CREATING A TRANSIT GENERATION: THE EFFECT OF THE U-PASS ON LIFELONG TRANSIT USE

by

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Abstract

This study examines how the U-Pass impacts transit usage after graduation. The primary source of information for this study is derived from an original survey that was developed and administered to Simon Fraser University Alumni regarding both current and school period transit use frequency. The data revealed that the U-Pass does play an important role in post-graduation transit use, which in turn can influence lifestyle choices. To extend the success of the program, it is recommended that a three-step approach be taken. First, an alumni pass for former U-Pass holders be made available to encourage the continued use of transit after graduation. Second, the U-Pass should be extended to other universities and colleges in the region, and service costs should be factored into the price paid by all students. And third, TransLink and the province of BC should work towards introducing a region-wide universal pass.

Keywords: Transit, Public Transportation, U-Pass, Deep Discount Group Pass

Subject Terms: Liveable Region, Sustainability, Mode Shift

Executive Summary

Public transportation plays an important role in enhancing sustainable lifestyles and communities by reducing automobile use, congestion, emissions of greenhouse gases and air contaminants, and by encouraging increased density in land-use planning. An increasingly common method of encouraging the use of public transportation is through the introduction of Deep Discount Group Passes. Many cities across North America have implemented such passes, and Vancouver is no exception. TransLink, the region's integrated transportation authority, introduced a "U-Pass" in 2003 to encourage transit usage among university students. The U-pass is included in every student's mandatory fees at participating universities. Each student receives an unlimited pass good for the transportation network at a heavily discounted price. While previous research has proven that the U-Pass has increased transit usage by students dramatically, the effect of the pass on transit use after graduation is largely unknown.

This study uses a policy analysis framework to investigate the impact of the U-Pass on post-graduation transit use. Original data was collected through an online survey of Simon Fraser University alumni regarding their transportation behaviours as students and post-graduation. Simple descriptive statistics, cross tabulations, and linear regressions were used to analyze the data from over 200 respondents, the results of which informed the policy options chosen for further study.

The key findings from the statistical analyses include:

- 53% of former U-Pass holders are current frequent transit users.
- 11% of former U-Pass holders who were frequent transit users in school have become non-transit users, and 17% have become infrequent transit users.
- 40% of former U-Pass holders use pre-paid fare media.

- 43% of former U-Pass holders reported that the ability to take transit or walk to their destination influenced where they live, work, and shop.

These results were used to develop policy options on how TransLink could increase the transit mode share among 25-34 year olds. Previous research has proven the success of the U-Pass program in increasing transit use among students, and this study shows that there is a strong link between former U-Pass usage and current transit use. The 25-34 age group is important because this is when university graduates typically enter the work force, make housing choices, and may form life-long habits. The goal is to help make public transit a 'way of life'. The proposed policy options are intended to build on the U-pass success through the expansion of the program and by providing a bridging mechanism for recent graduates. These options are:

- Expand the U-Pass to other post-secondary institutions in the Lower Mainland to increase both student transit use, and post-graduation transit use; negotiate transit service expansion costs into the U-Pass price; standardize U-Pass contracts with all participating schools.
- Introduce a graduate U-Pass extension that provides a deep discount pass for up to five years post graduation to further encourage transit use and influence life decisions made after graduation.
- Expand the benefits of Deep Discount Group Passes by working towards a region-wide universal transit pass.

In terms of ease of implementation, it is recommended that the first step be the introduction of the graduate pass as a pilot project to identify the demand and impact of such a pass. This project could run for 3-5 years while the U-Pass extension is assessed and negotiated. To encourage the greater population to mode shift to transit, it is recommended that residents be given a few day passes per month in exchange for a flat fee. This would encourage residents to introduce themselves to the transit system and pave the way for a region-wide universal transit pass.

Dedication

To Alex, for your love and support, from a move across the country to your daily encouragement, you have helped me every step of the way.

To my parents, for inspiring me to take chances and encouraging me to reach further.

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Glossary

GHG	Greenhouse Gas; typically used in reference to a combination of gases that trap infrared radiation to regulate Earth's atmosphere. The gases that make up the greenhouse gases are: water vapour, carbon dioxide, methane, nitrous oxide, ozone, and Chlorofluorocarbons.
HOV	High Occupancy Vehicle. For example, carpool or vanpool containing the driver and at least one other passenger.
Mode Share	Relative proportions of trips by various travel modes (SOVs, HOVs, transit, bicycle, pedestrians, etc.) during a particular time period.
SFU	Simon Fraser University, located in Burnaby, British Columbia.
SOV	Single Occupancy Vehicle. For example, a car containing only the driver.
TransLink	South Coast British Columbia Transportation Authority, also known as TransLink, located in Burnaby, British Columbia.
UBC	University of British Columbia, located in Vancouver, British Columbia.
U-Pass	An unlimited use, 3-zone, mandatory public transit pass provided to university students at select universities in the Vancouver region, paid for through student fees.

1 Introduction and Policy Problem

Public transportation is a common element in large urban centres around the world. For some, public transportation, or transit, is the only mode of motorized transportation to which they have access. For many others, personal vehicles, such as the car, play an important role in their everyday lives. Access to personal vehicles has had a tremendous influence on urban development, particularly in North America. Vancouver, British Columbia, is no exception, with people spreading further and further away from the downtown city core. There are many serious issues with urban sprawl, including environmental impacts, road congestion, and the overall inefficient use of time in daily commuting. Public transportation, on the other hand, can be a tool in creating more liveable and sustainable communities through the efficient movement of people. Both TransLink, the regional transportation authority, and Metro Vancouver, the regional advisory body, have committed to increasing the liveability of the Vancouver region in their long-term plans, and, among other things, public transportation is set to play a crucial role.

The world is facing some hard truths about global warming, as we humans are having a tremendous influence on the health of the planet. Many people believe there is nothing that they can do as an individual, and yet for many a choice exists to use a sustainable mode of transportation for their daily commute. There are several factors that may influence people's transportation choice, such as home location, work location, transportation access, and income. While many people in the Vancouver area do choose to take public transit, there is still a majority who choose private vehicles that clog the roads during rush hours and pour greenhouse gases (GHGs) into the air.

This study examines policies TransLink and the province of British Columbia could implement in the Vancouver CMA (census metropolitan area) to encourage 25 to 34 year old citizens to shift out of personal vehicles and use environmentally friendly modes of transportation. According to the 2006 Canadian Census results for the Vancouver CMA, 25% of 15 to 24 year olds use transit as their primary mode of transportation, while only 18% of 25 to 34 year olds use transit as their primary commuting mode. These numbers are higher than the Canadian average for the respective age groups, but leave much to be desired (Statistics Canada, 2008). The 25 to 34 year old cohort is an important age group to target for several reasons: many of these people have just finished their education and are entering their first jobs, for which they are deciding where to live, and what their primary mode of transportation will be. All of these decisions are influenced by previously developed habits, and those decisions will then influence future habit creation.

This age cohort is also very important to TransLink, particularly 25-34 year olds who previously held the U-Pass, a mandatory universal transit pass program set up with a select few universities and colleges in the Vancouver area. The U-Pass is intended to encourage transit use among students, who may in turn develop transit-using habits that will stay with them after they graduate. There is solid evidence that the U-Pass, and other Deep Discount Group Pass programs like it in North America, significantly increase transit usage among participants. However, there is very little research on what happens when people leave these programs. The research question for this study is 'Does the U-Pass affect transit use after graduation?' Particularly, I wanted to find out if the U-Pass influences transit use behaviour that would deliver different outcomes from what the census data revealed. Do former U-Pass holders tend to use transit more regularly after graduation than other university graduates who did not have a U-Pass? Do former U-Pass holders continue to make transit their primary mode of transportation? Do former U-Pass holders make

life decisions based on the ability to take transit? These are all questions that formed the basis of the research for this study.

Based on the effectiveness of the U-Pass at creating lifelong transit users, I ask whether there are policies or programs TransLink could implement to increase transit use among 25-34 year olds. The answer to this question was developed through existing research, as well as through a survey that I created and administered to Simon Fraser University (SFU) alumni. Respondents were asked about their current transportation choices, as well as their chosen transportation modes as students. The results from this survey helped to inform three policy options. The goal of these policy options is to build upon the success of the U-Pass program to increase ridership levels of those 25 to 35 year olds once they leave university. The policies are evaluated against a set of criteria to determine the most effective course of action. It must be noted, however, that this study should be regarded as a pilot project that could inform a much larger and in depth study on the subject. Time, capacity, and resources have all influenced the scope of this study.

The following section outlines the background research that informed the study. It includes four subsections, with the focus of the study narrowed down from the macro issue of sustainable and liveable communities, to how to increase transit mode share, to effectiveness of Deep Discount Group Passes, and ending with background information on the existing U-Pass program. An outline of the methodology follows, with key results presented after that. The evaluation criteria are then presented and discussed, along with the proposed policy options. The report finishes with an evaluation of the policy options and a policy recommendation.

2 Background

2.1 Liveable and Sustainable Region

The idea of sustainability has become an important issue in recent years. Human activities, particularly the burning of fossil fuels, have been linked to global warming. The rising global GHG emissions will cause great changes to our weather systems and pose threats to the habitats of all species, including humans. Thus, in an attempt to try to curb our impact on the planet, the concept of sustainable development has been brought to the fore (Goodland, 1995). The World Commission on Environment and Development defined sustainability as "development that meets the need of the present without compromising the future generations' ability to meet their own needs." (World Commission on Environment and Development, 1987) The Intergovernmental Panel on Climate Change recognizes that sustainable development also requires a balance of three critical elements of development: economic, social, and environmental. These are often referred to as the 'three pillars of sustainable development' (Sathaye, 2007). As such, one element cannot be exploited at the expense of another; as we try to target environmental impacts, the economic and social implications must not be ignored (Barbier, 1987).

Metro Vancouver and TransLink have both committed to creating a more liveable and sustainable region through their long term plans. Both plans address the targets set forth by the British Columbia government in 2007 of reducing greenhouse gas emissions in the province by 33% of 2007 levels by 2020, and by 80% by 2050. (TransLink, 2008) The importance of this commitment is not only for the health of the citizens, but also the health of the environment, efficient use of existing resources and infrastructure, and the reduction of the dependence on non-renewable resources.

Single occupancy vehicles contribute significantly to British Columbia's greenhouse gas emissions, and over half of the province's registered vehicles and population are in Metro Vancouver. (TransLink, 2008) According to the 2005 Lower Fraser Valley Air Emissions Inventory, 29% of the greenhouse gases emitted in Metro Vancouver come from cars and light trucks (Metro Vancouver, 2007). Metro Vancouver is going to experience a rapid rate of growth, expanding by one third between the years 2006 and 2040. The projected 3 million people will be spread out through the region, with significant growth occurring in: Burnaby/ New Westminster; Surrey/ Delta/ White Rock; and the northeast sector. (TransLink, 2008) In order to meet the needs of this increased population and abide by the goal of creating a liveable and sustainable region, a shift in development and lifestyle is required. This includes creating more people-oriented, rather than car-oriented, communities. Complete communities are communities where people can live and work with minimal travel, and where walking, cycling, and transit are the primary forms of transportation. A large part of making this plan a reality is to encourage people to make a transportation mode shift today, away from single occupancy vehicles towards public transit, walking, and cycling.

While walking and cycling are the most sustainable forms of transportation for individuals, they are not always the best choice for entire regions. Factors such as weather, distance, topography, and ability all play a role in transportation choices. Thus, when walking and cycling are not at the top of the list, public transit is the next most sustainable form of urban transportation. According to TransLink data, all forms of transit used in the Vancouver region emit less GHGs per passenger than single or double occupancy vehicles. The electric trolley busses and SkyTrain (electric light rail train) both emit only 0.1 tonne of GHGs per person (based on 20 passengers each on a 15 km round trip commute). The new hybrid diesel busses emit 0.21 tonnes of GHGs per person and the new diesel busses emit 0.27 tonnes of GHGs per person (both based on 20 passengers each on a 15 km round trip commute). Single or double occupancy

vehicles, on the other hand, range from 0.45- 1.3 tonnes of GHGs per person based on a 15 km roundtrip commute. (TransLink, 2008) While GHG emissions are not the sole measure for sustainability, it does provide a method of comparing the impact of various forms of transportation. According to the TCRP (Transit Cooperative Research Program), 'increasing transit ridership can support a wide variety of public policy goals, including energy conservation; air-quality improvement; congestion relief; mobility for transportation-disadvantaged groups; and the promotion of liveable communities, economic development, and sustained growth initiatives' (TCRP, 2007, Foreword). The next section will outline some of the considerations and methods associated with policies aimed at increasing transit mode share.

2.2 Increasing Transit Modal Share

An increase in the modal share of public transit requires an increase in transit ridership. Taylor et al. (2008) identify two categories of elements that can influence transit ridership: (1) external factors, and (2) internal factors. They define external factors as those that are 'largely exogenous to the system, such as service area population and employment… Internal factors, on the other hand, are those over which [transit agencies] exercise some control, such as fares and service levels.' (Taylor et al., 2008, p. 63) The European Commission on Transportation Research identifies influences in terms of direct and indirect strategies, where direct strategies aim to increase the efficiency and effectiveness of transit operations, and indirect strategies are broader public policies that influence ridership, but over which transit agencies exercise little control. For example, direct strategies include fare levels, service quality and quantity, marketing, facilities, and technologies employed in the provision of service. Indirect strategies could include taxes on car ownership and use, area-specific car use restrictions, land use policies, and alternative work situation policies (European Commission on Transportation Research, 1996). Through a series of case studies of U.S. transit agencies, the TCRP found that the two most

effective internal strategies used to target ridership are: operating/service adjustments (particularly increased route coverage, route restructuring, and increased service frequency); and the development of partnerships with various local entities (particularly universities) (TCRP, 2007). For the purposes of this study, internal or direct strategies are focused on because these are strategies that TransLink could implement to increase transit mode share in the Vancouver region. In particular, pass use, partnerships, and fare policies are considered.

Transit fare policies often have multiple policy objectives that they are intended to achieve. Some of these objectives include:

- Capture the cost of services;
- Generate revenue;
- Reflect the value of the service to the user;
- Promote equity objectives;
- Encourage commuters to mode shift;
- Redress problems stemming from the under pricing of the automobile (Cervero, 1990, p.118).

Many of these objectives conflict with each other, particularly revenue generation and encouraging mode shift. When considering pricing strategies as a means of increasing ridership, the long-standing conflict between ridership levels and fare revenues must be considered. Maximizing one typically results in the reduction of the other. As fare prices increase, ridership generally falls; as fare prices decrease, ridership generally increases (to a certain degree). As with any good or service, a demand curve exists that defines the price people are willing to pay for a given number of units. This demand curve also defines the consumer surplus, or the amount of money that the consumer is willing to pay above the set price.

