Congestion Pricing In Asia

Options and Impacts

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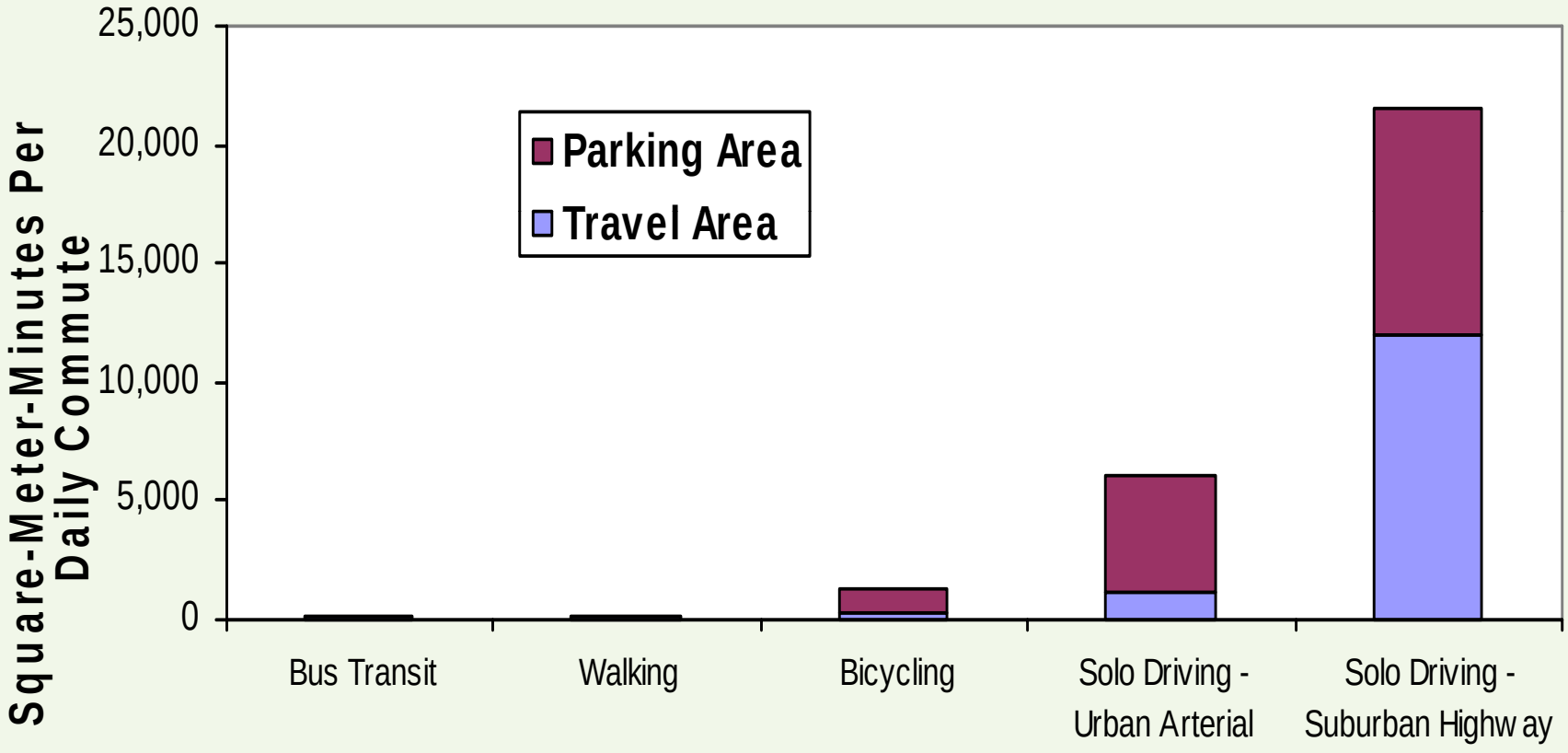
Road Space Required For Travel

Automobiles require far more road space per passenger than other modes.

Space Required For Typical Commute



Automobile travel requires far more space than other modes

Vehicle Travel Demand

Traffic congestion tends to maintain equilibrium: it increases until delays discourage additional peak-period vehicle trips. If urban roads are unpriced, added capacity is soon filled with generated traffic. As a result, without efficient pricing it is virtually impossible to eliminate urban traffic congestion by simply expanding roads.

Even affluent cities cannot afford to build enough road space to satisfy total travel demand. It is even less feasible for developing country cities.

Houston, Texas highways are congested despite efforts to expand capacity.

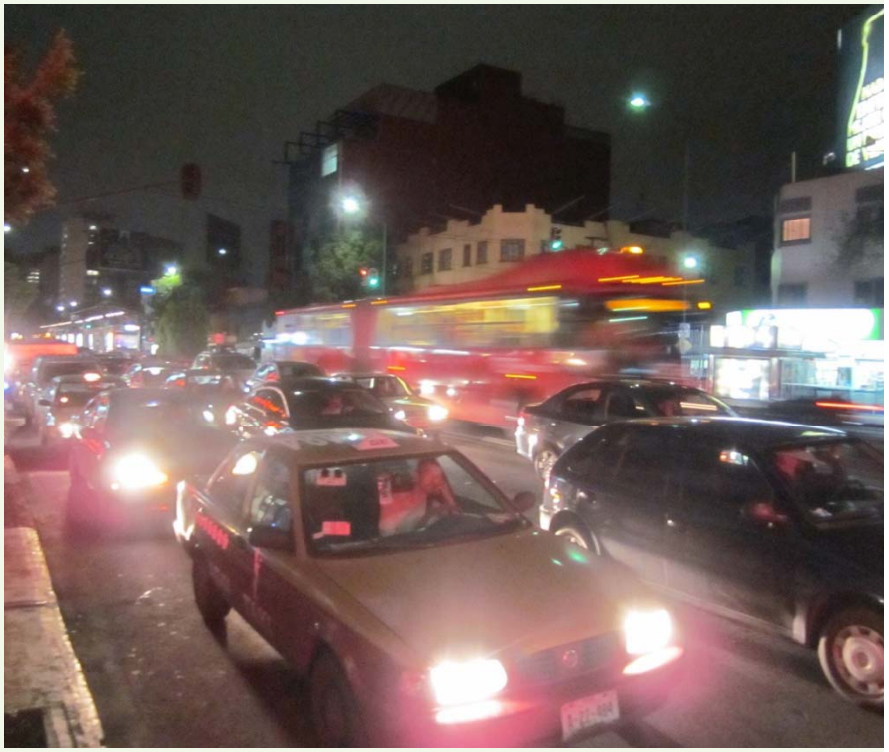
Motorists Must Pay Either Time or Money

Something must limit peak-period traffic volumes:

- Either congestion becomes self-limiting (motorists spend **time**).
- Or efficient pricing encourages some travelers who could drive to choose alternatives (motorists spend **money**).

