Improving Public Transit Fare System: A Case Study for TransLink Fare System in Metro Vancouver

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Abstract

This paper studies the effect on ridership based on changes in fare prices, and estimates the aggregate net transit-sourced revenue for TransLink, the regional transportation authority of Metro Vancouver. Our analysis is based on a model of historical transit demand that considers both fare elasticity and the issue of fairness based on distance travelled. The fare price adjustment problem is formulated as a deterministic integer programming model, and is solved using Excel. We find that a 10% increase in the cash fares but a 10% reduction in fares for passes and store values can increase the ridership by 1.2%. This increased ridership has a positive net impact on TransLink's operation after considering savings on traffic congestion, and overall allows TransLink to be more cost-effective.

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1 Introduction

Vancouver is Canada's most congested city [1]. TransLink, as the regional transportation authority, is exploring all alternatives to reduce the congestion [2]. Public transit is considered as a good alternative. However, the increasing fare prices for public transit since 2008 has exacerbated the doubts regarding the fairness of TransLink fare system.

The current fare structure, which can be best characterized as zone-boundary system, divides Metro Vancouver to three zones (See Figure 1). Travelling within the same municipality requires a one-zone fare; within two nearby municipalities requires a two-zone fare; and crossing all three zones requires a three-zone fare.

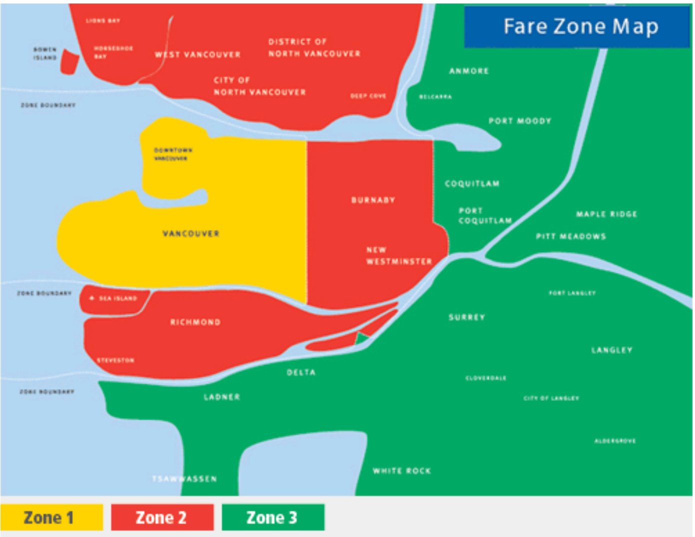

Figure 1: Metro Vancouver Fare Zone Map

Based on TransLink past 5 years' financial reports, approximately 50% of their revenue come from taxation, including fuel tax (around 22.5%) and property tax (around 21%); approximately 34% come from transit, which is mainly contributed by transit fare sales (around 33%). The remaining 16% revenue is consist of government transfer, interest income and etc.

After a close examination of the current fare structure and 2012-2014 financial reports, we found two issues which lead the public believe that TransLink has been unfair with their fare system.

First, TransLink's goal is to improve the usage of public transit, that is to increase the ridership. However, the 2013 and 2014 financial reports indicates otherwise. Due to 2012-2013 fare price increase, the public transit ridership overall dropped by 7.8 million while their transit revenue increased $35 million [5]. In 2014, the ridership has not risen back to the original level but the transit revenue has begun to drop, and the actual ridership has been constantly lower than TransLink expected. It appears that people are leaving the public transit system. In 2015, TransLink has officially began to implement Compass system (an electronic ticket system). However, due to the difficulty during the actual implementation, the ridership performance is still under expectation. Meanwhile, Vancouver has been found as the most congested city in Canada [1], which will worsen if people leave the system and become auto drivers.

Second, there are some boundary traverse cases where the crossing of a city boundary triggers a transit zone change. In such cases, travels can only be achieved by purchasing a two-zone fare. In some cases, such a zone-change happens even when one travels for a mere one stop. Here, we have the scenario where one group of transit users would potentially travel for a shorter distance, yet pay for a higher fare than another group of users who do not cross municipality boundaries. To quantify the probability of such boundary travel case, we refer to the earlier work by Tawfik [4] where the relationship between transit trips and fare zones were established by trip diary survey. We found that the percentage of arguably unfair cases of boundary travel is 19.3% (See Section B).This is the ratio of two-zone transit trips less than 15 km (the mean distance travelled for all transit users) over total two-zone transit trips, obtained from the sampled data collected by Tawfik.

