TRAFFIC CONGESTION PRICING IN THE WASHINGTON METRO REGION

Finding New Directions to Move Forward

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ABSTRACT

This paper explores implementing congestion charging for personal vehicles entering the District of Columbia. I will hypothesize that congestion pricing will increase dependency on public transportation, fund public transportation and physical infrastructure improvements, and create reliable travel times. A review of case studies in London and Stockholm indicate lower traffic volumes within the congestion pricing cordon area due to the congestion charge, while case studies of San Francisco and New York City explore political challenges to implementing a congestion charge. I argue that the Washington metropolitan region would benefit from a central employment area congestion charge, in conjunction with other congestion pricing mechanisms, to create a comprehensive traffic congestion management system.

KEYWORDS

Traffic planning, congestion pricing, demand-based parking, public transit, District of Columbia, express lanes

RESEARCH QUESTIONS

What congestion management strategies are currently in place in and around the District?
How can global case studies suggest future scenarios for congestion pricing in the District?
How might the District advance congestion pricing?
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**INTRODUCTION**

“There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.” — Niccolo Machiavelli

“Congestion pricing: A type of value pricing that sets the price for road travel to reduce congestion or to maintain free-flowing conditions. Congestion pricing is usually variable: the price changes as demand rises and falls over the course of the day. Congestion pricing may also be dynamic: the price may change in real time as sensors monitor traffic levels. The most common use of congestion pricing in the United States is to provide free-flowing lanes on congested segments of urban highways.”

1 Urban Land Institute, *When the Road Price is Right: Land Use, Tolls, and Congestion Pricing*, 2013: 11.
Singapore, London, Stockholm, Gothenburg, Durham, Milan, Rome, Edinburgh, Manchester, Netherlands, Copenhagen, Budapest, Djakarta, have all either introduced or attempted to introduce some form of congestion charging. At the national level, New York, San Francisco, San Diego, Denver, Houston, Salt Lake City, Minneapolis, Miami, Los Angeles, Atlanta, Seattle, and Northern Virginia (Washington metro region) have either implemented or completed in-depth studies to introduce dynamically priced high-occupancy tolling (HOT) lanes or shoulder lanes, variably priced parking, or variably priced bridge tolls. Whether successful or not, it exemplifies the fact that traffic congestion is a growing problem in many cities worldwide.

The theory behind traffic congestion pricing as an effective mechanism for traffic congestion management is partially driven by behavioral choices. When there is a cost associated with using the roadway, especially a charge that varies based on demand, drivers must decide whether the monetary cost outweighs the benefit of a shorter commute time. If priced correctly for optimization, drivers may alter their commuting habits in significant ways, including adjusting work schedules, foregoing trips that could be made at alternate times, and relocating closer to work, that contributes to an overall improvement in the efficiency of roadway usage. It also involves a cultural shift in viewing roadway usage as a privilege instead of a right. In addition, congestion pricing is politically controversial, which


is why it is seldom adopted into policy. This will be particularly important when considering traffic congestion charging feasibility in Washington, DC.

Congestion pricing has many obstacles. Many planners, citizens, and elected officials are reluctant at the idea of charging to use the roadway as, after all, Americans as taxpayers have already paid to use the roads. Some believe that it is also unfair to the low-wage earning population and that traffic congestion pricing only benefits the wealthy. Others are concerned that people unwilling to pay the toll will negatively affect local businesses within the charging area. Some studies show that road pricing does not necessarily reduce traffic congestion, but reduces vehicular traffic volumes. The lower general vehicular traffic volume is due to the decreased road network capacity from the variety of physical measures funded by the revenues, such as increased bus service, improved pedestrian and bicycle environments, and added safety measures at junctions.

In this paper, I will discuss traffic congestion pricing as a traffic congestion management tool and the theory behind it. While the toll revenue resulting from traffic congestion pricing can be a significant source of funding, this paper will not delve deep into

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revenue structures, but will discuss the charge as a value-based decision mechanism to improve commute times, reduce carbon emissions, and ultimately improve public transit service quality and increase ridership. Identifying prices that are appropriate for the maximum gain of social net benefit is important (i.e. not too low that the priced roadway becomes congested itself, and not too high that it goes unused), but this paper will not discuss the intricacies of the mathematics behind pricing algorithms.

Lastly, the case studies will assist in determining the proper pricing mechanism to apply to Washington, but it is understood that the case studies used as resources in this research are all very different in terms of geography, economies, population size and demographics, government systems, among other discrepancies. Singapore was the first city to implement the Area Licensing Scheme, thus paving the way for traffic congestion charging, but as it is so vastly different from the Washington metro region in terms of its political autonomy, I believe it is not a fair comparison and have decided not to include it in the case studies.

RESEARCH METHODOLOGY

My methodology began with a literature review of congestion pricing theory and case studies. I used online databases Wiley, JSTOR, ScienceDirect, and Academic Search Premier. My search included electronic versions of peer reviewed journals (a majority of

articles published by *Transport Policy* and *Transportation Research*) and texts published between 2006 and 2016. I interviewed Sam Zimbabwe, Associate Director of the Policy, Planning and Sustainability Administration at the District Department of Transportation (DDOT) for his expertise on the moveDC Long Range Transportation Plan, which includes a cordon charge element. I also interviewed Alex Block, the Transportation Program Manager at the Downtown DC Business Improvement District (BID), for his knowledge on the current climate of downtown transportation projects. I used DDOTs website for reports, and utilized Google to understand the political conditions in recent news articles from credible journalism institutions such as The Washington Post and The New York Times. Knowing that congestion charging schemes are continuously evolving, I could not completely rely on peer-reviewed journal articles, and as such used Google to search for current data involving cost and geography of the congestion pricing mechanisms in the case studies.

**LITERATURE REVIEW**

**Definitions**

*Cordon charging* is a fee paid for entering a boundary into a city center. The fee can be a flat rate or may vary based on peak periods of road usage. The charge is paid upon entry into the zone, and sometimes exiting, from multiple access points. London and Singapore are considered zonal schemes in that the payment must be made even if the trip originates within the charging area and no boundary is crossed. In the case of London, the
charge lasts for a 24-hour period, allowing drivers to leave and reenter the city center during this time span. Typically, this fee is collected from pre-registered users and is enforced through photographic recognition of license plates. There may be exceptions to the fee, including emergency service vehicles, taxis, motorcycles, buses and other high occupancy vehicles. Often times there are fee reductions for electric and hybrid vehicles, disabled passenger vehicles, and for those living within the zone.\textsuperscript{8} The most well-known cities for implementing the cordon toll are Singapore, London, and Stockholm; the latter two will be discussed in detail in the Case Studies section of this paper.

Toll roads are a common method of road pricing demonstrated in the United States, though they are not usually used to manage traffic congestion but are more revenue focused.\textsuperscript{9} Toll roads often charge a flat fee, which are collected at a toll booth payable by cash to an operator or exact change collection, and now increasingly through electronic methods. Depending on the size of the roadway, there may be several toll booths, and automatic number plate recognition (ANPR) may be available to pre-registered users. Tolls may also vary depending on the number of axels on the user’s vehicle. The toll is required in order to use the entire roadway, whereas express lanes charge for the usage of specific lanes adjacent to the roadway.


\textsuperscript{9} Ibid., 1381.
Express lanes differ from toll roads in that they are typically one or two designated lanes running parallel to the non-paid roadway, with limited interchanges, and may vary by price depending on vehicle demand, with peak periods charging a higher rate while off-peak times offer lower rates. Variable pricing in accordance with demand aims to regulate the roadway with maximum efficiency. Some express lanes may exempt high occupancy vehicles from the charge, while others may charge each vehicle regardless of passenger occupancy. Express lanes may allow higher speed limits than the adjacent, non-tolled highway. The toll is collected using either a transponder, such as E-Z Pass, mounted in the vehicle that automatically charges a credit card, or may use ANPR to identify non-registered users and issue a citation; however, many systems will allow a driver to pay through a “missed toll” process within an allotted amount of time, sometimes with an additional fee. Newly implemented systems often have a first-time forgiveness policy. The lanes are also patrolled by law enforcement to identify high occupancy vehicle violations.