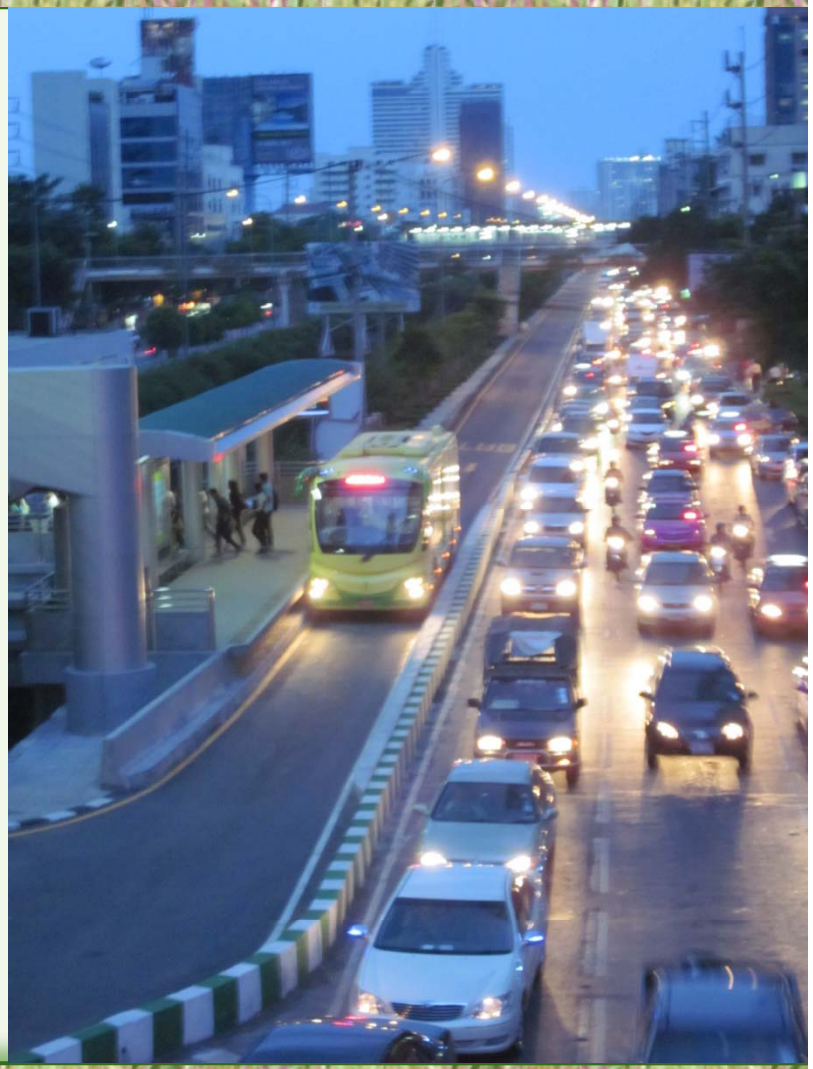
Pricing Increases Efficiency

- Pricing allows higher value trips and more efficient modes to outbid lower-value trips and less efficient modes for scarce road space.
- Pricing creates transparency. It explicitly tests motorists' willingness-to-pay for infrastructure expansion.
- It also generates revenues that can be used to improve transport (sidewalks, roads and public transit) or other useful public services.



Principles for Efficient Transport

- Diverse travel options (good walking, cycling and public transport).
- Efficient pricing (motorists pay for the road and parking infrastructure they use, and additional fees for the congestion, accident and pollution costs they impose on others.
- Road space allocation favors higher value trips and more space-efficient modes over lower value trips and more space intensive modes (such as bus lanes).



Efficient Pricing

- Either the price needed to reduce traffic congestion and raise traffic speeds to optimal levels.

or

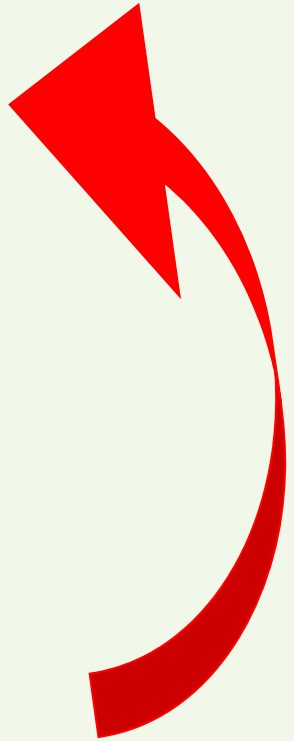
- The price needed to finance both roadway operations (ongoing repairs and maintenance) and capacity expansion to accommodate additional peak-period traffic volumes (typically $0.25 to $1.00 per additional vehicle-kilometer).

"Raise My Prices, Please!"

Of course, consumers do not like to pay more for roads and parking, but unpriced facilities are not really free, consumers ultimately pay through higher taxes and retail prices. The choice is actually between paying directly or indirectly.

Paying Directly Returns Savings To Motorists

Paying directly is more equitable and efficient, since users pay in proportion to the costs they impose. "Free" facilities force everybody to pay, including non-drivers and motorists who reduce their vehicle use. Paying directly gives individual consumers the savings that result when they drive less, providing a new opportunity to save money.

