Mobility Pricing in Metro Vancouver: Implementing a Decongestion Charge in the Region

by

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Abstract

The first Mobility pricing strategy for Metro Vancouver is been evaluated with the purpose of reducing traffic congestion in the region, addressing gaps in funding for transportation infrastructure, and ensuring an equitable system. The Mobility Pricing Independent Commission published the Metro Vancouver Mobility Pricing Study in May 2018. This report summarizes the findings and recommendation for a mobility pricing policy in the form of a decongestion charging scheme.

To inform the next phases of the Commission’s study, and potential implementation of the decongestion charge in the region, this thesis conducts a case study analysis of the implementation of congestion charge in London, Stockholm and Edinburgh. Key implementation factors such as transportation governance, political implications, public processes and equity, are analyzed and applied to the Metro Vancouver context.

Keywords: mobility pricing, decongestion charging, Metro Vancouver, congestion charging; implementation strategy.
Dedication

To my husband, this is for you and because of you. Thank you for supporting me through this.
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The completion of this research thesis was only possible with the help and support of many individuals in my life that provided their time, understanding and care. I would like to acknowledge the support of my family, who have inspired and motivated me through all my academic and personal endeavors.

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Table of Contents

Approval ............................................................................................................................ ii
Abstract ............................................................................................................................. iii
Dedication ........................................................................................................................ iv
Acknowledgements ........................................................................................................... v
Table of Contents............................................................................................................. vi
List of Tables ................................................................................................................... viii
List of Figures .................................................................................................................. ix
List of Acronyms ............................................................................................................... x

Chapter 1. Introduction and Research Question ........................................................... 1

Chapter 2. Literature Review .......................................................................................... 6
2.1. Pricing Urban Transportation ................................................................................ 6
2.2. Prices and Travel Behavior .................................................................................... 7
2.3. Congestion Charging Literature .......................................................................... 10
2.4. Congestion Pricing Methodologies ...................................................................... 12
   Facility-based scheme ................................................................................................. 12
   Cordon-based scheme ................................................................................................ 12
   Area-based scheme .................................................................................................... 13
   Charge type and time differentiation ........................................................................ 13
   Distanced-based scheme ............................................................................................ 14
2.5. Acceptance of Congestion Pricing ........................................................................ 14
2.6. Equity and Fairness .............................................................................................. 16

Chapter 3. Methodology ............................................................................................... 20
3.1. Comparative Case Study Framework .................................................................... 20
   3.1.1. Case Study Selection .................................................................................... 21
3.2. Key Parameters for Analysis ............................................................................... 23

Chapter 4. Case Study Analysis .................................................................................... 26
4.1. London .................................................................................................................. 26
4.2. Stockholm ............................................................................................................. 35
4.3. Edinburgh ............................................................................................................. 43
4.4. Summary Analysis from Case Studies .................................................................. 49

Chapter 5. Overview of the Metro Vancouver Mobility Pricing Study ....................... 61
5.1. The Metro-Vancouver Transportation Context .................................................... 61
   5.1.1. Transit plebiscite ........................................................................................... 66
   5.1.2. Tolls in Metro Vancouver ............................................................................ 68
5.2. Travel Patterns in Metro Vancouver ..................................................................... 69
5.3. TransLink and the Mayors’ Council on Regional Transportation ....................... 71
List of Tables

Table 1. Summary of Case Studies - Key Features..............................................................49
List of Figures

Figure 1. London’s Congestion Charging Zone (Transport for London) ......................... 30
Figure 2. Stockholm Congestion Charge Map ................................................................. 38
Figure 3. Map of Proposed Congestion Charge Cordon in Edinburgh (CEC 2004b) .... 47
Figure 4. Key Regional Transit Connections (TransLink 2018) ..................................... 63
Figure 5. Mode Share by Sub-region (2011 TransLink Trip Diary Survey) .................... 71
Figure 6. Map of 10-year investments (https://tenyearvision.TransLink.ca/) ............... 74
Figure 7. Point Charge Concept (Mobility Pricing Independent Commission) ............ 80
Figure 8. Multi-zone Distance-based Charge Concept (Mobility Pricing Independent Commission) ................................................................. 81
Figure 9. Transportation Governance for London and Stockholm (Lim. 2013) ............ 91
# List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>SFU</td>
<td>Simon Fraser University</td>
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<tr>
<td>CEC</td>
<td>City of Edinburgh Council</td>
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<tr>
<td>GLA</td>
<td>Greater London Authority</td>
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<td>GVRD</td>
<td>Greater Vancouver Regional District</td>
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<td>HSMO</td>
<td>Her Majesty’s Stationary Office</td>
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<td>HST</td>
<td>Harmonized Sales Tax</td>
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<tr>
<td>MPIC</td>
<td>Mobility Pricing Independent Commission</td>
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<tr>
<td>NDP</td>
<td>New Democratic Party</td>
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<td>P3</td>
<td>Public Private Partnership</td>
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<td>ROCOL</td>
<td>Road Charging Options for London</td>
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<td>RTM</td>
<td>Regional Transportation Model</td>
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<td>SL</td>
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<td>SS</td>
<td>Stockholmm Sparvagar</td>
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<td>TfE</td>
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Chapter 1. Introduction and Research Question

The increased need in transportation funding combined with the desire to address congestion and air pollution, have refocused policy on traffic congestion and mobility pricing options on the city-regional agenda in Metro Vancouver. TransLink, the public transit authority in the south coast of British Columbia, and the Mayors’ Council announced in June of 2017 the creation of an Independent Commission to evaluate a mobility pricing scheme for the region (Mobility Pricing Independent Commission, 2018).

The first Mobility pricing strategy for Metro Vancouver is been evaluated with the purpose of reducing traffic congestion in the region, addressing funding gaps for transportation infrastructure, and ensuring an equitable system for all users. The Mobility Pricing Independent Commission published the Metro Vancouver Mobility Pricing (“MPIC”) Study in May 2018 (Mobility Pricing Independent Commission, 2018). This report summarized the findings and recommendation for a mobility pricing policy, in the form of a decongestion charging scheme. The MPIC 1 established an eight-month research and public engagement process called “It’s Time”. During this period, a team of experts engaged in extensive research on policy, best practices, and transportation modelling was conducted to determine an effective decongestion charging strategy that would remedy Metro Vancouver’s congestion issues. Together with this technical work, the It’s Time public consultation process was conducted, which focused on education and engagement with key stakeholders and government officials explored potential implementation opportunities.

Throughout this report, the terminology mobility pricing and congestion charging will be used interchangeably as congestion charges are the mobility pricing strategy used more broadly. Most of the studies found in the case studies evaluated use the term congestion charge or congestion pricing, while the Metro Vancouver MCIP report uses Mobility Pricing and more limited, decongestion charging.

Two congestion strategies were illustrated in this report that could potentially meet the MPIC objectives: a regional point charge scheme and a multi-zone distance-

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1 The Mobility Pricing Independent Commission was created to provide recommendations on how to improve the way transportation is priced in Metro Vancouver. (TransLink, 2018)
based charge. Following the public engagement component of the *It’s Time* process, the MPIC identified key principles and objectives to guide the design and next steps of the mobility strategy policy. These include: congestion, fairness, supporting investments, and other matters such as economic benefits, privacy and stability.

The report prepared by the MPIC is only part of Phase One, which is based on the feasibility review of potential mobility pricing schemes in Metro Vancouver. The principles and objectives formulated in this document, composed with the proposed schemes, will be refined as future phases of this work to provide a practical decongestion charging program. The MPIC anticipates taking another six to twelve months to evaluate more iterations of the proposed scheme concepts, conduct an affordability and equity impact assessment, and evaluate available technology that would address the distanced-based charge scheme (Mobility Pricing Independent Commission, 2018).

Metro Vancouver is not the only region confronting the challenges of population growth and congestion. Mobility pricing in the form of congestion charges have been researched, studied, and implemented in other cities and regions such as London, Stockholm, Milan, and Singapore. These cities have implemented congestion charging schemes that have resulted in reductions in traffic congestion, and greenhouse gas emissions, while providing increased funding for transportation related improvements. The congestion charging implementation process used by these cities included political debates, public scrutiny, and careful consideration of technical challenges. Lessons learned from these cases can inform and provide further insights into the potential mobility pricing reality of Metro Vancouver.

Other global cities such as New York and Edinburgh, similarly attempted to introduce mobility pricing schemes to reduce congestion, with less than favourable results. In New York, the proposed congestion pricing scheme was never implemented due to political barriers, even though this initiative received overwhelming public support from the local population. This policy initiative did not pass the approval at the State Legislature. Edinburgh also attempted to implement a congestion charge scheme to reduce traffic in congested areas. Led by the City of Edinburgh Council ("CEC"), a

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2 Decongestion charge is a form of mobility pricing that is based on a range of fees charged to use transportation services and with the goal to reduce congestion. (Itstimemv.ca)
referendum took place in February 2005 with a defeat of 74% voting against a CEC proposal for a congestion charge (Gorman et al, 2008). Details of the congestion charge scheme considered for Edinburgh are provided in Chapter 4.

This is a key and strategic time in transportation policy in Metro Vancouver: where the first Mobility Pricing Scheme is being considered in the region. The level of complexity in the proposed policy is significant, and involves several stakeholders and key actors. How feasible is it for the Region to implement such policy? How effective can this proposal be in achieving a reduction in congestion while increasing revenues and assuring equity for all residents? How successful can regional agencies be in managing any resistance from the public? This research explores key lessons from the implementation of mobility pricing schemes in other cities and applies them to the Metro Vancouver context and proposed mobility pricing policy. Implemented but also non-implemented cases were analyzed as they provide valuable information as Metro Vancouver embarks in the next steps of this policy initiative. This research project is based on addressing the following question:

*What can the Metro Vancouver Mobility Pricing Policy learn from experiences in other cities in implementing a successful mobility pricing scheme?*

As discussed in subsequent analysis chapters, case lessons from successful and failed mobility pricing efforts help inform nascent approaches such as what is being considered in Metro Vancouver. The analysis of failed cases strengthens the opportunity to learn as it provides significant information related to policy process and political challenges. Edinburgh was selected as the case study to be analyzed as a congestion charging scheme was considered, but never implemented. (See, for example, section 4.3).

The results of this research project are intended to provide recommendations to the MPIC, the Mayor’s Council, and TransLink on the next phases of Mobility Pricing Policy. As identified in the Metro Vancouver Mobility Pricing Study, the next phase of the MPIC’s work includes the assessment of affordability and equity. These are two very important objectives that influence the design of a potential charging scheme, however, metrics to measure the effectiveness the strategy in reaching these objectives have not
been considered in the next steps for the MPIC’s work. The results of this study will provide more information about the potential implementation of this strategy.

To answer the research question, a comparative case study analysis was conducted to determine the factors and key lessons from the selected cities that help determine the success or failure of the implementation of the congestion charging policy. Further details on the methodology and selection of case studies are explained in Chapter 3. The selected case studies examine the implementation of congestion charges in London, Stockholm, and Edinburgh. These three case studies were selected by considering their relevancy to the Metro Vancouver context in terms of political structure, transportation goals and conditions, and other similarities such as densification, housing, and economy.

A case study approach was selected as congestion charges have been implemented only in a few regions worldwide. Even though London and Stockholm have demonstrated the effectiveness of implementing congestion charges, other cities such as Edinburgh had failed attempts at the implementation of charges. This research is aimed to identify and compare the set of policy factors for implemented and non-implemented cases. Comparisons are essential to establish systematic similarities and differences between an observed (Berg-Schlosser, 2015), and in this case, implemented policy strategy in London and Stockholm, and lessons from failed efforts from Edinburgh.

The goal of the case study analysis is to understand the behavioral and social conditions through the actors’ perspectives. Congestion charging is very complex and due to this, a holistic and in-depth exploration is required that examines real cases through contextual analysis. Even though a case study method has demonstrated to be effective in studying social and behavioral phenomenon, there are some limitations to this approach. Some criticism to this approach is the lack of robustness as it relates to research. Whether as a single or multiple case study approach, for this study only three cases are evaluated, which might not provide enough evidence to generalize (Zainal, 2007).

Many of the research studies on this topic focus on the relationship between road pricing characteristics, welfare effects, and road pricing technologies. Literature on implementation challenges (beyond equity and acceptability) and key policy drivers is
limited. Studies found in the subject are focused on the evaluation of impacts over the implementation of congestion charges on equity and fairness. Concerns over social equity related to financial burden placed on low income drivers and people with mobility impairments who lack other transportation alternatives (Ziyuan et al, 2018, Eliasson, 2016, Kristoffersson et al, 2017). In addition, fewer papers discuss the implications of non-implemented congestion charging cases and comparisons between those implemented. By using a comparative case study analysis, this paper will also contribute to fill the gap in literature.

The key parameters evaluated in the case studies include the following:

- **Political Implications** such as climate, feasibility, and efficacy are closely related to the creation, design, and implementation of transportation policies such as decongestion charges.

- The design for the implementation of decongestion charge relies significantly on the structure and **governance for transportation** related programs. There is a significant difference in the implementation strategy which is closely related to the governance type. If multiple agencies and/or government levels are part of the governance for transportation policy, then the complexity of the policy increases.

- Public acceptance is key for the implementation of road pricing. The public engagement process for each of the case studies is reviewed to determine the extent and strategies used that helped secure public support.

- Issues related to how “fair” road pricing is, continues to be debated amongst scholars and policy makers. The most prevalent argument against congestion charging is **equity** (Eliasson, 2016). A review of how equity was addressed during the implementation (and post-implementation) of decongestion charges in the case studies is conducted in this analysis. Attention is put into the implication of equity during the creation of congestion charges as this is a focus in the proposed Metro Vancouver Mobility Pricing Scheme.
Chapter 2. Literature Review

A broad range of academic papers, journals, and articles were reviewed dating back from 1970s when congestion pricing schemes started to emerge in European cities. Research material from the early 1970s and beyond have been reviewed in detail as they provide information of the state of congestion charging prior to their implementation. Since the application of road pricing schemes is limited to cities that have implemented or considered it, the body of literature available is based on assessments conducted for case studies such as London, Stockholm, and Singapore. Papers with scientific studies were very limited as the application of this type of policy has only been conducted for a handful of cities across the world.

2.1. Pricing Urban Transportation

The purpose of costing transportation is to provide further policy direction related to the implementation, use and investments in transportation infrastructure. Currently, transportation is priced via different sources, including public and private usage, subsidies and varying levels of taxation. Fuel costs and transit fares are some of the ways transportation infrastructure is funded today. The lack of understanding and evaluation of the true cost of transportation causes a distortion of prices among all modes of transportation.

The link between the cost of transportation and cost recovery needs to be further reviewed. If the cost of transportation is calculated by measuring the total cost associated with the mode divided by the total amount of traffic volumes, this may not provide meaningful information that will help guide prices as it only provides descriptive rationale for cost. Through economies of scale, the average cost of transportation could decrease to optimal pricing (marginal costs), which would not allow for cost recoveries. In this context, marginal cost can be defined as the cost of providing for one additional trip, given that there are other users already accessing the system. In countries like Canada, where it is geographically large compared to the density in population, the Canadian transportation system would not be able to recover costs in many areas. However, where there are rising costs of transportation like dense, urbanized and
congested cities, it is possible that marginal costs would rise enough to generate revenues (Gillen et al., 2006).

Another challenge when trying to determine the cost of transportation is to measure the costs directly related to the user, such as travel time. The equivalent monetary value of the time spent while traveling could exceed the actual amount paid. The cost of congestion delays, air pollution, traffic related accidents, and greenhouse gas emissions are called external costs. These are defined as the social cost imposed on others, but not paid for by the users. On the other hand, “Internalised” costs are paid for by the user and are taken into consideration when making decisions related to the use of transportation infrastructure. Several studies have been conducted to evaluate the impacts of such costs (Zhang et al 2005, Boardman, et al 2005). Other type of externalities has been identified but less studied which include water pollution, noise, vibrations, visual intrusion, and security risks. There is significant body of literature that have focused on determining the magnitude of external costs in transportation (Zhang et al, 2005, Nash 2005, Gillen et al. 2006).

The cost imposed on users should be directly related to the cost users impose on society. Direct user fees tend to provide users with more awareness towards the travel choice the impact imposes on others such as traffic delays, GHG emissions, and others. Being aware of such factors could encourage users to change travel choices. Based on the literature review, several studies show that current transportation pricing programs to not reflect user pay the marginal cost for the use of transportation, vehicular use (Litman 2002, Delucci 1996, Caltrans 1997).

2.2. Prices and Travel Behavior

While there is evidence that transportation costs such as fuel, parking, automobile purchase, and transit prices can influence the decisions to travel, some experts argue that it is really the level of service that dictates travel behavior (Wachs, 1981). This literature review was conducted to determine whether prices have an influence on travel patterns, as this is the premise under which congestion charge is based on.
Fuel prices are mostly reflective of overall demand as well as international trade policies. A study of the comparison of fuel prices across the globe show that countries with more expensive fuel prices have much lower fuel consumption per capita than those with cheaper fuel (Shackson, 1979). This study was based on a comparison between Italy, United States, and Mexico. Italy’s fuel prices were double the price than in the United States, and their mean gasoline consumption was less than half. Similarly, Mexico’s fuel prices were about a third of the United States, and drivers consumed about one third more gasoline than in the United States. The results revealed in this study are convincing in trying to demonstrate how prices influence travel behavior.

Another study conducted by Goen and White showed that in West Germany, fuel prices as well as automobile costs were significantly more expensive than those in the United States. Fuel prices were approximately twice more expensive in Germany, and fuel consumption was less than 27% in Germany when compared to the United States. Residents in West Germany travelled 47% as many miles per capita as Americans. These results can also be attributed to the higher use of fuel efficient vehicles in West Germany (Goen and White, 1975).

Changes in fuel prices are not the only evidence of how prices influence travel behavior. Parking charges can also influence significantly travel choices. Following the work by Donald Shoup, who revolutionized the idea of parking and changed it from a rather boring subject to the urban planning problem of the century. In his 2005 book titled “The High Cost of Free Parking”, Shoup suggested parking reforms which include pricing on-street parking right to regulate on-street use, as well as increased revenues for improvements in public infrastructure. Although Shoup’s focus was on the amount of space parking occupies, its effects on overall affordability, vehicle cruising, and its connections to zoning and land use, his studies demonstrate that a change in behavior occurs when parking is priced right.

An important comparison is also to consider transit fares and travel patterns. Limited research was found regarding the direct relationship between transit fares and transit use, as an isolated relationship. Most studies are related to transit ridership elasticity and the increase in transit use due to other factors. However, one study by the American Public Transit Association demonstrated that transit use decreased when the price of transit fares increased. (American Public Transit Association, 1991). Another
study by the Transportation Research Board on transit pricing and fares showed that there is high sensitivity by travellers in response to changes in fares. This was more prominent for those that travel off-peak than those travelling during peak times (Pratt et al., 2004).

There is evidence that fuel prices, parking charges, and transit fares influence travel behavior. All those combined could have a positive impact in shaping travel behavior to get people to switch to transit and other modes. If fuel and parking prices were raised enough, and transit fares were decreased to a level where people are encouraged to take transit, then congestion would improve, and travel reliability would increase. This is ignoring the potential for induced demand caused by space available for new trips. However, this cannot be realized because the real cost and finance of transportation services are not appropriate. The cost of transportation is not assessed based on the desired demand outcome (ie. reduction of vehicular use), and also ignores external costs such as congestion delays. Setting the prices for fuel, parking, and transit are done independently and financing of these services is also done in isolation. Furthermore, these three alone do not represent the actual cost of transportation services.

Fuel costs represent only a portion of the total cost of automobile use. Fixed costs such as registration fees, insurance, maintenance, and depreciation are all part of vehicle ownership and usage cost. The high fixed costs of owning a vehicle make it attractive to use it, even when disincentives are present, such as increased fuel prices. Based on 2018 data from the BCAA, fuel was the second highest annual expense following depreciation, and it averaged to be $1,500 for a compact vehicle and routine maintenance ranged from $500 to $700. (BCAA, 2018)

Parking prices are set following different bylaws and policies set by municipalities. Typically, parking pricing regulations are determined based on a theory that relates pricing to parking supply and on-street space use. Essentially, on-street parking is priced to ensure a certain level of occupancy and reduce the need for cruising (Shoup 2006, Baldour et al 2013). Off-street parking bylaws are set by the appropriate municipality and are typically based on user demand. Residential, commercial, and office off-street parking requirements are set to meet existing user demand. There is a disconnect between parking regulations and prices to travel choice, and more specific to
vehicle use. Prices and regulations are directly related to parking demand and use, rather than travel mode.

