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

Sustainable Transport:
A Sourcebook for Policy-makers in Developing Cities
Module 2b

# Mobility Management

– revised August 2004 –

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. The *Sourcebook* is not sold for profit. Any charges imposed are only to cover the cost of printing and distribution. 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:

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### 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 2b

# Mobility Management



## About the author

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## 1. Introduction

***Mobility Management*** (also called ***Transportation Demand Management*** or TDM) is a general term for strategies that result in more efficient use of transportation resources, as opposed to increasing transportation system *supply* by expanding roads, parking facilities and other motor vehicle related facilities. Mobility Management emphasises the movement of people and goods, not just motor vehicles, and so gives priority to public transit, ridesharing and non-motorised modes, particularly under congested urban conditions.

There are many potential Mobility Management strategies with a variety of impacts. Some improve transportation diversity (the travel options available to users). Others provide incentives for users to change the frequency, mode, destination, route or timing of their travel. Some reduce the need for physical travel through mobility substitutes or more efficient land use. Some involve policy reforms to correct current distortions in transportation planning practices.

Mobility Management is an increasingly common response to transport problems. Mobility Management is particularly appropriate in developing country cities, because of its low costs and multiple benefits. Table 1 lists some of the reasons to implement Mobility Management in developing countries. Developing countries have limited resources to devote to transportation infrastructure. Developing country cities often have narrow and crowded streets, limited space for parking and a diverse mix of road users, leading to conflicts over space and risk of crashes. Few developing countries can afford to build the highways and parking facilities that would be needed if automobile ownership becomes common. A major portion of the population cannot afford to own private motor vehicles, so investments and policies that favour automobiles over other travel modes may be inequitable and unsatisfactory for solving most residents' travel needs. When all factors are considered, Mobility Management is often the best solution to transportation problems.

Current planning practices tend to create a self-fulfilling prophecy: by favouring automobile travel and giving little support to other modes such as walking, cycling and public transit, the quality of these other modes declines. As a result, automobile travel tends to be faster, more convenient, more comfortable and safer than other modes, so more people will try to own a car or travel by taxi whenever possible. The resulting traffic congestion, parking congestion, pollution, crash risk and sprawl make all travellers worse off. Improving the quality of alternative modes can benefit everybody, and placing constraints on the total amount of driving that occurs in a community can benefit everybody, including people who must drive. For example, if Mobility Management strategies improve transit service quality so wealthy commuters shift from driving every day to riding transit most days and only driving when necessary, they will experience less traffic congestion and fewer parking problems on the days they drive.

Automobile dependency imposes large economic, social and environmental costs, although many of these costs are indirect and so not perceived by individual motorists.

***"Mobility Management is particularly appropriate in developing country cities, because of its low costs and multiple benefits."***

Highway investments sometimes appear more cost effective than alternatives such as public transit investments, but this is false economy, since roads are just a small part of the total costs. An automobile-oriented transportation system also requires each user to own and operate a vehicle, it requires space for parking at each destination, and it increases danger and pollution. The total costs of increased automobile dependency are far higher than the total costs of providing good public transit service.

Most households are better off if their community has an efficient, balanced transportation system with good quality walking, cycling and public transit service, even if they must pay more in vehicle user fees, than if their community is automobile dependent, requiring each household to bear the costs of owning a car, funding roads and parking facilities, enduring traffic congestion, and suffering high rates of

**Table 1: Factors that justify Mobility Management in developing countries.**

| | |
|---|---|
| **Infrastructure supply** | Infrastructure is often in poor repair.<br>Urban roads, parking, sidewalks and paths are often congested and crowded.<br>Streets and sidewalks serve many functions and users (walking, talking, retail businesses, sleeping, begging, etc.)<br>Streets not well designed for heavy motor vehicle traffic. |
| **Vehicle supply** | Low automobile ownership among general population.<br>Medium to high automobile ownership among middle-income households.<br>High automobile ownership growth rate among wealthy households.<br>High bicycle ownership in some regions.<br>Medium to high supply of public transit and taxi vehicles. |
| **Personal mobility** | Large variation in mobility between different income groups: low mobility among the general population and high mobility among wealthier groups.<br>High mobility growth rate among medium-income households. |
| **Transportation diversity** | Considerable diversity (walking, cycling, animal carts, public transit, private automobile).<br>Conditions of alternative modes, such as walking, cycling, public transit, are often inferior (slow, uncomfortable, unsafe, unconnected, etc.). |
| **Institutional capacity** | Some developing countries have poor civil institutions to plan, implement and enforce traffic improvements.<br>Sometimes poor cooperation between different levels of government.<br>Most decision-makers are relatively wealthy and so tend to personally favour automobile-oriented improvements. |
| **Government costs** | Limited funding for transportation infrastructure and services. |
| **Consumer costs** | Many households spend a large portion of income on transport. |
| **Traffic safety** | High traffic casualties per motor vehicle.<br>High risk to vulnerable road users (pedestrians, cyclists, animals, etc.). |
| **Comfort** | Low comfort levels for non-motorised travel (walking, cycling, animal carts, etc.).<br>Low comfort levels for most public transit.<br>Medium to high comfort for private automobile and taxi travel. |
| **Environment** | High pollution concentration in urban areas.<br>Pavement of greenspace (farmlands and wildlife habitat) a problem in some areas. |
| **Land Use** | Medium to high accessibility in urban areas (many destinations can be reached by walking, cycling and public transit).<br>Poor and declining accessibility in most suburbs and new communities.<br>In some regions, limited land available for new transportation infrastructure. |
| **Economic development** | High dependence on imported transportation goods (vehicles, parts and fuel).<br>Economic development harmed by dependency on imported goods. |

traffic crashes. Put another way, Mobility Management provides opportunities to governments, businesses and individual consumers to save money and avoid indirect costs. Investments in transportation alternatives and Mobility Management programs are often far more cost effective than continual public investments in road and parking facility expansion to accommodate increased private automobile travel.

Automobile dependency also tends to be harmful to the national economy. Most developing countries import vehicles and parts, and many import fuel. Even countries with domestic vehicle assembly plants will find that the majority of manufacturing inputs are imported (raw materials, components, technical expertise, etc.). Vehicles and fuel are the largest category of imported goods in many developing countries. Shifting expenditures from vehicles and fuel to more locally-produced goods tends to increase regional employment and business activity, supporting economic development. Even countries that produce their own petroleum are better off conserving fuel so there is more available to export.

## 2. Basic concepts

Mobility Management increases travel options and encourages travellers to choose the most efficient mode for each trip. It does not eliminate automobile travel, since cars are the best mode for certain types of trips, but it tends to significantly reduce the amount of personal vehicle travel that would otherwise occur, particularly in urban areas.

Mobility Management is sometimes criticized for placing unfair restrictions on automobile travel, but this is not necessarily true. Without careful management automobile traffic will regulate itself in an inefficient way, through congestion, parking problems and crash risk. A well-planned Mobility Management plan rations road and parking space more efficiently, and improves travel options, ultimately making everybody better off overall, including people who shift to alternative modes and those who continue to drive.

There is tremendous potential for applying Mobility Management to helping address transport problems in developing countries. In many cases, effective Mobility Management during early stages of development can avoid problems that would result if communities become too automobile dependent. This can help support a developing country's economic, social and environmental objectives.

Which set of Mobility Management strategies you should implement will vary depending on your community's demographic, geographic and political conditions. It is usually best to implement a variety of strategies. Most individual Mobility Management strategies have modest impacts, affecting just a few percent of total vehicle travel. As a result, they are seldom considered the most effective solution to a transportation problem. But Mobility Management strategies can have cumulative and synergetic impacts (their total impacts are greater than the sum of their individual impacts), so it is important to evaluate a Mobility Management program as a package, rather than as individual strategies. Effective programs usually include a combination of positive incentives to use alternative modes ("carrots" or "sweeteners") and negative incentives to discourage driving ("sticks" or "levelers").

For example, just improving transit service (perhaps by building a metro system or creating busways) may by itself reduce urban-peak automobile travel by only 5%. Just implementing parking management may reduce automobile travel by only 5%. But if implemented together, they may produce a 15% reduction in urban-peak automobile travel, because they provide

### Traffic, mobility and accessibility

How transportation is defined and measured can affect which policies or projects are adopted. A particular policy or project may appear worthwhile when transport system performance is measured in one way, but undesirable when it is measured another way.

Conventional approaches often assume that transportation means *motor vehicle traffic*, measured in terms of per capita vehicle ownership and vehicle-kilometres, average traffic speed, roadway level of service, etc. From this perspective, anything that increases motor vehicle traffic speed and volume is considered desirable, and anything that reduces motor vehicle traffic speed and volume is considered harmful.

A more comprehensive approach assumes that transportation means *personal mobility*, measured in terms of person-trips and person-kilometres. From this perspective, strategies such as better transit services and rideshare programs may improve transportation without increasing total vehicle-kilometres. However, this approach still assumes that movement is an end in itself, rather than a means to an end, and increased personal movement is desirable.

The most comprehensive approach evaluates transportation is in terms of *accessibility*, the ability to reach desired goods, services and activities. This is the ultimate goal of most transportation, and so is the best definition to use in transportation planning. It recognises the value of more accessible land use patterns and mobility substitutes as ways to improve transportation while reducing total physical travel.

Many transport projects improve accessibility by some modes, but degrade it for others. For example, increasing roadway capacity and traffic speeds tends to improve access by automobile but reduces it by other modes, such as walking, cycling and transit. Only by defining transportation in terms of accessibility can these trade-offs be considered in the planning process.

a combination of positive and negative incentives for middle-class commuters (those who have the option of driving) to use alternative modes. A package of complementary Mobility Management strategies is often more effective at reducing traffic congestion than far more costly roadway capacity expansion projects. Table 2 provides a broad overview of Mobility Management options. Several are discussed in detail later in this module.

Mobility Management involves prioritising travel based on the value and cost of each trip. It gives higher value trips and lower cost modes priority over lower value, higher cost trips. For example, transit and freight vehicles usually have relatively high value, and so can be given priority over private automobile travel. Transit, rideshare vehicles, bicycling and walking generally cost society less per trip than single occupant automobile travel (in terms of road space, parking costs, crash risk imposed on other road users and pollution emissions), and so should receive priority over private automobile travel. This is the opposite of conventional transport planning practices (see text box "Traffic, mobility and accessibility"), which often give priority to automobile travel, for example, by widening roadways to increase motor vehicle traffic speeds, and increasing the amount of urban land devoted to automobile parking, at the expense of walking facilities and transit.

**Table 2: Examples of Mobility Management strategies.**
**Mobility Management includes more than three dozen strategies that improve transportation options, encourage use of efficient modes, create more accessible land use patterns, and reform biased planning practices.**

| Improve Transport Options | Incentives to Reduce Driving | Parking and Land Use Management | Programs and Policy Reforms |
|---|---|---|---|
| Alternative Work Schedules | Walking And Cycling Encouragement | Bicycle Parking | Access Management |
| Bicycle Improvements | Commuter Financial Incentives | Car-Free Districts and Pedestrianised Streets | Carfree Planning |
| Bike/Transit Integration | Congestion Pricing | Clustered Land Use | Commute Trip Reduction Programs |
| Carsharing | Distance-Based Pricing | Location Efficient Development | Market Reforms |
| Flextime | Fuel Taxes | New Urbanism | Context Sensitive Design |
| Guaranteed Ride Home | HOV (High Occupant Vehicle) Priority | Parking Management | Freight Transport Management |
| Individual Actions for Efficient Transport | Parking Pricing | Parking Solutions | Institutional Reforms |
| Park & Ride | Pay-As-You-Drive Vehicle Insurance | Parking Evaluation | Least Cost Planning |
| Pedestrian Improvements | Road Pricing | Shared Parking | Regulatory Reform |
| Ridesharing | Speed Reductions | Smart Growth | School Transport Management |
| Shuttle Services | Street Reclaiming | Smart Growth Planning and Policy Reforms | Special Event Management |
| Small Wheeled Transport | Vehicle Use Restrictions | Transit Oriented Development (TOD) | TDM Marketing |
| Taxi Service Improvements | | | Tourist Transport Management |
| Telework | | | Transport Management Associations |
| Traffic Calming | | | |
| Transit Improvements | | | |
| Universal Design | | | |

## Prioritising transportation

Transport planning involves countless decisions concerning the allocation of public resources and the management of public facilities. For example:

- The allocation of public road space involves trade-offs between general traffic lanes and parking lanes (which favour automobile travel), bus lanes, bicycle lanes and sidewalk space.
- Roadway design and management that increases motor vehicle traffic volumes and speeds tends to create environments that are less suitable for pedestrian travel. Traffic calming programs tend to benefit non-motorised transport but reduce traffic speeds.
- Devoting public land to parking facilities, generous parking requirements in new developments, and land use management practices that encourage dispersed development patterns tend to benefit motorists and encourage automobile dependency. Parking management and smart growth land use policies that encourage more clustered development tend to support non-motorised and public transit accessibility.
- Pricing of vehicles, fuel, roads, parking and public transit can favour certain types of travel (this is discussed in Module 1d: *Economic Instruments*).

Such decisions effectively prioritise transportation activities and modes. They determine the convenience, speed and safety of different modes, and public resources that are allocated for transport activities. Transportation prioritisation decisions are often made without explicit consideration of their impacts on travel behaviour or overall transport system efficiency.

Prioritising transportation involves explicit consideration of these impacts, with the goal of ***giving higher value trips and lower cost modes priority over lower value, higher cost trips***. For example, emergency vehicles, transit and freight vehicles tend to have relatively high value per vehicle-kilometre, and so can be given priority over private automobile travel. Transit, rideshare vehicles, bicycling and walking generally cost society less per passenger-trip than single occupant car travel (in terms of road space, parking costs, crash risk imposed on other road users and pollution emissions), and so should receive priority.

Transportation prioritisation changes the way public resources are used, including how public roads and parking facilities are designed and managed, traffic speed regulation, pricing, and investments. Transportation prioritisation is not a single strategy; it is a planning approach that can affect various policy and planning decisions, and involves specific Mobility Management strategies. Transportation prioritisation involves two steps:

1. *Determine the basis of prioritisation*. This involves ranking trips, modes or users to determine which should have priority under various circumstances.
2. *Developing methods for prioritisation*. This involves allocating funding, road space, public land, traffic management or other resources to favour higher ranking trips, modes or users.

Conventional planning practices allow automobile traffic to dominate urban road space. Although in theory motorists and non-motorists may have equal right to use public roads, motor vehicle traffic squeezes out other uses due to its greater size, speed and danger. Cars use ten to fifty times as much space per passenger as other modes, and they endanger pedestrians and cyclists. More efficient management gives priority to modes that require less space per passenger-kilometre, and to particularly high-value trips, such as emergency and freight transport.

