

POLICY SERIES



Winning the battle with traffic congestion

The benefits of accurate transport pricing

By Stuart Donovan

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Executive Summary

Most of us have experienced the frustration of being stuck in traffic when you need to be somewhere else. As Canada's cities have grown in size (and become increasingly motorized) congestion and all its associated economic, social, and environmental impacts have become all the more common. In 2008, for example, Toronto was ranked the fourth most-congested region in North America (behind only Los Angeles, San Francisco and Chicago), with the direct cost of congestion estimated to be in excess of \$2-billion per year. Canada's government agencies have responded to ever-growing congestion by trying to increase the capacity of the transport system. They hope that building wider roads and providing public transit will reduce congestion, at least to tolerable levels. This investment, however, ignores other ways to manage congestion.

Instead of increasing the capacity of the transport system, Canada's government agencies should implement accurate transport pricing that charges people more to travel in peak times. Travelling during peak times incurs substantially higher costs (in terms of both infrastructure and external costs, such as congestion) than does travelling during off-peak periods.

Accurate transport pricing not only reduces congestion, it also generates additional revenue to fund investment in additional capacity when and where it is justified by demand. Most importantly, accurate transport pricing is mode-neutral in that it neither discriminates against nor favours any transport mode, although it does favour high-value vehicles, such as buses and emergency vehicles. Accurate transport pricing also allows people the freedom to manage their travel needs in the way that best suits them. Some workplaces, for example, may allow their employees to work flexible hours in order to reduce their transport costs.

This paper suggests that accurate transport pricing is an essential part of Canada's transport investment. There is no need to reinvent the wheel: Canadian cities and towns can emulate cities overseas that have invested in and benefitted from accurate transport pricing.

Introduction

Canadian government agencies continue to invest heavily in urban transport infrastructure. In 2008-2009, the federal government alone spent \$4.1-billion on transport, with the provinces and municipalities contributing additional funds (Transport Canada 2008). Much of this money is being invested in transport projects designed to reduce congestion, such as roadway capacity expansion as well as additional infrastructure and services to support sustainable transport modes, such as walking, cycling, HOV (High-occupancy Vehicle) and public transit.

And the battle with congestion is a worthy fight: Estimates suggest that congestion costs Toronto's economy upwards of CAD \$2-billion per year (Preville 2008). Expanding the capacity of our transport systems, however, considers only the supply side of the transport equation. To increase the capacity of our transport systems certainly helps more people move around, but it does not encourage them to move around more efficiently. Most importantly, investing in transport infrastructure has not delivered free-flowing roads.

International experience suggests beating congestion depends less on the capacity of the road network and more on how accurately car travel is priced. Accurate transport pricing aims to ensure that people face the true costs of their travel decisions, especially at peak times when the economic cost of travel is much higher. Only when people are confronted with accurate price signals will they begin to make more efficient choices about when, where and how they travel—all of which contribute to significantly reduced congestion.

Because it costs more to travel at peak times, accurate transport pricing solutions are able to achieve a number of benefits. The most obvious is greatly reduced congestion: Cities such as London and Stockholm reduced the numbers of cars on the road during peak periods by 10 to 30 per cent, greatly alleviating congestion and delays. Accurate transport pricing also ensures that government agencies do not have to second-guess what transport infrastructure people want to have. Instead of picking winners, government agencies simply need to increase the price of travelling at peak periods until the revenue raised justifies investment in increased capacity.

Accurate transport pricing is mode-neutral in that it neither discriminates against nor favours individual transport modes. It allows people the freedom to manage their own travel needs in ways that best suits them, given the relative costs of travel that they face. When faced with higher prices for travelling in peak periods, many people respond in ways that reduce their need to travel. For example, workplaces can invest in telecommuting and/or flexible work hours, such as four-day weeks, to help their employees avoid travelling in peak periods. Alternatively, some people may over time live closer to where they need to be and avoid the need to travel altogether.

Accurate transport pricing must be an essential part of Canada's future transport system. Canadian cities can emulate cities overseas that have benefitted from accurate transport pricing systems. Ultimately, achieving free-flowing roads depends less on how much new infrastructure we can build than on how we price use of existing infrastructure.