An important consideration when thinking about pricing and travel behavior is to understand not only the relationship between them but how transportation funding is collected and invested in appropriate infrastructure. With the use of fuel taxes, parking prices, transit fares, and other pricing mechanisms, governments fund projects related to transportation services. Construction and maintenance of highways and roads, cycling facilities, and transit networks are all subsidized in part, by these type of pricing schemes. As vehicles are becoming more fuel efficient, active transportation modes are becoming more attractive, and people tend to travel less far for work and leisure, there is also less income for the government to continue to build and maintain transportation facilities (Wachs, 1981).

2.3. Congestion Charging Literature

Literature on congestion pricing started with the recognition that road charges could offer a solution for congested roads, as studied by Pigou (1920) and Knight (1924), and other researchers in the realm of economics. From a merely academic interest, the issue of congestion has grown significantly across major urban cities. Vickrey and A.A. Walters were the first ones to study and write on the issue of congestion and posed it as a problem for governments. Vickrey, a Nobel Prize winner, focused on the connection between cost and system efficiency. His first study was conducted on the New York subway. He proposed the review of the transit fare structure that would allow for an increase utilization for transit facilities (Vickrey, 1955). By increasing fare prices during peak periods, congestion would not necessarily decrease, but would be spread over a longer period. By imposing higher costs of travel during peak periods, commuters are more willing to shift their travel patterns. Thus, he brought the idea that toll charges during peak hours would help lessen congestion.

The traditional approach of dealing with growing number of vehicles was to expand the supply of roads and infrastructure (Beaty, 2010). By building new roads or expanding existing facilities, more jobs and urban centers were generated, creating a positive economic impact. However, this approach has proved to fail in urban areas. With increased supply, the demand also increases as people anticipate the supply and
more vehicles fill the new roads (Litman, 2011). Moreover, space becomes scarce, making continued expansion too costly.

Since increasing supply was no longer efficient, policymakers, and economists started to take a closer look at the demand. A different, and likely, more feasible approach is to reduce demand. A way to make vehicle use less popular, is by increasing the cost of vehicle usage. An increase in the cost of vehicle ownership, tax or road use, are ways to reduce the attractiveness of using vehicles. A similar approach is to increase the effectiveness of the alternatives, that is making transit more efficient and less costly (Deelen, 2012).

Vickrey identified the dangers of allowing roads to be perceived as “free”. He used the example of New York bridges, where new bridges were planned to be tolled to recover construction costs, while old ones remained free. He argued that the results of such policy would be that motorists would prefer using the free bridges over toll ones. Thus, causing more congestion on those bridges. Expanding road and highway infrastructure were not solutions to the congestion problem, as Vickrey pointed out in his study. By studying Washington, DC transportation policies, he estimated that for every $3,000 car added to traffic during peak times a $23,000 investment was required to offset that additional vehicle (Vickrey, 1963). To effectively determine the charge for a toll, it should be set equal or higher than the marginal (social) cost to society that a driver imposes on others. (Vickrey 1992).

A.A. Walters had similar views as Vickrey. While most economists were interested in the idea of decreasing taxes, Walters argued that the opposite would be more effective in reducing demand. Walters also argued the idea that roads were a public good. A public good should be readily available and free for use by the public. However, as it related to highways and other heavily travelled roads, any additional vehicle imposes a burden to another person driving (Walters, 1968). Both Vickrey and Walters looked at technology as a possible way to implement charges.

Since the implementation of several congestion charging schemes, social, and political considerations have prevented road charging to become widely accepted. More recent publications in congestion charging focus on political feasibility, public acceptance, and equity. These concepts are explained in more detail in later sections.
2.4. Congestion Pricing Methodologies

The terms mobility pricing and congestion pricing will be used interchangeably throughout the next sections. Mobility pricing covers a broader set of pricing policies that extend beyond traffic or vehicular congestion, however the existing mobility pricing schemes implemented and even proposed for the region are focused on congestion pricing. Pricing schemes can be categorized in many ways, the following presents them based on the scale of the scheme.

Facility-based scheme

Facility-based schemes are the most common form of congestion pricing. Tolls, placed on highways or important corridors, is a fee collected at the crossing points. Toll can be placed along the facility and cover all lanes, or selected ones such as Highly Occupied Tolled Lanes (“HOT”), or Highly Occupied Vehicle Lanes (“HOV”) can receive exemptions to the toll. These tolls can either be located at single point of entrance or throughout the facility with multiple charging points. The latter is designed to more closely relate the cost of the tolls to the length of trip or travel (De Palma and Lindsey 2011). Several highways facilities within United States and Canada include this type of pricing scheme, such as I-15 Express and the 407 in Toronto. More recently in the British Columbia, the Port Mann Bridge and the Golden Ears Bridge were priced using tolls at the bridge crossings, but charges were removed on September 1, 2017 by the newly elected Provincial Government led by Premier John Horgan.

Cordon-based scheme

A cordon is set for a specific area and charges are paid upon crossing the cordon, either on the inbound, outbound, or both directions. This scheme was successfully implemented in Stockholm and Singapore, which will be explained with more details in later sections. Other cities such as New York, Edinburgh, and Manchester also proposed this type of scheme but have been rejected. This scheme is one of the schemes proposed by the MPIC.
Area-based scheme

This area-based scheme is based on vehicles paying when entering or exiting a determined area or zone and can also include a fee to travel within the same area. Areas can be defined by natural physical barriers such as water bodies or mountains, but also by arbitrary boundaries that delineate neighbourhoods or districts. Typically, boundaries in the built environment include bridges, major roads, tunnels and others. London is the only city currently operating under an area-based scheme.

Charge type and time differentiation

Pricing can be flat or dynamic. For all the schemes presented, the charges can be flat or responsive to time of day or other conditions. Implementation of the schemes have typically been with the use of flat rates as the technology available and monitoring practices only allow for this type of pricing mechanism. However, time of day or day of week rate changes have been applied in London, US, Singapore, and Stockholm. Responsive tolls that vary in real-time have been applied only for toll type schemes in HOT lanes to increase traffic flows. Responsive tolls that are reactive to traffic conditions are widely studied and have been implemented with two conditions: Toll increases based on lane occupancy, and a self-learning technology that dynamically changes tolls based on the willingness of drivers to pay for tolls (Yin and Lou 2009). Predictive charging schemes are considered more advanced as this requires congestion forecasting models. Based on congestion and toll modelling, predictive pricing could be effective in preventing traffic flow disruptions (Dong et al. 2007).

There are other dimensions that should be considered when determining the charge, aside from time differentiation, vehicle type and weight are also important. The weight of the vehicle has an impact on the durability of the road, and is an important factor as it relates to road rehabilitation requirements. Most roads, in particular regional type connections such as highways, have specific vehicle weight and dimensions. (British Columbia Ministry of Transportation and Infrastructure, 2015). Essentially, the heavier the vehicle the road is designed for, the more expensive it is to build and maintain the facility.
Distanced-based scheme

Under this scheme, charges are directly related to the amount of distance travelled, either linear or non-linear (De Palma and Lindsey 2011). This scheme can be implemented with a combination of tolls, such as the High-Occupancy Tolled (HOT) lanes, and innovative technology such as vehicular tracking devices. This scheme is being considered by the MPIC as a possible solution to congestion in Metro Vancouver. Further details on the proposal are included in Chapter 5.

2.5. Acceptance of Congestion Pricing

Public acceptance plays a key role in the implementation of congestion pricing. Acceptability or acceptance is defined as the public opinion towards congestion charging. The literature review demonstrates that low public acceptance is the most significant barrier to the implementation of congestion pricing. Congestion charges have been successfully implemented in several cities including Singapore, London, Hong Kong, Stockholm, and Milan. However, attempts in several cities such as New York, Copenhagen, Manchester, and Edinburgh have failed. In most of the cases, studies point that “lack of public support and political courage” are the main barriers in the implementation of this type of strategy (Garling and Schuitema, 2007).

Most of the studies conducted in implemented and non-implemented cases point to the importance of the level of information given to users related to the scheme and impacts, as well as the direct benefits and use of toll revenues (Grisolia et al, 2015). For cases where a trial was implemented, the user familiarity to the scheme and experience was helpful in implementation of a permanent congestion charging scheme (Schuitema et al 2010, Eliasson and Jonsson, 2011).

Based on study of over 20 papers on congestion pricing acceptance and key factors, general opposition was found due to the lack of trust in the way the toll revenues would be used (Kim et al, 2013). Lack of public knowledge of the impacts of a congestion pricing is another important barrier as it related to acceptability. Providing appropriate public information is important, which includes marketing efforts related to the benefits (Cools et al. 2011). As part of this, the scheme needs to be properly
explained to the public, key players are required, such as news media to emphasize the benefits of this type of policy (Grisolia et al. 2015).

Acceptability was also found to increase when there is general awareness of the negative effects of vehicular use. The more the public is aware and agrees with the adverse effects of congestion and increased vehicle use, the higher the acceptability when a congestion charging scheme is proposed (Jones, 2003, Schade and Schlag 2003, Steg, 2003). In addition, the study suggests that the policy outcome is also influenced by the extent to which the public is aware of the transportation-related problems the charge is addressing (Nilsson et al, 2016). If the public is aware of the transportation problems, then they are more likely to believe the charge will fix those problems.

Public attitudes towards congestion charging is closely related to the characteristics of each of the public groups. In other words, residents in car-dependent areas will be less likely to understand the benefits of a charging scheme, than those that live in congested and dense areas. Similarly, groups that affiliate themselves over the protection of the environment are more likely to support congestion charging scheme, than those that do not consider the environment as a factor (Jaensirisak et al. 2009). The public will evaluate the charging scheme based on their own values.

Public acceptability is also linked to the charge amount, period, and area of charge. An appropriate fee or charge should be considered that covers times of the day that are tightly related to congestion.

Studies also show that public acceptance increase when the scheme is delivered as a package and includes information such as revenue use and measurable benefits. Providing benefit information that is not only for everyone (i.e. Travel time saving) but for the collective improves the public perspective. The level of acceptability increases by informing the public on how the charge will improve public transportation and the environment and will be equitable for all (Schuitema et al. 2001). Public and political approval relies significantly on proving the congestion program is equitable. This factor is explained in more detail in the following section.

Attitudes towards congestion pricing change over time. Studies conducted for several cities that introduced congestion charging but also other pricing mechanisms
such as toll rings, show that support increased after the implementation of the charge (Schuitema et al. 2009). In London, Stockholm, and Milan, positive attitudes developed post-implementation. (Ziyuan et al, 2018) There seems to be a general tendency to increase acceptance once positive effects are perceived, both individually and collectively.

The recent transit plebiscite that took place in Metro Vancouver in 2015 sheds some light to the public attitudes towards a fee increase for the use of transportation services. Public acceptability for the transit plebiscite in the region was challenged by other factors such as, a battle against taxes, and lack of trust on the operations of the transit authority. Details on this and its connections to the potential charging scheme are explained in later sections.

2.6. Equity and Fairness

When it relates to congestion pricing, most debates revolve around financial impacts and equity. However, equity is defined in many ways depending on the different interests at different times. Transportation equity can be considered in two different ways: transportation as an end or to an end (Taylor, 2010). Transportation to an end looks at transportation to get to activities that are non-transportation related. Therefore, transportation is not really used for mere enjoyment or use for it, but rather the need to get from point A to point B and elsewhere. Transportation is used for people to get to work, to school, to shopping stores, and for recreational activities. This is the way most transportation experts consider transportation.

Policy makers, politicians, and transportation professionals understand the important link transportation provides to employment, education, health care, cultural practices, and others. Transportation relates to the level of accessibility society has to diverse activities, essential, and non-essential. Public investment in transportation infrastructure should consider the need to provide basic access and mobility for all residents.

Studies on equity are very extensive, for this study, the literature review around equity was framed in the context of transportation finance. Equity can be defined in two dimensions: Horizontal and vertical equity. Horizontal equity relates to the price impacts
on each member of the same group in relation to one another. For example, horizontal equity is represented when all members of the same income class pay the same fares. Vertical equity considers the impacts of prices on members of different groups in relation to one another. An example of the application of vertical equity is when prices are set based on income levels, or when subsidies are provided to lower income groups (Taylor, 2010).

Transportation funding programs and initiatives are generally focused on revenue generation, influence travel behavior, and/or income redistribution. Congestion pricing has traditionally been implemented to substantially reduce and manage traffic congestion (Small, Winston & Evans, 1989). Funding for transportation programs have also been accessed via non-transportation methods, such as sales tax. However, policy makers argue that by de-coupling user consumption and price paid, a change in travel behavior is not encouraged (Taylor, 2010).

As it relates to transportation prices and vertical equity, a significant body of literature suggests that lower income population is more likely to be influenced by changing prices, increasing fares, tolls than higher income groups (Harvey 1994, Richardson & Rae 1998, Santos & Roley 2004). Which might imply that a congestion charge will negatively impact these groups. However, studies also suggest that higher income groups are the more likely to drive for longer distances during peak hours of traffic, which implies that this group might be the most impacted by pricing policies such as congestion pricing (Schweitzer & Taylor 2008).

Equity in transportation finance has not been properly defined. Different studies frame equity in many ways and with different evaluation approaches. To complicate matters, there is no standard metrics set for which equity can be measured. Whether it is measured by kilometres travelled, or mode access, or fare price, all these factors yield to varying results. Beyond vertical and horizontal equity, which are not enough to define all dimensions of transportation finances, the literature suggests that equity can be applied to the different players and actors. Accordingly, equity can be applied to individuals, groups, and jurisdictions. Transportation scholars tend to focus on individual equity, advocates and activists on group equity, and politicians in geographic equity (Taylor, 2010). Geographic equity relates to the jurisdictional focus of the governmental structure within the region. Politicians are elected based on their spatial jurisdiction and
with the mandate to represent their constituents. Hence, transportation finance equity needs to also look at the geographic equity dimension.

The distribution of transportation funding within the different levels of governments are very related to geographic equity. Federal funding allocation into state or provincial levels and beyond, follows a geographic redistribution and debate around geographic equity. For example, the redistribution of fuel taxes among states or municipalities is carefully considered to understand the basis for the distribution. How much do revenue making states / municipalities get compared to those that are merely consumer states / municipalities?

Several studies challenge the way transportation investment is distributed. Current transportation investment distributions favour suburbs more than urbanized centres (Chen 1994, Bullard, Johnson and Torres 2004). The distribution of investments is disproportionate to areas where there is less transportation infrastructure and overall revenues. This is also a representation of the political influence over geographic equity. Transit systems and fares are another example. Transit ridership is highest in the most dense and urbanized areas yet debates around transit investment is focused on less serviced areas, which account for very little ridership (Taylor, 2010). The counter argument to that is that ridership is low because services are not provided. Nevertheless, the conversations on geographic equity occur for this case since politicians are represented based on geographical distributions. Under this condition, transit and transportation investment is distributed “equally” among geographic areas, ignoring ridership, usage or revenues.

From the perspective of the citizens, equity and fairness are also viewed in different ways. Significant debates revolve around the perceived fairness of congestion pricing from the consumer as well as from the citizen’s perspectives. The literature defines consumer perspective as the assessment of how the charge affects the person, i.e. How much to pay, whereas the citizen perspective focuses on how the citizen assesses the fairness of the charge, disregarding self-interest. It can be difficult to determine the latter given that assessments of fairness are tight to one’s experience and impacts, however there is evidence that people’s choices and opinions are affected by more than just self-interest. Concerns over the environment and equity can also influence people’s opinions (Eliasson, 2016).
From the consumer’s perspective, fairness in congestion pricing can be assessed by determining the amount paid, time savings, and overall benefits from the revenues. These factors can be measured and there are studies that have attempted to capture these metrics (Eliasson and Mattsson 2006, Levinson 2010). There are four parts to congestion pricing, these include charges, cost adaptation, travel time, and benefits from revenues. From the citizen’s perspective, it is more difficult to assess the level of fairness given that the concept of equity here is more abstract. By removing the impact on self-interest, the factors that influence citizen perspective include equity and justice, human rights, equality and other social objectives. Added to this is the sense that equity within these factors will also vary depending on the different groups, specifically low versus high income groups (Eliasson 2016).

The topic of equity and fairness in transportation policies in the region have recently been challenged by the elimination of the tolls in two bridges, the Port Mann and Golden Ears bridges. Premier Horgan removed the tolls citing it as “unfair for those living south of the Fraser”, which provides context to the discussion of fairness and equity for transportation in the Region. Later sections describe with more detail the impacts and considerations for equity and fairness in a potential congestion charging scheme in Metro Vancouver.
Chapter 3. Methodology

3.1. Comparative Case Study Framework

The analytical framework selected for this thesis is a comparative case study analysis to establish patterns in similarities and differences for the case studies evaluated. In science, comparisons are used to determine systematic factors that explain and predict a phenomenon. The framework is based on matching and contrasting cases to establish common relationships and eliminating factors that do not represent causality (Berg-Schlosser, 2015). Causality relationships can help make predictions and affect the outcome. Knowing about causality can be useful for social science researchers because it allows predicting events and making it possible to act to affect the future (Brady, 2013).

Case study research allows for the evaluation of expected patterns or past studies of complex phenomena. In social sciences, this approach is widely used as it goes beyond quantitative evaluation and provides for a holistic and in-depth evaluation of behavioral or social issues. Literature on this research methodology show uses in the fields of sociology (Grassel & Schirmer, 2006), but also in government, in cases where government policies or initiatives were effective in addressing the goals of the policy (Zainal Z., June 2007). Since this research is related to congestion charging, which is a program implemented by the government and presents a series of social and behavioral responses by the citizens, then it was deemed appropriate to use case studies as the methodology.

Another advantage of the selected methodology is the ability to examine data that is very specific to the context. In the case of congestion pricing, the implementation of such strategy is dependent upon the government structure, political will, public attitudes, and other key factors that are contextual to the City or Region. Since case study analysis is based on the context of each case, it is important to select cases carefully and in a crafty way so to avoid the use of misleading or irrelevant information.
This approach has also been challenged by researchers as it poses some limitations. The analysis of case studies could be considered as “not robust enough” as it includes the examination of several cases that do not necessarily lead to a generalization of the issue been examined. The conclusions and recommendations that are drawn from a case study review cannot be generalised without determining the context of the study itself. In other words, since the research of case studies only use a limited number of subjects, the results of the data collection and analysis would not permit the scientific generalisation of the results.

With the limitations in mind, this methodology was selected as the cases selected have been analyzed and appreciated for their context. The following sections explain in more detail the selection of case studies.

3.1.1. Case Study Selection

A careful selection of case studies was conducted following a set of criteria given the Metro Vancouver context and with the goal to provide direction in the next phases of the Mobility Pricing implementation. The first condition was ensuring that both implemented and non-implemented cases were selected as both provide valuable information on key factors of the success of the policy. An important condition was to select cases where there is appropriate documentation on policy formation and implementation. Given that congestion pricing has not been widely implemented, well-documented cases are limited, and this is required to obtain a detailed picture of each case.

There are several schemes for mobility pricing, however case studies that were based on cordon and area-based charges were the only ones considered as these two represent the methods that were proposed by the MPIC. A cordon-based charging scheme is based on setting a specific area, where charges are paid upon crossing the cordon. Distance-based charges are directly related to the amount of distanced travelled, hence a fee is charged for each kilometre or mile travelled. Further details of the proposed mobility pricing schemes are explained in Chapter 5 of this report. Finally, it was crucial to select cases that are applicable to the Metro Vancouver context. The three cases studies were selected considering their applicability to the Metro Vancouver region in terms of political structure, which means selecting regions with a democratic
local government that is self-regulated; transportation goals and conditions, such as
goals to invest in sustainable modes and reduce congestion; and other similarities in the
social sphere of factors such as densification, housing, and growing economy.

The cities selected as case studies include the following:

- The Central London congestion charging zone – the tale of four decades
  on the road to congestion charges and political will;

- Stockholm priced zone cordon – the successful implementation of a trial
  that led to public acceptance;

- Edinburgh Congestion Pricing Experience – the lessons from a
  congestion charging strategy that did not reach implementation.

Other cities and regions across the world including Singapore, Milan, and Hong
Kong, have also implemented transportation pricing schemes though were not selected
as their context was not applicable to the Metro Vancouver region, significant literature
about their schemes and post-implementation assessments were not readily found, or a
combination of both. Singapore was the first city implementing a congestion charging
scheme, however the political structure and policy process is significantly different than
in the region. The national government in Singapore proposed, selected and
implemented a congestion charging scheme without requiring the approval of the
citizens. A comprehensive public consultation period took place, but their government
structure does not require the final approval of the citizens to implement such initiative.
Singapore retains an authoritarian or autocratic influence when it comes to politics,
economy, and other policy matters. The birth of Singapore's political system as an island
republic started with the leadership of Lee Kuan Yew and the People's Action Party
("PAP"). The PAP overwhelmingly won elections in 1959 and have been in power ever
since then as a unicameral parliament republic (Henderson, 2012). The government in
Singapore can be described as a hybrid between a democratic and authoritarian regime,
some call it a "soft democracy" (Roy, 1994). Some experts even argue that Singapore
continues to be fundamentally undemocratic (Reyes, S. 2015). Singapore's government
focuses on the pursuit of control and order. The definition of good government in this
state relates to political stability and adequate levels of economic and education
development (Roy, 1994). To achieve this, the PAP government does so by the application of censorship, electoral regulations, and other restriction (Henderson, 2012).

