MOBILSERVICE

Plattform für eine zukunftsorientierte Mobilität

Erfahrungsaustausch zu Road Pricing
Referate aus den IDTP Congestion Charging Workshops

In einer wachsenden Anzahl von Städten hat die Einführung eines Road Pricings dazu geführt, dass Verkehr, Stau und Luftverschmutzung drastisch reduziert werden konnten. Demgegenüber wurden dadurch Mittel für den öffentlichen Verkehr erhöht. In mehreren Workshops des Institute for Transportation and Development Policy IDTP im Herbst 2006 diskutierten Entscheidungsträger, Planer und Profis die weltweiten Erfahrungen. Hier finden Sie die Präsentationen. (Sprache: en)

Weitere Informationen:
IDTP http://itdp.org/cpw/index.html

Echange d'expériences sur le péage routier
Résultats des ateliers organisés par l'IDTP sur le road pricing

Les bilans positifs du péage routier s'additionnent et les villes qui ont introduit cette mesure montrent des résultats positifs en termes de réduction du trafic, des bouchons et de la pollution atmosphérique. Dans le même temps, ces mesures ont souvent permis d'accorder plus de moyens aux transports en commun. L'Institute for Transportation and Development Policy IDTP a organisé plusieurs ateliers de discussion, dans le courant du mois d'octobre 2006, dans le cadre desquels les acteurs concernés ont pu échanger leurs expériences. Vous trouverez ici les exposés des participants. (langue : anglais)

Pour plus d'informations:
IDTP http://itdp.org/cpw/index.html

24.09.2007 http://www.mobilservice.ch

Mobilservice Redaktion: Andreas Blumenstein und Julian Baker
c/o Büro für Mobilität AG
Hirschengraben 2 | 3011 Bern | Tel.: +41 (0)31 311 93 63 redaktion@mobilservice.ch

Mobilservice Administration: Ursula Gertsch
c/o Rundum-mobil
Buchholzstrasse 7a | 3604 Thun | Tel.: +41 (0)33 334 00 25 info@mobilservice.ch

Congestion Charging and Road Pricing For High Performance Transportation

Schedule and Venue
12 December, 9 am - 4 pm
Jogjakarta Plaza Hotel

Organizers
ADB, CAI-Asia, *EMBARQ*, the World Resources Institute (WRI) Center for Sustainable Transport, ITDP, Environmental Defense, and Sida-SENSA

Background
Most Asian countries have established and implemented roadmaps on vehicle emission and fuel quality standards but rapid traffic growth counters much progress in curbing emissions, as well as traffic congestion. Road pricing is an option that uses a price mechanism to effectively regulate traffic flow and to reduce in-vehicle travel time. The technologies and techniques used to implement road pricing policies are not new and have been tested in different parts of the world. However, the implementation of such policies is often influenced by other economic, social and institutional factors. While Singapore pioneered the introduction of road pricing, this has not been actively followed up in other Asian Countries. The successful expansion of road pricing in European countries is generating new interest in many Asian cities where traffic problems abound.

Objectives
The main objective is to present decision makers with information to enable them to apply road pricing in the medium term as part of an integrated strategy of sustainable transport, specifically through:

- Review of experiences in Singapore, Europe, and the US on road pricing;
- Review of technological developments and their implications for the design, implementation and evaluation of road pricing schemes;
- Review of cost benefit analysis of road pricing schemes and their impact in relationship to other economic policy instruments, including implications on reduction of GHG and criteria pollutants;
- Identification of supportive institutional and policy context for the introduction of road pricing;
- Discuss how several major Asian cities are considering these strategies to help manage traffic, cut pollution and greenhouse gases, and create high performance transportation systems.

Participants
25-30 participants with a mix of policy makers and technical staff from national and local levels, academics and other stakeholders which have a direct role in urban transport planning and management with interest in considering road pricing or congestion charging to manage traffic and pollution, enhance revenues for transportation systems, improve public transportation, and develop a higher performance transportation system.

Contact Persons
Lee Schipper
EMBARQ, World Resources Institute
schipper@wri.org

Cornie Huizenga
CAI-Asia
chuizenga@adb.org

Michael Replogle
Environmental Defense
mreplogle@environmentaldefense.org

Agenda for Road Pricing BAQ Pre Seminar, Yogyakarta, 12 December 2006

- **Introduction, motivation, theory, implementation – global overview**: *Michael Replogle*, Environmental Defense/ITDP
- **Singapore implementation.** *Eddie Lim Sing Loong*, MSI Global
- **Stockholm implementation** *Oskar Allarik*, Miljoekansliet, Stockholm City – 10 min
- **Technical Challenges of Electronic Road Pricing**: *Takakazu Tsuji*, Mitsubishi Heavy Industries
- **Economic, Environmental, Ethical, Marketing, Political Issues**: *Lee Schipper*,
- **The Way Forward: Congestion Pricing in Asian Cities?**
- **Jakarta** - *Daryati Rini*, Head, System Development Section, Jakarta Transport Office
- **Asian Development Bank perspective** – *Jamie Leather, ADB*

BAQ Sub Workshop #30 on Congestion Charging and Road Pricing
Yogyakarta, 15 December 2006
DRAFT AGENDA November 28, 2006 – Speakers subject to confirmation

