Division 44
Environment and Infrastructure
Sector project "Transport Policy Advice"


# Module 1d
# **Economic Instruments**

– revised January 2004 –

**Sustainable Transport:**
**A Sourcebook for Policy-makers in Developing Cities**

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

## Overview of the sourcebook

### Sustainable Transport: A Sourcebook for Policy-Makers in Developing Cities

#### What is the Sourcebook?

This *Sourcebook* on Sustainable Urban Transport addresses the key areas of a sustainable transport policy framework for a developing city. The *Sourcebook* consists of 20 modules.

#### Who is it for?

The *Sourcebook* is intended for policy-makers in developing cities, and their advisors. This target audience is reflected in the content, which provides policy tools appropriate for application in a range of developing cities.

#### How is it supposed to be used?

The *Sourcebook* can be used in a number of ways. It should be kept in one location, and the different modules provided to officials involved in urban transport. The *Sourcebook* can be easily adapted to fit a formal short course training event, or can serve as a guide for developing a curriculum or other training program in the area of urban transport. GTZ is meanwhile elaborating training packages for selected modules, being available from June 2004.

#### What are some of the key features?

The key features of the *Sourcebook* include:

- A practical orientation, focusing on best practices in planning and regulation and, where possible, successful experience in developing cities.
- Contributors are leading experts in their fields.
- An attractive and easy-to-read, color layout.
- Non-technical language (to the extent possible), with technical terms explained.
- Updates via the Internet.

#### How do I get a copy?

Please visit http://www.sutp-asia.org or http://www.gtz.de/transport for details on how to order a copy. You may also order via transport@gtz.de.

#### Comments or feedback?

We would welcome any of your comments or suggestions, on any aspect of the *Sourcebook*, by e-mail to transport@gtz.de, or by surface mail to:

Manfred Breithaupt
GTZ, Division 44
P. O. Box 5180
D - 65726 Eschborn
Germany

### Modules and contributors

*Sourcebook Overview and Cross-cutting Issues of Urban Transport (GTZ)*

#### Institutional and policy orientation

*1a. The Role of Transport in Urban Development Policy* (Enrique Peñalosa)
*1b. Urban Transport Institutions* (Richard Meakin)
*1c. Private Sector Participation in Transport Infrastructure Provision* (Christopher Zegras,MIT)
*1d. Economic Instruments* (Manfred Breithaupt, GTZ)
*1e. Raising Public Awareness about Sustainable Urban Transport* (Karl Fjellstrom, GTZ)

#### Land use planning and demand management

*2a. Land Use Planning and Urban Transport* (Rudolf Petersen, Wuppertal Institute)
*2b. Mobility Management* (Todd Litman, VTPI)

#### Transit, walking and cycling

*3a. Mass Transit Options* (Lloyd Wright, University College London; Karl Fjellstrom, GTZ)
*3b. Bus Rapid Transit* (Lloyd Wright, University College London)
*3c. Bus Regulation & Planning* (Richard Meakin)
*3d. Preserving and Expanding the Role of Non-motorised Transport* (Walter Hook, ITDP)

#### Vehicles and fuels

*4a. Cleaner Fuels and Vehicle Technologies* (Michael Walsh; Reinhard Kolke, Umweltbundesamt – UBA)
*4b. Inspection & Maintenance and Roadworthiness* (Reinhard Kolke, UBA)
*4c. Two- and Three-Wheelers* (Jitendra Shah, World Bank; N.V. Iyer, Bajaj Auto)
*4d. Natural Gas Vehicles* (MVV InnoTec)

#### Environmental and health impacts

*5a. Air Quality Management* (Dietrich Schwela, World Health Organisation)
*5b. Urban Road Safety* (Jacqueline Lacroix, DVR; David Silcock, GRSP)
*5c. Noise and its Abatement* (Civic Exchange Hong Kong; GTZ; UBA)

#### Resources

*6. Resources for Policy-makers* (GTZ)

#### Further modules and resources

Further modules are anticipated in the areas of *Driver Training*; *Financing Urban Transport*; *Benchmarking*; and *Car Free Days*. Additional resources are being developed, and an Urban Transport Photo CD-ROM is available.

# Module 1d
# **Economic Instruments**

Findings, interpretations and conclusions expressed in this document are based on information gathered by GTZ and its consultants, partners, and contributors from reliable sources. GTZ does not, however, guarantee the accuracy or completeness of information in this document, and cannot be held responsible for any errors, omissions or losses which emerge from its use.

## About the author

**Manfred Breithaupt** received his Masters in Economics in 1975. After working as Transport Economist for a German consulting company in Europe, Africa and Asia he joined GTZ in 1981 and has since served as Senior Transport Advisor. His experience covers transport planning, transport sector policy and restructuring, mode specific technical assistance (including urban transport), and privatisation and commercialisation. He also works as an Assistant Professor for transport planning and policy.

**Author:**
Manfred Breithaupt (GTZ)

This module draws heavily from: GTZ, Economic Instruments for Sustainable Road Transport – an Overview for Policy Makers in Developing Countries, by Jan Schwaab and Sascha Thielmann, 2001

**Editor:**
Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
P. O. Box 5180
D - 65726 Eschborn, Germany
http://www.gtz.de

Division 44, Environment and Infrastructure
Sector Project "Transport Policy Advice"

Commissioned by

Bundesministerium für wirtschaftliche
Zusammenarbeit und Entwicklung (BMZ)
Friedrich-Ebert-Allee 40
D - 53113 Bonn, Germany
http://www.bmz.de

**Manager:**
Manfred Breithaupt

**Editorial Board:**
Manfred Breithaupt, Karl Fjellstrom*, Stefan Opitz, Jan Schwaab

* *We would like to acknowledge the role of Karl Fjellstrom for critical review and appraisal of all contributed articles, identifying and coordinating with contributors, and other contributions concerning all aspects of the sourcebook preparation as well as for editorial and organizational supervision during the entire process of the sourcebook's development, from its initial conception until the final product.*

**Cover photo:**
Karl Fjellstrom
An electronic road pricing gantry in Singapore, December 2002

**Print:**
TZ Verlagsgesellschaft mbH
Bruchwiesenweg 19
D - 64380 Roßdorf, Germany

Eschborn, 2002 (revised January 2004)

# 1. Introduction

## 1.1 Overview

Economic instruments have a long history – both in developed and developing countries. Transport has always been used to generate state revenues. Many instruments that will be discussed in this module, in fact, can be found in various forms of horse ownership charges, and road and bridge tolls in many countries' economic histories. By 1776 Adam Smith, in *The Wealth of Nations*, had already outlined the basic principles of a sound transport policy, drawing from basic principles of taxation and financing schemes (Metschies, 2001). Economic instruments thus are not new transport policy "tools." Yet they are under-utilised. They should be applied to help meet current economic, social and ecological challenges.

> ***"... in no other major area are pricing practices so irrational, so out-dated, and so conducive to waste as in urban transportation"***
>
> William S. Vickery, 1996 Noble Prize laureate in Economics (quoted from ICLEI 2000)

Economic instruments have been mainly implemented in OECD (Organisation for Economic Cooperation and Development; a grouping of industrialised nations) countries. Increasingly, however, non-OECD countries recognise the potential of economic instruments. It enables them to both pursue development goals and to raise public revenues while simultaneously helping guarantee mobility in increasingly congested cities. It is crucial for policy-makers in developing cities to have a grasp of international experience with economic instruments and understand their potential contribution to sustainable development in their cities.

## 1.2 Costs of urban transport

Two major categories of costs of urban transport can be distinguished:

- ***Internal costs*** stem from the provision (construction, maintenance) and use of transport infrastructure. These costs have to be recovered from infrastructure users or from the public. Internal costs are the basis for all decisions on the transport market. They largely determine both individual mobility demand, and transport supply via rentability decisions of transport providers or calculations on the economic feasibility of infrastructure projects, etc.
- ***External costs***, on the other hand, are costs of transport which accrue to people other than those engaged in the transport activity. They stem from (mostly negative) side-effects of transportation, such as congestion, accidents, emissions and pollution, noise, and aesthetic factors which all negatively affect people and/or future generations. Such costs are rarely borne by road users. Even countries that have implemented the "user pays principle" (every transport user pays for all costs he/she incurs), basically apply it only to private costs. As a consequence, road transport is too cheap and its use inefficient.