In general, Mobility Management should reflect the following priorities:

1. Emergency vehicles/trips
2. Walking
3. Cycling
4. Public transit
5. Service/freight vehicles
6. Taxi
7. Single occupant cars
8. Automobile parking

The greater the degree of conflict the more explicitly prioritisation must be applied. For example, in suburban areas it may be sufficient to perform road shoulder maintenance and enforce traffic laws to insure that cyclists may safely use public roads. In crowded urban areas it may be necessary to dedicate a special lane to bicycles, or to apply traffic calming and close some streets to through automobile traffic to create a network of "bicycle boulevards" where non-motorised travel has priority over motor vehicle traffic.

**Influencing the demand to travel: a wide range of possible measures**

"TDM Planning", http://www.vtpi.org/tdm/tdm50.htm

Not all Mobility Management strategies affect travel directly. Some provide a foundation for other strategies.

Mobility Management strategies use a variety of mechanisms to change travel patterns, including facility design, improved transport options, pricing, and land use changes. These affect travel behaviour in various ways, including changes in trip scheduling, route, destination, and frequency, plus traffic speed, mode choice and land use patterns. Table 3 summarises travel changes that result from various Mobility Management strategies.

**Table 3: Examples of Mobility Management travel impacts. Different types of Mobility Management strategies cause different types of travel changes.**

| Strategy | Mechanism | Travel Changes |
|---|---|---|
| Traffic calming | Roadway redesign | Reduces traffic speeds |
| Flextime | Improved transport choice | Shifts travel time (when trips occur) |
| Road/congestion pricing | Pricing | Shifts travel time, and route, reduces peak-period vehicle traffic |
| Distance-based charges | Pricing | Reduces overall vehicle travel |
| Transit improvements | Improved transport choice | Shifts mode, increases transit use |
| Rideshare promotion | Improved transport choice | Increases vehicle occupancy, reduces trips |
| Pedestrian and bicycle improvements | Improved transport choice, facility improvements | Shifts mode, increases walking and cycling |
| Carsharing | Improved transport choice | Reduces vehicle ownership and trips |
| Smart Growth, New Urbanism | More efficient land use, improved travel choices | Shifts mode, reduces vehicle ownership and trip distances |

## 2.1 Rationale for Mobility Management

Mobility Management can provide multiple benefits including congestion reduction, road and parking facility cost savings, consumer savings, improved consumer choice, road safety, environmental quality, community liveability, efficient land use, and equity. Mobility Management can provide significant savings to consumers and society by reducing and deferring roadway capacity expansion costs. As a result, total benefits are often much greater than solutions that only address one or two problems. Mobility Management can greatly expand the range of solutions for addressing transport problems, and allows solutions to be tailored to a particular situation. It can often be implemented quickly, and target a particular location, time period or user group.

**Fig. 1**

*Traditional transport planning in developing cities prioritises car travel (and hence drivers) over all other transport modes (and people).*

Karl Fjellstrom, 2000 (Surabaya)


*"It is usually best to implement a variety of strategies."*

To understand why such large benefits are possible it is useful to consider some basic market principles. Efficient markets have certain requirements, including consumer choice, competition, cost-based pricing, and economic neutrality in public policies. Most markets generally reflect these principles: consumers pay directly for housing, food and clothing. But transportation markets tend to violate these principles: consumers often have few viable options, many costs are external or fixed, and government policies often favour one mode over others. Mobility Management strategies can help correct these market distortions, creating a more efficient and equitable transportation system, as described in Table 4.

**Table 4: Mobility Management helps correct market distortions that encourage excessive automobile use, resulting in a more efficient and equitable transport system.**

| Market Requirements | Current Market Distortions | Management Solutions |
|---|---|---|
| Choice. Consumers need viable transport and location options to choose from | Consumers sometimes have few viable alternatives to owning and driving an automobile, and living in automobile dependent communities | Mobility Management strategies can increase transport options, for example by improving transit, cycling and walking conditions, and pricing options |
| Competition. Producers must face competition to encourage innovation and efficient pricing | Most roads and transit services are public monopolies. There is often little competition or incentive for innovation | Mobility Management strategies can remove barriers, and encourage competition and innovation |
| Cost-based pricing. Prices should reflect costs as much as possible, unless a subsidy is specifically justified | Transportation in general, and driving in particular, is significantly underpriced: most costs are either fixed or external. This results in economically excessive levels of driving and automobile dependency | Many Mobility Management strategies involve more efficient pricing. Some require subsidies, but these are often less than current subsidies for driving, or justified on equity grounds |
| Economic neutrality. Public policies (laws, taxes, subsidies, and investment policies) should apply equally to comparable goods and users | Tax policies, and many transportation planning and funding practices favour automobile traffic over demand management alternatives | Many Mobility Management strategies help correct existing biases in transportation planning and investment practices |
| Land use. Land use policies should not favour automobile oriented development | Zoning laws, development practices and utility pricing tend to encourage lower-density, automobile-dependent land use patterns | Mobility Management strategies help create more efficient land use patterns and discourage car-dependent development |

## 3. Mobility Management planning and evaluation

### 3.1 Introduction

Transport planners often focus on improving car traffic flow and parking opportunities, and sometimes they recommend major new transit services such as subways and commuter rail systems. However, they often overlook cost-effective opportunities to improve more basic transportation options, such as non-motorised travel conditions and bus services, even though these represent a major portion of travel activity.

Conventional transport planning practices tend to undervalue Mobility Management strategies (see text box "Traffic, mobility and accessibility, page 3). For example, conventional transport planning considers highway widening beneficial, because it increases motor vehicle traffic speeds and volumes, but ignores the delays that this may cause to non-motorised travel, and the tendency to promote urban sprawl. Vehicle flow is relatively easy to measure and so tends to receive the most attention, while non-motorised travel and land use accessibility are more difficult to measure, so they tend to be ignored. This skews planning decisions toward capacity expansion and away from Mobility Management.


**Fig. 2**

*Singapore has recently implemented a range of Mobility Management measures in the Chinatown area, including pedestrianised streets, evening road closures, widened and attrative newly-paved walkways, tree-planting for shade, more parking restrictions, transit improvements (including bus and MRT expansion in the area), and an innovative 'smart bike' program providing free bicycle use.*

Karl Fjellstrom, July 2002

**Mobility Management in The Netherlands**

In The Netherlands, many businesses participate in Mobility Management programs. Experience has shown that companies can reduce car use by 5–10% simply through basic measures such as company bicycles and car-pooling. An average trip reduction of 15–20% is possible with stronger measures and disincentives, such as parking restrictions.

OECD 2001, Influencing Travel Demand, Unpublished

Table 5 summarizes differences between conventional and comprehensive transportation evaluation, showing various ways in which conventional planning undervalues Mobility Management solutions.

Different travel changes provide different types of impacts. For example, a strategy that shifts travel from peak to off-peak periods has different benefits and costs than a strategy that shifts travel modes or encourages more efficient land use. Table 6 shows how well different travel changes achieve various transport objectives.

## 3.2 Best practices

Best practices for comprehensive transport planning and evaluation include (*Comprehensive Transport Planning*, VTPI, 2002):

- Use *accessibility-based* planning, which considers mobility as a means to an end, rather than an end in itself. This allows consideration of the widest possible range of solutions to transportation problems, including mobility substitutes and land use management that reduces the need for physical travel.
- Use *comprehensive estimates* of costs and benefits, including all road and parking expenses, downstream congestion, impacts on non-motorised transport, vehicle ownership costs, environmental impacts, impacts on travel choice and strategic land use objectives.
- Present results in units that are easy to understand and compare. For example, present costs and benefits in annualised dollars per capita, per vehicle, per vehicle-km, per passenger-km, or per additional trip.
- Indicate any impacts that are not quantified in the analysis because they are difficult to measure, and describe their impacts qualitatively. For example, describe how each option impacts equity objectives, economic development, and strategic land use goals.
- Do not focus only on motor vehicle traffic conditions as an indicator of transportation system quality. Also consider factors such as transportation system diversity, affordability, transit service quality, and the quality of walking and cycling conditions (Figure 3).
- Indicate the distribution of benefits and costs, and evaluate impacts in terms of equity objectives.
- Use statistical techniques to incorporate uncertainty and variability in economic analysis.
- Describe how different perspectives and assumptions could effect analysis conclusions.
- Produce reports that are understandable to a general audience and include all relevant technical information.


**Fig. 3**
***Diversity, affordability, and the quality of walking and cycling conditions are sometimes neglected as indicators of transport system quality.***
Gerhard Metschies (Guangzhou); GTZ Urban Transport Photo CD

### Table 5: Comparing conventional and comprehensive planning

VTPI, http://www.vtpi.org/tdm/tdm76.htm

| | Description | Conventional | Comprehensive |
|---|---|---|---|
| **Selection of Options** | Range of solutions considered. | Often ignores TDM | Includes TDM options |
| **Investment Practices** | How funding is allocated, and the flexibility with which it can be used for the best overall option. | Favours large investments | Applies least-cost planning |
| **Underpricing** | Degree to which vehicle use is underpriced, resulting in excessive travel demand. | Ignored | Considered |
| **Modeling Practices** | Whether transport modeling uses current best practices to predict travel and economic impacts. | Limited analysis capability | More comprehensive |
| **Measuring Transportation** | Methods and perspectives used to measure travel (vehicle traffic, mobility or accessibility) | Measures vehicle traffic | Measures accessibility |
| **Uncoordinated Decisions** | Whether transport and land use decisions are coordinated to support strategic regional objectives. | Not considered a problem | Considered a problem |
| **Generated Traffic** | Whether planning takes into account the full impacts of generated traffic and induced travel. | Ignores many components | Includes all components |
| **Downstream Congestion** | Additional congestion on surface streets that results from increased highway capacity. | Ignores for individual projects | Includes |
| **Consumer Impacts** | Techniques used to evaluate the consumer impacts of changes in the transport system. | Travel time changes | Consumer surplus analysis |
| **Vehicle Costs** | Whether all vehicle costs and savings are considered, including long-term costs. | Only short-term operating costs | All affected vehicle costs |
| **Parking Costs** | Parking costs, including costs borne by motorists, businesses and governments. | Only if paid by motorist | Includes |
| **Construction Impacts** | Whether increased congestion delays during construction periods are considered in evaluation. | Ignores | Includes |
| **Non-motorised Travel Impacts** | Accessibility, convenience, safety, comfort and cost off walking and cycling. | Ignores | Includes |
| **Transportation Diversity** | Quantity and quality of travel options (particularly those used by non-drivers) are considered. | Limited analysis | Comprehensive analysis |
| **Environmental Impacts** | Impacts on air, noise and water pollution; greenspace preservation and community livability. | Limited analysis | Comprehensive analysis |
| **Impacts on Land Use** | The degree to which each option supports or contradicts strategic land use objectives. | Ignores | Includes |
| **Equity Impacts** | The degree to which each option supports or contradicts community equity objectives. | Limited analysis | Comprehensive analysis |
| **Safety and Health Impacts** | How safety and health risks are measured. | Per veh.-mile crash risks | Per-capita health risks |

### Table 6: Benefits of different travel impacts

| Objectives | Reduced Traffic Speeds | Shift Trip Time | Shorter Trips | Shift Mode | Reduced Veh. Trips | Reduced Vehicle Ownership |
|---|---|---|---|---|---|---|
| Congestion Reduction | | • | • | • | • | • |
| Road Savings | | | • | • | • | • |
| Parking Savings | | | | • | • | • |
| Consumer Savings | | | | • | • | • |
| Transport Choice | | | | • | • | • |
| Road Safety | • | | • | • | • | • |
| Environment Protection | | | | • | • | • |
| Efficient Land Use | | | • | | • | • |
| Livability | • | | | | • | • |

[ • indicates a beneficial impact. Blank means no impact, or mixed positive and negative impacts. ]

# 4. Mobility Management policy and institutional reforms

## 4.1 Introduction

Mobility Management requires carefully planning, management and enforcement. Policy and institutional reforms are often needed to correct existing distortions that undervalue alternative modes and management solutions to transportation problems.

Mobility Management requires that public officials and the general public gain more respect for alternative modes, such as transit, mini-buses and non-motorised modes, and shift away from an automobile-dominated vision of their transportation future. Many people assume that since automobile ownership and use tend to increase with income, policies that favour automobile travel support economic development, but this is not true. Mobility Management can increase economic productivity and development by improving mobility in the most cost effective way. Although highway improvements that support productive industries, such as manufacturing, mining, agriculture and tourism, contribute to economic development, motor vehicles used as consumer goods tend to be economically harmful, particularly in regions that import vehicles and fuel (Litman and Laube, 1999).

Many developing countries lack adequate traffic education and enforcement institutions. There is often little connection between the traffic rules that are taught and what people actually observe: transportation regulations may be flaunted and violations seldom punished. Public sidewalks may be taken over by vendors, homeless people and vehicle parking. Vehicle and fuel taxes may be unpaid. Such problems must be corrected as part of effective Mobility Management. This requires developing institutional capacity, professional skills and training, adequate pay, and modern equipment.

There is usually no single strategy that will address transportation problems, and it is not always possible to predict the effectiveness of a particular parking management strategy or anticipate all future conditions. The best approach is to use flexible, ***least-cost planning*** to determine the optimal set of strategies and actions to be implemented at each point in time. Least-cost planning considers demand management solutions equally with strategies to increase capacity, considers all significant impacts (costs and benefits), and involves the public in developing and evaluating alternatives. For example, it means that transit improvements, rideshare programs, or road pricing can be implemented instead of roadway capacity expansion, if they can improve mobility at a lower total cost, including costs to governments, businesses, consumers and the environment. If a particular demand management strategy can reduce traffic or parking demand by 10%, it is considered to be worth at least as much as a 10% increase in road or parking facility capacity, and often more when indirect impacts, such as environmental and safety impacts, are considered. Least-cost planning may require reforming current planning and funding practices that favour highway capacity expansion over management strategies.

This approach involves the following steps:

1. *Identify objectives (general things that you want to achieve) and targets (specific things that you want to achieve).*
2. *Identify various strategies that can help achieve the objectives and targets. These can include both projects that increase capacity and demand management strategies.*
3. *Evaluate the costs and benefits of each strategy (including indirect impacts, if any), and rank them according to cost-effective-ness or benefit/cost ratios.*
4. *Implement the most cost-effective strategies as needed to achieve the stated targets.*
5. *After they are implemented, evaluate the programs and strategies with regard to various performance measures, to insure that they are effective.*
6. *Evaluate overall results with regard to targets to determine if and when additional strategies should be implemented.*

This approach allows contingency-based planning, that is, planning that addresses uncertainty by deploying solutions on an as-needed basis. For example, a transport plan may identify 5 strategies to implement immediately, another 4 to implement in two years if stated targets are not achieved, and another 3 can be implemented in the future if needed. This tends to be cost

effective and flexible, because strategies are only deployed if they are needed, and additional strategies can be ready for quick implementation if unexpected changes create additional needs. This type of planning is ideal for medium and long-range transport and land use planning.

