Presentation outline

• Setting the scene
• How was the trial designed?
• How did the system work?
• What were the effects?
• How was the system received by the public?
• What happened afterwards?
Stockholm traffic planning problems

Severe traffic congestion
Population expansion
Economic growth
Physical constraints:
Water
Protected areas
Suggested solutions

• Traffic infrastructure investment
  – Road links
    • Ring road completion
    • Bypasses
  – Public transportation improvements
    • Rail capacity increase
• Traffic management
  – Improved traffic signal systems
  – Motorway control systems
  – Incident management

Congestion charging
Another problem…

Stockholm local politicians
All they could agree on…

Before elections 2002:

Stockholm local politicians

No congestion charging if we win - I promise!

No congestion charging if we win - I promise!
It is not always easy to be a politician…

Before elections 2002:

No congestion charging if we win - I promise!

Stockholm local politicians

After elections 2002:

No congestion charging if we win - I promise!

Sweden national politicians
It is not always easy to be a politician…

Before elections 2002:

Stockholm local politicians

After elections 2002:

Sweden national politicians

No congestion charging if we win - I promise!
It is not always easy to be a politician…

Before elections 2002:

Stockholm local politicians

No congestion charging if we win - I promise!

After elections 2002:

Sweden national politicians

My price to support the left: congestion charging!

No congestion charging if we win - I promise!
It is not always easy to be a politician…

After elections 2002:

Stockholm local politicians

My price to support the left: congestion charging!

Sweden national politicians

Congestion charging? Let’s try!
It is not always easy to be a politician…

After elections 2002:

I did what I could…

Stockholm local politicians

My price to support the left: congestion charging!

Sweden national politicians

Congestion charging?

Let’s try!

You betrayed us!
The congestion charge – a tax!

• Regional or local government not authorised to introduce a congestion fee
• National decision
• Regulated by law
• Executive responsibility - the National Road Administration
The trial - objectives

- Reduce traffic volumes by 10-15% on the most congested roads
- Increase the average speed
- Reduce emissions of pollutants harmful to human health and of carbon dioxide
- Improve the urban environment as perceived by Stockholm residents
The Stockholm trial design

1. Improved public transport  
   (Aug 2005 - Dec 2006)

2. Park & Ride facilities  
   (Aug 2005 - )

3. Congestion charging  
   (Jan - July 2006)
Stockholm County

County area 6500 km²
Charging zone 47 km²
City of Stockholm 770 000 inhabitants
Charging zone 280 000 inhabitants
County 1.9 millions inhabitants
Improved Public Transport
From 22 August 2005

- 14 new express bus lines
- 18 bus lines with extended service
- 197 new buses
- Improvements of rail-bound lines
- 1800 new park-and-ride places
- New bus lanes, bus stops
Charging cordon

- 18 charging points
- charge on entry and exit
- E4/E20 bypass free
No barriers, no stops, no roadside payments

- Current fee shown on control point display
- Automatic identification. License plates were photographed
- A limited part of the car was shown on photograph – people and objects inside the car cannot be seen
Identification mainly through Onboard units (OBU)

Total number of onboard units distributed
approx. 423 000

OBU 48.4%
OCR¹ 41.8%
MCR² 9.8%

¹) Photos, ²) Manual recognition
Congestion charges and times

PEAK PERIODS
7.30-8.30 a.m., 4-5.30 p.m. SEK 20 EUR 2

SEMI PEAK PERIODS
7.-7.30 a.m., 8.30-9 a.m.
3.30-4 p.m., 5.30-6 p.m. SEK 15 EUR 1.5

MEDIUM-VOLUME PERIODS
6.30-7 a.m., 9 a.m.-3.30 p.m.
6-6.30 p.m. SEK 10 EUR 1

MAXIMUM CHARGE PER DAY: SEK 60 EUR 6

Evenings, Saturdays, Sundays, holidays: NO CHARGE
Payment

- Tax decision made each day
- Payment due in 14 days
- Payment options
  - Seven-Eleven shops, Stationary shops 22 %
  - Bank/post office
  - Internet, by credit card or Internet account
  - Automatic debiting on specified account (transponder users) 65 %
| Date       | Due date | Status | Total amount | Balance due |
|------------|----------|--------|--------------|-------------|-------------|
| 2006-02-20 | 2006-02-27 | Betald | 20,00 kr     |             |
| 2006-02-08 | 2006-02-13 | Betald | 45,00 kr     |             |
| 2006-01-19 | 2006-01-24 | Betald | 20,00 kr     |             |
| 2006-01-15 | 2006-01-23 | Betald | 20,00 kr     |             |
| 2006-01-13 | 2006-01-17 | Betald | 10,00 kr     |             |
| 2006-01-09 | 2006-01-16 | Betald | 30,00 kr     |             |
An average weekday in May