Various studies in OECD countries have shown that the gross external costs of land transport are as large as 5% of Gross Domestic Product. The conceptualistion of transport costs in terms of internal, external and combined social costs is presented in Table 1.

**Table 1: Classification of the costs of transport.**

oecd, 1995

| COST CATEGORIES | Internal/Private Costs | External Costs |
|---|---|---|
| **Transport expenditure** | Fuel and vehicle costs; tickets/fares | Costs paid by others (e.g. free provision of parking spaces) |
| **Infrastructure costs** | User charges, vehicle taxes and fuel excises | Uncovered infrastructure costs |
| **Accident costs** | Costs covered by insurance, own accident costs | Uncovered accident costs (e.g. pain and suffering imposed on others) |
| **Environmental costs** | Own disbenefits | Uncovered environmental costs (e.g. noise disturbance to others) |
| **Congestion costs** | Own-time costs | Delays/time costs imposed on others |

In order to comply with the 'polluter pays' principle, in which the polluter is required to cover the full cost of their pollution, and in order to establish an efficient and sustainable urban transport system, it is essential that externalities are minimised. It is important to minimise or eliminitate externalities because in a market economy transport users base their decisions (e.g. how, when and where to travel) on the costs of different options. If prices of some options (e.g. travel by private car) underestimate costs such as air pollution, congestion, road infrastructure, global warming and others, then allocation of resources in the transport system will be innefficient and unfair.

Though the cost structure of urban journeys varies in different cities, in general road transport by private motor vehicle is currently too cheap for the traveller. A substantial portion of the cost of such journeys is imposed upon the wider community.

The best way of reducing externalities is through a price-based approach which aims to make transport users pay the full costs (private, environmental, other) of their individual trips.

*"... In general road transport by private motor vehicle is currently too cheap for the traveller. A substantial portion of the cost of such journeys is imposed upon the wider community"*

Full cost pricing (or 'internalisation' of transport costs) cannot be achieved in a short time frame. Steep price hikes would be too extreme to be politically acceptable. Adjustment of market structures, transport use, behaviour, technologies and supply/demand patterns needs time. This time must be reflected by sound long-term strategies. Internalisation of costs which are currently imposed externally upon persons other than the individual transport user is an indispensable element of a sustainable transport system, but it must be achieved step-wise, not shock-wise. Only then will full cost pricing have a chance of being accepted by market participants and gaining sufficient political support.

## 1.2 What are the policy options?

### Approaches to regulation

Four different elements of an approach to regulation can be discerned:

- ***Regulatory and planning instruments***: The regulatory approach administratively sets standards, restrictions, administrative procedures, and so on. Regulatory instruments follow a command-and-control approach.
- ***Cooperation agreements***: Cooperative approaches try to get all the people engaged in a specific issue involved in a process of voluntary communication and negotiation.
- ***Economic instruments***: Market-based approaches use economic incentives and/or disincentives to pursue a policy goal. The price mechanism serves as a vehicle for policy enforcement. Two basic instruments exist:
  - ***price instruments*** have an immediate influence on commodity prices, e.g. by imposing a tax on specific goods;
  - ***quantity instruments*** restrict the availability of a good and leave the formation of prices to the market. Auctions and bidding schemes are examples of quantity instruments in effect.
- ***Information instruments***: Information about transport issues can serve as a basis for more rational transport decisions of transport users and suppliers. The choice of transport modes, the acceptance of policy measures and the use of vehicles can be improved through moral suasion and transport-related education. Information instruments include public awareness campaigns, public information procurement and public acceptance monitoring.

Increasingly, policy makers are supplementing widely used regulatory instruments with cooperative agreements and economic instruments; these instruments allow them more flexibility in their pursuit of sustainability and are more efficient. In particular, direct price instruments, such as taxes and charges, are becoming a major policy focus. However, quantity instruments such as auctions are also being applied, as is the case with the Singapore vehicle quota systems and the auctioning of new car licenses in Shanghai.

### Which types of economic instruments exist?

There are three basic types of economic instruments in transport policy:

- ***Charges and taxes*** should be levied as a means to reduce transport demand in general, discourage the use of certain modes of transport, or certain transport technologies. Charges are normally directly linked to the public provision of services (such as road use charge, parking fees, etc.), whereas taxes do not have this direct link to any particular service. Rather, they are seen as specific sources for the general budget. In many countries charges, fees, surcharges and so on can often be imposed by city governments, while taxes and excises can only be applied by the national level of government. This is for example the case in Indonesia, even after extensive city government fiscal autonomy was implemented in 2001.
- ***Subsidies*** aim at decreasing the cost of certain transport modes, such as public transport. That is, financial incentives encourage switches towards more favoured transport modes such as public transport, walking and cycling.
- ***Auctions and bidding schemes*** are used to put a price on transport in a regime that quantitatively restricts access to transport. When the number of cars is restricted, auctioning can assign licenses or certificates to those market participants with the highest willingness to pay.

Economic instruments can be applied in various forms and ways (see Table 2), many of which will be discussed later in this module.

### Why should economic instruments be used?

Economic instruments are characterised by their use of market forces, i.e. the price mechanism, to achieve policy objectives. Their use can be beneficial in developing cities for a number of reasons:

- ***Revenue generation***. Price instruments usually generate additional revenues. In many countries fuel and vehicle taxes play a major role for state funding and financing of transport policy programs.
- ***Market-economy compatibility***. By using the price mechanism as a vehicle for cost internalisation, market allocation processes are not distorted.

**Table 2: A survey of possible economic incentives and instruments.**

Jan Schwaab / Sascha Thielmann, 2001

| Type of incentive or disincentive | Possible Economic Instrument(s) | Selected Economic Measure(s) |
|---|---|---|
| - Discourage motorized vehicle ownership | - tax/charge on vehicle purchase/ownership/ scrappage | - annual vehicle tax<br>- registration tax/charge<br>- (re)sales tax/charge<br>- scrappage tax/charge |
| | - restricting the number of vehicles and/or new registrations | - auction schemes competitive bidding for new licenses<br>- licensing car ownership |
| - Discourage motorized vehicle use<br>- Encourage switch to public or non-motorized transport | - tax/charge on vehicle use | - fuel tax<br>- pay-at-the-pump (sur)charges |
| | - tax/charge on road and/or infrastructure use,<br>- restricting access to urban centres or special areas | - parking fees<br>- city tolls<br>- road pricing<br>- bridge tolls<br>- cordon pricing<br>- congestion pricing |
| | - subsidies for public transport and/or multimodal transport (modal subsidies) | - subsidised public transport fees<br>- subsidies for public transport networks and operation<br>- tax-deductable public transport expenses<br>- P&R schemes |
| - Encourage lower emission technology use and innovation | - taxes/charges on vehicle purchase/ownership/ scrappage,<br>- taxes/charges on vehicle use,<br>- taxes/charges on road and/or infrastructure use | - tax differentiations based on emissions<br>- carbon/energy taxes<br>- emission fees<br>- emission-based surcharges<br>- subsidies, tax rebates for low emission vehicles/technologies |

- ***Enforcing the user-pays principle***. By charging for the use of infrastructure and vehicles, as well as for indirect costs such as congestion, pollution, noise and accidents, travellers pay for the costs of their transport.