1:30 – 3:00 PM
• **Introduction** – *Michael Replogle**, Environmental Defense/ITDP
• **Singapore case study** - *Mr. Chow Kuang Loh**, Singapore Land Transport Agency
• **London case study**- *Murad Qureshi*, elected Member of the Greater London Authority
• **Synthesis of 12 December pre-event with emphasis on way forward on CP in Asia** – *Lee Schipper and Wei-Shiuen Ng**, EMBARQ, World Resources Institute
• **Panel Discussion and Q&A**

* Indicates confirmed speaker

Road Pricing and Congestion Charging

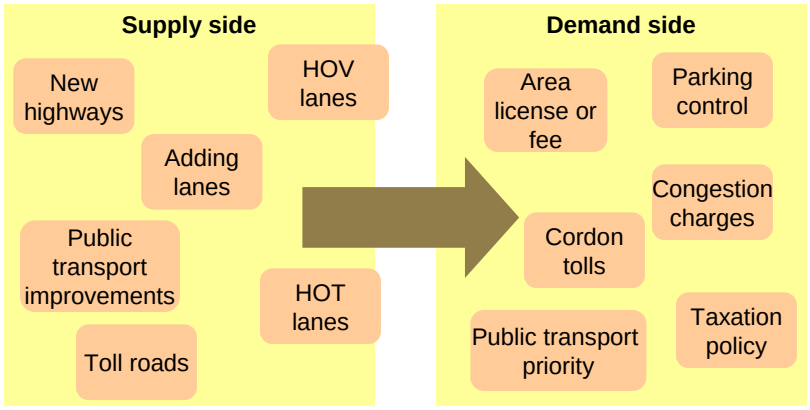
Experience, Opportunities, Motivation

by Michael Replogle
Environmental Defense and the Institute for Transportation and Development Policy

Presentation to BAQ-pre-meeting
12 December 2006

We Can't Build Our Way Out of Congestion

Transportation systems worldwide are undergoing a shift from supply side techniques to demand management



Adapted from Derek Turner Consulting

Road Pricing and Congestion Charging: What Is It?

- Charge for use of road or area
- Fixed or time-of-day fees
- Paid in a variety of ways:
  - Electronic payment
  - Cash payment
  - Prepayment

Road Pricing and Congestion Charging: Why?

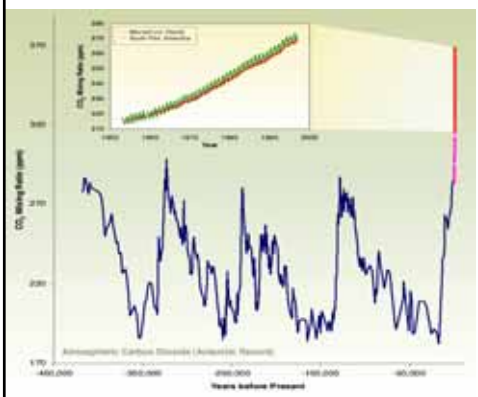
- Curb traffic demand to reduce congestion, pollution, fuel use
- Manage road space for highest productive capacity to reduce congestion, pollution, GHG emissions, and fuel use
- Generate revenue for roads, public transportation, impact mitigation, other things

ITDP

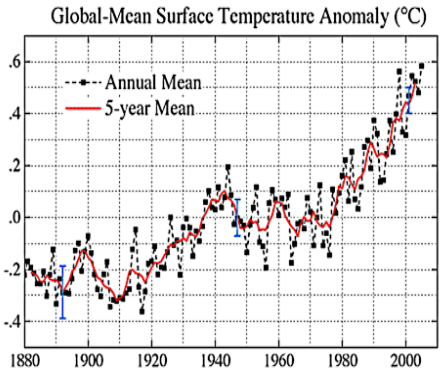
e ENVIRONMENTAL DEFENSE
finding the ways that work

2005: Highest CO_2 & Warmest Year: Transportation A Major Contributor

Increasing fuel use increases CO_2, the leading greenhouse gas



Source: Ralph J. Cicerone, Finding Climate Change and Being Useful, National Council for Science and Environment, 2006



Source: NASA Goddard Institute for Space Studies

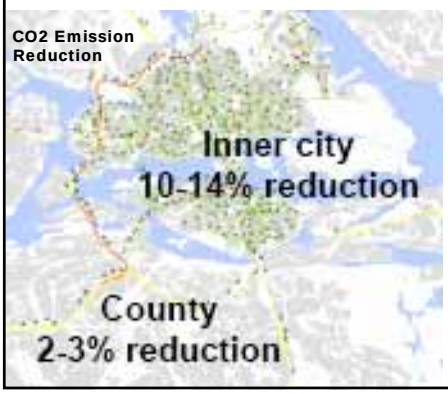
ITDP

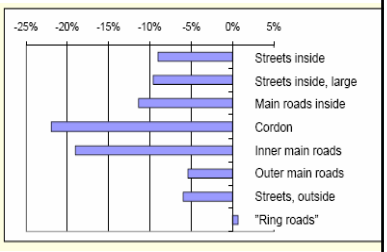
e ENVIRONMENTAL DEFENSE
finding the ways that work

Why Implement Congestion Pricing?