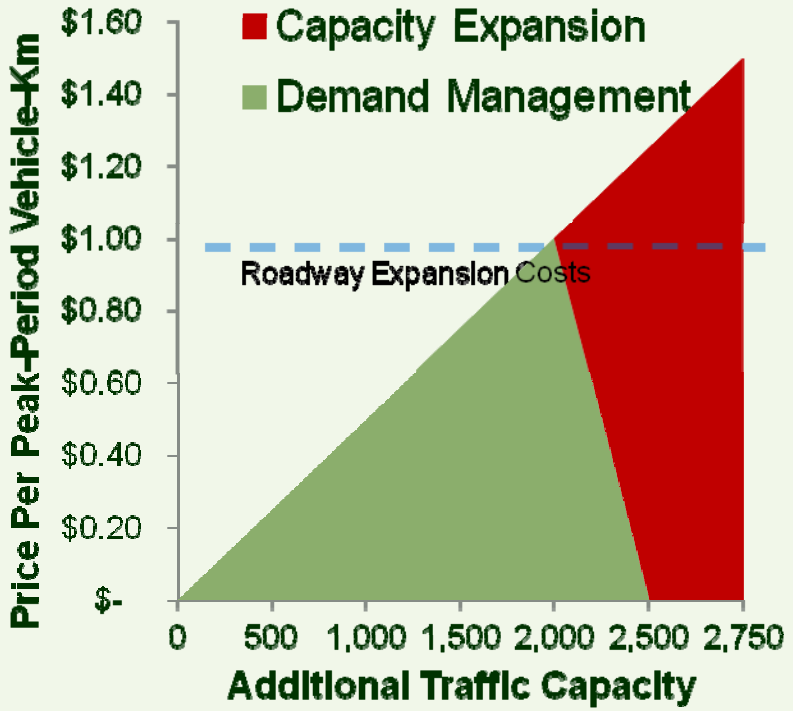


Changing Assumptions

Previously, transport professionals generally assumed that since increased mobility is overall beneficial and productive, increasing urban roadway capacity is socially and economically desirable, and so deserves subsidy.

Now we realize that automobile travel is just one form of transport, and motor vehicle travel imposes large costs as well as benefits, so an optimal transport system limits vehicle travel and roadway expansion through efficient pricing and providing high quality alternatives.

According to the new paradigm, urban roads should be priced to test demand, and only expanded if peak-period travel demand can generate sufficient revenues to finance all costs, so increased vehicle travel is not subsidized.



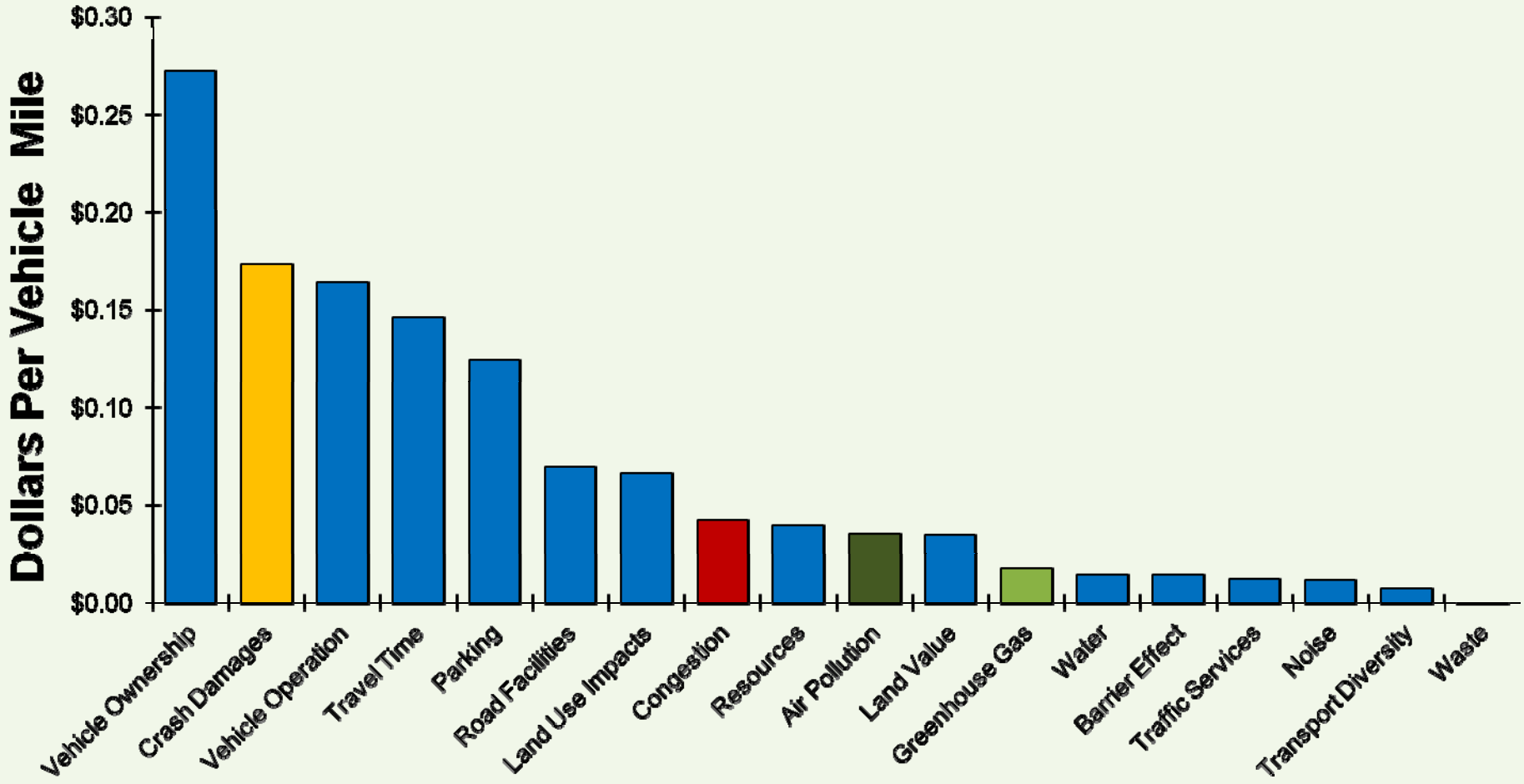
Road pricing should test consumer demand. Urban roadways should only be expanded if peak-period toll revenue can repay the full incremental costs.