Consumption of a good generally occurs when the utility gained from consuming that good is higher than the cost of lost utility. The associated utility costs are often represented by the market price, however not all costs are necessarily accounted for. The demand for a transit trip

can be viewed as a function of both the utility of the trip and the associated costs. These costs can include: 'time (access time, wait time, travel time), money (transit fare), and uncertainty (schedule adherence, safety, etc.)' (Taylor et al., 2008, p. 62). Consumers will compare the costs of transit with other modes of transportation to determine which mode they will use. Each person derives a different level of utility from trips made by transit or other modes of transportation, which can also vary from trip to trip, depending on the reason for the trip and the destination. It is the utility that determines the price each individual is willing to pay for the trip.

Market demand curves are generally aggregates of many people's willingness to pay for a given amount of goods or services at a particular price. The quantity demanded is determined by a movement along a demand curve in response to a change in price. When both quantity and price are in their log form, the slope of the curve represents the price elasticity of the good or service. Litman (2007) explains the basics of elasticities and how they affect transportation decisions.

> 'Price sensitivity is measured using *elasticities*, defined as the percentage change in consumption resulting from a one-percent change in price, all else held constant. A high elasticity value indicates that a good is price-sensitive, that is, a relatively small change in price causes a relatively large change in consumption. A low elasticity value means that prices have relatively little effect on consumption. The degree of price sensitivity refers to the absolute elasticity value, that is, regardless of whether it is positive or negative. For example, if the elasticity of transit ridership with respect to transit fares is –0.5, this means that each 1.0% increase in transit fares causes a 0.5% reduction in ridership, so a 10% fare increase will cause ridership to decline by about 5%. Similarly, if the elasticity of transit ridership with respect to transit service hours is 1.5, a 10% increase in service hours would cause a 15% increase in ridership' (Litman, 2007, p.38).

There are three classifications of elasticity: elastic, unit elastic, and inelastic. Elastic demand curves have a price elasticity of greater than 1.0 in absolute value. This means that for every percent change in the price, the percent change in quantity demanded is greater than 1.0. If the measured elasticity is positive then a positive or negative change in price results in the same directional change in quantity; a negative sign indicates that the two move in opposite directions. Unit elastic goods are those where a one percent change in price results in a proportional, or one

percent, change in quantity demanded. Inelastic goods are often goods that people need or for which few substitutes exist and where the elasticity has an absolute value less than one (Pendick and Rubinfeld, 2004).

When a transit authority looks to increase ridership, they must understand the elasticities of demand for various transportation modes. There are some categories of transit users whose demand curves are relatively inelastic, such as daily commuters and those dependent on public transit for any number of reasons. These people will likely use transit regardless of the price, within reason. These people are not necessarily the ones who must be enticed or persuaded to use transit because they are already using it. It is still important, however, to identify this group's major reasons for using transit to better understand their transportation behaviours. If people who are already using transit regularly tend to have relatively inelastic demand curves, then people who are not currently using transit regularly must have elastic demand curves. These people are also likely to have a willingness to pay below the current cost of taking transit; if not, they too would already be taking transit.

As was stated above, demand for a good is tied to the expected utility of consuming that good. Utility can vary significantly from individual to individual and, in the case of transportation demand, trip to trip. This means that transportation demand is often determined by the utility of the activity for which transportation is required. In an experiment conducted by Garling et al., non-drivers were lured to make multiple fictitious trips by car to a distant destination where a good could be purchased at an attractive price. Since the outcome was positive, participants developed a positive attitude toward choosing to drive for this particular trip, continuing to do so even when the location of the fictitious place became closer. This, when compared to the control group who regularly chose to walk to the closer location, proved that multiple repetitions influenced the act of collecting information on what mode to choose, leading the formation of a driving habit (Garling and Axhausen, 2003).

On the flip side, the mode of transportation chosen can be heavily influenced by the perceived disutility of the associated costs, particularly the costs of compliments and substitutes. For example, many people find the utility of using private vehicles greater than that of transit, which both influences their decision to use private vehicles (if they have access to them) and their decision to not use transit (Taylor, et al., 2008). This phenomenon can be explained by the concept of cross-elasticities. As Litman explains, '*Cross-elasticities* refer to the percentage change in the consumption of a good resulting from a price change in another, related good. For example, automobile travel is complementary to vehicle parking and a substitute for transit travel, so an increase in the price of driving tends to reduce demand for parking and increase demand for transit' (Litman, 2007, p.38).

For this reason, policies that increase the costs of using one's personal vehicle can help to induce transit ridership and can complement transit based policies. The disutility associated with personal vehicle use, however, has historically been difficult for individuals to identify. "While the automobile has provided many of us individually with tremendous freedom and opportunity at fairly low personal cost, our massive response to and dependence upon it have provided us with great collective costs which we are beginning to refuse to tolerate. Congested roadways, polluted air, death and injuries from accidents, and depletion of natural resource reserves are among the common costs we pay collectively for the private advantages gained from automobility" (Wachs, 1976, p. 97) Therefore, when considering transit policies, the externalities of personal vehicle use are important costs to take into account. Decisions to target these associated externalities, however, typically require the conscious support of the community for policies to be successful.

A potential way of influencing the perceived utility of transit use, thus causing a modal shift, is through the development of new habits and the breaking of old habits. According to Banister, who conducted a heuristic study on the effect of habits on modal choice, "…travel

patterns are based on decisions, most of which are influenced strongly by habit. If an individual makes a trip one day by a particular mode, he is likely to use the experience of that trip in his decision on the following day" (Banister, 1978, p.6). Banister goes on to say that if individuals receive "continued reinforcement in the form of satisfactory outcomes for trips, habits are formed that may be insensitive to marginal changes in the transport system… and the market mechanisms virtually cease to operate" (Banister, 1978, p. 6-7). This means that as habits become more entrenched, marginal time and cost factors become less important in the decision making process. There are two types of changes that can affect habits: a change in personal circumstances, such as the purchase of private vehicle; or a large-scale policy change, such as an area-wide pricing scheme or a system of physical restraint on traffic (Banister, 1978, p. 7). These two types of changes can be seen in both the act of graduating and beginning a career, and the introduction of programs like the U-Pass program. Both of these factors play an important role in the proposed policies for this report. Further discussion on the importance of habit formation and the role of the U-Pass is provided in Section 2.4. The following section outlines the concept of Deep Discount Group Passes and their usefulness in increasing transit ridership.

2.3 Deep Discount Group Passes

TransLink currently offers a number of fare options, including one-time cash fares, discounted pre-purchased FareSaver tickets, monthly FareCards (which allow unlimited use within a given number of zones during a one month period), as well as limited access fare options such as the Employer Pass and various concession pricing. While regular transit users can take advantage of these discounts, the fare options do not necessarily entice non-transit users. There have been several studies (Brown, Hess, and Shoup, 2002; Nuworsoo, 2004; Taylor, 2008) that indicate that the best way to increase ridership is though the introduction of Deep Discount Group Passes. '[These] pass programs provide groups of people with unlimited ride transit passes in

exchange for a contractual payment for or on behalf of pass users by an employer or other organizing body' (Nuworsoo, 2004, p.1). Deep Discount Group Passes have another important element: they are mandatory for all members of the group. This ensures that no matter how many people actually use the services, everyone pays for the pass. The mandatory nature of the pass can entice people who perhaps would not have used transit to use it simply because they have a pass to use. It can also entice people who are already occasional transit users to use it more frequently. The end result, therefore, is increased ridership overall. TransLink currently has one true Deep Discount Group Pass programs: the U-Pass. Elements of the U-Pass are explained in Section 2.4.

What is clear through both TransLink's experience with the U-Pass and through studies conducted on similar programs elsewhere is that Deep Discount Group Passes result in very large increases in ridership within the participating groups. The University of California Los Angeles (UCLA) introduced the BruinGo program that allowed UCLA students, staff, and faculty to ride for free to and from campus. These trips are tracked and charged to the university, who pays for them through parking fees collected on campus. The result of the program after one year was that student transit trips increased by 51%, faculty/staff transit trips increased by 73%, and vehicle trips dropped by 11% for students and 6% for faculty/staff (Brown, et al. 2002). The University of British Columbia (UBC) has reported similar results from the introduction of the U-Pass in the Vancouver region. These U-Pass results will be discussed further in Section 2.4.

In order for a deep discount group pass program to be successful, however, the increase in demand must be met with increased service provision. This means that the transit agency will typically have to incur costs to provide an adequate level of service. Nuworsoo (2004) argues that the costs of service improvement associated with the expected increase in demand should be incorporated into the price of the pass. If these costs are not covered by the revenue generated through the program, then more revenue must be generated elsewhere or other benefits must be taken into account to off-set the costs.

What is not clear is how these pass programs affect behaviour after the participants leave the program. Are the high ridership levels maintained or do they decrease? Has the deep discount group pass program affected the participant's willingness to pay for transit services? Are they more or less likely to pay regular fares after having had a deep discount? And, how did the pass program affect their transportation and life choices after leaving the program? These are all questions I examine through my research.

2.4 TransLink's U-Pass

The U-pass program offers mandatory three-zone transit passes at a reduced rate to students at participating universities in the Vancouver region. The U-Pass was originally introduced in 2003 as separate contracts between TransLink and the University of British Columbia (UBC), and TransLink and Simon Fraser University (SFU). Another contract has since been negotiated between TransLink and Langara College. The three goals of these agreements for the universities are:

- Provide a lower-cost transportation option for UBC/SFU students;
- Reduce automobile use to relieve traffic congestion and pollution;
- Ease traffic congestion and automobile parking requirements at UBC/SFU and surrounding area. (University Transit Pass Agreement, Jan 2002, p. 1)

TransLink's primary goal for the program is to encourage students to take transit with the intention of making them life-long transit users. The result thus far has been a staggering increase in transit usage among students. Although it is difficult to determine exact numbers, TransLink estimated that transit ridership in 2003 increased by 53% among UBC students, and by 39% by SFU students over 2002 rates as a result of the U-Pass program. (TransLink, 2003) The actual increases could be much higher, as these are only estimates of trips to and from the campuses. Due to the nature of the flash pass, students simply need to show the operator their pass without

having it swiped or recorded (as there are no fare gates in the system), making it is very difficult to track U-Pass usage around the region. UBC has conducted independent transportation studies on transportation modes and frequency of trips to and from the UBC Point Grey campus. According to the 2007 Transportation Status Report, SOV trips to and from the campus have decreased by 14% between 1997 and 2007, and transit trips have increased by 185%. Also of interest is that HOV trips and pedestrian trips each decreased by about 36%. Therefore, although SOV trips have decreased, the majority of the mode shift has been from pedestrian and HOV trips to transit. While this result is disappointing, it illustrates the need for policy combinations that will work together to target SOV trips. UBC has implemented some complementary policies, such as reducing parking supply by about 25% and increasing the price of parking from $2.00/day in 1997 to $4.50/day in 2007, and they continue to look for other ways to reduce the number of SOV trips to and from campus (UBC, 2008).

The U-Pass was originally intended to be revenue neutral based on previous student transit usage. This means that when the program was negotiated between TransLink and UBC, and then TransLink and SFU, it was decided that the cost of the U-Pass to each student at their respective schools would be equal to the pre- U-Pass revenue generated from student transit pass purchases, divided by the total number of students at the respective schools. As a result of this policy, TransLink receives no additional income from student transit users (except from student body growth), regardless of U-Pass usage. The student bodies believed this would prevent the U-Pass from becoming an income generator for TransLink, however the U-Pass usage rate was greatly underestimated, leading to the U-Pass program becoming a large loss-generating program. The dramatic increase in student transit demand has required high capital investment on the part of TransLink. The revenues from the U-Pass do not cover these costs, requiring TransLink to seek other revenue sources just to cover the program costs. Had costs been negotiated into the contracts, the losses to TransLink could have been significantly decreased.

A significant reason why TransLink implemented the program and continues to maintain it in the face of these losses has been to create lifelong transit users through habit formation. As noted above, habit formation has been proven to be very important in consumer behaviour and utility specification, where an individual's current preferences depend on his/her past consumption patterns (Pollak, 1970; Fuhrer, 2000). The role of habits in travel behaviour research has historically been overlooked, largely because of the cross-sectional nature of transportation research. Cross-sectional research, aimed at developing models that can be used in transport planning to forecast how travellers choose between available alternatives, is generally limited to socio-demographic variables, and historical behaviour is generally ignored (Garling and Axhausen, 2003). Possible habit indicators could include: the number of public transit trips in a given time period; distance to the regularly chosen location; the most frequent occurring departure time; past use and vehicle ownership; and past and current ownership of 'season tickets' for public transport (Garling and Axhausen, 2003). As outlined in Section 3, the survey for this study did include questions pertaining to past and present transit use, past and present pass ownership, and length of daily commute time.

The U-Pass has been successful in creating transit use habits while students are at school, however after graduation those habits may be broken through the act of purchasing a car or moving away from transit services. Graduation represents a structural change in a student's life, where they go from earning little, if any, money, to being gainfully employed. As Banister (1978) explains, a change in personal circumstances, like graduation, would likely result in the reassessment of habits and lead to the formation of new ones, or the reinforcement of old ones. To counter-act the pull to purchase a car after graduation, policies are needed to target the post graduation time period when students are in danger of losing their transit-based habits.

3 Methodology

Transit research, particularly ridership data collection, can be obtained through several different methods. The basic methods are: manual boarding/alighting counts; automated passenger counts; farebox data; and customer surveys. TransLink currently relies heavily on farebox data and customer surveys, like the Trip Diary. While TransLink knows how many U-Passes have been distributed, there is very little information collected on where students go with the U-Pass, how frequently they use it, and what happens post-graduation. Surveys have been the predominant way of collecting information, but have their limitations in terms of scope and sampling challenges, testing respondent veracity, and other factors.

I began my research on the impact of the U-Pass on post-graduation ridership levels with a search of the literature. I found studies on transit ridership and the role of Deep Discount Group Passes, but unfortunately there is very little research on what happens to transit usage when participants leave a program. To date, I have been unable to find other research on how university based transit passes, such as the U-Pass, affect transit usage, transportation choices, or, more broadly, lifestyle choices. Therefore, the only way to gather this type of information is to ask former U-Pass holders directly about their current transportation behaviours.

This study depended heavily on gaining access to former U-Pass holders. UBC and SFU have had the U-Pass in place for the longest period of time (since 2003), which made them the obvious choices. UBC has had quite extensive research performed on campus transportation through the TREK program, particularly on the effect of the U-Pass on current student behaviour and university expenditures. SFU, on the other hand, has done very little research on transportation to and from campus, and the impact of the U-Pass and thus, the university

administration was likely to be interested in my research. Therefore, I chose to focus on SFU alumni and how the U-Pass has affected transportation behaviours.