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passages</td>
<td>371 300</td>
</tr>
<tr>
<td>Tax decisions</td>
<td>115 100</td>
</tr>
<tr>
<td>Reminder 1</td>
<td>6 300</td>
</tr>
<tr>
<td>Reminder 2</td>
<td>1 500</td>
</tr>
<tr>
<td>Appeals to the tax authority</td>
<td>100</td>
</tr>
<tr>
<td>Court appeals</td>
<td>5</td>
</tr>
<tr>
<td>Tax income</td>
<td>SEK 3 060 000</td>
</tr>
<tr>
<td>Number of calls to customer services</td>
<td>2 200</td>
</tr>
</tbody>
</table>

System availability 99.9 percent
Trial evaluation - organisation

Reference group (experts, authorities, interest groups):

- **What to evaluate and how**
- **Environmental charging office**
- **Commissioning/coordination of subprojects**
- **Evaluation experts within different areas (consultants, universities, authorities)**
- **Delivering subprojects**
- **Reports (ca 25)**

Scientific reference group

Receiver reference group

Scientific reference groups

Following the work, giving feedback

Expert group

Summarise and evaluate subprojects

Summary of the expert group
Evaluation tasks

- Car Traffic
- Public transport
- Stockholm county travel survey
- Business and economic impacts
  - Retail sales, contractors, taxi, transport services etc
- Environment and health effects
- Effects on regional economy
- Other studied effects
  - Traffic safety, noise, attitudes, events affecting the evaluation programme
- Cost benefit analysis
Evaluation programme

- Evaluation of the Stockholm trial objectives
  - Complete analysis (25 evaluation projects)
    - (Before) autumn 2004 (spring 2005)
    - (During) spring 2006

- Monthly indicators - monitor changes over time
  - Selected indicators
    - Monthly indicators starting in October 2005, ends September 2006

- “Go live” - effects after introduction
  - Selected indicators
    - Daily starting the 3 January 2006 during the first 2 weeks of the congestion charging
Traffic effects
Every 4th car disappeared!
Passages in/out of congestion charging zone 06:00 – 19:00
Passages in/out of congestion charging zone 06:00 – 19:00

-28% -24% -23% -22% -22% -22% -30%

2005 (beräknat)
2006
Changes by vehicle type  
(charged period)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Number</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>- 89 200</td>
<td>- 30 %</td>
</tr>
<tr>
<td>Light truck</td>
<td>- 10 100</td>
<td>- 22 %</td>
</tr>
<tr>
<td>Truck</td>
<td>- 1 500</td>
<td>- 13 %</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>- 500</td>
<td>- 54 %</td>
</tr>
<tr>
<td>Total</td>
<td>- 101 313</td>
<td>- 28 %</td>
</tr>
</tbody>
</table>
Less traffic also inside and further outside the zone

Inner city street
Main inner city street
Inner city arterial
Inner city (VMT)
Charging cordon
Inner approach road
Outer approach road
Outer city road
Tangential road
Smaller effect that expected on E4-Essingeleden bypass
30-50% less time in queues

Delay time, AM peak

- Inner main roads, inbound
- Inner main roads, outbound
- Inner streets
- Inner main roads, northbound
- Inner main roads, southbound

fm 2005  fm 2006
Even larger effect on PM peak

![Graph showing delay time, PM peak for different categories of inner main roads and streets, with data for 2005 and 2006.]
Passages in/out of the congestion charging zone

Vehicles/h

Time

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

0 5000 10000 15000 20000 25000 30000 35000 40000 45000

April 2005
April 2006
These traffic categories were exempted:

- Vehicles from Lidingö passing through within 30 minutes
- Taxis
- Emergency vehicles
- Vehicles with disability permits
- Foreign vehicles
- Transport services for disabled
- Motorcycles
- Buses over 14 tons
- Vehicles using alternative fuel
30 percent exempted passages
Share of alternatively fuelled vehicles for 2005 and 2006 by region and type of buyer

- Stockholm P
- Västra G P
- Övr Sverige P
- Stockholm J
- Västra G J
- Övr Sverige J
Total public transport trips

Påstigande per vardagsdygn, 1000-tal

jan  | feb  | mar  | apr  | maj  | jun  | jul  | aug  | sep  | okt  | nov  | dec
1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | 2400 | 2600 | 2400 | 2200 | 2400

2004  | 2005  | 2006
Public transport

- About 5% more public transport passengers, but average crowding about the same
- The public transport extensions did not reduce car traffic
- Improved driving conditions for bus traffic
- The additional park-and-ride facilities were used
- Travellers were satisfied with the direct bus lines
Where did all the drivers go, just simply vanishing…?
Many different adaptation strategies

- Several different ways to change travel pattern:
  - Change mode
  - Change route
  - Change destination
  - Trip chaining

- About half of the car trips shifted to public transport
- New park & ride facilities were used – but a small contribution
- Changed departure times not a large effect
What car trips "disappeared"?

