Stockholm's Congestion Pricing

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Webinar Transcript

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Landmark Designation

The program described in this case study was designated in 2013.

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The panel that designated this program consisted of:

- Mark Dessauer, Blue Cross Blue Shield of NC Foundation
- Jacky Kennedy, Green Communities Canada
- Ryan Lanyon, City of Toronto
- Nathalie Lapointe, Federation of Canadian Municipalities
- Patricia Lucy, Translink
- David Levinger, Mobility Education Foundation
- Geoff Noxon, Noxon Associates
- Chuck Wilsker, U.S. Telework Coalition
- Phil Winters, CUTR and the University of South Florida

This transcript covers a webinar held on Tuesday, March 11, 2014. Additional materials about this program can be found at: http://toolsofchange.com/en/case-studies/detail/670.

Introduction by Jay Kassirer

Welcome everyone, to today's webinar on Stockholm's experience with congestion pricing.

Today's cases study features strong, ongoing impact data in terms of modal share shifts for driving vs. alternative modes of transportation. It is a rare example of introducing then removing and then reintroducing an intervention (Reversal Design). It speaks to the importance of timing referendums after rather than before trials or pilots, and to the dynamics of shifting public opinion. It also shows that congestion pricing can be popular, work well, and generate significant additional funds for municipalities.

We're very lucky to have with us today the person who directed and designed the evaluation of the city's congestion charges - Jonas Eliasson. He's Professor of Transport Systems Analysis at the Royal Institute of Technology, and Director of the Centre for Transport Studies there. Professor Eliasson has a long involvement in analyzing, developing and applying transport policies and appraisal methodologies.

He's acted as an expert advisor to many city leaders and national governments on strategic transportation issues, often involving sustainable transport planning, transport pricing and social and economic appraisal. He is a frequent advisor to the Swedish government on transport policy issues, has chaired the National Committee for Analysis of the National Transport Investment Plan, and is a member of the Standing Experts Advisory Board to the National Appraisal Guidelines Committee.

His research interests include the use of cost-benefit analysis and applied planning, wider economic impact, transport modeling, transport pricing, public and political acceptability of transport policies and valuations of travel time and reliability. It's a great pleasure and privilege to welcome Jonas Eliasson.

Jonas Eliasson, Professor, Royal Institute of Technology

It's nice to be here. I wish I could see you all as well, but I can just imagine you all over there.

I'm here to talk about the Stockholm Congestion Charges. As you may know, Stockholm's Congestion Pricing system was introduced in 2006. First, just a word about Stockholm.

[Slide] Stockholm is a region with around two million people. We have a good public transport system but we also have a lot of cars. It's a relatively rich city so most households will have at least one car, possibly two. Compared to its size, it's a very congested city.

As you can see from the picture here, we have a lot of water. It's built on a harbor. To the east is a lake and also to the west and to the north and to the south, which means that

most car trips will pass over one of the relatively narrow bridges in and out of the historical area. Trying to build more bridges and more tunnels across this lake and across this sea is very expensive and also brings a lot of environmental intrusion. That means that these streets and these bridges are really, really congested. We can probably say that we're a congestion index on par with London and Paris despite being only two million people, and also, despite having a good public transport system.

[Slide] A brief history about the Congestion Charges. The concept has been discussed more or less extensively since about the early 1990s but hasn't really got any public or political support and I think the discussions in Stockholm were similar to those in most cities. The notion came up from time to time, but no one was keen on doing this. But then, the small Green Party managed to bring this forward after its election to Parliament in 2002. With just a few years' preparation, it was introduced as a trial between January and July 2006.

It was an extremely controversial measure and I think it's fair to say that even the traditional friends of congestion pricing … transport experts, environmental experts and so on … they were hesitant to say that this was a good idea because it was brought in against really heavy public opposition. But, to everyone's surprise, following the referendum in September 2006, the opposition had changed into a majority in favor of the charges. In that referendum, 53% of the population in Stockholm voted in favor of keeping the charges. You might know that Sweden has relatively high taxes, but we don't generally vote in favor of just raising taxes on ourselves, so this was really a major surprise. I will say something about what may have caused this extreme change in opinion.

Charges were reintroduced a year after the referendum because they had been abolished right before the referendum, at the start of the referendum process. They were permanently reintroduced in August of 2007 and they have been in charge ever since. The majority in favor of keeping them is even higher now. We do repeated surveys of public attitudes and ask questions like, "If there was another referendum, would you vote in favor of keeping the charges?" All the time, roughly 70% of the population says that they would vote in favor of keeping the charges.