Building on the above two problems, we are interested in the following questions:

(i) What would be the minimum price that could be charged such that the current TransLink's current transit-sourced revenue (namely, not including taxation, tolls, and interest income) could be maintained within a tolerable range?

(ii) What will such a price do to the ridership count?

(iii) If a reduced, single-fare price can be established, how will this change the travel pattern for people who are not regular transit users?

(iv) If a reduced, single-fare price can be established, how will this change the travel pattern for people who are travelling 2- or 3-zones by car?

We build on the current fare structure and construct a new model that gives the optimal price for each fare type. In particular, we estimate the price elasticity for each fare type, and model commute behaviour in Metro Vancouver as a choice between differentiated products. Thus, each commuter is viewed as a consumer, each travel method (auto driving, auto passenger, bike, walk, and transit) is a product, the costs (operating, parking, fuel, overall driving, and transit costs) are product characteristics, and the set of fares (none for auto driver, auto passenger, bike, walk, and separate fare types for transit users) is the consumer's choice set. We quantize the step size for the price of downward or upward adjustments. Our variables of interest are the number of steps we can make, which indicates the downward price adjustment we can make.

2 Background

2.1 Fare Structure Study

In 2015, TransLink officially began to use Compass system, which is an electronic fare card system. Users have to tap the card every time getting on/off a train/bus. Due to the difficulty of actual implementation (users forgot to tap out and caused a system failure), TransLink adopted a flat fare policy on its bus operation. Meanwhile, TransLink has already been considering a new fare structure to increase the ridership. A number of studies had been conducting on finding a "fair" fare structure for Metro Vancouver. Tawfik has studied the possibility of distance-based fare structure and time-of-day fare structure as well as their impact in Metro Vancouver [4].

Tawfik's model identified a large range of socio-demographic characteristics of Metro Vancouver residents, including age, income, household size etc; and it then used these characteristics to derive an approximate price elasticity of public transit fare. The research suggests that a distance-based pricing strategy will substantially improve the efficiency and fairness of the transit system. However, the model did not reflect how the proposed structures will impact the overall ridership.

Tawfik also assumes that price elasticity is crucial to decide a new fare pricing policy. However, Tawfik 's model didn't consider the relationship between fare structure and traffic congestion. Our model focuses on how the fare change would impact overall ridership and traffic congestion without completely changing the whole fare structure.

2.2 Traffic Congestion Study

There are various approaches to measure congestion and estimate its costs. The TransLink study [8] uses an approaches where it recognizes that there is an "optimal" volume of traffic and economically efficient level of congestion. This "optimum" corresponds to the traffic volume at which the benefit of the last marginal trip is equal to the cost of that trip. Additional trips beyond that optimum are considered excess traffic, as they generate more costs than benefits. The extent of net costs related to those additional trips - vehicle operating and time costs of driving and related social costs - constitute then the costs of congestion.

In the study, excess traffic is calculated based on the costs of driving (assumed to consist of a cash component and a time cost component), average actual speed, average posted speed, speed-flow relationship, and travel demand function. This methodology involves deriving the average cost function and the marginal cost function for the given travel demand function and travel costs, and finding such volume of travel at which marginal cost is equal to price (i.e. travel cost) that travellers pay. This is the "optimal" volume of travel. In congested road conditions, the optimal volume of travel is usually lower than the actual travel; the difference is the excess traffic that results in excess congestion. The costs related to the excess traffic, net of benefits, are then considered as congestion costs.

Instead of using a combined cash cost of driving and time cost of driving as our projected cost of traffic congestion, our model takes the more conservative approach by including only the cash cost of driving, which is enumerated the total of average cost of driving, accident cost and air pollution cost.