Demand-based parking is one of the newer traffic congestion pricing mechanisms. Currently, San Francisco and Los Angeles are the only US cities with the system in place, while many other cities, including Boston and Washington, have plans to introduce demand-based parking pilot programs in the near future. Sensors in the asphalt detect and monitor parking usage, and the meters are adjusted depending on the location, time of day, and day of the week. The rule of thumb with value priced parking is that at any given time, about 20% of parking spaces should be unoccupied and available. Using San Francisco’s
rates for example purposes, hourly pricing can vary from $0.50 to a maximum of $6.25 and also applies to city-operated garages.\textsuperscript{10}

Theory

Congestion pricing theory appears similarly in literature with traffic congestion as an economic definition of an externality, and pricing as the appropriate response.\textsuperscript{11} Transportation economics has been heralding road pricing for decades,\textsuperscript{12} and the introduction of the London congestion charge is known in economic circles as a triumph.\textsuperscript{13} The basic economic principle, \( P=MC \), if often cited, where a social optimum exists when prices for goods (\( P \)) and services equals the marginal cost (\( MC \)) it took to produce those goods and services. Roads are a good that can be jointly consumed, and when they become congested from over consumption, everybody suffers from degraded service as they cannot travel as efficiently when there is no congestion.\textsuperscript{14} Simply put, the costs of roads should be


paid by those who use them.\textsuperscript{15} While Americans pay taxes to maintain the roadway, it is often hard to distinguish where the money is going. A congestion charge is a very deliberate toll, usually with a clear allocation of revenues; there is better “piece of mind” knowing where the money is being spent.

Pigou is mentioned in many works concerning traffic congestion pricing, as he was the first to argue for a tax on congestion in his 1920 textbook \textit{The Economics of Welfare}. The Pigouvian tax seeks a correction to negative market externalities with the inclusion of social costs; however, the theoretical equation is lacking in the denominator that one’s value of time may greatly differ, complicating the computing of tolls.\textsuperscript{16} For instance, does one value a thirty-minute travel time savings in one trip in the same manner as three separate ten-minute travel time savings? Does one value travel time savings more when commuting to work or when running errands?\textsuperscript{17} There are almost limitless variables to consider when pricing the roadway efficiently. William Vickrey is also a common mention in traffic congestion theory, laying claim to the principle that the price of the toll must be higher than the benefit the driver receives from the journey.\textsuperscript{18}

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\textsuperscript{15} de Palma, “Traffic Congestion Pricing Methodologies and Technologies,” 1394.
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\textsuperscript{17} Georgina Santos and Jasvinder Bhakar, “The Impact of the London Congestion Charging Scheme on the Generalized Cost of Car Commuters to the City of London from a Value of Travel Time Savings Perspective” \textit{Transport Policy} 13, no. 1 (January 2006): 23.
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\textsuperscript{18} Albalate, “What Local Policy Makers Should Know about Urban Road Charging: Lessons from Worldwide Experience” 963.
\end{flushright}
simple pricing mechanisms in 1963, including varying tolls entering Manhattan via the George Washington bridge.\textsuperscript{19}

In more modern times, Donald Shoup is a widely regarded expert in the economics of parking. He is a UCLA professor most known for his 2005 book, \textit{The High Cost of Free Parking}, made popular by using his interesting sense of humor and years of dedication to researching parking economics to explain why cities should charge fair market prices for on-street parking.\textsuperscript{20} His book highlights the fact that \textit{everyone} pays for “free” parking, whether through higher prices on housing, higher rents, or higher prices on goods and services - all regardless if one owns a car or not.\textsuperscript{21} His work is so influential that many cities adopted some of the policies proposed in his 2005 book, which are discussed in his 2011 edition. Shoup’s three basic principles are to set the right price for curb parking, return the revenues to the metered area to pay for local public services, and remove minimum parking requirements (i.e. for shopping centers, restaurants, office buildings, etc.).\textsuperscript{22}

It is important to consider that even those not willing to pay the cost to use the roadway, or choose to pay a higher price for parking, still receive the residual benefits from those that do pay. Congestion pricing revenues may fund the transit network, for example,

\textsuperscript{19} Harsman, “Political and Public Acceptability of Congestion Pricing,” 854.


\textsuperscript{21} Donald Shoup, \textit{The High Cost of Free Parking} (Chicago, IL: American Planning Association, 2011), 2.

\textsuperscript{22} Ibid., xix.
resulting in improved bus service quality and additional routes. Aside from revenues, bus riders also enjoy the reduced congestion that the charge stimulates, and therefore shorter travel times if the congestion pricing scheme is successful.\textsuperscript{23} Demand-based parking may lower the number of vehicles searching for a parking spot, as well as lessen the amount of time spent circling an area to find parking, therefore reducing congestion for all users of the roadway in that locality.

Case Studies

London

London is perhaps the most well-known example of successful implementation of traffic congestion pricing in the form of a cordon zone charge. Adapted from Singapore’s Area Licensing Scheme introduced in 1975, and the first traffic congestion charging measure since then, London implemented the cordon zone charge in 2003.\textsuperscript{24} The cost to enter or drive within central London in 2003 was GBP 5.00 (\textapprox USD 8.00)\textsuperscript{25} between 7:00 AM and 6:30 PM on weekdays excluding public holidays\textsuperscript{26}, and in 2016 is currently GBP 11.50 (\textapprox USD 15.00) with a slight change to the hours, now ending one half hour earlier at 6:00 PM.\textsuperscript{27}

\textsuperscript{23} Santos, “Value of Travel Time Savings Perspective,” 22.

\textsuperscript{24} Harsman, “Political and Public Acceptability of Congestion Pricing,” 855.

\textsuperscript{25} Historical Rate Table utilized for conversion from www.xe.com

\textsuperscript{26} Leape, “The London Congestion Charge,” 159.

The cordon area initially covered 21 square kilometers (8 square miles) which is roughly 1.3% of Greater London, but in 2007 a westward expansion was made to include Kensington and Chelsea, enlarging the cordon zone to 39 square kilometers (15 square miles). Other revisions since inception include discounts to annual and monthly payments, inclusion of neighborhoods on buffer areas outside of the zone to receive the 90% resident discount, more stringent regulations for the low emission vehicle discount, and free corridors added during the western extension where it was determined the traffic did not greatly contribute to congestion when traveling through a specific segment.

On Christmas Eve in 2010 the Western Extension Zone was removed from the congestion charging zone, after only three years in operation. The Mayor of London at the time, Boris Johnson, said of the removal, “It is essential that the Congestion Charge is made fairer and more effective, but also that it continues to do what it says...and remains a deterrent to all but essential journeys into the heart of the Capital.” At this time, the Alternative Fuel Discount also ended, and a Greener Vehicle Discount was used in its place. The Greener Vehicle Discount was created as newer automotive technology emerged in the

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29 Ibid., 183.
30 Ibid., 181.
31 Ibid., 182.
32 Ibid., 182-183.
form of electric and hybrid electric plug-in vehicles, or vehicles emitting 100g/km of CO2 or less.\textsuperscript{33}

\textbf{Figure 1: 2016 Map of Central London Cordon Zone}

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\includegraphics[width=\textwidth]{2016_map_of_central_london_cordon_zone}
\caption{2016 Map of Central London Cordon Zone}
\end{figure}

Source: Transport for London.

The immediate effects of the London congestion charge exceeded the projected expectations. In 2005, two years after implementation, Leape’s study shows numerous improvements, including a 30% overall reduction in congestion delays within the charging zone and a 17% higher average traffic speed. The reduction is partly due to commuters selecting alternate modes of transportation, changing trip times to before or after the charge, diverting routes to outside the cordon, and canceling trips altogether.\textsuperscript{34} The implementation of the cordon zone charge has ultimately affected the choices people make on their commuting habits. Also impressive is the shift in the composition of traffic to 1/3

\textsuperscript{34} Leape, “The London Congestion Charge,” 166.
fewer total private cars, 28% more bicycles, 22% increase in taxis, and a 21% increase in bus presence within the zone.\textsuperscript{35}

The long term effects of the cordon zone charge are mixed. Transport for London’s (TfL) 2012 report indicates a 13% increase in trips taken in 2011 compared to 2000; their response was that had all things remained unchanged prior to the cordon zone charge, there would be an estimated 1.5 million additional car trips per day in 2011.\textsuperscript{36} TfL released Report 8 in 2015 which indicates an overall 3.1% decline in traffic volumes from 2008-2014, but has started to rise in 2014 by 3.4% from the previous year. TfL alludes to an increase in population beyond the census predictions, as well as economic growth post-recession, for the reasoning behind heightened traffic volumes.\textsuperscript{37}

While the long term improvement in congestion is questionable, it is apparent that London has strengthened its public transport system and walking and biking infrastructure. The net revenues from the congestion charge (about half of the gross revenue, the other half funds the operational cost) mainly funds bus network operations, with a smaller share distributed to roads and bridges, road safety, walking and cycling, and distribution of freight.\textsuperscript{38} Over the last fifteen years, London’s residents have shifted the mode share away

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\textsuperscript{35} Ibid., 165.