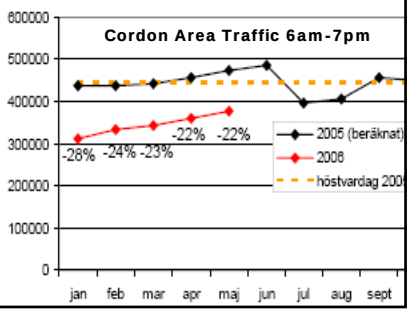
Stockholm designed its system to boost environmental performance:

- **Traffic reduced overall by ¼**
- **Queue times down 30-50%**
- **Emissions down 14%**



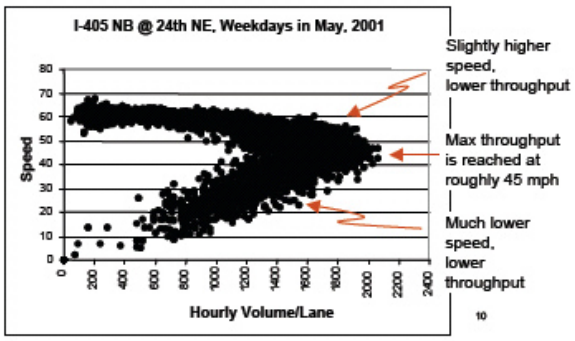


Overall Traffic Reduction



Congestion Management: Key to High Performance Corridors

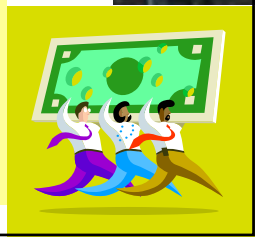
If congestion reaches critical point, speeds drop, vehicles bunch up, and per lane throughput plummets



Source: Doug MacDonald, Highway Congestion: What Is To Be Done? *WS DOT, http://www.wsdot.wa.gov/secretary/*

Many Approaches to Congestion Charges

- **Cordon entry permit**
  - Payment at toll plaza – e.g. Norway cordon systems
- **Area License**
  - Paper license or Transit Pass for visual inspection, database option – e.g., Singapore 1970s
  - Virtual license with digital camera enforcement – e.g., London Congestion Charge
  - Electronic Road Pricing – e.g., truck pricing systems Swiss, Austrian, German
- **Corridor or spot tolls approach** - e.g., most toll lanes
- **Workplace parking levy, parking excise tax, and cash-in-lieu-of-parking incentives**



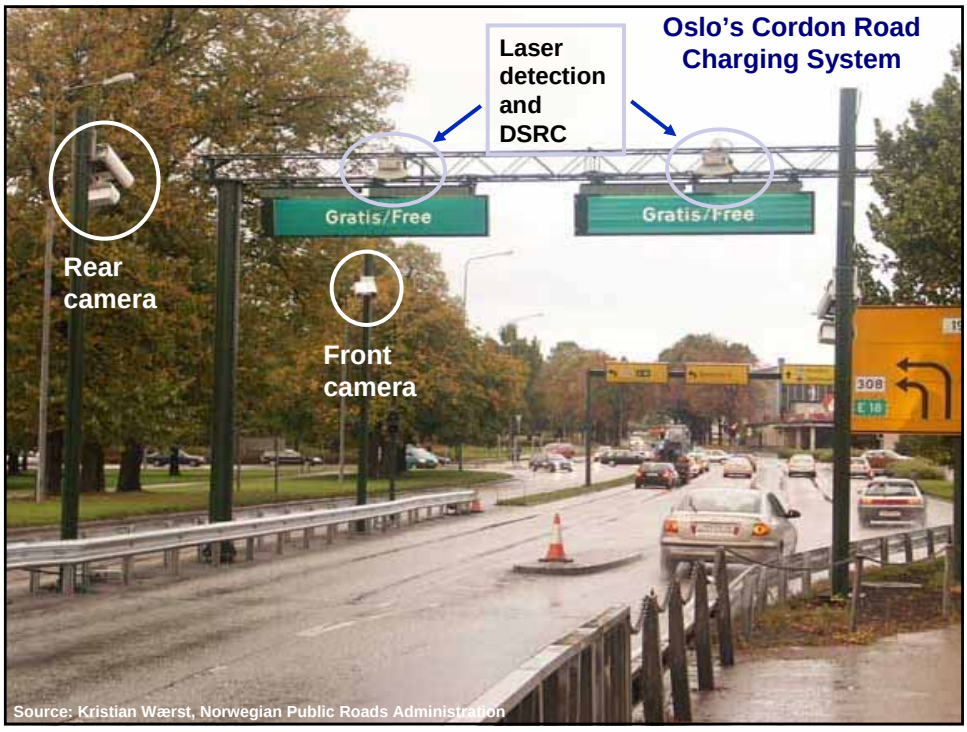
Time-of-Day Road Pricing Is Practical With Automated Toll Collection

- Coin machine & attended toll collection: 300 vehicles/hour capacity
- Automated toll collection: 1600+ vehicles/hour per lane capacity using Direct Short Range Communication (DSRC) transponders