While several avenues of access were explored, the final survey was administered to SFU alumni through the monthly SFU alumni e-newsletter. The SFU Alumni office was very cooperative, allowing me to include a short paragraph explaining the study and a link to the web based survey in the November e-newsletter. Accessing alumni in any other way would have been prohibitively expensive and time consuming, making the study impossible to undertake as a Master's level thesis. The November e-newsletter was sent to alumni on November 12th, 2008, and the survey instructions informed respondents that they had until November 30th, 2008 to complete the survey. By November 30th, 2008, the survey had had 214 respondents, with 10 observations requiring deletion. The explanation for this is provided in Section 4.1.

The electronic aspect of the survey was important for targeting the sample I desired. Since the U-Pass was introduced in the fall of 2003, graduates from before and after the introduction were likely to be regular email users and relatively internet savvy. This method of administration also fit well with the required time line, cost limitations, and made data collection very straightforward. The survey tool I chose to use was the SFU WebSurvey tool, which is a secure and encrypted website created and maintained by SFU. While the tool lacked some stylistic capabilities, it ensured that all of the data collected would be maintained and stored within Canada. The WebSurvey enabled several different forms of questions, but did not allow subsamples to be created through screening techniques. For this reason, some questions were not mandatory, allowing respondents to skip them if the question subject did not apply to them. Some information may have been lost as a result, however I was constrained by the survey tool.

The web method of access had a number of advantages, as well as some disadvantages. While the e-newsletter was sent to all SFU alumni, response to the survey was entirely voluntary, giving rise to the likelihood of selection bias. The results are not weighted, as weighting may

compound the existing biases. Accessing a very large number of SFU Alumni, however, enabled me to have a sample of both students who graduated before the U-Pass, as well as graduates who had a U-Pass while at university. This was important for comparison and analysis purposes to determine the predictors for post graduation transit usage.

I analyzed the data from my survey using several statistical methods. Simple descriptive statistics were developed to understand respondent characteristics, such as who had a U-Pass, who uses transit frequently, gender, and income. The demographic characteristics are presented in Section 4.3. Cross tabulations of former U-Pass holders and non U-Pass holders were developed with many of the important characteristics and questions from the survey. This enabled to me to get a sense of the differences between graduates who had a U-Pass versus those who did not. This is a key element of the study, as it highlights whether the U-Pass has been successful in achieving its goal of affecting behaviour after graduation. Finally, regressions were estimated using OLS through the statistical package SPSS. Different specifications were used to understand the relationship between a few key independent variables and the tendency to use transit frequently after graduation. The regression specification and results can be found in Sections 4.5-4.7.

The next section outlines the descriptive statistics found through the survey results. These statistics helped to form the policy options, which will be presented later in Section 6.

4 What Happens to Transit Usage After Graduation?

This section briefly outlines the survey specifics, including the sample, variables, and key descriptive statistics.

4.1 Sample

The survey had 214 total responses. Of those 214, 10 responses were eliminated because of potential confusion about the U-Pass. 9 of the 10 eliminated responses were removed because the respondent indicated that they had graduated before or in 2003, but had had a U-Pass. The U-Pass was not introduced until the fall of 2003, thus the respondents were either confusing the U-Pass with a former student transit pass, had had a U-Pass for a short period of time because of a late graduation, or had made a mistake in their responses. Because of the uncertainty surrounding these responses, they were removed to eliminate their effect on the rest of the data. The other eliminated response was removed because of the respondent's current residence location. This left the total sample at 204 responses. Within this remaining sample, 7 respondents indicated that they had graduated in 2004 or later, but had not had a U-Pass. This is plausible since there is an opt-out channel students can take, although it is very difficult to do so. These students also could have simply not known they had a U-Pass because perhaps it was mailed to wrong address. Since the reason for not having a U-Pass was not asked, I cannot know the why the respondents indicated that they did not have a U-Pass. I have chosen to include them in the study, however, and treat them as part of the sample that did not have a U-Pass. It is because of these responses that I have also chosen to use the responses from the question 'Did you have a U-Pass?' as the control variable for involvement in the program.

4.2 Dependent Variable

The purpose of the study is to determine how the U-Pass affects transit behaviour after graduation. Therefore, to understand how the U-Pass, as well as other characteristics, had an influence on those who had it versus those who did not, the measure, or dependent variable, for this study is the frequency of transit usage after graduation. The key question that targeted this information was: 'Approximately how many round-trip public transit trips did you make while at SFU?' The answer choices given for each were: a) Never; b) 1-2 times/ month; c) 1-2 times/ week; d) 3 or more times/ week. Respondents were asked an identical question on their frequency of transit usage during university for comparison purpose. Both of these questions were modelled after a question asked in the U-Pass Evaluation Survey conducted by TransLink in December 2004. Although the measure was slightly different (number of one-way trips in an average week), the TransLink survey found that the average student in 2004 used their U-Pass for 6 or less one-way trips per week. According to 2006 Canadian Census, 25% of 15-24 year olds use transit as their primary mode of transportation, whereas only 18% of 25-34 year olds and 15% of 25-54 year olds use transit as their primary mode for commuting (Statistics Canada, 2008).

For the purpose of analysis, I coded the survey data into three categories: frequent, infrequent, and non-transit users. For university transit use frequency, I coded non-transit users as those respondents who said they never took transit. Infrequent transit users were those people who responded that they took transit 1-2 times per month. Frequent transit users were those who said they used transit 1-2 times per week or 3 or more times per week. I made the division between infrequent and frequent based largely on my knowledge of student schedules; most full-time students take three to six classes per semester, which, depending on how they are scheduled, could mean that a student has to go to campus two to five days per week. Since some students may only go to campus two days per week, I decided that 1-2 round-trip transit trips per week could mean that person is a frequent transit user.

For current transit use frequency, I chose to maintain the coding used for the university transit use frequency for consistency purposes. The 1-2 times/ week category would be more suited to the infrequent category for daily commuters, however only 10% of the respondents reported that they used transit 1-2 times/ week. This decision was also in accordance with a British Columbia Automobile Association (BCAA) and Greater Vancouver Transportation Authority (GVTA) study that asked BCAA members about their willingness to change their single occupancy vehicle (SOV) behaviour. In this study, 52% of the respondents said they were willing to do one or more of the following: combine trips, switch to a sustainable mode (car/vanpooling, cycling, walking, transit), and/or eliminate 2 SOV trips per week. Thus, for the purposes of this study, 1-2 round-trip transit trips per week could represent people who are in the process of becoming frequent transit users. Table 1 shows the results from the survey broken down by respondents who had a U-Pass and respondents who did not have a U-Pass.

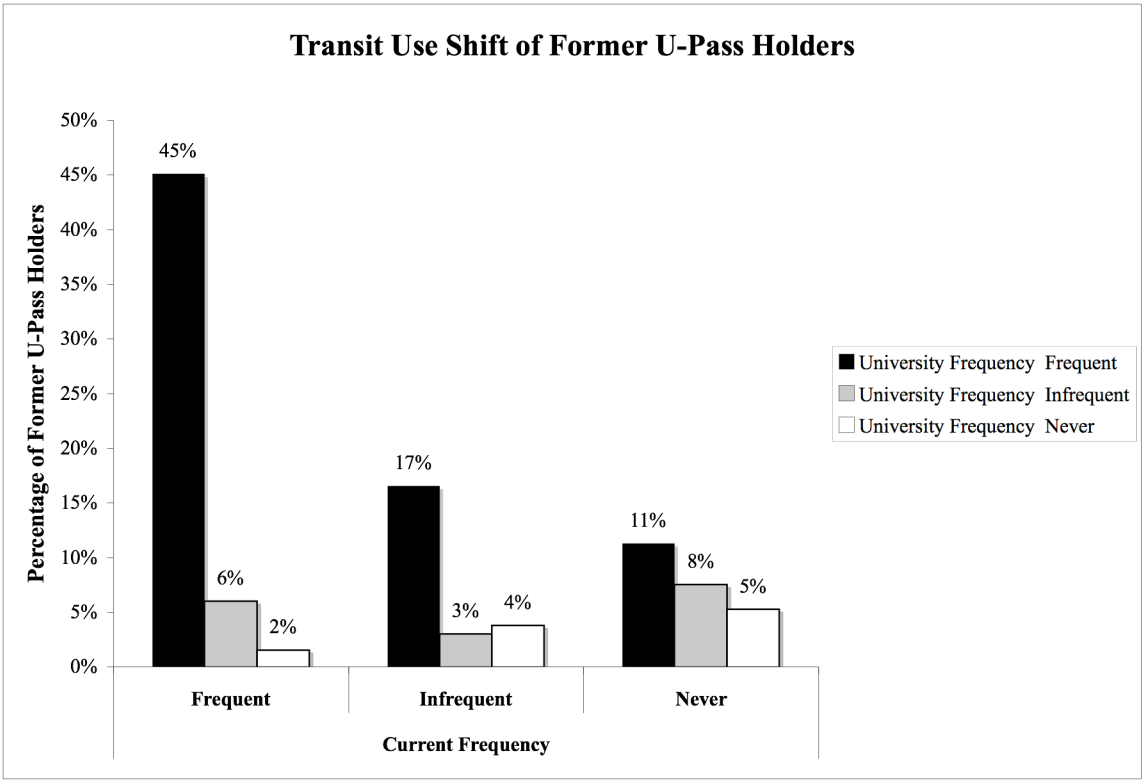
Table 1 Frequency of Transit Use During University and Post Graduation

	Did Not Have a U-Pass		
	Never	Infrequent	Frequent
University Frequency	31%	21%	48%
Current Frequency	41%	17%	42%
	Had a U-Pass		
	Never	Infrequent	Frequent
University Frequency	11%	17%	73%
Current Frequency	24%	23%	53%

Transit proved to be an important element of life as a student for most of the respondents, particularly former U-Pass holders. Table 1 shows that the distribution of the frequency of transit use tends to even out after graduation for both former U-Pass holders and non U-Pass holders, although former U-Pass holders retained a higher share (76%) of frequent and infrequent transit users after graduation. A slight surprise, however, is that the share of frequent transit users in the

'Had a U-Pass' group decreased by more than the share did for the 'Never Had a U-Pass' respondents between university and the present, and the share of non-transit users increased after graduation. This prompted a cross tabulation analysis of how former U-Pass holders' transit use changed after graduation. Figure 1 shows this break down.

Figure 1 *Frequency of Transit Use Shift of Former U-Pass Holders*



While it was expected that frequent transit users in university would remain frequent transit users after graduation, Figure 1 shows that a surprising 11% of former U-Pass holders who were frequent transit users in university and have become non-transit users, and 17% of shifted from being frequent transit users to infrequent transit users. This is an important piece of information to have when trying to decide how to increase transit usage in the post-graduation population. Potential reasons for this shift will be explored in subsequent sections to better inform the policy options presented later.

4.3 Independent Variables

Table 2 shows the breakdown of the sample into the key demographic-based independent variables. These variables were chosen based on hypothesis and other research reports. Past behaviour is often a good predictor of future behaviour, thus respondents were asked about their transit usage during university. Former U-Pass ownership is a critical variable for this study, so the direct question about the U-Pass was included as a key independent variable. Other sources of transit research often point to transit access as an important catalyst to transit usage, therefore a question regarding the distance to the closest transit access point was asked. Proximity to a transit access point, however, can be endogenous with frequency of transit. It is difficult to separate out which influenced which the most; do frequent transit users choose to live near transit, or does living close to transit create frequent transit users. At first thought, some people may not think gender is an issue with transit use, however sense of safety can have a significant impact on women's use of transit. Unfortunately, transit safety and security issues were not explored in the survey for this study, and several respondents commented that perhaps it should have been. Household income was included to determine whether the stereotype of low-income people using transit occurred or if the U-Pass changed perceptions and results. Table 2 shows the respondent characteristics. The results are discussed further below.

Table 2 Independent Variable Responses

Variable	Answer	Share of Total Sample
Frequency of transit use during university	Never	18%
	1-2 times/ month	18%
	1 or more times/ week	64%
Did you have a U-Pass while at university?	No	35%
	Yes	65%
Closest transit access point	Not within walking distance	14%
	5-10 minute walk	86%
Primary mode of transportation	Walk, cycle, carpool	15%
	Public transit	40%
	Car, truck, van as driver	44%
Gender	Male	37%
	Female	63%
Income	$0- $19,999	11%
	$20,000- $34,999	13%
	$35,000- $49,999	15%
	$50,000- $64,999	18%
	$65,000- $79,999	10%
	$80,000- $100,000	13%
	$100,000 +	20%

As Table 2 shows, the sample did not have equal representation in all of the variables. Gender and U-Pass ownership had an approximate split of 60-40, while the Primary Mode of Transportation indicated a 40% share of transit users. This figure is much higher than the results of the Canadian Census, which could indicate an over representation, or a highly effective U-Pass program. Household income is generally evenly spread, although the largest category is the $100,000.00 + category. Almost 60% of respondents were above the median 2005 household income for the Vancouver CMA, which was $55,231.00 (Statistics Canada, 2008). Transit access had a heavy proportion of respondents who lived within a 5-10 minute walk of their closest transit access point, which is not representative of the entire Vancouver region. This information is

important to keep in mind when analyzing the data and evaluating policy options, as not everyone has equal and/or easy access to transit. However, this may be a goal worth working towards to increase transit ridership.

To further understand the characteristics of the respondents, the key independent variables were crossed with the U-Pass ownership variable. This cross tabulation further revealed who former U-Pass holders are and their characteristics, as compared to non U-Pass holders. Figures 2 and 3 show the results of the cross tabulation graphically.