3 Model Outline

Our model considers a population of potential transit users distributed across the TransLink catchment area. Based on the count of revenue passengers in a fiscal year, we develop a novel transformation of data to allocate the overall revenue passenger count for the bus operation and rail operation of TransLink to travel counts completed on each fare type. Thus we are able to work in the space of passenger counts of fare types. For each fare type, by incorporating price elasticity, our model computes the increase (decrease) in passenger count per unit decrease (increase) in the fare price, which leads to decrease (increase) in parking taxation and fuel taxation revenue.

In setting the fare, our model considers different methods of public transit such as

SkyTrains, Buses, and SeaBus can substitute for polluting vehicles, and is part of the choice set of the commuting consumers. For each fare type, by incorporating price elasticity, it further computes the aggregate cost of traffic congestion (gas, wear and tear, pollution cost, and accident cost).

4 Data

4.1 Ridership

During the time to formulate new fare pricing policy problem, we found there were not enough detailed data regarding the ridership among all municipalities. Hence, we summarize the ridership from each regions in Metro Vancouver from 2011 TransLink Trip Diary(B.1).

4.2 Traffic Volume Cost

	Low	Medium	High
Average cost of driving	$0.683/km	$0.605/km	$0.470/km
Accident cost		$0.179/km	
Air pollution cost		$0.023/km	
Total		$0.662/km	

Traffic Volume Cost [1]

4.3 Price Elasticity

There were three fare price adjustments in past 10 years: 2008-2009, 2010 and 2012-2013. Our calculation is based on 2012-2013 price adjustment due to the rapid population growth and new Skytrain line opened in 2009 (Canada Line) [5][6]. The formula we use to calculate price elasticity is called point elasticity since in short term, all three different calculation methods (point elasticity, arc elasticity, mid-point arc elasticity) have no difference. Details will be demonstrated in Section 5.

5 The Model

5.1 Overview

We begin by calculating the prices as set within the current fare structure. Given the revenue structure of TransLink, we also consider factors such as incremental change of fuel taxation, parking taxation, and cost of urban traffic in our model.

5.2 Assumptions

The following are the assumptions of all those models we presented:

1. Riders behaviours are consistent (those who are already regular transit users remain the same status);

2. Day passes will be considered as monthly passes;

3. It is transferable between all the public transit;

4. Bus fare is a flat fare under current fare system, which is not limited by zone boundaries;

5. FareSaver tickets considered as the same as the stored value.

6. Fuel price remains unchanged.

5.3 Factors not included

The following is the summary of elements that will be considered out of scope:

1. **Concession Fare**
   Concession Fare is eligible for children who are 5 to 13 years old, students who are 14 to 19 years old with valid Gocard, and seniors who are 65 or elder. From TransLink Trip Dairy, residents who are 18 to 64 years old has the highest percentage (67%) of taking transit compare with other age group of the residents

2. **Discount Fare**
   Weekday after 6:30pm and Weekend fare is all in 1-zone fare price

3. **West Coast Express**
   The fare price is based on different scale

5.4 Variables, Sets, and Parameters

Type	Name	Explanation
Variables		
	p_i	Indicates price for type i fare
	n_i	Indicates the number of step size for p_i to adjust
	q_i	Indicates the current ridership for type i fare
Sets		
	I	Set of fare types
	T	Set of all general fare types
		(cash fares, monthly Pass, UPass, FareSaver)
	A	Set of all covered municipalities
	N	Set of years
	U	Set of all public transit services types
Parameters		
	K	Current Parking Taxation Revenue
	F	Current Fuel Taxation Revenue
	B	Current Operating Cost
Intermediate		
Quantities	$Q_{i,n}$	The ridership for i fare in year n
	$P_{i,n}$	The price for type i fare in year n
	r_i	The ridership for type i fare
	w_a	The sampled transit users in the municipality a
		over total transit users in the municipality a
	$\tau_{a,i}$	The ratio of i^{th} fare type in a^{th} municipalities
	f_t	The ratio of travel counts completed on type t
		over all travels completed in T
	η_i	The price elasticity of type i fare
	C_i	The congestion cost for i fare

5.5 Ridership Calculation

q_i, $i \in I$, is the count of passengers for each fare type, and $q_u r_i = q_{i,u}$, with

$$\mathrm{q}_i = \sum_{u \in U} q_{i,u} + q_{i,u}\eta_i(\frac{\Delta p_i}{p_i}) \tag{5.5.1}$$

