



Analysis of traffic in Stockholm

with special focus on the effects of
the congestion tax, 2005–2008

SUMMARY



CITY OF STOCKHOLM
TRAFFIC ADMINISTRATION

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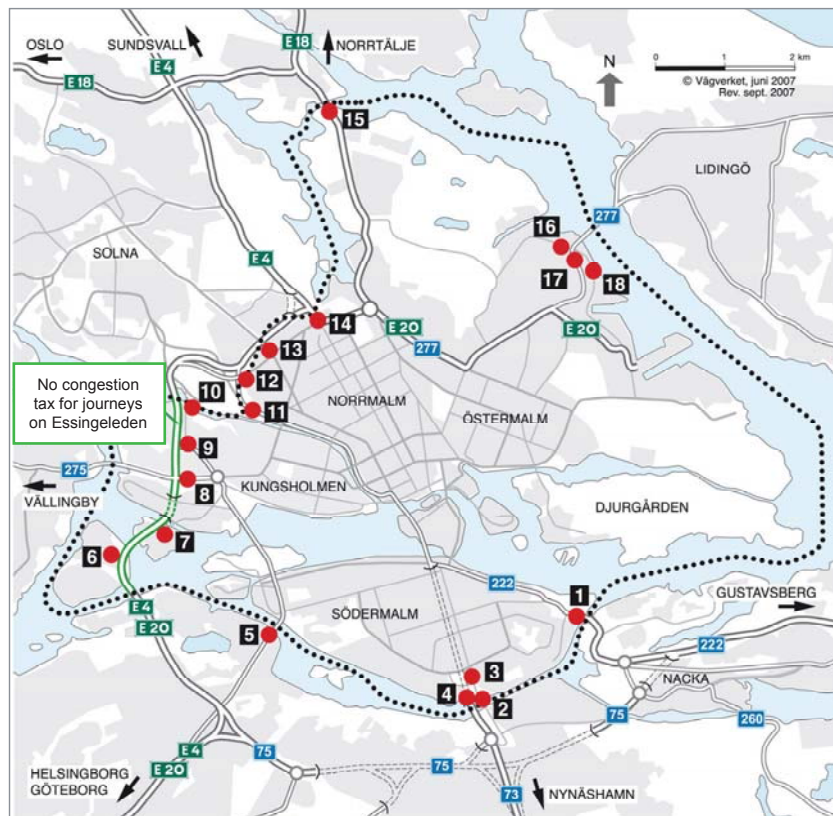
Congestion tax in Stockholm

The congestion tax is a charge levied on certain vehicles for passages in and out of Stockholm's inner city, between the hours of 06:30 and 18:30, Monday to Friday. The charge varies according to the time of day between 10 kronor (approximately €1) and 20 kronor (€2), with a maximum daily charge per vehicle of 60 kronor (€6). The tax does not apply overnight, at weekends and on public holidays or during the month of July, when traffic levels are generally lower. Certain alternative fuel vehicles, emergency vehicles, buses, diplomatic and foreign vehicles and motorcycles are exempted. There is no congestion tax for journeys on the western relief road, Essingeleden, or for journeys to and from the island of Lidingö which pass in and out of the congestion tax zone within 30 minutes.

The City of Stockholm's Traffic Administration aims to provide for the accessibility needs of individuals and businesses, whilst minimising the negative effects of urban traffic. The congestion tax trial in 2006 showed that the tax is an effective tool for regulating traffic in order to optimise the use of the city's infrastructure and thereby improve accessibility through reduced congestion. The trial ran for just seven months and there are some differences in the way the permanent charge now operates – for example the tax is now deductible for certain users and the structure of the exemptions has changed. There is therefore reason to study the effects of the

permanent tax to determine whether these might differ from those observed during the trial.