Moreover, it's nowadays supported by all political parties. We have five or six political parties represented in the regional and city and national Parliament and all of them are now in favor of keeping them, which is also a big change compared to how it was back in 2006.

[Slide] The charging system is relatively simple. It consists of a single cordon around the inner city area, but the reason that it's so simple is because we have a relatively simple network topology. This simple cordon actually captures or crosses all of the main bottlenecks in the transportation system …all the roads and bridges. What's a little bit interesting is that you pay the charge when you cross the cordon in both directions. Both towards the city and also out again. As you can see in the left picture, the brown areas

there are the densely populated areas and the red circle or the red cordon denotes where the charges actually are.

In the top right corner you can see that the charges are also time differentiated. It says there in Swedish money 10 Swedish Kroner, which is roughly $1.50 or 1 euro. I don't know what it is in Canadian dollar bills, but in U.S. dollars, 10 Swedish Kroner is roughly $1.50. It's differentiated, so you pay more during rush hours, the worst hour in the morning and the worst 1½ hours in the afternoon, and then you pay a little less on the shoulders of that time period, and then you pay 10 Swedish Kroner during the rest of the day. You don't pay anything in the evenings. You don't pay anything weekends. And you can only pay a maximum amount of 6 Euro per day and that maximum amount is mostly because of taxis and others who cross the cordon all the time. There's really no point in charging these kinds of vehicles any more.

[Slide] There are no toll plazas; it's based on free float. It was first based on transponders (tag and beacon technology) but that has now been replaced with automatic number plate recognition (ANPR) technology. It turned out that ANPR technology worked so well on identifying vehicles that the cost and burden of handling the transponders when people changed cars wasn't necessary.

[Slide] Effects. In most cities, the traditional argument against congestion pricing is that it simply will not work. There are very different variants on that argument, but things like "car drivers aren't driving just because they think it is fun, they really have to do what they are doing, otherwise they wouldn't be there." You would expect that a charge in the neighborhood of $1.50 or 1 Euro, maybe 2 Euros rush hours, wouldn't really affect traffic behavior. And you would be wrong.

[Slide] These are photos from the first day with the charges. This picture here, where it says Monday, January the 2nd is the last day without the charges and this is one of the many bottlenecks where you see one of the bridges leading from the east part into the western part. The picture over here, it's the first day with the charges. Roughly 20% of the cars are gone but since traffic queues are highly nonlinear in nature, removing roughly 20% of the cars from the street means that queues will almost disappear. After a week, it looked something like this. There were still cars on the street, obviously, but instead of standing still or almost still in car queues, they were moving, and moving cars don't queue up to any extent.

[Slide] Here's another picture. Here, in Swedish, it says: "Every 4th car disappeared." This used to be one of Stockholm's most congested junctions. You can see a man over here. He is from a motorist organization and he is holding a sign which says, "Abolish congestion charges. They won't work anyway." The public debate never really became the same after these first few weeks because the argument that it wouldn't work just simply disappeared. There were other arguments, both for and against congestion pricing in terms of equity or social welfare and stuff like that, but the argument that it's not going to work is just not true.

[Slide] Now, the decrease in traffic, corresponding to roughly 20% less traffic across the cordon, has been persistent since then. You can see in the blue box the daily average traffic before the charges from 2002 to 2005, and you can see that traffic has roughly been constant. The small decrease between 2004 and 2005 is because we opened a new bypass to the west of the city that year.

In 2006, when the congestion charges were introduced, traffic dropped almost immediately by 20%. They were reintroduced in 2007 and, as you can see, traffic levels have remained roughly constant until now.

What's interesting is that right before the referendum, the charges were abolished again, but then they were later reintroduced. For virtually 2 ½ years in between, around 2006 and 2007, we didn't have congestion charges and then traffic looked like this. Almost all of the car drivers came back, but not quite all of them. You can see that in the second part of 2006 and the first part of 2007, traffic levels were a bit lower than the corresponding spots for the years between 2000 and 2005.