\textsuperscript{38} Santos, “London Congestion Charging,” 186.
\end{flushleft}
from the personal vehicle by 11%, a feat unprecedented in any major city. Each year has been consistent in the mode shift increment to public transportation, walking, and cycling; even as road traffic levels grow, the car mode share continues to decrease. 39

The politics surrounding the London cordon zone charge is an aspect that is often cited in literature, as the implementation of the toll was partly the result of a significant election. After the Greater London Authority Act in 1999 granted the mayor powers to implement road user charges, Ken Livingstone was elected the first Mayor of London in 2000, and a major element of his platform was the commitment to introduce congestion charging. With several studies by the Department of Transport’s London Congestion Charging Research Program already completed in the 1990s and reviewed by the Review of Charging Options for London working group, popular support followed after a crucial 18-month public consultation process.40 The system was designed and managed by TfL, with a board whose members are appointed by the mayor, who also serves as chairman of the board.41

The conditions in London prior to the cordon toll assisted in the political and public accessibility piece. Public transit quality and usage rates were high, five years of technical analysis had been completed, and laws were in place prior to implementation.42 The city


42 Ibid., 177.
experienced very slow average traffic speeds; average speeds for trips across London in the early 1900s, before the car was introduced, were higher than that of 2002 when the average speed was just 8.6 miles per hour.\textsuperscript{43} In this respect, Washington is partially well-placed for traffic congestion pricing; average traffic speeds during rush hours are low as DC’s weekday population swells by 79%, the largest surge of commuters in the nation,\textsuperscript{44} and there has been extensive analysis on alternate traffic congestion reduction measures. However, the District is lacking reliable public transit as WMATA continues to experience lower ridership numbers and lower customer satisfaction ratings for Metrorail service, with reliability alone accounting for 30% of a customer’s dissatisfaction.\textsuperscript{45}

\textbf{Stockholm}

“In Sweden infrastructure charges can only be [applied to] a newly built bridge, tunnel or mountain pass, for example, in order to cover the construction costs. If the bridge, tunnel or mountain pass has already been built using public money, under Swedish law no charges may be introduced at a later date. Infrastructure charges are justified by the fact that the people who use the infrastructure are paying for it. If the aim is to reduce congestion in Sweden’s city areas, a congestion tax is used instead. Congestion taxes are

\begin{itemize}
\item \textsuperscript{43} Leape, “The London Congestion Charge,” 157.
\item \textsuperscript{44} DDOT, "moveDC Vehicle Element" 32.
\item \textsuperscript{45} Washington Metropolitan Area Transit Authority, “Improving Customer Service,” (December 3, 2015) 38.
\end{itemize}
justified by the fact that the people who are contributing towards congestion and environmental problems are paying for the costs to society this causes.”

The Stockholm congestion charge was permanently adapted in January 2007 after a seven-month trial. It is the third congestion charge (excluding Norwegian tolls, whose goal was not congestion management, but for finance) to be implemented, and is different from London in that it is a cordon charge rather than zone or area license scheme, and the payment varies depending on the time of day. As of a 2010 study, traffic was reduced both surrounding and within the cordon, average speeds increased, and public transportation usage increased. The original cordon charging area had 18 access points and was 30 square kilometers (11.5 square miles), but as of January 2016, the area has 26 control points and has extended to Essingeleden. The charge has increased to a maximum of SEK 105.00 (~USD 17.75) per day per vehicle, which would require crossing the cordon multiple times throughout a 24-hour period. The highest single amount to enter or exit the city at

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one time is SEK 35.00 (~USD 4.10) during morning and evening rush hours, 7:30 AM to 8:29 AM, and 4:00 PM to 5:29 PM. No payment is required from 6:30 PM to 6:29 AM.\textsuperscript{49}

The Swedish Transport Administration is responsible for the system, and the scope and design of the tax are decided by the Swedish Parliament. The technology for enforcing and collecting the tax is similar to that of London; vehicle license plate numbers are automatically identified when captured by camera via optical character recognition after crossing one of the 26 control points. Photos are sent to the Swedish Transport Agency and the registered owner of the vehicle is issued a bill at the end of each month. EPASS24 is the partner company that issues invoices for foreign registered vehicles.\textsuperscript{50}

\textsuperscript{49} Transport Styrelsen, “Congestion Taxes in Stockholm and Gothenburg.”

\textsuperscript{50} EPASS24, “Swedish Road Tolls” 2016, www.epass24.com
A significant aspect of the Stockholm cordon congestion charge is that the city enacted a seven-month trial period before permanently adapting the scheme. During this trial, they were able to monitor the resulting change in traffic while allowing the public to experience the impacts firsthand. The number of trips during the trial period declined by 20%. While it was expected that the number of trips surrounding the charging period would
increase, it actually decreased by 5.3%; this was partially attributed to the fuel price increase during the period.\textsuperscript{51} After the trial, the system of tolls was approved by a majority of voters in a local electorate, making Stockholm the only city in which congestion pricing has been adopted by a vote.\textsuperscript{52} Public support prior to the trial was less than 30%, which climbed to over 50% at the tail end of the trial, and nearly 70% during the reintroduction period after the trial.\textsuperscript{53} The toll from the trial resulted in at least a perceived, visible reduction of congestion and changed the opinions of the residents.\textsuperscript{54}

The City of Stockholm stated that the goals for the cordon charge were to “reduce congestion, increase accessibility, and improve the environment.” A 2009 report on the trial explains that the effects on congestion reduction were larger than expected, also with economic and environmental improvements made to the entire region, not just limited to the zone and close peripheral area.\textsuperscript{55} A 2012 study reviewing the congestion charge five years after implementation shows that the immediate effects were substantial, and while these effects lessen over time, they still persist in the long term as well. The graph below


\textsuperscript{52} Harsman, “Political and Public Acceptability of Congestion Pricing,” 856.

\textsuperscript{53} Vonk Noordegraaf, “Policy Implementation Lessons from Six Road Pricing Cases,” 178.


shows that the number of vehicles crossing the cordon in 2005, prior to the charge, was much higher than in 2006 when the trial period began, which is expected. The 2011 data is only slightly higher than the trial period, emphasizing the fact that the effects of the toll have held steady for five years.\textsuperscript{56}

**Figure 4: Stockholm Average Number of Passengers Across Cordon 2005-2011**

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\includegraphics[width=\textwidth]{figure4.png}
\caption{Stockholm Average Number of Passengers Across Cordon 2005-2011}
\end{figure}


**New York City**

An area-wide congestion pricing scheme for New York City was proposed in 2007 as part of Mayor Bloomberg’s sustainability plan. The plan was hotly debated for a year, at

which point both sides agreed that goals of congestion reduction, cleaner air and mass
transit improvements, needed to be achieved. Polls showed residents were in favor, and a
version of the plan was backed by City Council members, but as the New York State
Assembly failed to act on the plan, Legislature was not able to adopt the plan by the federal
funding deadline in 2008.57

The basic elements for the broad environmental agenda of PlaNYC30 included a USD
8.00 charge per day for passenger vehicles entering Manhattan south of 86th Street,
Monday through Friday from 6:00 AM until 6:00 PM. There would be a 50% discount for
passenger vehicles driving only within the zone, and a significantly higher fee for trucks,
USD 21.00 per day traveling into the zone, with a larger reduction of about 75% for trucks
driving only within the zone.58 The proposed zone was roughly the size of London’s original
cordon zone, about 10 km by 3.5 km.59

57 Bruce Schaller, “New York City’s Congestion Pricing Experience and Implications
for Road Pricing Acceptance in the United States,” Transport Policy 17, no. 4 (August 2010):
266.