It is with this purpose that the Traffic Administration has carried out a monitoring programme of the effects of the congestion tax through to 2008 (albeit a somewhat less comprehensive programme than that which was carried out during the trial). In summary, the monitoring shows that the effects of the permanent



The location of the congestion tax cordon in inner Stockholm.

Source: The Swedish Transport Agency.

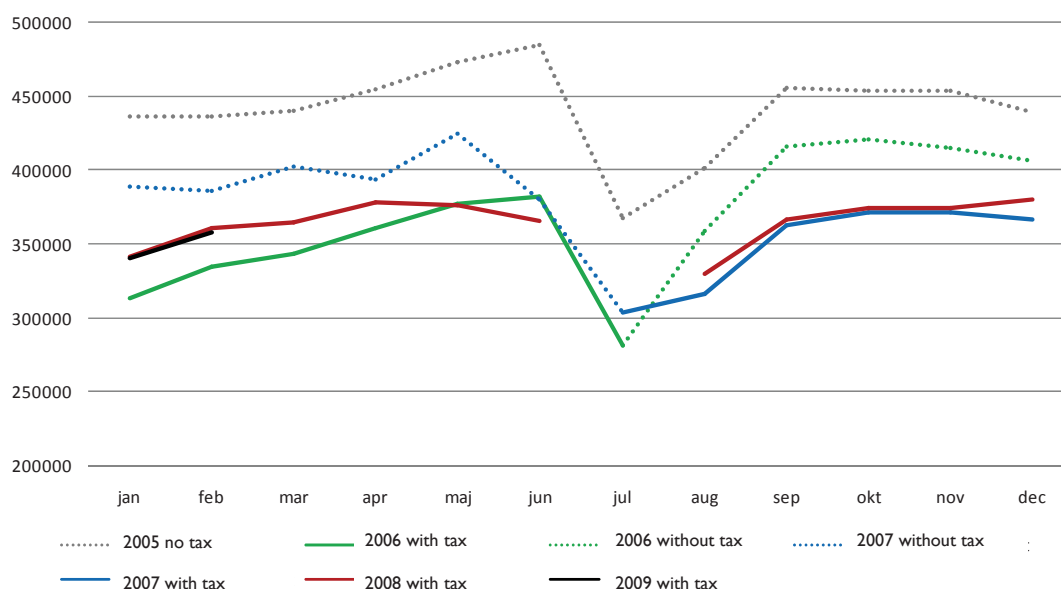
tax are generally comparable to those observed during the trial. The congestion tax thus continues to be an effective demand management tool within Stockholm's dynamic traffic system.

The reduction of traffic over the tax cordon is still large – though a little less than during the trial

During the trial of congestion tax in 2006, the number of vehicles crossing the tax cordon was reduced by 22 percent, compared to the situation without congestion tax in 2005. In 2008 the reduction of traffic across the tax cordon was 18 percent, compared to 2005 – still a large reduction though not as large as during the trial. This is, amongst other factors, due to an unusually large reduction of traffic during the first few months of the trial in 2006, rather than a significant increase of traffic since that time. There

is for example no significant difference in traffic levels between winter 2009 and winter 2008. These observations together support the hypothesis that the lower traffic levels during the early part of the trial were a result of an unusually large number of motorists choosing not to drive. This may be partly due to weather conditions (there was a large snowfall in winter 2006), but also that traffic in early 2006 was affected by drivers taking time to adapt to the congestion tax, and to understand how it functioned.

Also interesting to note is that one third of all passages of the congestion tax cordon are through trips, that is to say have neither an origin nor a destination in the inner city.



Average number of vehicle passages over the congestion tax cordon, on taxable days, between 06:00 and 19:00.