Figure 2 *Cross Tabulation of Former U-Pass Holders and Key Demographic Variables.*

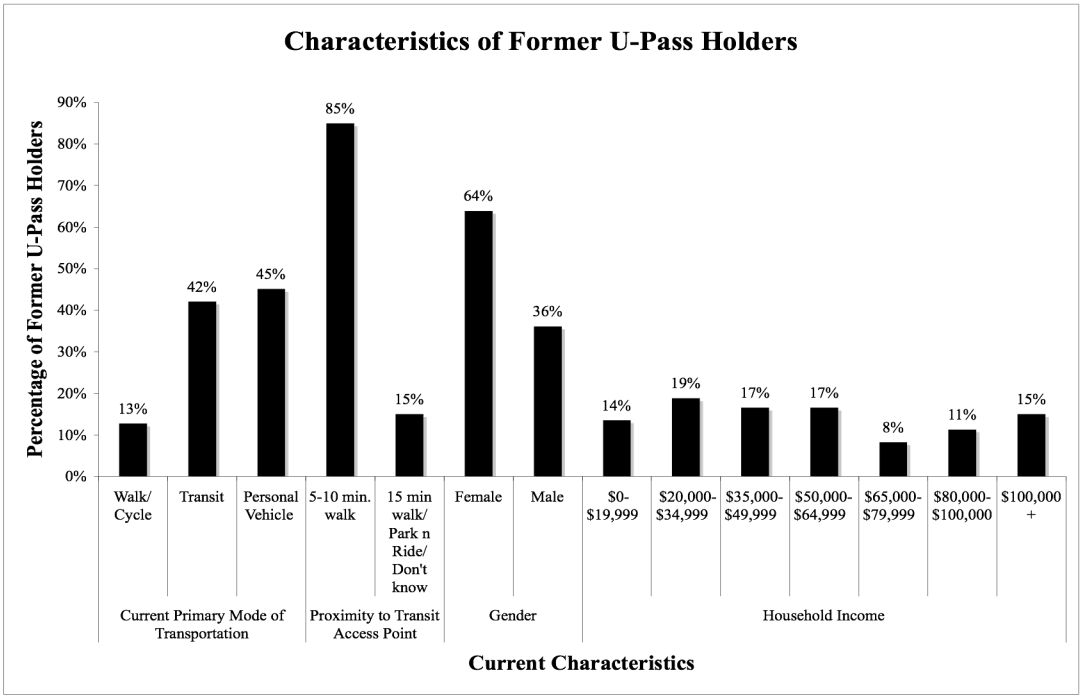
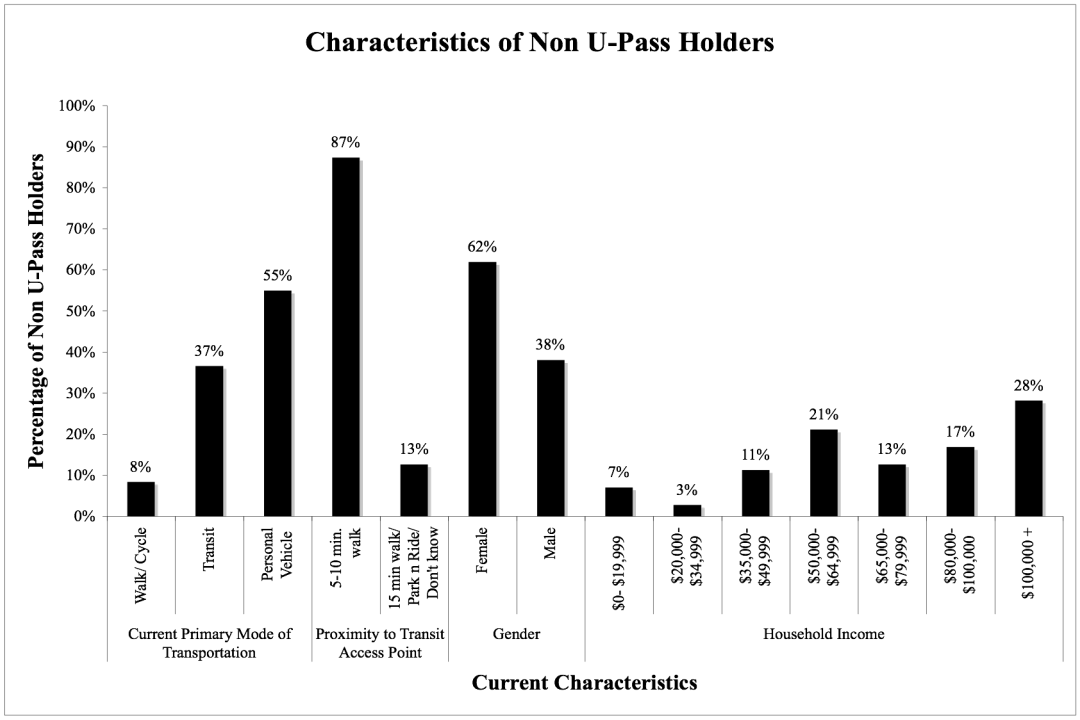


Figure 3 *Cross Tabulation of Non U-Pass Holders and Key Demographic Variables.*



As was mentioned before, the sample of respondents was not a random sample with equal representation. However, these graphs contain valuable information regarding the sample characteristics. For example, former U-Pass holders are more likely to make transit their primary mode of transportation, while non U-Pass holders are more likely to choose to use personal vehicles. Both former U-Pass holders and non U-Pass holders had an 85% response rate for living within a 5-10 minute walk of a transit access point. Both groups also had similar gender splits of approximately 60% female respondents. Former U-Pass holders had a higher proportion of respondents who reported having household incomes of $50,000.00 or less, which is likely due to the fact that all former U-Pass holders must have graduated in the spring of 2004 or later. Thus, they have not had the same amount of time to advance their careers and earn higher incomes as non U-Pass holders.

The following section outlines the significant transportation related findings, including further discussion on the primary mode of transportation responses.

4.4 Transportation Characteristics

4.4.1 Primary Mode of Transportation

From the above analysis, the demographic characteristics of both former U-Pass holders and non U-Pass holders were outlined. Respondents were also asked what their primary mode of transportation is and why they use it, which will help to highlight why some people choose transit and others do not. The wording of the question in the survey was: 'What is your current primary mode of transportation to work/ school?' Respondents were given the following response choices:

a) Car, truck, or van- as driver
b) Car, truck, or van- as passenger
c) Public transit
d) Walk
e) Bicycle
f) Motorcycle

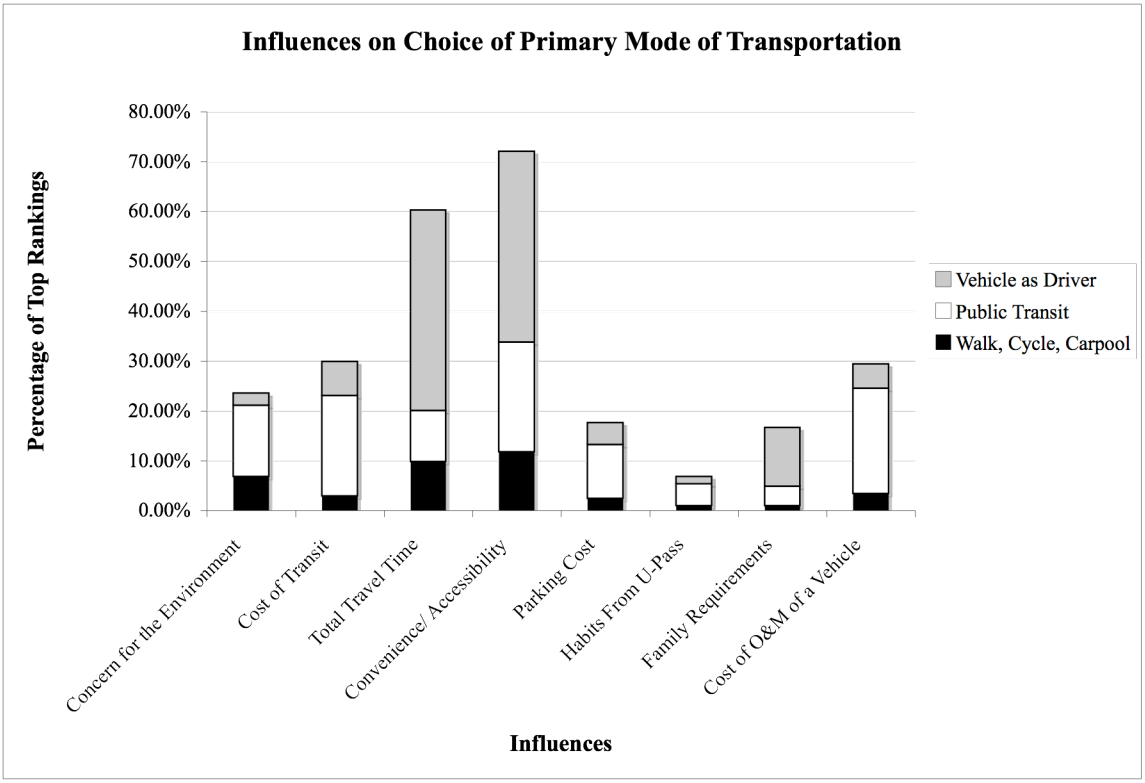
g) Taxicab
h) Other

In the sample for this study, none of the respondents chose motorcycle, taxicab, or other as their response choices. For the purpose of understanding who is currently using sustainable modes of transportation, the data was coded into three groups: 3 = Car, truck or van as driver; 2 = Public transit; 1 = Walk, bicycle, and car, truck, or van as passenger. The drivers were separated out to determine how many people are actually driving personal vehicles as their primary mode of transportation. Public transit was also on its own, as it is the focus of this investigation. Only nine respondents were vehicle passengers, and it was presumed that they were in effect carpooling. Walkers, cyclists, and vehicle passengers were lumped together because the sustainable nature of each of the mode shares. The reason for doing this was to focus on TransLink's goal of modal shift, by getting people out of single occupancy vehicles and into a more sustainable mode of transportation. This analysis identifies who needs to be targeted. For the regressions later in the report, the coding changed slightly so that vehicle passengers were lumped in with vehicle drivers. The reason for doing this will be explained in the regression section.

Of the 204 respondents, 44% (n= 90) said that driving a car, truck, or van is their current primary mode of transportation. This is significantly different from the Statistics Canada rate of 70% for 25-54 years old. 40% (n= 82) of the respondents used transit as their primary mode of commuting, which is significantly higher than the Statistics Canada rate of 25% for 15-24 year olds, and 18% for 25-34 year olds. Lastly, 16% (n= 32) walked, cycled, or carpooled.

The following Figure 4 shows the breakdown of why respondents choose their primary mode of transportation. Respondents were asked to rank their top three choices, which were then recoded so that the first and second choices were grouped together and the third place rankings were grouped with the remaining choices.

Figure 4 *Influences on Transportation Choice*



As you can see in Figure 4, total travel time and convenience were unsurprisingly reported as the most important reasons for choosing the primary mode of transportation, particularly as vehicle driver. The cost of operation and maintenance of a vehicle was an important contributor to choosing transit, as was the cost of transit. Interestingly, though, was that respondents did not believe that the U-Pass had much of an influence on their choice to take transit now. This result indicates that although the U-Pass has proven to have had an effect on post graduation transit use in other results, respondent's perceptions were that it has not influenced their decisions. Although this may be disappointing at first glance for proponents of the U-Pass, this result may follow the theory of habituation, which generally says that a behaviour becomes habitual when it is no longer cognitively controlled or guided by deliberate intentions, but is guided by routine and requires little cognitive effort for its initiation and execution (Ajzen, 2002). Respondents may carry a habit of transit use as a result of the U-Pass until other deliberate intentions break the habit. These other deliberate intentions could take the form of the influence

identified above. The results of this survey question, however, indicate that in order to attract commuters to transit, the convenience/ accessibility and total travel time of transit must be targeted.

The following section explores the transit use characteristics of the respondents to better understand how both former U-Pass holders and non U-Pass holders use transit services.

4.4.2 Transit Usage Characteristics

A number of questions on respondents' transit usage characteristics were asked to better inform the potential policy options. Figure 5 and 6 show the breakdown of two transit use characteristics, mode and payment method, by former U-Pass ownership.

Figure 5 *Transit Use Characteristics for Former U-Pass Holders*

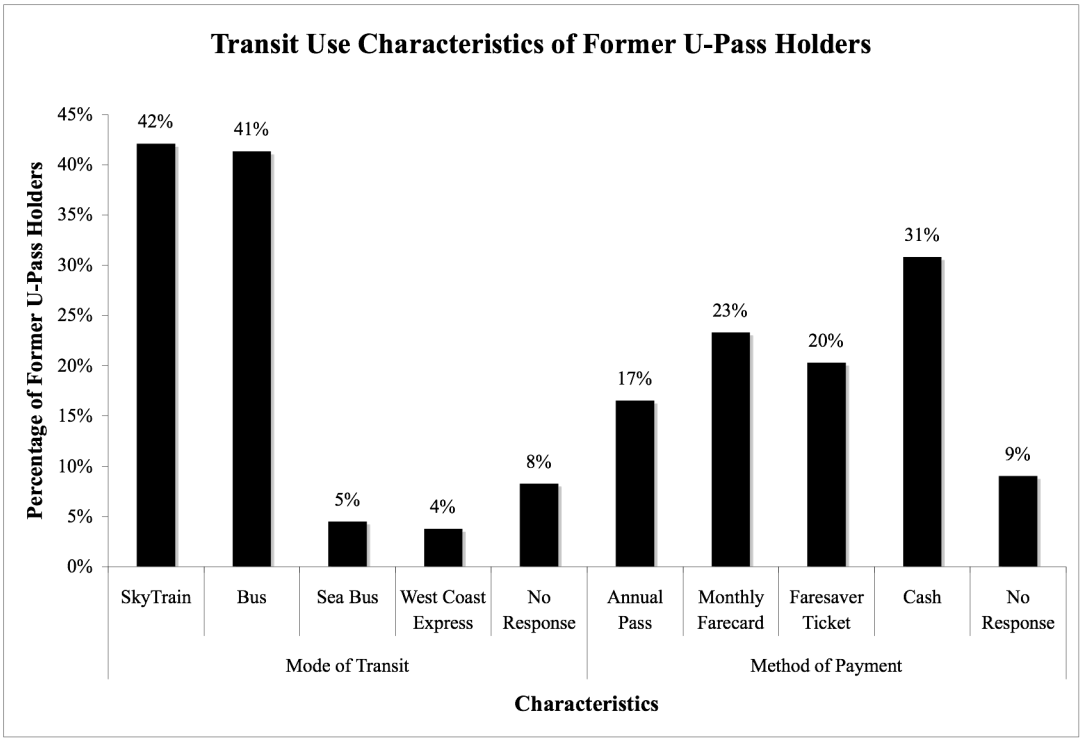
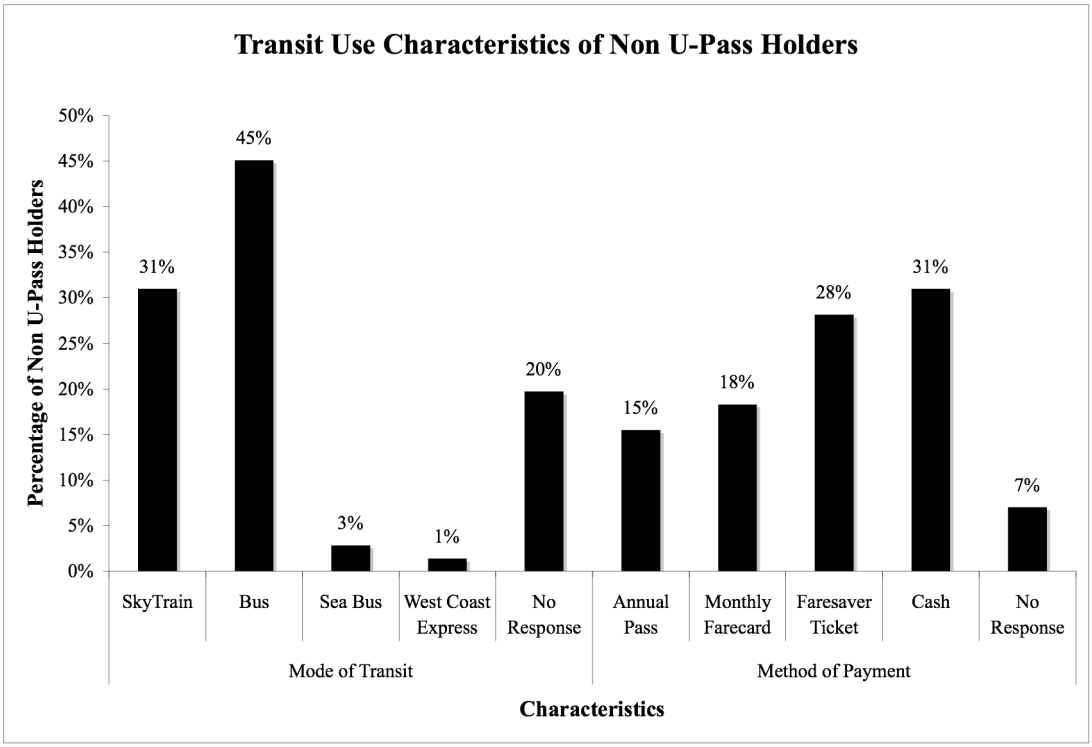


Figure 6 *Transit Use Characteristics of Non U-Pass Holders*



Both former U-Pass holders and non U-Pass holders had very similar current transit use characteristics. However, a slightly higher percentage of former U-Pass holders use SkyTrain and use prepaid fare medium, which may be a result of having had the U-Pass. Former U-Pass holders may have chosen to live closer to SkyTrain stations, making it more convenient to use SkyTrain, and their experience with the U-Pass may have encouraged the purchase of unlimited use fare media such as the annual Employer Pass and the monthly FareCard. These are speculations, however, and the difference between the two groups should not be overstated.