Vehicle Travel Price Sensitivity

Recent experience indicates that vehicle travel is often quite price sensitive: even modest tolls (such as $0.10 per vehicle-kilometer) can significantly reduce vehicle travel demand (by 20-40%). As a result, many toll roads have not achieved their projected traffic volumes and revenues.

In other words, *many motorists want additional roadway capacity only if somebody else pays*. This suggests it is generally more economically efficient to price existing urban roadways to reduce demand, rather than to build costly new urban highways.

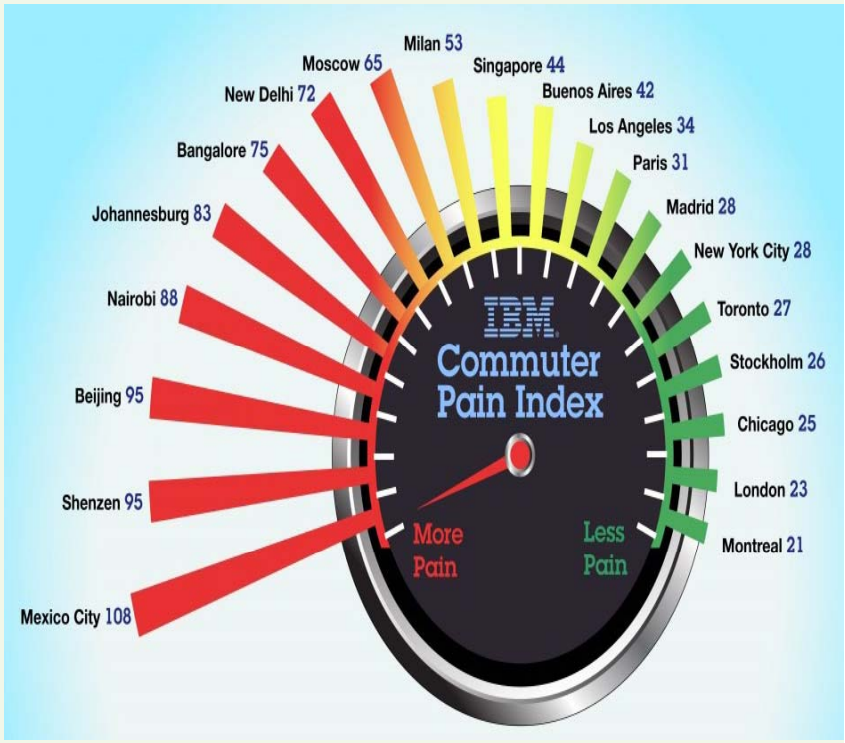
Comparing Costs



Traffic Problems In Developing Cities

Traffic problems tend to be particularly severe in developing country cities.

- Traffic and parking congestion.
- Traffic accidents
- Inadequate mobility options for non-drivers, causing inequity.
- High transportation costs to consumers.
- Pollution emissions.
- Economic costs of importing fuel.
- Negative impacts of sprawled development.



Very Appropriate In Developing Cities

Efficient road pricing is very appropriate in developing country cities because:

- Vehicle ownership rates are low, so pricing benefits most residents and is progressive with respect to income.
- Traffic congestion is particularly intense and there is insufficient money to significantly expand roadways.
- It can help prevent automobile dependency and sprawl. It helps preserve walking, cycling and public transit use.
- They can adopt new pricing technologies at relatively low costs.

Types of Pricing

- Road tolls
- Area (cordon) fees
- Parking pricing
- Fuel tax increases
- Weight-distance fees
- Distance-based insurance and registration fees
- Emission fees
- Vehicle purchase taxes and registration fees
- Public transport fares

Cost-Based Pricing

Rank	Category	Examples
Best	Time- and location-specific road and parking pricing	Variable road pricing, location-specific parking management, location-specific emission charges.
Second Best	Mileage-pricing	Weight-distance charges, distance-based vehicle insurance and registration fees, mileage based emission charges.
Third Best	Fuel charges	Increase fuel tax, pay-at-the-pump insurance, carbon tax, increase Hazardous Sub. Tax.
Bad	Fixed vehicle charges	Current MVET, vehicle purchase and ownership fees.
Worst	External costs (not charged to motorists)	General taxes paying for roads and traffic services, parking subsidies, uncompensated external costs.