- ***Incentive-based transport policy approach***. As part of demand side management, economic instruments can contribute to reducing transport demand, change the modal split by inducing substitution (e.g. in favour of public transport) and change transport behaviour. On the supply side, economic instruments can enable fair competition among the transport modes and induce incentives for technical change and higher efficiency of vehicles, transport infrastructure, and mass transit systems.
- ***Dynamic incentives***. Economic instruments can set dynamic incentives for substitution, technical change and the research and development of pollution abatement technologies. An example is provided by the refinery upgrade process in Germany and Hong Kong. Normally a switch to refinery technology allowing production of ultra-low sulphur (< 10 parts per million) diesel would take more than a decade, but with tax incentives in place the upgrades in Germany were implemented in around three years.
- ***Greater flexibility***. In general, economic instruments offer more flexibility than regulatory instruments as individuals and firms can more flexibly adapt to economic incentives than to administratively set restrictions.

### What are the limitations of economic instruments?

There are several drawbacks that possibly reduce the appeal of economic instruments in certain situations:

- ***Initial public antipathy***. Perhaps the major obstacle to applying economic instruments is that politicians and the public tend to react negatively to new charges and fees.
- ***Uncertainty about the right level of prices***. Correct prices require information about the level of internal and external costs. Due to valuation problems this information may not be adequately obtained, thus making it difficult to set levies at the "right" level. Furthermore, policy objectives can only be reached indirectly as economic instruments only set up a framework within which each individual makes his or her own decision. Such market reactions cannot be exactly predicted; hence the use of economic instruments may require several readjustments in order to reach a certain policy objective.
- ***Uncertainty about the reaction lags***. Reaction times of market participants may be long. Increases in fuel prices, for instance, show only little reductions in fuel demand (so-called small elasticities) in the short run, but greater elasticities in the long run (cf. Oum *et al*. 1990).

> ***"Economic instruments can only form a part, albeit an important one, of a sustainable transport strategy"***

- ***Unpredictable and unstable revenues***. Despite their large potential to create revenue, economic instruments may sometimes provide a shaky basis for revenue generation. This is particularly the case with environmentally motivated price increases, which trigger substitution, technical change and a reduction of environmental use. This successful decrease in environmental use will thus correspond to a decrease in revenue.

Taking the above concerns into account, economic instruments should always be embedded in a broader policy strategy for sustainable transport. Economic instruments can be implemented in a step-wise manner as medium to long term policy measures to:

- improve the efficiency of the transport system, and reduce congestion
- set economic incentives for technical changes
- raise start-up capital for public transportation.

Economic instruments should be adjusted frequently and in a predictable manner.

## 2. Getting started: putting theory into practice

Implement economic instruments within a sustainable transport framework requires strategic actions and decisions. The following steps are particularly important:

1 *Get people together and set economic, environmental and social objective(s)*
2 *Conceptualise a comprehensive urban transport strategy*
3 *Evaluate feasibility of economic instruments*
4 *Choose the appropriate economic instrument and its specifications*
5 *Determine institutional requirements for implementation and control*
6 *Determine funding, financing and revenue allocation*
7 *Determine adjustment period and schedule for implementation ("action plan")*
8 *Create and/or raise public awareness and acceptance.*

### Step 1: Get people together and set economic, environmental and social objectives

In the first step the requirements for sustainability are broken down to the specific needs of the country or local community. Therefore, it is crucial to initiate a discussion process involving represenatives of the major groups from decision makers in the administration and the public and those affected by transport and transport measures. Typically a working group consisting of the main stakeholders will be formed, including:

- several ***public authorities*** (including road transport office, legal office, public works office, press/public relations office, treasury/ finance office, taxation office, parking office, traffic police, planning boards, environmental offices) and parliamentary representatives,
- ***transport market participants*** (e.g. private transport users, public transport associations),
- ***Non-government organisations*** (NGOs) with interest in environmental and social issues,
- the ***press and electronic media***.

In order to avoid conceptual mistakes it is crucial to get all major stakeholders together and involve them in formulation of proposals from an early stage (Figure 1).

**Fig. 1**
***A working group on rural roads financing, Bangladesh.***
Rainer Kuhnle

### Step 2: Conceptualise a comprehensive road transport strategy

Experience shows that transport policy is most effective when measures are taken as part of a comprehensive transport policy mix. To avoid conflicts between goals set in Step 1, measures must complement each other. Although there is no "blueprint" for ideal policy packages, general guidance can be drawn from recent experience.

As a first step towards a concept of a sustainable road transport policy it is important to analyse the existing policies and conditions, and to identify economic instruments already in use. Therefore, it is important to know and identify the special conditions in a country or community. For example, many "master plans" already include requirements for parking areas and zoning.

### Step 3: Evaluate the feasibility of economic instruments

The third step towards the use of economic instruments is the evaluation of their feasibility in the given transport policy context. Within this process the following questions have to be answered:

- ***Appropriateness***. Are economic instruments appropriate to achieve the goals derived from Step 1?
- ***Technical feasibility***. Is there a working price mechanism available? What kind of

equipment and technical knowledge is required?

- ***Financial feasibility***. What does it cost to implement and operate systems based on economic instruments (e.g. costs of technical equipment such as road toll booths, maintenance costs and staff, etc.)?
- ***Institutional feasibility***. Are there sufficient institutional capacities to pursue set-up, implementation, enforcement, management and control of economic instruments?
- ***Public acceptance***. Is there strong public resistance to economic instruments (see margin note)?

| | Australia | Austria | Belgium | Canada | Czech Republic | Denmark | Finland | France | Germany | Greece | Hungary | Ireland | Italy | Japan | Luxembourg | Mexico | Netherlands | New Zealand | Norway | Poland | Portugal | Spain | Sweden | Switzerland | Turkey | United Kingdom | United States |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor Fuels** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - Leaded/unleaded differential | + | + | + | | | + | + | + | + | + | + | + | + | | + | + | + | + | + | + | + | + | + | + | + | + | |
| - Gasoline (quality differential) | | | | | | | + | | | | | | | | | | | | | | | | + | | | | |
| - Diesel (quality differential) | | | | | | + | + | | | | + | | | | | + | | | + | + | | | + | | | | |
| - Carbon/ energy tax | | + | | | | + | + | | + | | | | | | | | + | | + | | | | + | | | | |
| - Sulphur tax | | | | | | | | | | | | | | | | | | | + | | | | + | | | | |
| - other excise taxes (excl. VAT) | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | + | + | + | + | + | + | + |
| **Vehicle Registration** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - Sales/excise/ registration tax differential | | + | + | + | | + | + | | | + | + | + | + | + | | + | + | | + | | + | | + | + | + | | + |
| - Road/registration tax differential | | + | + | + | + | + | | | + | + | + | + | + | | | + | + | | + | | | + | + | + | + | | + |
| **Direct Tax Provisions** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - Free company car part of taxable income | | | | | | | + | | + | | | | | | | | | | | | | | | | | | |
| - employer-paid commuting expenses part of taxable income | + | | + | | | + | + | | + | | | | | | | | | | | | + | + | + | | | + | + |
| - Free parking part of taxable income | + | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| - Commuting expenses deductible from taxable income if public transport is used | | | | | | | | | | | | | | | | | | | | | | | | | | | + |

**Fig 2**
*Examples of economic instruments in environmental transport policy in OECD countries.*
OECD 1997, pp. 20-22

## Indonesia's experience with fuel price rises

Gasoline prices in Indonesia were increased from a very low level, by about 75% between October 2000 and July 2002. The fuel subsidy, while still large, was reduced considerably from its peak of around US$5 billion in 2000. Early in 2003, however, a further price rise – influenced by two year peaks in international oil prices – was implemented simultaneously with substantial telephone and electricity price rises.

This approach of simultaneous price rises in basic utilities proved to unwise from the perspective of public acceptance. While earlier protests against the fuel price rises had been muted and had dissipated within days, the package of price rises in early 2003 sparked sustained massive protests in major cities across the country. The government was eventually forced to roll back the price rises, so prices returned to their earlier levels. One of the lessons from the Indonesian experience is that any effort to raise fuel prices from highly subsidised levels must be accompanied by an astute and ongoing awareness campaign.

For most developed countries economic instruments are widely used (see Figure 2), since in these countries sufficient institutional capacities are generally available.