Denver motorway toll collection

Trondheim, Norway

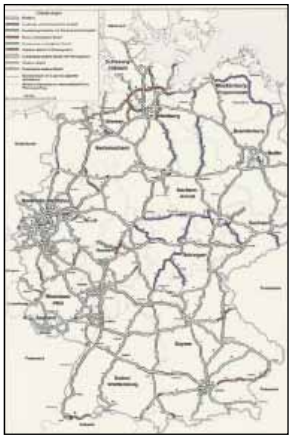
Oslo's Cordon Road Charging System



Source: Kristian Wærst, Norwegian Public Roads Administration

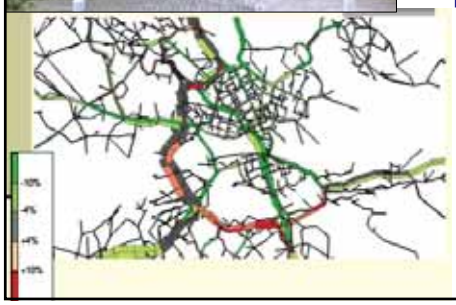
German Truck Tolling

- 2005: Introduced €0.12/km toll on trucks over 12 tons on 12,000 km autobahn system
- Uses Global Positioning System (GPS) and 500,000 on-board units
- 1 million toll transactions/day
- Revenue pays for transport improvements



Source: Andrea Kossak, http://www.hhh.umn.edu/img/assets/20164/Kossak%20-%20Pricing%20in%20Germany.pdf

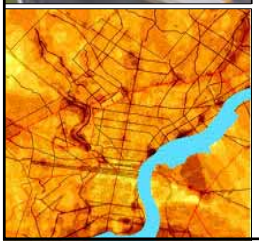
Road Pricing and Congestion Charging: How?



Traveler response to changes in price of travel changes:

- When travel is done
- How travel is done
- Where goods and people travel
- Incidence of total travel

Road Pricing and Congestion Charging: Where?



- Urban centers facing serious traffic congestion
- Motorways where current or future congestion threatens loss of peak period capacity
- Corridors or regions where added revenue is needed from vehicle users
- Corridors where road user fees may achieve other objectives – e.g., emission based fees to manage pollution hot spots, truck tolls to divert goods movement to rail or other corridors

Some Recent Developments in Congestion Charging

- 1970s: Singapore cordon charge, full electronic road pricing (ERP) in 1996
- 1986: Bergen, Norway, toll ring
- 1990-2003: Oslo, Trondheim & other Norwegian cities adopt toll rings
- 1995-96: Southern California high occupancy toll lanes (I-15, SR-91)
- 2000: Congestion pricing of NY bridges
- 2002-2004: Swiss, Austrian truck tolls
- 2004: London cordon charge
- 2005: Germany tolls autobahn trucks
- 2006: Stockholm congestion charge
- 2005: Minnesota, Colorado HOT lanes

Oslo Toll Ring

Road Pricing and Congestion Charging: How Much?

US Dollars	Capital costs	Operating costs (annual)	Revenues (annual)
URBAN SCHEMES			
London	$180 M.	$180 M.	$360 M.
Stockholm	$260 M.	$26 M.	$105 M.
Singapore	$130 M.	$9 M.	$52 M.
NATIONAL SCHEMES			
Germany: 2005	$2,880 M.	$810 M.	$2,860 M.
Austria: 2004	$485 M.	$46 M.	$1,000 M.
Switzerland: 2001	$270 M.	$46 M.	$1,050 M.

Cost-Effectiveness Matters

Cost of Road Pricing in 2005*	London Cordon (ANPR based)	Stockholm Cordon (DSRC based)	Singapore Cordon (DSRC based)	Germany truck toll (GPS based)	Swiss truck toll (DSRC & GPS based)
Average Charge	€7.4/day (now €11.8)	€2.7/day	€0-2/trip	€0.12 (40 ton truck)	€0.67 (40 ton truck)
Operating Cost as % of Revenue	48%	25%	7%	16%	4%
Annual cost (including capital) as % of revenue	55%	40%	40%	23%	8%

Source: European Conference on Transport Ministers, 2006, http://www.cemt.org/topics/taxes/Paris06/Conclusions.pdf
* 2006 costs are shown for Stockholm

Oslo Toll Ring

- Purpose: finance ½ cost of 50 transport projects in 2 muncipalities, with 20% for public transport
- Toll ring (white lines) cover all roads in three corridors
- 50% of Oslo's population live outside the toll ring
- Operating cost: 10% of tolls
- Tolled traffic 250,000/day
- Fixed tolls by vehicle class with prepayment discounts

Source: Kristian Wærst, Norwegian Public Roads Administration

Next Step for Oslo: Congestion Charging Light?

Proposed tolls designed to encourage & finance public transport

Fees :

NOK 3,- (1 unit) in both directions

NOK 6,- (2 units) in both directions

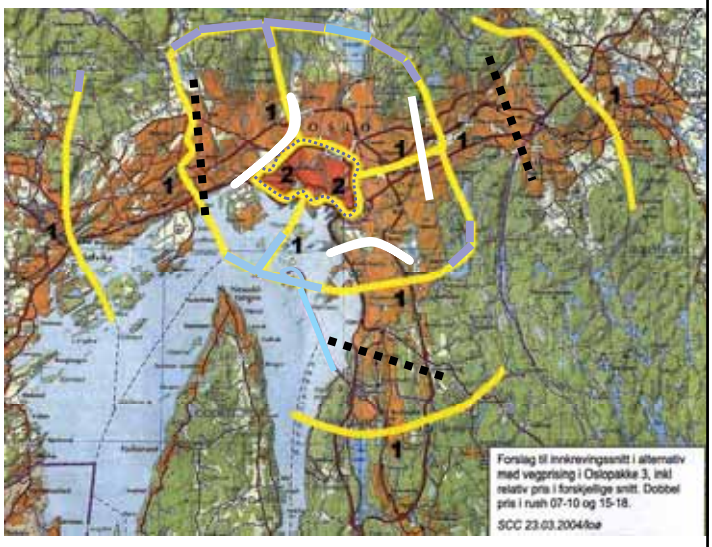
+ Double fees in peak periods

+ Free periods late evening and night

+ Double fees for heavy vehicles.