What that means is that not all of the car drivers that disappeared during the trial, when the congestion charges were first introduced, came back. Somehow, they had developed other travel patterns during the seven month trial and perhaps discovered public transportation, for example, wasn't so bad after all. They had discovered other departure times or other travel patterns in general. We don't know really, exactly what they did during the two years, but it's perfectly obvious that some of the effects of this change in travel behaviour remained, even after the charges were gone.

[Slide] Removing 20% of traffic has huge effects on queues and congestion. Roughly speaking, 30-50% of the queuing time was gone. The blue and the green bars in this chart represent queuing time increments. The black error bars represent travel time variability; the distance between the top bar over here and the lower one over here, is a measure of how much travel time varies from day to day. Even if you travel at the same time, this depicts the big afternoon rush.

Mean congestion went down, and travel time variability decreased even more. For example, if you need to choose your departure time in order to be in time for an important meeting or something, then you need to choose your departure time with respect to the maximal travel time rather than the mean one. This decrease in travel time variability was actually as much appreciated by the population as the averages were.

[Slide] What happened to that disappearing traffic? Quite a lot of the drivers changed to public transport - to transit - but only roughly half of them. It turns out that roughly half of them changed in other ways. They more or less disappeared. We don't know exactly what they did. Some probably changed destinations. Some of them changed to other departure times. Some started trip chaining. Some changed routes. Roughly half of the change consists of public transport switching and roughly half of it consisted of other kinds of changes.

[Slide] This slide refers to transferability. The traffic models in Stockholm, which I was actually in charge of handling at the time, had predicted a traffic decrease across the cordon of roughly 16%. Now, 16% less traffic, that's a huge change. It's an enormous change, so no one actually believed this. Not even myself, I should say. I thought that if we got maybe 10% less traffic that would be really a success. But the actual effect was 20%, which was even more than the forecasts. The difference between 16% and 20% is not really a big thing. I think that the basic message here is that if you are in a city and you have a transport model that actually predicts that congestion charges will work in a certain way, then most of the time, provided that you have a decent transport model, you can actually trust that. You can probably trust the transport model more than you can trust your own gut feeling - at least *my* gut feeling - and I have been developing transport models for rather a long time.

[Slide] The other thing here is that defining a charging system is actually difficult. This is a picture from the model. Despite the fact that our charging system looks relatively simple, it's actually iteration number 17 or 18. The first four or five attempts actually created more congestion than they solved because we were mainly moving congestion around within the city. Having reasonably lots of time - at least a half year, a decent, preferably good transport model, and trying out different designs …. that is really something that you want to do. You should not just throw things on your paper and hope it will work.

[Slide] Now, let's talk more about public opinion. As I said, no transportation planners would believe that costs would affect traffic, even some politicians didn't think so. But there is a price point where people change their opinions. That's even harder than to change traffic.

[Slide] This is a media picture. As you would expect, the media were overwhelmingly negative before the trial so the headlines were always, all the time, "Charges headed for the ditch," or "The Charging Chaos Continues." But a few weeks after implementation, we had a completely different media picture. Then the exaggerations of positive headlines were just as big as the exaggerations of the negative headlines had been.

You can see a couple of positive examples here. Things like, "Stockholm Loves the Charges," "The Charges Are A Complete Success," "Everyone Makes a Thumbs-up for the Charges," and so on. Of course, this is typical media exaggeration, but you can see the general picture.

[Slide] If you look at the public opinion pattern, you can see that we actually started out, back in 2004 with a negative opinion, but we still had the support from something like 40% of the people. As the introduction of the charges came nearer and nearer, public support for the charges fell back. Immediately before the introduction of the charges, we were down to public support of around 33%, if I remember it right.

However, once people saw the benefits, once they saw these almost empty streets and once they saw the improvement of the public environment, then support for the

congestion charge started to increase again. Up until the point when the referendum was held, here, where 50% were in favor of keeping the charges. Support continued to improve, actually. In 2007, the government made the formal decision to reintroduce the congestion charges. By that time, around 65% of the population had grown in favor of keeping the charges. It continued to improve and now I haven't drawn in the 2013 figures, but as I said, in the introduction, roughly 70% of the population now support keeping the charges.

[Slide] If you want to introduce something like this, then the point in time to NOT have a referendum would be this point (before a trial) because people are almost always the most negative immediately before the introduction of something that they don't know. Either you have a referendum and the whole political debate well in advance, somewhere over here, and try to win support in advance, or you do it after the trial, to let people actually experience both that the benefits are probably larger than they anticipate and also that it's actually not as bad as they think. Immediately before the introduction, people will see the disadvantages more than they when they actually experience it in real life.