58 Peters, “Results Not Guaranteed,” 126.

59 Ibid., 127.
PlaNYC30 detailed that toll would not apply to the peripheral of Manhattan; there would be no charge for driving on: West Street and West Side Highway, FDR Drive, Battery Park Underpass, Queensboro, Williamsburg, Manhattan and Brooklyn bridges, as pictured below. Tolls would be collected using technology already in place, E-ZPass. The plan
indicates that the three-year trial period would be conducted with very little City and State funds, mainly leveraging Federal and private dollars.⁶⁰

Figure 6: Map of New York City Proposed Congestion Charge Zone

A major element to New York’s congestion pricing scheme failure was political. Before Mayor Bloomberg’s proposal in 2007, there were several ongoing developments within and outside City government; congestion charging was first brought up by transit rider, pedestrian, and bicyclist advocacy groups that were concerned with the city’s

continuing transportation needs, the same groups that had successfully campaigned in the 1980s for major capital investments in the region’s transportation system. The groups were joined by business and environmental groups, prominently The Partnership for New York City, which represents large businesses in the city, as well as university-based research centers, and elected officials. By producing a series of reports that analyzed alternative pricing schemes, discussed technical feasibility, showed strong voter support, and identified barriers to gaining public acceptance, this collective helped lay the groundwork for what would be the City’s development of the Mayor’s proposal.61

A group of civic, business, and labor organizations opposed to the plan formed the coalition “Keep NYC Congestion Tax Free”. This coalition mainly represented Manhattan’s outer boroughs; Queens, Brooklyn, The Bronx, and Staten Island. The group argued that the congestion charge was a regressive tax that would most negatively affect lower and middle income earning residents, only benefitting affluent Manhattanites. They developed an alternative plan in which the city would still be eligible to receive the Federal grant money. The plan focused on value pricing on parking in Midtown and Lower Manhattan, reforming the system for issuing parking placards to City employees and encouraging them to utilize mass transit, expanding the number of taxi stands to reduce time spent “cruising for

passengers,” increasing fines for parking violations, implementing variable pricing on existing tolled crossings, and adjusting traffic signals to become more efficient.62

While the document is persuasive, it lacks citations for much of the data and does not explain how revenues were calculated. Considering the fundamental theory that those who use the roads should pay for them, Keep NYC Congestion Tax Free should reflect on the fact that about 23% of Brooklynnites commute via personal vehicle compared to 8% of Manhattanites, while roughly the same percentage in both areas use public transit.63 It is also interesting that the document commends Bruce Schaller at several points, who claims in his Transport Policy journal article, “While congestion pricing generated strong feelings both in favor and against, overall press and public reaction was surprisingly positive.”64

The politicians of the outer boroughs embodied the dissatisfaction of their constituents by strongly opposing the mayor’s plan65; however, the plan successfully coursed through several milestones before reaching its ultimate demise at the final phase. First, Bloomberg’s plan was introduced to the State Legislature in summer 2007, where they decided to create a Traffic Congestion Mitigation Commission, comprised of members appointed by the Governor, Mayor, heads of majority and minority conferences in each


63 Peters, “Results Not Guaranteed,” 120.


house of the Legislature, and the City Council speaker. The Commission was tasked with evaluating different pricing and non-pricing approaches to traffic congestion, and to deliver their recommendations to the State Legislature by the end of January 2008. Second, the City and Metropolitan Transportation Authority (MTA) secured a $354 million Federal grant from the US Department of Transportation (DOT), conditional upon the State Legislature’s approval of the plan by April 2008. Third, the Commission held several public hearings on the plan and alternatives, and leveraged staff support from the city and state DOT, MTA, Port Authority of New York and New Jersey to consider alternatives.\(^{66}\)

The Commission recommended a modified version of Bloomberg’s original plan, based on public input, which reduced the size of the charging area, collected fees for only in-bound travel, replaced the intra-zonal fee with taxes on Manhattan garage parking and taxi trips, and added a $1 surcharge for cash payments. The modified plan focused on pricing trips that were responsible for the most severe congestion and had the best transit alternatives. It would reduce vehicle miles traveled (VMT) by 6.8%, motorists would experience 30% less time in gridlock within the pricing zone and 20% less in adjacent areas, and the $491 million projected net revenues would be committed to transit enhancements. The new plan was adopted by the Commission by a 13-2 vote, with the opposition votes cast by members appointed by New York State Assembly Speaker Sheldon Silver, whose

significance will be discussed later.\textsuperscript{67} City Council then supported the plan by a 30-20 vote, and the last and final step was the State Legislature vote in Albany.

As the State Senate was Republican-controlled, Bloomberg’s plan was thought to be approved if it came to a vote. The Assembly Speaker, Silver, left the Democratic conference to decide if the bill would be voted upon. Assembly Democrats blocked the vote, the federal funding deadline passed, and the proposal died.\textsuperscript{68} The mayor was angry that elected officials refused to vote, and Silver responded that the congestion pricing bill was not even close to a majority of the Democratic conference during the closed-door meeting where no formal vote was taken. The Senate majority leader pushed for a floor vote, but Senate Democrats refused to take the floor.

Partly to blame for the plan’s failure was thought to be personal; Silver and Bloomberg had a tumultuous past. Silver had blocked legislation on another of Bloomberg’s plans in 2005, and particularly in the media, has been accredited as responsible for the 2008 congestion charging plan failure. Democrats in the Legislature took a personal disliking to Bloomberg, saying his demeanor was condescending, and his detachment from traditional politicking doomed the plan, one Assemblyman saying “It really doesn’t work up here, and it didn’t help at all,” another saying, “The word ‘elitist’ came up a number of times.”\textsuperscript{69}

Eight years after Mayor Bloomberg’s PlaNYC30 failed, congestion charging has reemerged. Move NY Fair Plan is the current bill proposal from the Democratic Assembly

\textsuperscript{67} Ibid., 268.
\textsuperscript{68} Ibid., 269.
\textsuperscript{69} Confessore, “$8 Fee for Manhattan Gets Nowhere,” \textit{The New York Times}. 
that has far more political backing than previous efforts.\textsuperscript{70} The plan will implement tolling on bridges spanning the East River that are currently non-tolled, and will reduce the current fare for bridges spanning the Hudson. Vehicles entering Manhattan from 60\textsuperscript{th} Street will also be charged, similarly to the revision made to Bloomberg’s plan. The baseline toll would be equal to the current cost to enter the Brooklyn Battery Tunnel and Queens Midtown Tunnel under the East River, with peak/off-peak pricing from there. The bill would grant the Triborough Bridge and Tunnel Authority jurisdiction to adjust the tolls to mitigate congestion.\textsuperscript{71} Taxis and ride sharing services, like Uber and Lyft, would be charged a per mile fee for entering central business district. Additionally, the plan has proposals to convert existing train tracks into a new light rail line connecting the Bronx, Queens and Brooklyn, connecting several underserved neighborhoods throughout the 24-mile line.\textsuperscript{72}

\begin{flushright}


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Part of the reason this plan may be successful is due to New York’s aging subway experiencing a significant increase in delays since 2012, and the plan takes the outer boroughs into account promising tangible, new and improved transit. The bill has support
from five Assembly members from Brooklyn, four from the Bronx, four from Manhattan, and one from Queens, which is more outer borough support than Mayor Bloomberg’s earlier effort. Governor Cuomo has been vocal about his support of the MoveNY Fair Plan, which will be essential to pass the bill through the State Legislature.

San Francisco

San Francisco appears to be the US city on the leading edge of traffic congestion pricing mechanisms, with two techniques already implemented: demand-based parking in the downtown area and variable priced bridge tolls on the San Francisco-Oakland Bay Bridge. There is also a plan for cordon charging to enter the central business district, and the study was funded through the Federal Highway Administration’s (FHWA) Value Pricing Pilot Program. As the cordon charge has been put on hold, San Francisco focuses on transportation demand management techniques in its most recent transportation and mobility plan.

*SFPark* uses demand-responsive pricing to open up parking spaces on each block and reduce circling and double-parking. Rates may vary by block, time of day and day of week. Rates will be adjusted by no more than 50 cents per hour down or 25 cents per hour up,

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and no more often than once per month.” San Francisco first piloted the demand-responsive parking pricing zones in 2011, also funded with FHWA’s Value Pricing Pilot Program. After the pilot ended in 2013, SFPark’s evaluation showed positive results and the system was permanently adopted; however, there are limitations, understandably political, that keep the meters from being truly demand-responsive. This will be further discussed in the critiques section.