The model parameters r_i, $i \in I$ (the set of fare types considered in Base Model (5.8) and Boundary Travel Model (5.9)), achieve the transformation of raw data of count of revenue passengers to the passenger count for the i^{th} fare type. Let A be the set of all municipalities in the TransLink catchment area (North Shore, Vancouver, Barnaby, New Westminster, Surrey, Richmond, Coquitlam, Pitt Meadows, Maple Ridge, and Fraser Valley). Furthermore, let T be the set of all fare types (such as cash fares, monthly passes and fare savers). Thus for $t \in T$, we define

$$\mathrm{r}_i = \sum_{a \in A} (w_a \tau_{a,i})(f_t) \tag{5.5.2}$$

5.6 Price Elasticity

Our model derives the price elasticity η_i for i^{th} fare type, with

$$\eta_i = \frac{\frac{\Delta Q_{i,2013} - \Delta Q_{i,2012}}{Q_{i,2012}}}{\frac{\Delta p_{i,2013} - \Delta p_{i,2012}}{p_{i,2012}}} \tag{5.6.1}$$

where $Q_{i,2012}$ and $Q_{i,2013}$ is the count of passengers for the i^{th} fare type in 2012 and 2013, respectively, and $p_{i,2012}$ and $p_{i,2013}$ is the price of the i^{th} fare type in 2012 and 2013, respectively.

The price elasticity poses a data and computational challenge due to the lack of available data. Our data transformation thus made it possible for the computation of price elasticity for each fare type. More concretely, our model derives $Q_{i,2012}$ and $Q_{i,2013}$. In particular, $Q_{i,2012}$ is computed by multiplying 2012 overall passenger counts by ($\sum_A w_a \tau_{a,i}$) and f_t. On the other hand, $p_{i,2012}$ and $p_{i,2013}$ is readily available from the TransLink archived data.

5.7 Taxation and Congestion Calculation

5.7.1 Parking Taxation (K)

Our model denotes K as parking taxation, and ΔK_i denotes the decrease/increase of parking taxation, induced by the increase/decrease of commuting consumers choosing the transit product, i^{th} fare type. ΔK_i is computed as the ratio of change in commuting consumers $\frac{q^*-q}{q}$ multiplied by the product of the contribution from auto drivers to the ratio of change and existing parking taxation revenue, namely, K.

5.7.2 Fuel Taxation (F)

We denote F as fuel taxation, and denote ΔF_i as the decrease (increase) of fuel taxation, induced by the increase/decrease of commuting consumers choosing the transit product, i^{th} fare type. ΔF_i is computed as the ratio of change in commuting consumers $\frac{q^*-q}{q}$ multiplied by the multiplicative product of the contribution from auto drivers to the ratio of change and existing fuel taxation revenue, namely, F.

5.7.3 Congestion (C)

Our model considers the alleviation of traffic congestion attributed to the increase of commuting consumers and hence a prorated reduction of number of auto driver on roadways. In the case of increasing transit usage, it is understood that the ratio of increase in commuting consumers and decrease in commuting auto drivers must be equal to or less than 1, since commuting consumers who previously preferred other methods of transportation are now attracted to transit given the downward price change.

We consider the alleviation of traffic congestion as another source of intangible revenue, computed by the non-incurrence, or savings of traffic congestion costs, which our model defines to include cost of driving (gas, wear and tear), air pollution cost and potential accident cost. The adopted model parameters, C_i, $i \in I$ are based on the study of traffic congestion in Metro Vancouver i.

Our model takes the lowest average cost of driving to take a conservative approach. and we estimate total savings to be at 0.662 cents per kilometer driven by a vehicle. We estimate the mean distance driven for auto drivers who would have otherwise taken one-zone transit to be 12.5 km, and 20 and 30 km for drivers who would have otherwise taken two-zone and three-zone transit, respectively.

5.8 Base Model

Our objective is to increase the level of transit use (by way of increasing passenger count for fare types), and thus the fares given the current zone boundary and fare types. Our model respects the constraints that the aggregate transit-sourced revenue must be equal to or greater than the combined transit-sourced operating costs for the Bus Division and Rail Division for TransLink.