This is at one point in time when both Edinburgh and Manchester in the U.K. tried to have a referendum. They thought they would have reasonably high support and then, predictably, support fell and fell and fell and then they had their referendums right here. They actually never saw the potential benefit that congestion charges could bring, which I think was a mistake by the decision makers.

[Slide] Why then, did the opinion change? I think there are four basic building blocks when you explain this.

1. The first is that it was actually better than people thought. The benefits were larger than expected. It's important to know that both the personal and the social benefit matter. It's both a matter of self interest and it's also a matter that people seeing that other people in society benefit too.

It is important to have some sort of objective, comprehensive and preferably independent measurements to take. In the case of Stockholm, the whole evaluation process was outsourced to academia, academics, independent consultancies and independent governmental agencies. As a whole, almost 100 persons were involved in some capacity on this evaluation. I think we had 35 different contractors evaluating everything from, well obviously, traffic flows, traffic times, emissions, traffic safety, but also things like how they perceived our environment … garbage collection … even the children's participation in sports activities, for some reason. That really wasn't my favorite topic, but it was felt to be important by some people.

2. The second part is, it's not as bad as you thought. The negative effects turned out to be much smaller than it appeared.

3. The third part is that decision makers need to be honest in the sense that they need to have a plan consistent with their goals. If they're saying that they want to reduce

congestion, for example, then it should be evident that it was actually designed with that intention. In Norway, for example, they have a couple of urban road pricing systems, but they are designed to bring in maximum revenues. They aren't designed to actually reduce congestion. Some Norwegian agencies have tried to rebrand or re-label their systems as congestion pricing systems instead. If you have congestion pricing system, you don't, for example, charge traffic in the middle of the night, which the Norwegian systems typically do. You need to have a system design that actually shows that you try to do what you say that you want to do.

4. The fourth thing is try to associate it with strong attitudes. In Stockholm people have very strong feelings about the environment, so emphasizing the environmental benefits was important. Also emphasizing, in the Stockholm case, that it's felt to be a fairly fair principle that polluters pay. Once you say that, okay - if you create congestion by driving on the street, you should also pay for that. It's okay to keep driving, as long as you pay for the congestion that you create.

We had this debate where, at first, I think that people thought that this was some sort of anti-car measure in a general sense; that decision makers wanted people to stop driving their cars, completely, but that was actually not the case. What the decision makers wanted to signal was that it's okay to drive, as long as you don't drive as much in the worst congested areas, in the worst congested times. Once people understood that the message was not to stop driving - it was drive less at these particular places, at these particular times - it was a much easier to communicate it.

Part of that was that revenues were, somewhat surprisingly, earmarked for road investment. This, I think, sent the signal that it's not that we dislike cars completely, it's just that we dislike congestion, and to reduce congestion, we need to price some particular links at some particular times. That's a different message than trying just to reduce car traffic on the whole.

[Slide] Adapting, as I said, it's not as bad as you think. Adapting is easier than most people believe. We did a survey where we asked people a couple of months after the charges were introduced, whether people had actually reduced the number of car trips across the cordon. When you compared the number of people who actually said that to the objective traffic measurement… the stated effect from the survey was somewhere between 5% and 10% in terms of traffic reduction, while the measured effect, looking only at private cars across the cordon, was roughly 30%.

Another way to say that is that around three-quarters of this 30%, this reduction, was people who weren't even aware that they had changed. People changed without even knowing it themselves.

The second bullet point said that people became more positive during the trial and then a year afterwards, more than half had actually forgotten that they had become more positive. How can people change without noticing it? I think most of the car drivers out

there, in a specific time and in a specific place, are actually not habitual car drivers. It's not the same people out there driving on the same link each time, each day.

[Slide] If you look, for example, at the cordon in Stockholm, 29% of the vehicles crossing the cordon on any given day are what you can call habitual car drivers. These are the people who actually do the "five trips per week - five working day trips per week" travel pattern. 14% of the cars are drivers who do four trips per week on average. More than half are people who drive there only seldom or occasionally. 25% make less than one trip per week and 32% drive between one and three round trips per week.