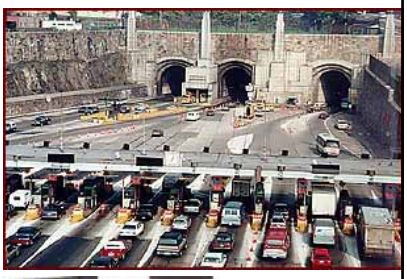
City borders

The toll ring



Time-of-Day-Tolls Fund Public Transport, Cut Congestion: NY-NJ Hudson River Crossings

- Peak period tolls raised in 2000 from US$4 to US$5 with toll transponders
- 7% traffic shift to off-peak
- Carpooling, public transport use increased 20%+
- Revenue boost of $400 million used to fund better public transport



725 buses daily carry 35,000 passengers on I-495 contra-flow lane approaching Lincoln Tunnel

US Motorists Paying to Use Managed Lanes: Saving Time, Funding Better Public Transport

- 1996 underused San Diego High Occupancy Vehicle (HOV) lanes converted to High Occupancy Toll (HOT) lanes funding new bus services
- Charge can vary every 6 minutes to manage congestion: US$.07-.50/km
- 2005 Minnesota HOT lanes adopt similar strategy
- But many other US regions use tolls just to build more roads faster

Tolling Existing Lanes: Acceptable When It Boosts Performance, Choices

Public has approved of tolls on formerly free roads when used to improve public transport, cut congestion, boost travel speeds:

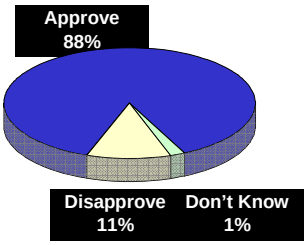
- London
- Singapore
- Oslo
- Trondheim
- Bergen
- Stockholm

Popular opinion on cordon charge in Stockholm for - against:

Before start of tolling: 31% - 62%

After 6 months: 52% - 40%

San Diego's I-15 HOT Lane is Popular



Source: Kristian Wærst, Norwegian Public Roads Administration

Boosting Travel Choices Is Crucial

Stockholm Congestion Charge implemented to boost public transport

New government will reinstate congestion charge to fund roads

Road charging plus better transit service resulted in:

- **45,000 more public transport passengers/day**
- **Faster bus speeds**

- 12 new express bus lines
- 18 bus lines with extended service
- Improvements of rail-bound lines
- 1800 new park-and-ride places

Source:
http://www.stockholmsforsoket.se/upload/Infomaterial%20MAK/Gunnar%20MAK%20Impacts%20juni%2006%20low.pdf

Lessons from European Conference of Transport Ministers on Road Charges

- Cost-effectiveness & public acceptance, not technical feasibility, are the key issues for road charging
- Decision to implement road charging is driven by the perceived urgency of congestion, financing, environmental problems the system is designed to address
- Absolutely critical to success: clarity of policy objectives for introducing charging & complete and unambiguous specification of functions the contracting authority requires of the system
- Advice on system specification and procurement should be sought from experts and officials who have worked on existing charging systems internationally
- Procurement requires a major effort by contracting authority

Source: European Conference on Transport Ministers, 2006, http://www.cemt.org/topics/taxes/Paris06/Conclusions.pdf

Implementing Road Pricing Step-by-Step

- Articulate system objectives
- Affirm legal authority: who can implement? Under what conditions? On which facilities?
- Determine implementation framework: Area license fee? Cordon charge? Corridor time-of-day tolls? Use of toll revenues?

- Design & evaluate road pricing plan
- Adopt system plan, financing scheme
- Procure management & technology services: system development, integration, operation, enforcement, evaluation, marketing

For More Information

Michael Replogle

Transportation Director, Environmental Defense

President and Founder, Institute for Transportation and Development Policy

Emeritus Member, Transportation Research Board (TRB) Committee on Transportation in the Developing Countries

Member, TRB Committee on Road Pricing

1875 Connecticut Ave. NW

Washington, DC 20009

mreplogle@ed.org

202-387-3500

www.environmentaldefense.org/go/transportation

www.itdp.org

Road Pricing and Congestion Charging

Implementation Challenges

by Michael Replogle
Environmental Defense and the Institute for Transportation and Development Policy

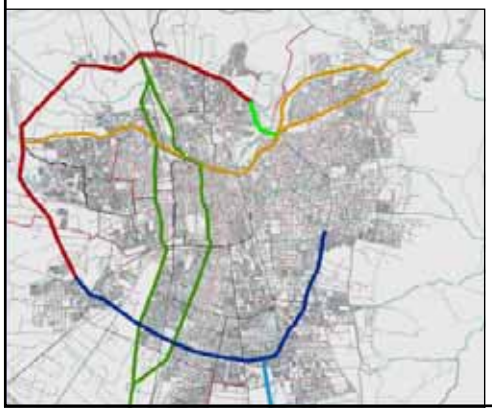
A Few Lessons from Abroad: Chile, Oslo, UK