Rapid increase in the number of exempted alternative fuel vehicles – which cross the tax cordon more often than the average vehicle

Of all passages across the congestion tax cordon, 28 percent are made by vehicles exempted from the tax. The total proportion of exempted passages is the same as during the congestion tax trial, but the reasons for the exemptions have changed. The proportion of passages made by alternative fuel ve-

hicles has increased from 3 percent during the trial to 13 percent in 2008. Taxis are no longer exempted from the tax, as they were during the trial, but even though a proportion of taxis are also alternative fuel vehicles, this does not fully account for the rapid increase in the number of passages by alternative fuel vehicles.

Analysis of passage data shows that alternative fuel vehicles make on average 70 percent more journeys over the congestion tax cordon than the

average for taxable vehicles. The increasing number of alternative fuel vehicles is probably a further contributory factor in the increase in traffic across the congestion tax cordon in 2008 compared to the trial in 2006. The exemption for alternative fuel vehicles will cease in July 2012.

Congestion is still reduced – but not on all roads

Measurements show that, in 2008 journey times are on average shorter than before the congestion tax trial on all classes of road, with the exception of orbital roads. On inner radial roads during the morning peak period, queue time has reduced by almost a half. Increased journey times on the orbital routes are closely linked to ongoing construction works in and around the inner city, most notably at Norrtull, a major entry point to the city from the north.

Small changes in traffic levels on Essingeleden and Södra länken

Traffic levels on the E4 Essingeleden (the western relief road) remained largely unchanged during 2008. Average daily traffic flows on Essingeleden in October 2008 were approximately 160,000 vehicles per day. Vehicle flows on Södra länken (the southern relief road), have fallen in 2008 (down 4.6 percent, compared to 2007), for the first time since the road opened in 2004. The reduced traffic levels in 2008 are confirmed by the fewer number of closures necessitated by stationary traffic in the tunnel during the year.

Measurements show that traffic levels within Stockholm's inner city remain unchanged overall between 2007 and 2008. This suggests that there is no general tendency towards increased use of the road space freed up by reduced traffic in the inner city as a result of the congestion tax. Traffic on orbital roads has increased by between 5 and 10 percent compared to 2005. This is partly a result of the background trend of increasing traffic and partly due to traffic avoiding the inner city.

Improved environment, health and traffic safety as a result of less traffic – but the congestion tax is not the only factor

Changes in road traffic patterns have affected emissions of pollutants. One of the reasons that traffic levels are now somewhat higher than during the congestion tax trial is the increased proportion of exempted alternative fuel vehicles. These vehicles have lower emissions than vehicles not classed as alternative fuel vehicles, and so most of the environmental benefits observed since the trial are a result of the increased number of alternative fuel vehicles. The proportion of alternative fuel vehicles registered in the City of Stockholm has increased from 5 percent at the end of 2006 to 14 percent at the end of 2008. The changes in the make up of the vehicle fleet are not exclusively due to congestion tax, but surveys show that exemption from congestion tax is the single most significant incentive for those buying alternative fuel vehicles in Stockholm. Estimates during the congestion tax trial showed that emissions of CO₂ from motor vehicles in the inner city fell by between 10 and 14 percent as a result of the congestion tax – reductions of a further 4 percent have been estimated since the permanent implementation of the congestion tax.

During the trial of congestion tax it was concluded that the overall impact of reduced traffic, but increased average speeds, gave a positive result for road safety. Road accident statistics show the significant reduction in the number of people killed and injured on the roads in fact began in 2003/4. No clear change in this trend can be observed as a result of the implementation of congestion tax, although there is too little data to make a definitive analysis. The biggest reduction in injuries is amongst vehicle drivers and passengers, which may be explained by a combination of factors including better vehicle and road design. It is difficult to determine a clear effect of the congestion tax for road safety.