- Work/school: -22%
- Business: -30%
- Shopping/service: -27%
- Recreation: -23%
- Other: -33%
What car trips "disappeared"?

Work/school:
- Most went to public transport;
- A few changed route
High income earners largest group affected
– Middle income earners show largest change

*Car trips during charged hours with origin/destination in inner city*

- High: -15%
- Low: -6%
- Middlelow: -25%
- Middlehigh: -9%
- Middle: -30%
How many pay – and how much?
Fees paid in a 2 week period

Almost half of privately owned car

5% of privately owned cars – 1/3 of private car revenue
Who pays most?

- Inner city and Lidingö inhabitants pay twice as much as others
- "Rich" households pay almost three times as much as "poor" households
- Working persons pay about three times as much as others
- Men pay almost twice as much as women
Traffic effects summary

- 20-25 percent less cars on congestion cordon
- 14 percent less mileage in charged area
- 1 percent less mileage outside charged area
- 30 – 50 percent delay time decrease
- Travel time variation decrease
Traffic safety

• Less traffic – fewer accidents
• Higher travel speed – worse injuries (small effect)
• Time period too limited to observe accident rates
• Estimated reduction of personal injury accidents of 5 - 10 % within the congestion charging zone
Environment and health effects

- CO2: - 14 percent
- NOx: - 7 percent
- PM$_{10}$: - 9 percent
- Emissions were reduced in the “right” area
Noise – not much of an effect

- Approximately 1 dBA, and at most 2 dBA
- Effect not audible
- Share of disturbed people decreased
Retail

- Minor effects on the retail trade
- Department stores, malls and shopping centres trade increased 7% in city (+7% in nation)
- Small-scale shops sales -6% (trend)
Cost benefit analysis

• Costs of the trial EUR 340 millions
• Congestion tax a permanent feature
  – Net gain EUR 77 millions/year – considerable values in social benefit
  – Payback time 4 years
• Expansion of bus traffic a permanent feature
  – Benefits EUR 18 millions/year
  – Operating costs EUR 52 millions/year
Costs and benefits by category

- Travel time gain
- Adaption cost
- Congestion charge
- Net effect
Urban environment

• Difficult to measure
  – Weather important factor

• Positive indicators
  – Car accessibility, air quality, traffic tempo

• Unchanged indicators
  – Safety, noise

• Negative indicators
  – Public transport, walk and bicycle accessibility, overall feeling
The objectives were fulfilled

• Reduce traffic volumes by 10-15% on the most congested roads
  – Reduction of 20-25%

• Increase the average speed
  – Travel times reduced 30-50%, except of E4/E20

• Reduce emissions of pollutants harmful to human health and of carbon dioxide
  – 14% reduction in city centre, 2.5% Stockholm County

• Improve the urban environment as perceived by Stockholm residents
  – Difficult to measure
Large effects as compared to other measures

• Eastern bypass
  – 14% traffic reduction over the inner city cordon

• Western bypass:
  – 11% traffic reduction over the inner city cordon

• Free public transport
  – 3% less car traffic in the county

1.5 bilj €
2 bilj €
0.5 bilj €
How was the trial received by the public?
Was it a good idea to carry out the congestion charge trial?
### Results of the referendum 17 Sept 2006

<table>
<thead>
<tr>
<th>Area</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockholm City</td>
<td>53 %</td>
<td>47 %</td>
</tr>
<tr>
<td>County (14 Municipalities)</td>
<td>40 %</td>
<td>60 %</td>
</tr>
<tr>
<td>Not voting (11 Municipalities)</td>
<td>48 %</td>
<td>52 %</td>
</tr>
</tbody>
</table>
They agreed on…

Referendum - Let the people decide!

Before elections 2006:

Stockholm local politicians
It is not always easy to be a politician…

Referendum - Let the people decide!

Before elections 2006:

Stockholm local politicians

After elections 2006:

Sweden national politicians
It is not always easy to be a politician…

After elections 2006:

Stockholm local politicians

After elections 2006:

Sweden national politicians

Congestion charging?
Let’s make it permanent
It is not always easy to be a politician…

Before elections 2006:

Stockholm local politicians

After elections 2006:

Sweden national politicians

You betrayed us!