Many developing countries, however, have little experience with economic instruments in urban transport policy. All countries have tax authorities and, hence, some institutional experience with economic measures. This experience can and should be used as a basis for the introduction of economic instruments.

### Step 4: Choose the appropriate economic instruments and their specifications

When choosing an economic instrument the following issues should be considered:

- ***Type of instrument***. Which type of instrument shall be implemented? Which kind of incentive/disincentive structure shall be created? What is the object of regulation (emissions, fuels, vehicles, city entry, road use, technology, etc.)?
- ***Specifications***.
  - Which burden/subsidy shall be levied/granted? Shall there be differentiated rates, and what kind of differentiation?
  - Who has to pay, or: who is eligible for subsidies?
  - How shall revenues be raised (time of payment(s), charging mechanism, etc.)?
- ***Introduction***. What is the time-frame for phase-in procedures and the timing of strategies?

Any transport framework based on economic instruments should have the following key characteristics:

- ***Comprehensibility and transparency***. Any instrument's pricing structure should be understood by users whose behaviour it is meant to influence; no undue transaction costs to identify the appropriate information should exist;
- ***Stability and foreseeable development***. Measures should not fluctuate or be altered arbitrarily or in unpredictable ways, phase-in and/or phase-out periods should be carefully designed and well communicated;
- ***Measurability, cost effectiveness and objectivity***. The data required to calculate charges etc. should be objectively measurable, cost-effective to collect and unambiguous to apply;
- ***Cost recovery***. The costs imposed by the pricing scheme should reflect the real costs of transport;
- ***Political and institutional support***. Political commitment is crucial for the implementation of economic instruments, and for the setting up of institutions for their enforcement.

### Step 5: Determine institutional requirements for implementation and control

As Step 5 several crucial institutional decisions should be taken:

- ***Lead agency for setting up the program***. The lead agency is responsible for a successful planning, implementation and management of the project. Potential lead agencies include state agencies, local and regional agencies, new public entities, and private companies. The selection depends on various factors, including jurisdictional power needed for implementation, level(s) of government involved, public participation, the possibility that new authorities might better administer new programs, and experience and capacities of existing bodies.
- ***Operation authorities***. Which kind of institutional body is necessary for the management and operation of economic instruments as part of a sustainable transport strategy? How many different state and private authorities are involved? In many developing and developed countries, however, a major obstacle to a comprehensive transport strategy is the division of powers among many different institutions and a lack of coordination between these authorities.
- ***Involved jurisdictional bodies***. The third institutional issue corresponds to a clear understanding of which level of government has the jurisdictional authority and the administrative power to set up economic instruments.

### Step 6: Determine revenue allocation

A highly controversial issue is the allocation of revenues from economic instruments such as taxes and charges. Revenue allocation is a crucial factor for public acceptance of transport

measures. There are five options for revenue allocation:

- Addition to the general budget. In this case economic instruments serve as an additional source of consolidated revenues.
- Earmarking for transport sector investment. The earmarking of revenues constitutes the basis for a self-financing of the transport sector. Revenues from the transport sector are dedicated to specific expenditure items in the transport sector.

  Earmarking of revenues for transport sector investment increases public acceptance of economic instruments. Revenues can serve as a basis for making alternative transport modes more attractive. Charges on individual car use make that mode of transport less attractive (push factor), whereas facilities for non-motorised transport and comfortable and reliable public transport at reasonable prices offers a promising alternative (pull factor). This approach is therefore often referred to as "push-and-pull" strategy.

  Many Eastern European countries, including Bulgaria, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia, have Road Funds or earmarked schemes to allocate revenue from transportation charges to finance road maintenance, public transport and road safety measures. Chapter 3 provides a case study of the Mexican Environmental Trust Fund.
- Revenue-neutral redistribution. In order to lower the overall tax burden on society as a whole, additional revenues from economic instruments in transport policy can be rebated.

**Fig. 3**

***Car Free Days such as those held in Surabaya, Indonesia, implemented with the support of GTZ, can raise awareness about a range of sustainable transport issues, including application of economic instruments.***

Karl Fjellstrom

### Step 7: Determine adjustment period and schedule for implementation

Usually, before phasing in economic instruments, there is an extensive testing phase to determine and evaluate how a specific transport market reacts to the introduction of economic instruments. As a general approach, the introduction of economic instruments follows a multi-stage approach:

1. ***Political plan of action, discussion and design*** *of economic instruments;*
2. ***Trial period*** *with selected testing areas, and evaluation of results;*
3. ***Redesign of economic instruments*** *according to evaluation results, and plan of action for actual phase-in procedures;*
4. ***Phase-in with modest rates and speed****, long adjustment periods, step-wise increases of rates;*
5. ***Evaluation of first results after some years****, cut-off point or redesign if necessary;*
6. ***Full implementation of measures****, and coordination of economic instruments with other measures;*
7. ***Control and readjustment of measures*** *for the time of use of economic instruments.*

### Step 8: Raise public awareness and acceptance

Successful implementation of economic instruments ultimately depends on political support and public acceptance. Any (additional) levy on private car or motorcycle ownership or use will be opposed if it is "sold" to the public merely as an additional charge instead of a contribution to improve the (city) environment, economy or social equity. For more details please see Module 1e: *Raising Public Awareness about Sustainable Urban Transport*.

## 3. The national framework: the basis for economic instruments

Since the main concern of the Sourcebook is the city level of government, the national framework will be discussed only briefly. For more details please refer to Schwaab & Thielmann (2002).

On a national or federal transport policy level, economic instruments should be implemented as part of a nation-wide transport strategy. The most important examples of such national economic measures include:

- vehicle taxation
- fuel taxation
- national road pricing schemes.

These instruments are implemented in many developed and developing countries. Fuel taxes and vehicle taxation are among the most important sources of state revenues in many countries. They should be seen as an integral part of modern transport policies as they allow for flexible transport demand management and sound revenue generation (Figure 4).

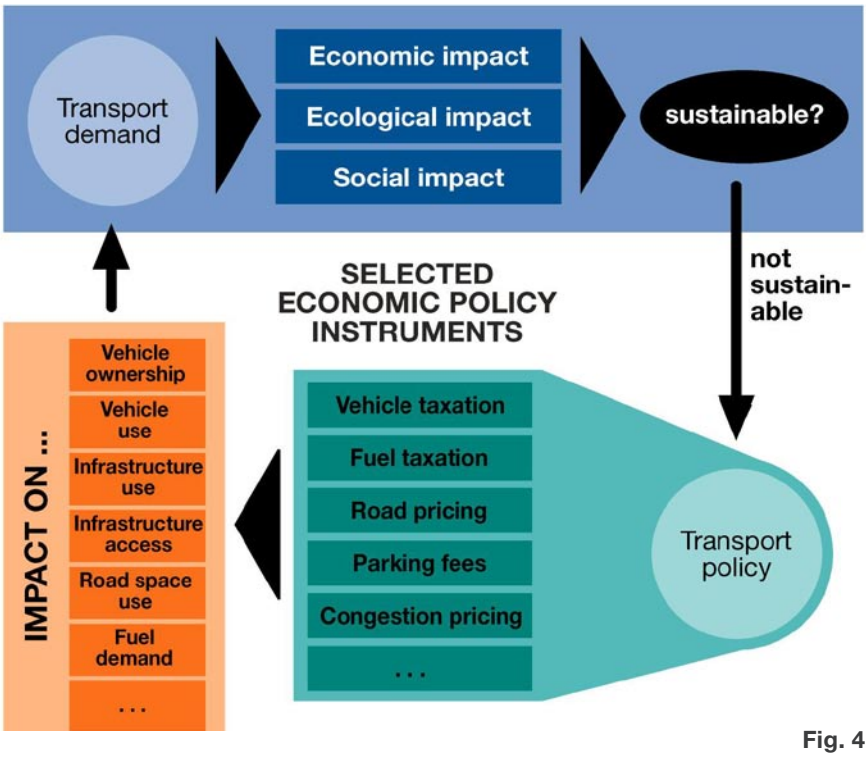


**Fig. 4**

*Economic instruments influence the demand for and impacts of transport.*

Jan Schwaab / Sascha Thielmann, 2001

### 3.1 Vehicle taxation

Throughout the world, vehicle taxation is used as a stable source of state revenues. It is fairly easy to collect once a comprehensive system of car registration is in place. GTZ, 2001 (Metschies) documents a world-wide GTZ survey of vehicle registrations.