***"Transport planning goals and objectives should emphasise accessibility and mobility (moving people and goods), not just the movement of vehicles."***

## 4.2 Best practices

- Establish cooperation and common goals among all agencies involved in transport and land use decisions, including those involved in funding, transport planning, land use, public safety and law enforcement. They should be accountable for safety, security, environmental and basic mobility objectives.
- Transport planning goals and objectives should emphasize accessibility and mobility (moving people and goods), rather than the movement of vehicles.
- Planning should consider the transportation needs of people who are physically, economically and socially disadvantaged.
- One agency should coordinate transportation management throughout an urban region.
- As much as possible, traffic management and traffic law enforcement agencies should be independent, to avoid political favouritism and erratic policy changes when new mayors or political parties take office. This provides stability and helps agencies recruit and retain professional staff.
- Traffic management agencies may have independent revenue sources (parking fees, traffic fines, congestion charges, a portion of fuel taxes, etc.) to ensure long-range funding.
- Traffic police have a vital role to play in the success of traffic management (Figure 4). This may require special efforts to establish modern traffic enforcement techniques, adequately train and pay officers to maintain a professional force, minimise corruption and favouritism, and maintain good communications with the public.
- Educate decision-makers and staff about Mobility Management objectives, techniques and resources.
- Transport decision-making should be based on least-cost planning principles, allowing *management strategies* equal consideration in planning and funding as *capacity expansion* projects.
- Identify and correct policies and planning practices that tend to undervalue alternative modes or result in car-dependent transport and land use patterns.
- Establish a "Fix-it-First" policy (see text box), which means that roadway capacity expansion projects are only implemented if operations and maintenance programs for existing facilities are adequately funded.
- Develop an effective evaluation program that tracks progress toward goals and objectives.
- Reward successful transportation programs. For example, higher levels of government can provide additional funding to local governments that are successful at achieving traffic management, road safety and emission reduction objectives.

**Fig. 4**

***Traffic police have a vital role to play in implementing Mobility Management measures in developing cities. In many developing cities, including for example Bangkok, the police retain a 'veto' over many Mobility Management measures, and they therefore must be involved and consulted in policy development.***

Hong Kong (unknown)

### "Fix It First" spending priority

"Fix It First" means that transportation planning and funding give top priority to maintenance, operations and incremental improvements to existing transportation facilities, and major capital projects are only implemented if there is adequate additional funds.

Current transportation planning and funding practices often favour capital expenditures over maintenance and operations. Capital projects are considered prestigious (public officials can participate in ribbon-cutting ceremonies and have their names on plaques attached to new roads, bridges and rail facilities) and some transportation funds may only be used for major capital improvements. This encourages jurisdictions to expand transportation system capacity and implement major new projects even when they have inadequate resources to maintain and operate existing facilities, or when incremental improvements to existing facilities and demand management strategies would provide greater economic benefits.

### 4.3 Institutional reform information resources


- International Institute for Energy Conservation (http://www.cerf.org/iiec/offices/transport.htm).
- Booz-Allen & Hamilton, *Organising for Regional Transportation Operations: An Executive Guide*, Federation Highway Administration and Institute of Transportation Engineers (http://www.ite.org/library/ROOExecutiveGuide.pdf), 2001.
- John Cracknell, *Experience in Urban Traffic Management and Demand Management in Developing Countries*, World Bank, Urban Transport Strategy Review (http://wbln0018.worldbank.org/transport/utsr.nsf), 2000.
- Patrick DeCorla-Souza *et al.*, *A Least Total Cost Approach to Compare Infrastructure Alternatives*, Transportation Modeling Improvement Program, FHWA (http://www.mip.fhwa.dot.gov), 1999.
- Ralph Gakenheimer, "Urban Mobility in the Developing World," *Transportation Research* A, Vol. 33, No. 7/8, Sept./Nov. 1999, pp. 671-689.
- WSDOT, *What Is Least Cost Planning?* (http://www.wsdot.wa.gov/regions/northwest/Mt-Baker/Planning/least_cost_planning.htm), 1999.


## 5. Examples of Mobility Management strategies

This section describes some examples of Mobility Management strategies. This is just a small sample of the full range of potential strategies available. For more specific information see resources listed below, particularly the Victoria Transport Policy Institute's *Online TDM Encyclopedia* (http://www.vtpi.org).

### 5.1 Smart growth – land use management strategies

*Smart growth* is a general term for land use practices that create more accessible land use patterns which reduce the amount of travel needed to reach goods and services. Smart growth is an alternative to urban sprawl; the two land use patterns are contrasted in Table 7.

Smart growth includes a number of individual policies and practices, such as those listed below. Objectives and strategies differ depending on whether an area is urban, suburban or exurban. Land use planning and Smart growth concepts are discussed in more detail in Module 2a: *Land Use Planning and Urban Transport*.

#### Smart growth practices

- *Strategic planning*. Establish a community "vision" which individual land use and transportation decisions should support.
- *Create more self-contained communities*. Reduce average trip distances, and encourage walking, cycling and transit travel, by locating schools, shops and recreation facilities in or adjacent to residential areas.
- *Foster distinctive, attractive communities with a strong sense of place*. Encourage physical environments that cerate a sense of civic pride and community cohesion, including attractive public spaces, high-quality architectural and natural elements that reflect unique features of the community, preservation of special cultural and environmental resources, and high standards of maintenance and repair.
- *Encourage quality, compact development*. Allow and encourage higher density development, particularly around transit and

commercial centres. Demand high quality design to address problems associated with higher density.

- *Encourage infill development*. Locate new development within or adjacent to existing urban areas. Encourage redevelopment of older facilities and brownfields.
- *Reform tax and utility rates*. Structure property taxes, development fees and utility rates to reflect the lower public service costs of clustered, infill development, and encourage businesses to locate in accessible locations.
- *Concentrate activities*. Encourage walking and transit by creating "nodes" of high-density, mixed development linked by convenient transit service. Concentrate commercial activities in these areas. Retain strong downtowns and central business districts. Use access management to discourage arterial strip commercial development.
- *Encourage transit-oriented development*. Encourage dense development within walking distance (0.4 to 0.8 km) of transit stops, and provide high quality pedestrian and cycling facilities in those areas.
- *Manage parking for efficiency*. Encourage shared parking, and other parking management strategies. Reserve the most convenient parking for rideshare vehicles.
- *Avoid overly-restrictive zoning*. Reduce excessive and inflexible parking and road capacity requirements. Limit undesirable impacts (noise, smells and traffic) rather than broad categories of activities. For example, allow shops and services to locate in neighbourhoods provided they are sized and managed to avoid annoying residents.
- *Create a network of interconnected streets*. Keep streets as narrow as possible, particularly in residential areas and commercial centres. Use traffic management and traffic calming to control traffic impacts rather than dead ends and cul de sacs.
- *Site design and building orientation*. Encourage buildings to be oriented toward city streets, rather than set back behind large parking lots. Avoid large parking areas or other unattractive land uses in commercial areas.
- *Improve non-motorised travel conditions*. Encourage walking and cycling by improving

## Travel blending or 'social marketing'

Partly adapted from: Walter Hook & Lloyd Wright, *Reducing Greenhouse Gas Emissions by Shifting Passenger Trips to Less Polluting Modes*, Nairobi, 2002.

Transportation agencies in cities in various parts of the world, including Santiago, Chile, have implemented a low-cost marketing technique called "travel blending" that can result in significant mode shifts. It uses direct marketing and personal contacts with residents to provide them with better information about their travel options.

The program involves contacting households in a particular area (usually one well served by transit) in order to identify people who are most receptive to changing their travel behaviour, and supplying them with information such as public transit guides, cycling maps and information on other Mobility Management services. Residents are even offered a household visit by a travel planning expert. Feedback from these interviews is used to identify ways to improve local transportation services.

### Impressive results

The results to date have been remarkable. In the first trial in Perth, approximately $61,500 was expended in consulting costs to conduct the surveys and information provision activities. Of the 380 households targeted, the program produced a 6% decrease in auto use immediately and an additional 1% decrease after 12 months. Public transport trips rose from 6% of all trips to 7%, cycling trips doubled from 2% to 4%. The results have held even two years after the assistance was delivered. The technique is now being applied throughout Australia and in some cities in Europe. Similarly impressive results are being achieved at extremely low costs.

The consulting firm Steer Davies Gleave implemented a Travel Blending program in Santiago, Chile. The Santiago results suggest that Travel Blending could become part of an effective, low-cost emission reduction package for certain developing-nation cities. Steer Davies Gleave report an astonishing 17% reduction in car driver trips (as a proportion of participating and non-participating households combined), with a 23% reduction in car driver kilometres and a 17% reduction in time spent traveling.

### Traffic management agencies

Cracknell, 2000

Some cities have created competent professional traffic management agencies outside the city structure to help isolate technical functions from the political cycle. Overall policies must still be approved by city political leaders, but if the professional agency is successful and respected the likelihood of erratic change is reduced. For example:

- Several cities in Mexico have created independent transport institutes. These have secure funding (e.g., the institute in Ciudad Juarez receives 1.75% of city revenues), contract terms for senior staff that do not coincide with the political cycle, and do not depend on the may to select the institute's president.
- The Urban Planning Institute in Curitiba, Brazil is independent of the city government.
- The city of Sao Paulo, Brazil has established a separate traffic management agency with clearly defined responsibilities. Although the president is politically appointed, the professionalism of the organization has been respected, resulting in the first president maintaining his post for eight years.

**Table 7: Comparing smart growth and sprawl**

| | Smart growth | Sprawl |
|---|---|---|
| **Density** | Higher density | Lower density |
| **Growth pattern** | Infill (brownfield) development | Urban periphery (greenfield) development |
| **Land use mix** | Mixed land use | Homogeneous land uses |
| **Scale** | Human scale. Smaller buildings, blocks and roads. Careful detail, since people experience the landscape up close, as pedestrians | Large scale. Larger buildings, blocks, wide roads. Less detail, since people experience the landscape at a distance, as motorists |
| **Transportation** | Multi-modal transportation and land use patterns that support walking, cycling and public transit | Automobile-oriented transportation and land use patterns, poorly suited for walking, cycling and transit |
| **Street design** | Streets designed to accommodate a variety of activities. Traffic calming | Streets designed to maximise motor vehicle traffic volume and speed |
| **Planning process** | Planned and coordinated between jurisdictions and stakeholders | Unplanned, with little coordination between jurisdictions and stakeholders |
| **Public space** | Emphasis on the public realm (streetscapes, pedestrian environment, public parks, public facilities) | Emphasis on the private realm (yards, shopping malls, gated communities, private clubs) |

walkways, street crossings, protection from fast vehicular traffic, and providing street amenities (trees, awnings, benches, pedestrian-oriented lighting, etc.). Improve connections for non-motorised travel, such as trails that link dead-end streets.

**Table 8: Smart growth implementation**

| Smart growth measure | Implementation mechanism |
|---|---|
| Increased density and infill development | State growth controls<br>State development incentives<br>Local growth controls<br>Local incentives |
| Transit oriented development | State development incentives<br>Local growth controls<br>Local incentives |
| Jobs/housing balance | State growth controls<br>State development incentives<br>Local growth controls<br>Local incentives |
| Land use mixing | Local growth controls<br>Local design controls<br>Local incentives |
| Tax, development fees and utility pricing reforms | State tax policy<br>Local development and tax policy<br>Utility rate structure |
| Neotraditional design | Local growth controls<br>Local design controls<br>Local incentives |
| Site design and parking management | Local zoning codes<br>Local design controls |

- *Preserve green space*. Preserve open space, particularly areas with high ecological and recreational value. Channel development into areas that are already disturbed.
- *Encourage a mix of housing types and prices*. Develop affordable housing near employment, commercial and transit centres. Develop second suites, apartments over shops, lofts, location-efficient mortgages and other innovations to help create more affordable housing.

## How it is implemented

Smart Growth is usually implemented as a set of policies and programs by state/provincial, regional or local governments. Implementation often requires policy and institutional reforms, and multi-jurisdictional coordination. Table 8 indicates the level of government action that can implement specific Smart Growth measures.

## Smart growth resources

- Danielle Arigoni, *Affordable Housing and Smart Growth: Making the Connections*, National Neighborhood Coalition (http://www.neighborhoodcoalition.org), 2001.
- *Centre for Liveable Communities* (http://www.lgc.org/clc) helps local government and community leaders in land use and transport planning.
- *Centre for Watershed Protection* (http://www.cwp.org) provides analysis and resources for minimising hydrologic impacts and pollution.
- Congress for New Urbanism (http://www.cnu.org) is a movement centered on human scale communities.

- Reid Ewing, *Best Development Practices*, Planners Press (http://www.planning.org), 1996.
- Joel S. Hirschhorn, *New Community Design to the Rescue*, National Governor's Association (http://www.nga.org), 2001.
- Todd Litman, *Land Use Impact Costs of Transportation*, VTPI (http://www.vtpi.org), 1999.
- *NEMO Project* (http://www.canr.uconn.edu/ces/nemo) provides resources for communities to reduce their amount of impervious surfaces.
- *Planners Web* (http://www.plannersweb.com), includes a sprawl resources guide, a primer for citizen planners, and other resources.
- *PolicyLink* (http://www.policylink.org) provides information on Smart Growth policies to benefit disadvantaged populations.
- *Smart Growth Network* (http://www.smartgrowth.org) provides information and support for Smart Growth planning and program implementation.
- US EPA, *Improving Air Quality Through Land Use Activities*, EPA420-R-01-001, Transportation and Air Quality Centre, (http://www.epa.gov/otaq/traq), 2001.
- US EPA *Smart Growth Website* (http://www.epa.gov/smartgrowth).
- US EPA *Smart Growth Index (SGI) Model*, (http://www.epa.gov/smartgrowth/sgipilot.htm), 2001.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.
- World Health Organisation *Healthy Cities Project* (http://www.who.dk/london99) provides information on international efforts to create healthy cities.


## 5.2 Non-motorised transport planning

*Non-motorised transport* (also known as *active transport* and *human powered transport*) includes walking, cycling, hand carts and animal carts. Non-motorised travel is critical for a diverse transport system. Non-motorised modes are important in their own right, and most transit trips include walking links - non-motorised transport improvements are often one of the most effective ways of encouraging transit use (Figure 5). The quality of the pedestrian environment is important for community livability and social cohesion. Making streets pleasant and safe for walking allows residents to interact and children to play.