SFPark’s system is administered by the San Francisco Municipal Transportation Agency (SFMTA) and uses thousands of smart meters, payable by phone or credit card in addition to cash, and sensors in the pavement that collect occupancy data and communicate it regularly to data management systems. The pilot used areas that were both treated (subject to price adjustments) and controlled (did not change existing meter price). The program’s slogan was “Circle Less, Live More,” as it aimed to reduce congestion caused by cruising for parking, and sought to achieve an efficient level of occupancy using the proper price adjustments.76

During the pilot, price adjustments were made on a monthly basis when the average occupancy during a time band exceeded 80% or fell below 60%, but could only increase 25 cents per month, decrease up to 50 cents (if average occupancy fell below 30%), and had a

75 SFPark, “How It Works” 2016.

minimum of 25 cents per hour and a maximum constraint of $6 per hour.\textsuperscript{77} Using the small increments, trial-and-error aims to create prices that vary by time and location to produce an average occupancy rate of 60-80%.\textsuperscript{78} These criteria also apply to the way SFPark is managed today. There were 256 blocks eligible for rate changes during the pilot, of which only nine had reached the $6 per hour cap, and 179 were at the 25 cent minimum by the 10\textsuperscript{th} rate adjustment in April 2013.\textsuperscript{79} Prior to the pilot, all blocks in the same zone were a flat rate of $3 per hour. During spring 2012 of the evaluation period, prices on almost every block had declined during the morning time band, slightly increased during mid-day/afternoon, and were lower than mid-day prices during the last time band (after 3 pm) but higher than the prices of the morning time band.\textsuperscript{80}

Variable-priced bridge tolling on the San Francisco-Oakland Bay Bridge began in July 2010, and was primarily to finance seismic retro-fitting and maintenance, but it does vary in price according to time of day. The toll does not change based on real-time demand, rather, on conventional rush hour/peak driving times. Prior to implementation, it was a $4 flat fee to cross the bridge; the rush hour price is now $6, $2.50 for carpools, $4 for off-peak hours.

\textsuperscript{77} Ibid., 79.

\textsuperscript{78} Gregory Pierce and Donald Shoup, “Getting the Prices Right: An Evaluation of Pricing Parking by Demand in San Francisco” \textit{Journal of the American Planning Association} 79, no. 1 (January 2013): 69.

\textsuperscript{79} Millard-Ball, Weinberger and Hampshire, “Is the Curb 80% Full or 20% Empty? Assessing the Impacts of San Francisco’s Parking Pricing Experiment” 79.

\textsuperscript{80} Pierce and Shoup “Getting the Prices Right” 69.
and no charge for carpoolers during off-peak hours.\textsuperscript{81} Previous studies for congestion pricing for the bridge had been completed in the early 1990s, but the toll increase required legislative authorization, and the legislature was skeptical about supporting any proposal perceived as a tax increase.\textsuperscript{82}

Out of the seven Bay Area Bridges, the San Francisco-Oakland Bay Bridge is the only one with the peak/off-peak variable toll; the other bridges experienced a $1 toll hike. This decision was made because the San Francisco-Oakland Bay Bridge is the most congested travel corridor in the Bay Area, and carries about 1/3 of the combined traffic of all seven bridges. Bay Area Toll Authority (BATA) administers the toll revenues collected on all of the bridges, and operates under the Metropolitan Planning Commission. BATA has the authority to adjust toll prices and also operates the electronic toll collection system, FasTrak. California Department of Transportation (Caltrans) owns, operates, and maintains the bridges.\textsuperscript{83}

There is currently limited literature analyzing the bridge toll for effectiveness on mitigating congestion; this may be due to reasons including the fact that the variable toll was only applied to one bridge crossing as opposed to the entire network, or there was little

\textsuperscript{81} Kate Foreman, “Crossing the Bridge: The Effects of Time-Varying Tolls on Curbing Congestion” \textit{Transportation Research Part A} 92 (October 2016): 79.


\textsuperscript{83} Lee and Frick, “Congestion Pricing Projects in the San Francisco Bay Area: I-680 Express Lanes and Bay Bridge Time-of-Day Pricing.”
public awareness of the project. After four public meetings were held in the affected area (Oakland, San Mateo, Concord, and San Francisco), only a total of 1,126 comments were received across a platform including public hearing comments, letters and emails, and web survey responses, with the latter method of communication holding the majority of total responses.

The findings show that the greatest impact was on carpoolers; with the change in fare from $0 to $2.50 (on all Bay bridges), this prompted some casual carpoolers to drive alone, with the perception that carpool lanes would be slower with toll equipment now installed in carpool lanes. During the first four months of the increased charge, there was a slight increase in the number of solo drivers as compared to the same time frame during the previous year, and a significant decrease in the number of carpoolers, dropping by roughly 30% across all seven bridges. Bay Area Rapid Transit (BART) experienced a 3,600 passenger increase in the westbound direction during the AM peak period in December 2010 compared to April/May 2010, prior to the toll hike. Models developed to sort out external factors, such as gas price increases and unemployment levels, indicate that the HOV toll applied to carpoolers was responsible for over half the reduction in peak period usage.

86 Ibid.
Cordon Charging was one of the elements in the San Francisco County Transportation Authority’s (SFCTA) 2010 Mobility, Access, and Pricing Study. The study was funded by FHWA’s Value Pricing Program, but the Authority had started exploring congestion pricing in 2004 following London’s 2003 implementation. The initial four design options, which included a downtown cordon, a larger northeast cordon, a gateway, and a double ring, were assessed with public input. It was decided the gateway charge would not affect driving within the city’s most congested areas, and though it would likely reduce regional trips, it would encourage more vehicle trips within the city with the excess capacity created. The double ring received far too much public and stakeholder backlash, as the costs would be higher. The downtown cordon was decidedly too small of an area to be effective, not generating enough revenue to be financially feasible, and trips would be diverted around the zone.88

Figure 7: San Francisco Initial Program Design Options

Table 1: San Francisco Initial Program Design Options

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>CHARACTERISTICS</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtown Cordon</td>
<td>Over 1.3 million daily trips to, from, and within area</td>
<td>Targets subset of congested areas</td>
<td>Greatest edge impacts (traffic diversions) among scenarios</td>
</tr>
<tr>
<td></td>
<td>Best implemented as fee on crossings</td>
<td>Zone has best transit options</td>
<td>May be difficult to understand zone boundaries</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Least financially feasible</td>
</tr>
<tr>
<td>Gateway</td>
<td>Over 4.6 millions daily trips to, from, and within the area</td>
<td>Most legible area</td>
<td>Minor, diffuse benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor, diffuse impacts</td>
<td>Least able to manage internal travel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Most difficult to deliver substantial benefits</td>
</tr>
<tr>
<td>Double Ring</td>
<td>Over 4.6 millions daily trips to, from, and within the area</td>
<td>Begins to manage internal travel</td>
<td>May be difficult to understand multiple boundaries</td>
</tr>
<tr>
<td></td>
<td>Combines fee on gateway crossings with additional fee on downtown cordon</td>
<td>Reduces issues on edges of downtown cordon</td>
<td>Higher costs</td>
</tr>
<tr>
<td>Northeast Cordon</td>
<td>About 3 million daily trips to, from, and within area</td>
<td>Targets congested areas</td>
<td>Includes some areas with fewer transit options than Downtown Cordon</td>
</tr>
<tr>
<td></td>
<td>Fee on crossings in the northeast corner of San Francisco</td>
<td>Highest congestion reduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Most manageable impacts, particularly on edges of zone</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Greatest improvement in auto and transit travel times</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highly legible boundaries</td>
<td></td>
</tr>
</tbody>
</table>


The cordon plan was aimed to be a complimentary pricing strategy in conjunction with the performance-based parking system, but made note that the cordon would be a more area-wide method of reducing congestion, whereas the parking pricing measures combat very localized congestion. The cordon would reduce single-occupancy vehicle travel during peak travel time. The proposed toll was $3 to drive in or out of the cordon only during peak congestion times, unlike London’s 6AM-6PM charging zone time span, with a

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89 Ibid., 34.
maximum charge of $6 per day. Public input had a strong preference for a flat fee versus a fluctuating rate, to limit possible confusion.\textsuperscript{90} The program would provide $60-$80 million in annual net revenue, which was promised to improve transit service,\textsuperscript{91} but the plan is not specific on the projects it would fund.

The timeline for the program included a series of focus groups and public workshops from 2007-2010, meetings with business owners and business interests in 2008, and direct outreach to stakeholder and advocacy groups.\textsuperscript{92} After receiving key feedback from all groups involved, and identifying relevant study components in response to address the concerns with proper analysis, the next steps were to complete an environmental review in 2012, and there were hopes to launch a pilot in 2015. The program lost traction as the initial strong support from the mayor turned into tepid endorsement,\textsuperscript{93} and the study indicates difficulty communicating effectively with the public, “significant challenges remain after a basic level of information is imparted. Details such as time-of-day price variation and electronic detection payment have important implications for addressing key stakeholder concerns, yet are a challenge to communicate in a straightforward fashion.”\textsuperscript{94}

\textsuperscript{90} Ibid., 19.
\textsuperscript{91} Ibid., 37.
\textsuperscript{92} Ibid., 43-46.
\textsuperscript{94} San Francisco County Transportation Authority, “San Francisco Mobility, Access, and Pricing Study,” 49.
SFCTA produced a Congestion Management Program document in 2015 that is more Transportation Demand Management (TDM) focused, with non-fee programs and policies to reduce congestion by travel behavioral changes, and such as flex-time or staggered work hours, residential outreach programs, car-sharing and bike-sharing programs, commuter benefits ordinances, and the commuter shuttles pilot program. The document only mentions the cordon charging plan at one point: “Further evaluate potential congestion pricing program for the Northeast Cordon.”