We define the aggregate transit-sourced revenue to be the sum of transit fare sales, TransLink's portion of parking taxation and fuel taxation after adjusted for the decrease/increase due to increase/decrease in transit usages, as well as Golden Ears toll revenue and cost of traffic congestions. Our model also defines transit-sourced operating costs to include fuel and power, insurance, maintenance, materials, utilities, rentals and leases, property taxes, and salaries and wages for the Bus and Rail Divisions.

Then, our objective is to

$$\text{Maximize} \sum_{i=1}^{10} \Big(q_i + q_i \eta_i n_i (\frac{\Delta p_i}{p_i}) \Big) \tag{5.8.1}$$

We adopt the convention that a positive n_i represents a downward price adjustment in our model solution, whereas a negative n_i represents an upward price adjustment.

Our choice model observes the following constraint subject to

$$\Big(\sum_{i=1}^{10} q_i p_i + K + \sum_{i=1}^{10} \Delta K_i + F + \sum_{i=1}^{10} \Delta F_i + \sum_{i=1}^{10} C_i \Big) - \sum_{i=1}^{10} B_i \leq 0 \tag{5.8.2}$$

5.9 Boundary Travel Model

The Boundary Travel model differs from the Choice model only in that it considers a new fare class for transit users who purchased two-zone cash fares / stored values yet travel for a distance that is less than the average travel distance for all transit users. We computed the average travel distance for all transit users to be

$$\frac{\text{number of boarded passengers}}{\text{service km} \times \text{utilization ratio}},$$

where boarded passengers is defined as the total number of passengers using transit, and utilization ratio is defined as

$$\frac{\text{passenger kms}}{\text{capacity kms}}.$$

With the Boundary Travel model, we seek to construct an optimal fare structure that addresses sufficiently the fairness problem with the current fare structure. Namely, we seek to increase the level of transit use (by way of increasing passenger count for fare types), and thus optimize the fares given the current zone boundary and fare types. Our model respects the constraints that the aggregate transit-sourced revenue must be equal to or greater than the combined transit-sourced operating costs for the Bus Division and Rail Division for TransLink.

This model differs from the Choice model in that we added:

p_{11} denote price for adjusted 1-zone fare, previously 2-zone cash fare

p_{12} denote price for adjusted 1-zone fare, previously 2-zone fare saver

6 Computational Results

6.1 Base Model Results

Our model indicates that a 20% increase in the cash fares but a 10% reduction in fares for passes and store values can increase the ridership by 1.2%. This increased ridership has a positive net impact on TransLink's operation after considering the savings of traffic congestion.

The following table summarizes the computational result for the Base Model.

	Current Fare	Proposed Fare
1-zone cash	$2.75	$3.35
2-zone cash	$4.00	$4.90
3-zone cash	$5.50	$6.70
U-pass	$38	$33
1-zone pass	$91	$81
2-zone pass	$124	$111
3-zone pass	$170	$152
1-zone stored values	$2.10	$1.60
2-zone stored values	$3.15	$2.40
3-zone stored values	$4.20	$3.20

6.2 Boundary Travel Model Results

Our model indicates that a 10% increase in the cash fares but a 10% reduction in fares for passes and store values can increase the ridership by 1.2%. This increased ridership has a positive net impact on TransLink's operation after considering the savings of traffic congestion.

The following table summarizes the computational result for the Boundary Travel Model.

	Current Fare	Proposed Fare
1-zone cash	$2.75	$3.35
2-zone cash	$4.00	$4.90
3-zone cash	$5.50	$6.70
U-pass	$38	$33
1-zone pass	$91	$81
2-zone pass	$124	$111
3-zone pass	$170	$152
1-zone stored values	$2.10	$1.60
2-zone stored values	$3.15	$2.40
3-zone stored values	$4.20	$3.20
2-zone cash*	NA	$3.35
2-zone stored values*	NA	$1.60

7 Conclusion

In summary, our research has shown that there is a space for current fare structure to improve in Metro Vancouver. The price elasticity our model calculated shows that Vancouver residents are sensitive to public transit fare price. By simply raising the regular fare price and decreasing the passes prices, more people will enter the public transit system while the whole transit system can still generate enough revenue to effectively operate. In addition, the increased ridership is coming from those who are auto drives, which indicates the new policy can help to improve Vancouver current traffic congestion issue. The same strategy can also help to minimize the boundary travel problem. Our model is solved by Excel which means that it is possible for us to implement other socio-demographic characters to make the model more realistic.