Congestion charging?
Let’s make it permanent!
Permanent system in operation

- No charge in July
- Taxi and transport for disabled not exempted
- Alternatively fuelled car exempted only for 5 years
- Administrative fee for delayed payment 200 SEK (previously 500 SEK)
- Congestion charge tax deductible for commuting and business
- No transponder needed for autogiro payment
- Easier administration for companies
First month (August) effects
Continued monitoring

- Traffic volumes, travel times monthly
- Total VMT, congestion, travel time variance October
- Effects on retail (600 stores, 12 shopping centres) 2008
- Effects on environment 2008
- Bottleneck analysis 2008
- Parking 2008
- Traffic safety 2008
- Cost benefit analysis 2008
- Regional economic analysis 2008
Conclusions on the Stockholm Congestion Charge Trial

- The charging scheme proved to be efficient
- The trial made it possible for everyone to see for himself
- The visible effects made people change their minds
- The change of minds made it possible to make the efficiency gains permanent
The end

More information (in English) :
www.stockholmsforsoket.se (trial)
www.vv.se (current system)
Benefits and costs

Tabell 13. Samhällsekonomiska nyttor och kostnader, miljoner kronor per år.

<table>
<thead>
<tr>
<th>(milj. kr per år)</th>
<th>Trängsel-skatt</th>
<th>Utökad busstrafik</th>
<th>Totalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kortare restider</td>
<td>523</td>
<td>157</td>
<td>680</td>
</tr>
<tr>
<td>Säkrare restider</td>
<td>78</td>
<td>0</td>
<td>78</td>
</tr>
<tr>
<td>Förändrat resande</td>
<td>-13</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Ökade reskostnader</td>
<td>-763</td>
<td>0</td>
<td>-763</td>
</tr>
</tbody>
</table>

**Summa trafikanteffekter**

<table>
<thead>
<tr>
<th></th>
<th>-175</th>
<th>181</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindre klimatgasutsläpp</td>
<td>64</td>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>Hälsoeffekter och övriga miljöeffekter</td>
<td>22</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Ökad trafiksäkerhet</td>
<td>125</td>
<td>0</td>
<td>125</td>
</tr>
</tbody>
</table>

**Summa övriga effekter**

<table>
<thead>
<tr>
<th></th>
<th>211</th>
<th>0</th>
<th>211</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trängselskatteintäkter</td>
<td>763</td>
<td>0</td>
<td>763</td>
</tr>
<tr>
<td>Kollektivtrafiktäkter</td>
<td>184</td>
<td>0</td>
<td>184</td>
</tr>
<tr>
<td>Intäkter från bränsleskatt</td>
<td>-53</td>
<td>0</td>
<td>-53</td>
</tr>
<tr>
<td>Slitage på infrastruktur</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bibehållen kollektivtrafikstandard</td>
<td>-64</td>
<td>0</td>
<td>-64</td>
</tr>
</tbody>
</table>

**Summa offentliga intäkter och kostnader exkl. drift- och investeringskostnader**

|                          | 831  | 0   | 831  |

**Totalt samhällsekonomiskt överskott exkl. drift- och investeringskostnader**

|                          | 867  | 181 | 1048 |

transek PART OF WSP GROUP
Benefits and costs

Tabell 15. Nyttor och kostnader vid en permanentning av Stockholmsförsöket.

<table>
<thead>
<tr>
<th>(milj. kr per år)</th>
<th>Trängsel-skatt</th>
<th>Utökad busstrafik</th>
<th>Totalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samhällsekonomiskt överskott (exkl.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>drift/investering – se Tabell 13)</td>
<td>867</td>
<td>181</td>
<td>1048</td>
</tr>
<tr>
<td>Driftskostnader</td>
<td>-220</td>
<td>-341</td>
<td>-561</td>
</tr>
<tr>
<td>Snedvridnings- och alternativkostnad</td>
<td>118</td>
<td>-181</td>
<td>-62</td>
</tr>
<tr>
<td>Samhällsekonomiskt överskott per år vid en permanentning</td>
<td>765</td>
<td>-341</td>
<td>424</td>
</tr>
<tr>
<td>Avskrivningskostnader för investeringar</td>
<td>-50</td>
<td>-3</td>
<td>-53</td>
</tr>
<tr>
<td>Snedvridnings- och alternativkostnad</td>
<td>-26</td>
<td>-2</td>
<td>-28</td>
</tr>
<tr>
<td>Samhällsekonomiskt överskott inkl. avskrivningskostnader</td>
<td>690</td>
<td>-346</td>
<td>344</td>
</tr>
</tbody>
</table>
Regional long term planning – forecasting 30 years ahead

- Congestion increases
- Public transport looses market share
- Difficult to reduce congestion by public transport improvement