Critiques

Beginning with the first case study, London’s congestion charging zone has high operational costs due to the ANPR technology used to capture license plates and distribute tolls. With this high cost of operations, it does not seem effective to give residents a 90% discount; it should either be a lower discount, or free for those living within the zone. This is true for DC as well, the central charging area in the moveDC plan is roughly 2.5 square miles and mainly consists of commercial and government buildings. The people that live within this zone are paying a premium to reside there, perhaps choosing that location for


96 Ibid., 56.

transit access, walkability, and bike-ability. I think that a charge to enter the cordon would be more appropriate for DC than the zonal scheme, as it would be more efficient to implement a number of access points versus having multiple EZ-Pass readers throughout the city.

Washington would be well placed for a cordon charge as EZ-Pass is used in the metro area, and many cars are already equipped with the transponder; Zimbabwe reports that the District would need to become EZ-Pass members, as there are currently no EZ-Pass tolls within the District of Columbia, only in surrounding areas such as Virginia. Systems using transponders fitted to vehicles have more reliable capture rates and more cost-effective back-room operation than congestion charging systems that use other methods, such as ANPR. The cost and level of effort of becoming affiliated with EZ-Pass would be an opportunity for further research in strengthening the case for a cordon charge in Washington, DC.

One issue with the original Stockholm congestion tax was the exemption of “green vehicles” and the huge presence of company vehicles. With the introduction of the tax, many companies purchased green vehicles for their employees as a workaround to dealing with the cumbersome administrative task of handling the charge payments, and 91% of all sales of alternative fuel vehicles from 2001-2009 were company cars. Aside from the exemption of green vehicles from the cordon charge, Stockholm has many other incentives, 

\[98\] Zimbabwe, Phone Interview, August 16, 2016.

including free residential parking and no taxes levied on alternative fuels, but the spike in sales of new alternative fuel vehicles was greatest after the trial and during the permanent adaption of the congestion tax.\textsuperscript{100} A decision in fall of 2008 phased out the green car exemption over the next three years, with the exemption ending in July 2012.\textsuperscript{101}

One issue with Sfpark is that the meter pricing adjustments are not completely responsive to demand. Using real time demand pricing, since the sensors are capable, would be more effective in mitigating congestion. It would also be more effective if there was not a cap rate of $6 per hour on parking. The problem is understandably political; it would be difficult for the general public to plan trips when they are not certain what the parking will cost at their destination. A resolution to this is that the SFPark mobile application shows parking space availability and prices, allowing drivers to plan their journey ahead of time, but not all drivers have a smart phone. Overall, my critique is that adjusting the parking rate only once per month by increments of 25 cents is limiting the effectiveness of demand-based parking, and is not a considerable effort to reducing congestion.

A critique of San Francisco’s Bay Bridge toll is that the 50% increase (from $4 to $6) in the bridge fee during peak hours pales in comparison to overall journey cost, making the toll about a 2-5% increase in the total cost of driving for those coming from the suburbs. The reduced salience of the toll produces little change in the behavioral choices made

\textsuperscript{100} Borjesson, “Stockholm Congestion Charges – 5 Years On,” 7.

\textsuperscript{101} Hultkrantz, “Green Cars Sterilize Congestion Charges,” 112.
concerning travel planning, making it less effective for mitigating traffic congestion.\textsuperscript{102} In addition, survey and focus groups reacted to the toll with resigned acceptance, indicating that they had more concern over gas price increases and income security during a time when the job market was unstable.\textsuperscript{103}

Another issue with the San Francisco-Oakland Bay bridge toll is that implementing a toll on carpooling, where it was previously free, was a detriment to mitigating congestion. One problem was that the difference in cost between the cash/FasTrak toll and the carpooling toll was not significant enough for people to continue carpooling if already doing so, or switch to carpooling if previously driving alone. The 30\% reduction of carpool lane usage was during peak hours and there was a slight increase in normal lanes, meaning not all carpoolers shifted to private vehicles, but also switched to public transit or other means. Also, the installation of the toll booths in the carpool lanes, where there previously were none, may have caused perception that carpool journeys would be subject to queues and wait times.

When considering the congestion charge for DC, the number of diplomatic workers that drive into the District could claim diplomatic immunity and refuse to pay the congestion charge, the fines produced from violations, as well as parking fees and fines. This has been a problem in the past for New York City, with an estimated $16 million owed in

\textsuperscript{102} Foreman, “Crossing the Bridge,” 81.

\textsuperscript{103} Deakin, et. al., “Bay Bridge Toll Evaluation: Final Report,” ES-3
unpaid parking fines issued to diplomatic vehicles. Additionally, London has had a similar problem with foreign diplomats visiting the city; unpaid citations given to those with diplomatic immunity consist of roughly GBP $95M (USD $125M) for foregoing the congestion charge between February 2003 and July 2016. TfL’s general manager for the congestion charge responded to the issue, “We are clear that the congestion charge is a charge for a service and not a tax. This means that diplomats are not exempt from paying it. We continue to pursue all unpaid congestion charge fees and related penalty charge notices.”

Washington is home to many embassies and this could be a high cost for the District in terms of lost revenues, enforcement, and the administrative costs associated.

Throughout my research, I’ve noticed that many proponents of congestion charging are quick to point out the immediate success of London and Stockholm in reducing congestion, but do not look at long range results, or perhaps omit this point to burgeon their viewpoint. As mentioned previously, London’s congestion was reduced by 30% immediately following implementation, but the long term studies show this congestion is rising to pre-charging levels. This is not necessarily a negative result of the charge; had the charge not been implemented, traffic congestion levels would likely be much higher.

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today. The main point being that organizations bringing forth congestion charging plans should not be promising reduced congestion, but rather managing forecasted growth. It is also important to note that traffic congestion charging may not create a faster commute, but rather a more predictable commute, which Zimbabwe believes is something DC residents can get behind.

A criticism often brought up regarding congestion pricing in the form of a cordon is that retail stores within the charging area will suffer revenue losses. Most studies show that businesses remain unaffected by the charge years after implementation. Large efforts were made in Stockholm to track the effects of congestion pricing on retail sales, only to find a very weak correlation. Similar conclusions have been made in other cities that the change to retail sales is minimal or non-existent. Stores around the peripheral area may experience some loss, but on average the effect on retail in the city center is small. One argument is that even if retail within the cordon becomes unattractive, rent prices will respond and counteract any negative effect.


107 Zimbabwe, Phone Interview, August 16, 2016.

EXISTING TRAFFIC CONGESTION PRICING MECHANISMS IN THE WASHINGTON METRO AREA

The traffic congestion that the Washington metro region experiences is varied; Zimbabwe states that DDOT sees the biggest issue with moving people in and out of the downtown area during peak times, while Block says, “DC gets a bad rap for its traffic congestion, but downtown is not horrible.” He believes the real issue is the congestion on the highway system, and thinks that is where tolling would make an interesting case. He also states of the Downtown DC BID, “We’re eager to develop political momentum to make a case for system efficiency not automotive efficiency. Our goal is not to reduce congestion, but manage it. Strategies like more biking and walking.”