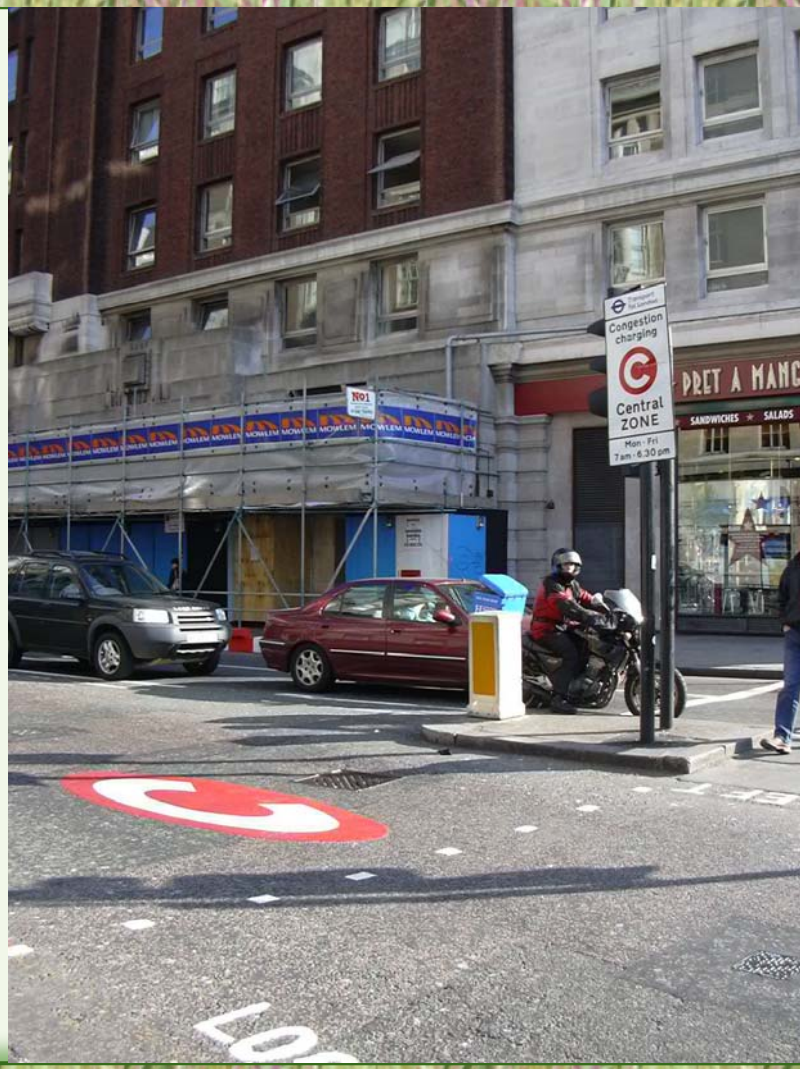
Appropriate Pricing of Various Costs

Cost	Pricing Method	How Calculated
Congestion	Time and location based vehicle fees or road tolls.	Prices are higher under congested conditions. Price to reduce traffic volume to optimum flow.
Roadway costs	Road tolls or weight-distance fees.	Cost allocation applied to all roadway costs, including traffic services, rent and taxes on roadway land.
Accidents	Time- and location-based fees, or distance-based fees.	Current insurance premiums prorated by annual mileage, increased to account for uncompensated accident costs.
Parking	Charge users directly for parking using time and location based fees.	Fees set to recover parking facility costs and maintain 85% occupancy during peak periods.
Pollution Emissions	Time and location based fees (if possible) or distance-based fee.	Vehicle emission rates (grams per mile) times regional pollution unit costs (cents per gram).
Fuel externalities	Fuel tax.	External costs of producing, importing and consuming fuel, including greenhouse gas emissions.
Sprawl (inefficient land development)	Impervious surface or per-space parking tax. Property taxes and rents on roadway land. Environmental land value taxes. Location-based development fees, utility fees and taxes.	At least comparable to taxes and rents applied to other land uses, with extra fees for environmental costs (such as stormwater management costs), and higher fees and taxes to reflect the higher costs of providing public services in dispersed areas.

Road and Area Tolls

A fee for driving on a particular road or in a particular area (such as downtown).

- Toll booths
- Window sticker.
- Electronic toll collection using roadside transponders.
- License plate tracking using optical character recognition.
- GPS-based tracking of vehicle location (can also price parking and provide other benefits).

