

## THE PEP TOOLBOX PROMISING PRACTICES

### Summary

The Stockholm County Council implemented a trial to improve access on the busiest roads, to reduce emissions and to improve street-level environment perceived by people in the inner city. The trial consisted of three parts: extended public transport, congestion tax and park-and-ride sites in the city and the county. The road charging system resulted in a reduction in road use and emissions. This will on the longer term result in 27 premature deaths avoided.

### General description of the promising practice

Project title	The Stockholm Trial; The effects of congestion tax on air quality and health
Under the auspices of	Stockholm City Council
Funding	The trial was funded by the Swedish government
Start date	January 2006
End date	July 2006
Coordinating partner	Miljöavgiftskansliet/Congestion Charge Secretariat, City of Stockholm
Contact details	Miljöavgiftskansliet/Congestion Charge Secretariat, City of Stockholm Muriel Beser Hugosson, Ann Sjöberg and Camilla Byström Department of Applied Environmental Science, Stockholm University, S-106 91 Stockholm, Sweden Tel.: +46-(0)709 38 30 86. Email: <a href="mailto:christer.johansson@itm.su.se">christer.johansson@itm.su.se</a> (C. Johansson).
Other partners involved (optional)	The City of Stockholm provided general information on the Stockholm Trial, the evaluation and extended park-and-ride sites. The Swedish Road Administration was responsible for the design and operation of the technical system and information on how the congestion tax was to be paid. SL – Stockholm Transport - was responsible for expanding public transport services and park-and-ride sites. All costs were covered by the Swedish government.
More details can be found	C. Johansson, et al., The effects of congestion tax on air quality and health, Atmospheric Environment (2008), doi:10.1016/j.atmosenv.2008.09.015
Other relevant links	<a href="http://www.stockholmsforsoket.se/templates/page.aspx?id=12555">http://www.stockholmsforsoket.se/templates/page.aspx?id=12555</a>

### Intervention description

The issue	A number of cities have implemented congestion charges or low emission zones to reduce traffic congestion and the health impacts of traffic emissions. So far, however, very few studies have been carried out on the quantitative effects of road pricing or low emission zones on air pollutant concentrations, population exposure and health. The study describes the effects a road charge system in Stockholm has on emissions, levels of air pollutants, and health.
Aims & objectives	The goals of the trial: <ul style="list-style-type: none"> <li>To reduce the number of vehicles that cross the inner-city segment during morning and afternoon rush hours by 10 to 15 per cent</li> <li>To improve access on the busiest roads in Stockholm</li> <li>To reduce emissions of carbon dioxide, nitrogen oxide and particles in inner-city air.</li> <li>To improve the street-level environment perceived by people in the inner city.</li> </ul>
Type of intervention	Economic, regulatory, investment, behaviour, awareness and innovation
Intervention	The Stockholm Trial consisted of three parts:

	<p>1) Extend public transport (16 new bus lines)  2) Congestion tax  3) More park-and-ride sites in the city and the county</p> <p>The total public transport service was extended by 7 per cent and the park-and-ride capacity was extended by 29 per cent.</p>
Implementation level	Regional
Target population/groups	General population
Magnitude of target population	1.44 million people
Aspects of transport, environment and health included	Air pollution, congestion
Methods used	<p>See also 'Intervention'</p> <p>The road charging system: drivers paid every time they passed a toll station. Highest amount due was SEK20 (corresponding to €2.20) during rush hours and lowest amount (SEK10) early in the morning or in the evening. The maximum amount paid for one day was SEK60. Nights, holidays and weekends were free of charge. Taxis, buses, motorcycles, and cars classified as environmental vehicles (e.g. powered by electricity or biofuels) were exempted.</p>
Stakeholder involvement	<p>The public and/or stakeholders participated somewhat before and during the intervention.</p> <p>An expert group consisting of eight traffic experts with different fields was consulted for advice.</p> <p>In terms of development, see the partners involved.</p> <p>Trade and other visitor-intensive business, merchants and driving schools, distribution, waste collection, taxis, courier services and special transport services for the elderly and people with disabilities were interviewed as part of the evaluation.</p>