In addition, road pricing schemes have been implemented in cities like San Diego, Orange County, Houston, Minneapolis, Denver, Salt Lake City, Seattle, and Miami. However, the implemented schemes are based on high-occupancy toll lanes, which is not the scheme proposed for Metro Vancouver, and hence does not meet the criteria for this case study selection.

The review of these case studies provides an understanding of the components in the mobility pricing policy that made these cities succeed or fail when implementing these strategies. Each of the three cases evaluated presented similarities and differences, such as the way they were implemented, the political climate and public attitudes. The goals for the congestion pricing programs for each were different as well, which contributed to the outcome in political and public support.

3.2. Key Parameters for Analysis

Based on the literature review conducted, as well as the case studies selected, the following represent the key parameters considered to assess the each of the decongestion charging schemes:

Political Implications:

A central requirement for the implementation of transportation policy is to understand and align political support (Althaus et al. 2011). Political implications such as climate, feasibility, and efficacy are closely related to the creation, design, and implementation of transportation policies, such as decongestion charges. The case studies will be reviewed with a focus on the political implications that contributed to the implementation of the decongestion charge, and those that negatively affected the outcome of this policy.

Transportation Governance:

As the approach for this analysis centres on the context for each of the cities evaluated, the transportation governance for each will be reviewed in detail as an
important parameter for the implementation of decongestion charges. The design for the implementation of decongestion charge relies significantly on the structure and governance for transportation related programs. There are significant differences in the implementation strategies selected which strictly follow the organization and structure of transportation governance. If multiple agencies and/or government levels are part of the governance for transportation policy, then the complexity of the policy increases.

In the context of urban transportation, governance is extremely important as transportation interfaces with a diversity of infrastructure. The federal or provincial governments are responsible for inter-regional type movements while local movements are the responsibility of the municipality. In some instances a regional government will also be involved in transportation systems, as inter-municipal trips are of regional interest. The efficiency of the transportation system is improved when all levels of government are aligned, which means reinforced and integrated objectives. To achieve effective transportation planning, there needs to be linkages to spatial planning (Lim, 2013). The only way to achieve this is by integrating transportation with community, environment, and economic level planning, which involves all governance levels.

Literature on how transportation governance in Canada impacts transportation policy, has been reviewed with a focus on municipal and provincial level relationships (Althaus et al, 2011). This analysis focuses on a detailed review of each of the governance structures for London, Stockholm, and Edinburgh, and how it dictated the path to congestion charges.

Public Process and Implementation

As pointed out in the literature review, public acceptance is key for the implementation of road pricing. The public engagement process for each of the case studies will be reviewed to determine the extent and strategies used that helped secure public support or enforced those opposing it. It is also important to note that the public process and the outcomes, are also linked to political implications such as political efficacy. The amount of public trust on the different levels of government to take on effective actions against congestion is an important aspect of the implementation of decongestion charges. Post-implementation studies related to public processes and acceptability have all been linked to marketing, perceptions and implementation (Vonk
Noordegraaf et al 2013, Borjesson et al, 2011). This analysis explores the public process and response, and its effect in the implementation strategy used for each of the case studies.

Equity Considerations:

Issues related to how “fair” road pricing is, continues to be debated amongst scholars and policy makers. The most prevalent argument against congestion charging is equity (Eliasson, 2016). This analysis will review how the issue of equity was addressed during the implementation (and post-implementation) of decongestion charges in the three case studies. Attention is put into the implication of equity during the creation of congestion charges as this is a focus in the proposed Metro Vancouver Mobility Pricing Scheme, which will be described later in this report. As found in the literature review, there is no agreed definition on equity and fairness in relation to decongestion charges, hence this review gathers a broad spectrum of equity initiatives.
Chapter 4. Case Study Analysis

4.1. London

London, which is also called Greater London, is the capital city for England and the United Kingdom and is also the largest city. It is governed by the Mayor of London and the London Assembly. London has acquired a global city status due to its leadership in the areas of sustainability, diversity, connectivity, finance, knowledge excellence, and others (Global Alliance of SMEs, 2016). London possesses a diverse population of over 8.8 million based on Census data in 2016 (Office for National Statistics, 2016).

Residents in Central London wanted the local government to address key issues related to congestion and lack of public transportation\(^3\). Traffic congestion was worsening and travel times increasing for over one million Londoners that entered the city centre daily (ROCOL 2000). The issue of traffic in the City has always been in discussion since the 1960s, with the Ministry of Transportation creating a commission to investigate opportunities for traffic reduction. In 1964, what is known as the Smeed Report was completed, and provided recommendations to introduce user charges for road users as taxes as other existent vehicle costs did not consider the actual cost of travel and were not effective in reducing congestion (Leape, 2006). At that time, road pricing schemes were considered infeasible as the cost of implementation and enforcement could be considerably high, and the actual benefits would not measure up. In the early 1970s several road pricing proposals were considered, including a ‘supplementary licensing’ scheme, all of which were rejected (Livingstone, 2004).

With significant population growth in London in the 1980s, and worsen traffic conditions, the demand for public transportation was significantly higher. It was evident that new measures needed to be put in place to encourage people to switch from vehicles to public transportation services. This was also helped by the increased interest in protecting the environment and reducing pollution (Livingstone, 2004). In the

\(^3\) The ROCOL report included a survey conducted in 1999 that showed both congestion and public transportation were top priorities for residents. Concerns over public transportation was selected by 46%, while congestion was selected by 33% of Londoners.
In the early 1990s, the national Department for Transport created the London Congestion Charging Research Program with the purpose to evaluate opportunities to reduce traffic congestion in London. This program concluded in 1995 that a congestion charge would be the appropriate measure to implement to reduce congestion. This recommendation also considered the charge to provide a rather quick payback for initial implementation costs (MVA Consulting, 1995).

These efforts were in response to public concerns over traffic congestion, lack of public transportation, and poor air quality. As shown in the results of a 1999 survey, Londoners rate congestion as one of the top public concerns for the City (ROCOL 2000). The Greater London Authority Act 1999 gave powers to Greater London, which consisted of the Mayor and Assembly, to implement congestion charges and/or workplace parking levies. The government supported the preparation of an independent study to evaluate a congestion charging scheme for London, including costs and potential outcomes. This report is called the Road Charging Options for London (“ROCOL”), provided a preliminary analysis of the type of charging scheme and potential implementation of this in Central London. By 2000, the public was widely in support of a congestion pricing scheme due to the increased need to improve traffic conditions. The ROCOL study concluded that an area charge of five pounds would be successful in reducing congestion and bring a steady stream of revenue for public transportation improvements.

As previously indicated, Transport for London (“TfL”) was created by the Greater London Authority (the “GLA”) Act 1999 as a statutory body to provide the Mayor with support in developing and implementing efficient transportation policies. Its main duty is to provide public passenger transport services including highway and roads. The governance structure includes board members and TfL Chief Officers. The elected Mayor is responsible to develop and implement transportation policy and overall direction, while TfL is responsible to act as the implementer or operating agency. TfL board of directors, which is chaired by the Mayor, consists of appointed members that come from a wide spectrum of backgrounds. At present, the board includes previous Members of Parliament, CEOs, professors and other high-profile professionals from diverse organizations. The Board delegates to the Chief Officers management functions and day to day business operations. Currently there are nine Chief Officers, all of which are appointed by the Board (Transport for London, 2018).
The implementation of a congestion charging scheme was key in Ken Livingstone’s political platform, who at the time was running for office of mayor in May 2000. Ken Livingstone was a high-profile political figure in London that was known for his opposition to Margaret Thatcher’s policies. Prior to taking office as the first Mayor of London, he was the Leader of the Greater London Council from 1981 to 1986, Member of Parliament representing Brent East from 1987 to 2001, and Councillor for the Greater London Council from 1973 to 1986 (Ray M., 2008). He received overwhelming public support during the municipal elections and was elected the Mayor of London. Congestion charging was a central policy in his platform, and after an 18-month public consultation process, the scheme was implemented in February 2003 (Leape, 2006).

The revenues from the charges were allocated for the implementation of projects included in the City of London’s transport strategy4, as mandated by the Greater London Authority Act 1999. Net revenues have been allocated over 10 years to transit improvements, bus network operations, roads and bridges improvements, road safety, walking and cycling infrastructure, and freight movement (Santos, G, 2008). The use of revenues for local improvements helped raise public support over the charging scheme, as residents not only experienced a decrease in overall congestion, but also improvements in other transportation facilities across the City.

If revenues were to be included as part of London’s general budget, public acceptability and political support would have been different. Based on a survey conducted in 1999, respondents changed their attitudes toward the idea of congestion charging when told the revenues were to be invested in transportation improvements within the City. Public support increased even further, when residents were asked if they would be supportive of been part of selecting what to spend the revenues on (ROCOL, 2000.) However, since the revenues are earmarked to invest in the Mayor’s plan, it does not allow for flexibility in terms of revenue allocation.

In February 2007, the congestion charging scheme was expanded to the west to cover most of the Royal Borough of Kensington and Chelsea, and parts of City of Westminster. This decision was following Mayor Livingstone plans to extend the charge zone and achieve further reductions in congestion. TfL identified this zone as the most appropriate for the extension given the area was suffering from severe congestion, was

4 Document that sets out the Mayor’s Policies and proposals to reshape transport in London.
well served by public transit, and was suitable for diversion routes for drivers that wanted to avoid the charge zone.

In May 2008, Boris Johnson was elected as the new Mayor for City of London, and in his manifesto, he committed to engage with Londoners in a consultation process to review the future of the Western Extension. During this consultation process he asked residents of London whether to retain the existing charging scheme, remove it or change it. The consultation process resulted in sixty two percent of respondents supporting the removal of the Western Extension. By January 2011, the Western Extension congestion charge was removed.

Congestion Charge Model

The primary objectives or goals for the congestion charge included a reduction of congestion across the City, improvement of air quality and public health, improvement of journey time reliability for car users, and creation of a long-term funding source for public transit improvements. (Bhatt et al., 2008)

The scheme was implemented in February 17, 2003 with a daily charge of £5 for those entering the congestion charging zone. This fee applied to vehicles entering and parking within the zoning charge from Monday to Friday, between 7:00 AM and 6:30 PM. This charge was later increased to £8 in July 2005 for economic considerations (i.e. increased revenues). This area licensing scheme covers 22 square kilometres in Central London, which represents about 1.3% of the total area in Greater London, but encompasses the political, business, finance and entertainment centre. The pricing program also included improvements in public transportation, with increases of 40% in bus and train capacity by 2011 (Bhatt et al., 2008). Fees were subsequently increasing to £8 as Livingstone argued this would result in a further decrease of congestion and increase in net revenues (Leape, 2006). Today a daily charge of £11.50 is charged to vehicles within the charging zone between 7:00 AM to 6:00 PM, weekdays only (Transport for London, 2018).
Video cameras monitor the charging zone, with a total of 203 cameras set initially in the network and strategically located in the entry and exit points, as well as in key public destinations within the charging zone. The cameras are equipped with high quality plate recognition software with an accuracy of 90%. (Santos, 2004). Exemptions and discounts are provided for residents of the charging zone, buses, taxis, emergency vehicles, hybrid cars, and motorcycles. In February 2007, the zone was extended to the west to create an enlarged congestion area, and a total of 650 cameras were set up to cover the charging zone. Payment options include the City’s congestion charging website, text message, at selected shops, or by phone. Late payments include a daily fee of £10 (Bhatt et al., 2008).

The westward extension included congestion charging fees, but also measures such as improvement to bus services, funds available for local authorities to access for further traffic measures such as parking and others. Reductions and exemptions are applicable including a 90% discount for residents of the zone that are registered with TfL. Residents living right outside of the boundary were also eligible for the discount. The 2007/08 financial report continued to positive revenues (£137 million), even after accounting for all associated costs (Transport for London, 2008).
Impacts

Impacts on traffic volume and congestion reduction were felt immediately after implementation. Traffic within the charging zone reduced by 15% during the charging hours, and vehicle volumes entering the charging zone reduced by 18%. These improvements in congestion reduction resulted in a decrease in travel delays by 25% and bus use increased by 40% (TfL, 2003). These levels of traffic reduction were maintained through 2004 and 2005 (TfL, 2005).

In 2003-2004, congestion charges brought a total of £186.7 million in revenue (TfL 2003-2004 Annual Report), and this has continued to increase with a 2017 reported revenue of £230 million (TfL 2017-2018 Annual Report). During the first years the revenue collected was used mostly to cover for the costs of implementation, which was approximately £140 million.

Traffic impacts after the western extension took place in 2007, similarly exhibited a reduction in congestion. Initially a 20% reduction was the result soon after the implementation of the charge, with traffic levelling at 30,000 fewer cars or 10% of overall vehicle reduction. Monitoring by TfL also indicates that the impact to businesses has been neutral, even though further monitoring should take place to fully understand the impacts of the charges or other broader economic conditions (Transport for London, 2008). This charging zone extension was eventually removed in January 2011, as residents supported its removal in a public consultation process that was requested by then Mayor Johnson.

In terms of transit services, TfL increased the number and frequency of bus services, added new routes and incorporated large buses in their fleet (TfL, 2004a). Transit ridership increased between 2003 and 2004 due to people trying to avoid the congestion charge tolls, but also the large-scale transit improvements that were implemented in London prior to the implementation of the charge (TfL, 2005b). Transit impacts were also experienced in the increased performance for transit services; bus speeds increased by 7% and 3% inside the charging zone, and overall, respectively (TfL 2004a).
Case Study Analysis

The main objective of the congestion charge in London was for the reduction of traffic congestion around the charging zone (TfL, 2004). The charges were also contributing to Mayor Livingstone’s transportation strategy, which included to “reduce congestion, make radical improvements in bus services, to improve journey time reliability for car users, and to make the distribution of goods and services more reliable, sustainable and efficient” (TfL, 2004). The objectives of the decongestion program were specific and quantifiable in terms of vehicle volume and travel time.

Even though the reduction of GHG emissions was not listed as an objective of this congestion pricing scheme, improvements in air quality were measured after the implementation of the charge. The improvement of air quality was directly linked to reductions in vehicular traffic within the charging zone, but also the improvement in vehicle fuel technology, as discounts and exemptions were provided for vehicles that incorporated hybrid technology or similar clean fuel engines. Further studies on the environmental impacts of the charge are required to assess whether the scheme was responsible for emissions reduction. It is also noted that this initial reduction could be related to the implementation of the scheme, but further reductions like this might not be possible by adjusting prices or expanding the charging zone (Bhatt et.al. 2008).

The public consultation that took place in London prior to the implementation of the charges was very extensive. Two public consultation processes took place, in which the public was informed on the proposed scheme, and then asked to have a say on the charge levels, hours of operations and designated zone (Santos, 2008). The public, as well as key stakeholders were involved including businesses and the entertainment community. Information was sent to homes in London with detailed information on the proposed charging zone. A website was made available for information and feedback on the proposed charges. The information shared with the public also included information on who were impacted and what to do to mitigate it. This was also broadcasted on television and radio stations and published in newspapers.

Social and equity impacts have not been thoroughly assessed in London. Evidence based studies argue that the equity impacts for the London congestion charging scheme could be considered as positive due to the increase in public
transportation investment. The way London tackled equity was via the introduction of discounts and exemptions for specific user groups. Residents living within the charging zone were granted a 90% discount (Ziyuan G et al. 2017).

In contrast with the Metro Vancouver region, the authority or governance over transportation in London is done at the municipal level. By giving the local government limited autonomy over transportation policies, facilities, services and funding, the Mayor of London has the authority over transportation decisions, pending public consultation processes and with the coordination of TfL. As set in the London Authority Act (1999), the Mayor has the authority over transportation following certain policies as established in the Act. The Mayor has the duty to prepare a transportation strategy containing general transport policies that promote and encourage safe, integrated and efficient transportation facilities. The Mayor is required to consult and publicize proposed strategies with the public before exercising the general powers of the Authority (UK Legislation, 1999). As it is explained further in Chapter 6, in Metro Vancouver, transportation governance is approached as a regional authority and involves a different governance structure. These differences could impact the way a congestion charging scheme is implemented in the region. Mayor Livingstone was very determined to work and implement the congestion charges in London, as he expressed in his manifesto. He conducted a very thorough public consultation process, as explained earlier, but did not consider a referendum, unlike other cities, such as Stockholm and Edinburgh.

Even though road pricing is considered a viable way to reduce congestion by economists (Lindsey, 2006), politicians are not convinced as obtaining public support remains a challenge. Ken Livingstone took a radical risk by implementing road pricing. His victories during his first and second Mayoral election of London, and post implementation of the congestion charge, is proof that his popularity continued even after the London Congestion Charge. It is important to note that Ken Livingstone’s re-election does not certainly mean that Londoners voted for the congestion charges.

The politics of congestion charging in London extended beyond the implementation of the program. The initial charge was established based on political decisions and not economic principles. It was determined that £5 would be sufficient to deter driving and achieve the objectives of the decongestion strategy. The level of the charge, charge differentiation based on vehicle type or time of day, times of operation,
and the zone limits, were all decided based on the results from the extensive public consultation process, as well as political considerations (Santos and Fraser 2005). Public acceptability increased due to these political decisions, as it was visible by the public that their feedback was taken to design the final congestion program.

A referendum in London did not take place as part of the implementation of congestion charges. Ken Livingstone was voted as Mayor of London for a second term after the implementation of the congestion charge, which points at his continued popularity even after the implementation of charges. However, if a referendum would have taken place in London regarding congestion charges, the results could produce negative or positive results, as opposition to charges continued post-implementation as well (Santos G. 2008).

Another key factor in the London case was its simplicity. The final design of the congestion charge in London might not have followed technical principles of economics or sophisticated traffic modelling, however, it was still successful. As Santos and Fraser quote, the London Congestion charge shows “that much can be achieved with an unsophisticated policy that is easy to implement” (Santos and Fraser, 2006).

The ROCOL (2000) report recommended the hours of operation for the charge to be between 7:00 AM and 7:00 PM, however the final congestion charge model was effective Monday to Friday from 7:00 AM to 6:30 PM. This change in hours was due to demands from the entertainment community over concerns that charges until 7:00PM could affect theatre-goers, within the charging zone (Santos and Fraser 2006). This is another example of how the politics behind congestion charging affected more than just the implementation and extended beyond the design of the program itself.

The scale of the charging zone covers approximately 21 square kilometres as it is centred mainly in Central London. Based on the proposed mobility pricing schemes for Metro Vancouver, the scale will be significantly larger than the case for London. As the proposed Metro Vancouver schemes are covering most of the region which is approximately 2,700 square kilometres.
4.2. Stockholm

The City of Stockholm is the capital of Sweden and is situated in the central part of the Stockholm County. Population has been growing rapidly, with a total of 2 million residents in the county, and around 0.9 million in the City of Stockholm. Traffic levels have been steadily increasing across Stockholm, with road capacity not increasing due to the challenging typology of the City.

It is bounded by water and preserved green areas. Before the implementation of congestion strategies, congestion in the City were averaging 200%, that is three times the free flow travel conditions (Eliasson, KTH Royal Institute of Technology, CTS Working Paper 2014: 7). Stockholm has a broad and comprehensive public transportation system that is operated by Storstockholms Lokaltrafik AB (SL), a corporation under the Stockholm County Council. The creation of SL started with AB Stockholm Spårvägar (SS), a transit company owned by the City of Stockholm and established in 1915 to coordinate the operations of two separate private tramway systems. Bus operations were also integrated, and the first part of the Stockholm Metro was opened in 1950. By January 1967, SS was renamed to SL once the metro, train, and bus systems were merged into a single operation under the authority of the Stockholm County Council. The County consists of 26 municipalities with over 2 million people and 40,000 new residents added every year (Sandstrom, I. 2017 Transport Administration).

SL is a politically governed limited company consisting of a board of directors, who are nominated by the county politicians. Major decisions are made by the Board as well as SL’s management team. The Board of Directors consists of elected officials by the County Council Assembly and employee representatives (Stockholm Transport. 2007).

Public transportation in Stockholm consists of a commuter rail network, a subway network, light rail, and extensive bus services. Altogether, public transportation accounts for 80% of all trips to and from the city centre during peak service hours, and to 60% to 65% during off peak. Congestion charges in Stockholm were implemented as part of a trial period of seven months in 2006. This was a followed by a referendum where the majority voted in favour of congestion charging (Eliasson, 2014).
In the early 1990s tolls were proposed to increase funding for other transportation initiatives. This was supported by environmentalists that saw this as an opportunity to manage traffic and reduce auto-dependence in Stockholm. The proposal did not move forward, however conversations continued regarding the implementation of other types of congestion charging schemes. This was particularly important as the Green Party became interested in pursuing this initiative given it was considered a solution to environmental impacts (Eliasson, 2016).