Doing something that affects these occasional and seldom car drivers is relatively easy. They are the persons who will change without even noticing it themselves. Let's say that the occasional car drivers dropped their trip frequency from three trips per week to 2.5 trips per week. This is a change in travel patterns that people typically won't notice themselves, but which makes all the difference to aggregate traffic flows.

[Slide] Another interesting thing is that all kinds of travel groups have changed their attitudes. These four lines show the support for congestion charges in the group who don't even have a car. That's this group, who turned out to be not really positive. Only 60% of them were in favor of congestion charges to start with. Remember, these are people who don't even have a car, so they disliked it for other reasons. Support in this group dropped as well, but once they saw the benefits, they became more positive, as well.

What's even more surprising is that people who paid often, say they were crossing the cordon between three, four, maybe five times—five roundtrips—per week. They, of course, started out being really, really negative. Only 20% of them were positive in Stockholm. They became a little bit more negative in 2005 and now, when they see the benefits, more than half of them would vote in favor of keeping the charges, despite the fact that they are the ones who cross the cordon at least five roundtrips per week.

[Slide] Political acceptability is affected by how the public thinks. It's also a case that power over assigned revenues is a key issue for political acceptability. Who gets the credit and who gets the blame? How does the new revenue stream from the charges affect state and regional negotiations over funding? The key to achieving political acceptability in this case was getting the state, the region and the city of Stockholm to strike a negotiated agreement about what to do with the revenue. It's a fairly long story involved in the particularities of how Swedish transportation funding works, but the key point is that the politicians were not really keen on doing it until they had made sure that they were keeping their fair share of both the revenues and the power in town.

[Slide] In summary, the congestion charges actually work. Quite a few people were reluctant to accept it at the time and I think that was affected by cost. However, there are many ways to adapt. It's not just by public transport. We have a really good public transportation system, but there are many alternatives. There are other departure times,

other routes, other destinations, trip chaining, bicycles … there are all kinds of other patterns. It's not just public transportation.

Looking at traffic, considerably less than half of traffic is work trips. Work trips are, perhaps, the most hard to change, actually, but there is quite a lot of different kinds of professional traffic. There is also leisure traffic, visiting, shopping, etc. People change all the time, so adapting is actually easier than most people would think. Getting public acceptability is about good design, it's about consistency with the goals that you're setting and it's also about associating with the "right" existing attitudes, which means that if you have a high level of environmental concerns, for example, then associating with environmental benefit is a good way to go.

Politicians. They care about the institutional setting, maybe even more than acquiring public support, but they need to make sure that they get their fair share of both revenues and credit. If you want politician to do something, you need to make sure that the institutional setting is right.

[Slide] If you want to read more about this, there is a large amount of literature and reports that I would be happy to send to anyone who's interested.

Q&A

Q: Let's start off with the question about the amount of money that was involved when cross the cordon. It's not a lot of money. How can you get such a great impact from such a small payment?

Jonas Eliasson: I think that there are a couple of reasons for this. First, I should say that the transport model, as I mentioned, was actually able to forecast the response. Even if the sum looked small to us, to me as well actually, the transport model wasn't fooled by it. The model was typically calibrated or estimated on how people react to other kinds of costs, things like gasoline prices, gasoline costs, parking costs, public transport fares, and stuff like that. Even if it looks like a small sum, the predicted forecast actually coincided fairly well with what was mentioned.

I think that part of the reason that it was so comparatively big is that because we actually tried to keep open as many alternatives as possible. I mean, you could change departure time; you could change route; you could change destination; you could change to public transport; you could change to other kinds of transport modes. When you increase gasoline prices, it's very hard to avoid paying the gasoline price, right? The only thing that you can do is make shorter trips or you switch modes, for examples, changing your departure times don't really help. The more alternatives you keep open, the higher will your response be.

It also makes the cost more visible. I mean, gasoline price is sort of hidden. You only pay when you fill your tank, which is a miscommunication. Every time you cross, you actually see the charge that you are paying.

Finally, it's different people every day. I think it's hardest to affect those people who are really, really habitual car drivers, who drive there every day and have no intention of ever changing. The people who drive there just occasionally, they are relatively easy to affect by this kind of pricing.

Q: Besides typical public acceptance issues, like equity, the biggest challenge in North America is the investment required. Can you tell us more, please, about the costs of implementing the system, return on investment over time and how revenues are used?