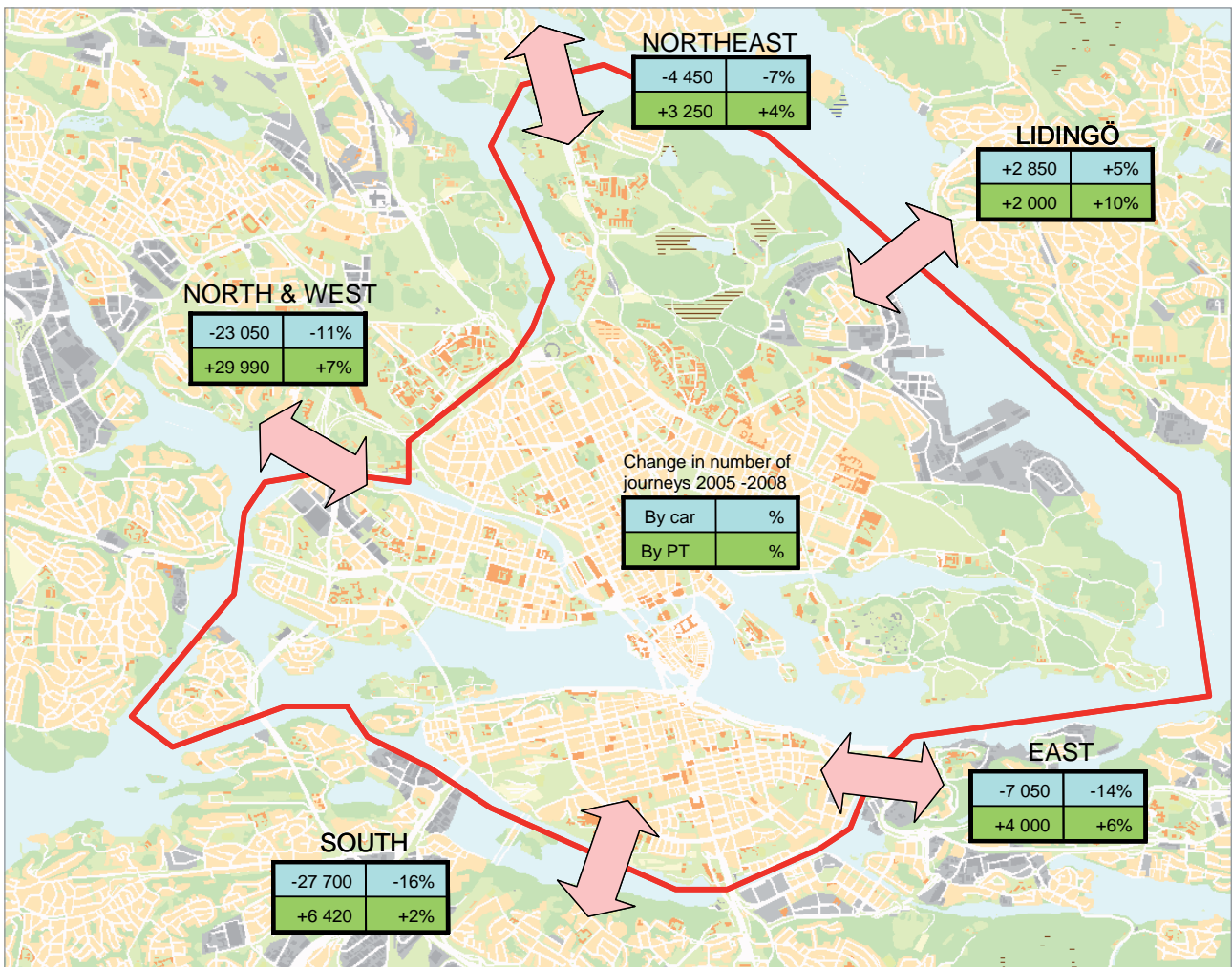
More people cross the cordon using public transport – both as a result of the congestion tax and of a rapid population increase

Travel by public transport across the congestion tax cordon has increased continuously since the introduction of the congestion tax in 2005. In total there were approximately 80,000 more journeys per taxable day across the cordon by public transport in 2008 compared to 2005 before the introduction of the tax, an increase of 7 percent. The growth in travellers is observed across all public transport modes, with the metro carrying more than half of the new journeys. Further analysis shows that roughly half of this overall increase is probably as a result of growth in the region’s population.