There are many specific ways to improve non-motorised transportation, as discussed in the Module 3d: *Preserving and Expanding the Role of Non-motorised Transport*.

**Fig. 5**

***An unsupportive pedestrian environment acts as a disincentive for people to use public transport.***

Karl Fjellstrom, Mar. 2002 (Cairo, Egypt)

Some key strategies are:

- Establish connected walking networks.
- Provide adequate walkway widths. Prevent vendors, pavement dwellers, vehicle parking and other uses from blocking walkways.
- Maintain path surfaces. Establish a system to quickly identify and correct problems.
- Create bike lanes and bicycle boulevards (streets where bicycles have priority and motorists must drive at low speeds) where appropriate.
- Correct roadway hazards to non-motorised transport.
- Improve non-motorised transport facility management and maintenance.
- Accommodate people with disabilities and other special needs.
- Develop pedestrian-oriented land use and building design.
- Use street furniture (e.g. benches) and design features (e.g. human-scale street lights).
- Apply traffic calming, speed reductions and vehicle restrictions.
- Provide bicycle safety education, law enforcement and encouragement.
- Integrate cycling with transit.
- Provide bicycle parking.
- Address security concerns of pedestrians and cyclists.

## How it is implemented

Pedestrian and cycling improvements are usually implemented by city governments. It usually begins with a pedestrian and bicycle plan to identify problems and prioritise projects.

### Kunming public transport priority

http://www.movingtheeconomy.ca/cs_kunming.html

The Kunming Public Transport Masterplan was begun in 1993 by the city of Kunming, China and its sister city, Zurich. Supported by the Swiss Agency for Development and Cooperation, the project defined clear priorities for the use of city streets with the aim to transport people, not cars, giving priority to public transport, bicycles and pedestrians. Affordability as well was an important aim. Two principal components of the transportation policy were to run the existing buses, and to re-introduce trams on reserved lanes that were taken away from use by private car.

A first "Demonstration Bus Line", running on reserved lanes began operation in April 1999. Following its success, a second line was built (this one without support from Zurich), beginning operation in June 2002, with plans for two more lines. The bus lanes will be changed into Modern Tram lanes once bus capacity is no longer sufficient.

Other components of the project include:

- More than 20 newly designed intersections with separate lanes for left turning bicycles.
- Safe pedestrian crossings at street level.
- Pedestrian-only streets in shopping zones in the city centre.
- Pedestrian islands in the middle of city streets to improve safety of street crossing.
- Studies on minimizing urban sprawl by building densely designed towns along existing railway lines.

No other city in China is following so comprehensive an urban development and transportation policy. It was a courageous step by the municipal government of the city of Kunming, to take away one lane from non public transport and dedicate it exclusively to buses. No other city in China has a concept for developing the greater city region like Kunming with densely built new towns along the railway, as a precondition for using public transport in a high degree.

Kunming planning officials are monitoring the public's response to these projects through public surveys. The first, in 1999, found the total satisfaction rate of citizens toward the project to be 79% and by 2001 the total satisfaction was over 96%.

## Travel impacts

Non-motorised improvements can substitute directly for automobile trips. Walking and cycling improvements also support transit and are critical to reducing per-capita motor vehicle trips.

Nearly all trips involve non-motorised links, often on public rights-of-way, to access an automobile or transit vehicle. Travel surveys and traffic counts usually under-record non-motorised trips, because they ignore or undercount short trips, non-work travel, travel by children, recreational travel, and non-motorised links. For example, trips that are classified as "car" or "transit" trips are often actually "walk-car-walk", or "walk-bus-walk" trips, yet the walking component is not usually counted, even if it takes place on a roadway.

In recent years several evaluation tools have been developed to predict demand for non-motorised travel, evaluate walking and cycling conditions and predict the effects of pedestrian and cycling improvements (see the "Evaluating Non-motorised Transport" chapter of the *Online TDM Encyclopedia*).

## Non-motorised transport resources

- ADONIS, *Best Practice to Promote Cycling and Walking and How to Substitute Short Car Trips by Cycling and Walking*, European Union (http://www.cordis.lu/transport/src/adonis-rep.htm), 1999.
- The *Bicycle Information Centre* (http://www.bicyclinginfo.org) provides information on non-motorised transport planning and programs.
- *Centre for Alternative and Sustainable Transport* (http://www.staffs.ac.uk/schools/sciences/geography/cast/casthome.html) performs research on non-motorised, sustainable transport.
- Robert Cervero and Carolyn Radisch, *Travel Choices in Pedestrian Versus Automobile Oriented Neighbourhoods*, UC Transportation Centre, UCTC 281 (http://www.uctc.net), 1995.
- DETR, *Cycling Bibliography and Walking Bibliography*, Department of Environment, Transport and Regions, (http://www.roads.detr.gov.uk/roadnetwork/ditm/tal), 2000.
- DRD, *Collection of Cycle Concepts*, Danish Road Directorate (http://www.vd.dk/wimpdoc.asp?page=document&objno=17291), 2000.
- I-ce, *The Significance of Non-Motorised Transport for Developing Countries: Strategies for*

*Policy Development*, World Bank, Urban Transport Strategy Review (http://wbln0018.worldbank.org/transport/utsr.nsf), 2000.

- *International Bicycle Fund* (http://www.ibike.org) provides information and resources to support cycling.
- *Less Traffic* (http://www.lesstraffic.com) provides information on traffic reduction strategies.
- Todd Litman, et al., *Pedestrian and Bicycle Planning; A Guide to Best Practices*, VTPI (http://www.vtpi.org), 2000. Guide with extensive references.
- *Local Government Commission* (http://www.lgc.org) has resources for neighbourhood planning and pedestrian/bicycle improvements, including "Designing Safe Streets and Neighbourhoods", "The Economic Benefits of Walkable Communities" and "Why People Don't Walk and What City Planners Can Do About It" fact sheets.
- Roger Mackett, *How to Reduce the Number of Short Trips by Car*, European Transport Conference, University College London (http://www.ucl.ac.uk/transport-studies/shtrp.htm), 2000.
- *Oregon DOT Bicycle and Pedestrian Planning* (http://www.odot.state.or.us/techserv/bikewalk/obpplan.htm) shows good non-motorised planning.
- *Pedestrian Information Centre* (http://www.walkinginfo.org) is a planning information clearinghouse.
- John Pucher and Lewis Dijkstra, *Making Walking and Cycling Safer: Lessons from Europe*, Transportation Quarterly, Vol. 54, No. 3, Summer 2000, available at VTPI (http://www.vtpi.org).
- *Push Play, Movement=Health - Guidelines for the Promotion of Physical Activity*, Hillary Commission and Push Play (http://www.pushplay.org.nz), 2001.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.
- Walking Steering Group, *Developing a Walking Strategy*, UK Department of the Environment Transport and the Regions (http://www.local-transport.detr.gov.uk/walk/walk.htm), 1996.
- WTPP, *World Transport Policy and Practice – Special Pedestrian Planning Issue*, Volume 7, Number 4 (http://www.ecoplan.org/wtpp/wt_index.htm), 2001. Articles on ways to improve walkability.
- Charles Zeeger, et al, *Pedestrian Facilities User Guide: Providing Safety and Mobility*, (http://www.walkinginfo.org), Highway Safety Research Centre, Federal Highway Administration, Publication FHWA-RD-01-102, 2002.

## 5.3 Transportation market and pricing reforms

Motor vehicle travel tends to be underpriced: many of the costs of driving are indirect, borne by society in general rather than individual motorists. Many market reforms charge motorists directly for the costs they impose. This gives motorists an incentive to use vehicles more efficiently, and provides a new opportunity to save money by driving less. For example, if parking facility costs are subsidised through taxes or rents, motorists who reduce parking demand by shifting to another mode do not receive any savings. Charging motorists directly for parking lets motorists save when the parking costs they impose are reduced.

Many people assume that low transportation prices help stimulate economic development, but they actually tend to have the opposite effect. Underpricing transportation through low taxes and subsidies encourages inefficient transportation patterns, including use of fuel-inefficient vehicles and increased motor vehicle travel, which reduces overall economic productivity and increases consumption of imported goods. Reforms that reflect basic market principles such as marginal-cost pricing, cost recovery, economic neutrality and improved consumer options tend to increase overall productivity and economic development. Specific market reforms are described following.

### Vehicle tariffs and industrial development

Countries can establish import and industrial policies to favour efficient travel modes. Non-motorised vehicles and buses can have relatively low import tariffs and taxes, while private automobiles and fuels can have relatively high tariffs and taxes to discourage their purchase.

### Commuter financial incentives

*Commuter financial incentives* include several types of incentives that give employees financial rewards for using alternative commute modes:

- ***Parking cash out*** means that commuters who are offered subsidised parking are also offered the cash equivalent if they use alternative modes.
- ***Travel allowances*** are a payment to employees instead of parking subsidies. Commuters

### The full costs of motor vehicle transportation

Motor vehicle transportation involves a variety of costs, many of which are indirect or external (Litman, 2002).

- Vehicle ownership (purchase, registration fees, insurance).
- Vehicle operation (fuel, maintenance, repair, tolls).
- Parking
- Traffic congestion
- Traffic crashes
- Roadway facilities (including the land devoted to roads).
- Traffic services
- Negative land use impacts (sprawl, damage to cultural and environmental resources, increased impervious surface and resulting stormwater management costs, more dispersed land use patterns and resulting reductions in accessibility).
- Negative social impacts (reduced opportunity for non-drivers, reduce community cohesion)
- Barrier effect (reduced mobility and safety to pedestrians and cyclists)
- Energy consumption externalities
- Air pollution
- Noise
- Water pollution
- Waste disposal (junk vehicles, used tires, battery waste, etc.)

can use this money to pay for parking or for another travel mode.

- ***Transit and rideshare benefits*** are free or discounted transit fares provided to employees.
- ***Reduced employee parking subsidies*** means that commuters who drive must pay some or all of their parking costs.
- ***Company travel reimbursement policies*** that reimburse bicycle or transit travel as well as automobile mileage for business trips.

## Road pricing

Road pricing means that motorists pay directly for using a particular roadway or driving in a particular area. It has two general objectives: revenue generation and congestion management.

*Congestion pricing* (also called *value pricing*) refers to road pricing used as a demand management strategy to reduce traffic congestion. Congestion pricing requires time-variable tolls, with higher during peak periods and lower or non-existent when roads are uncongested. Time-variable tolls can be based on a fixed schedule daily and weekly schedule, or they can be *dynamic*, meaning that rates change depending on the level of congestion that exists at a particular time. It can be implemented on existing roadways to avoid the need to add capacity. Some highways have a combination of unpriced lanes and value priced lanes, allowing motorists to choose between driving in congestion and paying a toll for an uncongested trip.

Economists have long advocated road pricing as an efficient and equitable way to pay roadway costs and encourage more efficient transportation. However, consumers tend to oppose any new fee, and motorists can be a strong political lobby against road pricing, even in developing countries where they represent a small portion of citizens. Road pricing must therefore be presented as a package that provides a variety of benefits, and as a substitute for other equally unattractive taxes or fees.

Road pricing should be implemented in conjunction with improved transportation options, so consumers have viable alternatives.

## Revenue-neutral tax shifts

Since governments must tax something to raise revenue, many economists recommend shifting taxes from socially desirable activities to activities that impose external costs. For example, revenue from increased road use charges and fuel taxes could be used to reduce employment and general sales taxes, resulting in less vehicle travel and more employment and business activity. This can provide multiple benefits, including economic development, environmental protection, and more efficient transportation.

Some developing country governments undertax or subsidise vehicle fuel as a way to minimise transportation costs, but this is poor public policy. It is unfair, because most of the benefits accrue to wealthier consumers (because they drive more than average), and it encourages inefficient transportation habits, including larger vehicles and increased driving. Higher taxes on fuel and lower taxes on goods such as basic food products and tools tend to provide greater overall equity and economic development benefits.

## Neutral tax policies

An efficient tax structure is economically neutral. It would not favour automobile expenditures over other transport modes, transport over other consumer expenditures, or transport facilities over other investments. Some current tax policies unintentionally favour car use.

Employee parking subsidies are often exempt from income taxes, and land devoted to parking is often taxed at a lower rate than if the land was used for a building. This creates an incentive for employers to provide free parking as an employee benefit, but without parking cash out policies, employees using other modes receive no comparable benefit.

## Improved transportation pricing methods

Current transportation pricing methods have several problems. Fuel taxes and vehicle registration fees do not accurately reflect many of the costs imposed by a particular vehicle. Fuel tax revenue is likely to decline in the future as vehicles become more fuel efficient and shift to alternative fuels.

## Neutral planning and investment policies

Some current planning and investment practices favour car-oriented transportation improvements over other modes, and favour

transportation over other types of public expenditures. (For more information refer to the "Comprehensive Transport Planning" chapter of the VTPI *Online TDM Encyclopedia*.)

### How it is implemented

Most comprehensive market reforms require federal or state/provincial legislation. Some tax reforms (such as tighter controls over personal use of business vehicles) can be implemented by government agency administrative action. Road and parking pricing can be implemented at the local or regional level. Parking pricing, parking cash out and distance-based insurance can be implemented by businesses.

***"Travel impacts are greatest if reforms are predictable and gradual, and if they are supported by other transport and land use reforms."***

### Travel impacts

Travel impacts are greatest if reforms are predictable and gradual, and if they are supported by other transport and land use reforms that improve accessibility and transportation options. The "Transportation Elasticities" chapter of the *Online TDM Encyclopedia* (http://www.vtpi.org/tdm/tdm11.htm), and PETS (2000) describe ways to predict the travel impacts of more optimal pricing. Potential travel reductions are large. Charging motorists directly for the costs of driving, and eliminating distortive tax and investment policies, can reduce automobile use by 20 – 50% (ICF, 1997; Litman, 2000).

### Best practices

- Price reforms should be predictable and gradual.
- Various price reforms should be considered, including higher fuel prices, road tolls and parking fees.
- Price reforms should be selected to provide multiple benefits, including economic development, transport improvements, environmental protection and increased equity.
- Price reforms should explicitly address equity issues, if necessary, by using revenues in ways that benefit disadvantaged populations.
- Increases in automobile user fees should be implemented with improved travel options, so travelers can choose alternative modes to avoid price increases.

### Recommended road pricing characteristics

Cracknell, 2000

An effective and fair road pricing system should reflect the following characteristics.