Jonas Eliasson: The investment costs and the first year of operation were roughly around $200 million U.S. That includes the first year operation and I want to point out that the first year operation involved quite a lot of changes. For example, the legal foundation of doing congestion pricing, what constituted a legal proof of passage, had to change because of a court order during the operation, which meant that they had to sort of reveal the technical system for legal issues.

The revenues from the system are roughly $100 million U.S., so you recoup just the investment costs, in terms of revenues, after two years. As you might have understood because of this legal thing, the system cost much more than it would have done if we had done it right the first time around. The procurer, which is the National Transportation Agency in Sweden, they often say that if they had to do it once more, once again, they probably could have been able to build this for less than half of the investment cost.

The operating costs, the running and reinvestment costs, are roughly $10 million U.S., so basically, it was a $200 million investment cost, with $100 million in revenues and $10 million in running costs each year.

Another nice figure is the social benefit. If you do a social cost-benefit analysis where you put the value of the travel time savings, the emission savings, the traffic safety benefits and so on, you get a social surplus each year of roughly $80 million U.S. That's mainly the worth of the travel time savings and these travel times' savings are then sort of exchanged for higher productivity on the labor market, for example.

Q: Let's talk a little bit about transferability. I think there are many cities across the world who watched and saw it happen in Stockholm and are saying, "Well, you know, it was a very unusual situation politically. It just happened to work and it will never be able to happen here." What do you say to people like that in other cities, about how transferable it really is and what the lessons have been?

Jonas Eliasson: There are two main lessons here. First, that it worked from a traffic point of view. Here I think the transferability lesson is that the transport model, the transport analysis predicted that this would happen. No one believed this, but it actually happened.

The best way to answer the transferability question would be to set up a good transport analysis and see what will happen. If you design the system really carefully and if the transport model says that it will work, then it probably will ... even if you don't think so. Good transport models are actually often more truthful and objective than people's gut feelings are.

The second transferability question is whether the political aspect is transferrable. Here, I think, there is lots of evidence from all kinds of cities that people tend to grow much more positive over time. You just need to survive in the Valley of Death while support is dropping just before implementation. Once benefits appear and once people get used to this, after half a year or something, then support will be much higher. We have seen this pattern in London, we've seen it in Oslo, we've seen it in Singapore, we've seen it in Milan; and in Rome… all over the place. People are very negative at first, but once they see the benefits and get used to things, then it's easier.

Q: Can you talk more about using technology for implementing congestion pricing ... Intelligent Transportation System techniques?

Jonas Eliasson: What was used here first was a transponder-based system … a tag and beacon system. Each vehicle had to be equipped with a transponder and that transponder then registered the passage across the cordon. For those vehicles that didn't have a transponder, we had automatic number plate recognition (the ANPR system) which looked up the owner of the vehicle in the National Vehicle Registry. It was anticipated that the ANPR identification rate would be something like 50% or 60%, which meant that we were going to need to use a transponder to drown in manual identification.

After improving the ANPR system, it turned out that the ANPR identification rate could be pushed upwards of 97%, and 97% was so high that the effort and the cost of actually handling all these transponders when people sold their cars and changed ownerships and everything, wasn't really worth it. The transponders were actually abolished back in 2008 or 2007. Now we exclusively use ANPR for identification.

Q: What about privacy issues with ANPR?

Jonas Eliasson: The privacy issue is handled this way: the only data that is kept is the amount of the invoice. What the ANPR system does is it checks who owns the vehicle that just passed. It keeps the proof of passage in the database, which is not public, then it sums all of the proofs of passages during a month and that is sent to the vehicle owner's home address, an invoice for the total monthly bill. On that invoice, it doesn't say where you passed or how many times or what time.

If you contest this invoice, if you think there's something wrong with your invoice, then it's possible, with your authorization, for the transportation agency to unlock this database and look more closely at what passage you actually have made. The only thing that is kept is the total for the owner of the registration plate. There's no photo of the actual car, no photo of yourself or what people are in the car, for example. That means

that if someone has been fiddling with your number plate, forged your number plate, it will actually be hard to prove that it's not your car because you can only see a portion of the car.

You can see the colour of the car and a bit of the bumper. Privacy is a big issue and we've made some efforts to make sure that privacy is kept.

Q: Can the information gathered by used for other transportation planning uses?

Jonas Eliasson: Yes. We use it, for example, for obvious things like traffic volumes. You can use it for continuous traffic measurement. We get traffic volumes for a large number of links, more or less in real time. After one or two days we are also able to find temporal resolution because we get the traffic flow by the minute.