In the early 2000s, the social-democratic national government set a commission to review a new infrastructure agreement, which included the review of funding sources such as road pricing. This initiative was not taken well by the Conservatives, who blame the social-democratic government of having a secret agenda to use road tolls to fund infrastructure in Stockholm. In response to this, the social-democratic Mayor of Stockholm promised that no road tolls would be implemented in the City during the election cycle. To win the elections, the social-democratic party knew that they needed the support of the Green Party. Consequently, they committed to approve a full-scale congestion charging trial as it was demanded by the Green Party in their interest to move forward with the initiative. During elections, the social-democratic party won both the national and local level governments, and a full-scale trial process began.

Following the approval of a full-scale trial, congestion charging, and road tolls became a contentious political topic. The public was divided with more visible opposition taking over, which was only exacerbated by the broken promise of the Mayor, who committed to not implement road tolls during the election campaign. Convinced that they would win, opponents proposed a referendum takes place to approve the charges. The trial put the social-democrats in a vulnerable spot, therefore agreed on the referendum as this would give them the opportunity to separate themselves from the charging scheme. However, the referendum was approved to take place after the trial period.

The objective of the trial was to test if congestion charges could improve the efficiency of the traffic system. The trial started in January 2006 with a scheme that included a cordon-based toll\(^5\). Upon introduction of the charges, traffic numbers

\(^5\) Cordon or area tolls are paid by motorists to drive in a determined area and apply during peak periods
dropped significantly across the City. Overall traffic reductions accounted for 30%-50% (Eliasson, Hultkrantz, Nerhagen, & Rosqvist, 2009: Eliasson, 2008). A key development in the Stockholm implementation of congestion pricing is the public attitudes towards it. Prior to the trial implementation, public support was only 34%. The lack of support was partially due to the political debates, but also the lack of trust in the outcome of the trial. Once the trial started, public support increased to 53%. The immediate impacts in congestion reduction helped improve public attitudes and turned the media from intensely critical to positive (Isaksson and Richardson, 2009).

Shortly after the trial ended in July 31st, 2006, Sweden general elections and the congestion charge referendum took place on September 17, 2006. Residents of the City of Stockholm, as well as 15 municipalities near Stockholm were asked to vote to make the congestion charges permanent. The referendum results showed that citizens wanted to keep the tolls with a small majority close to 51.3% of votes in favour of making the charges permanent (Scuitema G. et al. 2010).

The general elections resulted in a new leadership at the national and local levels. Even though they were in opposition of the congestion charges, they promised to follow through with the referendum results. After reviewing the results and the outcomes of the trial, the new national government agreed to continue with a tolling system as part of a transportation investment package. The Swedish Parliament agreed on the keeping the charges permanent for Stockholm. Details of toll revenues allocation were part of the package, focusing on investments in road infrastructure and major rail projects.

The negotiation for the allocation of toll revenues was the point of debates among politicians. The congestion charging revenues were considered a national tax that would end up as a federal funding source. Stockholm argued that the money should be available for the City as it was theirs to collect. The dispute over revenue allocation was resolved by the creation of a 10-year investment plan, which accounted for a €10 billion investment package, where infrastructure in Stockholm was identified for further improvements (i.e. New Stockholm bypass)(Eliasson, 2007).

The congestion charging scheme was reintroduced as a permanent policy in August 2007. Like what was experienced during the trial, public support increased over
time once the charge was made permanent. Public support levels increased from 65% in December 2007, to 72% in 2013.

**Congestion Charge Model**

The congestion charging scheme in Stockholm was implemented with the objectives of reducing congestion, improving air quality and public health, and improving journey time reliability for car users.

Entry points into the inner city were tolled with a total of 18 charging points. The charging stations were located on arterials leading into the inner city. The system was implemented with the use of cameras and automated payments; plate numbers were recorded and subsequently charged when crossing the charging points via cameras. However, during the trial period vehicles were identified with the use of transponders. At full implementation of the plan (post referendum), the system changed to plate number detection. Plate number detection cameras were considered during the trial as a secondary means for vehicle identification. However, cameras worked so well that plate number selection was used for the permanent system.

![Stockholm Congestion Charge Map](image)
The charge per passage, per direction was 10 to 20 SEK (10 SEK = 1.50 CAD) depending on the time of day, with a maximum charge per day of 60 SEK. Some exemptions were put in place including buses, foreign vehicles, and for specific trip routes. These exemptions accounted for about 15% of all passages. Exemptions for alternative fuel cars were successful as well, as the share for alternative fuel cars increased by 12% between 2006 to 2009 (Eliasson, KTH). However, this exemption was removed in 2009, as it was determined that this initiative accomplished the role of facilitating the introduction of alternative fuel vehicles.

Impacts

The effects of this pricing program were proven to be successful, with traffic reductions up to 30% in the city centre. Since the inception of the program, there were significant reductions in traffic. Traffic reduction across the cordon accounted for about 20% and has maintained the same reduction levels ever since 2006 (Croci, 2016).

When the trial ended, and tolls were removed in preparation to the upcoming general elections and congestion charge referendum, the traffic volumes rose, though not to the exact levels, which demonstrated a shift in travel patterns. After the reintroduction of the charges after the referendum in 2007, volumes remain similarly to those experienced during the trial (Eliasson, 2016).

Travel time impacts were also significant during the implementation of the trial and beyond. Substantial decreases in travel time occurred in the inner city arterial roads with a reduction of 14% in the charged zone and 1% outside the zone. This resulted in an increase in travel time reliability, as the reduction in travel time increased the certainty of the duration of vehicle trips, along arterial roads. Public Transportation increased by 6% to 9%, though it is hard to determine if this was due to the charges been implemented or the improved transit system. No significant changes were observed for shifts to cycling, carpooling, or telecommuting (Borjesson M. et al 2011).

Due to the reduction of travel distances and congestion, traffic emissions were also reduced to the same degree. Approximately 10% - 15% of emissions were reduced in the inner City, and 2% - 3% of Carbon Monoxide emissions were reduced across the metropolitan area in Stockholm.
Case Study Analysis

Unlike the London example, the road for Stockholm’s congestion charges encountered two significant differences: Transportation authority over policies included the national government, and the revenue allocation was distributed over a broader transportation plan. In London, the 1999 Act provided limited authority to the Mayor to implement policies such as congestion pricing. Consequently, Mayor Livingstone was able to implement the London congestion charge plan without requiring the approval of higher levels of government. Stockholm, on the other hand, required the support of the local government, but ultimately the approvals of the national government. It was key for the Green Party to demand the congestion charge trial to provide support to the social-democratic party.

The Stockholm road for the implementation of congestion charges also centers in politics. Like in London, with the election of Mayor Livingstone, it was political triggers that aided the implementation of the trial. The pressures of winning the elections caused the social-democrats to agree on the demands imposed by the Green Party.

The distribution of the charge revenues was also different from what Livingstone had planned for London. As the revenues in London were solely for the delivery of the City’s 10-year transport plan, Livingstone invested in significant transit improvements. In Stockholm, where the revenues are considered a national tax, the revenues were planned to be invested in delivering a 10-year transportation plan that includes transportation infrastructure improvements such as roads and bypasses, but also on other improvements at the national level.

Equity considerations in the Stockholm case have been researched more than the other case studies. Charges in Stockholm are considered progressive as “high-income groups paid more than low-income groups, employed paid more than unemployed, etc.” (Borjesson et al, 2012). However, a quantitative study conducted by Eliasson, also shows that even though low-income groups pay less than high income individuals, low income groups pay more relative to their income (Eliasson, 2016). Accordingly, the debate regarding how progressive or regressive congestion charges are in Stockholm is ongoing. Eliasson studied not only equity as an outcome of the charge program, but also public’s perception of fairness in Stockholm post-implementation.
Based on a survey focusing on citizen’s perspectives on fairness, Eliasson concludes that congestion charges in Stockholm are perceived as “fair”. In the study, it was found that differences in citizen’s preferences over the charges were negligible across different income groups. However, results were less conclusive with regards to equity. Low income groups agree more significantly than high income groups on the need to address the gap between rich and poor, and how decongestion charges affect them.

Another approach to address equity has been to ensure the allocation of revenues for welfare purposes. There are several ways to allocate revenues including: funds to improve public transportation services, discounts for certain user groups, tax cuts proportional to vehicle use, and other types of strategies. In Stockholm, the revenue from the decongestion charges are dedicated for the improvements of roads and other metro improvements in the Stockholm region, which likely has a small effect on the distribution of the revenue benefits across income groups. (Kristoffersson I. et al. 2017).

The introduction of congestion pricing in Stockholm did not have a smooth transition and in fact, encountered significant public resistance. Public opinions were mainly affected by the way politicians introduced the charges. Before the elections in 2002, the Stockholm Social-Democrats’ leader, Annika Billstorm, promised that road charges would not be introduced. However, soon after the elections, and with the pressure exerted by the Green Party, she had to accept the trial proposal at the National level (Borjesson M et al. 2012). How Stockholm managed to survive strong public resistance, and gain their support and trust deserves to be explored in more detail as part of this analysis.

At the beginning of the trial, support for the charges was at about 34% however once the trial started and the first effects on congestion were apparent, support raised to about 53% (Scuitema, 2010). Some initial public support was experienced in Stockholm due to the public witnessing high level of congestion, negative environmental impacts, and lack of transportation funding in the region. The successes of the referendum were in part because of the trial.

Several authors attribute increased public acceptability with familiarity (Jones, 2003, Santos, 2008). Uncertainty over the effectiveness of the policy negatively impacts
public support towards the charges. In the case of Stockholm, the trial helped provide certainty over the effectiveness of the congestion charge, mainly decreased congestion because of the charges helped increase support (Borjesson et al., 2012). Residents in Stockholm were also able to experience the “downside of the charges” through the trial. The perceived increase in travel costs and change in travel behavior, were not as bad as residents expected (Henriksson, 2009). Familiarity over new charges, such as a fee for a good or service that was not previously charged is also key in congestion charging and in the Stockholm trial example.

An interesting phenomenon that can also explain Stockholm’s road to the acceptance of congestion charges, is “cognitive dissonance”. In simple terms, it means “accept the unavoidable” (Borjesson et al., 2012). Once the charges were implemented, it becomes less attractive to spend time and energy opposing them. An experiment conducted by Schade and Baum, demonstrates that respondents are more supportive over charges if they are led to believe that charges are certain to be implemented (Shade & Baum, 2007).

Harsman and Quigley analyzed the referendum results that took place in Stockholm after the congestion charge trial. Based on this, it was determined that referendum results were affected by traffic reduction due to the trial, but also political views (Harsman & Quigley, 2010). A strong correlation was found between resident’s support over the charges, and support for political parties in support for the charges (Borjesson et al. 2012). Those residents that were supportive of the Green Party and the Social-Democrats were more supportive overall of the charges.
4.3. Edinburgh

The city of Edinburgh is the capital and is the second most populated city in Scotland. Its boundaries cover about 260 square kilometres. Population in Edinburgh is estimated to be over 500,000 in 2017 (Office for National Statistics). It is the fastest growing city in the UK, with population growth expected to be 750,000 residents by 2042 (Transport for Edinburgh, Strategy for Delivery 2017-2021). Within the City, about 40% of residents do not own a vehicle, and approximately 43% of residents travel by sustainable modes to work, which includes 13% by foot (Saunders J, 2005).

After the reorganisation of the local government in 1999, the City of Edinburgh Council (“CEC”) was created and has local administration powers that include: housing, planning, local transport, parks, economic development, and regeneration (Government of the United Kingdom, 1994). Transportation projects of national importance are regulated and funded by the Scottish Parliament and Scottish Government. The CEC created an executive body called Transport for Edinburgh (“TfE”) responsible for transportation projects within the City. This organization was created on October 2013 and is the parent company for Lothian Buses and Edinburgh Trams. The main role of TfE is the operations of public transportation within the City, which includes the integration of trams and bus systems. CEC is, at the core, the ultimate entity responsible for the use of funds for transportation projects and operations by TfE. Part of the governance for TfE includes the Board of directors with the Chief Executive and eight board members.

Edinburgh had been contemplating introducing road pricing since 2001, when the Transport (Scotland) Act 2001 (Acts of the Scottish Parliament, 2001) was passed. This Act introduced legislation that allowed local authorities to impose congestion charging on public roads. The Act also sets guidelines for the mechanisms in which congestion charging should be delivered, as well as four major policies (Saunders J, 2005):

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6 The Local Government etc. (Scotland) Act 1994 (c.39) is an Act of the Parliament of the United Kingdom which created the current local government structure of 32 unitary authorities covering the whole of Scotland (“History of Local Government in Scotland” Scottish Government)
• The scheme will reduce congestion and/or noise and emissions;

• Net revenues will be additional (i.e. Not to replace baseline transport funding from other sources);

• Fair treatment for all of those paying for the charges and those who benefit from the scheme; and

• Availability of a wide range of public transit improvements before charge is introduced.

The City Council eventually decided to introduce pricing, subject to the results of a referendum. A Referendum was held in February 2005 and about 74% of residents voted against congestion pricing, and the plans were abandoned as a result. Over 60% of eligible voters participated in the referendum, making it a success in terms of turnout (BBC News Online, 2005b).

Edinburgh’s population\(^7\) and economic growth started to drive the growth of vehicular use within the city. Vehicle registration increased significantly in 2000, with congestion predicted to rise by 25% between 2006 and 2026\(^8\). CEC presented a new Transport Strategy in 2004 (City of Edinburgh Council, Local transport strategy 2004-2007), which was focused on plans to implement a road user charging policy and introduction of new tramlines within the City. This document was prepared following a 1999 report on health impacts that recommended the improvement of public transportation, as well as a reordering of the transportation mode hierarchy by putting the private vehicle as the lowest in priority (Gorman, et al 2008).

As explained earlier, the transportation governance in Edinburgh follows a political structure based on a local unitary authority, as there is no regional level government that is involved with transportation. Both the Scottish Parliament and Government are involved in transportation related projects of national significance but are not necessarily involved with local level improvements or operations.

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\(^7\) Growth projected to be 34, 800 more jobs between 2006 to 2015 (Office of National Statistics).

The purpose of a road user charging scheme in Edinburgh was based on reduction in traffic growth in congested areas, and to increase revenues for investment into improving public transportation. Studies conducted by the City projected that without a congestion pricing scheme, traffic volumes would increase by 50% by 2020, and congestion would also increase by almost 180% (Gorman et al, 2008).

CEC set out the need to create an arms-length company responsible to study, manage, and potentially deliver a road user charge scheme. The company was called ‘Transport Initiatives Edinburgh’ (“TIE”). TIE conducted a proposal that was focused on the need to increase funding for new infrastructure in the City.

An extensive public consultation process took place between 1999 and 2003. Residents of Edinburgh were asked to pick between three options: Single cordon scheme, a double cordon scheme, or no charge. Throughout the five phases of the consultation process, residents’ approvals over the double cordon scheme did not increase and stayed at around 36% in support of a double cordon congestion charge. Although public support was not reflected during the public consultation process, Council had already made the decision to move forward with the referendum (Allen S et al 2005). Based on the Transport (Scotland) Act 2001, Council has the ability to implement congestion charges, hence the referendum that took place was likely a plebiscite. Although most of the research literature found on Edinburgh congestion charging qualifies it as a referendum, this paper will define it as a plebiscite.

The plebiscite was conducted in February 2005 and residents were asked to vote on the Council’s preferred congestion charging option which was designed as a double cordon scheme. Council proceeded with this option because ‘of its ability to influence city-wide congestion levels and to fund region-wide traffic improvements’ (PRoGRESS 2004). Based on the research conducted for this case study, Council’s intentions on the decision to move ahead with the least supported option could not determine. However it is important to consider this as this decision played a significant impact in the results of the plebiscite. The turnout was approximately 61.8% of registered residents. The results turned out to be 74.4% of residents rejected the double cordon congestion charge proposed by Council.
Congestion Charge Model

The road user charge proposal consisted of a cordon-based scheme with an inner and an outer cordon. This proposal also incorporated an integrated set of measures such as public transit improvements to be implemented before the charge, and other improvements to be carried out with the charge revenues. Residents would be charged £2 once daily for crossing one or both cordons in the inbound direction. For the outbound direction, charges would only be conducted during peak periods. This system was planned to operate only on weekdays. Exemptions were also proposed for residents living out of the cordon boundaries, where a charge was eliminated for those crossing the outer cordon.

Exemptions were also provided for people with mobility impairments that made driving a vehicle their only way to mobilize, emergency vehicles, public transit vehicles, motorbikes, and emergency vehicles. Council also added powered two-wheelers, licensed taxis, and vehicles belonging to an approved ‘city car club’ scheme. Further exemptions were applied at a later stage of the proposal for residents of Edinburgh who live outside the outer cordon; they would not be liable to pay for the outer cordon charge (Saunders J. 2005).

A double cordon system was proposed in comparison to a single cordon or an area-based system, due to its feasibility for implementation and simplicity. As figure 3 shows, inner and outer cordons were proposed. Automatic number plate recognition technology was planned to be used for enforcement.
Predicted Impacts

As this scheme was never implemented, a review of impacts can only be conducted for those predicted by the modelling exercise undertaken by TIE in 2002. A traffic model forecast was conducted to predict the potential benefits the proposed congestion charge would bring, compared to a “do nothing” scenario. The overall impacts to traffic included: a 21% traffic congestion reduction, 9% reduction in travel time delays, 30% reduction of vehicle volumes entering the city centre during peak periods and 8% entering the outer cordon (Allen S. et al 2005). The predicted results align with those found in London and Stockholm, which also implemented cordon-based schemes.

Similarly, TIE also prepared modelling exercised to identify the economic impacts of the scheme. Over a 20-year lifetime, the projected revenues would have contributed over £500 million towards public transportation services, €111 million for roadways improvements, £17 million for accessible transportation, and 24 £million for road safety improvements. The allocation of these funds was not fully defined, and some attribute the lack of public support on not having a well-developed plan to sell to the public (Allen el al 2005).
Case Study Analysis

A post-mortem evaluation conducted by Allen et al, showed that some of the reasons why the referendum results did not support the scheme was related to the lack of understanding by the public. Allen’s study conducted surveys that demonstrated that while residents of Edinburgh agreed that congestion was a significant problem in the city, they did not believe the proposed scheme would be effective in addressing congestion. Residents’ opposition to the charges were also exacerbated by the lack of understanding of improvements that revenues could provide for. Lack of support by transit riders was surprising, as funds were promised to be allocated to improvement in public transportation. However, detailed plans for those improvements were never determined, which did not allow residents to fully understand the potential positive impacts of the scheme.

The plebiscite process also brought distrust from the residents to the City’s Council. After the public continued opposition towards the charging scheme over the course of the public consultation process, Council still decided to move ahead with the plebiscite with their “preferred” congestion charging option.

The plebiscite was design underestimating the degree of the public’s opposition to such scheme. Public distrust over the use of revenues and lack of equity between residents inside and outside the proposed double cordon charging zone, were also factors that played in the public’s rejection over the Edinburgh Congestion Charging proposal (Allen et al, 2006). The case study suggests that a trial and referendum are preferred, as the trial would allow for residents to witness the potential positive effects of a decongestion charge, while realizing the financial impacts to be less than anticipated (Ziyuan et al 2016).

To address fairness, the improvement projects to be carried out with the congestion charge revenues were carefully considered to ensure an appropriate geographical distribution. Investments were expected to be conducted in relation to the charge payers. Approximate 55% of the revenues was planned to be spent within the Edinburgh charge area, and the remainder in the outside.

The implementation strategy for the congestion charge in Edinburgh was conditional to the delivery of several pre-charging investment projects including bus
priorities, Park and Ride strategies, and railway improvements. The City Council was not able to deliver public transportation related improvements as funding was not available. Additional funding for bus improvements were dependent on the Scottish Executive, which delivers funds in the form of capital money for infrastructure but not for additional services. Thus, Council was limited in their abilities to provide public transportation improvements prior to the implementation of a congestion charge. This created public criticism over the lack of improvements and overall benefits to residents. Further public transport improvements were also dependent on neighbouring municipalities, which were hostile as they did not perceive the congestion charge as a benefit to their residents. They found it unfair to increase charges and impact residents from their municipalities (Allen, 2006). Many residents perceived the road user charge scheme to have the only purpose of raising revenues.

4.4. Summary Analysis from Case Studies

Based on the review of the case studies outlined previously, lessons can be drawn from the different types of pricing strategies, as well as their implementation and subsequent results. There were certain similarities and differences in each of the schemes that can attribute to the successes and/or failures of the implementation of the congestion charging program. A summary table with the main features of each of the case studies is included in the following table.