Understanding urban transport problems

Over the last few decades, many of Canada's larger urban areas, especially Vancouver and Toronto, have faced an increasing demand for vehicle travel that has in turn created congestion and all of its subsequent economic, social and environmental effects. Most of us have experienced the frustration of being stuck in traffic, but there are other more subtle and serious side effects of congestion. For example, congestion can delay ambulances, greatly increasing risks for their valuable and vulnerable human cargo.

In response to growing congestion, most cities have sought to increase the capacity of their transport networks through, for example, building wider, faster roads. As our cities and towns have developed and grown in size, it has become increasingly costly and impractical to expand the capacity of existing road networks. Faced with high costs, many places shifted focus from increasing the capacity of the existing road network to invest instead in new infrastructure and services for alternative transport modes, such as HOV, buses and rail. A common justification for investment in alternative transport modes is that they have capacities far in excess of roads, which is certainly true. A bus lane, for example, has the capacity to move approximately 10,000 passengers per hour, whereas a general traffic lane reaches capacity at just over 2,000 passengers per hour (Transit Cooperative Research Programme 1999). Focusing on the capacities of various transport modes, however, obscures fundamental issues with use of the transport system. Drivers pay the same costs to drive at peak times. Similarly, bus and train fares rarely vary much from peak to off-peak periods. Travelling

at peak times, when capacity is constrained, currently costs the same as travelling during off-peak periods, when spare capacity exists. Canada's transport systems are stuck using a 1950s approach to pricing that simply does not create good outcomes.

The problem of excessive demand and finite capacity is not in itself unique, although it is particularly problematic for road networks for a number of reasons. First, the space used by one person in one vehicle is not available for use by anyone else. Once travel demands approach the capacity of the road, we are essentially competing with each other for use of the available space. Second, travel delays increase dramatically as demand approaches the capacity of the road network, such that a small increase in the number of people driving creates large delays for everyone. (Similarly, a small drop in vehicle traffic can reduce delays dramatically, which is another argument for increasing use of alternative transport modes). The third and final problem with placing excessive travel demands on transport networks with finite capacity is that some vehicles are doing more work and thus are of higher value than others are. Buses, for example, carry more people than cars do, so allowing them to travel more quickly is a major benefit. Similarly, commercial vehicles, such as delivery vehicles, are of relatively high value because of the essential nature of their activities. Emergency vehicles have the greatest value of all; people may die if they cannot get timely assistance. These vehicles get stuck in the same traffic as everyone else. When all the lanes are blocked, a siren is useless. In the current environment, all vehicles face the same congestion, irrespective of their value.

Instead of pouring money into expanding the peak capacity of the transport network,

government agencies would be better off addressing the core issues afflicting urban transport systems—namely the extremely high peak demands and the absence of similarly timed price signals. This issue is discussed in more detail in the following section.

Picking winners versus win-win transport solutions

The first major issue Canadian cities must resolve is how to manage peak-hour congestion so we can give priority to high-value vehicles. Many places have developed bus and freight priority lanes, although they prioritize buses at the expense of everyone else. By selectively picking winners, dedicated transport lanes fail to recognise that many other drivers would also benefit greatly (and, most crucially, be willing to pay for) increased speed and reliability.

A better solution is to price travel in such a way that users deal with the true cost of their travel choices, which includes capacity (for example the width of the road) and negative externalities (for example congestion and air pollution). Put simply, it should cost more to travel at peak times (in areas where congestion exists) than off-peak periods, when spare capacity is available.

This definition of the urban transport problem, as well as our suggested solution, is not new. As far back as 1963, William Vickrey observed:

[I]n no other major area are pricing practices so irrational, so out of date, and so conducive to waste as in urban transportation. Two aspects are particularly

deficient: the absence of adequate peak-off differentials and the gross underpricing of some modes relative to others.

In nearly all other operations characterized by peak load problems, at least some attempt is made to differentiate between the rates charged for peak and for off-peak service.

Vickrey practised what he preached: During the 1930s and 1940s, he would rollerskate to work on the other side of Manhattan in order to save money and avoid traffic. Vickrey's economic analysis of transport costs found that people who drive during peak periods should pay up to 10 times more than they do in off-peak periods, while peak-hour rail fares should be three times higher (Vickrey 1963). Despite the fact that five decades have passed since Vickrey's research, our approach to congestion has not moved beyond simply increasing the capacity of our transport networks, capacity that is little utilised outside of peak hours.