8 Discussion and Future Work

Our model considers prices both within the current fare system and a modified fare system for Metro Vancouver. It might improves regular transit riders satisfaction, and the fairness of fare system, which there are no extra zones fare for riders who are travelled a stop between zone boundaries. The following sections provide ideas for possible future work.

8.1 Price Elasticity

One possible improvement for our model is to incorporate income level and population growth in the price elasticity estimation.

8.1.1 Income Level

Income level is one of the factors to the price elasticity, and it is also worth to consider the impact of changing fare price. That is, riders who are under different income level can directly affect to the decision making on whether taking transportation or driving. One of Metro Vancouver study [3] shows that the transportation cost is considered as "heavy" for low income households. They are more sensitive to price adjustment.

8.2 Population Growth

Population increases in Vancouver every year, which is a factor affecting revenue and congestion calculation in our model. Since the population growth is mostly related to immigration these years, people tend to take transportation as a first step to be familiar to the environment. When the population increases, ridership increases, which the revenue increases as well. Also, the traffic congestion is also affected.

8.3 Ticket Time limitation

In current fare structure, for every ticket (regular fare and stored value fare), the valid time is 90 minutes. However, the time of travelling across three zones may take longer than the specific time frame. The 90 minutes is arbitrary. It may be another factor for the system to be perceived as unfair.

8.4 Traffic Congestion

Our model is based on a linear traffic congestion cost, which is an average cost and saving for commuting riders and auto drivers. However, the congestion cost will be better modelled by a non-linear function. Further study and modelling will be needed to improve the congestion estimation.

8.5 Data Collection

Currently, Compass card has introduced into the fare system in Metro Vancouver. We will soon have more recent and accurate records of each riders and stations. We have different ideas on the fare system. For example, we have tried to analyze the distance based model with current resources. We could certain produce more detailed results with data such as the number of riders travel between each pair of station.

Appendix A TransLink Background

A.1 TransLink Operation Structure

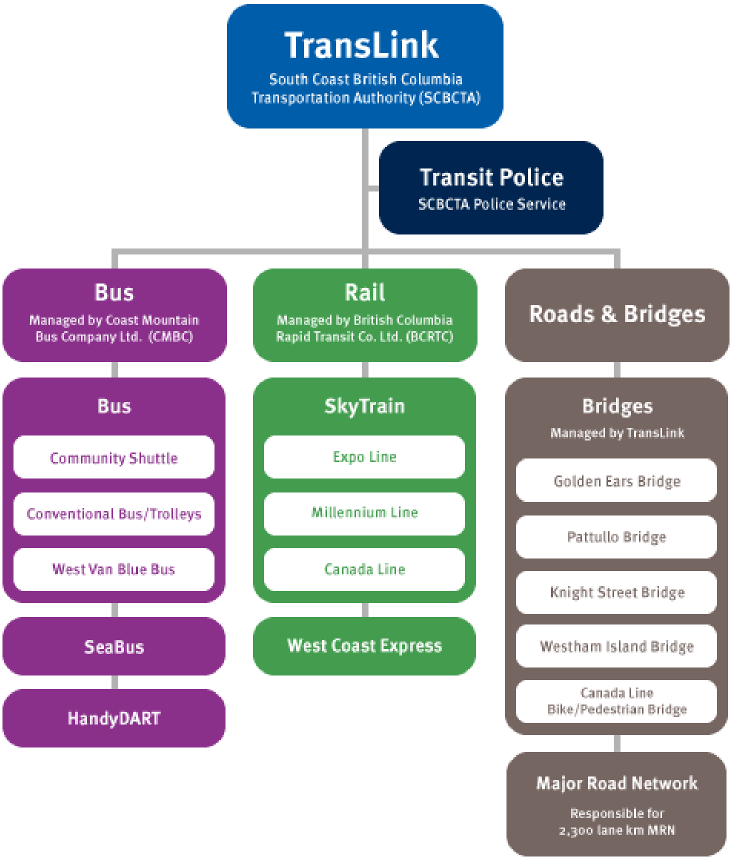

Figure 2: Summary of TransLink's operational structure

Source:`http://www.translink.ca/en/About-Us/Corporate-Overview/Operating-Companies/Overview.aspx`