**User perspective:**

- Easy for users to understand.
- Convenient – does not require vehicles to stop at toll booths.
- Transport options – consumers have viable travel options available (i.e., alternative modes, travel times, routes, destinations).
- Payment options – easy to use with multiple payment options (cash, prepaid card, credit card.)
- Transparent – charges evident before trip is undertaken.
- Anonymous – privacy of users is assured.

**Traffic authority perspective:**

- Traffic impacts – does not require all vehicles to stop at toll booths or in other ways delay traffic.
- Efficient and equitable – charges reflect true user costs.
- Effective – charges reduce congestion by changing travel behaviour.
- Flexible – easily accommodates occasional users and different vehicle types.
- Reliable – minimal incorrect charges.
- Secure and enforceable – minimal fraud or non-compliance.
- Cost effective – positive return on investments.
- Implementation – minimum disruption during development. Can be expanded as needed.

**Society's perspective:**

- Benefit/cost – positive net benefits (when all impacts are considered).
- Political acceptability – public perception of fairness and value.
- Environment – positive environmental impacts.
- Integrated – same charging system can be used to pay other public service fees (parking, public transit, etc.).

## Bicycle encouragement in Africa

http://www.ITDP.org

In light of rising petrol prices, advocacy groups in Kenya and Tanzania are changing the public perception of the bicycle as vital tool for development, and convincing their governments to make bicycles less costly. Kenya recently eliminated the import tariff on bicycles, and Tanzania reduced the duty on bicycle tires. When Ghana eliminated its tariff on the importation of bikes, bike imports skyrocketed 1,000%.

On June 13th, 2002, the Kenyan government announced the elimination of bicycle import duties. The decision comes on the heels of a rise in petrol prices, and should give a significant boost to bike sales and use. The International Technology Development Group (ITDG) in Kenya was a key force behind the decision.

The lower bike prices will enable more widespread bike ownership among commuters and bike taxi operators, many of whom are currently renting bicycles. Some existing bike taxi operators complain that the low price of bikes will lead to an influx of taxi operators, creating too much competition to maintain previous incomes. Others say that this fear is unfounded, due to the rising petrol prices that will create more demand for bike taxis.

By contrast, the Tanzanian government has yet to remove bicycle import duties, although they have recently reduced the duty on bicycle tires by 10%. While tires comprise only 1/6 of the price of a new bike, they are the most expensive part that needs routine replacement, so it will be more affordable for people to keep their bikes on the road. In a country where the average price of a bike is Tanzania Shs 60,000 and the per capita income is Tanzania Shs 270,000 per annum (a bicycle costs about 22% of average annual income), this is an important first step.

The Association for the Advancement of Low-Cost Mobility, the organization that lobbied for the reduction, is taking their campaign further, hoping to convince the government to follow Kenya's lead and reduce the duty on the entire bike.

The benefits of reducing or eliminating the tax are numerous. With access to this low-cost transportation, villagers can take grain to the market in larger quantity and more quickly; children in rural areas can reduce their travel time to school by hours; traditionally disadvantaged groups, such as women, can increase their access to self-employment opportunities.

## Transportation market reform resources


- The *Center for a Sustainable Economy* (http://www.sustainableeconomy.org) publishes Tax News Update, a free weekly electronic newsletter that reports on environment-related tax news.
- Alan Durning and Yoram Bauman, *Tax Shift*, Northwest Environment Watch (http://www.northwestwatch.org), 1998.
- EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, Environmental Issues Series No. 18, European Environment Agency (http://org.eea.eu.int), Nov. 2000.
- *European Transport Pricing Initiatives* (http://www.transport-pricing.net).
- Oscar Faber, *Fair and Efficient Pricing in Transport - The Role of Charges and Taxes,* European Commission DG TREN in association with EC DG TAXUD and EC DG ENV. Available through the European Program for Mobility Management (http://www.epommweb.org), 2000.
- J. Hoerner and J. Mutl, *Good Business: A Market Analysis of Energy Efficiency Policy*, Center for a Sustainable Economy (http://www.sustainableeconomy.org), 2000.
- ICF, *Opportunities to Improve Air Quality Through Transportation Pricing*, Office of Mobile Sources, EPA (http://www.epa.gov/otaq/market/pricing.pdf), 1997.
- Doug Koplow and John Dernbach, *Federal Fossil Fuel Subsidies and Greenhouse Gas Emissions: A Case Study of Increasing Transparency for Fiscal Policy*, Annual Review of Energy and Environment, Vol. 26 (http://www.annualreviews.org), 2001, pp. 361-89.
- Todd Litman, Charles Komanoff and Douglas Howell, *Road Relief; Tax and Pricing Shifts for a Fairer, Cleaner, and Less Congested Transportation System in Washington State*, Climate Solutions (http://www.climatesolutions.org), 1998.
- Todd Litman, *Socially Optimal Transport Pricing and Markets*, VTPI (http://www.vtpi.org), 2000.
- Todd Litman, *Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications*, VTPI (http://www.vtpi.org), 2002.
- Gerhard Metschies, Fuel Prices and Taxation, with Comparative Tables for 160 Countries, German Agency for Technical Cooperation (http://www.zietlow.com/gtz/fuel.pdf), May 1999.
- NEPP 3, *National Environment Policy Plan 3*, (English Language version 264 pages), Ministry of Housing, Spatial Planning and the Environment, The Netherlands (http://www.netherlands-embassy.org/c_envnmp.html) 1998.
- OECD, *Database on Environmentally Related Taxes*, (http://www1.oecd.org/env/policies/taxes), 2001.

- Stephen Potter and Tom Rye, *The Potential for Further Changes to the Personal Taxation Regime to Encourage Modal Shift*, DTLR (http://www.dtlr.gov.uk/itwp/modalshift), 2000.
- *Redefining Progress* (http://www.rprogress.org) promotes market reforms that incorporate environmental and social values into economic decisions.
- T&E, *Counting the Kilometres - And Paying for Them; How to Introduce an EU Wide Kilometre Charging System*, European Federation for Transport and Environment (http://www.t-e.nu), 2000.
- US EPA, *Directory of Air Quality Economic Incentive Programs*, (http://yosemite.epa.gov/aa/programs.nsf), 2001.
- William Vickrey, *Principles of Efficient Congestion Pricing*, Columbia Univ., 1992, available at http://www.vtpi.org/vickrey.htm.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.


## 5.4 Public transport improvements

Public transport in developing cities is the subject of Modules 3a: *Mass Transit Options*, 3b: *Bus Rapid Transit,* and 3c: *Bus Regulation & Planning* of this *Sourcebook*.

## 5.5 Commute trip reduction programs

*Commute trip reduction* (CTR) (also called *employee trip reduction*) programs give commuters resources and incentives to reduce their automobile trips. CTR programs typically include some of the following strategies:

- Commuter financial incentives (parking cash out and transit allowances).
- Rideshare matching.
- Parking management and parking pricing.
- Alternative scheduling (flextime and compressed work weeks).
- Telework; substituting telecommunications for physical travel.
- TDM marketing and promotion.
- Guaranteed ride home.
- Walking and cycling encouragement.
- Walking and cycling improvements.
- Bicycle parking and changing facilities.
- Worksite amenities to reduce the need to drive for errands.
- Company travel reimbursement policies that reimburse bicycle or transit mileage for business trips when these modes are comparable in speed to driving, rather than only reimbursing automobile mileage.
- Company vehicles, to eliminate the need for employees to drive to work in order to have their cars for business travel.

CTR programs must be able to meet employees' diverse and changing needs. Many employees can use transport alternatives part-time, if given suitable support and incentives. For example, many employees can car pool, telecommute or flextime two or three days a week. Some employees may be able to bicycle commute part of the year.

### How it is implemented

To establish a commute trip reduction program, a business usually develops corporate goals and objectives, policies and procedures, and services and benefits. Travel surveys help plan and evaluate programs. CTR programs may be managed by an in-house Employee Transport Coordinator, a specialised transport services company, or a local transport management association.

### Travel impacts

Most peak period travel in developing cities is for commuting. Though there is limited experience with CTR programs in developing cities, such programs may have positive impacts by reducing peak period congestion in any city where automobile commuting contributes significantly to urban traffic congestion and pollution problems. Even in low-income cities there may be opportunities to avoid traffic problems by encouraging employees who own an automobile to use alternative commute options at least part-time.

CTR travel impacts can be measured in the following ways:

- *Mode split*: The portion of trips currently made by single occupant vehicle (SOV), transit, ridesharing, cycling and walking.
- *Average vehicle occupancy* (AVO): Number of people traveling in private vehicles divided by the number of private vehicle trips. This excludes transit vehicle users and walkers.

- *Average vehicle ridership*: All person trips divided by the number of private vehicle trips. This includes transit vehicle users and walkers.

### Africa safe routes to school

http://www.movingtheeconomy.ca/cs_tanzania.html

The majority of Tanzania's urban dwellers face chronic mobility problems including: high proportions of family income needed for daily travel; long travel distances due to fast city growth; a poor route infrastructure network, especially for walking and cycling; and a high number of traffic accidents involving non-motorised transport users.

These problems are even worse for school children, who are sometimes denied access on private buses. Female students are sometimes forced to engage in relationships with male drivers or conductors to facilitate easy entry in the private buses and many children suffer from poor attendance and late arrival at school. The cost of transport also limits access to schools and disrupts education, especially of female pupils.

The Association for Advancing Low Cost Mobility (AALOCOM) was formed to address the mobility needs of Tanzania's urban dwellers, starting with school children. The Safe Routes to School Demonstration Project is in the planning stages at the time of writing, but it is a spectacular example of a community responding to a community problem in a manner that is participatory, broad-based and open. AALOCOM recognises that the success of the project depends on the participation of the different parties responsible. Using a broad base of stakeholders (parents, teachers, police, NGOs, transportation officials and decision makers), AALOCOM's participatory approach creates a sense of ownership and responsibility around child, pedestrian and cycling safety issues.

The project will be piloted in a medium sized city with significant traffic problems, using schools with a high percentage of children residing 2-3 kilometres away. It will focus on:

- Identifying walking and cycling routes to school where traffic safety is a major concern.
- Educating parents about child pedestrian safety issues and solutions;
- Developing traffic calming and infrastructure plans.
- Working with parents, community leaders and decision makers to reach agreement on what changes to make.
- Facilitating availability of affordable bicycles to teachers and pupils.

- *Vehicle trips* or *peak period vehicle trips*: The total number of private vehicles arriving at a worksite (often called "trip generation" by engineers).

In developed countries, comprehensive CTR programs typically reduce peak-period automobile trips by 10 – 30% at a worksite, and even more if supported by regional Mobility Management strategies such as transit improvements.

A British study of CTR programs found that: *These organisations managed to reduce the numbers of cars arriving at their sites by more than 14 per 100 staff – more than an 18% reduction in the number of cars. Sixteen of the travel plans cut car use by more than 10%, five by more than a fifth and two by more than 50%. (DTLR, 2002).*

Table 9 shows the predicted trip reduction impacts of various strategies in a Sacramento (USA) CTR program.

## Best practices

- Make CTR programs diverse and flexible to meet employees' varying needs. Design programs to support a variety of choices and incentives. The more incentives a program includes, the more effective it is likely to be.
- The most effective programs include both travel choice improvements (improved transit, ridesharing, cycling, walking, telework) and incentives to reduce driving.

**Table 9: Sacramento trip reduction credits from specific strategies. Values indicate how much commute travel is predicted to decline in response to these strategies.**

| TDM Strategy | CBD | Within 660 ft of Transit Station | Elsewhere |
|---|---|---|---|
| Rideshare Vehicle Preferential Parking | 10% | 5% | 5% |
| 100% Transit/ Rideshare Subsidy | 35% | 25% | 10% |
| 50% Transit/ Rideshare Subsidy | 20% | 15% | 10% |
| Vanpool Program | 10% | 10% | 10% |
| Worksite Showers and Lockers | 5% | 2% | 2% |
| Guaranteed Ride Home | 2% | 2% | 2% |
| Onsite Childcare | 5% | 5% | 5% |

## Clean commute in South Africa

http://www.cerf.org/iiec/offices/as-project.htm

On 12 May 1997, IIEC-Africa and the Department of Minerals and Energy jointly launched a transport reduction program known as the Clean Commute (the SeSotho name is "Leeto le Phepa"). The Clean Commute initiative features innovative mechanisms such as car-pooling and van-pooling schemes as well as flexible work hours and tele-commuting options to reduce the impact of single-occupancy vehicles on South Africa's increasingly grid-locked roads. Additionally, the initiative will be working closely with the Midrand Transport Association and the mini-bus taxi industry. The Clean Commute is initially being pilot tested in Kyalami Business Park in Midrand. Funding for the Clean Commute is shared jointly between the Dept. of Minerals and Energy and the US Environmental Protection Agency.

In April 1998, IIEC-Africa co-hosted a one-week Sustainable Transport Study Tour to the Netherlands for South Africa's Parliamentary Transport Study Group and other key transport officials. The study tour was developed to investigate the policy, planning, and project work of Dutch transport officials, and determine the applicability of these interventions in the South African context. The study tour covered key transport topics such as developing effective public transportation systems, planning for bicycle and pedestrian friendly communities, understanding transport economics and externalities, and revitalising central business districts. IIEC-Africa co-hosted this tour with the Centre for Energy Conservation and Environmental Technology in Delft. The study tour produced a ten-point set of recommendations for sustainable transport activities in South Africa.

### Clean commute information centre

In conjunction with a major travel demand management project in the Midrand area, IIEC and its Clean Commute partners are developing a business plan for a Commuter Information Centre. The Centre will offer information on park-and-ride opportunities, existing public transport routes, schedules and fees, and in general promote public transport and non-motorised transport options for residents, workers, shoppers, business travellers and tourists. IIEC's partner in this work is MidTran; the work is jointly funded by the CSIR and US EPA.

- Worksites that lack public transit can still have effective programs based on ridesharing and cycling encouragement.
- Executive commitment can affect program effectiveness. If employees perceive support from top company officials they are more likely to participate in trip reduction efforts.
- Involve employees and labour organisations in CTR program planning and marketing. Support or resistance from labour organisations can affect program effectiveness.
- Encourage the concentration of employment into large commercial centres with good quality public transit service, and appropriate amenities such as shops and services within convenient walking distance.
- Form transportation management associations so employers in an area can coordinate their CTR programs.
- Guaranteed ride home and marketing programs can significantly increase the effectiveness of other strategies, although they have little effect by themselves.
- Some types of work require employees to have an automobile, although this can be address if employers have a vehicle pool or carshare services available for business trips.

