

ITDP ENVIRONMENTAL DEFENSE finding the ways that work

Road Pricing and Congestion Charging

Experience, Opportunities, Motivation

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

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7 Converging Forces Driving Transportation Transformation...

- Congestion
- Finance
- Security
- Public health & safety
- Climate change
- Economic competitiveness
- Quality of life

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We Can't Build Our Way Out of Congestion

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

Supply side	Demand side
New highways	Area license or fee
HOV lanes	Parking control
Adding lanes	Congestion charges
Public transport improvements	Cordon tolls
Toll roads	Public transport priority
	Taxation policy
	HOT lanes

Adapted from Derek Turner Consulting

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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

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What Role for Road Pricing?

- Manage roads for highest productivity
- Cut pollution, fuel use, CO₂, congestion
- Generate revenue for public transport & high performance transport infrastructure/services
- Or build more roads faster (spurring more traffic and pollution)

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2005: Highest CO₂ & Warmest Year: Transportation A Major Contributor

Increasing fuel use increases CO₂, 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

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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**



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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




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Oslo's Cordon Road Charging System

Laser detection and DSRC

Gratis/Free

Rear camera

Front camera



Source: Kristian Waerst, Norwegian Public Roads Administration

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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
- Cut freight greenhouse gas emissions 7%




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

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Road Pricing and Congestion Charging: How?

Traveler response to changes in price of travel:

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





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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







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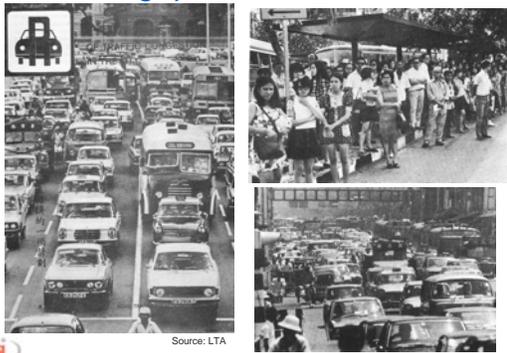
Some Recent Developments in Congestion Charging

- 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




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Singapore in the 70's...



Source: LTA

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Singapore today... after 30 years of road pricing

Now competing successfully with the US for the world's best and brightest...



CBD and motorway toll rates adjusted 4x/year to keep traffic speeds at peak system performance

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1998: Singapore Electronic Road Pricing (ERP)



Gantries

In-Vehicle Unit (IU) & Cash Card

Enforcement Cameras

Central Computer & Processing System

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Toll Rates Set to Achieve Performance Standards

- Review every 3-months
- Adjust up/down to ensure efficient use of roads



Expressways: 45 kph, 65 kph

CBD/Other Roads: 20 kph, 30 kph

Arrows indicate: Increase (red), Decrease (green)

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London's Congestion Charge: Guarding Economic Vitality, Climate, Health

- Mayor Livingston promised congestion pricing to protect environment, economy
- Won 2 elections on this platform
 - Cut inner London traffic levels 15%
 - Cut road transport delays 25%
 - Increase speeds 15% inside zone
 - Improve conditions outside zone
 - Speed buses, boost reliability
 - Net revenue of £130m/year
 - Achieve a modal shift
- Two-third majority still approves



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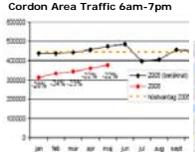
Congestion Charging for High Performance Networks

Stockholm Central Area Charge

- Traffic reduced overall by 1/4
- Queue times down 30-50%
- Emissions down 14%



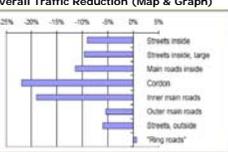
Cordon Area Traffic 6am-7pm



CO2 Emission Reduction



Overall Traffic Reduction (Map & Graph)



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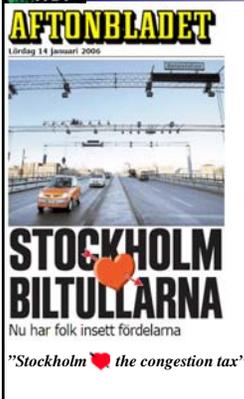
Tolling Existing Lanes: Acceptable When It Boosts Performance, Choices

Public opinion of cordon charge in Stockholm **for** - **against**:

Before start of tolling: **31%** - **62%**

After 6 months: **52%** - **40%**

After 9 months: **67% approval**




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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%20jun%2006%20low.pdf>

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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

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Performance-Focused Government Incentives Spur Bi-Partisan Innovation

Urban Partnership Agreements: \$850 m for New York City, San Francisco, Miami, Minneapolis, Seattle

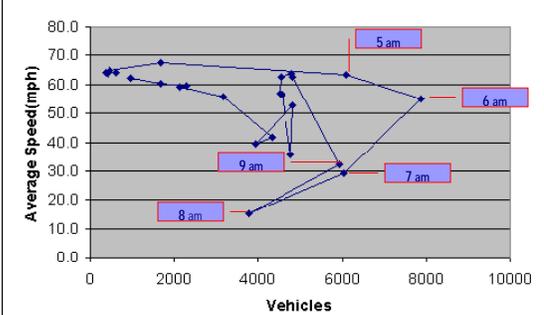
- Congestion pricing existing roads
- Traffic operations
- Bus Rapid Transit
- Telework, PAYD insurance

US\$8 a day tolls to enter Manhattan proposed to fund public transport



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Stop-and-Go Motorways: Bad Delay, Bad Pollution



Traffic Speed and Volume I-66 East, Northern VA, Wednesday March 7, 2007

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Congestion Pricing of New Capacity

Afternoon Peak on the Private SR 91 Toll Road in Orange County, CA

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2 toll managed lanes carry as much peak hour traffic – at 3 times the speed - as moved in 4 free, but congested lanes

Traffic in Peak Hours on Eastbound SR91 Friday Afternoons 2004

Lane Type	Vehicles Per Hour Per Lane
Congested General Purpose Lanes	~800
Toll Managed Lanes	~1600

Average Traffic Speed Peak Hours Eastbound SR 91 Friday Afternoons 2004

Lane Type	Miles Per Hour
Congested General Purpose Lanes	~25
Toll Managed Lanes	~75

So why not consider toll management of existing lanes?

Report to Congress on the Value Pricing Pilot Program Through March 2004, US Federal Highway Administration (2004), available at: [http://knowledge.fhwa.dot.gov/cops/hc/natl/All+Documents/AD2716CC3E3A07788257005064E5614/\\$FILE/March%202004%20Report%20of%20congress.pdf](http://knowledge.fhwa.dot.gov/cops/hc/natl/All+Documents/AD2716CC3E3A07788257005064E5614/$FILE/March%202004%20Report%20of%20congress.pdf)

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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

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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.

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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

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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>

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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



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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