4.4.3 U-Pass Characteristics

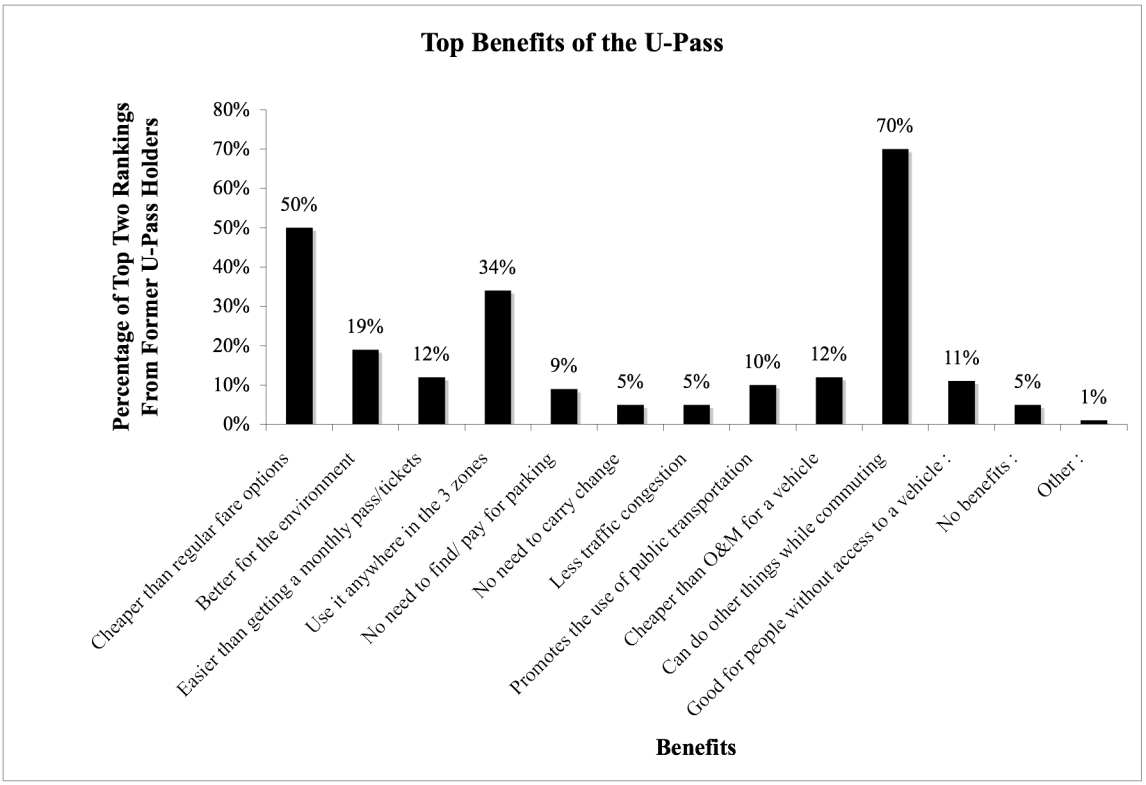
A few questions about the U-Pass were asked to determine how the U-Pass affected behaviour and what U-Pass holders liked and disliked about the U-Pass. These questions were:

a) In your opinion, what were the top three benefits of having a U-Pass?
b) In your opinion, what were the top three drawbacks of having a U-Pass?
c) What was the main reason why you did not use your U-Pass?
d) Did the U-Pass influence your choice of transportation after graduation?
e) How did the U-Pass affect the influence of transit and walking on lifestyle decisions?

The responses to these questions will highlight what works well with the program, and what should be improved on.

For the first question regarding the benefits of having a U-Pass, respondents were asked to rank the top three out of 12 benefits, with No Benefits and Other also being an option. These options were derived from the 2004 TransLink U-Pass survey. For analysis purposes, I recoded the responses so that first and second rankings were one group as the 'top' rankings, and the third place rankings were coded as not being ranked. This enabled me to determine respondents' true top choices. The results are shown in Figure 7 below.

Figure 7 *Top Ranked Benefits of the U-Pass*

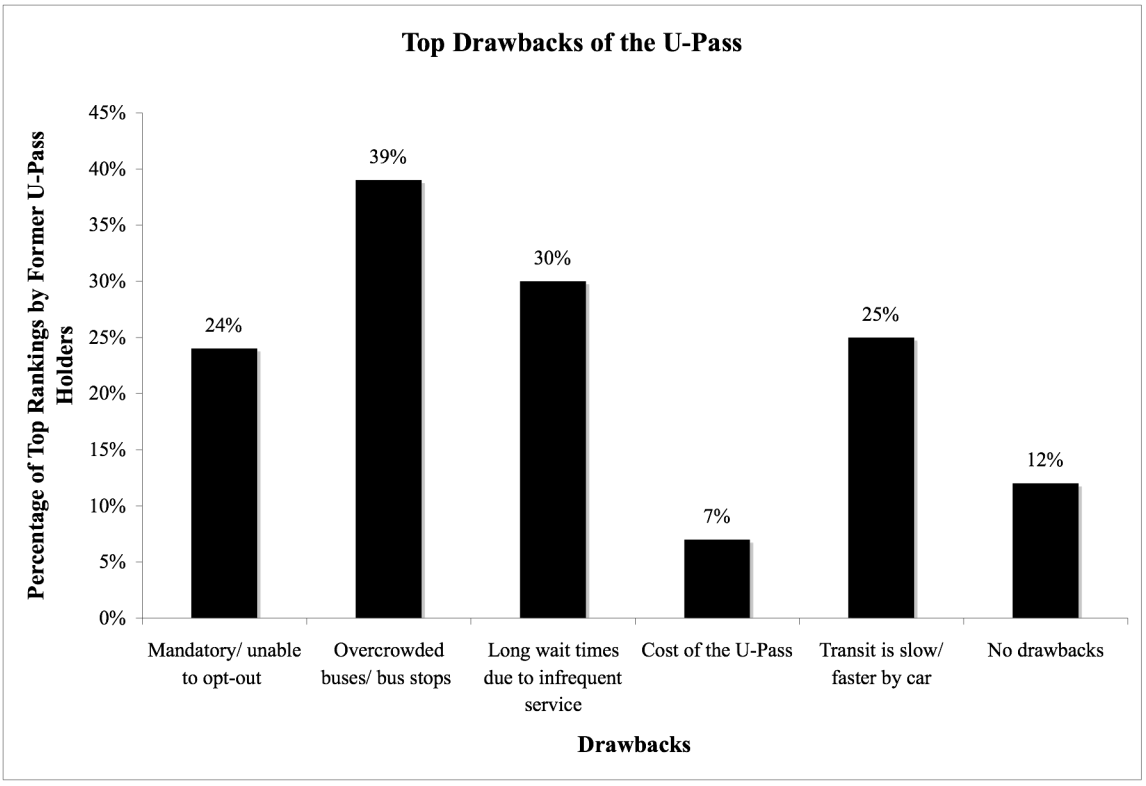


As Figure 7 shows, the benefits that respondents ranked as the most important were: 'cheaper than regular fare options'; 'can use it anywhere across the 3 zones'; and 'can do other things while commuting'. This indicates that U-Pass holders valued the U-Pass for its personal attributes, such as convenience, cost, and multi-tasking capabilities, and not necessarily for its societal attributes, such as mode shift capabilities, environmental benefits, or vehicle offsets. This is important not only for the consideration of policy options, but also for marketing schemes for programs like the U-Pass. At this point in time, these respondents were more concerned about how the program affected them, not how it will benefit society.

The next question analyzed was the reported drawbacks of the U-Pass. Again, respondents were asked to rank their top three choices from six options. These options were also inspired by the 2004 TransLink survey on the U-Pass. Like the benefits question, the responses

were recoded so that the first and second rankings formed the 'top ranked' category. Figure 8 shows this breakdown.

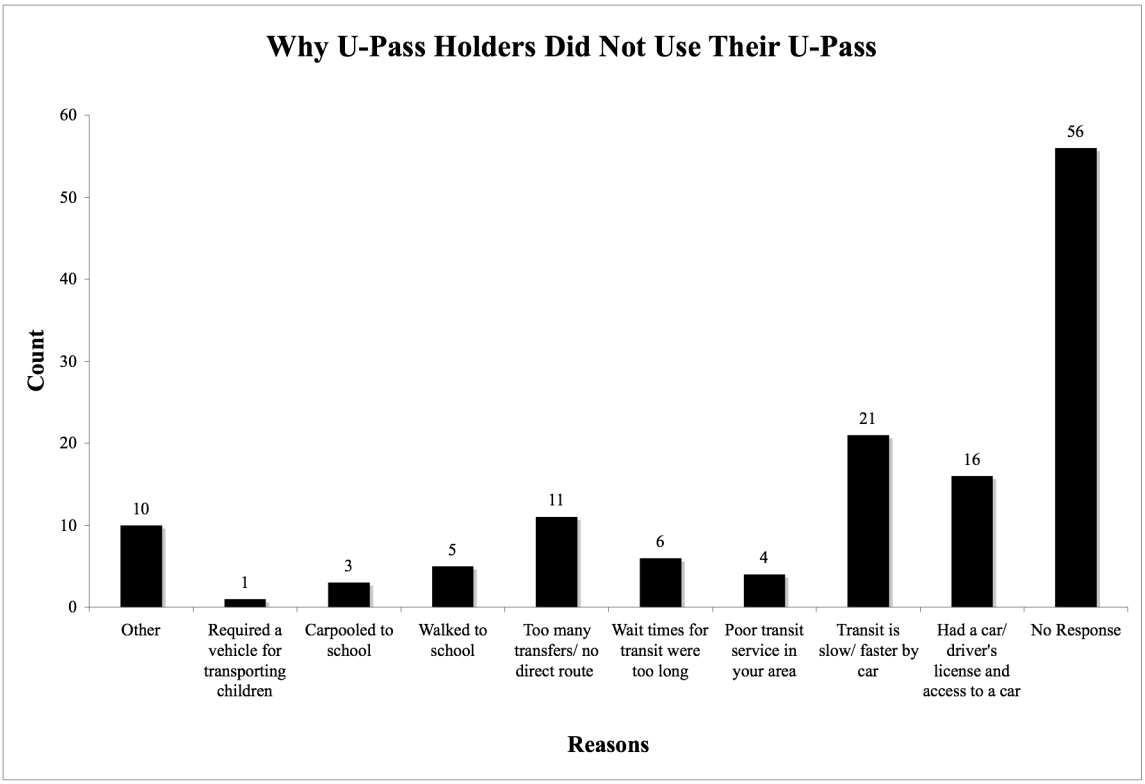
Figure 8 *Top Ranked Drawbacks of the U-Pass*



What is of most interest about the findings shown in Figure 8 is that respondents were less concerned about the U-Pass program characteristics than the conditions of the transit services. Although the mandatory aspect of the program was the fourth most popular response, it was overcrowding, infrequent service, and the speed of transit service that were rated as the top three drawbacks. This information is useful for transit agencies, as it shows that it is generally the quality of service that determines the success of a program like the U-Pass. However, this conclusion begs the question of which should come first, service improvements, or pass programs? This question would have to be answered by the transit agency based on resources available and other determining characteristics.

Now that we know what U-Pass holders thought of the benefits and drawbacks of the program itself, the next question determines why U-Pass holders did not use their U-Pass. This question required respondents to simply indicate the one main reason they did not use their U-Pass. Nine response options were given, and respondents who did not have a U-Pass were allowed to skip this question. The response rates are shown below in Figure 9.

Figure 9 *Why Former U-Pass Holders Did Not Use Their U-Pass*



The most popular reason for not using the U-Pass was again because of transit service. Respondents reported that transit is too slow and that they could get to their destination faster by car. This was supported by the second most popular reason of having a car or access to a car. Respondents who either owned a car or had access to a car were less likely to use their U-Pass. The unfortunate aspect of this question was the number of 'other' responses, which was not accompanied by a space for respondents to elaborate, and the number of 'No Responses'.

The next question of interest for this study was whether the availability of transit or the ability to walk to a destination affected lifestyle choices of the respondents. Respondents were asked to answer Yes or No to whether the ability to take transit or walk affected the following decisions: where they live; where they work; where they shop; where they can go to school (if they are or are considering going to school); and where they socialize.

Since one of the goals of the U-Pass is to create lifelong transit users, it is hoped that former U-Pass holders will make life decisions, like where to live and work, based on the availability of transit or the ability to walk. To obtain information on how the respondents' lifestyle decisions were affected by the U-Pass, the question regarding lifestyle choices was crossed with the question on whether respondents had had a U-Pass or not. Figures 10 and 11 show this breakdown.