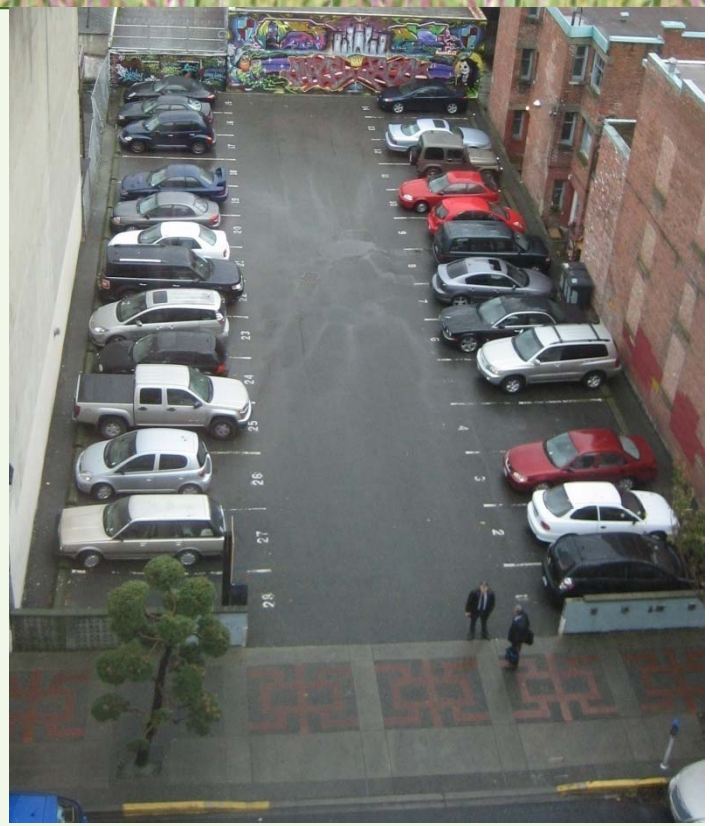


Parking Pricing

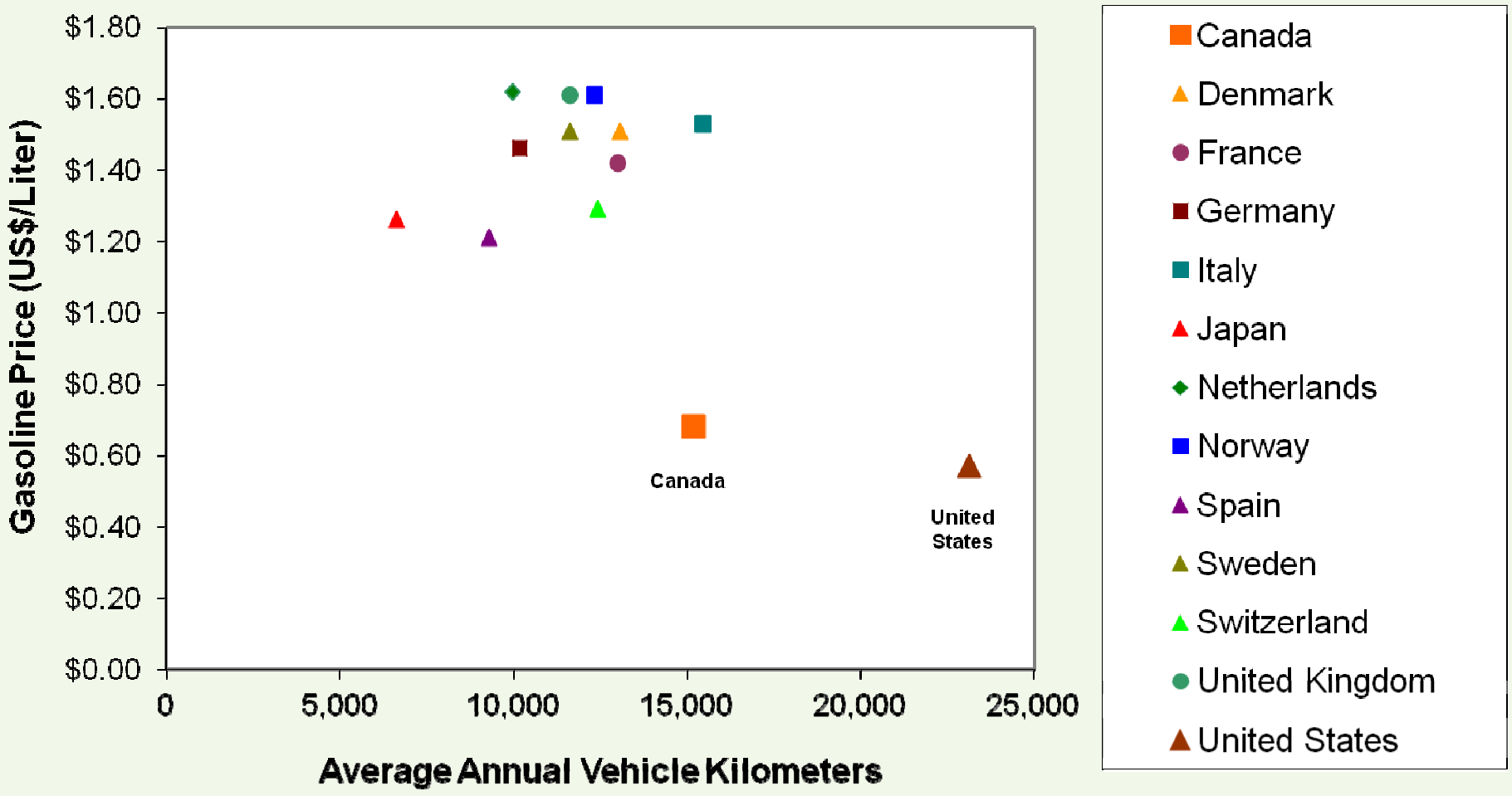
- Charge motorists for using parking facilities.
- Expand when and where parking is priced (e.g., evenings and Sundays, residential streets).
- Congestion pricing, with higher rates at times and locations with higher demand to encourage more efficient use of parking facilities.
- Reduce long-term discounts and “early bird” specials. Shift to shorter time periods (e.g, hourly rather than daily).

Unbundling and Cash Out

- **Unbundling** – Parking is rented separately from building space, so for example, rather than paying $1,000 per month for an apartment with a “free” parking space, residents pay $900 per month for the apartment and $100 per month for each parking space they use. This prevents residents from paying for parking spaces they do not need.
- **Cash out** – Employees who are offered a subsidized parking space can choose instead to receive its cash equivalent if they use another commute mode. This is more equitable and encourages use of alternative modes.