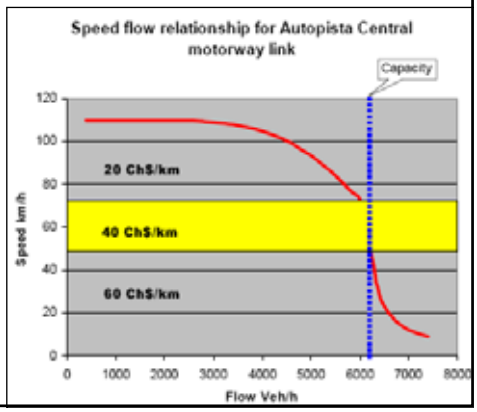
- Determining what is priced: corridors or area?
- Legal authority
- Realistic time frame for procurement
- Socialization & marketing
- Enforcement
- Financing: PPP or public finance?

Santiago, Chile, Variably Priced Toll Roads

- Public Private Partnership toll road concessions underway
- All with 3 price levels: 6/12/18 US cents/km
- 1 million interoperable DSRC toll tags to be in use by 2007
- Partial toll collection started 2004

Source: Luis Willumsen, Steer Daves Gleave



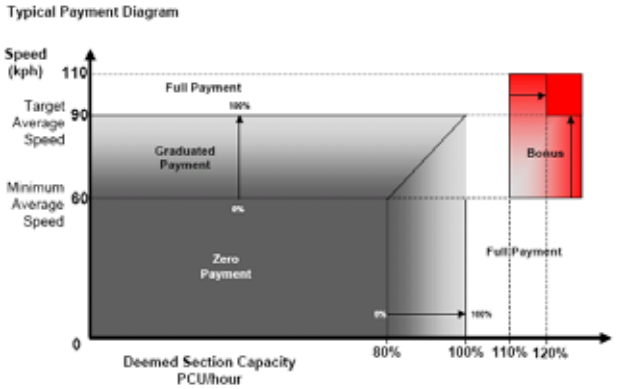


Congestion Management Payment: Rewarding Traffic Management

Payment to concessionaire based on measured actual hourly traffic speeds and flows by 2km road segment

Congestion Management Payment Contract Darrington to Dishforth A1 Highway in Yorkshire, UK

(a non-tolled road)



Source: http://wip.tu-berlin.de/workshop/2005/papers/briggs_drewett_Private%20_Financing_of_Projects.pdf; Clement Walsh (PricewaterhouseCoopers)

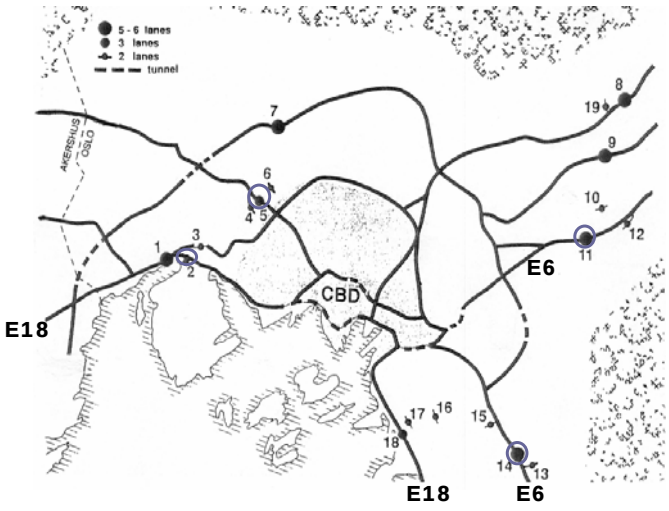
Concessionaire Compensation Tied System & Environmental Performance

- Payment to contractor based system throughput at given level of service instead of toll collected
- Payment adjusted for safety and environmental performance
- Accrual of penalty points beyond a limit triggers default and remedy period
- Failure to remedy means contract termination

Adapt from example of British Columbia's Sea-to-Sky Highway:

PPP deal total payment = *(Availability payment) + (Vehicle usage payment)*
+/- (Performance Incentive payments) + (End Payments)

Oslo Toll Ring layout



Best place for toll ring was halfway between city border and the city center, for economic & political reasons

Four minor roads had to be closed to make "watertight" ring

Source: Kristian Wærst, Norwegian Public Roads Administration

Oslo Toll Ring Experience

- 3-5% reduction in traffic created new space for efficient public transport, walking, cycling
- 6-9% growth in public transport
- Higher workload and more comprehensive computer systems in the back office system than expected

City Hall area before and after opening of new public transport, road tunnel and toll ring

Adapted from Kristian Wærst, Norwegian Public Roads Administration

Some Legal Issues in Norwegian Tolling

- **Drivers right to pay cash (at certain petrol stations within 2 days and at coin machines at some toll stations)**
- **Obligation to inform drivers about toll**
- **Anonymous tags available for privacy**
- **Toll schemes renewed every 15 years**