Figure 10 *Influence of Transit and Walking on Lifestyle Choices For Former U-Pass Holders*

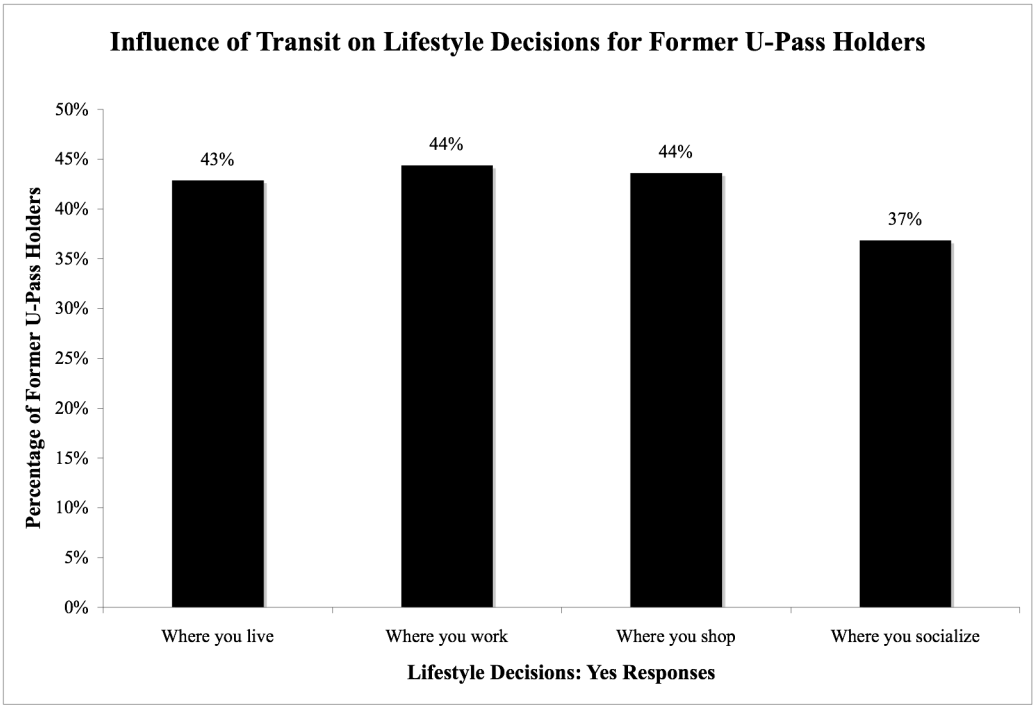
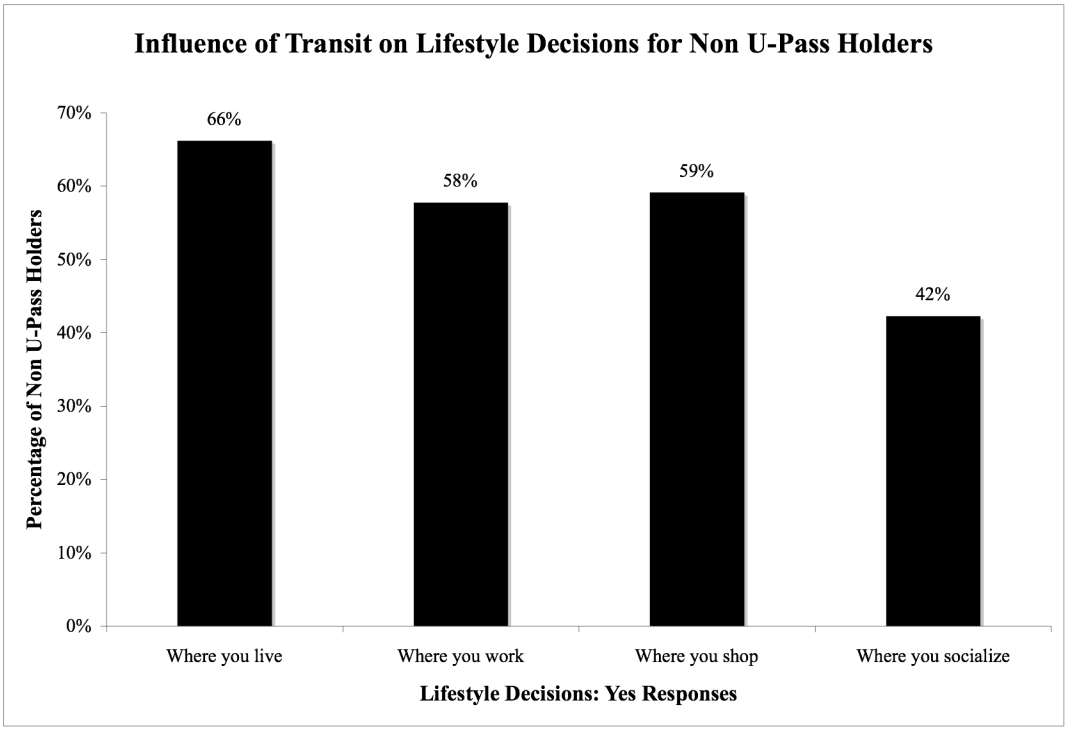


Figure 11 *Influence of Transit and Walking on Lifestyle Choices For Non U-Pass Holders*



The information revealed in Figures 10 and 11 indicates that the U-Pass had minimal effect on the respondents' lifestyle decisions. The non U-Pass holders actually had a higher incidence of transit and walking influence on lifestyle decisions. This result does not support the hypothesis that lifestyle decisions after graduation are dramatically influenced by the U-Pass. However, the survey sample has likely had a significant impact on these results, particularly the high rate of respondents who live within walking distance of transit and the high proportion of respondents who reported choosing transit as their primary mode of transportation. For these reasons, further research with a larger, more random sample is required to understand the long-term effect of the U-Pass on lifestyle decisions.

In summary, the main conclusions from the cross tabulations are that the U-Pass has resulted in a higher retention rate of frequent and infrequent transit users, however there is still a significant shift from frequent U-Pass users to infrequent or non-transit users after graduation.

There were several important reasons identified for people not using their U-Pass or transi in general, which included the mandatory nature of the U-Pass and transit service characteristics. Unfortunately, the survey for this study did not go into much depth regarding service characteristics, therefore it cannot be factored into why graduates do or do not use transit currently. Also of importance, and slightly disappointing, was the finding that the U-Pass did not have a significant impact on lifestyle decisions made after graduation.

The following sections outline the logistical regression specification and the results from the regressions.

4.5 Regressions

While cross tabulations can illustrate respondent characteristics well, they cannot indicate correlations. Performing regressions on the data will identify the individual relationships between each independent variable and the dependent variable, holding all other variables constant. Determining the equation was quite difficult for this study, as I could not find a similar study that uses econometric modelling. Therefore, some variables are included because they have been proven to be important in other transit usage studies, while other variables are hypothesized to be relevant. The purpose of running the regression was to get a sense of the importance of some key variables, recognizing the econometric challenges, such as potential endogeneity. An excellent next step for further research is to undertake a larger survey of university graduate and a more advanced statistical analysis.

As was presented in Section 4.2, the dependent variable for this study is current transit use, and is measured by the reported frequency of current transit use. Respondents were given four response options, which were then coded into three categories: 2= Frequent; 1= Infrequent; and 0= Never use transit. The regression analyzes the independent variables in relation to the

dependent variable to determine which have the most significant correlation with frequency of current transit use.

For the study and the regression, I hypothesized that the most important factor in the frequency of transit usage after graduation is U-Pass ownership while in university. This hypothesis is rooted in the knowledge of how Deep Discount Group Passes increase transit usage among members, as well as research that finds that people who have used transit in the past are more likely to use it again. I have also included other potentially significant factors in determining transit usage among SFU graduates and their hypothesized relationship with the dependent variable (positively or negatively correlated). The source column indicates the source of the hypothesized relationship. Table 3 gives a summary of these hypothesized relationships:

Table 3 Hypothesized relationships between the dependent and independent variables

Variable Name	Measures/ Coding	Hypothesized Relationship	Source
Frequency of Transit Use During University	0= Never use transit 1= Use transit 1-2 times per month 2= Use transit 1 or more times per week	+	Banister, 1978; Ajzen, 2002.
Had a U-Pass in University	1= Yes 0= No	+	Banister, 1978; TCRP, 2007.
Closest Transit Access Point	1= 5-10 minute walk 0= 15 minute walk, Park n Ride, or Don't Know	+	Sanchez, 1999.
Average Commute Time	The natural log of the reported commute time by respondent	-	Sanchez, 1999.
Commute Mode	Car, truck or van as driver = 1 All others = 0	-	Hypothesis, observed behaviour
	Walk, Bicycle, Car, truck or van as passenger = 1 All others = 0	+	
Marital Status	1= Legally married, common law 0= Never legally married, separated, divorced, widowed	-	Hypothesis
Household Income	1 = $0- $19,999 2 = $20,000- $34,999 3 = $35,000- $49,999 4 = $50,000- $64,999 5 = $65,000- $79,999 6 = $80,000- $100,000 7 = $100,000 +	-	Gomez-Ibanez, 1996
Gender	1= Female 0= Male	-	Gordon et al., 1989.

The hypothesized effect of the frequency of transit use in university is positive because of the habit formation in the formative young adult years. If students developed a habit of using transit frequently during university, I hypothesize that those habits will positively influence their transit usage after graduation. This hypothesis is routed in the idea that past behaviour can be used a good predictor of current and future behaviour (Banister, 1978; Ajzen, 2002; Garling and Axhausen, 2003). In terms of the influence on the U-Pass, Banister (1978) also found that large-scale policy changes, such as an area wide pricing scheme, could affect transportation choice

habits. From this logic, it can be hypothesized that the U-Pass could have a positive impact on the habit formation of taking transit, therefore making it more likely that former U-Pass holders would continue to use transit after graduation. This hypothesis must be balanced against the life change of graduating, however if the habit is strong enough, life decisions might be made to accommodate the habit.

With this in mind, the variable regarding the proximity to a transit access point is believed to also have a positive relationship with the frequency of transit use. Sanchez found that people who live close to transit are more likely to use it for commuting purposes. This relationship, however, is likely endogenous, meaning that it is difficult to determine which causes what. Taylor et al. (2008) deal extensively with this issue, but it is beyond the capacity of this study to address this problem extensively.

Each respondent was asked to enter his or her average commute time in minutes, and the natural log of the total commute time was used in the regression. The mode of transportation was not taken into account, however this is accounted for by adding a variable, which multiplied the commute time by two mode dummy variables. This will be explained further below.

The natural log of commute time would typically be hypothesized as having a negative effect on the frequency of transit usage. Sanchez (1999) supports this hypothesis when he says that the further a worker must travel for work, the less likely they are to use public transportation to do so. This hypothesis is also based on survey responses regarding the perceived speed of transit. Respondents cited travel speed as an important factor in their transportation mode decision, therefore it is assumed that the further a person must travel, the less likely they are to use transit. However, as a result of adding mode variables, and particularly mode*time variables, which are explained below, the commute time variable has come to represent the length of transit commute default. Since using transit should have a positive relationship with frequency of current

transit use, but the length of trip should not necessarily matter, it is expected that Commute Time and Frequency of Current Transit Use have a positive but insignificant relationship.

Two commute mode dummy variables were added to the equation because the above commute time does not take the mode into consideration in the measure. Respondents reported their commute time in minutes, but were not asked to identify how the commute occurred. Another question in the survey, however, asked respondents about their primary mode of transportation. The responses were broken down by relative speed and mode. This is a slightly different coding than for the previously discussed descriptive statistics because here we are interested in how the mode will affect the distance travelled in a given amount of time. For this case, carpooling, or vehicle passenger, was coded with vehicle drivers as they share the same mode of transportation. For the first dummy variable, walking and cycling were coded together because these modes are relatively slow and are typically only used for short distances; a 30 minute walk or cycle will not result in as much distance covered as a motorized vehicle. Walk and cycle were coded as 1, and all other modes were coded as 0, which will enable the identification of how likely people who currently walk or cycle will use transit frequently. It is hypothesized that there will be a positive correlation between walking and cycling and frequency of transit use. This hypothesis is largely based on UBC and TransLink observed mode shift due the U-Pass introduction; walking, cycling, and carpooling had the highest rate of mode shift at UBC as a result of the U-Pass (UBC, 2008).

Dummy number two for commute mode was focused on personal vehicle users, which coded drivers and passengers of vehicles together because this is the mode of most interest to shift to transit use. Although carpooling is considered a good alternative to transit, it still requires a personal vehicle and is not as energy efficient per user as a public transit vehicle. Personal vehicle users were coded as 1, and all other modes were coded as 0, which will indicate the likeliness of vehicle users to use transit on a frequent basis. The hypothesis is that there will be a

negative correlation between frequency of transit use and vehicle users because survey respondents indicated that having a car or access to a vehicle was a significant reason for not using their U-Pass. A few survey respondents, typically vehicle drivers, also indicated in their commute time entries that their commute time would almost double if they were to take transit instead of a private vehicle. While this may have been an exaggeration and not actually the case, there is a belief amongst many drivers that transit is slow. Because of this, I expect drivers will be less likely to use transit the longer their commute is.

Two other variables were added to accommodate the lack of mode information in the commute time variable. To understand the effect of the mode on the commute time, each mode dummy variable was multiplied by the commute mode. The two categories for the dummy variables are the same as above for the mode variables, which makes transit users the default in both dummy cases. Transit users commute time information is thus be captured in the natural log of commute time variable. These variables will show the correlation between increasing trip length by mode and the frequency of transit use. It is expected that as walking and cycling trips increase in length, the likelihood of using transit will increase, producing a positive correlation.

The opposite is true for personal vehicle users; it is expected that as car, truck, or van trips become longer, the tendency to use transit will decrease, producing a negative correlation between the two variables. This hypothesis is based on Banister's (1978) conclusion that people are most likely to use the same mode of transportation that they used yesterday, unless something changes in their personal lives or a large-scale policy affects that chosen mode. Long distance commuters are also unlikely to switch to transit at this point in time because transit service is not as frequent or widespread the further out one radiates from the downtown core (unless one has access to West Coast Express or SkyTrain). Long transit trips also tend to require several transfers, which were indicated in the survey as a reason to not use transit. As Wachs (1976) explains, travellers' perceptions and attitudes are not only affected by total travel time, but also

by time spent walking, waiting, transferring, and/or parking a vehicle. To most personal vehicle users, the car deemed superior in minimizing out-of-vehicle time over transit.

Marital status is expected to have a negative relationship based on both combined income potential and the need to accommodate two people's transportation needs. It is hypothesized that double income earner households will likely own at least one car to accommodate at least one person's commute needs, and that two incomes make a personal vehicle more affordable. Gordon et al. (1989) found that married workers tend to undertake longer work trips than either single or divorced workers. This variable is tied closely to the household income variable, which is also expected to be negative based on the results of Gomez-Ibanez's (1996) study, which found that transit use decreased as income increased. Higher income also has a tendency to be linked with suburban living, which tends to increase the travel time to work. Gender is also expected to have a negative relationship with frequency of transit use. As Gordon et al. (1989) found, most women combine trips and perform many of the household errands which transit does not typically lend itself well to. Gordon et al. (1989) also found, however, an absence of gender differences in transit use, which is most likely caused by the diffusion of automobile ownership. A concern for safety and security was raised by some of the female survey respondents, indicating that women may not feel as safe on a public transit system then in a private car. Unfortunately, this influence was not captured in the survey itself.