Reductions in queue times on the radial routes have also benefited bus journey times on six of the seven routes where measurements were taken. No significant improvement in journey times has been observed for the trunk bus routes within the inner city.

Travellers adapt in many different ways

The analysis of the congestion tax trial, which included a travel behaviour survey, showed that the increase in the number of public transport passengers as a result of the tax was not equivalent to the reduction in journeys made by car across the congestion charge cordon. The analysis concluded that travellers adapted their journey patterns such that the total number of journeys reduced. There



Change in the number of person journeys by car and SL over the congestion tax cordon, 06:30 -18:30, as a result of the congestion tax (scaled for population increase), between autumn 2005 and autumn 2008. Journeys with tvärbanan and to and from Essingeledens junctions are not included as it is not possible to determine direction. The figures should thus not be totalled.

are many ways for individuals to respond to the increased journey costs imposed by the congestion tax, for example to change mode, journey time or route, to combine several errands into a single journey, or to choose an alternative destination or other substitute (for example work or shop from home).

In 2008 there were approximately 96,000 fewer journeys per taxable day by car across the congestion tax cordon compared to 2005, whilst the equivalent increase in journeys by public transport over the same period is approximately 45,000. Public transport has increased its market share for journeys from every direction. The monitoring for 2008 thus supports the conclusion of the analysis of the trial period - that approximately 50 percent of journeys no longer made by car have switched to public transport. Both the reduction in car journeys and the increase in public transport journeys confirm a continued effect from the congestion tax; however other factors, most significantly the increase in population have also had an impact.

The changes in travel patterns resulting from the congestion tax might also be expected have an impact on parking patterns. However, a statistical analysis of parking patterns between 2005 and 2008 does not show any significant break in the background trends as a result of the congestion tax. Analyses during the congestion tax trial showed that the increased capacity in park and ride sites implemented as part of the trial was a more significant factor than the congestion tax itself in people's likelihood to use the sites. The capacity usage of both park and ride and on-street parking within the congestion tax zone has increased steadily throughout the period.

The volume of cycle traffic could also be expected to be affected by the congestion tax as a result of the increased cost of travelling by car, some increased crowding on public transport and the improved cycling environment as a result of less traffic. The number of cyclists across the inner city cordon and an inner screen line (Saltsjö-Mälarsnittet) has increased steadily over the last 20 years. There are now more people cycling to and from the inner city compared to the situation before

the congestion tax trial, but it is not possible to say whether this is a direct result of the congestion tax as annual variations, the implementation of new cycling infrastructure, economic and weather patterns can also have had an impact on the results.

A small number of drivers contribute a large proportion of the incomes – but the average cost per passage is low

An analysis of vehicle passages during a two week period in October 2008 shows that 37 percent of all privately owned vehicles in the county paid the congestion tax on at least one occasion. However, less than 4 percent of this group paid 200 kronor (€20) or more during that period, accounting for one third of the revenues from privately-owned vehicles. Just one in one thousand cars in the dataset reached the maximum possible tax for a two week period of 600 kronor (€60).

The taxable vehicles in the analysis made on average seven passages of the congestion tax cordon over the two week period studied, at an average total cost of 83 kronor (€8:30), giving an average cost per passage of a little over 11 kronor (€1:10). Those cars which are exempted from the tax make significantly more passages, 12 per vehicle on average. A geographical analysis shows that those most frequently paying the congestion tax live in areas surrounding the inner city with on average higher incomes and greater car ownership. The residents of the municipality of Lidingö make by far the most passages per resident – journeys to and from Lidingö have no alternative but to pass through the congestion tax cordon, and journeys made through the cordon within 30 minutes are exempted.