#### Best practice case study: vehicle taxation in Germany

A differentiated system of vehicle taxation in Germany offers incentives for car owners to switch to low emission vehicles. This system is applied to both passenger cars and trucks.

#### Specifications of vehicle taxation

Passenger cars. For passenger cars, engine volume forms the basis of the tax system. The annual tax is levied relative to engine power, i.e. per 100 cc of engine power. The tax is differentiated by both emission levels and fuel types. Diesel engines are generally taxed at higher rates to compensate the lower fuel tax rate on diesel. Table 3 presents the annual tax levied for a 1,400 cc vehicle per year.

**Table 3: Vehicle tax differentiation in Germany.**

German Federal Ministry of Transport, Building and Housing

| | Annual vehicle taxaton in Germany Example: 1,400 cc vehicle (e.g. VW Golf, Toyota Corolla, etc.) | |
|---|---|---|
| **Emission level** | Petrol engine | Diesel engine |
| **Euro 4, Euro 3,** | 65 US$ | 174 US$ |
| **Euro 2** | 77 US$ | 187 US$ |
| **Euro 1** | 137 US$ | 291 US$ |
| **reduced emission vehicles (low emission level)** | 191 US$ | 345 US$ |
| **reduced emission vehicles (medium emission level)** | 266 US$ | 419 US$ |
| **others** | 320 US$ | 473 US$ |

**Table 4: Tax bonus scheme in Germany.**
German Federal Ministry of Transport, Building and Housing

| | Tax Bonus for environmentally friendly cars | |
|---|---|---|
| | Petrol engine | Diesel engine |
| Euro 4, Euro 3 | 276 US$ | 553 US$ |
| "3 litre car" | 460 US$ | 460 US$ |
| Euro 4 and "3 litre car" | 736 US$ | 1,012 US$ |

For environmental reasons, the vehicle tax includes an additional incentive to buy low-emission and fuel-efficient cars. For the period of 2000 to 2004 low-emission passenger cars that are registered for the first time get a tax bonus of up to US$ 1,012. The structure of the tax bonus is summarised in Table 4.

*"A tax bonus aims at stimulating the purchase of fuel-efficient and low emission vehicles"*

***Trucks.*** The system of differentiated vehicle taxation is also applied to trucks where vehicle classification according to emission and noise levels forms an integral part of the tax regime.

### Jakarta raises vehicle taxes by 50 %

Excerpts from The Jakarta Post, 9 Nov. 2002

Without involving the public, the Jakarta administration decided on Friday to increase annual vehicle taxes from 1 percent to 1.5 percent of the vehicles´ value.

Jakarta currently has 3.8 million vehicles and motorcycles. The vehicle tax income represents 80 percent of the city´s provincial tax revenue, while entertainment, hotel and restaurant tax contributes 10 percent and other taxes and levies such as advertising tax makes up the balance. The provincial tax revenue represents about 50 percent of the city´s total income.

## 3.2 Fuel taxation

Fuel consumption can be regarded as a good approximation of road use as it is generally related to individual road use. Taxing fuel consumption is the most common form of 'proxy' user charging in road transport. Fuel taxation can effectively be applied to recover variable infrastructure costs. It offers a simple and reliable way of charging the users of transport infrastructure relative to their individual use, and implementation and enforcement is rather easy as the tax can be levied at a few fuel distribution centres.

*"Both the global and the local environment benefits from fuel taxation"*

Fuel taxation, however, provides only an approximation of road use. Moreover, fuel taxation does not distinguish between road uses which have a very high marginal cost (e.g. during peak periods in congested areas) and uses which impose a low cost. For the time being however, in many developing cities fuel taxation provides the best proxy of vehicle use charges which can be achieved at reasonable implementation costs. Despite the potential of fuel taxation, many developing countries continue to subsidise fuel (see Table 5).

There is always strong public resistance to fuel and vehicle taxation (see text box "Jakarta raises vehicle taxes by 50%"). Opposition to fuel taxation, however, should not be seen as an insurmountable obstacle to the introduction of or increases in fuel taxes. It should rather be a reminder that increases should take place gradu-

**Fig. 5**
*Up-country petrol sales, Guinea.*
Gerhard Metschies

ally (e.g. with no more than 10% increase at a time) and that building public awareness is very important. In many European countries fuel tax increases follow a foreseeable schedule with small but continuous tax increases. These are announced well in advance in order to reduce public resistance and to allow consumers to take foreseeable medium-term fuel price increases into account when buying a new (and hopefully fuel-efficient) car.

*"Road pricing creates revenues for transport infrastructure investment and contributes to congestion management"*

The German fuel tax is levied on producers of fuel and oil products. Tax incidence, however, is shared by supply and demand. The tax rates are differentiated by fuel type and, starting in autumn 2001, also by the criterion of sulphur content. Tax rates on fuels in Germany are listed in Table 6.

## Experience with an environmental trust fund in Mexico

The Environmental Trust Fund in Mexico was created in 1992. It's main purpose was to finance environmental, transport-related projects such as vapour recovery systems in refueling stations, and public awareness campaigns. Funds came from a fuel tax increase of US1 cent per litre of gasoline.

Between 1992 and 1998 the Environmental Trust Fund received approximately US$70 million in funds.

### Lessons learned for other developing cities

The Mexican experience reveals the following main points relevant to other developing cities:

- It is possible to implement relatively straightforward mechanisms for raising funds for projects to reduce adverse impacts of transport and air pollution.
- Fuel taxation is an administratively easy way to generate revenues for environmental projects, and fuel taxes provide a broad and secure basis for long-term financing and hypothecation (earmarking) schemes.
- Fragmented institutions and political factors pose the main threat to a continuously working system.

**Table 5: Fuel price regimes.**
Gerhard Metschies, 2001

| Fuel price regime | Examples from developed countries | Examples from developing countries | Gasoline prices per liter in 2000 [US cents] |
|---|---|---|---|
| **High taxation** | EU countries, Hong Kong | Côte d'Ivoire, Bolivia, Burundi | **> 72** |
| **Medium taxation** | South Africa, Austalia, Canada | Chile, Cameroon, Malawi | **48 - 72** |
| **Low taxation** | USA | Ethiopia, Vietnam, China | **33 - 47** |
| **Subsidised fuel prices** | Saudi Arabia | Turkmenistan, Indonesia, Iran | **2 - 32** |

**Table 6: Fuel tax differentiation in Germany.**
German Federal Ministry of Transport, Building and Housing

| | Fuel taxation in Germany (tax per litre) | |
|---|---|---|
| | Gasoline | Diesel |
| **high sulphur content (> 50 mg per kg)** | **0.58 US$** (of which 0.11 US$ as eco tax) | **0.42 US$** (of which 0.11 US$ as eco tax) |
| **low sulphur content (≤ 50 mg per kg)** | **0.56 US$** (of which 0.09 US$ as eco tax) | **0.40 US$** (of which 0.09 US$ as eco tax) |

Fuel is treated as any other good, therefore, an additional value added tax (VAT) of currently 16 % is levied as well. This lifts the overall tax element of fuel retail prices to a total of almost 70 % of the final pump price.

The timing of strategies, and long-term implementation and adjustment periods is important. Every fuel tax increase causes intense public discussions and resistance. In order to reduce friction over an adjustment, public acceptance should be built through awareness campaigns and the planning of long and foreseeable adjustment periods. As with public transport fares and other price increases, regular, small price rises according to a pre-determined and transparent formula (e.g. based on inflation and international oil prices) are preferable to large, infrequent price increases.