High Occupancy Toll (HOT) Lanes

Current traffic congestion pricing mechanisms in place in the Washington Metro Region are the I-495 and I-95 Express Lanes, or HOT Lanes, in Northern Virginia. The 95 Express Lanes are reversible, operating northbound in the morning and southbound in the evening. The pricing is dynamic, with electronic message signs indicating the pricing at the access point. Any time a pricing sign is available, a driver can choose to take the express lane or remain on regular lanes. Pricing signs along the express lanes indicate the tolls for

109 Zimbabwe, Phone Interview, August 16, 2016.

110 Block, Phone Interview, August 23, 2016.
exits farther down the express lanes, drivers can then decide if they want to pay the next
toll and continue driving in the express lane. All drivers need an E-ZPass transponder, or E-
ZPass Flex to bypass the toll when driving with three or more people in the vehicle (HOV-3).\textsuperscript{111}

Virginia recently launched a countdown to the conversion of HOV lanes to HOT lanes
on I-66. All eastbound lanes of I-66 inside of the beltway are currently HOV-2 during the
morning rush hour and westbound lanes are HOV-2 during the evening rush hour. Starting
next year, these will be converted to HOT lanes, where those driving with fewer than three
people in the vehicle will be tolled. A press release from the office of the Virginia Secretary
of Transportation indicates that tolling of this portion of I-66, between I-495 and Route 29
in Rosslyn, will enhance connectivity, move more people, support multimodal
improvements, and create more reliable trips for carpoolers, buses, and toll-paying
drivers.\textsuperscript{112} A recent Q&A article in the Washington Post in the recurring column, “Dr.
Gridlock,” understands that the HOT lanes will have longer tolling periods than the previous
HOV times, expanded to 5:30 AM to 9:30 AM and 3:00 PM to 7:00 PM, to cover the traffic
surge that currently occurs just before and after the HOV restriction period. The article also

indicates that revenues are said to be promised to finance programs that would expand carpool facilities and add commuter buses.¹¹³

Figure 8: Project Map of I-66

From personal experience driving on the express lanes in Northern Virginia, there are times when they, too, become congested. This could be due to one or more of three issues: the price is too low, the road’s capacity is too small, or the modal alternatives are

inadequate; for the Washington metro region, I believe it to be a combination of pricing and inadequate modal alternatives. Generally, in the United States, the price levels are not high enough to truly make efficient use of congestion pricing. This is typically due to political decisions; TransUrban and VDOT reached an agreement on the maximum allowable charge in order to make the pricing scheme politically acceptable. There are also more laws surrounding environmental justice and accessibility, as compared to London where the congestion charge is roughly USD 15.00. The express lanes currently range from 20 cents per mile to one dollar per mile on average during rush hour, with the possibility of higher rates during unusually heavy congestion. As far as modal alternatives, as stated previously, Metro ridership is on a downward trend since its peak ridership numbers in 2010, with customer satisfaction rates dropping as well.

Central Employment Area Cordon Plan

MoveDC is the Long Range Transportation Plan produced by the District Department of Transportation (DDOT). The plan was released in 2014, and though just one element of many in the overall vision, the cordon was the item that received immediate reaction. Sam Zimbabwe of DDOT explained that MoveDC is a long range vision plan looking 25 years ahead; it is a document updated regularly that guides transportation policy and

114 Peters, “Results Not Guaranteed,” 115.
infrastructure decisions in the District of Columbia, based on future modeling of transportation conditions considering land use. As DDOT is able to move ahead with specific items from the plan, there are more detailed studies and preparation involved, including community engagement and planning work in order to transform long term visions into reality. The cordon is certainly not part of the two-year action plan, but a future item needing further research.\textsuperscript{116}

DDOT identifies transportation problems that DC might experience with future modeling, and addresses the problems with plans to solve them in accordance with the District’s goals for sustainability and accessibility. The cordon element in MoveDC was reached after testing three scenarios: doing nothing, focusing on improving the commute into and out of downtown, and connecting neighborhoods more effectively paired with congestion charging on arterials. The result was a hybrid of managed lanes and a cordon around the central employment area/the greater central business district, which Zimbabwe discusses was difficult to determine without natural boundaries, and is more or less the historic city.

Zimbabwe states that the congestion charge for the central employment zone in Washington was thought to be “around the price of a round-trip metro fare.”\textsuperscript{117} At this time, a round-trip fare on Metrorail ranges from $3.50 to $11.80; setting the optimum price will take more analysis. Washington metro residents should be aware that DDOT does not

\textsuperscript{116} Sam Zimbabwe, Phone Interview (August 16, 2016).

\textsuperscript{117} Zimbabwe, Phone Interview, August 16, 2016.
believe the cordon charge will necessarily reduce congestion, but rather facilitate continued population growth and keep congestion from getting worse.\footnote{118} The congestion charge could potentially reduce traffic volumes, as per the London case study, but a reduction in volume does not always result in reduced traffic congestion.

One common response to the cordon charge in the District of Columbia is the belief that there is a Federal policy prohibiting DC from imposing commuter taxes on non-residents. This law is up for interpretation, and does not hold ground to eliminating the possibility of a cordon charge. It is true that the District has limitations due to the Home Rule Act, where income earned in the District cannot be taxed on non-residents. This is a concern to many District residents who pay for services used by people employed in DC but residing in other states. It also makes funding public transit more difficult; in New York City, employers pay tax per employee to fund public transportation.\footnote{119}

\footnote{118} Ibid.

\footnote{119} Ibid.
Figure 9: DDOT moveDC Map of Proposed Central Employment Area Cordon Charge

Source: DDOT moveDC Multimodal Long-Range Transportation Plan. Purple shading indicates proposed cordon charge area.
Figure 10: Additional Map View of Proposed Central Employment Area Cordon Charge

Source: DDOT moveDC Multimodal Long-Range Transportation Plan.

Multimodal Value Pricing Pilot for Metered Curbside Parking

“Because cities can charge parked cars more easily than moving cars, getting the prices right for curb parking is a cheaper version of congestion pricing for traffic.” 120

120 Pierce and Shoup, “Getting the Prices Right,” 68.
DDOT has plans for a performance-based parking pilot in the Chinatown/Penn Quarter area of downtown DC, which was supposed to begin in the summer of 2015; however, this is not the first encounter DC has had with demand-based parking. The “Performance Parking Pilot Zone Act of 2008” legislation allowed the mayor to establish a performance-based parking pilot program to manage curbside parking and reduce congestion within the established zones, which were limited to the area surrounding Nationals Stadium, Columbia Heights, and H. Street NE. The Act states that the Performance Parking Pilot Program would terminate two years after the effective date of the Act.

The Performance Parking Pilot Zone Act also indicated that revenue from parking meter adjustments, less the cost of procurement and maintenance, must be used for non-automotive transportation improvements, generally falling into the categories of mass transit enhancements, pedestrian enhancements, and bicycle enhancements.\textsuperscript{121} DDOT, in partnership with the National Capital Regional Transportation Planning Board (TPB) of the Metropolitan Washington Council of Governments (MWCOG), conducted extensive data collection on the areas to understand occupancy rates and determine performance of the spaces by block. After analyzing the data, DDOT proposed modifications for pricing the meters and usage of revenues.

The Chinatown/Penn Quarter Value Pricing Pilot for Metered Curbside Parking is different from previous efforts in that the pilot is both assessing whether price adjustment can work to manage occupancy, reduce circling for parking, and whether it can reduce the cost and improve the accuracy of occupancy data to a point where it is sustainable to manage parking with value pricing in a broader area. Sam Zimbabwe expects the parking price adjustments to begin this fall, with adjustments to pricing made quarterly thereafter. It will be the first time that metered parking will be adjusted for value pricing in the District, moving beyond data collection and analysis, and one step closer to implementation.

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122 Zimbabwe, Phone Interview (August 16, 2016).
As mentioned previously, the Chinatown/Penn Quarter Parking Pilot project timeline has been delayed. The first pricing adjustment was slated to be implemented in summer of 2015, with the comprehensive impact assessment following in fall of 2016. The first price adjustment has not yet transpired, but Zimbabwe hopes it will begin fall of 2016. Alex Block, Transportation Program Manager at the Downtown DC BID, noted during our interview that the City Council had raised parking meter rates across the city in attempt to close the
budget gap, and this affected DDOT’s preliminary studies while collecting baseline occupancy data, which may have contributed to the delay.\textsuperscript{123}

PROPOSED PRICING STRATEGIES

Preventing a Piecemeal System: A Congestion Charging Network

After analyzing case studies, both successful and unsuccessful, it seems that a combination of traffic congestion charging mechanisms might be the best option for the Washington metro area. Like the moveDC plan, a cordon charge would be one element, but in order to manage congestion there will need to be additional traffic congestion pricing measures, in conjunction with non-tolled transportation demand management strategies. DDOTs efforts with demand-responsive parking is a good first step, as are the managed lanes and express lanes in Northern Virginia; however, the addition of a central employment area cordon charge is a bold move toward a comprehensive traffic congestion mitigation system. The cordon charge would not be the end-all problem-solver, nor the final measure, but another necessary step toward achieving a less auto-dependent city.

There will certainly be political and public opposition, which is why a strong stakeholder involvement process would be essential for making these elements work together. The fact that price adjustments to DDOT’s performance-based parking pilot will only be made on a quarterly basis, whereas San Francisco adjusts prices on a monthly basis,

\textsuperscript{123} Block, Phone Interview with Alex Block: (August 2016).
is indicative of the severe political implications prohibiting the District from making more impactful adjustments. The challenge will be ensuring that traffic congestion pricing elements are part of a system-wide network, versus on a piecemeal basis.