## Evaluation

Evaluation methods & study design	<p>The effect of the Stockholm Trial on road traffic was quantified in terms of traffic flow by counting vehicles and by calculating road use, i.e. the number of vehicle kilometres travelled in the area. Congestion was quantified in terms of journey times obtained from floating car measurements or from traffic cameras. Data on the composition of the vehicle fleet were acquired by manually recording vehicle types over stretches of road where control points existed before the trial.</p> <p>Emissions from road traffic are described with emission factors for passenger cars (petrol and diesel), light commercial vehicles, heavy goods vehicles.</p> <p>Air quality was measured at 20 sites in the Stockholm area before and during the trial.</p> <p>The annual mean PM10 and NOx concentrations and exposures due to local road traffic emissions were calculated using a wind model and a Gaussian dispersion model.</p> <p>Population exposure and health impact assessment were calculated using a formula.</p> <p>A cost-benefit analysis (CBA) was also part of the trial.</p>
Evaluation results	<p>Based on measured and modelled changes in road traffic, it was estimated that this system resulted in a 15 per cent reduction in total road use within the charged cordon. Total traffic emissions in this area of NOx and PM10 fell by 8.5 per cent and 13 per cent, respectively. Air quality dispersion modelling was applied to assess the effect of the emission reductions on ambient concentrations and population exposure. For the situations with</p>

	and without the trial, meteorological conditions and other emissions than from road traffic were kept the same. The calculations show that, with a permanent congestion tax system like the Stockholm Trial, the annual average NOx concentrations would be lower by up to 12 per cent along the most densely trafficked streets. PM10 concentrations would be up to 7 per cent lower. The limit values for both PM10 and NO <sub>2</sub> would still be exceeded along the most densely trafficked streets. The total population exposure of NOx in Greater Stockholm (35*35 km with 1.44 million people) is estimated to decrease by a rather modest 0.23 µg/m <sup>3</sup> . However, based on a long-term epidemiological study that found an increased mortality risk of 8 per cent per 10 µg/m <sup>3</sup> NOx, it is estimated that 27 premature deaths would be avoided every year. According to life-table analysis this would correspond to 206 years of life gained over 10 years per 100,000 people following the trial if the effects on exposures were to persist. The effect on mortality is attributed to road-traffic emissions (most likely vehicle exhaust particles); NOx is merely regarded as an indicator of traffic exposure.
Conclusions	The goal of traffic reduction has been achieved, and hence the environmental goal. The degree of achievement of the city environment goal is more difficult to interpret.  This study demonstrates the importance of not only assessing the effects on air quality limit values, but also of making quantitative estimates of health impacts in order to justify actions to reduce air pollution.
Gaps encountered	Health was determined in terms of the health impact assessment. Measurement of the physical activity of the population could also be interesting in terms of health.

### Implementation issues

Costs	The societal costs and benefits of the two largest components of the Stockholm Trial were analysed: the congestion-charging system and the expansion of bus services. If viewed solely as a short-term trial which, once terminated, will not be resumed, the Stockholm Trial represents a disbenefit of some SEK2.6 billion in socio-economic terms. Investments in and the operation and administration of the congestion-charging system account for the largest portion of this sum.  If congestion charging were to be made permanent, calculations suggest that the effect would be to generate a substantial annual surplus in CBA terms of some SEK760 million (after deductions for operating costs). The investment cost sustained by society would be 'repaid' within four years in the form of socio-economic benefits.  The plus side of the cost-benefit analysis contains, for example, shorter travel times (value: SEK600 million p.a.), improved traffic safety (SEK125 million p.a.) and the positive effects on health and the environment (SEK90 million p.a.). Income from the congestion tax is estimated at around SEK550 million p.a. (after deductions for operating costs). For every Krona generated through the 2006:X Transek AB cost-benefit analysis of the Stockholm Trial congestion tax, the benefits to society amount to approximately 90 öre (SEK0.90). Cost-benefit calculations show that the expansion of bus services will be unprofitable both during the trial period and if the system is made permanent. The benefits are estimated to total SEK180 million p.a., compared with costs of SEK520 million p.a. for running the extra services.
Sustainability	The intervention can be sustained in the future. It will permanently affect risk factors and it can be transferred to other regions.
Intersectoral collaboration	The programme mobilises professionals from different sectors and institutions (transport, health and the environment).
Ease of implementation: Lessons learned	Many cities have implemented congestion charges or low emission zones to reduce traffic congestion and the health impacts of traffic emissions.

	Communication about and participation of the population in the discussion of (the effects of) congestion tax is an important part of the implementation.
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**Full assessment**

<b>HEALTH EFFECTS</b>		<b>INTERVENTION DESIGN</b>		<b>IMPLEMENTATION</b>	
★ ★ ★ ★ ☆		★ ★ ★ ★ ★		★ ★ ★ ★ ☆	
Measured health effects	☆☆☆☆	Study design	★★★★★	Sustainability	★★★★★
Assumed health effects	★★★★☆	Evidence base for effectiveness	★★★★★	Inter-sectoral collaboration	★★★★☆
		Combination of measures used	★★★★☆	Transferability	★★★★☆
☆☆☆☆ no info	★☆☆☆☆ weak/negative	★☆☆☆☆ moderate/dubious	★★★★☆ good/positive	★★★★★ excellent/very positive	

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