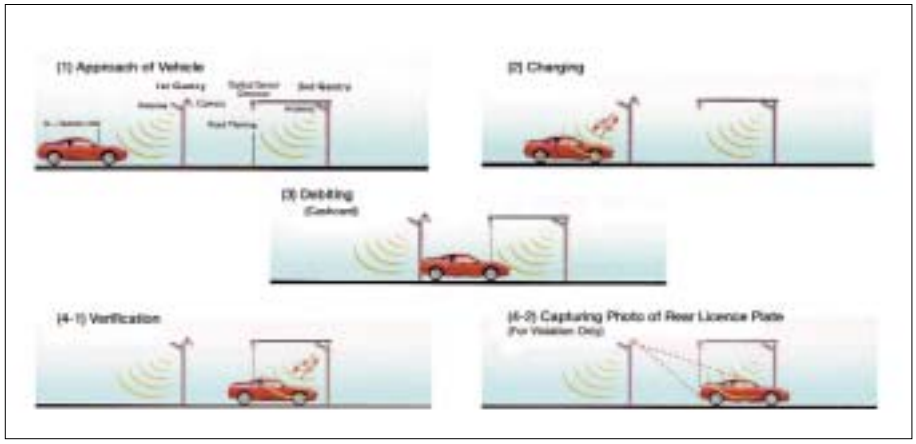


Figure 4.5:
ERP system procedure in Singapore
Source:
http://itshongkong.com

Prior to the launch of the ERP system, two important programmes were initiated: the 10-month long IU fitting programme and the ERP publicity programme. With ERP, motorists shall be more aware of the true costs of driving. With ERP the LTA wants to encourage motorists to choose when to drive, where to drive, or whether to drive or seek other modes of transport, e.g. car-pools or use public transport.

Charges are levied on a per-pass basis (pay-when-you-use principle), and they are differentiated according to

- day, time of the day (rush hours are 2 or 3 times more expensive),

- type and size of vehicle (basically the categories consist of taxis and passenger cars < 1,600 cc, cars > 1,600 cc, goods vehicles & buses, motorcycles, other),

Tolls for passenger cars in Singapore $ per pass Monday to Friday	7.30 a.m. - 8.00 a.m.	8.00 a.m. - 8.30 a.m.	8.30 a.m. - 9.00 a.m.	9.00 a.m. - 9.30 a.m.	9.30 a.m. - 10.00 a.m.	10.00 a.m. - 12.00 p.m.	12.00 p.m. - 12.30 p.m.	12.30 p.m. - 5.30 p.m.	5.30 p.m. - 6.00 p.m.
Expressways									
- AYE between Portsdown Road and Alexandra Road		0.50	2.00	0.50					
- CTE after Braddell Road, Serangoon Road and Balestier slip Road	1.00	2.50	3.00	0.50					
- CTE between Ang Mo Kio Ave 1 and Braddell Road	1.00	1.00	0.50	0.50					
- ECP after Tanjong Rhu Flyover		1.50	2.00	0.50					
- ECP from Ophir Road		1.00	1.50						
- PIE after Kallang Bahru exit	0.50	1.50	1.00						
- PIE eastbound and Mount Pleasant slip road into the eastbound PIE	0.50	1.50	1.00	0.50					
- PIE slip road into CTE	1.50	2.00	2.50	1.00					
Arterial Roads									
- Bendemeer Road southbound after Woodsville Interchange	0.50	0.50	0.50	0.50					
- Kallang Road westbound after Kallang River	0.00	0.50	0.50	0.50					
- Thomson Road southbound after Toa Payoh Rise	0.50	1.00	1.00	0.50					
- Restricted Zone (Nicoll Highway)	0.50	2.50	2.50	2.00	1.00		0.50	1.00	1.50
- Restricted Zone (All other gantries)		2.00	2.50	2.00	1.00		0.50	1.00	1.50

Table 4.4:
ERP differentiations for passenger cars
Source: LTA Singapore

- congestion level (at present, prices do not fluctuate directly with actual traffic volumes, but they are readjusted quarterly according to the evolving traffic conditions),
- road and place of gantry.