Source: Kristian Wærst, Norwegian Public Roads Administration

London's Congestion Charge

- Implemented in 2004 by Mayor Livingston
- Successful in meeting most goals
- Toll raised, cordon being expanded to a larger area
- Revenues fund improved public transport
- Automated number plate recognition (ANPR) payment system and related enforcement costs have been high relative to revenue

Objectives of London's Cordon Charge

- **Reduce inner London traffic levels by 10-15%**
- **Cut road transport delays by 15-25%**
- **Increase speeds by 10-15% inside zone**
- **Improve conditions outside zone**
- **Improve bus operations**
- **Produce net revenue of £130m p.a.**
- **Achieve a modal shift**

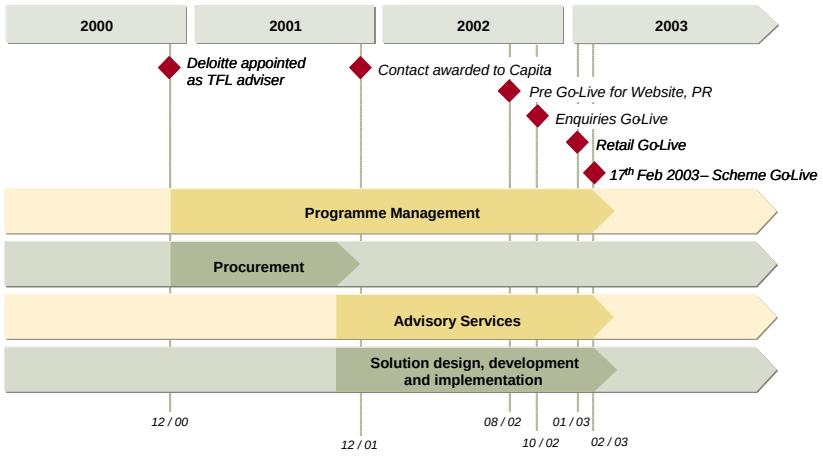
Source: Derek Turner Consulting

Issues Affecting London Cordon Charge Introduction

- Legal powers granted in 1999/2000 to introduce a scheme
- Road Charging Options for London (ROCOL) report: 2000
- *Political issues:*
  - Congestion charging key issue of mayoral elections in 2000
  - Required delivery within timescale of Mayor's first term
- *Delivery Issues*
  - Project team assembly
  - Integration of in-house and management consultancy teams
  - Procurement for a £230m project:
  - World's largest road user charging operation

Source: Derek Turner Consulting

London Cordon Charge Timescale for Implementation: 2 years



Source: Derek Turner Consulting

London Scheme uses one of many methods:

- Cordon entry permit
  - Payment at toll plaza
- Area License
  - Paper license for visual inspection, database option
  - Virtual license with digital camera enforcement
  - Electronic Road Pricing
- Workplace Parking Levy
- Corridor approach

– Virtual license with digital camera enforcement

- "Intermediate technology" scheme allowed rapid implementation
- Cameras enable greater scope for enforcement
- Ability to discriminate by vehicle type
- Payment easier – can be made on day of travel
- Possibility of future development into tag and beacon system

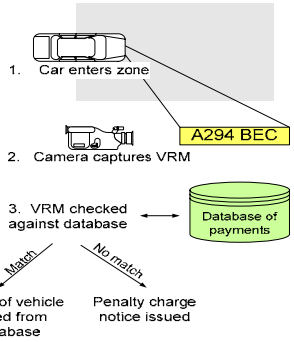
Source: Derek Turner Consulting

… and applies only to a small part of London

covers a 21km^2 charging zone with around 200,000 vehicles a day on some of London's most congested streets.

Source: Derek Turner Consulting

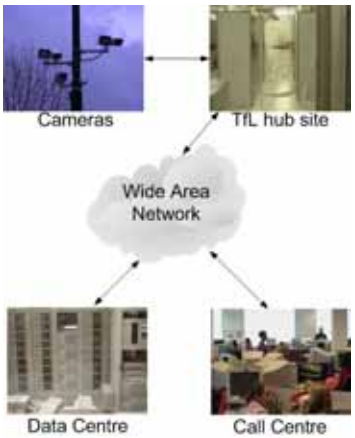
London Charging Zone Monitored by Digital Cameras



Automatic Number Plate Recognition (ANPR) technology enables information regarding capture and keeper to be identified.

Source: Derek Turner Consulting

Cordon Charge Uses Comprehensive Communications Network



Source: Derek Turner Consulting

Simple Charge Structure With Many Payment Options

Who is charged?