4.6 The Functional Equation

The proposed equation to address the question of why people choose to use transit after graduation is:

TG = f(TU, U, NU, CT, CMWC, WCT, CMV, VCT A, I, MS, G)

Where:
TG = Transit Usage After Graduation
TU = Transit Usage During University

U = U-Pass Access

NU= Number of Semesters with the U-Pass

CT = Natural Log of Commute Time

CMWC = Commute Mode Walk/Cycle

WCT= Commute Mode Walk/Cycle * Natural Log of Commute Time

CMV= Commute Mode Personal Vehicle

VCT= Commute Mode Personal Vehicle * Natural Log of Commute Time

A = Access to Transit

I = Household Income

MS = Marital Status

G = Gender

This gives an expected equation of:

$$TG_i = c + \beta_1 TU_i + \beta_2 U_i + \beta_3 NU_i - \beta_4 CT_i + \beta_5 A_i + \beta_6 CMWC_i + \beta_7 WCT_i - \beta_8 CMV_i - \beta_9 VCT_i - \beta_{10} I_i - \beta_{11} MS_i - \beta_{12} G_i + \varepsilon_i$$

Where i = 1, 2, 3, … 204

Before the regressions, correlations were computed to anticipate multi-collinearity problems. The table can be seen in Appendix B. The only correlations above 0.7 occurred between the mode variables and the Time*Mode variables, which was to be expected. This gave me confidence to proceed with the regressions. The following Table 4 shows the results of two regressions estimated by OLS with SPSS. Regression 1 is a base case model upon which Regression 2 and 3 were built.

The significance of each variable is indicated with stars next to the t-statistic. One star indicates significance at the 10% confidence level, two stars indicate significance at the 5% confidence level, and three stars indicate significance at the 1% level.

Table 4 Regressions

Variables		Regression 1	Regression 2	Regression 3
C		(2.79)	(2.90)	(3.09)
Frequency of Transit Usage During University		0.01 (0.25)		
Have a U-Pass		0.17 (2.0)**	0.17 (2.03)**	0.17 (2.09)**
Transit Access		0.14 (2.58)**	0.14 (2.71)***	0.14 (2.75)**
Natural Log of Commute Time		0.1 (1.42)*	0.1 (1.44)*	0.1 (1.45)*
Gender		0.0 (0.02)	0.0 (0.05)	
Household Income		-0.02 (0.34)	-0.02 (0.38)	
Marital Status		0.05 (0.82)	0.05 (0.81)	
Commute Mode	**Walk/ Cycle**	-0.64 (2.22)**	-0.64 (2.23)**	-0.65 (2.3)**
	Personal Vehicle	-0.74 (3.04)***	-0.74 (3.06)***	-0.73 (3.1)***
Time* Mode	**Walk/ Cycle**	0.43 (1.53)*	0.43 (1.54)*	0.45 (1.62)*
	Personal Vehicle	0.05 (0.22)	0.05 (0.2)	0.036 (0.16)
Number of Semesters With U-Pass		-0.10 (1.12)	-0.09 (1.11)	-0.1 (1.17)
Adjusted R Bar Squared		0.505	0.508	0.52
Number of Observations		204	204	204
Degrees of Freedom		12	11	8

*The t-statistics are in parentheses *Significant at 10% ** Significant at 5% ***Significant at 1%*

4.7 Summary of Major Findings

The following section examines the variables that are statistically significant in the regressions to determine consistency with previously defined hypotheses and to provide detailed information that will be used in the development and analysis of policy alternatives.

The final regression had the insignificant variables removed to better understand their effect on the overall regression. The variables removed were: frequency of transit use during university; gender; household income; and marital status. The effect of removing these variables was that the significance of the previously significant variables increased; however the magnitude of the change was small. Therefore, it can be assumed that for this particular specification and sample, university transit use, gender, income, and marital status are not important in explaining transit use after graduation. The following paragraphs explain the results of the rest of the included variables.

Having had a U-Pass proved to be significant in the expected direction at the 5% level in all three specifications. One of the reasons why frequency of transit use during university was dropped was because it had some overlap with U-Pass ownership. The U-Pass variable proved to be a more important indicator of transit use after graduation in this study, therefore it was kept in all three specifications.

Transit access was statistically significant in the expected positive direction at the 5% level in Regression 1 and 3, and at the 1% level in Regression 2. This means that current proximity to transit is important in determining current frequency of transit use. What is important for policy considerations is how can one's choice of where to live be influenced to encourage transit use. Developments along the SkyTrain show that there is a demand for housing located in close proximity to transit stations, particularly modes of transit that are efficient and convenient. Although TransLink has had very little control over the land use along transit routes, encouraging people to use transit may increase demand for housing developments along frequent transit routes, which developers will hopefully meet. TransLink can also work to improve transit services on existing routes to better serve the residents along those corridors.

Both Commute Mode variables proved to be significant, although both have a negative correlation with the frequency of transit use. This means that people who currently walk, cycle, or

use a personal vehicle are not likely to use transit on a frequent basis. This supports the habits theory that suggests that what people did yesterday and today is what they will likely do tomorrow. As Fujji and Kitamura found, large-scale external policy changes can affect habits. These policies can either be targeted at getting existing drivers out of their cars, or target recent graduates as they face one of the largest life changes to continue to use transit rather than purchase and use a personal vehicle. The policy options presented later focus on the development of transit use at both the student level and the post-graduate level.

The natural log of Commute Time was significant at 10% in all three specifications, and had the expected positive relationship. This is largely a result of adding the Commute Time*Commute Mode dummy variables. Since the commute mode dummies only account for walk/cycle or personal vehicle use, public transit use becomes the default mode. This means that in the Time*Mode variable, Commute Time represents the relationship between the length of commute by transit and the frequency of current transit use. Therefore, currently using transit as the primary mode of transportation has a positive relationship with the frequency of current transit use, but the length of the trip is not significant in determining the frequency of use.

The Walk/Cycle Time*Mode variable proved to be significant at the 10% level in the expected positive direction, suggesting that there is a strong correlation between the length of a walk/cycle commute and the tendency to use transit frequently. This supports the behaviour observed at UBC with the introduction of the U-Pass, where pedestrians and cyclists had a high rate of mode shift to transit. This intuitively makes sense, because walking and cycling are both open to weather elements, as well as other factors, which may entice them to use transit instead of walking or cycling on a given day. While it is understandable that walkers and cyclists would use transit, it is not the desired mode shift to achieve a more liveable region. The Time*Mode variable for personal vehicle use showed an insignificant positive correlation between the length of vehicle commute and transit use frequency. While the relationship is the opposite of what was

expected, the lack of significance means that this data does not support the hypothesized relationship.

The next section will describe the criteria and measures against which the policy options are assessed.

5 Criteria and Measures

In this section, I will outline the proposed policy options, as well as the criteria and measures against which each option will be evaluated. Table 5 defines the criteria and the following subsections further explain the relevance and measures of each.

Table 5 Criteria and Measures for Assessment of Policy Alternatives

Criteria		Description	Measures
Cost	New Service Investment, Administrative	Projected magnitude of incremental cost for implementation	Scale: High, Medium, Low
Effectiveness	Ridership Account	Projected change in Ridership levels from program implementation	Scale: High, Medium, Low
	Environmental Externalities	Change in GHG emissions as a result of mode shift	Scale: High, Medium, Low
Equity	Horizontal	Income, Students, Alumni • Costs incurred • Benefits received	Scale: High, Medium, Low
	Vertical	Income, Regional • Costs incurred • Benefits received	Scale: High, Medium, Low
Feasibility	Public Acceptability	Will the citizens of the Vancouver CMA likely accept this policy?	Yes/ No

5.1 Cost

The cost account is one of the most important considerations in any policy decision, particularly when program expansion is being considered. All of the presented policy options will have the following cost elements: new service investments and administrative costs. What will differ between policy options is the magnitude of the incremental costs of implementing the policy. For the purposes of analysis in this study, the measure of the cost criterion will be a scale

of low, medium, and high. Low means that the incremental cost increase would likely be manageable with existing revenues. Medium means that the incremental increase in costs will be significant, but manageable in the medium term if the policy is expected to achieve a substantial increase in revenue, or new revenue streams are exploited. High will mean that the associated incremental costs will be prohibitively high unless ridership and revenue sources increase to offset the costs.

New service investment levels will depend heavily on the ridership account, which will indicate the change in ridership levels. Based on the predicted change in ridership, investment requirements can be determined. For example, according to the U-Pass Review, TransLink increased transit capacity by 27% to meet U-Pass demand between 2002 and 2004 (Urban Systems, 2005). Administrative costs will include the costs of employing people to run the program as well as the pre-implementation negotiation and planning costs. Many of these costs could be off loaded from TransLink to participating schools, or stream lined to increase efficiency.

5.2 Effectiveness: Ridership Account

The ridership account will assess the change in the number of people using transit services because of the policy option. This will be a very difficult criterion to measure, as TransLink does not have a reliable and robust method of tracking the number of trips made both in the past and currently. The only method of tracking trips at this point is through the Trip Diary, conducted every few years. The Trip Diary only captures a small component of the population and is a voluntary survey. The Trip Diary also does not track the U-Pass as one of its influences. TransLink can also estimate the total number of trips by fare revenue, however there are faults with this method as well. Cash and Faresaver tickets are relatively easy to track, while almost all passes (monthly, annual, and the U-Pass) are used as flash passes meaning they are not swiped upon entry into the transit system. Therefore, there is no way of knowing how often pass holders

use transit nor where they travel. There has been talk of introducing a Smart Card, which will make trip tracking much easier and more effective. Until then, ridership levels for this study will have to be estimated from the survey results and previous U-Pass research.

The measurement for this criterion will be a scale of high, medium, low. High will represent a significant incremental increase (beyond normal increases due to population growth) in ridership levels that will require significant service investment to meet demand. Normal growth projections due to population growth is generally around the 2% level. What was observed by both TransLink and UBC with the introduction of the U-Pass was an increase of approximately 50% in transit trips made by students. SFU and UBC are the largest post-secondary institutions in the Vancouver CMA, and they had lower levels of previous transit use than many smaller colleges around the region. Thus, estimated ridership increases among those institutions could be in the 15-20% range. Medium will represent an annual incremental increase in ridership that is above the normal 2% growth rate, but below the U-Pass projected growth rate of 15-20%. Low will represent a small incremental increase in transit ridership that could be handled with existing and planned infrastructure and service. This could signify an annual increase in and around the 2-3% range.

5.3 Effectiveness: Environmental Externalities

The purpose of the proposed policy options is to induce a change in mode share, particularly from single occupancy vehicles to public transit. Although there will be environmental consequences of expanding infrastructure and service, the primary environmental externality of concern for this study is the change in CO_2 emissions from transportation modal shift. Before any action is taken on any policy that would affect ridership and service increases, a full environmental assessment should be undertaken. Such a study is beyond the scope of this report. Thus, with that in mind, it is expected that each of the policies presented should cause reduction in CO_2 emissions if successful, differing only in magnitude. The more people that

switch from single occupancy vehicles to transit, the larger the decrease in CO_2 emissions. Therefore, this criterion is highly dependent on the ridership criterion. A significant increase in ridership would likely result in a significant decrease in SOV trips.

The measure applied to this criterion will again be a scale of high, medium, and low. High will indicate there will be a significant decrease in CO_2 emissions from SOV trips. Since the government of British Columbia has set a target of decreasing CO_2 emissions by 33% of 2007 by 2020, a significant reduction would be an annual reduction of 3% or more, or some sort of combination to reach the target. Data collected by TransLink, which was presented earlier in the background section, indicates that single occupancy car trips produce three times the amount of CO_2 emissions as new diesel buses per person, and 20 times that of SkyTrain and electric trolley buses per person. Therefore, the region would need to see a shift of 3% of car drivers to transit per year to reach the target by 2020.

5.4 Equity

An important preface to equity in terms of transit and transportation as a whole is that an important discussion is required regarding who is responsible for equity issues. Equity is a tricky subject to deal with and is not necessarily the responsibility of the transportation agency to deal with. It is often easier for higher levels of government to determine who is affected both negatively and positively by a policy, and what kind of actions should be taken to mitigate the difference. However, for the purposes of assessing the proposed policies, a brief discussion on the equity impacts on various groups are included in this report.

The equity criterion is broken into two parts: horizontal and vertical equity. Horizontal equity assesses how the policy option will affect people within the same group. The horizontal equity groups are: income brackets; students; and alumni. The focus is on equality for horizontal equity, meaning that all individuals within a given group are treated equally. Most importantly,

the criterion explores whether each individual will pay the same amount, receive the same benefits, and have the same access. Vertical equity, on the other hand, involves an analysis of how individuals in different groups are affected. Vertical equity does not necessarily mean that the policy has to be applied in an equal manner. Vertical equity can mean that variations are employed through the policy, or other complementary policies, to offset inequalities that occur in real life.

Measuring equity relies heavily on group based data, including income bracket data, home and work location, and former U-Pass involvement, which was collected from the survey results and is supplemented by Canadian Census data. The equity criterion is measured by a scale of high, medium, and low. For the purposes of this study, a high measure means there is high degree of equity between all members of a group or between groups. Medium means most members of a group will be treated in the same way, while some members may not. A low measure indicates that many members of a particular group are not treated the same, or that the policy favours some groups over others.

5.5 Feasibility

The feasibility account assesses the wider public's predicted acceptance of the policy. This includes political feasibility, taxpayer attitudes, and other transit rider attitudes. Feasibility acts as an indicator for how easily the policy could be adopted. Feasibility will be measured with a simple yes or no, where yes means the policy is publicly acceptable, and no means it is not feasible.

The following section will outline the proposed policy alternatives, followed by an evaluation of those alternatives with regard to the above criteria.

6 Policy Alternatives and Evaluation

The purpose of this section is to propose and evaluate policy options that would build on the success of the U-Pass program. The status quo will be presented and used a base case against which the other three policy options will be assessed. The policy options have a common goal of increasing transit usage among 25-35 year old citizens of the Vancouver Region. These policy options have been derived from the survey results, as well as from research on other jurisdictions. The policy options presented are not mutually exclusive and are meant to build on one another.

6.1 Alternative 1: Status Quo

For the purposes of comparison, the status quo involves no change from what currently exists. This means that UBC, SFU, and Langara College would maintain their revenue neutral agreements in which all registered students are eligible to receive a U-Pass. This policy is considered a legitimate option for indirectly targeting the transit use of 25-34 year olds through the development of transit use behaviour during the typical 18-24 year old student period.