**Stakeholder Involvement Process**

It is crucial to gain public and stakeholder acceptance in order for a cordon charging scheme to experience successful implementation. Stockholm’s congestion pricing trial period was key in gaining support for permanent adoption of the charge; the initial idea of the charge was vehemently opposed, survived a difficult and complicated political and legal process, and eventually gained support by more than 2/3 of the population. As London’s congestion charge was partly a political move and a major element of the Mayor’s platform, perhaps aiding him in securing office, there clearly was enough public support as he was elected. Part of the stakeholder involvement process is targeted communication; “knowing” the audience, and explaining how the policy or plans impact them personally.

First, public involvement should occur early and often during all phases of planning. While seemingly time consuming, it proves to save time in the long run; when the public is unaware of planning efforts and voices concerns after construction or implementation is already underway, this is even more costly and time consuming. An extensive 2013 study on public acceptability of congestion charging from MWCOG in partnership with the Brookings Institution and funded with a FHWA grant was the result of a deliberative dialogue with

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Washington metropolitan residents. The study points out that decision-makers and opinion leaders often assume that congestion charging plans will be faced with strong opposition from citizens; however, the study finds that public attitudes are much more complex.\(^{126}\)

When given three different pricing scenarios, essentially a vehicle miles traveled (VMT) fee, zone charge, and priced express lanes, the most common findings were that people were skeptical of pricing as a solution to regional transportation problems, but were more in favor of those that directly benefitted their daily lives. This is why it is important for public outreach to include explanations of the benefits such as increased choice and control in their commute, and that these benefits outweigh the cost of the congestion charge, especially since those involved in the forums were very concerned about losing options.\(^{127}\)

The study team’s response to the worries regarding losing options was to improve transit service before implementing road pricing; however, I disagree, as road pricing can be an answer to improving transit service.

A clear description of the allocation of funds to improve public transit, pedestrian and bicycle infrastructure is also effective in gaining support. Learning from the case of Bloomberg’s proposal, it is essential to include plans for areas surrounding the zone, and how people in these areas can benefit from the charge as well. Transit improvements should be made to underserved neighborhoods, and existing roadway improvements should be made to be inclusive of all modes of transportation. Aside from bike lanes and


\(^{127}\) Ibid., 9.
adequate sidewalks for pedestrians, this can include bump-outs for buses to also improve the flow of traffic, appealing to drivers as well. To appeal to long distance commuters from Maryland, Virginia, West Virginia, and possibly farther, it should be explained that a portion of the revenues will fund the maintenance of existing roadways and bridges.

Throughout the public outreach process, meetings should be held in a variety of forms to accommodate all residents; various locations that are accessible by transit, transportation should be offered to areas that are not accessible to transit, webinars for those that cannot attend in person, outreach to places of work where people may have very little opportunity to otherwise voice their concerns, as well as Town Hall meetings. There should be translators available for those who do not speak English, and sign language interpreters for the deaf community. Online polling, as well as randomly selected postal mail surveys, should also be used to collect data surrounding public opinion.

Property owners within the cordon charging area would be a large stakeholder group. Part of the Downtown DC BID’s work is communicating the city’s ideas to their Board, which is comprised of the owners of buildings that fund the BID with incremental taxes on their commercial properties. It is an opportunity for the BID to have input on decisions and work with government agencies that are responsible for implementing new policy. As there are a lot of constraints on government ability, they might not be able to communicate something that the BID can, “We can help the city develop a business case
and sell it to our Board—protected bike lanes, Bike Share, and a number of other programs,” states Block, “The BID acts as a voice for businesses.”

Freight industry would be impacted by the congestion charge and subsequently stakeholder meetings should be held with the relevant associations. Some plans for congestion charging offer discounts to truck fleets, while others charge more for freight trucks. Many countries in Europe charge additional per mile fees to freight vehicles, as they are a major cause of roadway congestion. MoveDC does not detail in its cordon element how freight industry would be handled, but I would propose a higher congestion charge for these vehicles as they create a greater impact on congestion with slower travel speeds and produce more emissions. Freight truck drivers could also benefit from congestion charging, as they are typically paid per mile, and their journey would be more reliable; however, the best scenario would be that the congestion charge changes the way freight companies operate by avoiding driving during peak hours.

Taxi, car-sharing, and on-demand car services are another stakeholder group affected by the congestion charge. London exempts taxis and private hire vehicles, while Stockholm fully enforces the charge. I believe for the District the charge should be exempt; taxis and car-sharing services are potentially reducing the number of vehicles on the road at a given time, providing transportation to those who choose not to drive a personal vehicle. Increasingly, these car services are pooling passengers and reducing vehicle miles traveled per person in this respect. Representatives from the Taxicab, Limousine and Paratransit

128 Block, Phone Interview, August 23, 2016.
Association and the Taxicab Operators Associations would need to be involved in the stakeholder involvement process, as well as companies such as Uber, Lyft, Car2Go, and ZipCar.

A trial period for the congestion charge would be the greatest way to reduce skepticism, as is evidenced in Sweden, and as found through public outreach response in MWCOG’s study. The trial would be more of a social experiment than scientific; it would likely result in perceived improvements in traffic congestion and public acceptance. Some trials only simulate payment, such as in California, and with only a sample of volunteers. I believe the District would need to start with a few thousand volunteers, some that pay and some that simulate payment to compare travel behaviors of each. A trial in which all drivers are involved would be more impactful, and would follow if the volunteer sample proved successful. The congestion charge would then need to be implemented as a temporary measure with a fixed lifespan, pending permanent implementation after evaluation of the study.

CONCLUSION

After analysis of the case studies and finding that congestion charging can be used in Washington when approached with the right framework, the point that must be stressed is that traffic congestion pricing will not make commutes shorter and faster, but rather more reliable. Congestion pricing will likely reduce commutes initially and the rates will rise over time, but at a slower pace than that of the population rates increasing, as has been the experience of London and Stockholm. Metro London’s population is roughly 14 million,
while Washington metro has about 6 million, and about 2 million in Stockholm; the improvements to congestion have been greatest in Stockholm, and this could be because it is a smaller, more manageable area. London has recently experienced rapid population growth, and as such, congestion is nearing pre-charging levels. The District is experiencing higher population growth rates in recent years and is well-placed for the congestion charge in this respect.

With a strong stakeholder involvement process, I believe a central employment area cordon charge is feasible for the District of Columbia. The benefits of congestion charging range from predictable trips for those using the roadway, improvement to public transit with revenue generated from tolling, increased ridership on public transportation, reduced single-occupancy vehicle travel, decreased emissions and particulate matter, and spearheading a bold effort in the United States to set an example for how cities can manage traffic congestion. If Washington can overcome multiple jurisdictional issues and political implications to implement the congestion charge, it will be a sign to the rest of the country that the United States is able to accommodate evolving transportation demands, which will be necessary in the near future with autonomous vehicles on the roadways.

Additionally, the revenues generated from the congestion charging scheme will enable the District to expand transportation demand management strategies such as car sharing, teleworking, variable work hours, among other programs that alleviate traffic volumes. Some cities in the US have partnered with Uber to subsidize fees for trips originating from home to a transit station, and vice versa; this would be agreeable for the Washington metropolitan area, especially during Metro’s SafeTrack program where
frequent and prolonged maintenance and repairs impact several metro stations. Uber may serve as a connector to the nearest alternate transit stop. The logistics of this program would be an opportunity for further research.

Though downtown DC is the largest employment area, the Washington metro region is becoming increasingly less monocentric. As employment increases in areas like Arlington, McLean/Tysons Corner, Bethesda, and further west to Reston, Herndon, and Ashburn, a cordon in downtown DC will not greatly impact commutes for these areas also experiencing high volumes of traffic. An appropriate measure for mitigating congestion, reducing emissions in accordance with DC’s Sustainability efforts, and improving public transit with the revenues is charging a vehicle miles traveled (VMT) fee. Throughout my research I came across a number of areas in the US that have piloted this effort, most notably Oregon and California. This would be a great opportunity for further research in reducing congestion in the Washington metro region.


Block, Alex. Transportation Program Manager of Downtown DC BID, interview by Anna Corniel. *Interview with Alex Block of the Downtown DC BID* (August 23, 2016).


Zimbabwe, Sam. Associate Director of Policy, Planning and Sustainability Administration DDOT, interview by Anna Corniel. Interview with Sam Zimbabwe of DDOT (August 16, 2016).