You can also get some kinds of aggregate data. You can, for example, from the vehicle registry, get disclosures of the share of lorries, for example. In principle, if you're a researcher, then you can get some additional data. You can, for example, get traffic flows broken down by postal code area but then you have to sign a number of non-disclosure agreements and so on because this is sort of pushing the border on the privacy issue.

We use the information for different kinds of transportation planning, but obviously, not as much as we could have been doing if we were, for example, allowed to get even more detailed data on the actual drivers.

Q: To what extent did the limited number of access points facilitate the whole exercise? In a city with a great number of access points, would your approach still work?

Jonas Eliasson: From a technological point, it would work, but the cost of the system would go up. Now, the cost of these gantries [technologies] is going down all the time. Gothenburg, which is Sweden's second largest city, introduced congestion pricing just a year ago and they have a large number of access points. I think it has something like 50 or 60 access points compared to our 18. That actually brought down the cost for each of these gantries, which make all the photos. It makes it more costly, so you want to keep the number of access points down just for cost issues, but from a pure technological point of view, it's really not more complicated to have a really high number of access points than a lower number.

Q: Earlier on, you briefly touched on some of the other issues that people raised, including social equity. Would you talk about your response to concerns that congestion pricing unfairly burdens those with less money or any other of the social equity issues that are often brought to you?

Jonas Eliasson: There are three different kinds of answers that I'm going to give. The first answer is that the total equity effect would depend on what you do with the revenues. If you really want to benefit the poorer groups, then you should spend the revenues from the congestion charging in a way that benefits the low income group. For

example, subsidizing public transport would be an obvious example, or for that matter, lowering the tax in the lowest income tax bracket. That's the first answer. What you do with the revenue is really the key point here.

The second point is that it's actually the high income groups that drive the most cars, especially in the downtown areas. We are talking about the really most congested downtown areas, where typically the white-collar, high-income work places are located. Especially if you already have relatively a high public transportation modal share, then the low income groups - or most of them anyway - are already in the transportation system as opposed to driving their cars in the rush hour. That's the second point.

The third point is that if you accept that scarce resources are prized, then you have already accepted that we actually allocate things according to people's income. If you don't like it, and there are good reasons to do this, then the instrument of choice would be to change the tax system or that part of the social security system. If you really want to think about the things that people really have to have, then you would think about things like housing, food, healthcare. We already pay for this. If you think that pricing roads is unfair to the poor, then you could make an even stronger argument that pricing food is unfair, or putting a price on housing is unfair, or putting a price on healthcare is unfair. The same answer you would give to those kinds of questions, but we already do redistribution from high income groups to low income groups through the taxation and social security system. The exact same is true for pricing transportation.

Q: If these other issues aren't really obstacles, what are the main obstacles, really, for congestion charging? If it's so good, why isn't it more common?

Jonas Eliasson: I think it's because before you introduce it, the losers of the system or the potential losers of the system, they are a small but very, very vocal group who will be aware that they are potential losers from it. The winners of the reform, they are not really aware of it. You will face a public opposition from a very vocal, small group and the beneficiaries of it, they aren't really aware of it. That group, who will in the end, benefit from it, they won't know before.

What you need is a good political decision maker who is brave enough to sort of face that Valley of Death between the point in time where the idea is introduced and after the introduction, where people actually start seeing the benefits from it. That's why. It's much easier to do things where you take a little bit of money from lots of people who won't really be aware, then handing over this pot of money to people who are aware about the benefit from it than doing it the other way around.

Q: Stockholmers are known to be very concerned about climate change. Is support for congestion charges based more on the potential decrease of emissions-causing climate change or is it that they've just seen so much difference in terms of congestion being improved in the city?

Jonas Eliasson: I would say that it's a bit of both. We actually did quite a lot of surveys where we tried to sort of do formal regressions on people's attitudes towards climate and congestion and explaining their attitudes to congestion pricing. There are basically two groups. One group is what you could call the environmental group, which sort of just wants to decrease traffic for environmental reasons, for climate change and also because of local air quality. The other group is what we call the transport efficiency group, which actually enjoys congestion reduction, enjoys the increased allocation efficiency, and so on. These seem to be two distinct groups, so the key to getting public support is making sure that you have support from both of these groups … both the environmental groups and the transport efficiency group.