A.2 Fare Zone Division

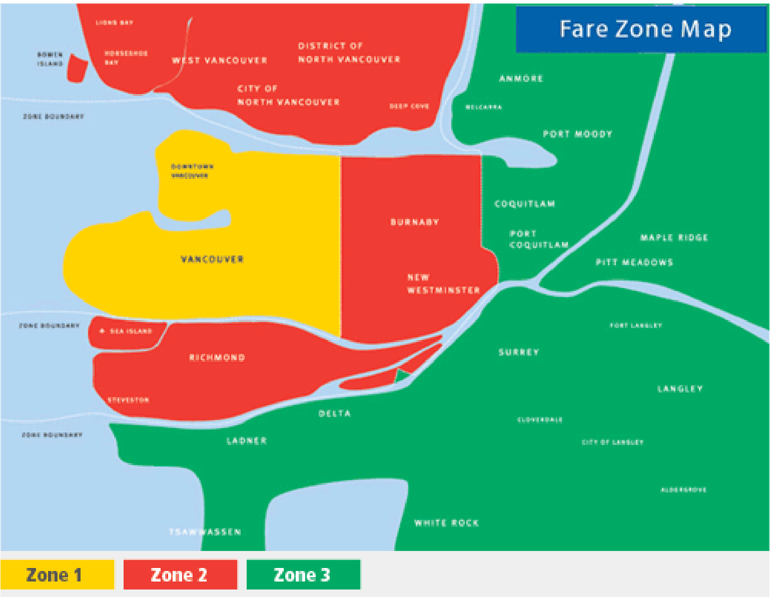

Figure 3: Fare Zone Map in Metro Vancouver

Available from: http://www.translink.ca/en/Fares-and-Passes/Fare-Zone-Map.aspx

Zone 1: City of Vancouver, University Endowment Lands
Zone 2: Lions Bay, Bowen Island, West Vancouver, District of North Vancouver, City of North Vancouver, Burnaby, New Westminster, Richmond, Annacis Island
Zone 3: Annacis Island, Surrey, White Rock, Langley, Belcarra, Anmore, Port Moody, Coquitlam, Port Coquitlam, Pitt Meadows, Maple Ridge

A.3 2012-2013 Fare Adjustment

		2010 - 2012		2013 - Now	
Cash fare		Adults	Concession	Adults	Concession
Regular Fare (Weekdays, till 6:30pm)	1 zone	$2.50	$1.75	$2.75	$1.75
	2 zone	$3.75	$2.50	$4.00	$2.75
	3 zone	$5.00	$3.50	$5.50	$3.75
Discount Fare (Weekday after 6:30, Weekends & holiday)	all zones	$2.50	$1.75	$2.75	$1.75
Prepaid fare		Adults	Concession	Adults	Concession
Monthly FareCard	1 zone	$81	$46.50	$91	$52
	2 zone	$110		$124	
	3 zone	$151		$170	
Monthly FareCard	1 zone	$81	$46.50	$91	$52
	2 zone	$110		$124	
	3 zone	$151		$170	
Day Pass		$9.00	$7.00	$9.75	$7.50
Upass		$ 30		$ 38	

Appendix B Table of Results

B.1 New Fare Structure of Base Model

	Current Fare	Proposed Fare
1-zone cash	$2.75	$3.35
2-zone cash	$4.00	$4.90
3-zone cash	$5.50	$6.70
U-pass	$38	$33
1-zone pass	$91	$81
2-zone pass	$124	$111
3-zone pass	$170	$152
1-zone stored values	$2.10	$1.60
2-zone stored values	$3.15	$2.40
3-zone stored values	$4.20	$3.20