Table 1. Summary of Case Studies - Key Features.

<table>
<thead>
<tr>
<th>Features</th>
<th>London</th>
<th>Stockholm</th>
<th>Edinburgh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charging Scheme</td>
<td>London Congestion Charging Scheme (LCCS)</td>
<td>Stockholm Congestion Charge (SCC)</td>
<td>Edinburgh Congestion Charging Scheme (ECCS)</td>
</tr>
<tr>
<td>Scheme Type</td>
<td>Cordon Pricing - Area licensing in Central London</td>
<td>Cordon Pricing in the inner city</td>
<td>Dual Cordon Pricing (once a day charge)</td>
</tr>
<tr>
<td>Starting Year</td>
<td>February 2003</td>
<td>January 2006 (Trial) August 2007 (Permanent)</td>
<td>2005 Referendum (did not pass)</td>
</tr>
<tr>
<td>Area (sq. km)</td>
<td>21</td>
<td>30</td>
<td>&lt;260</td>
</tr>
<tr>
<td>Implementation</td>
<td>Transportation Governance</td>
<td>Fee</td>
<td>Single Passage fee (daily limits). Pay for entrance and exit.</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------</td>
<td>-----</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>£5 (2003), £8 (2005), £10 (2011), £11.50 (2014)</td>
<td>SEK 20 - peak period, SEK 15 (30 min before and after peaks), SEK 10 (rest of the day), max daily fee SEK 60</td>
</tr>
<tr>
<td></td>
<td>Elected Mayor / Transport for London</td>
<td>£1 = $1.70 CAN</td>
<td>SEK 1 = $0.15 CAN</td>
</tr>
<tr>
<td>Governance</td>
<td>Stockholm County Council / Storstockholms Lokaltrafik</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elected Council / Transport for Edinburgh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results</th>
<th>Trial</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referendum</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Reduction of traffic (opening year)</td>
<td>14% (2003)</td>
<td>21% (2006)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Reduction of traffic – 5-year post implementation</td>
<td>21% (2008)</td>
<td>20% (2011)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

The implementation of the congestion charging scheme was different in each of the case studies. In all of them, the exploration of a mobility pricing policy started years before their actual implementation. London started the exploration of road user schemes since the publication of the 1964 Smeed Report, which outlined the criteria for a successful road pricing scheme. It was not until 2003 that Mayor Livingstone implemented a successful pricing scheme for Central London. In Stockholm, studies to implement congestion charging started in the early 1990’s with the implementation of the trial in 2006, and subsequent full pricing program in 2007. Edinburgh started the evaluation of a road pricing later as they learned from the successful experiences in London. Edinburgh City Council started evaluating options in 2001.
The impacts of traffic congestion are mainly felt at the local level. Municipal level governments are typically the ones interested in pursuing policies or programs to mitigate and alleviate traffic congestion. In the case of London, Stockholm and Edinburgh, the municipal government took the initiative to examine congestion charging to address increasing traffic volumes. Authority over transportation policy and infrastructure in London was provided to the Mayor, following the establishment of the Greater London Authority Act 1999, which gave powers to Greater London to implement congestion charges and/or workplace parking levies. Like London, the City of Edinburgh obtained additional authority that would permit the implementation of policies such as road pricing in the Transport (Scotland) Act 2001.

Stockholm is the only case that has a more complicated transportation governance structure, where the Local and National Governments need to approve policies that include charges over public infrastructure. To implement the proposed charging scheme, the City of Stockholm had to obtain public support via a referendum, and then approvals at the National Parliament and Government levels. The successes of the implementation of charges in Stockholm were due to “stars aligning” in the timing of the elections. First, the political climate was one that allowed the Green Party to demand the consideration of congestion pricing and the promise of a trial to take place. Without that, the trial and subsequent referendum success would not have been possible. Second, both the national and local government elections were won by the same party, the social-democrats. Support over transportation policies over different levels of governments adds complexity over the implementation of this type of strategies. Metro Vancouver, as a regional transportation entity will likely face significant challenges in the coordination of this type of policies. Chapter 6 explains in more detail how this could apply to the Metro Vancouver context.

The political opinions and public acceptance for each of the case studies were crucial in dictating the success of the implementation of the charges. Congestion charging schemes are typically motivated by the intentions of reducing congestion, increasing revenues, improving public transportation, limiting impacts to the environment, and focus on the implementation of innovative social, financial and technological solutions. In the cases of London, Stockholm and Edinburgh, key objectives were similar and were mainly focused on congestion reduction, and increased revenues. However, some argue that in most cases the actual implementation of road
pricing schemes and other transportation innovations are a direct result of political decisions or processes (Fietelson and Salomon, 2004, McQuaid & Grieco, 2005). Of all the case studies, it was evident that congestion charging happened because of political processes or triggers such as an election campaign promise, political demands over elections, and transportation governance structures.

Mayor Livingstone centred his manifesto on the introduction of a congestion charge program in London that would reduce congestion and increased revenues to improve transit. Upon becoming the Mayor, he moved quickly into the implementation of such policy, taking advantage of his renewed powers that gave him authority over transportation in the City. In Stockholm, the pressures of the general elections created an opportunity for the Green Party to demand the consideration of a congestion charge in the City. To have a chance at winning the elections, the social-democrats worked to obtain support from the Green Party. Once the social-democrats won both the national and Stockholm elections, the Green Party demanded the implementation of a full-scale congestion charging trial, which was followed through the social-democrats as part of their agreement (Eliasson, 2014). In both examples, it was political processes that gave birth to the consideration and implementation of congestion charging.

This is also evident in cases where political opposition to road pricing precluded the adoption of such policies. The opposition demonstrated by residents in Edinburgh, as well as the adjacent local authorities caused the rejection of the road pricing proposal (McQuaid and Grieco 2005). CEC moved ahead with the referendum, even when residents in Edinburgh and adjacent municipalities did not support the plan. This political decision caused distrust towards the CEC. It is also important to highlight that a public referendum was not required in the case of Edinburgh, just like the example in London. After the 2001 Transport Act, the local government was given the authority to implement such strategy. However, CEC still decided to move to a referendum. Rye et al. (2005) and Saunders (2005) argue that this path forward was selected by CEC as a direct response to public and media criticism over the consultation process that took place in 2002, and with the purpose to diffuse opposition to the scheme as a local election issue (Allen, 2006).

From the case studies evaluated, political stamina is required to drive a congestion charge from concept to reality. For most of the case studies evaluated the
implementation of a congestion charging scheme took several years and, in some cases, attempts to be successfully implemented. Several years of efforts are required from politicians to move such policy forward, hence the term political stamina. The failure or success of such policy constitutes a political risk for politicians, both in support or against it. Key factors identified in the implementation of congestion pricing in London, and Stockholm include the presence of a political champion, reliance on politics over policy technicalities, and consideration of impacts to constituents and communities. In the case of Edinburgh, no considerations were made to address the impacts to residents, and where politics set priority. When the CEC decided to move on to a referendum, the issue of congestion charges became a political matter.

Ken Livingstone represented a political champion within the London case study (Leape 2006). He pushed for the adoption and implementation of a successful congestion charging program for London. As discussed earlier, policies such as congestion charging have typically been a product of political processes, as such, political champions are essential to help implement policies. Rye, Gaunt, and Ison (2008) analysis on the implementation of congestion charging in Edinburgh suggest that the presence of a political champion was lacking, which is why the approach selected by CEC was to go directly to a referendum, which eliminates political liability. The nature of political leaders within a national or regional level is significantly different than a municipal context. Politicians at the municipal level are known “in person” and have direct communication with their constituents. Therefore, continual briefing and feedback is received from the public (Althaus et al. 2011). By selecting to move forward with a referendum, the CEC opted to remove any political responsibility over the results on themselves. This tactic is meant to diffuse responsibility over the implementation and in fact, give the residents the opportunity to decide. Whether the referendum and/or implementation is a success or failure, is not a reflection of the CEC.

Relying on politics more than policy technicalities is an interesting feature of the case studies evaluated. In all the cases, the implementation of congestion charging was driven behind the scenes by political “moves”, such as election promises or campaign manifestos. Technicalities over the actual charging scheme, charge value, or modelling results were not as scrutinized as expected by politicians, public or media.
The political consultation and communication process each of the municipalities took to implement congestion charging schemes contributed to the actual implementation of the charge. It is important to propose the implementation of a congestion charge at the right timing. As experienced in London and Stockholm, a comprehensive consultation process took place soon after the elections, where both Ken Livingstone and the social-democratic party took leadership, respectively. Providing the public with the understanding of the charging scheme is important, and even more important is to let the public perceive an inclusive and transparent process.

The public consultation that took place in London prior to the implementation of the charges was very extensive. Several public meetings were provided, and information was widely shared in television, radio, and newspapers. A website was created to provide for information to the public as well as receiving feedback about the congestion charging proposal the public was informed on the proposed scheme, and then asked to have a say on the charge levels, hours of operations and designated zone (Santos, 2008). The information shared with the public also included information on who were impacted and what to do to mitigate it. A public consultation that is perceived to be transparent and extensive helps obtain support. The decongestion charge scheme in London responded to public feedback during the engagement process. The scheme was modified to reduce hours of operation in response to the entertainment community, which was concerned over impacts to theatre attendance.

An appropriate communication and consultation strategy needs to encompass the support of the public and political will. In the case of Edinburgh, the public process the local government designed caused distrust among the residents. The distrust was caused by several factors through the public consultation process design and referendum decision by CEC. Throughout the process, the public expressed their opposition for the double cordon charging scheme, yet CEC still decided to move with a referendum and recommended the scheme that was least supported by the public. Upon completion of the last phase of the public engagement process, the double cordon scheme was only supported by 34% of the residents. With slight changes, the CEC moved forward with a recommendation to implement the double cordon scheme via a referendum. The reasons the CEC provided for their selection was because they determined that this scheme had the abilities to “influence city-wide congestion levels and to fund region-wide traffic improvements” (PRoGRESS 2004).
For the implemented cases, education and communication were provided throughout a consultation process where the public was informed on the collection charge, technology, alternative options, as well as the benefits the congestion charge would bring. Some of the studies included information of congestion impacts and causes that helped explain further the objectives of the proposed scheme.

Post-implementation monitoring is also part of the information packages provided to residents in both London and Stockholm. Communication should continue post-implementation of the congestion charge. In the case of Stockholm, it was quite helpful for the public to know about the positive effects of the congestion charge. Information was shared related to congestion relief post-event and provided value for the ultimate implementation of the charge.

The three-case studies implementation approach were different, London’s predominant Mayor’s power and support for congestion charges helped determine its implementation, whereas in both Stockholm and Edinburgh a referendum occurred first (Ziyuan et al., 2018). In the case of Stockholm, a trial occurred before the referendum, which played a significant role in its acceptance, unlike Edinburgh, where implementation failed. A congestion charging trial allows for the opportunity to test and experience the effects and benefits of congestion charging. By experiencing the positive impacts, anxiety and distrust in the system reduces and public acceptance increases. This is more impactful when real traffic relief is experienced through a trial (Ziyuan et al.,2018). However, there is always the risk that a trial might result in not meeting expectations due to poor implementation (Eliasson 2008).

A trial increases the willingness of people to accept a user charge that was not there before. A trial allows residents to experience the benefits of the congestion charge, congestion reduction. Moreover, by experiencing the impacts of the congestion charges, residents can realize that the perceived “downsides” of the charges such as increase travel costs and travel behavior changes are not as bad as expected. Studies on public acceptance in Stockholm showed that the support rate for the scheme increased from 33% to 51% after the trial and referendum, and even increased to 70% five years after implementation (Borjesson et al 2011).
A trial and referendum are considered two key political and public processes that can contribute to public acceptance (Noordegraf et al. 2014, Sorensen et al. 2014, Hysing, 2015). However, like the example in London, these two are not crucial for the implementation of a congestion charge. Strong political will can also dominate the implementation of mobility pricing. As the legislation allowed for it, the power of the Mayor in London to implement a congestion charging scheme did not require further political approvals or public acceptance upon implementation (Anas and Lindsey, 2011).

As pointed earlier in this analysis, transportation governance can play a key role in the implementation of the strategy. Regardless of the implementation approach, whether it is implemented by a trial and referendum, or via the powers of the Mayor, public support is still required to ensure the viability of the policy.

For the case studies evaluated, the objectives of the proposed congestion charging scheme were threefold: alleviate traffic congestion, revenue generation, and reduce the negative impacts of congestion on the environment. Clarity over the purpose, principal, and objectives is important for the public to understand and support the proposed scheme. In the case of London, simplicity over the congestion charge program, helped obtain public support because it was easy to understand. It is also equally crucial to align objectives with the charge model. Confusion over multiple objectives or lack of clarity can result in negative public response. For London and Stockholm, the primary objective was congestion relief, yet the public was confused over two aspects: In London there was an additional charge for high emission vehicles, and in Stockholm there was a charge exception for hybrid vehicles. Both of those measures were abandoned after the public expressed confusion, and it was determined that they contravened the primary objective of the charge, which is to reduce traffic. Simple and measurable objectives that align with the proposed charging model were key to allow the public to understand the proposed schemes.

The distinction between a user fee and a transportation tax must be made clear for the public. From a jurisdiction perspective, different levels of government are restricted on the type of charge to be implemented. In the case of London and Edinburgh, the municipality has the authority to impose user fees, however, the implementation of taxes requires involvement of other levels of government and legislation. In the case of Stockholm, the scheme mechanism was a user fee, however the allocation of the revenue was treated as a tax. A tax is a compulsory payment,
whereas a user fee is charged only to those that consume or “use” the service for which
the fee is levied (Bird and Tsiopolos 1997). When applied to congestion charges, it
makes sense to consider user fees more appropriate as fees are been applied to
individuals that are seeking to consume or use the road space during the allocated
times.

A tax and a user fee also differ in the intended use of the revenues collected. A
tax is enforceable by law, levied by a public body and imposed by the authority of the
legislature. It is also intended for public purpose or in simpler terms, the purpose is to
raise revenues. A user fee is intended to recover the cost of providing those services.
Thus, revenues collected from user fees cannot be utilized for general expenses, but
rather, purposively designated for the provision of the service. This distinction is
particularly important for economic and political reasons. Even though it might seem
more politically and economically attractive to seek for increased revenues that can be
spent to offset general costs, it might be more palatable for the public to support a user
fee, as the cost and revenue will be directly transfer to users (Althaus et al. 2011).

Livingstone’s proposal included a significant proportion of the congestion charge
revenues to be invested in public transportation infrastructure, which was very appealing
to Londoners. In Stockholm, after a long debate between the national and local
governments over revenue allocation that occur prior to its permanent implementation, a
10-year investment plan was created where some amount was allocated to local
transportation improvements. Unfortunately, even after Stockholm demanded the
revenues to be allocated for the City only, the congestion charge revenue was treated as
a national tax (Eliasson, 2014).

In Sweden, existing infrastructure cannot be charged, but only taxed from a legal
point of view. Furthermore, municipalities in Sweden are not allowed to levy taxes on
other than their own citizens. The congestion charge, as design in London would not
have worked in Stockholm from a legal perspective. Although the City of Stockholm was
the one responsible to initiate and design the implementation of congestion charges, it is
the responsibility of the national government to administer the charges and revenues.
This added significant concerns and uncertainty over revenue allocation and
transportation grants for municipalities. This added to the already complicated
negotiation process between the national and municipal level over infrastructure funding.
Stockholm politicians had always expressed their frustrations over the lack of infrastructure funding from the national government, and the signal of a new stream of funding from the congestion pricing was not welcomed. The solution to this disagreement was the creation of a major transport investment package, where the national government made commitments over significant transportation projects (Eliasson 2014).

Defining and understanding the uses of the revenues is important for the public and politicians. Although the primary objective of most of the congestion charging schemes evaluated is based on traffic congestion reduction, all case studies reported significant increases in revenues\(^9\). Initially, a significant portion of the revenues were utilized to pay for the cost of implementation, and subsequently to continue the operations of the charges. Remaining revenues were directed to expenses related to congestion charges including transit services and subsidies for disadvantageous groups.

The provision of convenient, accessible, and comfortable transit services was also identified in the literature and case studies evaluated. The case for congestion charges depends on two key factors: significant traffic congestion that impose critical issues in society, motorists, and, opportunities for commuters to modify travel patterns (Lindsey 2008, Congestion Relief: Assessing the Case for Road Tolls in Canada). A congestion charge should only be implemented if a comprehensive and integrated plan for transportation options is available. Options should include transit, cycling, and walking improvements, that extend beyond infrastructure. Access, cost, quality, schedules and comfort are also important when addressing the public. By providing a comprehensive plan that is properly communicated, support will be more easily obtained as the public can clearly see the value of the congestion charge.

London’s area-wide transit system is extensive and includes Underground, Buses, Tramlink, the Docklands Light Railway, London River Services and the London Overground. Thus, upon implementation of the congestion charge, Londoners had very attractive transportation alternatives. During the seven months trial in Stockholm, residents were able to test the charging scheme. The trial occurred following significant

investments in transit funding and upgrades, which contributed to the post-trial support from voters (Eliasson, 2008). In the case of Edinburgh, voters were more supportive of the proposed congestion charge scheme once it was communicated that a significant amount of revenues were intended to be spent on improvements of bus services (Farrell and Saleh, 2005). Even though there was a slight increase in support, residents in Edinburgh still voted against the charge due to other factors such as political distrust, and lack of understanding of the policy.

Upon the implementation of a congestion charge, defining a governance structure or arrangement, as well as a centralized administration is crucial to ensure the success of the implementation plan. It is worth noting the process London took as it was comprehensive. To evaluate and move forward with an implementation strategy, London created a team of 70 members that included government representatives and professional consultants. Task forces were created to focus on several aspects of the plan including a consultation and communications team (Richards, 2006).

As found in the literature review the implementation of a congestion charging scheme is dependent upon public acceptability, and user charges can lead to equity and fairness concerns. The distribution of charges among different socioeconomic levels can be perceived as unfair, groups such as low-income and the disability community. One of the ways London and Stockholm attempted to tackle the equity piece is by applying exemptions to groups. In London, full exemptions were given to residents with disabilities, as well as 90% discounts for those living within the central zone (Santos and Fraser, 2006).

An analysis by Borjesson, where an evaluation of the Stockholm charging scheme was conducted five years post-implementation, Borjesson argues that the concept of “fairness” is a problem within the implementation of this type of schemes. To address fairness consideration, the question is interpreted as identifying who the “winners and losers” are. In Stockholm, the charges were progressive as higher income groups were charged more, employed residents pay more than unemployed ones and so on. However, upon further research and surveys conducted by Eliasson, it was demonstrated that low income groups pay more relative to their income. Thus, the debate regarding how progressive or regressive congestion charges are in Stockholm is ongoing.
Other than exemptions and the idea of implementing a progressive charge, other dimensions of fairness and equity have not been evaluated for the case studies presented. From all the factors evaluated in this case study analysis, the concept of equity and fairness is the most ambiguous one. As found in the literature, the definition of what constitutes a “fair” charging scheme, or what is “equitable”, has not been agreed or standardized. Stockholm is the only case that has attempted to conduct further studies on equity and fairness via the analysis of surveys post-implementation. These surveys measure the public perception of the charges (i.e. Fairness) and try to quantify the charge value to income levels.
5.1. The Metro- Vancouver Transportation Context

Like most urban regions across the world, residents in Metro Vancouver consistently rank traffic congestion and transit amongst the most serious issues in the region, together with housing and unaffordability (Beatty, 2010). Metro Vancouver is considered one of the most livable regions due to its climate and its geography. The issues of congestion and transit have been caused by the fast growth of population, which is projected to grow from 2.4 million in 2011 to 3.4 million by 2041 (2006-2041 Metro Vancouver Regional Strategy), and the scarce amount of space available for transportation infrastructure. This is exacerbated by the “limited” amount of investments allocated to transportation infrastructure in the last decade (Arnold, 2013).

This population growth projection can lead to significant amounts of vehicles added on the road. The total number of registered vehicles grew by 441,000 between 2001 and 2016, which amounts to a 37% increase to a total of 1,600,000 vehicles in the Region (Metro Vancouver “Total number of registered vehicles”, 2001-2016). It is important to note that this increase in number only accounts for vehicles registered within Metro Vancouver, overall traffic in the road network will also be increased by vehicles entering the region from neighbouring municipalities such as trips originated along the Sea to Sky corridor communities (Squamish-Lillooet Regional District) or those coming from Chilliwack, Abbotsford or beyond (Fraser Valley Regional District).