- **£5 per day**
- **By vehicle registration mark**
- **Payment made daily, weekly, monthly or annually**
- **Weekdays, 7am - 6.30pm**
- **Those vehicles not exempt**
- **Payment in advance or until 12am of day zone entered**
- **Charge doubles after 10pm**

How to pay

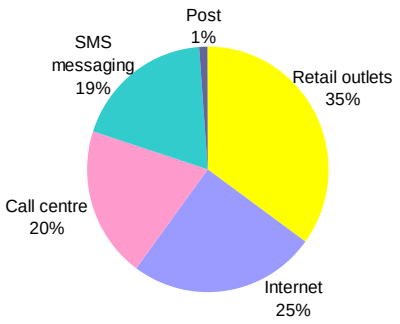
- **www.cclondon.com**
- **SMS text messaging**
- **200 PayPoint outlets in zone**
- **9000 PayPoints nationwide**
- **Free standing machines in car parks in zone**
- **Post**
- **Phone**

Source: Derek Turner Consulting

Public Information Campaign Facilitated Smooth Launch

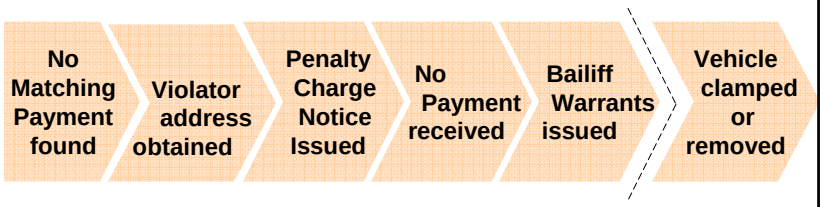
- **Leaflets to 3 million households**
- **Over 35,000 packs to businesses operating fleets of 25 or more vehicles**
- **Call centre (0845 900 1234)**
- **Advertising on TV, radio, newspapers**
- **www.cclondon.com**
- **Face to face activity in boroughs**
- **Emails to businesses in and around London**

Split of payment channels Feb - Aug 2003



Source: Derek Turner Consulting

Strict enforcement…



Persistent Evaders

- £80 penalty reduced if paid within 14 days
- Motorists can contest incorrect input of vehicle registration detail

Adapted from Derek Turner Consulting

London Cordon Charge Performing Well But System Costs Are Comparatively High

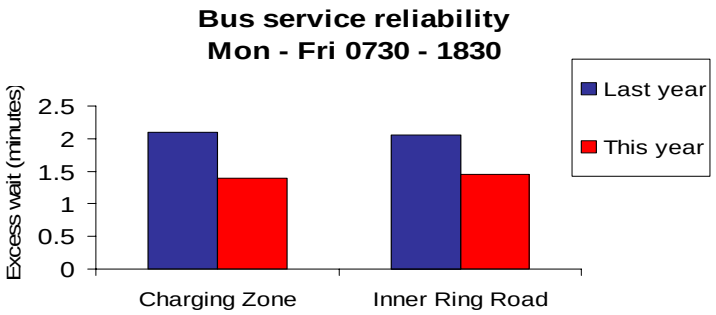
- **Congestion has decreased by about 30%**
- **Weekday speeds in/around zone grew by 10 – 20%**
- **NOx, PM emissions down 13-15% in zone**
- **Public transport is coping well**
- **Buses are benefiting from reduced congestion**
- **Payment systems working satisfactorily**
- **Public remains supportive of scheme**

"We always thought we had to live with congestion in our city centres. London has shown this is no longer true."

- Susan Kramer (board member for Transport for London and previous Liberal Democrat mayoral candidate)

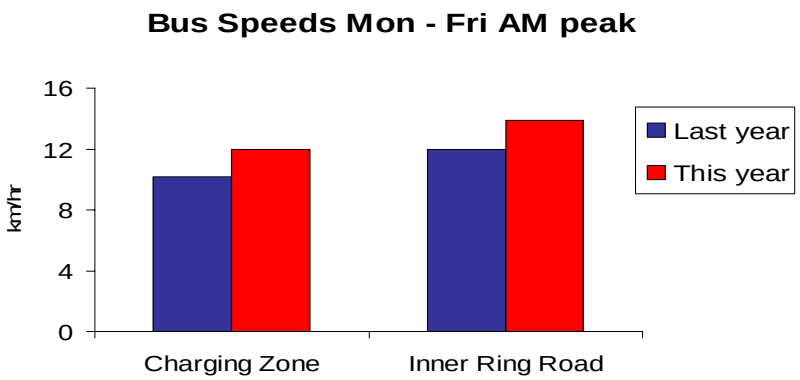
Source: Derek Turner Consulting and Transport for London 4th Annual Report on Congestion Charge, 2006.

Bus reliability has increased by over 25%



Source: Derek Turner Consulting

Peak Time Bus Speeds Up 20%



Source: Derek Turner Consulting

Lessons From London Cordon Charging

- Political commitment mandatory
- Strong project management required
- Integrated team and partnership essential
- Clear procurement strategy a must
- Presenting congestion charging as part of an overall transport strategy
- Importance of public information campaign
- Cost-effectiveness of charging system is an issue with London's technology design

Source: Transport for London

Adapted from Derek Turner Consulting

Implementing Road Pricing Step-by-Step

- Articulate system objectives
- Affirm legal authority: who can implement? Under what conditions? On which facilities?
- Determine implementation framework: Area license fee? Cordon charge? Corridor time-of-day tolls? Use of toll revenues?

- Design & evaluate road pricing plan
- Adopt system plan, financing scheme
- Procure management & technology services: system development, integration, operation, enforcement, evaluation, marketing

For More Information

Michael Replogle

Transportation Director, Environmental Defense

President and Founder, Institute for Transportation and Development Policy

Emeritus Member, Transportation Research Board (TRB) Committee on Transportation in the Developing Countries

Member, TRB Committee on Road Pricing

1875 Connecticut Ave. NW

Washington, DC 20009

mreplogle@ed.org

202-387-3500

www.environmentaldefense.org/go/transportation

www.itdp.org