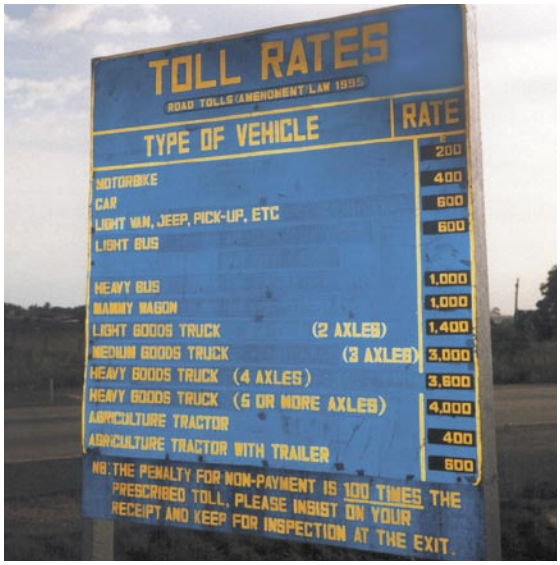


**Fig. 6**
*Toll sign on the way from Accra to Tema, Ghana.*
Gerhard Metschies

### 3.3 Road pricing

Road pricing is a flexible and efficient way to charge road users for their actual road use. It can be differentiated by vehicle type or time of the day. Road pricing may be applied to the overall road network or to particular roads or bridges. Road pricing is normally applied to selected routes only. It is then either implemented in order to recover investment costs for expensive infrastructure such as express motorways and bridges or to impose an extra charge on the use of congested roads during peak periods.

In an increasing number of cases, toll schemes are implemented to finance infrastructure investment. In many instances private investors are involved on the basis of BOO/BOT models (build, own, operate / build, own, transfer) where the private sector invests in infrastructure and is allowed to recover investment costs by collecting tolls for a certain period of time (see further Module 1c: Private Sector Participation in Urban Transport Infrastructure Provision).

In urban areas, tolls are not necessarily raised for financing purposes but rather as an incentive not to use congested roads. In many densely populated urban areas in developing countries it is virtually impossible to provide sufficient road capacity to meet peak time demand. Urban road pricing then tries to restrict that demand by increasing travel costs. Urban road pricing may refer to single roads (toll roads), to cordon boundaries (cordon pricing), or to complete areas of a city (e.g. the central business district).

## 4. The provincial and urban level: meeting 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. On the regional and local level important economic instruments which are implemented in many countries include:

- surcharges on national/federal measures
- parking fees
- urban road and congestion pricing.

### 4.1 Surcharges on national/federal measures

Good examples of surcharges on national measures include:

- locally differentiated levies on vehicle taxation
- transport-related surcharges on national/federal income- and company-taxation
- fuel charges (“pay-at-the-pump charges”)
- 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, as has been done successfully in Bogotá, Colombia (see text box).

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

### 4.2 Parking fees

In many 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.

Parking fees may create considerable revenues for the local municipality. In many developed cities, fees for public parking are in the range of US$ 1 to 2 per hour. In developing mega-

## Fuel surcharge in Bogotá

*Adapted from Angélica Castro Rodríguez, TransMilenio: a Way of Life,* **http://www.partnerships.stockholm.se**, *2002*

In the city of Bogotá a 20% surcharge is collected on all gasoline sales. 50% of the resources generated are used for the construction of the infrastructure required for the operation of the TransMilenio system. In this way the private vehicle owners (19% of the population) finance part of the infrastructure for the operation of a massive public service transportation system that has a 72% utilisation by low income citizens. This is how social equilibrium is generated in the city. There is a financing scheme for the infrastructure of the system in 15 years with resources from the city and the central government for the development of the project in the long term.

This plan takes into account US$ 1,296 million from the year 2000 coming from the nation's resources and US$ 674 million from the District (from the gasoline surcharge) for a total of US$ 1,970 million. This is equivalent to an estimated participation from the nation in the financing of the system of 66%.

cities parking fees may be at similar levels. In Buenos Aires, Argentina, for example, parking fees at private car parks in 2001 amounted to about US$ 2 per hour (and US$ 8–10 per day in 2001). Although these private car parks also include a guarding component, it shows a willingness (and ability) to pay for parking (Figure 7).

By introducing parking fees, car use in urban areas becomes more expensive and thus less attractive to many motorists. This can help reduce congestion and encourage alternative modes of transport. When combined with a 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 hour congestion.

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.

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.

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.


**Fig. 7**

***Private parking lots are prominent in central Buenos Aires. Charges of around US$ 2 per hour were imposed in 2001.***

Manfred Breithaupt, 2001

### Parking charges in Quito

Quito, Ecuador, imposed a new parking charging scheme in the city centre to help raise funds for its Bus Rapid Transit System. This represented a new source of funds for the city, as parking was previously unregulated. This funding scheme (as well as other innovative approaches to economic instruments and financing of mass rapid transit) is discussed in Module 3b: *Bus Rapid Transit*.

### Congestion charging in London

Congestion charging is a key element of many recent urban transport proposals, e.g. "The Mayor's Transport Strategy" for the City of London, where a cordon pricing scheme will come into effect in early 2003. For details see http://www.london.gov.uk/mayor/strategies/transport.

**Fig. 8**

*Vendors, pedestrians, and vehicles competing for scarce urban road space, Dar Es Salaam, Tanzania.*
Gerhard Metschies

Parking policy in ***Bremen***, Germany follows an integrated approach. It includes measures to raise public awareness, improvements to public transport, parking management, and town planning. Pricing elements of the strategy include:

- making sure that there is no free or unregulated parking in urban centres
- having the price and quantity of parking lots determined by the appropriate demand for short-term and long-term parking (highest prices at the most attractive locations)
- ensuring that car use plus parking charges in the city do 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.

## 4.3 Urban road and congestion pricing applications

Road and congestion pricing are used as demand management strategies on local roads. Urban road pricing generally aims to achieve fuller cost recovery for urban transport and infrastructure use.

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. Decentralisation of institutional powers creates incentives for local policy makers to use economic instruments, and enables efficient urban road network use.

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. It also reduces the need to add new road capacity. The main objectives of road and congestion pricing typically include:

- a change in the time of travel: from peak to off-peak traffic with a consequent reduction of peak period traffic and a potential reduction of total traffic
- 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 quality of urban life
- a means to generate revenues.

Congestion pricing should be seen as a gradual process that starts on a pilot scheme basis and then aims at successive extensions and improvements.

There are two main forms of road and congestion pricing:

- ***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.

Technically, road and congestion pricing can be implemented in different ways at various levels of 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.
- ***Manual toll station***. Motorists have to pay a road charge on entering the priced area.
- ***Electronic charging systems***. Vehicles are equipped with electronic tags that allow the automatic identification of vehicles at non-stop tolling stations (as in Singapore, which is explained in more detail following).

Current congestion pricing applications provide only an approximation of distance driven. Ideally, congestion pricing should be based on the actual distance travelled, differentiated by time

and route. At present, however, technical limits only allow a rough approximation; vehicles are only charged on entering a controlled area. The actual amount of driving done within the area (and hence the costs imposed) is not reflected in the charge.

One of the key lessons learned from many congestion pricing projects is that the rationale 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, public support will be higher.

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.

Congestion pricing requires strong planning institutions. The institutional capacity required for Singapore-like applications may be lacking in most developing cities. Nevertheless some form of congestion pricing would be an efficient way to address urban congestion in many developing cities. Congestion pricing is so far the only proven mechanism of achieving large, short-term modal shifts away from private transport and in favour of public transport.

### Best practice case study: City toll ring in Trondheim, Norway

In several 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.

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. Trondheim has already introduced a comprehensive road pricing scheme and is currently working on its continuous improvement.