To further understand the implications of a mobility pricing strategy in Metro Vancouver, it is important to understand the actors responsible for the implementation of regional transportation initiatives and infrastructure. There are four levels of government that are responsible for transportation, each with different responsibilities. The Federal Government, the British Columbia (BC) Provincial Government, Metro Vancouver, and each of the municipalities within the Region, which include 21 municipalities, one First Nation and Electoral Area A. Transportation infrastructure and services fall under the jurisdiction of all four levels of government, thus, collaboration is required for a regional initiative.
TransLink, formally known as the South Coast British Columbia Transportation Authority, is the agency responsible for the regional transportation network in Metro Vancouver. It provides for public transit services in the region, and is also responsible for the movement of people, goods and services, including the Major Roads Network (“MRN”). The MRN consists of 2,400 lane km (600 road km) of transportation network designated and dedicated for the movement of goods and transit, such as truck routes and transit lines. The MRN is owned, maintained and operated by each of the individual municipalities. However, TransLink provides funding to maintain, upgrade and operate the MRN. As part of the MRN, TransLink owns bridge infrastructure including the Westham Island, Pattullo and Knight Street bridges. (TransLink, 2018).

All transit services are operated and provided by TransLink including Skytrain, express and regular bus, ferry and rail transit (West Coast Express) services. The governance structure of TransLink includes the Mayors’ Council on Regional Transportation, the TransLink’s Board of Directors which is appointed by the Mayors’ Council and are responsible to supervise the management and operation of TransLink, and TransLink’s Chief Executive Officer, responsible for the day to day management (TransLink, 2018).

TransLink started operating in 1999 and since then has implemented the expansion of transit services throughout the region. Most significant has been the construction and operation of rapid transit including the Millennium, Canada and more recently, Evergreen Rapid transit lines. Figure 7, shows the map of key regional transit connections.
The Mayors’ Council is made up of representatives from the 21 municipalities within the Metro Vancouver area, as well as Electoral Area A and the Tsawwassen First Nation. The purpose of this Council is to represent citizens of the region; they appoint TransLink’s Board of Directors and approve transportation plans. They are also responsible to identify funding opportunities for transit and transportation improvements, as well as negotiating with other levels of government.

In 2014, The Mayors’ Council developed a 10-Year Vision for Metro Vancouver Transit and Transportation (Mayors’ Council on Regional Transportation, 2014). This document indicated the investments required to service future growth needs in public transit, major roads, cycling and walking in the region. The Plan identifies major transportation projects such as the Millennium Line Broadway Extension, South Fraser Rapid Transit; an increase in transit services for bus, rail and seabus; improvements to the Major Roads Network (MRN); walking and cycling improvements for regional facilities; and investments into mobility innovation such as mobility pricing (Mayors’ Council on Regional Transportation, 2014).

Funding mechanisms across the region to invest in transportation are complicated. Depending on the type of transportation infrastructure, funding is collected
and available from the Federal Government, the Provincial Government, TransLink, and each of the 21 municipalities, plus the Electoral area and treaty First Nation. To understand the funding sources and infrastructure gaps in the region, it is important to clarify the responsibilities for each of the different levels of government involved in the provision of transportation. As reviewed in the case studies, governance over transportation represents a key consideration in the implementation of transportation policies. Both London and Edinburgh’s local government obtained limited powers to implement charges for the use of public roads, whereas Stockholm requires the approvals of the local and national governments.

In Metro Vancouver, transportation infrastructure is being funded by a variety of user fees including transit fares, fuel taxes, and public subsidies such as property taxes, BC Hydro Levy, and other transfers from the Federal and Provincial Government. From the Federal Government, transfer funds include shares from the federal gas tax, building Canada fund and Provincial-Territorial base fund. Funding is allocated to each municipality or region based on population growth or via the application for funds. The Provincial government funds transportation infrastructure with the use of provincial fuel taxes, motor vehicle licensing and registration fees, and fines, which are mostly allocated for the construction and maintenance of road infrastructure (Ahmad, 2014). Tolls and other road pricing strategies have not been historically significant, but in BC revenues were collected for two bridges. Tolls collected for the Port Mann and Golden Ears bridges were recently removed by the new provincial government, which is explained in more detail in section 5.1.2.

Mobility pricing includes all forms of user pay to access transportation related infrastructure. In the Metro Vancouver region, shifting the way mobility is priced is viewed to replace fuel tax revenues, as vehicles are becoming more fuel efficient, and to increase revenues to support public transit improvements. Fuel taxes have increased from 8 cents per litre in its inception in 2000, to 17 cents a litre today. The transit fare system is based on zones, as well as by type of transit ticket. Fares range from $2.95 for single passes within zone 1, to $5.70 for zone 3. Concession, monthly passes, and day
passes are also available at discounted rates. Student passes and handy Dart services (accessibility services) are also provided with special rates\(^\text{10}\).

TransLink source of revenues include transit fares, fuel taxes and property taxes, which cover most of the costs; smaller contributions come from regional parking sales tax, BC Hydro levies and subsidies from District of Mission and the West Coast Express commuter rail (TransLink, 2018).

Public-private partnerships (“P3”) also present an opportunity for funding, for major infrastructure projects. In Canada, P3 projects have been typically implemented for road infrastructure projects such as the Port Mann / Highway 1 project in BC. Regarding transit projects, private partnerships have also been considered in the region. The construction and operation of the Canada Line, the third rapid transit line connecting Vancouver and Richmond, was delivered via a partnership between the public and private sectors. This project was delivered as a P3, where funding was provided by the Federal Government, BC Government, Vancouver Airport Authority, TransLink, City of Vancouver, and In TransitBC – the private partner (Canada Line Rapid Transit Inc., 2006). Public transit in Metro Vancouver is funded by both, user fees and public subsidies. Transit fares cover about half of the operating cost required to provide the service. In comparison, the idea that drivers pay in full for the use of their vehicle is false. The perception of the cost been paid for by vehicle users consider only private costs such as: purchasing the vehicle, insurance and maintenance costs, and fuel charges. However, once those are paid, drivers use the road “for free”. Drivers contribute to funding transportation infrastructure by only paying for fuel taxes and parking, when necessary.

The cost of transportation infrastructure in the region includes the construction and maintenance of roads, bridges and public transit services, the provision of related services such as traffic signals and wayfinding, and parking space provision which takes up road space. In addition, there are external costs that are not reflected which include environmental costs, noise pollution, and urban sprawl. Based on studies conducted in North America, these external costs account for about 40% of the total price of the use of vehicles (Victoria Transport Policy Institute, 2016).

\(^{10}\) Rates and Fares by TransLink (https://www.TransLink.ca/Fares-and-Passes.aspx )
A study conducted by TransLink in 2013 aimed to estimate the total cost of transportation that reflects on external factors and public subsidies. The study estimated that approximately $2.9 billion dollars a year are needed to support vehicular use in Metro Vancouver, with an additional $690 million for trucks (TransLink, Transportation Funding: Regional Transportation Strategy Backgrounder #10). The total amount estimated to be collected by fuel taxes and parking fees in Metro Vancouver is about $406 million, which is just a fraction of the total cost of providing the service (Lee, 2018).

5.1.1. Transit plebiscite

As part of the Mayors’ Council efforts and Provincial pressures to increase funding in transportation infrastructure, a regional transportation plebiscite took place in the Spring of 2015, and asked Metro Vancouver residents if they would support a 0.5 percentage point increase to the Provincial Sales Tax. The “Congestion Improvement Tax” would have been an increase for the sales tax applied to all goods sold in the Region. The increase in sales tax was intended to fund transportation projects as identified in the Mayors’ Council 10-Year Vision for Metro Vancouver Transit and Transportation plan.

The Provincial government, led at the time by Premier Christy Clark, took a back seat during this referendum process. The Province position was to let the mayors lead the efforts in coming up with a proposal and leading the public education / consultation process (Denis, Jen St, 2014).

Close to 760,000 Metro Vancouver residents voted during the plebiscite which accounts for about 49% of registered voters in the region. The vote was approximately 62 percent No and 38 percent Yes. The results overwhelmingly supported the No, as a response to the increase in Provincial Sales tax across the Region, which was a disappointing result from the perspective of the Mayors’ Council that was looking at bridging the transportation funding gap as identified in the Mayors’ Council Plan. Although Federal and Provincial funds were committed to the delivery of the Plan, funding was required as part of the regional share.

11 Results by Elections BC. (https://elections.bc.ca/news/nr-pleb-2015mvtt-9/)
The public focused on expressing dissatisfaction over other items unrelated to the ballot. Leading the No vote was the Canadian Taxpayers Federation, which campaign centered around TransLink’s mismanagement of funds and lack of trust in their executives (Canadian Taxpayer Federation, 2015). Although most municipalities within the Region, scholars, and economists actively promoted in favor and educate residents in Metro Vancouver on the plan and the benefits increased transportation funding would bring, the public ultimately voted no on the initiative.

Through the preparation of the 10-Year Vision for Metro Vancouver Transit and Transportation plan and the role the Mayors’ Council took during the transportation plebiscite, the regional governance structure showed a unified leadership and common vision. Both, the Mayors’ Council as well as TransLink worked towards the same goal to obtain support for the increased tax, with the goal to fund transportation projects as per the Mayors’ plan. Although, the plebiscite was not successful, it demonstrated the ability of the regional government to work towards a common goal.

Currently, the Metro Vancouver region continues to focus on the implementation of the 2017 plan from the Mayors’ Council on Regional Transportation. All levels of government, including the Federal and Provincial governments are committing contributions to cover a significant share of the capital costs required to implement the Mayors’ plan, pending further regulations and agreements.

The BC Government promised to pay for 100% of the capital costs required for the Pattullo bridge, while TransLink would be responsible for any of the operating and servicing costs. Recently, TransLink and the BC Government have approved a deal for a region-wide development cost charge on new construction and increases in parking sales tax to 24% (currently at 21%). In addition, TransLink is also conducting a transit fare review, to increase it modestly and support the delivery of the Phase 2 of the Plan.

Phase 2 of the Plan is estimated to cost $7.3 billion to deliver all the regional transit improvements. Both, the Federal and Provincial governments have committed to contribute $2.0 billion and $2.5 billion, respectively. The Region is expected to contribute the remainder, via a combination of TransLink funding and other sources such as transit fares, private financing, gas tax revenues and others. The Mayors’ Council approved a funding strategy to support the regional share for Phase 2. This strategy includes: transit
fare increases in 2020 and 2021, a 3% parking sales tax increase in 2019, property tax increases estimated at $5.50 per average household, Development cost charges (“DCC”) and Commercial revenues (TransLink, 2018).

5.1.2. Tolls in Metro Vancouver

The tolls implemented by the Provincial Government along two bridges in Metro Vancouver were intended to recover the capital and operational investments for the improvements that both bridges required via P3 contracts, and not for congestion reasons. However, tolls are a form of mobility pricing, and the closest one implemented in the region that resemble a user fee. Therefore, it is worth examining the implementation and subsequent removal of tolls in the region. Tolls across BC can be implemented by following the BC Ministry of Transportation and Infrastructure “Guidelines for Tolling”. (Ministry of Transportation, 2003) This document establishes the regulations under which tolling can be implemented. The guidelines are mainly focused on partnerships between public and private sectors to fund provincial transportation infrastructure.

As described in previous sections there is an important difference between a user fee and a tax; tolls represent a form of user fee as only those using the infrastructure pay for it. When comparing toll charges to gas taxes, the main difference was that tolls are only paid by those accessing the toll bridges, while gas taxes are paid by all of those purchasing gas, and not necessarily using an infrastructure. A tax is used to fund capital infrastructure, thus, those paying gas taxes are contributing towards capital related projects. However, a tax does not capture the cost a user imposes on others. When choosing to drive on a road, a user is affecting others in terms of increasing delays and pollution. A user fee, such as a toll, provides the opportunity to account for externalities, which are not accounted for in the gas tax (Zhang et al 2005, Boardman, et al 2005).

The Golden Ears Bridge was opened in June 16, 2009 and was built to replace a ferry service. The bridge is own by TransLink and connects Langley on the south side with Pitt Meadows and Maple Ridge to the north. The cost of the bridge was estimated at $808million dollars, and the financing for the bridge construction included a P3 through which TransLink is leasing the bridge for a span of 35 years.
The Port Mann Bridge spans over the Fraser River and connects Coquitlam and Surrey. It is owned by the Ministry of Transportation and Infrastructure and is part of the Highway 1 route. The replacement of the bridge took place as part of the Gateway Program, which was a plan by the Ministry to address growing congestion (Ministry of Transportation of British Columbia, 2005). Total costs for the bridge construction and highway upgrades were estimated at $2.46 billion. With the additional of maintenance and operation costs, the total cost adds up to approximately $3.3 billion. Revenues collected from the tolls of both bridges did not fully covered for the actual cost for operating them annually (TransLink, 2016, Vancouver Sun, 2017).

During the elections campaign for the Federal Government in 2017, the NDP candidate and now Premier John Horgan promised the removal of bridge tolls in BC, namely, tolls along the Port Mann and Golder Ears bridges. The argument the NDP leader put against tolls was based on fairness. As Premier Horgan expressed in several of his campaign speeches, the tolls were considered unfair for people south of the Fraser. The “Toll Free BC” campaign was very central in Premier John Horgan’s platform, and some attribute his win to this promise (BCNDP, 2018).

The removal of the tolls was effective on September 1st, 2017. Although the toll removal was well received by many as now a charge is not required anymore to cross those bridges, concerns remained over the finances and budgeting over transportation projects. The tolls were put in place to pay for the investment over the construction and improvements of both bridges. Premier Horgan assures that like other transportation infrastructures, debt from building and improving the bridges would be paid for from general revenue, as it has traditionally been across British Columbia (Vancouver Sun, 2017). The removal of the tolls also had a positive impact regarding the popularity of the NDP leadership for communities south of the Fraser.

5.2. Travel Patterns in Metro Vancouver

TransLink prepares a Regional Trip Diary Survey with the objective of collecting travel data from a random sample of residents within the Metro Vancouver region. The region has conducted trip diary studies since 1980s to obtain information on travel patterns across the region. This approach allows TransLink to collect valuable data that help identify patterns and emerging trends. Trips diary studies were conducted in 1985,
1992, 1994, 1999, 2004, 2008 and 2011 (TransLink, 2013). Data has been more recently collected on 2016, though results of this Trip Diary Survey have not been released yet.

The 2011 Survey is the most recent published set of data and summarizes the travel patterns of a random group from September 15th to December 12th, 2011. This period is typically selected as it represents more typical commuter trips, avoiding the summer season and before entering the winter holidays.

Based on the study results, the average number of daily trips by residents in Metro Vancouver is approximately 2.77 trips per person, which is a slight increase from the 2008 trip diary average at 2.68 trips per person. Another interesting result is noting that the peak hour, which is defined as the hour with the highest traffic volume, is in the morning peak between 8:00 AM and 9:00 AM, while the highest period occurs in the afternoon. Between 3:00PM and 6:00PM the total cumulative traffic numbers are the highest.

The mode split for residents in Metro Vancouver has been steadily increasing towards the use of more sustainable modes. However, the use of automobile is still the dominant mode, with an average of 57% for the region (not including auto passenger). This study also evaluates the trip length based on different modes. For auto drivers, the average trip length is approximately 9.9 km, while for transit riders is 12.6 km (the highest of all modes) (TransLink, 2013).
5.3. TransLink and the Mayors’ Council on Regional Transportation

The beginnings of TransLink, previously known as the Greater Vancouver Transportation Authority (GVTA) were based on a series of events and regional discussions that concluded with the creation of a regional transit authority in 1997. Operations of transit services in Vancouver and Victoria were run by BC Electric Railway back in the early 1960s, which was purchased by the Province in 1962. During this period the line was operated by BC Hydro. In 1976 the system was assigned to BC Transit, which was a provincial crown corporation responsible to provide all services, control expenditure and manage contracts. However, BC transit was running into funding problems, as revenues were difficult to predict, and Provincial contributions were increasing every year. The regional district did not have control over public transit, and they were interested in changing that (Wales T, 2008).

The Greater Vancouver Regional District (“GVRD”), now known as Metro Vancouver, had a vision for regional transportation planning and started a series of studies and regional workshops focused on transportation governance. Several governance structure proposals came out of those workshops, all pointing at the same...
outcome, which was the GVRD wanting to play a central and key role in regional transportation (Wales, 2008).

There were two key events that helped build momentum towards a regional transportation governance, the first was the election of Vancouver Councillor George Puil as Chair of the GVRD board, and second, the decision by the Province to download the responsibility of approximately 600 kilometres of highway infrastructure to the local governments. George Puil was focused on putting transportation in the front and centre of regional discussions. With the Province ‘declassifying’ highway infrastructure and making it the responsibility of the municipalities, it added financial burden to the cost of maintenance and construction.

The 2007 governance change\(^{12}\) within TransLink was triggered by the significant disagreements between the Province and TransLink Board that peaked through the Canada Line project. The Province, via the then Minister of Transportation and Infrastructure requested the review of TransLink governance. The Province worked for a year, reviewing TransLink operations and funding sources. This work concluded with the replacement of the municipality board to an independent board consisting of nine directors with no formal local political ties. The new model would have TransLink no longer reporting to Metro Vancouver, but rather to the new Mayors’ Council on Regional Transportation to make key decisions on funding and regional priorities. Such model is unique. The cities evaluated as part of the case studies do not resemble the governance structure, as established in Metro Vancouver.

In addition, the Province panel recommendation also included a change in TransLink planning practices for transportation systems; they recommended a three-stage planning framework which includes a 30-year provincial vision, 10-year TransLink strategic plan, and a three-year operating plan. This was concluded with the purpose of properly integrated provincial and regional interests in the planning framework (Lim, 2013).

Beyond the Mayor’s Council role within TransLink’s governance, the Council has taken several initiatives related to regional transportation issues. The transit plebiscite

\(^{12}\) South Coast British Columbia Transportation Authority Act
http://www.bclaws.ca/civix/document/id/lc/statreg/98030_01
that took place in 2015, was initiated by The Mayors’ Council to close the funding gap and deliver the improvements laid out in the 10-year transit plan. Further details of the transit plebiscite are provided in the next section. More recently, the Council put forward a campaign titled “Cure Congestion” with the purpose to educate the region on the 10-Year Vision for Metro Vancouver Transit and Transportation, and help voters guide their decision for the Provincial Elections that took place in May 9th, 2017.

Following the BC General election in May 2017, the Mayors’ Council prepared the “90 Day Action Plan”, which was created to call on the then newly elected Provincial Government, New Democratic Party, to act in the delivery of the 10-Year Vision for Metro Vancouver Transit and Transportation. The 90-Day Action Plan focuses on five priority areas including the approval of the Pattullo Bridge project, contributions towards new transit projects, legislating new development levy for transportation, increased regional collaboration with the region’s mayors, and eliminating the referendum requirement on Metro Vancouver projects (Mayors’ Council on Regional Transportation, 2017).

The 10-Year Vision for Metro Vancouver Transit and Transportation plan includes a $2 billion plan focused on delivering more public transit services, road improvements and active transportation related upgrades. Currently, TransLink is working on the delivery of Phase 1, which was approved in November 2016. Phase 2 of the plan includes transit infrastructure improvements such as the Broadway Subway Extension Line in Vancouver, new LRT line, which is currently been debated as a Skytrain system in Surrey, replacement of the Pattullo Bridge, and additional expansion of other transit services. Phase 2 of the Plan is estimated to cost $7.3 billion to deliver all the regional transit improvements.

The governance structure for TransLink has changed more than once within the span of a few years. These changes have been extensive, with a full restructure of the governance and planning framework. Governance structure and relationships still need to be tested in the region as they have demonstrated to be quite volatile in recent years. Both the Province and the regional government continue to express interest to control regional public transportation priorities. Thus, for the implementation of a program such as the scale of a mobility pricing strategy, government arrangements will need to be fully resolved.
The recent Municipal Elections that took place in October 2018, resulted in a shift in leadership for three of the largest cities within Metro Vancouver. Vancouver, Surrey and Burnaby have new mayors. City of Vancouver’s Mayor Kennedy Stewart, and City of Surrey’s Doug McCallum signal new perspectives in the region’s direction, as it relates to transportation. Mayor Stewart’s platform revolves around supporting transit in the region. He commits to expand transit services, reduce fees for seniors, people with disabilities and children, invest in the Broadway Subway Extension project, and work together with all levels of governments and regional partners to reduce congestion. (kennedystewart.ca, 2018). His views do not differ significantly from the previous leadership team in Vancouver – Vision Vancouver but focuses more significantly on transit services and regional support.
Mayor of Surrey Doug McCallum made a central promise to move away from plans to deliver the Light Rail Transit (LRT) system in Surrey. This is a significant shift as it means scraping a plan that was agreed by all levels of government, as part of the implementation of the Mayors’ Council 10-Year Vision for transportation. Phase 1 of the procurement process was already underway for the LRT alignment; however, Mayor McCallum is cancelling such plans as he is proposing to explore the opportunities to deliver on a Skytrain facility. This shift in local and regional leadership will significantly affect the next steps in the efforts to implement a mobility pricing strategy.