## Commute trip reduction program resources

- *Association for Commuter Transportation* (http://www.actweb.org) provides CTR resources.
- BC Transit, *Travel Options Manual*, BC Transit (http://www.bctransit.com/traveloptions/introduction/introduction.htm), 2000.
- CARAVAN, *Commuter Programs at the Worksite*, Commuter Information Centre (http://www.commute.com/wrksite.htm), 1999.
- *Centre for Urban Transportation Research*, (http://www.cutr.eng.usf.edu) provides resources and training for CTR program development.
- The *Commuter Challenge Program* (http://www.CommuterChallenge.org) provides businesses with expertise to reduce commute trips.
- *Commuter Choice Program* (http://www.commuterchoice.com) provides information on CTR programs.
- *AVR Employer Trip Reduction Software*, Centre for Urban Transportation Research, (http://www.cutr.eng.usf.edu/tdm/download.htm), 1998. Software that predicts the change in average vehicle ridership resulting from CTR measures.
- Dept. of Transportation, Lands and Regions, *Making Travel Plans Work: Lessons From UK Case Studies*, (http://www.dtlr.gov.uk), 2002.

- FDOT, *Commute Alternatives Systems Handbook*, Florida Department of Transportation (http://plan2op.fhwa.dot.gov/pdfs/Pdf1/Comm_alt.pdf), manual on CTR program development.
- Go Green, *Walk & Roll: A Guide to Active Transport To, From, and At the Workplace*, Canadian Council for Health and Active Living at Work (http://www.goforgreen.ca/resources/Resource.html).
- SAVE, *Toolbox for Mobility Management in Companies*, European Commission (http://www.mobilitymanagement.be), 2001. Information to help companies develop a mobility plan.
- US EPA, *Commute Alternative Incentives*, Transport and Air Quality TCM Technical Overviews, (http://www.epa.gov/ oms/transp/publicat/pub_tech.htm), 1998.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.
- WSDOT, *Employee Transportation Coordinator Handbook*, Washington State CTR Program (http://www.wsdot.wa.gov/partners/wsro/resource.htm), 1999.

## 5.6 Freight transport management

*Freight transport management* includes various strategies of increasing the efficiency of freight and commercial transport. Below are examples:

- Encourage shippers to use modes with lower social costs.
- Restricted delivery times in central business districts.
- Use of small and medium size vehicles with modern emission controls in the central city areas.
- Improve scheduling and routing to reduce freight vehicle mileage and increase load factors (e.g., avoiding empty backhauls), through increased computerisation and coordination among distributors.
- Organise delivery systems so fewer vehicle trips are needed to distribute goods (e.g., using common carriers that consolidate loads, rather than company fleets).
- Use smaller vehicles and human powered transport for local distribution.
- Implement fleet management programs that reduce vehicle mileage, use optimal sized vehicles for each trip, and ensure that fleet vehicles are properly maintained.
- Change delivery times to reduce congestion.
- Improve vehicle operator training to encourage more efficient driving.

Heavy trucks represent a major share of total traffic on some highways, particularly around major ports, rail terminals and industrial areas. Because of their size, freight trucks impose relatively high congestion, road wear, accident risk, air pollution and noise costs, so travel reductions (Figure 6) can provide significant benefits in areas where they are concentrated.

### Freight transport management resources

- Stefanie Boge, "The Well-Travelled Yogurt Pot: Lessons for New Freight Transport Policies and Regional Production," *World Transport Policy & Practice* (http://www.ecoplan.org/wtpp), Vol. 1, No. 1, 1995, pp. 7-11.
- J. Caceres and D. Richards, *Greenhouse Gas Reduction Opportunities for the Freight Transportation Sector*, David Suzuki Foundation (http://www.davidsuzuki.org), 2000.
- CST, "Freight Transport," *Sustainable Transportation Monitor*, No. 4, Centre for Sustainable Transportation (http://www.cstctd.org), 2001.
- Holger Dalkmann, "Sustainable Mobility: How to Move More Goods from Road To Rail - A Comparison of Germany & Britain," *World Transport Policy & Practice*, Vol. 6, No. 4, (http://www.ecoplan.org/wtpp), 2000, pp. 31-36.
- DETR, *Sustainable Distribution: A Strategy*, Department of the Environment, Transport and the Regions (http://www.dtlr.gov.uk/itwp/susdist), 1999.
- *Freight On Rail Website* (http://www.freightonrail.org.uk) promotes shifting freight transport from road to rail.
- Hagler Bailly, *Potential for Fuel Taxes to Reduce Greenhouse Gas Emissions from Transport*, Transportation Table of the Canadian National Climate Change Process (http://www.tc.gc.ca/Envaffairs/subgroups1/fuel_tax/study1/final_Report/Final_Report.htm), 1999.
- *Institute of Logistics and Transport* (http://www.iolt.org.uk) is a professional organisation.
- Per Kågeson and Jos Dings, *Electronic Kilometre Charging for Heavy Goods Vehicles in Europe*, European Federation for Transport and Environment (http://www.t-e.nu), 1999.
- Todd Litman, *Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications*, VTPI, (http://www.vtpi.org/tca), 2002.
- *Logistics World* (http://www.logisticsworld.com) is an Internet directory of logistics resources.

## Rickshaw trolley community solid waste collection

http://www.movingtheeconomy.ca/cs_rickshaw_trolley.html

Before the Rickshaw Trolley Community Solid Waste Collection system was introduced, solid waste in most of Mirzapur, India was collected from neighbourhood streets in handcarts and then dumped in heaps on bigger streets. From these heaps it was lifted onto bullock carts or tractor trolleys by shovel or a hydraulic loader. While being loaded, tractor trolleys blocked traffic on the narrow streets. This was inefficient, unsanitary and undependable since the city could not afford to keep the loader operating and the staff could not manage to lift more than a little bit of the city's garbage. Eventually garbage actually blocked many streets and drains, and obstructed maintenance of the drainage and water supply systems. The public had lost confidence in the city services and there was little money available for new equipment.

Solid waste needed to be lifted from the street to tractor trolleys without hydraulic equipment. To do this the municipality in 1995 designed and introduced a loading platform with an access ramp for direct loading into parked tractor trolleys. Now 10 collection depots manage the city's daily solid waste. They use available space along street rights-of-way and do not interfere with traffic movement. To make operation of the depots feasible, the service area had to be increased. This was achieved through the introduction of a three-wheeled rickshaw trolley with a modified frame for easier pedaling, and a tilting bin for easy unloading, designed and built by local workshops. These easy to move rickshaw trolleys have twice the capacity of handcarts and double their service area to 400 metres.

This low-cost system has eliminated the need for hydraulic lifting throughout the city and dramatically reduced staff physical contact with solid waste. The improvement in city appearance has changed the public attitude toward the city. In addition, the municipality has even donated a rickshaw trolley for replication to the city of Aligarh, provided technical assistance to numerous municipalities from India and Nepal, and is exploring opportunities for private processing of compost.


**Fig. 6**

*Curitiba's road traffic hierarchy restricts movement of heavy and long vehicles in the central traffic zone.*

Karl Fjellstrom, Jan. 2002


- A.C. McKinnon, J. Campbell and D. Leuchars, *Benchmarking Vehicle Utilisation: Measurement of Key Performance Indicators*, Energy Efficiency Best Practice Programme, Department of the Environment, Transport and the Regions (http://www.roads.detr.gov.uk), 1999.
- A.C. McKinnon, *A Logistical Perspective on the Fuel Efficiency of Road Freight Transport,* International Energy Agency (http://www.iea.org), February 1999.
- Glen Miller, Daniela Kiguel and Sue Zielinski, *Moving Goods in the New Economy: A Primer for Urban Decision Makers*, produced by Moving the Economy (http://www.city.toronto.on.ca/mte), Detour Publications (http://www.detourpublications.com/catalogue/transport.html#mg), 2001.
- MTE, *Moving the Economy; Economic Opportunities in Sustainable Transportation*, (http://www.city.toronto.on.ca/mte), 1998.
- OECD, *EST! Environmentally Sustainable Transport; Futures, Strategies and Best Practices*, (http://www.oecd.org/env/ccst/est), 2000.
- Office of Intermodalism, *Compendium of Intermodal Freight Projects*, Federal Highway Administration (http://www.fhwa.dot.gov/hep10/freight/comp.html).
- *Office of Freight Management & Operations, FHWA* (http://www.ops.fhwa.dot.gov/freight) promotes more efficient freight transport.
- Oxford Economic Research Associates, *The Environmental and Social Costs of Heavy Goods Vehicles and Options for Reforming the Fiscal Regime*, English, Welsh, and Scottish Railway (EWS Railway, 310 Goswell Rd, London EC1V 7LL; http://www.ews-railway.co.uk), 1999.

- Andreas Pastowski, *Decoupling Economic Development and Freight for Reducing its Negative Impacts*, Wuppertal Institute (http://www.wupperinst.org) 1997.
- T&E, *Towards More Sustainable Freight Transport*, European Federation for Transport and Environment (http://www.t-e.nu), 2000.
- Francis M. Vanek, "Sustainably Distributed? An Environmental Critique of the UK's Sustainable Distribution Policy," *World Transport Policy and Practice*, Vol.6 No.2 (http://www.ecoplan.org/wtpp), 2001, pp. 5-12.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.
- The *Wuppertal Institute* (http://www.wupperinst.org): research on strategies to increase freight efficiency and reduce environmental and social impacts.

*"More effective transport management is urgently needed in these cities in order to retain attractiveness to tourists."*

## 5.7 Tourist transport management

Many developing cities rely heavily on tourism-related revenues, but are suffering from rapidly worsening traffic conditions which make these places less desirable to tourists. Such cities – where it is often impossible for tourists even to safely cross a road – include for example Denpasar, Kuta, Legian, Sanur and Yogyakarta in Indonesia, and Chiang Mai and Bangkok in Thailand. More effective transport management is urgently needed in these cities in order to retain attractiveness to tourists.

Tourist transport management improves transport options for recreational travel and reduces motor vehicle traffic in resort and historic areas. Tourist travel has predictable patterns and needs, and occurs in unique environments sensitive to degradation by motor vehicle traffic. Tourist transport management can preserve the environmental amenities that attract visitors to an area, whether it is an historic city centre or a pristine natural environment.

Tourist transport management programs can include a variety of specific strategies to improve transport options, integrate alternative transport into tourist activities, provide disincentives to driving, and promote alternative modes. These can include:

- Shuttle services
- Taxi service improvements
- Cycling and walking improvements
- Bicycle parking
- Parking management and parking pricing
- Traffic calming
- Car-free planning and vehicle restrictions
- Marketing to encourage visitors to arrive without a car.
- Commute trip reduction programs for staff.
- Freight management to minimise truck traffic and restrict freight movements to particular parts of the day
- Equipment rentals (bikes, scooters, etc.).

Resort areas tend to have heavy traffic at particular seasons and times of the week. Visitors have particular mobility needs (e.g., travel between transport terminals, accommodations, restaurants and shops, tourists attractions, etc.) and baggage requirements (skis, surf boards, gifts to carry home). Many resort visitors will use alternative modes if provided with convenient, enjoyable and affordable alternatives.

Tourist transport management programs can involve developing car-free travel options and packages. This requires coordination to insure that visitors' mobility needs are served, and that travel options are well publicised. When planning a trip, potential visitors must be able to find out that they can arrive at their accommodations, travel to attractions, and carry any baggage they need, reliably and in comfort without a car.

Some sites restrict automobile use in certain areas or at certain times, and provide visitor access by shuttle services, bicycle rentals and pedestrian facility improvements.

### How it is implemented

Tourist transportation management programs are usually implemented by regional planning agencies, a parks agency, a Mobility Management program, tourist promotion agencies, tourist-related businesses (such as a large hotel), or by organisers of a special event (such as a major

festival). These programs are often initiated to deal with specific traffic congestion and parking problems, but may expand over time to become more comprehensive. Visitor organisations or private companies may organise and publicise car-free tour options and packages.

### Travel impacts

Travel impacts depend on the nature of the strategies that are implemented, the types of trips, location, and demographics of visitors. Large travel impacts are possible. Some resorts and destination parks have virtually eliminated private vehicle traffic.

### Best practices

Tourist Mobility Management planning should:

- Make it affordable, convenient and enjoyable to visit a resort community without using a private motor vehicle.
- Coordinate stakeholders (tourist agencies, transportation providers, hotels, resorts) to provide and promote car-free travel packages.
- Provide detailed information on the travel choices that are available and how to use them.
- Take into account visitors' transport needs and preferences, including baggage requirements and the need to accommodate changing schedules.
- Provide benefits to visitors who arrive without a car, such as priority access for buses.

### Tourist transport management resources


- Rosaleen Duffy, *A Trip Too Far: Ecotourism, Politics And Exploitation*, Earthscan Publication (http://www.earthscan.co.uk), 2002.
- *The Green Tourism Association* (http://www.detourpublications.com/cgi-bin/linker.cgi?, http://www.greentourism.on.ca) is a nonprofit organisation promoting responsible tourism.
- Martin Lanzendorf, "Social Change & Leisure Mobility, *World Transport Policy & Practice*, Vol. 6, No. 3, (http://www.ecoplan.org/wtpp), 2000, pp. 21-25.
- Todd Litman, *First Resort; Resort Community Transportation Management*, VTPI (http://www.vtpi.org), 1999.
- MOST, "Mobility Management for Temporary Sites," *MOST News*, No. 1 (http://mo.st), No. 2000.
- VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (http://www.vtpi.org), 2002.


## 5.8 Parking management

*Parking management* includes various strategies that result in more efficient use of parking resources. Parking management can help address a wide range of transportation problems, and is important in developing cities where space for parking is limited, and without careful management vehicles tend to take over all available public space, including areas intended for pedestrians, markets, parks and green space.

### Parking management strategies

#### Parking plan

Establish a municipal parking plan that identifies where parking facilities will be provided, how it will be managed and regulated, how public-owned parking facilities will be priced, and how parking regulations will be enforced. Perform parking supply and utilization surveys to identify and address problems.

#### Limit parking supply

Cities should minimise the amount of public space devoted to car parking. For example, avoid converting public squares, streets, sidewalks and unused public land into car parking areas. Instead, create municipal and private off-street paid parking. On-street parking should only be provided where roads have sufficient space, it should not block traffic lanes, it should not displace sidewalks, and it should be regulated and priced to give priority to higher-value users (described below).

#### Prioritise use

The most convenient parking spaces should generally be managed to favour priority uses, by regulating the type of users (e.g., loading, deliveries, visitors), regulating time limits (5-minute loading zones, 30-minutes adjacent to shop entrances, one or two hour limits for on-street parking in commercial areas), or pricing (higher prices and shorter payment periods at the most convenient spaces).