No negative impacts for business in the inner city

The effects for business have been analysed by comparing turnover before and after the implementation of the congestion tax for three statistical sectors: retail, wholesale and sales of motor vehicles

and fuel. The results show that the congestion tax has not had any negative impact on the overall turnover in the inner city when compared to the rest of Stockholm county. Both the retail and wholesale sectors show a more positive development of turnover in the inner city than in the rest of the county. This despite a general downturn in the Swedish retail sector since summer 2007, at the same time the permanent congestion tax was implemented. As with many other aspects, it is difficult to separate the impacts of the congestion tax from other external factors which may have an equal or larger impact.

The operating system shows a high level of functionality

In 2008 the congestion tax system handled approximately 82 million vehicle passages through the 18 charge points around the inner city. The proportion of data which was handled without loss reached 99.997 percent. This level of capacity suggests that only a catastrophic failure such as a sustained power outage at a charge point could result in any loss of data.

The tax generates net revenues – which will increase as operating costs fall

The revenues in 2008 from taxes, administrative and late payment charges, plus enforcement revenues amounted to approximately 850 million kronor (€85 million). The operational costs of the congestion tax for the Road Administration¹, the Tax Agency and the Enforcement Agency totalled 393 million kronor (ca €39.3 million), but this includes a number of one-off costs associated with changes to the operation of the tax. It is estimated that from 2010, as a result of efficiency improvements, operating cost will be approximately 250 million kronor per year. Net revenues will thus increase from 457 million kronor (€45.7 million) in 2008 to in excess

of 600 million kronor (€60 million) per year from 2010. The revenues are reinvested in improvements to the road network in the Stockholm region.

A majority of residents in the City of Stockholm continue to be in favour of the congestion tax

No new attitude surveys have been carried out as part of this monitoring programme, but an analysis has been performed of the various attitude surveys carried out during the period 2005 – 2007. The analysis, which includes only those survey results from residents of the City of Stockholm, shows that opinion towards the congestion tax has changed over that period. Before the implementation of the congestion tax trial, a majority of residents were negative, but swung to being marginally positive during the trial. In an attitude survey carried out in 2007, when the permanent congestion tax was implemented, attitudes were even more positive, with 67 percent in favour and 28 percent against.

Women were on average more positive towards the congestion tax than men throughout the period 2005 – 2007. Analyses show that this difference in opinion is largely due to on average lower access to a vehicle amongst women, and can thus be a reflection of the fact that women are less likely to pay the congestion tax.

Future monitoring of traffic in Stockholm requires a closer regional co-operation and improved methods

The monitoring report shows that it is becoming increasingly difficult to isolate the effects of the congestion tax both from other permanent and temporary changes in the traffic system, and from external factors. Against a background of a rapidly rising population and increased demand for travel it is essential to ensure that the transport system is meeting these challenges and that we are making optimal

¹ Responsibility for operation of the congestion tax was transferred from the Swedish Road Administration to the Swedish Transport Agency from 1 January 2009

use of existing and future capacity while minimising impact on the climate. A long term programme for monitoring the performance of the transport system as a whole will be an integral part of this work. In this context the continued monitoring of the congestion tax as a distinct element of the traffic system is increasingly less relevant.

A future monitoring programme for Stockholm's traffic system should be carried out at a regional level, in co-operation with other stakeholders. Such co-operation is essential, not least for an effective monitoring of those aspects which cover the secondary consequences of the performance of the traffic system and which should reasonably be carried out by bodies other than the Traffic

Administration, for example analyses of impacts for business and the environment or socio-economic studies.

Within the parameters of this study we have identified a number of areas where both the data quality for existing measurements might be improved upon, as well as new methods developed, for example for journey time monitoring, cycling and public attitudes. There is even the potential to make better use of data collected by the congestion tax system without affecting the security of personal data. For other aspects, for example the measurement of vehicle kilometres travelled and walking journeys, there is a need for further development of measurement and analysis techniques.



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