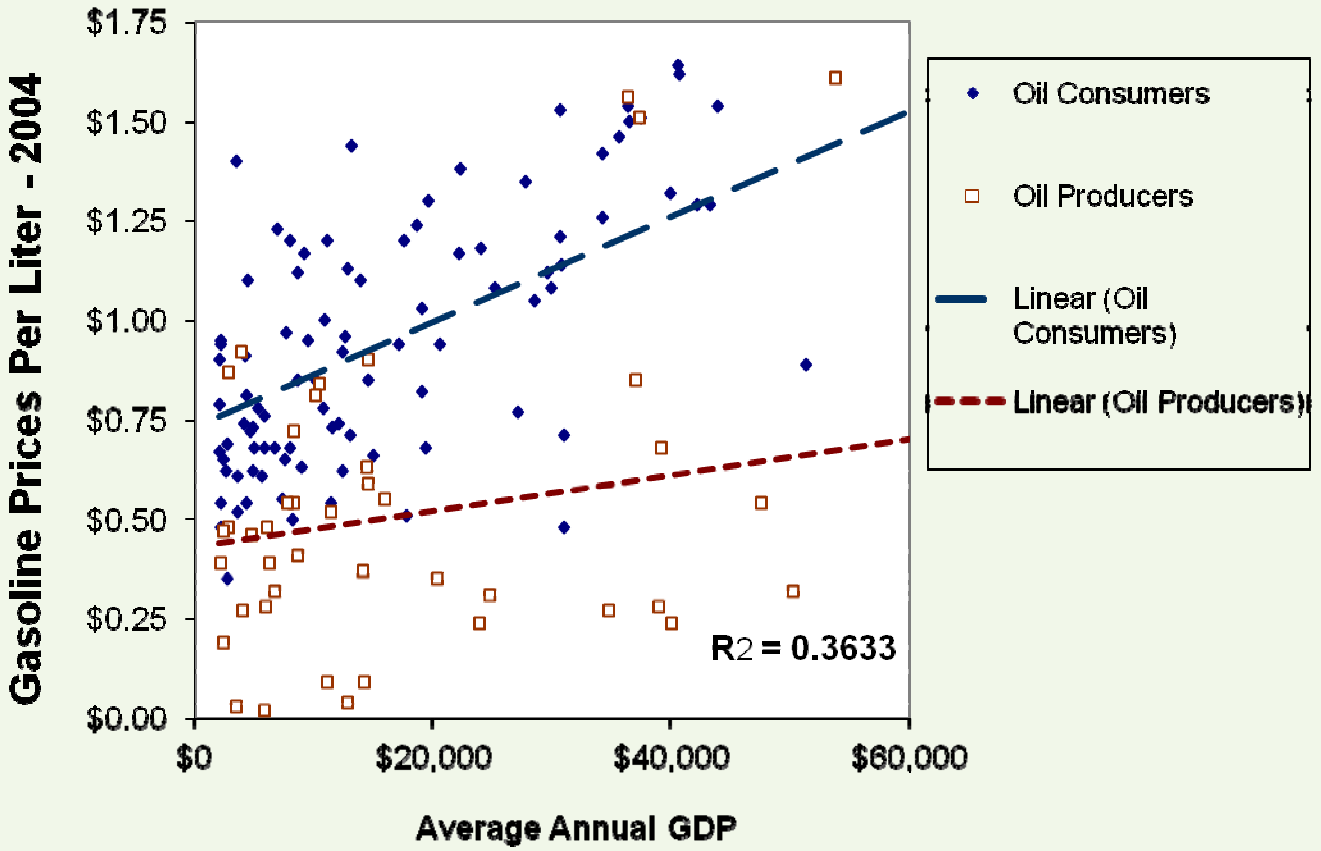
Fuel Taxes


$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Gasoline Price (US$/Liter)
0
5,000
10,000
15,000
20,000
25,000
Average Annual Vehicle Kilometers
Canada
United States
Canada
Denmark
France
Germany
Italy
Japan
Netherlands
Norway
Spain
Sweden
Switzerland
United Kingdom
United States

Per Capita GDP and Fuel Prices

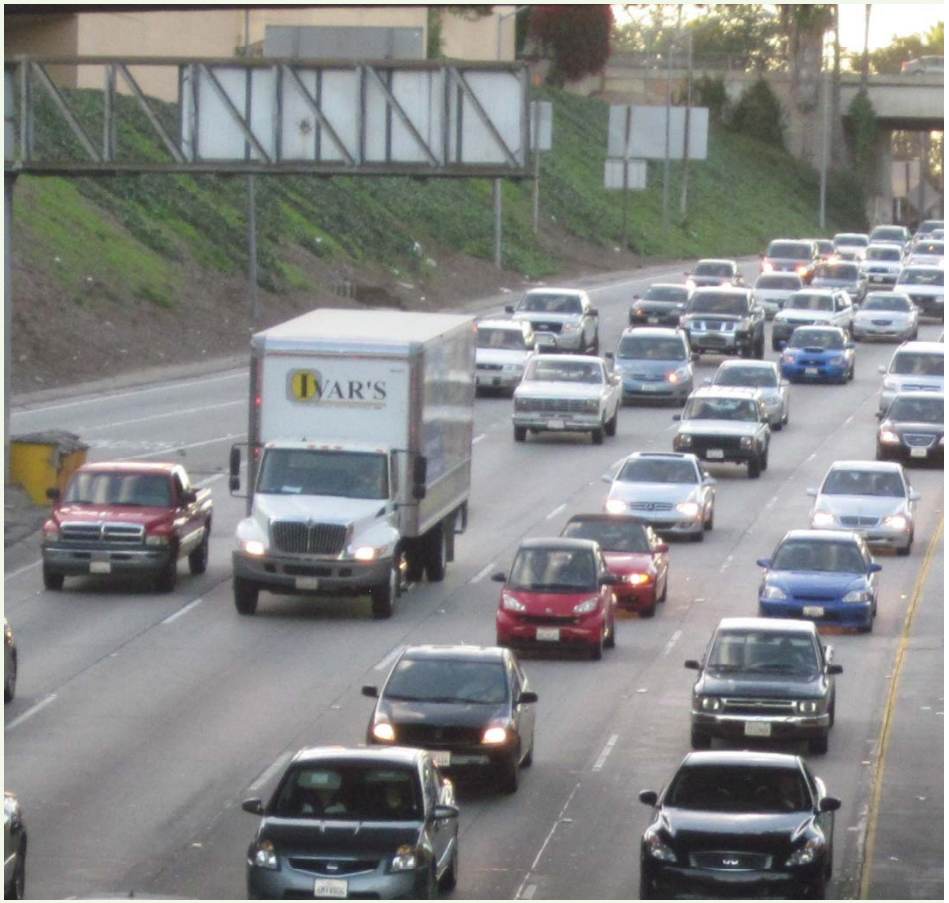
Productivity tends to increase with higher fuel prices, particularly in oil consuming countries (each dot is a country).

Fuel price data from Metschies, 2005



Weight-Distance Fees

Per-kilometer fees based on vehicle type, such as vehicle weight, fuel type and emission rates, to reflect roadway infrastructure and pollution costs. Often required only for freight vehicles. Requires annual odometer audit or on-board unit (OBU).



Distance-Based Pricing

Change insurance and vehicle registration fees from fixed to distance-based fees.

For example, a $600 annual premium becomes 3¢/km and a $2,000 annual premium becomes 10¢/km. This gives motorists a significant financial incentive to drive less, but is not a new fee at all, simply a different way to pay existing fees.

Vehicle Purchase and Ownership Fees

Vehicle purchase and ownership fees can be structured to support various objectives:

- High fees or auctions to limit total vehicle purchases.
- Higher fees for larger or more polluting vehicles.

But once a motorist pays these fees, they are encouraged to drive. It is generally more efficient to charge for vehicle travel.

New Pricing Systems

GPS-based vehicle tracking is now quite precise and reliable. As a result, new electronic system can make road and parking pricing convenient and cost-effective to operate if widely implemented, but have high initial costs and raise privacy concerns.

Evaluating Benefits

- Roadway expansion net benefits are reduced by *generated traffic*, which reduces congestion reduction benefits and increases external costs such as downstream traffic and parking congestion, accidents and pollution.
- Pricing and transit improvement impacts tend to start small but increase over the long run, in contrast with roadway expansion benefits which are large in the short-term but decline over time due to induced travel.