Priority, short-term parkers can be favoured with parking methods that include small increments (a few minutes) and allow users to pay for just the amount of time they are parked. Longer minimum time periods (such as parking tickets that are only sold in units of two hours or more) tend to overcharge short-term users.

**Fig. 8**
*Expanded walkways, bicycle parking, and less space for car parking are features of a successful parking management policy in Bogotá, Colombia. Parking restrictions were imposed to encourage use of alternative transport modes and make the city more 'democratic' by improving the quality of public space. Other Mobility Management measures included Car Free Day events, Ciclovia on Sundays, a sur-charge on fuel, an odd-even scheme, and bicycle facilities.*
Karl Fjellstrom, Feb. 2002

## Regulate parking facilities for efficiency

Parking can be regulated to encourage efficient use of existing capacity and achieve other objectives (Figure 8):

- Limit on-street parking duration (maximum amount of time that a vehicle can be left in one space), to discourage commuters from bringing cars to workplaces in the city centre, and discourage owners from using on-street parking for long-term vehicle storage. Alternatively, as in Belgrade, Yugoslavia, for example, apply a scale of parking charges so that the hourly rate becomes progressively more expensive for each additional hour.
- Limit use of on-street parking to area residents.
- Limit on-street parking of large vehicles.
- Prohibit on-street parking on certain routes at certain times (such as arterials during rush hour), to increase the number of traffic lanes.

## Impose parking prices

As much as possible, motorists should pay directly for using parking spaces, with prices set to make the most convenient parking spaces available for short-term uses and to provide revenues for transportation programs. For example, on-street parking spaces, which tend to be the most convenient and so is most suitable for short-term uses such as deliveries and shopping, should have higher prices than off-street parking, which is more suitable for long-term use by commuters and residents.

For example, a strategy used successfully in Bogotá, Columbia as part of the city's program to reduce private car use was to increase public parking fees and to remove limits on the fees that private parking companies could charge. The additional revenue from the higher municipal parking fees is dedicated to road maintenance and public transit service improvements.

Parking pricing typically reduces parking demand 10 – 30% compared with unpriced parking. Pricing of commuter parking, and time-variable rates (higher rates during peak periods) is particularly effective at reducing peak use. Charging motorists directly for the parking is more economically efficient and fair (horizontal equity) than unpriced parking that results in cross-subsidies from consumers who drive less to those who drive more than average.

When parking is priced, it is often leased by the month, with significant discounts compared with short-term pricing. This encourages motorists who pay the fee to drive in order to get their money's worth. It is more efficient to rent parking in smaller time blocks (hourly or daily rates), or to prorate monthly leases by days not driven. For example, if full-time parking costs $50 per month, commuters who only drive 3 days a week should only pay $30. This gives motorists more choices and a financial incentive to use alternative modes when possible.

### Tax parking facilities or their use

Some communities impose special taxes on parking. For example, the city of San Francisco charges a 25% tax on commercial parking transactions. This can be an effective source of revenue, and a Mobility Management strategy provided that the tax is passed on to users rather than being absorbed by businesses.

### Require vehicle owners to have off-street parking

Some cities with limited parking supply require residents to show that they have an off-street parking space before they are allowed to register an automobile.

### Shared parking

Sharing parking spaces typically allows 20 – 40% more users than if each motorist is assigned a space. For example, 100 employees can usually share 60 – 80 parking spaces. Even greater reductions are possible with mixed land uses, since different activities have different peak demand times. For example, a restaurant can share parking with an office complex, since restaurant parking demand peaks in the evening while office parking demand peaks during the middle of the day.

### More accurate parking requirements

Current parking standards published by international organizations such as the Institute of Transportation Engineers and other planning organizations reflect parking demand in developed countries where automobile ownership rates are high. Such standards tend to be excessive in developing countries with lower vehicle ownership rates, in urban areas with more diverse transportation systems, where parking is priced, and at sites with Mobility Management programs. Parking requirements can typically be reduced 10 – 30% at appropriate sites if standards more accurately reflect parking demand. Dense developing cities should consider setting maximum rather than minimum parking standards in city centres.

### Allow reduced parking requirements in exchange for Mobility Management programs

Parking requirements can be reduced at sites that implement Mobility Management programs. For example, parking requirements can usually be reduced at sites with commute trip reduction programs or accessible locations without problem.

### Control use of complimentary parking passes

In some cities, public officials provide complimentary parking passes giving motorists free use of public parking facilities. Although such passes are justified for use by public service vehicles, such as police and engineering officials engaged in official business, such passes are sometimes abused, and used for personal trips. Use of public parking passes should be carefully controlled, with regular audits.

### Transportation Management Associations

Transportation Management Associations (TMAs) are private, non-profit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical centre or industrial park. TMAs coordinate Mobility Management activities such as rideshare matching and transit promotion, and provide brokerages services to help individual businesses share and trade use of parking facilities. TMAs allow small employers to provide commute trip reduction services comparable to those offered by large companies. They are usually more cost effective than programs managed by individual businesses. Though currently common only in North America, TMAs may provide a useful model for developing countries.

### Cash out free parking

Cashing out parking means that commuters who are offered subsidised parking are also

**Integrated transport management in Bremen, Germany**

The city of Bremen has had great success in reducing car-based traffic in its historic centre. Half of all trips into the city centre are now made by public transport and a further 22% are made by bicycle. Public transport is used by 58% of the shoppers in the central district.

An integrated strategy of raising public awareness, providing better public transport and bicycling facilities, and implementing parking management has led to these impressive results. Key pricing elements in the parking strategy include:

- No free or unregulated parking in urban centres
- Parking pricing reflects demand, with higher prices at attractive locations
- Car use plus parking charges should not cost less than using public transport in the city.

Adapted from OECD 2001, Influencing Travel Demand, unpublished

offered the cash equivalent if they use alternative travel modes as described earlier in the section on commute trip reduction programs. his can reduce automobile commuting by 15 – 25%, and is fairer since it gives non-drivers benefits comparable to those offered motorists.

### Unbundle parking

Unpriced parking is often "bundled" with building costs, which means that a certain number of spaces are automatically included with building purchases or leases. It is more efficient and fair to sell or rent parking separately, so building occupants pay for just the number of spaces that they require, and can adjust their parking supply as their needs change.

### Location efficient development

Location efficient development means development that is designed and managed to take advantage of more accessible, multi-modal locations (good walking, cycling and transit). Parking requirements can be reduced in such areas due to reduced car ownership and use. This encourages infill, multi-modal development.

### Address spillover problems

Generous and free parking is often justified in order to avoid “spillover” parking problems in nearby areas. Spillover problems can be addressed directly with management, pricing and enforcement strategies. On-street parking can be limited to residents. Residential neighbourhoods can be designated "Parking Benefit Districts," where on-street parking is priced, with revenues used for neighbourhood enhancement or to reduce property taxes. Residents’ vehicles can be exempted from these charges.

### Develop overflow parking plans

Excessive parking is sometimes provided to meet infrequent peak demand during special events. Parking requirements can be reduced by developing an overflow parking plan, and other special event transportation management. For example, this could include use of remote parking facilities with shuttle bus service, and promotion of alternative transportation to the event, such as public transit and ridesharing.

### Parking maximums

Some urban areas limit the maximum amount of parking capacity allowed for various types of buildings or within a particular area as part of their Mobility Management programs. For example, the City of Seattle allows a maximum of one parking space per 1,000 sq. ft. of downtown office space, and the City of San Francisco limits parking to 7% of a downtown building’s floor area.

### Allow "in lieu" fees as an alternative to on-site parking

In lieu fees means that developers are allowed to pay into a fund for off-site municipal parking facilities instead of providing their own on-site parking. For example, rather than building 20 parking spaces at their site, a developer may contribute toward the construction of a 50-space parking facility that is shared among several sites. This results in more efficient shared parking facilities, and allows parking facilities to be located where they most optimal for the sake of urban design.

### Bicycle parking

Provide bicycle parking. Allow bicycle parking to substitute for minimum automobile parking in zoning codes.

### Parking facility design

Improved parking facility design can increase safety, improve aesthetics, and reduce stormwater management costs.
Table 10 summarises these parking management strategies, and indicates the potential reduction in parking supply that they can typically provide.

## How it is implemented

Parking management is usually implemented by local governments or individual businesses in response to specific parking and traffic problems. Transportation engineers and planners, either within public agencies or hired as consultants, are usually responsible for performing parking studies, evaluating parking solutions and developing parking management plans.

Below is the typical process for developing a parking management plan:

1. Define general problems to be addressed (parking congestion, traffic congestion, excessive parking facility costs, poor pedestrian environments, etc.) and the geographic areas to be considered.

**Table 10: A summary of various parking management strategies**

| Method | Advantages | Disadvantages |
|---|---|---|
| **Pricing and Regulatory Strategies** | | |
| Regulate curb-side parking (loading zones, 1-hour limits, etc.) for priority | Low implementation costs<br>Flexible – can be quickly changed or apply to specific times. | Enforcement requirements<br>Generates no revenue<br>Does little to reduce overall vehicle travel demand<br>May shift traffic to other locations |
| Impose parking prices | Generates revenue<br>Reduces travel demand<br>Allows higher priority uses more convenient spaces<br>Moderate implementation cost | Enforcement requirements<br>Risk of fraud<br>May shift traffic to other locations |
| Require vehicle owners to have an off-street parking space. | Reduces on-street parking congestion<br>My reduce vehicle ownership<br>Low implementation cost | Difficult to enforce (some residents may register there vehicles elsewhere. |
| Tax parking | Generates revenue<br>May reduce vehicle travel demand | May shift traffic to other locations<br>Risk of fraud |
| **More Efficient Use of Parking Facilities** | | |
| Share parking facilities | Cost effective<br>Can reduce parking requirements<br>Flexible | Reduces parking convenience<br>Requires new administrative arrangements<br>Depends on circumstances |
| More accurate parking supply | Cost effective<br>Can reduce parking requirements | May create future parking congestion problems |
| Reduce parking requirements for Mobility Management programs | Cost savings<br>Can reduce parking requirements<br>Creates incentives for employee trip reduction programs | Limited guidance available<br>Requires ongoing management |
| Transportation Management Associations | Can reduce parking requirements<br>Can provide many services to businesses, employees and customers | Requires new administrative arrangements |
| Control complimentary parking passes | Reduce vehicle travel demand<br>Can increase revenue | Requires review and enforcement |
| Cash out free parking | Can reduce vehicle travel demand & parking needs<br>Gives employers a way to reduce parking demand | Requires new administrative arrangements<br>Risk of fraud |
| Unbundle parking | Reduce vehicle travel demand<br>Can reduce parking requirements<br>Increases consumer choices | Requires new administrative arrangements<br>Risk of fraud |
| **Other Strategies** | | |
| Location Efficient Development | Supports land use objectives<br>Reduce vehicle travel demand<br>Can reduce parking requirements<br>Increases consumer choices | Slow to achieve benefits |
| Respond to spillover problems | Avoids problems<br>Is equitable | Requires new administrative arrangements |
| Overflow parking plans | Reduce vehicle travel demand<br>Can reduce parking problems<br>Is equitable | Requires new administrative arrangements |
| Parking maximums | Saves money<br>Supports land use objectives<br>Reduce vehicle travel demand<br>Can reduce parking requirements | May lead to future parking problems |
| In lieu fees | Saves money<br>Results in more efficient use of parking facilities<br>Reduce vehicle travel demand | Requires new administrative arrangements<br>May lead to future parking problems |
| Bicycle parking | Saves money (compared with automobile parking)<br>Supports bicycle travel<br>Is equitable | Only effective where people want to bicycle.<br>May lead to future parking problems |
| Improve parking facility design | Addresses many problems | May increase costs<br>Requires new design guidelines |

### Mobility Management in Aalborg, Denmark

The city of Aalborg has implemented a project aimed at reducing traffic to the city centre. This involves traffic calming and road closures allowing only public transport and bicycle access to the city centre, a citywide bicycle path system, an electronic parking information system (below), and the use of energy- and environmentally friendly buses and city cars.

#### *Real time parking information*

The Aalborg project included a parking guidance system providing real-time information on available parking spaces in city centre parking facilities. Parking availability is displayed on variable message signs posted along main roads leading into the city centre, similar to the system used in Sapporo, Japan (below). Following introduction of the scheme, 930 km per day have been saved due to drivers not having to circle for parking lots.

Adapted from OECD 2001

Karl Fjellstrom, Jan. 2002

2. Perform parking study that includes:
   - A parking supply inventory (how many spaces exist of each type of parking: public and private, on- and off-street, short- and long-term, free and paid, etc.) for each geographic area.
   - A parking utilisation study (what portion of each type of parking is used at various time, particularly peak-periods) for each geographic area.
   - Projections of how parking supply and demand are likely to change in the future, taking into account expected changes in land use, population, commercial activity, travel patterns, etc.
   - Use this information to identify when and where parking supply is or will be inadequate or excessive.
3. Identify potential solutions.
4. Work with all related stakeholders to prioritise options.
5. Develop an integrated parking plan that identifies changes in policies and practices, tasks, responsibilities, budgets, schedules, etc.

## Travel impacts

Automobile travel tends to be relatively sensitive to parking supply and price. Abundant, free parking encourages driving and helps create dispersed, automobile-dependent land use patterns. Parking management can help shift automobile travel to alternative modes, and improves access by creating more clustered, multi-modal land use patterns. As the number of parking spaces per employee in a commercial centre declines, use of alternative modes tends to increase. Charging employees directly for parking often reduces automobile commuting by 10 – 30% compared with employees who receive unpriced parking, particularly if implemented with improved travel choices and other Mobility Management strategies.

## Best practices

Parking management best practices include:

- Establish parking policies that encourage more efficient use of parking facilities whenever possible, in order to reduce the need to increase parking supply.

## Parking (mis)management in Bangkok, Thailand

In terms of road network density Bangkok is about average for an Asian city, but this relatively low road provision only partly explains the congested traffic. Bangkok with 338 parking spaces per 1,000 Central Business District (CBD) jobs far exceeds the average Australian city and is only a little less than the average US city with 380. By contrast, Singapore, Tokyo and Hong Kong average a mere 67 spaces per 1,000 CBD jobs (Kenworthy, 1995). The result is an inner city Bangkok streetscape dominated by cars; either parked, moving, or stationary in congestion.


Bangkok also applies a policy stipulating minimum parking facilities in new buildings. This results in up to 10 or more floors of many buildings devoted to parking (picture below). Predictable congestion results, for example, when 200 residents of a medium apartment block – all provided with parking spaces – try to drive to work in the morning via the narrow access roads. Despite the excessive devotion of space to parking, however, parking is often lacking where it would be most useful: close to outer stations of the Bangkok Skytrain MRT line.