Charging more at peak times should discourage some people from driving, thereby reducing delays for more essential vehicles, such as ambulances. Because transport modes, such as HOV, buses and trains, are able to spread the cost of travelling over more people, their relative attractiveness improves. All vehicles that remain on the road would stand to benefit from faster and more-reliable journey times. People who are discouraged from driving do not necessarily lose out completely: Some will turn to alternative travel choices, such as telecommuting and flexible work hours, in order to reduce their exposure to the peak-hour charges. In the long term, people may locate closer to where they need to be, thereby avoiding transport costs altogether.

The differences between accurate pricing and our current attempt to solve conges-

tion are clear: Rather than continuing with subsidies for peak-hour travel and trying to build our way out of congestion, implementing accurate pricing would provide price signals to help people and businesses identify the transport solutions that best suit their needs. Accurate transport pricing, which would see higher rates for travel at peak times of the day, is essentially no different from standard business practices that see hotels and airlines, for example, charging higher rates in the peak season. In effect, we are trying to rationalize demand based on price, rather than time spent in congestion. The following section discusses the highly successful accurate transport pricing system in Stockholm (Sweden), which has been in place since 2006.












The Stockholm Trial— Proving the benefits of accurate pricing

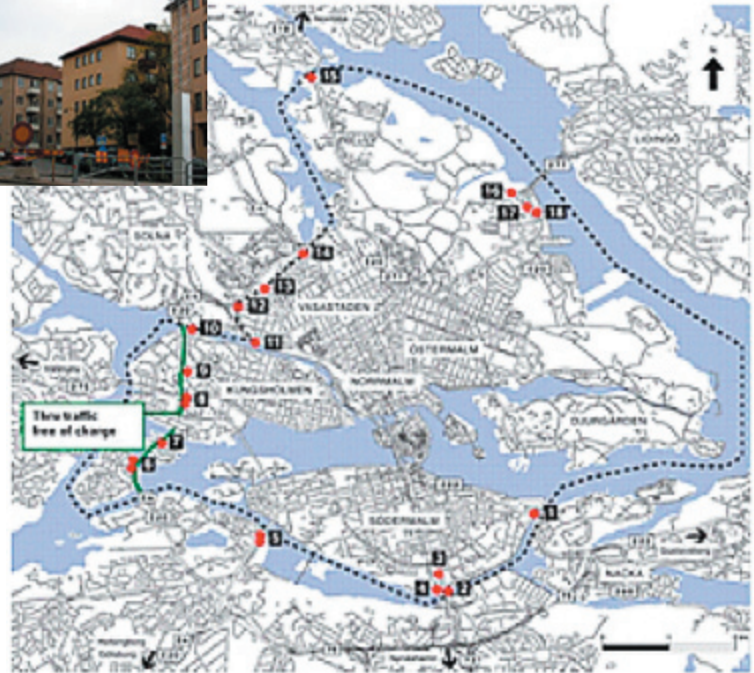
The City of Stockholm (population of approximately 1 million) has successfully implemented a time-of-use pricing scheme since 2006. After an initial trial, the system was approved by way of a referendum, where 53 per cent voted to make it permanent (Hugosson and Sjöberg 2006). Stockholm's time-of-use pricing scheme (which started life as The Stockholm Trial) applied a charge on vehicles travelling into the city centre on weekdays between 6:30 a.m. and 6:30 p.m. (There is no charge outside these times, on weekends or on public holidays.) Table 1 lists the normal weekday rates for the area affected by the charge.

Table 1 illustrates that beginning at 6:30 a.m., the charge ramps up and reaches a peak of about CAD 2.62 during the morning peak hour from 7:30 a.m. to 8:30 a.m. During the middle of the day (9:00 a.m. to 3:30 p.m.), the charge reduces to CAD 1.31, before again increasing during the peak afternoon period from 4:00 p.m. to 5:30 p.m., after which it again decreases. Cameras record the number plates of vehicles travelling beneath the toll gantries. Once recorded, drivers have several days to pay the charge—this mechanism is becoming the standard for freeway and bridge tolls. Regular users can purchase a GPS transponder to arrange for automatic payment. The accompanying images illustrate the technology used to detect licence plates and collect payment (Peterson 2009; Richard 2009; Road Traffic Technology 2010).