B.2 New Fare Structure of Boundary Travel Model

	Current Fare	Proposed Fare
1-zone cash	$2.75	$3.35
2-zone cash	$4.00	$4.90
3-zone cash	$5.50	$6.70
U-pass	$38	$33
1-zone pass	$91	$81
2-zone pass	$124	$111
3-zone pass	$170	$152
1-zone stored values	$2.10	$1.60
2-zone stored values	$3.15	$2.40
3-zone stored values	$4.20	$3.20
2-zone cash*	NA	$3.35
2-zone stored values*	NA	$1.60

B.3 Summary of Ridership within and between Regions in Metro Vancouver

	Nshore	Vancouver	Burnaby	Coquitlam	Richmond	Surrey	Langley	PittMeadows	FraserValley
Nshore	367200	67300	23200	5800	6000	5800	1900	1400	900
Vancouver	67900	1358000	159900	36100	104900	61900	8600	7900	6000
Burnaby	23700	158000	453000	62400	31400	55000	8500	8700	5400
Coquitlam	6100	34500	63200	340600	7000	16900	5800	18900	5800
Richmond	6700	106800	31400	7200	443400	54600	7100	2300	2800
Surrey	5700	63600	54600	17000	53100	905000	68200	5900	13600
Langley	1900	8000	9000	5800	6500	69300	249900	4200	27400
PittMeadows	1400	7900	8000	19100	2300	6100	4400	154300	8500
FraserValley	900	6000	5100	5600	2600	14000	27400	8800	654500
Total riders	481500	1810100	807400	499600	657200	1188600	381800	212400	724900

B.4 Trip Takens by Method of Payment by Age Group

	5 to 12	13 to 17	18 to 24	25 to 44	45 to 64	65 to 79	80 plus	Total Riders	Faretype percentage
Month pass	2916	35674	44778	158171	107405	44299	7832	401075	0.500114094
FareSaver	3708	12116	17630	60967	52512	12493	2371	161797	0.201750197
Upass		4632	122564	32743	2371		142	162452	0.202566939
Cash	1588	4432	11712	28746	19522	8879	1764	76643	0.09556877
Total Riders	8212	56854	196684	280627	181810	65671	12109	801967	

B.5 Trip Takens by Distance by Age Group

	5 to 12	13 to 17	18 to 24	25 to 44	45 to 64	65 to 79	80 plus	Total Riders
0 to 5	5378	28405	30470	68047	44284	28147	5428	210159
5 to 10	1937	18409	48392	67527	46181	15629	4145	202220
10 to 15	643	4084	39944	61394	35964	10082	1150	153261
15 to 20	60	2568	33705 3	4895	23192	4672	565	99657
20 to 30	194	2309	27795	33998	20212	4287	437	89232
30 plus		1079	16379	14765	11975	2855	384	47437
Total Riders	8212	56854	196685	280627	181810	65671	12109	801966

B.6 Summary of Percentage of Ridership in Each Zones from Each Regions in Metro Vancouver

	Nshore	Vancouver	Burnaby	Coquitlam	Richmond
1 zone	0.76	0.75	0.56	0.72	0.67
2 zone	0.20	0.18	0.44	0.18	0.22
3 zones	0.03	0.07	0	0.10	0.11
	Surrey	Langley	PittMeadows	FraserValley	**Zone percentage**
1 zone	0.83	0.90	0.82	0.96	0.77
2 zone	0.07	0.05	0.13	0.03	0.17
3 zones	0.10	0.05	0.05	0.01	0.06

B.7 Summary of Trips by Distance and Fare Zones

	Trips	1-Zone	2-Zone	3-Zone	Average Trip km	Total km	Total fare	Average Fare
0-5 km	4855	4696	159		3.09	14983	8856	0.59
5-10 km	4523	3575	948		7.40	33479	8843	0.26
10-15 km	3232	1133	2088	11	12.22	39494	7496	0.19
15-20 km	2045	333	1578	134	17.37	35518	4904	0.14
20-30 km	1702	127	825	750	24.40	41531	4798	0.12
Over 30 km	867	21	139	707	36.83	31931	2728	0.09
Total	17224	9885	5737	1602	16.88	196936	37625	0.19

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