Karl Fjellstrom, Dec. 2001

- The most convenient parking spaces should be managed and priced to favour priority users, such as people with disabilities, rideshare vehicles, delivery vehicles, business customers and clients.
- Parking prices should be higher during peak-periods. There should be little or no discounts for long-term leases.
- Parking should be considered a high-quality service. Signs, maps and brochures should be used to provide information to users. Facilities should be attractive and safe. User needs and potential problems should be anticipated.
- Parking services should not be one-size-fits-all. A parking facility may provide a variety of services tailored to different users, including valet services for premium users, convenient short-term parking for shoppers and delivery vehicles, longer-term parking for commuters and residents, and special arrangements when appropriate for commercial users.
- Parking facilities should be integrated with overall facility and district design and style.
- Parking management policies and programs should be coordinated through a district or region, so prices and management practices are consistent in comparable areas.
- Stakeholders should be involved in planning parking policies and programs.
- New technologies should be used to improve user service and revenue control.

### Information resources for parking management


- Dan Burden, *Street Design Guidelines for Healthy Neighborhoods*, Center for Livable Communities (Sacramento; http://www.lgc.org/clc), 1998.
- CORDIS, *Parking Policy Measures and the Effects on Mobility and the Economy*, Cost-Transport, CORDIS (http://www.cordis.lu), 1999-2002.
- CTR, *Local Government Parking Policy and Commute Trip Reduction; 1999 Review*, Commute Trip Reduction Office, WSDOT (http://www.wsdot.wa.gov/pubtran/ctr), 1999.
- *International Parking Institute* (http://www.parking.org) provides resources for parking professionals.
- Kyle Maetani et al., *Using Demand-Based Parking Strategies to Meet Community Goals; Local Government Parking Management Handbook*, Mobile Source Air Pollution Reduction Committee (MSRC), (http://www.aqmd.gov), 1996.
- Todd Litman, *Pavement Busters Guide*, Victoria Transport Policy Institute (http://www.vtpi.org), 1998.
- Oregon Downtown Development Association, *Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast*, Transportation and Growth Management Program, Oregon DOT and Dept. of Environmental Quality (http://www.lcd.state.or.us/tgm/publications.htm), 2001.
- *NEMO Project* (http://www.canr.uconn.edu/ces/nemo) addresses impervious surface impacts.
- Ryan Russo, *Planning for Residential Parking: A Guide For Housing Developers and Planners*, Non-Profit Housing Association of Northern California (http://www.nonprofithousing.org) and the Berkeley Program on Housing and Urban Policy (http://urbanpolicy.berkeley.edu), 2001.
- Seattle, *Parking: Your Guide to Parking Management*, City of Seattle (http://www.cityofseattle.net/planning/transportation/pdf/Parkingguide.pdf), 2001.
- Donald Shoup, "The Trouble With Minimum Parking Requirements," *Transportation Research A*, Vol. 33, No. 7/8, Sept./Nov. 1999b, pp. 549-574, also available at VTPI (http://www.vtpi.org).
- US EPA, *Parking Alternatives: Making Way for Urban Infill and Brownfield Development*, Urban and Economic Development Division, US Environmental Protection Agency, EPA 231-K-99-001 (http://www.smartgrowth.org/pdf/PRKGDE04.pdf), Dec. 1999.
- US EPA, *Parking management*, Transportation and Air Quality TCM Technical Overviews, US Environmental Protection Agency (http://www.epa.gov/oms/transp/publicat/pub_tech.htm), 1998.
- "Parking Solutions," VTPI, *Online TDM Encyclopedia*, (http://www.vtpi.org), 2002.


## 5.9 Vehicle fees, restrictions and car-free planning

Mobility Management measures can include restrictions on vehicle traffic, in congested areas and at peak times. Such schemes include car-free streets, cordon controls on entering a particular area (e.g. Singapore's Area Licensing Scheme and Electronic Road Pricing; Trondheim's toll ring; central London), and odd/even schemes and variations based

### Motorcycles banned in Guangzhou

Easing traffic conditions and mitigating air pollution is a major concern of Chinese policy-makers today and hence the ban of polluting vehicles is high on the agenda.

Guangzhou in southern China banned the use of motorcycles on major roads during peak hours starting May 1, 2004 and this ban will be extend city-wide by 2007. This move follows similar restrictions in Shanghai, Beijing and other Chinese cities.

According to Chinese newssources about 320,000 motorcycles are registered in Guangzhou, which contribute among other things about 20 percent to the city's carbon monoxide emissions. Guangzhou officials furthermore stated that this ban would contribute to the reduction of accidents and curb motorcycle-based robberies. The region itself (Guangdong Province) is home to many motorcycle factories, which cover about half of the world's production. Therefore the ban not only affects motorcycle-owners, but also an entire service and production sector.

The crucial question for transport planning, however, is how the freed-up road space is used: Is it simply used to accommodate more cars, which would travel faster and more comfortable? Or is it used to create bus lanes, pedestrian-friendly sidewalks and cycle lanes? In Guangzhou, authorities hope that most motorcycle-users switch to the new subway, which increased its frequency recently to cope with the rising demand. Other encouraging news is that – as News Guangdong reports - the use of bicycles increased and bicycle dealers report an increase in sales since the ban is enforced. On the other hand the ban may fuel the soaring demand for cars with long-term repercussions on land-use and modal-split.

Sources: http://www.walshcarlines.com, http://china.org.cn

on number plates. (Please refer to Module 1d: *Economic Instruments* for more information on London congestion charging.)

## Cordon / area pricing

### Singapore's Area Licensing Scheme and Electronic Road Pricing

Singapore introduced the Area License Scheme (ALS) in 1975, with the goal of reducing traffic during peak periods in the central business district. The system was based on vignettes and proved highly successful. In 1998 the ALS was 'upgraded' into an Electronic Road Pricing (ERP) system introduced to cover the CBD and several large nearby expressways.

ERP is simply an electronic system of road pricing. It is designed to automate the road pricing system – no more paper coupons or enforcement officers at the gantries, as used to be the case with the ALS. The main difference is the pay-when-you-use principle. This is a fair system as the motorist is charged only if they pass the ERP gantry.

With ERP, motorists are more aware of the true cost of driving.

- Charges are levied on a per-pass basis and vary according to time and congestion levels.
- With this system of charging, a motorist will be encouraged to choose whether to drive, when to drive and where to drive.
- They may choose a different route, mode, destination, time of travel, or not to travel.
- They may decide to car-pool or use public transport.
- Those who choose to pay and stay on the road enjoy a smoother ride.

The advantages of ERP as a form of Mobility Management are that it is:

- *Fair*: Charges are based on usage so those who contribute more to congestion pay more, and those who use the roads less frequently or who travel during non-ERP hours pay less or receive larger rebates.
- *Convenient*: No need to buy daily/monthly paper licences.
- *Reliable*: Does not need human enforcement, thereby removing the potential for human error (adapted from http://www.lta.gov.sg, 2002).

Such applications are feasible for developing cities. Indeed, the Singapore system remains one of the few examples worldwide of a policy instrument which has achieved massive and sustained modal shifts in favour of public transport. The potential relevance of such road pricing instruments as a way of influencing travel demand in developing cities arises because:

- Developing cities often have a low road network density and relatively few roads into the city, which means that relatively few barriers or gantries would be required. In Surabaya, Indonesia for example, a World Bank-funded study (Dorsch Consult, 1998) recommended an Area Licensing Scheme as the only way of achieving the required modal shifts to avoid intolerable congestion in coming years.
- Recent technological improvements in the area of electronic road pricing, smart cards and intelligent transport systems (ITS) may help application in developing cities (for more information, please refer to Module 4e: *Intelligent Transport Systems*). The Philippines, for example, has recently implemented a 'smart card' driver's license scheme. The license includes the driver's name and address, as well as digital copies of a fingerprint, photo image, previous driving offenses, and total points on their record. Chinese cities have similarly showed strong interest in ITS applications and this technology could be applied to road pricing.

### Trondheim's toll ring

Although cordon pricing schemes have been proposed in detailed studies in many large cities, including developing cities such as Jakarta, Surabaya, Bangkok and Manila, there remain very few examples of successful applications. One such example is that of Trondheim, Norway, which implemented a toll ring surrounding the city. Elements of the strategy include:

- 17 electronic toll stations:
- register traffic on access roads
- electronic payment lanes to avoid queues
- differentiated tolls
- cars equipped with electronic tag
- limited duration of the system (1991-2006)
- contracting-out of toll stations
- revenues earmarked for transport investment

- additional funding for road building, public transport, safety and environmental projects.

Features of the rate structure include:

- pay only once per hour on entry
- basic toll level 1.5 Euro
- heavy vehicles (> 3.5 t) pay double
- maximum fee per month: 60 payments
- free entry after 6 pm on workdays
- free entry at the weekends.

Results from Trondheim include:

- *Greater road use efficiency*: Changes in transport mode (from car to bicycle and walking), traffic reduction during tolled period, traffic increase on evenings and weekends.
- *Less pollution.*
- *Rise in "living conditions"*: Fewer waiting hours for public transport or in congestion, fewer delays in transport of goods.
- *Revenue creation.*

Lessons learned from Trondheim, which are equally applicable to developing cities considering area restriction schemes, include:

- Importance of public support for success of measure. In Trondheim this was achieved through public awareness campaigns. Social and business concerns were stressed (traffic reduction for "environmentalists", transport capacity improved for "motorists").
- Acceptance increased as residents gained experience with the system and saw its benefits.
- Contracting out/privatisation is helpful.
- Only a policy mix will be successful, in this case a toll combined with improved public transit service and non-motorised transportation facilities.

## Odd / even schemes and their variations

Another strategy is to use licence numbers to control vehicle use at certain times and locations. Cracknell (2000) surveys experience:

1. *Lagos, in the past, used the odd-even number plate applied to the centre of the city but the scheme is no longer operational;*
2. *Mexico City uses a scheme which prohibits car use throughout the federal district with number plates ending in "1" and "5"on Mondays, "2" and "6" on Tuesday etc for the 5-day working week ("Hoy No Circula");*
3. *Bogotá uses a scheme in which 40% of private vehicles cannot operate in the city from 7 – 9am and from 5.30 – 7.30pm in accordance with designated number plates (Figure 9);*
4. *Santiago de Chile introduced a scheme which operated only on days on which atmospheric pollution reaches emergency levels. In this case, all vehicles except buses, taxis and emergency vehicles were prohibited from circulation in morning and evening peaks on the six principal road axes which connect the outer and centre of the city;*
5. *Sao Paulo uses a scheme over a wide central area (within the Inner Ring – about 15km diameter) in which 20% of vehicles ("1" and "2" on Mondays etc) are prohibited from 07:00-08:00 and 17:00-20:00 for weekdays;*
6. *Manila uses a scheme which prohibits certain vehicles, again identified by number plates, from operating on the main traffic arteries during peak periods.*

## Disadvantages of odd/even schemes

An odd/even system may:

- Encourage an increase in the number of vehicles owned, as a means for households to avoid restrictions. This may not be a problem if such vehicle restrictions are implemented just one or two days a year.

### Mixed results from license plate restrictions in Athens

Instead of pricing signals, some cities have tried to use outright traffic bans to manage travel demand. Bans in the form of license number restrictions were tried in Athens, Greece; Bogotá, Colombia; and Mexico City.

Although these bans have been somewhat effective, many households bought a second car or switched license plates to meet their mobility needs. In Athens, the number of households with two cars increased, and motorists who were not allowed to enter the city centre drove around the city to get to their destination, thereby increasing the length of their trips while also increasing emissions. Cars bought for off-days are often second-hand, which tend to be more polluting.

Adapted from World Resources Institute, World Resources 1996-97, http://www.wri.org


**Fig. 9**

***Restrictions on car use in Bogotá included an odd/even system based on the last digit of vehicle number plates, which restricts 38% of vehicles each work day.***

Un nuevo Sistema de Transporte, Bogotá, 2000

- Are vulnerable to fraudulent practices such as fake number plates.
- Generate increased taxi trips if taxis are excluded from the scheme. Taxi oversupply is a problem in Mexico City and Bogotá.
- Does not provide a long term solution as it will be undermined by growth in vehicle ownership over time; and
- May be undermined by concessions and exemptions for special vehicles.

### Advantages of odd/even schemes

On the postive side, odd/even schemes:

- Are often accepted by the public as they show a commitment by government to act to reduce congestion and related air pollution.
- Are less difficult to enforce than anticipated.
- Can provide temporary relief in order to develop something better, such as public transport priority measures.
- Assist road based public transport, at least in the short term, as average travel speeds increase (Bogotá reported a 20% increase in travel speeds after the odd/even scheme inception).
- Can help generate public awareness in support of a motor vehicle 'restraint climate'.

## Mobility Management resources

- *Access; the Sustainable Transport Forum* (http://www.ecoplan.org/com_index.htm) is an information network exploring and promoting sustainable transport.
- Rahman Paul Barter and Tamim Raad, *Taking Steps: A Community Action Guide to People-Centred, Equitable and Sustainable Urban Transport*, (http://www.geocities.com/sustrannet) 2000 [see Sustrannet below]
- *Centre For Science And Environment (CSE)* (http://www.cseindia.org) is a network of professionals interested in environmental and sustainable development issues, located in New Delhi, India.
- *Center for Urban Transportation Research*, USF (Tampa; http://cutr.eng.usf.edu) provides Mobility Management materials and classes and the *TMA Clearinghouse Quarterly.*
- *Clean Air Initiative for Asian Cities* (CAI-Asia) (http://www.worldbank.org/wbi/cleanair/caiasia) promotes ways to improve air quality of Asian cities.
- *Commuter Choice Program* (http://www.epa.gov/oms/traq) provides resources for developing employee commute trip reduction programs.
- John Cracknell, *Experience in Urban Traffic Management and Demand Management in Developing Countries*, World Bank, Urban Transport Strategy Review (http://wbln0018.worldbank.org/transport/utsr.nsf), 2000.
- *Equity Watch* (http://www.cseindia.org/html/cmp/climate/ew) is a climate change newsletter from the Southern perspective.
- *European Program for Mobility Management* (http://www.epommweb.org) provides resources for Mobility Management planning and programs.
- *Institute for Transportation and Development Policy* (http://www.itdp.org) promotes equitable and sustainable transport policies and projects worldwide.
- The *International Forum for Rural Transport and Development* (IFRTD) (http://www.gn.apc.org/ifrtd) is a network to improve rural accessibility and mobility.
- The *International Institute for Energy Conservation* (http://www.iiec.org) has useful documents on transport issues in Asia, Latin America, and Europe.
- The *International Network for Urban Development* (http://www.inta-aivn.org) encourages exchange of information on best practices of urban development and renewal.

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