**Table 7: Road user tolls in Trondheim.**
Jan Schwaab / Sascha Thielmann, 2001

| | 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 |

All motorists entering the city centre are charged. The charges are differentiated by time and vehicle type as described in Table 7.

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.

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 maintain their growth levels.

### Best practice case study: mobility concept of the Land Transport Authority in Singapore

#### Policy background and objectives

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 experienced in other cities of the region, Singapore proactively implemented economic instruments for demand side transport management.

Demand side measures, including economic instruments, have been in effect since the 1970s. In 1995 the Land Transport Authority was formed to establish a comprehensive transport system that guarantees, controls and manages mobility in the city-state. 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.

*"In Singapore, a strictly controlled transport policy has kept urban traffic at acceptable levels"*

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, enabling growth; inclusion of the poor.
- 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 main strategy elements, to:

- 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.

### Electronic Road Pricing

Electronic Road Pricing (ERP) is aimed at managing transport demand through road pricing. The ERP system was introduced in 1998 after extensive trials. It replaced the Area Licensing Scheme, introduced in the mid-1970s, which required cars entering a designated central zone to display an Area License. This precursor to modern road-pricing schemes, in combination with the other elements of the system in Singapore, had been remarkably effective in limiting the use of private cars and encouraging the use of public transport.

ERP, however, allows for more finely tuned system than the earlier permit-based area licensing. 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 nor 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, 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. Enforcement is by way of cameras installed on the same ERP gantries (Figure 9). Measures are complemented by parking restrictions and charges (Figure 10).

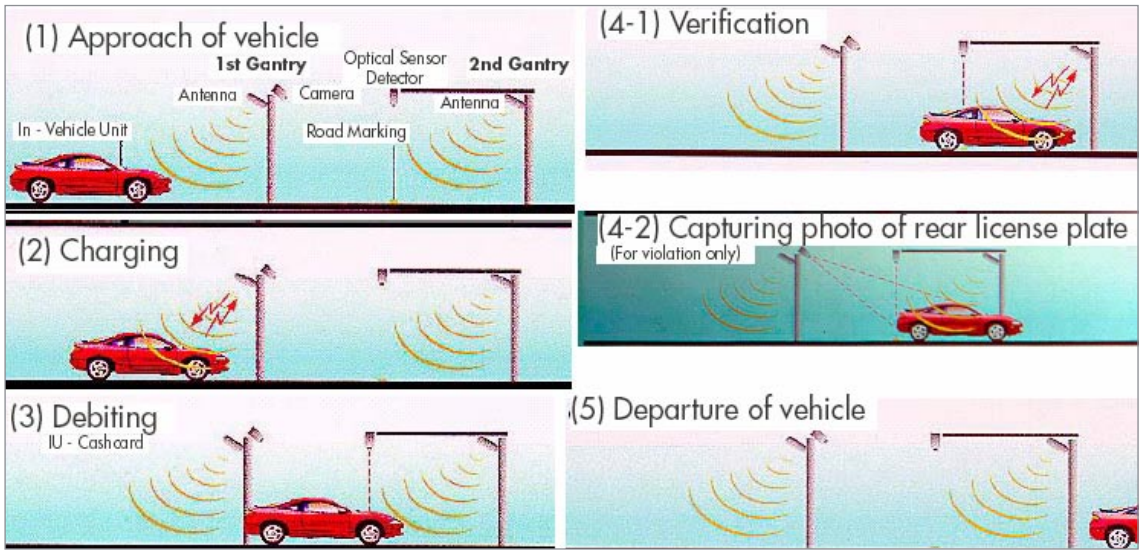



**Fig. 9**

*The Singapore Electronic Road Pricing gantries impose charges on private vehicles entering the central area.*

Singapore LTA (above); Karl Fjellstrom (below), Dec. 2002

Prior to the launch of the ERP system, two important programs were initiated: the 10-month long IU fitting program and the ERP publicity program. With ERP, motorists will 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, 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)
- 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.

**Table 8: Electronic Road Pricing rates for passenger cars, from 2 January 2003.**
http://www.lta.gov.sg

| Monday - Friday | 7.30 - 8.00am | 8.00 - 8.30am | 8.30 - 9.00am | 9.00 - 9.30am | 9.30 - 10.00am | 10.00 - 12.00pm | 12.00 - 12.30pm | 12.30 - 1.00pm | 1.00 - 5.30pm | 5.30 - 6.00pm | 6.00 - 6.30pm | 6.30 - 7.00pm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Expressways** | | | | | | | | | | | | |
| AYE between Portsdown Road and Alexandra Road | $0.00 | $0.50 | $1.50 | $1.00 | | | | | | | | |
| CTE after Braddell Road, Serangoon Road and Balestier slip Road | $1.50 | $2.50 | $3.00 | $1.00 | | | | | | | | |
| CTE between Ang Mo Kio Ave 1 and Braddell Road | $1.00 | $1.00 | $0.50 | $0.50 | | | | | | | | |
| ECP after Tanjong Rhu Flyover | $0.50 | $1.00 | $1.50 | $0.50 | | | | | | | | |
| ECP from Ophir Road | $0.00 | $0.50 | $0.50 | $0.00 | | | | | | | | |
| PIE after Kallang Bahru exit | $0.50 | $1.00 | $0.50 | $0.50 | | | | | | | | |
| PIE eastbound after Adam Road and Mount Pleasant slip road into the eastbound PIE | $0.50 | $1.00 | $1.50 | $0.00 | | | | | | | | |
| PIE slip road into CTE | $2.00 | $2.50 | $3.00 | $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 | $0.00 | $0.50 | $0.50 | | | | | | | | |
| Thomson Road southbound after Toa Payoh Rise | $0.50 | $1.00 | $1.50 | $0.50 | | | | | | | | |
| Dunearn Road eastbound after Dunkirk Avenue | $0.00 | $0.50 | $1.00 | $0.00 | | | | | | | | |
| Restricted Zone (Nicoll Highway) | $0.50 | $2.50 | $2.50 | $2.00 | $1.00 | $0.00 | $0.50 | $1.00 | $1.00 | $1.50 | $2.00 | $1.00 |
| Restricted Zone (All other gantries) | $0.00 | $2.00 | $2.50 | $2.00 | $1.00 | $0.00 | $0.50 | $1.00 | $1.00 | $1.50 | $2.00 | $1.00 |


**Fig. 10**
*Electronic Road Pricing in the premiere shopping area of Orchard Road is complemented by parking restrictions.*
Karl Fjellstrom, 2002

Such differentiation allows flexible road pricing. Table 8, which shows the ERP prices in effect from 2 January 2003, illustrates how prices for cars are differentiated according to day, time of day, type of road, and location. The rates in Table 8 apply to passenger cars. Motorcycles are generally 50% cheaper, and heavy vehicles 50% more expensive. Prices for light goods vehicles and taxis are similar to passenger cars, with very heavy vehicles and large buses generally double the price of passenger cars.

### Vehicle Quota System

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. Shanghai, China has recently implemented a similar system whereby new vehicle license are limited and passed to the highest bidders, although this has failed to prevent double-digit growth rates in the private car fleet.

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

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.

COE prices for bidding in early 2003 are presented in Table 9. Detailed facts and figures, as well as explanations of the different systems, are available at the LTA Website, http://www.gov.sg/lta/3_vehicles/9_Facts.htm#coe.

### Outcomes and results

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.

Several survey results show that the ERP system is working well. Traffic volumes in the Central

**Table 9: Vehicle quota tendering results, January 2003.**

http://www.lta.gov.sg

| Month of Bidding Exercise | Vehicle Category | Category A Cars (<=1600 cc) & Taxis | | Category B Cars >1600 cc | | Category C Goods vehicles & buses | | Category D Motorcycles | | Category E Open Category | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st Tender | 2nd Tender | 1st Tender | 2nd Tender | 1st Tender | 2nd Tender | 1st Tender | 2nd Tender | 1st Tender | 2nd Tender | |
| Jan-2003 | Quota | 1,342 | | 707 | | 577 | | 840 | | 1,094 | | 4,560 |
| | Successful bids | 1,335 | | 707 | | 566 | | 795 | | 1,094 | | 4,497 |
| | Bids received | 2,153 | | 1,128 | | 1,017 | | 795 | | 1,645 | | 6,738 |
| | Quota Premium | $28,489 | | $29,099 | | $13,101 | | $1 | | $29,001 | | - |
| | PQP for Feb 2003 | | | | | | | | | NA | | - |

* Note: Prevailing quota premium (PQP) for existing vehicles is a moving average of the QP over the last 3 months.