Travel Options Affect Pricing

Pricing travel impacts and consumer costs (loss of consumer surplus) are significantly affected by the quality of transport options. If alternatives are inferior a relatively high price is needed to reduce vehicle traffic volumes and congestion delays. If alternatives are convenient, comfortable and affordable, a smaller price is needed to reduce automobile travel demand and consumers are less harmed.

Travel Choices Study

- Home-to-Work vehicle trips elasticity averaged -0.04 (a 10% price increase causes a 0.4% reduction in commute trips) overall.
- Increased to -0.16 (a 10% price increase causes a 1.6% reduction in commute trips) for workers with the best transit service.

Indicates that high quality public transit service significantly reduces the price (road toll or parking fee) required to achieve a given reduction vehicle travel, a reflection of the smaller incremental cost to travelers (i.e., less loss of consumer surplus) when they shift from driving to high quality public transit.

Comparing Benefits

Planning Objectives	Expand Roadways	Efficient and Alt. Fuel	Improve Transit	Efficient Pricing
Vehicle Travel Impacts	*Increased*	*Increased*	*Reduced*	*Reduced*
Improve travel experience	✓		✓	✓
Reduce traffic congestion	✓		✓	✓
Roadway cost savings			✓	✓
Parking cost savings			✓	✓
Consumer financial savings	✓		✓	×
Improve mobility options			✓	✓
Improve traffic safety			✓	✓
Energy conservation		✓	✓	✓
Pollution reduction		✓	✓	✓
Land use objectives			✓	✓
Economic development	?	✓	✓	✓
Public fitness & health			✓	✓

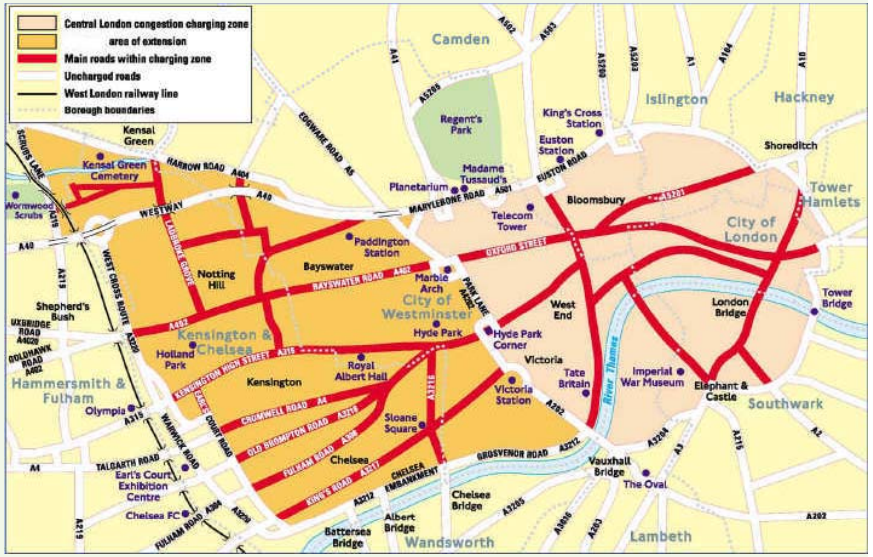
Comparing Road Pricing

Costs, Travel Impacts and Benefits	Road Pricing	Parking Pricing	Fuel Prices	Distance-Based Fees	Ownership Fees
Implementation Costs	High	Med./Low	Low	Medium	Low
Urban travel impacts	High	High	Medium	Medium	Low
Total veh. travel impacts	Low	Moderate	Moderate	High	Low
Traffic congestion reduction	High	Medium	Low	Low	Very Low
Roadway cost savings	High	Medium	Low	Low	Very Low
Parking cost savings	Medium	High	Low	Low	High
Increased traffic safety	Medium	Low	Medium	High	Low
Energy/pollution reductions	Medium	Medium	High	High	Low

Different types of pricing have different impacts. Road and parking pricing impacts tend to be concentrated and so are most effective at reducing urban traffic and parking congestion. Increased fuel prices and distance-based insurance and registration fees affect a larger portion of total travel and so tend to be more effective at reducing total accidents, energy consumption and pollution emissions. Increasing vehicle ownership fees tends to have minimal impacts unless they are large enough to significantly reduce total vehicle ownership.

Example: London

Since 2003 London has charged for driving private automobiles in its central area during weekdays. This significantly reduces congestion in that area, improved bus and taxi service, and generates substantial revenues (although more than a third are used to finance the payment system). The program expanded to new areas in 2007 but was reduced back to its original size in 2011.



Motorists pay by Internet or at kiosks. License numbers of vehicles driving in the area are tracked using roadside cameras.

Example: Stockholm

Since 2006 Stockholm has charged a tax for driving vehicle into our out of its central area during weekdays. After a six-month trail it was approved by a referendum. The tax varies, with higher rates during peak hours and no charge evenings, nights and weekends.

Vehicles entering the charge area are recorded electronically and sent a bill at the end of each month. Funds are used to improve local roads.

Example: Singapore

- Singapore first implement cordon-based congestion pricing in 1975. An ERP (Electronic Road Pricing) system introduced in 1998 now charges for different roads at different times automatically as vehicle passes under gantries.
- The charge has been successful in reducing peak-period traffic volumes an estimated 13%, which increases traffic speeds by 22%.

Optimal Travel Activity

With more efficient pricing travelers would drive significantly less, rely more on alternative modes and be better off overall.

Implications

- Without efficient pricing and improvements to alternative modes, urban traffic congestion is virtually unavoidable.
- Motorists either spend time or money. Spending money is more efficient overall because it allows higher value trips to “outbid” lower-value trips, and generates revenue.
- Urban traffic congestion is increasingly severe in developing countries.
- More efficient pricing can reduce congestion and help achieve other planning objectives. Although road tolls are most effective at reducing congestion, other pricing strategies (parking pricing, higher fuel taxes, and distance-based fees) may be easier to implement and provide greater total benefits.

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“Transportation Cost and Benefit Analysis”

“Smart Transport Emission Reductions”

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