These differentiations allow for flexible road pricing. Table 4.4 provides an example of differentiations for passenger cars.

The number of vehicles is restricted by a quota system in conjunction with a regular auctioning of vehicle licences.

The Vehicle Quota System (VQS) is aimed at directly restricting vehicle ownership in the territory. Vehicle quotas have been in effect since 1990. They have replaced earlier attempts to regulate car ownership indirectly through taxes and charges. Under the VQS, car licenses (COE, "certificates of entitlement") are sold through auctions. Under this scheme, the government decides upon the number of vehicles and an acceptable growth rate of the vehicle population and then auctions a corresponding number of additional certificates.

The certificates of entitlement are valid for a 10-year period. In a monthly tendering process, applicants are allowed to make a bid in order to receive a COE. After the bidding, all bids are ranked in descending order, and the highest bids are awarded a COE as long as the upper limit of the COE to be allocated (the "quota") is reached. The last bid to be accepted eventually determines the prices of all other bids, as the COE price offered in this bid (the so-called quota premium") is applied to all bids.

In the beginning of the 1990s quota premiums were modest. Increasing demand for car ownership, however, has increased premiums for

Table 4.5: **Tendering results for Certificates of Entitlement in Singapore**
Source: Land Transport Authority Singapore (ww.lta.gov.sg)

	Category A Cars up to 1,600 cc	Category B Cars, more than 1,600 cc	Category C Goods Vehicles, Buses	Category D Motor cycles
Quota	2,936	1,083	333	613
Quota premium	16,092 US$	15,862 US$	13,795 US$	478 US$
Total bids received	8,350	5,081	1,842	1,312
As % of quota	284 %	469 %	553 %	214 %

medium-sized cars to above Singapore-$ 40,000 (US$ 22,000) in 1994. Since quotas were increased in the mid-1990s, premiums for a medium-sized passenger car have fallen to Singapore-$ 28,000 (US$ 16,000) in 2001.

The results of the tender for various vehicle types in September 2001 are summarised in Table 4.5.

Outcomes and results

All in all, Singapore managed to reduce congestion and pollution resulting from car usage while maintaining high mobility in the city and between the central areas and the periphery. At the same time, the country continually attracted foreign investment and maintained high economic growth rates.

Less congestion due to ERP. Several survey results show that the ERP system is working well. Traffic volumes in the Central Business District during the ERP period have been reduced significantly. There was a