Business District during the ERP period have been reduced significantly. There was a slight spreading of the peak hour traffic as some vehicles took advantage of the lower charges between 7.30am – 8.00am and 9.00am – 9.30am.

The vehicle quota system has been successful in stabilising the number of vehicles in Singapore.

### Lessons learned

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. Automation 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 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.

## Resources

### More information

For an 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.

Further information on urban road and congestion pricing and additional case studies can be found on http://www.path.berkeley.edu/~leap/TTM/Demand_Manage/pricing.html and in OECD, 2001 (chapter 5) and Cracknell, 2000.

Trondheim's toll ring – as a pioneer case – is reference at the Website of the EUROPRICE Group of European cities investigating road pricing issues (http://www.europrice-network.org).

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 http://www.lta.gov.sg and http://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), TWU-43, which can be downloaded at http://www.worldbank.org/transport/publicat/pub_tran.htm.

### References


- Allport, R. (1996): *Transport Management: Private Demands and Public Needs*, in: Stubbs, J. / Clarke, G. (ed.), Megacity Management In the Asian and Pacific Region, Vol. I, ADB et al., Manila, pp. 177-226
- Breithaupt, M. (2002): *Mobility Management Measures – Transport Demand Management, Economic instruments*, Presentation at a Seminar on Sustainable Urban Transport System for Belgrade, September 2002
- Cracknell, J.A. (2000): *World Bank Urban Transport Strategy Review – Background Paper: Experience in Urban Traffic Management and Demand Management in Developing Countries*, Washington D.C.; available at http://www.worldbank.org/transport.
- European Conference of Ministers of Transport , ECMT (1998): *Efficient Transport for Europe, Policies for Internalisation of External Costs*, Paris

- European Conference of Ministers of Transport , ECMT (2000): *Economic Objectives of Introducing Tolls on Intercity Road Transport Infrastructure, Conclusions of Round Table 118*, Paris, Nov. 30-Dec. 1, 2000
- European Commission (1998): *Fair Payment for Infrastructure Use*, White Paper, presented by the Comission; available at: http://www.europa.int/comm/transport/infr-charging/library/charging-en.html
- European Commission (1999a): High Level Group on Transport Infrastructure Charging, *Final Report on Estimating Transport Costs*, May 1999; available at: (as above)
- European Commission (1999b): *Calculating Transport Infrastructure Costs*, Final Report of the Expert Advisors to the High Level Goup on Transport Infrastructure Charging, April 1999; available at: (as above)
- European Commission (1999c): *Calculating Transport Congestion and Scarcity Costs*, Final Report of the Expert Advisors to the High Level Goup on Transport Infrastructure Charging, May 1999; available at: (as above)
- European Commission (1999d): *Calculating Transport Environmetal Costs*, Final Report of the Expert Advisors to the High Level Goup on Transport Infrastructure Charging, April 1999; available at: (as above)
- European Commission (1999e): *Calculating Transport Accident Costs*, Final Report of the Expert Advisors to the High Level Goup on Transport Infrastructure Charging, April 1999; available at: (as above)
- Erdmenger, C. / Schreckenberger, S. (1998): *First Mover Advantage by Eco-efficiency - local incentives for environment and employment, Guide on economic instruments for local and regional authorities*, ICLEI "Policy & Practice Series", ICLEI, Freiburg
- German Technical Cooperation / GTZ (1998): *Fuel Prices and Taxation*, by G. Metschies; available at: http://www.worldbank.org/transport/urbtrans/other.htm
- German Technical Cooperation / GTZ (2000): *Surveys on Economic Instruments in Surabaya/Indonesia*, unpublished
- German Technical Cooperation / GTZ (2000): *Surveys on Economic Instruments in Buenos Aires/Argentina*, unpublished
- German Technical Cooperation / GTZ (2000): *Economic and Fiscal Policy Instruments*, Presentation at the International Conference on Sustainable Transportation and Clean Air, Jakarta, May 29 – 30, 2000, held by M. Breithaupt; available at: http://www.sutp.org/docs/eislides.pdf
- German Technical Cooperation / GTZ (2001): The World Bank Urban Transport Strategy Review, *Experience from Germany and Zurich*; available at http://www.worldbank.org/transport/utsr.nsf
- German Technical Cooperation / GTZ (2001): *Transport Demand Management: Towards an Integrated Approach*, Presentation at the European Investment Bank (EIB), June 6, 2001, held by M. Breithaupt; available at: http://www.sutp.org/docs/eib-tdm.pdf
- German Technical Cooperation / GTZ (2001): *Fuel Prices and Vehicle Taxation*, Second Edition September 2001, by G. Metschies, GTZ: Eschborn
- German Technical Cooperation / GTZ (2001): *Economic Instruments for Sustainable Road Transport - An Overview for Policy Makers in Developing Countries*, by J. Schwaab and S. Thielmann, GTZ: Eschborn
- Gilbert, R. (2000): *Sustainable Mobility in the City*, Presentation to URBAN 21, Global Conference on the Urban Future, Berlin, Germany, July 4-6, 2000; available at: http://www.cremtl.qc.ca/PDF /sustainable%20transportation.pdf
- Gwilliam, K.M. / Shalizi, Z. (1997): *Road Funds, User Charges and Taxes*, World Bank Discussion Paper TWU-26, Washington D.C.; available at: available at: http://www.worldbank.org/transport/publicat /twu_42.pdf
- International Council for Local Environmental Initiatives / ICLEI (2000): *Changing the Price Signal: How Local Governments Can Use Economic instruments to Cut Traffic and Pollution*, Toronto.
- Metschies, G. P. (2001): *Adam Smith and the Principles of a Sustainable Road Policy*, International Road Federation, Vernier
- Shon, E.-Y. (2000): *Developments in Road Pricing and Traffic Restraint, Seoul Case*, World Bank's Urban Transport Strategy Review, Asian Consultation Workshop, Univ. of Seoul

- Topp, H.H. (1995): *The role of parking in traffic calming*, World Transport Policy & Practice, Vol. 1, No. 3, pp. 17-22; available at http://www.agenda21.ee/english/transport/parking_calming.pdf
- United Nations Economic and Social Commission for Asia and Pacific / UN ESCAP (2001): *Sustainable Transport Pricing and Charges – Principles and Issues*; UN
- U.S. Environmental Protection Agency / EPA (1997): *Opportunities to Improve Air Quality through Transportation Pricing Programs*, Report for the Regional and State Programs Division, Office of Mobile Sources; available at: http://www.epa.gov/omshttp://www/market.htm
- Willoughby, C. (2000a): *Managing Motorization*, Discussion Paper TWU-42, Wahington: The World Bank; available at: http://www.worldbank.org/transport/publicat/twu_42.pdf
- Willoughby, C. (2000b): *Singapore's Experience in Managing Motorization, and its Relevance to Other Countries*, Discussion Paper TWU-43, Washington: The World Bank; available at: http://www.worldbank.org/transport/publicat/twu_43.pdf
- World Bank (2002): Cities on the Move: an Urban Transport Strategy Review; available at http://www.worldbank.org/transport.


Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Dag-Hammarskjold-Weg 1-5
Postfach 51 80
D - 65726 Eschborn
Telefon +49-61 96-79-1357
Telefax +49-61 96-79-7194
Internet: http://www.gtz.de

commissioned by

Bundesministerium für
wirtschaftliche Zusammenarbeit
und Entwicklung