At a recent Mayors’ Council meeting that took place in November 15th, 2018, Mayor McCallum announced the change in Surrey’s rapid transit project, from light rail to Skytrain along the Fraser Highway alignment. As per his campaign promise, he quickly moved to scrap light rail plans and obtain support from the Council. TransLink cancelled all expenditures plans for the project as work was already underway. To date, TransLink and City of Surrey had already spent $50 million and $20 million, respectively, as part of the pre-construction work required for the light rail project. This change came with support by a few, but also concerns over the rush decision of approving Skytrain as expressed more critically by Richmond Mayor Malcolm Brodie. Overall concerns over funding were discussed as well, with final conclusions that City of Surrey will conduct more studies as Mayor McCallum believes the estimated cost of $2.9 billion to be less than estimated, and Council directed staff to conduct more analysis on the process (Saltman J, 2018).

The history of the creation of TransLink and the role of the Mayors’ Council point to evidence over the state of regional transportation governance in Metro Vancouver. Governance for Regional Transportation has evolved significantly in the last decade, with major changes in governance taking place as recent as 2010, where TransLink and the Mayors’ Council new structure was approved. Whether this new structure is effective and appropriate, is still up for debate given it have only been a few years since this new structure was implemented. The implementation of a major regional transportation policy, such as a mobility pricing strategy, could demonstrate to be a difficult one given the “infancy” of the current governance model. Thus far, the most significant undertaking by the current Regional Transportation leadership has been the creation of the Mayors’ 10-Year Vision Plan, implementation of Phase 1 and funding
support for Phase 2 of the Plan. All of which have been of great significance in the region.

The recent changes in political leadership over the provincial and local governments have demonstrated to affect the course of transportation in the region. With the election of the new Provincial government leadership, Premier Horgan centered his political platform on the removal of tolls along two bridges, while the newly elected Mayor of Surrey, Mayor McCallum, made changes to the Mayors’ Plan within the first month of taking office. Political triggers such as the change of political leadership, have proved to bring significant transportation policy changes. This is like examples found in the case studies for London and Stockholm in particular. In both cases a new Mayor and a new leadership, led to the increased momentum over the implementation of a congestion charging strategy. Further details of the case studies are explained in the following chapter.
5.4. Mobility Pricing Independent Commission

Mobility Pricing is defined as strategies for pricing transportation options and modes. Pricing schemes can include a range of fees and charges such as road usage fees, transit fares and charges for using shared use services like taxis, bike sharing, car sharing or ride hailing (Mobility Pricing Independent Commission, 2018).

The 10-year Vision for Metro Vancouver Transportation Plan establishes initiatives to reduce congestion across the region via investments to public transit, bridges and active transportation modes. This plan also commits to evaluate mobility pricing strategies that support congestion reduction and sustainability. Due to this commitment, an Independent Commission was formed in the Spring of 2017. The Mobility Pricing Independent Commission13 (“MPIC”) consists of 14 representatives from across the region selected by the Mayors’ Council and TransLink Board (Mobility Pricing Independent Commission, 2018).

The purpose of the MPIC is to provide recommendations to TransLink and the MAYORS’ (VS. Mayor’s) Council about a mobility pricing scheme or approach that meet the core objectives of relieving congestion, promote fairness, and support transportation investment. This includes a recommendation on how to price transportation across Metro Vancouver in the form of a decongestion charge, that helps increase revenues, while ensuring fairness and equity (Mayors’ Council on Transportation, 2018).

The key objectives guiding the Commission’s decongestion charge recommendations are threefold:

13 The Mobility Pricing Independent Commission is a group of 14 representatives from across Metro Vancouver who were tasked with making recommendations about decongestion charging in Metro Vancouver to the Mayors’ Council on Regional Transportation and the TransLink Board of Directors. Although Commission members were affiliated with a variety of organizations, they participated in the Commission as private citizens.(itstimemv.ca)
• Reduce Traffic Congestion on roads and bridges;

• Promote Fairness; and,

• Support Transportation Investment

The Commission was tasked by the Metro Vancouver Mayors’ Council on Regional Transportation and the TransLink Board of Directors to investigate and report back on a mobility pricing strategy that would provide a more coordinated approach in paying for transportation infrastructure in the region. More specifically, the Commission looked at the opportunities for road usage charges or decongestion charges as part of the strategy.

A 10-month research was conducted that included a public engagement process – *Its Time* – to review opportunities for a comprehensive mobility pricing program that would include decongestion charges to meet the Commission’s objectives of reducing congestions, promoting fairness and supporting transportation infrastructure investments. During this period, baseline research, policy analysis, modelling exercises, public education and engagement were conducted to provide a recommendation to the Mayor’s Council and TransLink. The Metro Vancouver Mobility Pricing Study – Findings and Recommendations for an Effective, Farsighted, and Fair Mobility Pricing Policy, prepared by the MPIC was published in May 2018.

As part of the public consultation process, a two-phase approach was implemented with a series of online engagement, in-person meetings and workshops. All the engagement steps took place integrating a diverse group of stakeholders, elected officials and the user advisory panel. The Panel was created to represent Metro Vancouver’s diverse population. During Phase 1 of the consultation process, residents were introduced to the mobility pricing and decongestion charging concepts, objectives and principles (Mobility Pricing Independent Commission. 2018). In Phase 2, the public was asked on three decongestion charging models: fuel tax, distance-based charging and point-based charging could impact the region. Based on the responses collected and technical analysis conducted, the MPIC compiled findings and recommendations into the report published in the spring of 2018 (Mobility Pricing Independent Commission 2018).
The report explains the opportunities in transportation infrastructure following the strategies set out in Metro 2040 and the Metro Vancouver Regional Transportation Growth Strategy. All of which focus on achieving an “efficient, affordable, and sustainable transportation system” that provides access to everyone. Rising population growth and demands for transportation services will contribute to increased traffic congestion in the region. As part of the regional transportation plans, the region has a mandate to evaluate transportation demand management strategies, such as road pricing (Mobility Pricing Independent Commission, May 2018).

Previous approaches by the region to fund transportation projects such as roads and bridges, included toll charges and fuel tax. Fuel taxes have provided for transportation revenues but are not considered sustainable for the long term as vehicles are becoming more fuel efficient and technology, such as an electric battery, are replacing the need for fuel (Mobility Pricing Independent Commission, May 2018).

Furthermore, fuel taxes are not directly addressing the issue of congestion, as The Commission conducted preliminary studies, prior to the May 2018 Mobility Pricing Study, to understand the current state of traffic patterns. From their initial assessment, the areas with most congestion within Metro Vancouver include: vehicles entering and leaving downtown Vancouver, bridge crossings, Massey Tunnel, major arterial roads in Vancouver and Burnaby, near regional urban centres (Surrey City Centre, New Westminster, Metrotown and Richmond City Centre), and highways 1 and 91 (Mobility Pricing Independent Commission, 2017)

The following section provides information on the report’s key findings and strategic recommendations and provides some key comparisons with the case studies evaluated earlier.

5.5. Decongestion Charge Models

Two decongestion charging models are been proposed very broadly in the Commission’s report. Each of which includes a slight variation. Initially the Commission evaluated 8eight possible mobility pricing formulations but narrowed it to two as they align with the overall objectives of the Mobility Pricing strategy. The recommendation
includes a congestion point charge at key locations, and a distance-based charge that vary depending on time of day and location.

The congestion point charge model follows the implementation of real-life examples, such as the case in London and Stockholm. In these two cities, a central zone was established, and vehicles are charged at point locations entering and exiting the prescribed zone. The Commission’s report identifies a point charge system in Metro Vancouver that would locate charging points at or close to 12 crossings across the region. Charges are located along all bridge crossings (though not all the False Creek crossings) plus North Road, which is the boundary between Burnaby, New Westminster, as well as Coquitlam and Port Moody.

The charges should reflect on congestion levels hence would vary by time of day, location and directional travel. Higher rates would be charged during peak periods. A price cap could be implemented to address trips that crossed multiple points but will be explored as further research on this model develops. Based on the modelling conducted for this concept, the Commission found that congestion reductions were estimated to improve by 20-25%, while travel time reliability would improve by 17-20% (compared to 203 baseline). The implementation of this concept can follow similar technology as that of the tolls implemented along Port Mann and Golden Ears bridges.
The Commission conducted modelling analysis to determine the average cost per household under this concept. The estimated median weekday cost to households is in the range of $5 to $8 a day, or $1,800 to $2,700 per year. The results show that high income households would on average pay more, however low-income households would pay more in proportion to their income. As part of the further development of this concept, the Commission is exploring the amount needed to correct the imbalances in terms of equity of this concept.

The multi-zone distance-based charge concept would be based on zones within the region that would reflect on different charge rates. Zones are still being defined, but the report identified eight for the purposes of analysis and evaluation. Rates are charged during peak periods. Like the point-base charge, price capping for distance-based will also be explored to address long distance trips within several zones. Modelling results show an overall congestion reduction of 20-25% and travel reliability improvements of 18-23%. In terms of costs, the weekday average cost per household is $3 to $5 a day, or $1,000 to $1,700 per year.

Figure 8. Multi-zone Distance-based Charge Concept (Mobility Pricing Independent Commission)

The multi-zone distance-based charge resulted in better projection, however there are many uncertainties surrounding this concept. The cost implementation, operations charges and technology need further research, as this method has not been implemented before.
5.6. Findings and Recommendation

Based on the research and comprehensive public engagement process, the Commission found that congestion is an issue widely affecting residents in Metro Vancouver. Almost 90% of residents in the region say that they are frustrated with congestion caused by high traffic volumes (Mobility Pricing Independent Commission, May 2018) and measuring congestion are not easy tasks. Congestion can be measured in many ways, and the results might vary based on its definition and metrics used. Even when trying to measure it, different metrics would provide a different story (i.e. measure delays VS measure speeds).

Congestion impacts the reliability of travel times, in urban areas. About 74% of people in Metro Vancouver are frustrated with the lack of predictability in travel times in our region. An interesting finding was that people have more tolerance to certain levels of delay, if the travel times are predictable. Frustrations from residents are mainly based on unexpected delays and not been able to predict their arrival times.

Trip patterns show that most trips occur within each of the municipalities and only a portion of them are commuting trips to and from work. In the morning peak, only half of the trips are to and from work, while in the afternoon peak period, one third of them are trips commuting from work. Peak periods are defined as the time of the day when traffic conditions are at its peak, i.e. Congestion. Unlike traditional believes that peak periods are caused during the morning and afternoon peak hours as people commute to and from work, the report suggests that it is not the case. A significant portion of trips during peak hours are for recreational and other non-commuting purposes.

Regarding transit services, residents in the region feel that it would not be fair to charge for the use of roads in areas where transit services are not frequent. Availability and accessibility to transit were identified as integral to the development of a mobility pricing strategy that would include charges as the decongesting tool (Mobility Pricing, May 2018).

The MPIC report looked at other cities that have already implemented forms of decongestion charging schemes including London, Stockholm, Milan and Singapore. Research from other cities as well as the modelling exercise conducted as part of this study, demonstrated that after the implementation of a decongestion charge, most
people would continue to pay and drive. However, to visibly experience a reduction in congestion, only a few people need to change their behaviour major shift is not to transit, but rather shifts in time of the day, share car rides, and reduce trip lengths as noted in the Commission’s report. The results from the MCIP report are also compatible with those found during the evaluation of the case studies, where the reduction experienced in London and Stockholm accounted for about 20% - 22% across the charging zones.

The transportation industry is experiencing fast changes in technology and innovation. The introduction of ride-hailing companies, which is currently been reviewed by the Province, autonomous vehicles and electric technology will have an impact in the price of transportation, likely reducing the price of mobility. The use of car share and ride hailing services, as well as the growth in the electric vehicle industry could also impact positively environmental related initiatives. However, this might not be the case for congestion. A reduction in the cost of transportation might be beneficial, but only if it is done in an equitable manner that is sustainable. As per the objectives outlined by the Commission, ensuring a scheme that promotes fairness and addresses previous concerns over bridge tolls is important in ensuring public acceptability.

Time and money have an impact in the way people choose to travel. The time, the route and the mode of transportation chosen can be influenced by the travel time and the cost of that trip. Often, congestion is a sign that the right price for transportation use is not been charged. If adjusted properly, the cost of the use of transportation can effectively influence long term travel patterns. The Commission’s report also identified that in the cases evaluated including London, Stockholm, Milan and Singapore, the implantation of decongestion charges led to successful results as part of their congestion strategies, overall congestion reductions of 10%-20% while average travel time reductions of around one-third.

An important assessment conducted during this stage of the Commission’s study, was the review of the removal of tolls by the newly elected government in BC in September 2017. Both the Port Mann and Golden Ears bridges had toll charges that were applied to fund the investments on road and bridge infrastructures. The impacts of the tolls were negative as overall traffic over the Patullo bridge (not tolled), reduced upon the removal of tolls, but overall traffic increased across all bridges. Tolls were removed in September 1, 2017. Based on data collected by the Ministry of Transportation and
Infrastructure, the Port Mann Bridge had approximately 4.36 million vehicles crossing the bridge in September 2017, compared to 3.43 million in September 2016\(^{14}\). The Golden Ears Bridge also experienced an increase from 1.14 million, to 1.46 million after the removal of tolls\(^{15}\).

The most promising decongestion charging concepts for the region include a point-based charging system or multi-zone distance-based charge. As described in the Commission’s report, Metro Vancouver residents are concerned about the way revenues are used to fund transportation infrastructure in the region and have also express anxiety in the potential for increasing unaffordability in Metro Vancouver due to the potential decongestion charges proposed.

To obtain public acceptability and government support for a decongestion charge, equity and affordability need to be addressed in this strategy. Identifying opportunities to mitigate the financial impact of these charges in particularly sensitive communities such as low-income and seniors were considered an important component of this initiative. Equity is a very subjective measure and understanding how to implement the charges in an equitable manner, will continue to be explored by the Commission, the way to relocate costs so the charges are proportional to income.

Public support for mobility strategies and decongestion charges is only viable, if the proposed charge is effective in reducing congestion altogether. Thus, charges would need to be implemented to the degree that the cost will impact travel behavior. Modest increases in user costs might not have an effect in shifting travel behavior, and although it might increase revenues, it will not be effective in reducing congestion.

The Commission identifies in the report that currently, public support for decongestion charges is low at about 34%. However, a significant number of the public are also undecided or skeptical towards the introduction of charges in the region (32%). The results of this poll, which was conducted as part of the Commission’s work, are not any different from the public attitudes towards congestion charges in other cities. In London and Stockholm, the public support was at 30% and 21% respectively before the

\(^{14}\) Data collected by the Ministry of Transportation and Infrastructure (https://prdoas3.pub- apps.th.gov.bc.ca/tsg/)

\(^{15}\) Data collected by TransLink (https://www.TransLink.ca/en/About-Us/Media/2017/October/Backgrounder-on-Golden-Ears-Bridge-crossings.aspx)
implementation of the congestion charges. In both cities, public acceptability increased significantly after the initial implementation of the plan or trial. This was due to significant improvements in travel times, the increased cost not been as bad as expected, and the ability to adapt quickly to the charges. In addition, Livingstone’s commitment to investing charging revenues towards improved transit was supported by the public, which helped obtain further support for the charging scheme.

To obtain public support, it is key that the mobility pricing strategy addresses the public concern on equity, affordability, transit option improvements, and increased accountability and transparency in the way revenues are spent for transportation infrastructure.

Based on the analysis conducted by the MPIC, which included the use of the Regional Transportation Model, both concepts showed to be similar in achieving congestion reduction, and their effects on average household costs. The point-based charge concept is easier to implement given the existing technology is available (i.e. Tolls and electronic charging). The point-based charge system can follow similar technology as the one implemented for bridge tolls in BC. However, this concept would not allow for flexibility in terms of its integration to a broader mobility strategy in the region. If there are significant changes in land uses, such as the construction of new urban centres, or if decongestion charges need to dynamically vary in pricing to account for parking costs and others. Multi-zone distance-based charges would allow for a more flexible option as it can be easily refined and modified, but the implementation of this type of technology has yet to be proven.

The MPIC concluded that if the congestion issue is acute and of urgent need for improvements, then the point charge system should be considered. If the mobility pricing strategy is considered of a longer-term implementation, then is worth to explore zone-based distance travel charges, as this concept will provide for more flexibility and more closely reflect on user charges.

The Commission’s study included an estimate for potential rates and charges to be implemented as part of each of the concepts based on a combination of marginal social cost pricing, which should be between 50% to 75%, and minimum congestion reduction thresholds. This is due to the lack of a congestion reduction target; thus, the
costs and pricing need to be adjusted based on other factors such as regional travel time savings, visible congested time savings, and economic benefits. Both concepts include a minimum charge, which is the charge required to achieve the minimum level of meaningful congestion reduction (50%) and a minimum+ which is the one that would achieve a slightly higher reduction in congestion (75%).

The United Kingdom commissioned a study to review alternative methods of charging road use. The report titled the Smeed Report, was prepared by 11 economists and engineers in the 1960s and provided a recommendation for road pricing. The report was named after the project team lead, R.J. Smeed, the then deputy director of the British Transport and Road Research Laboratory, who was a statistician and transport planner. He identified Smeed’s Law, which is described as the motorists’ tolerance towards speed and risk, if speeds fall below 9mph, drivers would not go out (Weiss G. H, 1985).

The Smeed report concluded that the effects of speeding up congested traffic would benefit the economy by £100-£150 million per year. The report was based on understanding that the road user should pay for the cost that is imposed upon others, which covers road costs, congestion and social costs (i.e. Risk, noise and fumes). Compared to the report prepared by MPIC, the Smeed report provided a single scheme recommendation and more implementation details such as charging zones and boundaries, payment methodology, and a detailed economic analysis. The economic analysis provided in the Smeed report was focused not only on the overall congestion benefits, but also the positive impacts of the use for the revenue collected (Smeed R.J, 1964).

Once the report was released, it was received with hesitation by the Macmillan Government. In June 1964, the government reported that more studies and feasibility reviews were needed to understand the implications of such policy, and no commitments were made for the implementation of user charges (The Times, 1964). Some attention was brought back to the recommendations provided in the Smeed Report, by then Minister of Transportation Barbara Castle\(^{16}\). However, the political will that was required to fully implement the proposed scheme was not present and in fact was diminishing. By

\(^{16}\) Barbara Castle was Minister of Transport between 1965-1968, under the Wilson Government.
1970, the government changed, and the scheme died. The Smeed report continued to be an influential study that was studied and reviewed by many, including Singapore.

As pointed out during the evaluation of congestion charging in London, Stockholm and Edinburgh, political will continues to be key in the implementation of congestion charging. In the Smeed report example, the study was commissioned by the UK Government, but was never implemented due to lack of political interest.
Chapter 6.

Analysis and Considerations for MPIC

The findings and recommendations from the Mobility Pricing Independent Commission included two decongestion charging concepts, a point charge system and a distance-based charge. These recommendations were formulated based on a detailed process that incorporated technical analysis, and a 10-month public consultation and stakeholder involvement. Based on the review of the three case studies and the Metro Vancouver context, a series of considerations are being recommended for further evaluation by the MPIC for the implementation of a decongestion charge in the Region.

Key considerations were focused on the formulation and implementation of the policy, but not related to the technical aspects of decongestion charges. Reviews of the technology implemented, modelling tools, fee structure or overall operations of congestion charging systems were not considered as part of this research.

Based on the proposed mobility pricing schemes, and the evaluation of decongestion strategies in London, Stockholm and Edinburgh, five key considerations are discussed from a policy perspective:

- The transportation governance structure within the regional context;
- Political climate and triggers,
- The implementation of a trial and referendum in BC,
- The proposed mobility pricing policy objectives, which includes equity and fairness as core objectives of the scheme, and
- Clarity over revenue use and transit improvements.
6.1. Transportation Governance in Metro Vancouver

Transport is critical infrastructure that needs to be systematically and conveniently available for all users. Transportation governance concerns the “ownership and management of assets and resources to fulfill goals such as profit or welfare through the exercise of authority and institutional resources (…)”. (Rodrigue, 2017).

Governance within transportation in the region is quite unique and includes a considerable number of stakeholders. Transport governance arrangements in the region include The Mayors’ Council on Regional Transportation, and TransLink. The Province and Federal levels of government are also involved in transit and transportation projects in the region as it relates more closely to funding and inter-regional type movements. Transportation governance plays a key role in the consideration and implementation of decongestion charge schemes, as found in the case studies, review of the Metro Vancouver context and literature review.