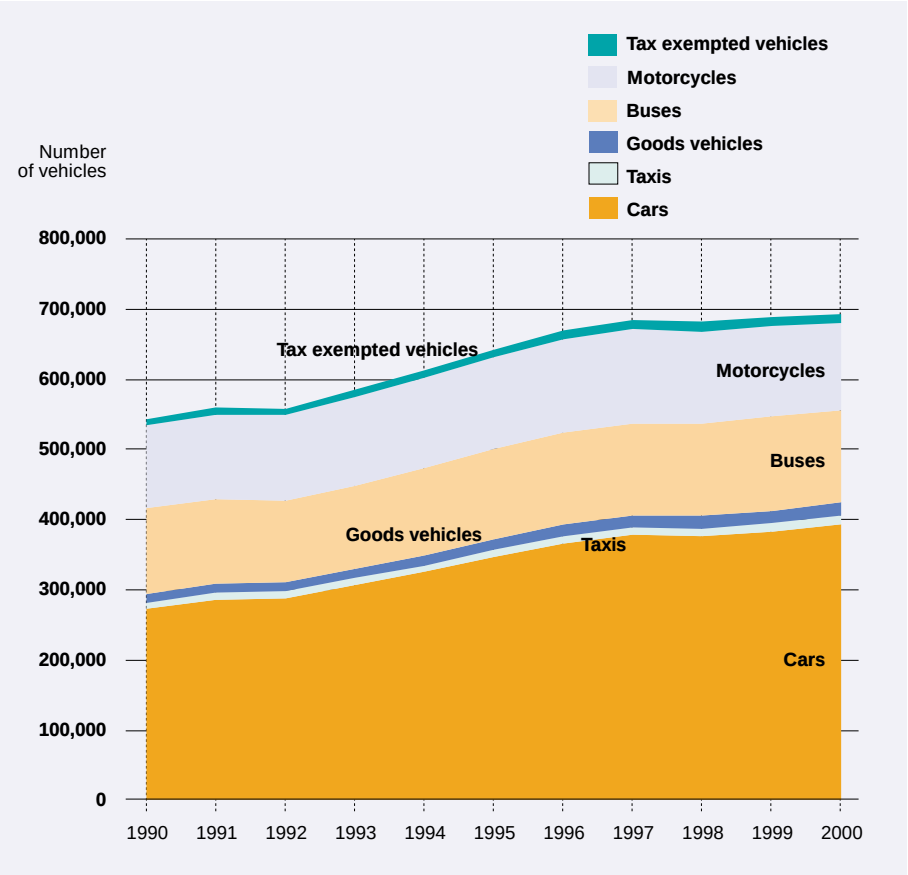


Figure 4.6:
Motor Vehicle population in Singapore, by vehicle type (1990-2000)
Source: Land Transport Authority Singapore (ww.lta.gov.sg)

slight spreading of the peak hour traffic as some vehicles took advantage of the lower charges between 7.30 am – 8.00 am and 9.00 am – 9.30 am.

Controlled vehicle population due to VQS. The vehicle quota system has been rather successful in stabilising the number of vehicles in Singapore. Figure 4.6 shows the development of the vehicle population between 1990 and 2000.

Lessons learned

Quite a few factor influenced the success of the Singapore transport policy.

Key factors to the success of the LTA's transport strategy include:

- **Centralised management and control.** The LTA was formed through the merger of formerly separate regulatory authorities. As part of a transport strategy for demand side management, e.g. to give incentives for a switch to public transport, push and pull factors have to be set comprehensively and in a proper schedule. The best timing and matching can be achieved through close cooperation, or centralised planning. Experience from other cities suggests that policy coordination problems are a major source for disjointed strategies that fail to induce modal changes.

- **High public acceptance.** The pricing schemes are generally considered as fair because they charge on a per-pass basis and pricing structures are time- and congestion-sensitive. Automatisation increased reliability, effectiveness and convenience. Furthermore, the integration of push factors (congestion pricing) and pull factors (cheap, convenient and ubiquitous public transport) allows for substitution and effective modal split changes. Embedding the use of Economic Instruments in a wider strategy raised public acceptance for Economic Instruments measures. A high proportion of commuting trips are now made by public transport.

- **Use of funds raised through ERP and VQS auctions for public transport projects.** Singapore has been able to attain a revenue that significantly exceeds the annual capital and operating cost of the road network, thus enabling it to meet the expenditure requirements of public transport.

The Singapore case has a couple of caveats. Several lessons can be learned:

- Win-win solutions are possible. The Singapore case shows that the goals of revenue generation and pollution mitigation are compatible and can be jointly pursued with the use of Economic Instruments. As a consequence, improvements in urban living conditions go hand in hand with satisfying increasing demand for mobility.

- It is technically feasible to charge road and congestion taxes, and it is possible to collect revenues electronically using automated systems.

- Road pricing and congestion pricing structures can be run with significant differentiation.

- It is possible and technically feasible to implement pricing structures that aim at optimising (peak) traffic flows.

- It is possible to influence transport demand using Economic Instruments; in particular, congestion pricing can effectively level off peak demand and induce substitution towards trips in off-periods and other transport modes.

Further Information. The Singapore case has been subject to extensive studies in the past years. For more information about the LTA's approach visit their websites at www.lta.gov.sg and www.onemotoring.com.sg. Also see the analyses in UN ESCAP (2000, pp. 187-192), and the World Bank Discussion Paper by C. Willloughby (2000b).