Table 1: Stockholm's variable congestion charge

SEK = Swedish crowns
CAD = Canadian dollars

Time of Day	Congestion Charge		
	SEK	CAD	
00:00-06:29	0	0.00	 am
06:30-06:59	10	1.31	
07:00-07:29	15	1.97	
07:30-08:29	20	2.62	
08:30-08:59	15	1.97	
09:00-15:29	10	1.31	 pm
15:30-15:59	15	1.97	
16:00-17:29	20	2.62	
17:30-17:59	15	1.97	
18:00-18:29	10	1.31	
18:30-23:59	0	0.00	



Post-evaluation studies assessed the performance of the congestion charge, and most reported overwhelmingly positive results. In their comprehensive study, Hugosson and J. Eliasson (2006) reported that the congestion charge had the following positive effects:

- *Traffic*—reduced by 20 per cent to 25 per cent overall, with greater reductions experienced in peak periods;
- *Congestion*—queues reduced by 30 per cent to 50 per cent, although they mainly disappeared within the cordon;

- *Public*—patronage increased by 5 to 10 per cent, with greater increases at peak times;
- *Emissions*—total vehicle emissions reduced by 14 per cent within the cordon, plus reduced noise; and,
- *Accidents*—overall fatalities and injuries reduced by 5 per cent to 10 per cent.

No adverse impact was noted on the retail environment or land values within the cordon (Daunfeldt, Rudholm et al. 2006).



This suggests that any reduction in attractiveness associated with the increase in transport costs was offset by increased accessibility (associated with reduced congestion) and improvements in environmental amenity, especially air pollution and noise.

Post-evaluation studies also noted that the traffic reduction was not uniform for all transport modes, with 30 per cent reductions for cars, 21 per cent for light trucks and 13 per cent for trucks. The congestion charge thus appeared to differentiate successfully between different types of vehicles depending on their value. Hugosson and Eliasson (2006) commented:

It is clear that the decline in traffic volumes and improved accessibility has led to a better work environment for commercial drivers, seen in varying measure in all studies with commercial drivers—bus drivers, taxi drivers, couriers and trades people—conducted before and during the Stockholm Trial.

Surveys also detected increasing public support for the congestion charge over the duration of the trial, which saw the 40 per cent support at the start of the trial increase to 53 per cent at the referendum, after which the scheme was implemented permanently. This suggests public acceptability of accurate transport pricing may improve over time, as their benefits become more evident. The overall economic benefits of the congestion charge had a payback period of only four years. This is considerably faster than comparable investments in transport infrastructure, which (because of their large capital costs) tend to have payback periods of 25 to 30 years.

The Stockholm experience with accurate transport pricing has been an unparalleled success by almost any measure. Canadian government agencies would do well to emulate their Swedish counterparts and implement accurate transport pricing, rather than persisting with expensive transport infrastructure that will not beat congestion or deliver free-flowing roads.

Addressing the issues of social equity and collection costs

Despite Stockholm's success at demonstrating the benefits of accurate transport pricing, many proposals struggle to gain public and political acceptance. Much of the opposition to accurate transport pricing focuses on its social impact. Opponents suggest that accurate transport pricing will place additional costs on low-income households. On average, however, accurate pricing is likely to have a disproportionately large impact on *high-income* households, who are more likely to have high-paying jobs in central city areas affected by accurate transport pricing. They are also likely to own more vehicles and to drive at peak times, and they are less likely to use alternative transport modes, such as walking, cycling, HOV and public transit. These characteristics suggest high-income households will pay disproportionately more than low-income households will.

Moreover, it is possible to support equitable social outcomes by applying the revenue in ways that benefit low-income households, such as:

- Eliminate (or at least reduce) other more regressive and damaging government taxes, such as income, payroll or property taxes;
- Deliver targeted welfare assistance, such as a transport benefit, to people or households that can demonstrate an adverse impact from accurate transport pricing;
- Fund concessionary public transit for marginal demographics, such as children, students, welfare recipients, or seniors; and,
- Lower the cost of travelling at off-peak

times, by reducing fuel tax. This would tend to benefit low-income households, because they often own older, less efficient cars and subsequently pay more fuel tax for every mile driven. It would also benefit commercial vehicles, which tend to travel more during off-peak periods.