Governance is a key topic when discussing transportation in an urban context. Before diving deeper into the governance structure in Metro Vancouver, it is important to highlight the reasons why governance plays a key role in the implementation of mobility pricing in the region. The efficiency and efficacy of the transportation system and services provided can only be supported by all three levels of government aligning objectives and reinforcing each other’s principles. Working cross-purposes or in silos will not contribute towards the delivery of a policy such as mobility pricing. Traditionally, transportation in the Region has been addressed with the approach to ‘optimize infrastructure’ to increase or improve capacity. This allowed the division of jurisdiction over roads and overall transportation infrastructure. However, in an urban context, this approach has changed significantly where the arrangement of people and space has become a function of the transportation system. There is an increased need for the integration and interaction of transportation and urban / spatial planning (Lim, 2012).

A review of the current governance structure is important prior to the implementation of a congestion charge in Metro Vancouver. Governance in transportation in the region has gone through changes in the last 10 years. TransLink governance structure changed in 2007, when the then Minister of Transportation and Infrastructure commissioned a review of TransLink’s governance (Wales T, 2008). From
that review, three changes were recommended and enacted: A new planning framework, 
a new three-part government structure, and the establishment of a TransLink 
Commissioner. The three-part government structure incorporated a new Council of 
Mayors and a non-political TransLink Board.

A study commissioned by TransLink in 2013, concluded that governance 
arrangements have been “quite volatile” and with significant changes occurring in 
“relatively frequent intervals” in Metro Vancouver. The study also highlights that the 
Province has been reluctant in providing local governments with a more active role in the 
planning and delivery of transit services (Lim, 2013). In 2014, a set of reforms were 
passed with the purpose of improving TransLink’s accountability. The reforms included a 
decrease in the number of Board seats (from 9 to 7), and dissolved the office of the 
TransLink Commissioner. By dissolving the Commissioner’s role, most of its powers 
were transferred to the Mayors’ Council (Gardiner, 2017).

The current transport governance structure in Metro Vancouver fails to link the 
urban region and its communities. To implement a strategy, such as a Mobility pricing or 
decongestion charges, the link between transportation, communities, environment and 
the local regional economy need to be explicitly explored. TransLink is responsible for 
the delivery of public transportation projects, while the individual municipalities are 
responsible for the planning of land use infrastructure.

London’s transport governance addresses the links between communities and 
transportation. The Mayor has powers that include setting the overall vision for the 
capital and the implementation of policies to deliver that vision. The creation of Transport 
for London (TfL), which is the integrated transportation agency responsible to operate 
the London transport system and implement the Mayor’s Transport Strategies (Transport 
for London, 2018), allowed for the integration of transportation policies that were specific 
to London. In Stockholm, the Stockholm County Council is responsible for public transit, 
and SL is the agency responsible to plan and develop public transportation (Sandstrom, 
I. 2017 Transport Administration). Transportation policy and funding for both London 
and Stockholm, are direct responsibility of the elected Mayor and the elected County 
Council, respectively. In Metro Vancouver, the development of overall policy direction 
and priorities are given by the British Columbia Government, Mayors’ Council, TransLink 
Board and Commissioner, which represents a much complex arrangement.
This complex arrangement also limits the ability to understand who is responsible for transportation policy decisions and implementation. The Provincial government has been the ultimate decision maker in the final implementation of rapid transit lines (Wales, 2008). For the implementation of tolls, the Province and TransLink implemented tolls for the Port Mann and Golden Ears Bridge, respectively, but it was the Province that had the recent decision of removing tolls in BC.

To successfully implement a mobility pricing scheme in the region, as proposed by the MPIC, the transportation governance in Metro Vancouver should be reviewed. More specific, the ability for this governance structure to take on the implementation of such a significant transportation program, such as a decongestion strategy. The last governance changes were triggered by disagreements between the Province and TransLink Board over the final phases and implementation of the Canada Line project. The complexity of a policy such as the mobility pricing proposal has the potential to trigger more disagreements over governance matters. Prior to this proposal moving forward, a final review of current TransLink governance should be considered, to ensure the Province, TransLink and the Mayors’ Council are comfortable and agree with the established governance arrangements.
In both, London and Edinburgh, the Mayors for each of those cities were provided with increased powers, which included the implementation of policies such as decongestion charges. If a similar process is considered for Metro Vancouver, is it possible to provide the Mayor’s Council, Metro Vancouver, or each individual municipality with powers that include transportation policy, vision and implementation? Should Translink’s governance and/or service mandates change yet again to resemble a regional body that incorporates policies that go beyond transit?

### 6.2. Political Climate and Triggers

As the cases in London, Stockholm and Edinburgh, initiatives such as decongestion charges were born as part of political processes that took place at the appropriate timing (Fietelson and Salomon, 2004, McQuaid and Grieco, 2005). This is also evident in the Metro Vancouver context, where political processes such as election periods were key for the removal of BC tolls. Most recently, a municipal election took place in October of 2018, creating some shifts in leadership. The most predominant is the election of new mayors for the three most urbanized and larger cities in Metro Vancouver: Burnaby, Vancouver and Surrey.

Mayor for Surrey Doug McCallum made a central promise to move away from plans to deliver the Light Rail Transit (“LRT”) system in Surrey. This is a significant shift as it means discarding a plan that was agreed by all levels of government, as part of the implementation of the Mayors’ Council 10-Year Vision for transportation. This shift in local and regional leadership will significantly affect the next steps in the efforts to implement a mobility pricing strategy.

Lessons from case studies show that timing the consideration of decongestion charges to align them with an election can provide for an opportunity for implementation. Intentionally or unintentionally, in London and Stockholm, new government leadership gave path to the implementation of decongestion charges. In the region, the next Provincial elections should take place in 2021, or sooner, followed by municipal elections in 2022. As decongestion charges can become a highly political issue, it is important to recognize which politician or party might push for such policy. In the case for London and Stockholm, there were political champions such as Ken Livingstone and the Green Party, respectively, both of which helped the ultimate implementation of the charges.
However, like in the example for Edinburgh, where decongestion charges were been considered, conversations failed as no politician or political party wanted to take responsibility for it, and the CEC voted to move it to a referendum.

Recent events in the region have helped push for public discussions and interest in mobility pricing such as the 2015 transit plebiscite and removal of BC bridge tolls. Even though the results of the plebiscite were not favourable, it served as an opportunity to gain attention and communicate the needs for funding for transit services. It also highlighted the severed inter-governmental relationship and public perception over TransLink mismanagement of funds and operations (Canadian Taxpayer Federation, 2015). With the removal of BC tolls, transportation funding needs to be revisited in the Province.

As per the case in London, it is important to have the presence of a political champion that would push for decongestion charges in the Metro Vancouver region. Livingstone was that figure in London and was instrumental in the delivery of congestion charges (Leape 2006). Mobility pricing in Metro Vancouver has the potential to be part of the political agenda for individuals or parties that focus on sustainability, and to some degree affordability. Fiscally conscious politicians can also support such policy as the charges allow for a stimulation of the economy, as well as the opportunity to close funding gaps.

6.3. The implementation strategy - trial and referendum

Based on the post-mortem evaluation of the transit plebiscite and the HST referendum, it is important to consider that a decongestion charging trial can provide for a better understanding of the scheme and the ability for the public to focus on the issue of congestion charges. This was also the experience in Stockholm, where a trial led to successful results during the referendum (Isaksson and Richardson, 2009).

To avoid the same issues that occurred during the transit plebiscite and HST referendum, where the public tended to vote on items unrelated to the ballot question (Abbott, 2015), providing for direct experience will be very valuable. A trial increases the willingness of people to accept a user charge that was not there before. Studies on public acceptance in Stockholm showed that the support rate for the scheme increased
from 33% to 51% after the trial and referendum, and even increased to 70% five years after implementation (Borjesson et al., 2012).

Part of the reason why the decongestion charge scheme in Edinburgh failed was because the residents did not fully understand the proposed scheme and potential benefits. Even transit riders in Edinburgh did not support the plan as benefits were not fully spelled out nor experienced by residents. A trial could have provided them with the opportunity to experience the benefits of the decongestion charge, and perhaps ultimately support the implementation of charges in Edinburgh.

In Edinburgh, the CEC decided to move to a referendum for the implementation of decongestion charges, even though they had obtained the power to implement it without the need for a referendum. This decision by the CEC impacted negatively the public perception over the decongestion charge proposal, as residents expressed their disapprovals throughout the public consultation process. From a political perspective, the CEC decided to move into a referendum to avoid political liability on the implementation of the policy. This is very similar to the case for the 2015 transit plebiscite in Metro Vancouver, where the Province decided to also call for a referendum as opposed to make a decision in support of the Mayor’s Council plan.

It is also important to note that there is a cost associated with a trial. In the Stockholm case, the national government assumed all the cost for the trial which was estimated at 3.8 billion SEK or approximately $550 million. Revenues from the charges were collected, however due to the short trial period; the amount collected did not pay in full for the cost of the trial implementation. Based on studies conducted a cost-benefit analysis resulted in a cost-benefit loss of 2.6 billion SEK or approximately $380 million (Beser Hugosson and Eliasson. 2006).

The area covered as proposed by the MPIC report is significantly larger than the case studies evaluated. Metro Vancouver’s is approximately 2,700 square kilometres, whereas London and Stockholm’s charge zones are about 21 and 30 square kilometres, respectively. Costs of implementation will be significantly higher for the Metro Vancouver Region and impacts will likely be hard to measure. As a regional entity, the MPIC is looking at a regional strategy for decongestion charges, however this is quite a unique approach, as there are no examples worldwide where a regional dtecongestion
charge was implemented. Reconsidering the area for the implementation of a
decompression charge should be considered, pending reviews of governance and equity
across the region.

Conducting a trial for an area like the City of Vancouver (115 square kilometres),
or a smaller area such as Downtown Vancouver (approximately 10 square kilometers) or
any major city centre, can provide for an easier trial process and implementation.
However, trialing congestion charges should be carefully designed, as there is a risk
for it to be unsuccessful. If not designed appropriately, the public will not support the trial
as they might be able to experience the benefits of such policy. As in the example in
Stockholm, the trial should achieve the following:

- Visible reduction of congestion during peak periods;

- Financial impacts should demonstrate to be minimal – once the public is
  able to experience the charges, they will realize the actual added costs
  are not as bad as anticipated.

- Familiarity with the congestion system – the trial should be in place
during a particular amount of time that would allow for the residents to
become familiar with the system

- Allow for transparency and communication regarding the charges – once
  the trial is implemented, it is important to communicate to the residents of
  the process, results and next steps.

6.4. Policy Objectives – Equity and Fairness

The MPIC identified key objectives for the regional mobility pricing initiative early
in the process. As part of a series of public engagement events, the Commission
launched the “Its Time” project, to kick start conversations and explore mobility pricing
principles and objectives. Through this process, three key objectives were identified:
reduce traffic congestion, promote fairness, and support transportation investment
(Mobility Pricing Independent Commission, 2018).
Reduction in congestion and increased transportation investments are objectives that can be achieved, measured and predicted given that those are tangible outcomes of the plan. However, measuring the level of fairness and equity tends to be more difficult as they tend to be very subjective terms. In London and Stockholm, the objectives for the proposed congestion charging scheme were only related to congestion reduction and revenue increases.

The MPIC considers the application of several principles to ensure a fair approach based on the input received by the public to the decongestion strategy. Consistency in the application of charges for different users’ needs to be explainable. There needs to be clarity in the way road usage and charges are related and determined for all users. Congestion charges should be representative of the economic costs of congestion for all users; this means that the charges will be different for users and will be based on decongestion benefits for each user group. Costs should be representative of the impact imposed by a motorist, transit rider, and others. However, costs should also be responsive towards socio-economic levels, which is another dimension to equity.

Another principle to ensure fairness in the application of this decongestion charge is the alignment of the charges with transit improvements, which was the case for London. As charges are implemented, transit access needs to be improved across the region. If transit improvements are not present, then reduction in congestion will not be achieved as people would not have other options but to pay and continue to drive. This is explored in more detailed in the following section.

To address equity, the MPIC identifies the promotion of equity as a key principle but have not defined equity or measurable outcomes. Revenues from this decongestion strategy should be considered to address affordability for those user groups that are more significantly impacted by increased charges. Inherently, a charge that is based on congestion is more equitable as it targets those that drive more. Some argue that people with higher incomes tend to drive more at peak congested hours. When assessing equity over decongestion charges, Stockholm is the only case that has attempted to study the impacts on equity and fairness.

A quantitative study conducted by Eliasson shows that even though low-income groups pay less than high income individuals, low income groups pay more relative to
their income (Eliasson & Mattsson, 2006). Another study conducted by Eliasson focuses on public’s perception of fairness in Stockholm post-implementation (Eliasson, 2016). In the study, it was found that differences in citizen’s preferences over the charges were negligible across different income groups. However, results were less conclusive with regards to equity. Lower-income groups agree more significantly than high income groups on the need to address the gap between rich and poor, and how decongestion charges affect them. As the study examples from Stockholm show, impacts from decongestion charges over fairness and equity have not been well defined, and are inconclusive. As mentioned earlier, Stockholm did not identify equity or fairness as an objective of the plan, whereas the MPIC did. Without a proper definition and expected outcome, it will be difficult to assess whether this objective is met and this could pose a risk for the implementation of the charge.

Another approach to address equity has been to ensure the allocation of revenues for welfare purposes, which the MPIC’s report also mentions. There are several ways to allocate revenues including: funds to improve public transportation services, discounts for certain user groups, tax cuts proportional to vehicle use, and other types of strategies. London provides discounts for residents of the congestion zone areas, vehicles used by disabled people, emergency and service vehicles, and others.

In Stockholm, the revenue from the decongestion charges are dedicated for the improvements of roads and regional transportation improvements in the Stockholm region, which has a small effect on the distribution of the revenue benefits across income groups. (Kristoffersson I. et al. 2017).

### 6.5. Revenue Use and Transit – Equity considerations

One of the objectives of the MPIC for the proposed mobility pricing schemes is to support transportation investments. Based on the literature review and the case studies evaluated, decongestion charging can provide for significant revenue generation. Depending on how the decongestion charge gets implemented, the charge could become revenue neutral, as there might be some political appetite for it (Althaus C et al., 2011). Perhaps removing the carbon tax, and even lowering transit fares could be explored in Metro Vancouver.
A significant portion of the revenues collected by charges will likely go towards recuperating the cost of implementation and operations; however, the remainder of the revenues should be directed towards other investments in transportation. Phase 1 and 2 of the work conducted by MPIC has not yet explored the specifics of the use of revenues. However, as per the case in London, it would help increasing public support if the use of revenues is committed for the improvement of transit. A commitment towards the delivery of the future phases of the Mayors’ Plan could be a way to increase acceptability for charges in Metro Vancouver and would also add value to the discussions over equity and fairness. By allocating charge revenues towards transit subsidies and towards the delivery of better transit services, public and political support will likely increase.

For a congestion charge policy to exist, there are two important factors: traffic congestion is present and is affecting the way residents travel, and alternate travel options must be available for residents. (Lindsey 2008). Alternative transportation such as transit services, cycling infrastructure and walking, among others, should be available and included within the scope of the charging scheme. Investments in alternate modes make it easier for commuters to support the charge. However, a key question here is do improvements in transit need to be in place prior to the charge or those services should be delivered as part of the revenues collected. In the case of London and Stockholm, public support increased as the revenues were committed towards improving public transportation. The share of people in Metro Vancouver that take transit is approximately 14%\(^{17}\), compared to London, where 85% of people take transit (Lindsey, 2008), and Stockholm, where approximately 80% of commuters into the City centre take transit (Eliasson, 2014).

In Metro Vancouver, there are several municipalities that do not account for rapid transit services or frequent buses. A map of the frequent transit network (FTN) as defined by TransLink, is attached in Appendix A. Municipalities such as Maple Ridge, Pitt Meadows, Delta, Belcarra and others do not include frequent or accessible transit services as other municipalities in Metro Vancouver. Without addressing the needs for public transit and alternate transportation options, a decongestion charge could result in an unfair policy for residents commuting to and from these cities. This was the case for

\(^{17}\) 2011 TransLink Trip Diary Survey
the removal of tolls in BC, as the NDP government considered tolls unfair for residents south of the Fraser.

Equity not based on demographics or socioeconomic level, but geographical equity is a risk inherent of a regional transportation strategy. A way to mitigate issues of geographical equity is the allocation of revenues that provide benefits to communities that would not have otherwise received any funding for transit or road improvements. Like the approach the Mayors’ Council 10-year Vision plan took, revenue use can be allocated in a more equitable way among all municipalities and user groups. The Mayor’s Council Transportation Plan included transit upgrades for all of the municipalities within Metro Vancouver.

For the implementation of a decongestion charge in Metro Vancouver, the use of revenues could be key in increasing public and political support. In Stockholm, the allocation of revenues towards public transit was not as explicit as the example in London. However, a list of broad investment commitments towards transportation were agreed amongst the government agencies, and communicated to the public.
Chapter 7. Conclusion

The research question that this study was trying to address is *What can the Metro Vancouver Mobility Pricing Policy learn from experiences in other cities in implementing a successful mobility pricing scheme?* Based on a case study review of cities that have implemented and evaluated congestion charges, key considerations have been drawn to inform the MPIC on the next phases of the evaluation of Mobility Pricing in Metro Vancouver.

The evaluation of the case studies in London, Stockholm and Edinburgh were complemented with the review of the Metro Vancouver context that allows for a better assessment of the Region’s current state in transportation policy and governance. Based on this research, five considerations have been concluded:

- **Transportation governance** in the region needs to be carefully reviewed to deliver on a congestion charging scheme. Based on recent changes that occurred in 2007, the Province, TransLink Board and the Mayors’ Council should revisit the governance arrangement to ensure they are ready to undertake the implementation of complex program such as mobility pricing. The governance structure in Metro Vancouver is quite complex compared to other metropolitan regions and one that has gone through many changes over the last few years. Most cities that have implemented a congestion charge consist of single body agencies that are responsible for the creation and implementation of transportation policy. Either a centralized administration will have to be created or agreements over congestion charges would have to occur among all government levels.

- Like any of the cities evaluated in the case study analysis, a congestion charge in BC will likely be part of a *political process* or processes. Election demands are likely the conduit for such policy, like what happened in London (Ken Livingstone election), in Stockholm (demands from the Green Party over the National elections) and even in BC with the removal of tolls (election campaign by Premier Horgan).
• Although it comes at a cost, a **trial** is the implementation approach recommended by several studies. Based on the evaluation of the 2015 transit plebiscite as well as the HST referendum, a trial will help the public understand the implications of a congestion charge and will allow them to focus on the issue at hand: congestion and revenues. Without a trial, a congestion charge referendum can run the risk of the votes been directed towards other issues unrelated to the ballot. In Metro Vancouver the transit plebiscite is a case in point. However, a trial could be unfeasible due to high cost. As the proposed scheme includes the entire Metro Vancouver region, a trial in such a large area could be excessively expensive. A reduced area(s) for a congestion trial should be considered.

• Revisiting the proposed scheme objective is important for the MPIC. **Equity and fairness** have been identified was a core objective within the plan. However, this could demonstrate to be the “Achille’s heel” of the policy as equity and fairness can be defined and measured in many ways. Without a more generally accepted definition and metrics, the policy can be proven to fail. Stockholm was the only case study that evaluated further the perception of fairness and equity post-implementation of the congestion charge. The ways cities have approached equity have been limited to: discounts and exemptions for groups and designing a progressive type of user fee. Both of which, have not been further analyzed nor quantified.

• **Agreement and clarity** over the use of revenues will help the region obtain support, if the funds are planned to be invested for transit services (Althaus C et al 2011). The MPIC should consider communicating the public early in the process about the allocation of funds and the infrastructure that will be improved if the charges are implemented. This can also help the increase of political support, if geographical equity is achieved in the process.
7.1. Research limitations

This study was limited to the evaluation of implementation process for congestion charges in three major cities. Given that congestion charges have only been implemented in a handful of places worldwide, the research available is limited and very case specific. This research attempted to generalize the findings of three case studies, London, Stockholm and Edinburgh, and apply them to the Metro Vancouver context.

The review of the case studies was only applying a policy lens and the analysis did not include aspects of decongestion charges related to technology, operations, enforcement or modelling. The study only reviewed the implementation strategies from a policy level. Thus, there could be further consideration for the MPIC for the technical aspects of the proposed scheme that this study is not accounting for. The cost associated with the implementation of a decongestion charging scheme was also not part of this analysis. However, it was found in the literature that implementation costs are high given the scale of the program and several economic studies have been conducted for the case studies evaluated post-implementation.

The considerations as provided in the previous section of this research paper, are very high level and only intended to inform the next phase of the MPIC strategy for Mobility Pricing. As this is the first time the region is reviewing a mobility pricing strategy, details and strategies have not yet been worked on, and will likely require more time for the MPIC to establish an implementation strategy.
Chapter 8. References


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Appendix

Frequent Transit Network (TransLink)

Description:
TransLink map: Frequent Transit Network in Metro Vancouver

Filename:
Appendix A frequent-transit-network-map.pdf