Put simply, it is better to address the social equity impact of accurate transport pricing through targeted reinvestment.

Objections to accurate transport pricing schemes also cite the cost of collection in comparison to standard revenue-raising mechanisms, such as fuel taxes. The collection cost of London's congestion charge, for example, accounts for 50 per cent of the total revenue collected (TfL 2007). Stockholm's more-advanced scheme, however, reduces the collection cost to only 28 per cent of total revenue (Eliasson 2007). Concerns over the collection cost are something of a red herring: The cost is more a function of technology and scale rather than an inherent inefficiency associated with accurate transport pricing. As the scale and maturity of accurate transport pricing schemes increases, the cost of collection would reduce. It is possible to expand the schemes in London and Stockholm across a wider area or to other cities, which would increase the total revenue for marginal additional costs, hence reducing the relative cost of collection. Collection costs (as a proportion of revenue) are also likely to decline over time, not only as the technology used for collection improves but also as consumers make more use of efficient payment options, such as GPS transponders and internet payment, rather than more-expensive

options, such as telephone payment. Similarly, familiarity and compliance with the pricing schemes tend to increase over time, further reducing back-end administration costs. Anonymous pre-pay transponders can alleviate privacy issues by removing the need to record vehicle movements. This is in contrast to the current schemes, which focus on recouping the charge after the trip has occurred. When implemented in this way, congestion charges are not much different from parking tickets—they simply record where a car was at a particular time.¹

Opponents of accurate pricing often suggest we could achieve the same benefits (e.g., reduced congestion) with higher fuel taxes. The main practical issue with this approach is that travel demands are relatively inelastic with respect to changes in fuel tax (T. Litman, (2007), for example, cites an elasticity of -0.30). Thus, using fuel taxes to achieve a 30 per cent reduction in vehicle travel (as recorded in Stockholm) would require a 100 per cent increase in fuel taxes. While fiscally efficient (because fuel taxes have low collection costs), higher fuel taxes do not target peak-hour travel.

This means that moves to raise fuel taxes to address congestion will have collateral impact on all those people who drive in off-peak periods. Higher fuel taxes subsequently miss one of the key points of accurate transport pricing: ie., we are trying to increase the cost of driving in peak periods, thereby encouraging people to travel more in off-peak periods. By failing to create a price differential between peak and off-peak periods, higher fuel taxes are a relatively blunt and ineffective tool for beating congestion.

Finally, while accurate transport pricing schemes incur high collection costs, these costs are outweighed by the wider economic benefits. Put another way, while high collection costs are financially inefficient, there are compensating broader economic effects that mean that accurate transport pricing is still worth pursuing. Cost-benefit analysis of Stockholm's scheme, for example, found that the congestion charge generated an economic surplus of SEK 683-million (CAD\$89-million) per year, despite the high collection cost (Eliasson 2007).

1. Privacy concerns can also be mitigated by ensuring the data collected is safeguarded and used only for the purposes for which it is collected.

Conclusions

A major change in transport priorities is required to beat the congestion that currently afflicts Canada's cities. Instead of investing in expensive transport infrastructure, government agencies should first implement accurate transport pricing schemes. A key aspect of these schemes is charging people more to travel at peak times and less to travel in the off peak. In this way, people are encouraged to make travel and lifestyle choices that reduce congestion. Higher peak charges would encourage, for example, greater use of shared modes (such as HOV and public transit) and acceptance of alternatives to travel, such as telecommuting. In the long term, accurate transport pricing schemes are likely to influence people to live close

to where they need to be, actively contributing to a more efficient urban form. Canadian consumers are accustomed to price differentials for time-sensitive commodities, which have delivered lower airfares at off peak times. In contrast, our transport systems (which are the ultimate time-sensitive commodity) provide no time-based price-signal and leave all vehicles stuck in the same frustrating congestion, irrespective of their value. Buses, commercial vehicles, and even ambulances suffer from slow and unreliable journey times. Only by charging more to travel at peak times, as other cities have done, will Canadian cities have a fighting chance of winning the battle with traffic congestion.

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