Through the research presented in this study and other research on the U-Pass, it has been determined that the program has been a resounding success in achieving the goals set out by the universities. According to UBC's Trek program, the U-Pass has resulted in UBC students enjoying transportation cost savings of more than $3 million per month, greenhouse gas emission savings of over 16,000 tonnes per year, and UBC has been able to defer of the immediate need to build 1,500 more parking stalls, resulting in a cost-savings of over 20 million dollars. (UBC Trek website) It is believed that SFU has had similar results, but on a smaller scale.

The results of the program for TransLink have been mixed; the survey results for this study found that 76% of former U-Pass holders remained frequent or infrequent transit users,

which is higher than the 59% of non U-Pass holders who currently use transit frequently or infrequently. This indicates that the pass has had success in influencing transit use post-graduation. However, TransLink has had significant losses as a result of the U-Pass program, primarily because of the revenue neutral agreement. TransLink has had to make major service investments as a result of the increase in ridership, yet has been constrained in revenue generation. According to the 2007 UBC Transportation Status Report, TransLink added 48,000 service hours on bus routes to UBC in September 2003 (the year the U-Pass was introduced) and currently more than 22,500 buses enter and leave UBC everyday. However, when the U-Pass agreements were negotiated between each school, implementation and service costs were not factored into the price that students would pay. The price was determined by calculating the then current revenue generated by student transit purchases, divided by the entire student body at each school. For this reason, each school has a different price that the students pay per month or semester, which creates inequalities between schools. It is in TransLink's best interest, from a cost perspective, to negotiate a U-Pass program with a school that already has high transit usage. However, limiting the U-Pass program to schools with already high transit use rates would not necessarily achieve the mode shift goal or have a significant impact on the lifelong transit usage habits of these students. Therefore, if the U-Pass program were to maintain the revenue neutral clause, it should be left applicable to the three schools that are currently participating.

6.2 Alternative 2: Status Quo *Plus*

This alternative builds on the existing U-Pass program through the addition of other schools and renegotiating the price of the U-Pass to include TransLink's associated costs. This policy option would also indirectly target the 25-34 year old cohort by expanding the results of the current U-Pass to a wider population. It is assumed that adding schools to the U-Pass program would likely achieve similar results as the SFU and UBC cases. As was presented earlier in the

report, 53% of former SFU U-Pass holders are current frequent transit users, with an additional 23% who are infrequent transit users, which gives a total of 76% of former SFU U-Pass holders that currently use transit. On the other hand, 42% of SFU alumni who were non-U-Pass holders currently use transit frequently, with 17% who are currently infrequent transit users, for a total of 59% of non-U-Pass holders who currently use transit. The results also show that 40% of former U-pass holders use prepaid fare media, specifically the Employer Pass or the monthly FareCard, whereas only 33% of non U-Pass holders do the same. Purchases of prepaid fare media is an important element of TransLink's revenue stream as it is paid upfront, regardless of the number of trips taken. Cash sales can fluctuate over the course of a month or a year, whereas monthly and annual passes enable TransLink to have a steady revenue source for planning purposes. Therefore, if TransLink were to extend the U-Pass to other schools, they could see an increase in transit use post-graduation by a wider population and an increase in use of pre-paid fare media.

The most significant downside of the U-Pass is the large loss incurred by TransLink as a result of the gap between the price of the U-Pass and the cost of meeting demand. Currently, each school has negotiated a different price that the students pay for the U-Pass due to the revenue neutral aspect of the agreement. This means that if the school had low transit usage to begin with, the price per student for the whole student body will be lower than a school that had a high proportion of transit users prior to U-Pass implementation. The population of the school will also affect the cost of service increase for TransLink; a larger school will likely need more service than a smaller school. The location of the school can also affect the cost to TransLink; a school located on existing service routes is easier to accommodate than a school where new services have to be routed. Two possible ways of overcoming the revenue shortfall could be: a) renegotiate existing agreements to include service improvement costs and ensure that all new agreements include cost projections in the price; and/or b) standardizing the price of the U-Pass across all schools.

However, the introduction of the U-Pass requires service expansion and accessibility improvements. The mandatory nature of the pass means that everyone who has a pass should be able to access transit, particularly the transit hubs on campus. This may mean that campus walkways and transit hubs need to be improved or moved to enable people with varying abilities to have access to transit services. TransLink is committed to making transit accessible to everyone through its Access Transit program, which has been recognized as a leading edge program (Leicester, 2005). In order to meet their own standards, TransLink may need to work with the universities/colleges to improve transit accessibility on campus to meet the needs of as many people as possible. This will increase the cost for both TransLink and the school; how much of that should fall on student pass prices is a negotiation that needs to happen on a case-by-case basis.

6.3 Alternative 3: Graduate U-Pass Extension

Several respondents of the survey suggested that a U-Pass extension be made available to recent graduates. The introduction of such a program would directly target the transit usage of the 25-34 year old cohort by providing a transition period for students where they could obtain a discounted annual pass that would encourage them to maintain their frequency of transit use and make life decisions based on the availability of transit.

The rational for introducing a policy such as this is demonstrated in the survey results, which indicated that there is a 17% shift of former U-Pass holders who were frequent transit users in university to being infrequent users after graduation, and a further 11% of former frequent users became non-users after graduation. This is further supported by the 2006 Statistics Canada data that shows that transit usage among 25-34 year olds is only 18%, which is 7% less than the 25% of 18-25 year olds that use transit as their primary mode of transportation (Statistics Canada, 2008).

Former U-Pass holders liked the price of the U-Pass, the universality of the pass, and the multi-tasking capability of commuting on transit. However, 24% of respondents ranked the mandatory nature of the U-Pass as one of the top drawbacks of the U-Pass. Therefore, TransLink could offer recent graduates the opportunity to purchase a pass without making it mandatory. Unfortunately this would affect the results of the program, as the mandatory nature of Deep Discount Group Passes is one of the most important aspects of increasing transit use. However, attempting to make this type of pass mandatory would be very hard to administer. The voluntary nature of the program could allow TransLink to charge more than what a mandatory pass would allow; survey respondents' reported willingness to pay for a mandatory pass is outlined below. The regression results also pointed to proximity to transit access points as a significant contributor to frequent transit use. By enabling recent graduates to access a discounted pass during the years when they are making decisions on where to live, TransLink could encourage settlement close to transit and the frequent use of the services.

The easiest way this could be achieved would be by offering a special annual pass rate to former U-Pass holders through existing fare dealers. This could essentially be an employer pass without the requirement of having an employer set it up. Although this would not achieve the same goals as a mandatory group pass, it could encourage the use of transit after graduation, thus building on a habit created during university. The pricing of the pass could fall somewhere between the price of the U-Pass and the Employer pass. Currently (as of January 1, 2009), SFU students pay $104/ semester for the U-Pass, which means if it were an annual pass it would cost $312/year. The current price of a 1 zone Employer Pass is $63.50/month, or $762/year, and a 3 zone Employer Pass (most comparable to a U-Pass) is $117/month, or $1406/year (TransLink website). The results from a willingness to pay (WTP) question on the survey revealed that 50% of respondents who are former U-Pass holders are willing to pay between $500 -$1250 for a mandatory, unlimited use, 3 zone annual pass. Non U-Pass holders had a very similar WTP, with

48% who would be willing to pay $500- $1250. The real difference lies in the number who are not willing to pay anything or up to $250; non U-Pass holders indicated that 37% would pay nothing or up to $250, whereas only 19% of former U-Pass holders would pay nothing or up to $250. Also interesting is the largest WTP price category for former U-Pass holders was the category closest to the current U-Pass price, $251-$500. This indicates that the U-Pass has influenced the valuation of mandatory, unlimited passes. The actual break down of the responses can be seen below in Figure 12 and 13.

Figure 12 *Former U-Pass Holders' Willingness to Pay for an Annual, Mandatory, Unlimited, 3-zone Transit Pass*

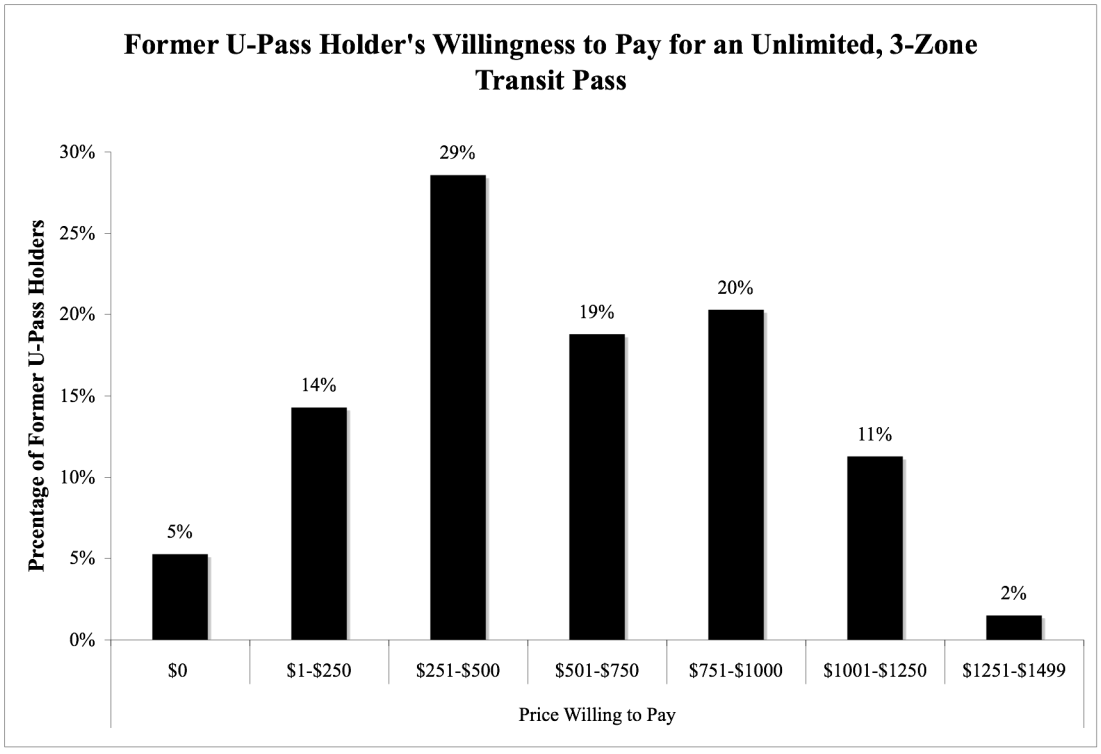
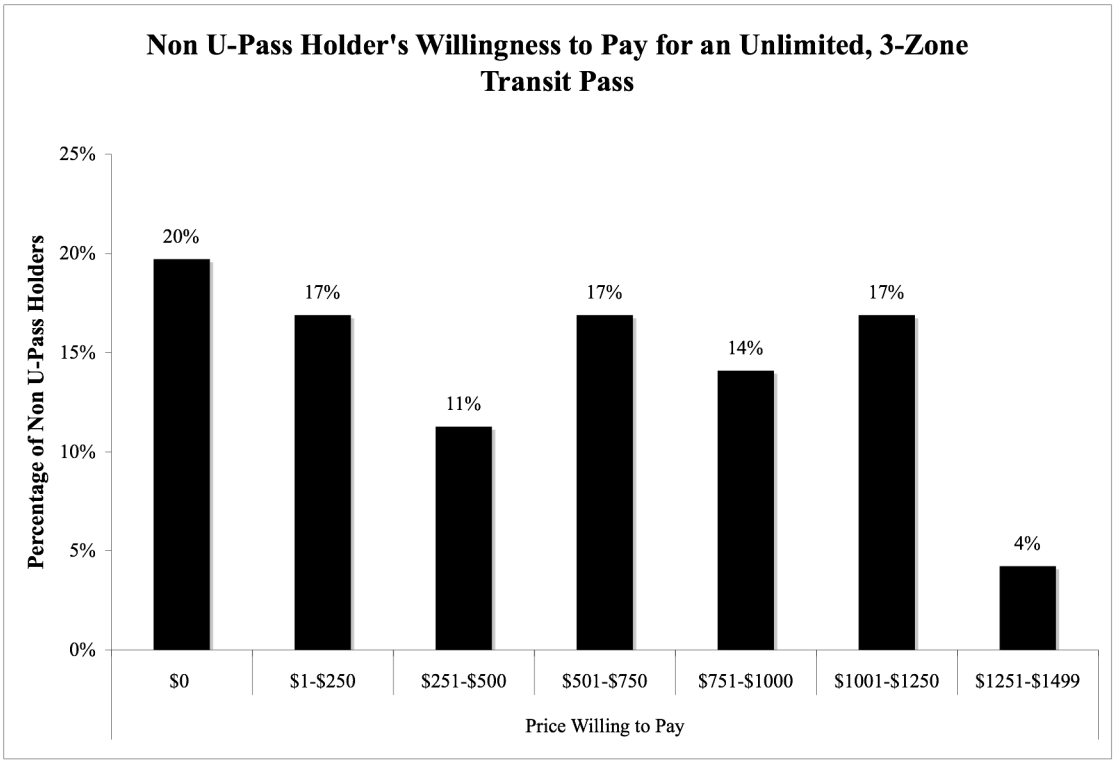


Figure 13 *Non U-Pass Holders' Willingness to Pay for an Annual, Mandatory, Unlimited, 3-zone Transit Pass*



There would be some challenges with the implementation of a U-Pass extension, such as proof of prior U-Pass ownership, but this could be overcome through the use of an alumni database. For privacy purposes, the universities may need to control the databases, however TransLink could submit requests for verification. This could also open up marketing opportunities for TransLink to encourage the use of transit after graduation.

6.4 Analysis

The following subsections provide an assessment of the four policy alternatives against the previously specified criteria in Section 5. The alternatives are first presented in a matrix to allow for easy comparison of the relative merits and drawbacks of each policy alternative. The

evaluation of each alternative is based on the best available information, including the survey data, existing research, and public documents. Table 6 shows the evaluation overview.

Table 6 Evaluation Matrix

<table>
<tr><td colspan="4"></td><td colspan="3">Policy Options</td></tr>
<tr><td>Criteria</td><td colspan="3">Measure</td><td>Status Quo</td><td>Status Quo Plus</td><td>Graduate U-Pass Extension</td></tr>
<tr><td rowspan="2">Cost</td><td colspan="3">Incremental Service Investment</td><td>Low</td><td>High</td><td>Medium- Low</td></tr>
<tr><td colspan="3">Administration</td><td>Low</td><td>Medium-Low</td><td>Medium</td></tr>
<tr><td rowspan="2">Effectiveness</td><td colspan="3">Incremental Ridership Increase</td><td rowspan="2">Low</td><td rowspan="2">Medium</td><td rowspan="2">Medium</td></tr>
<tr><td colspan="3">Environmental: Decrease in CO_2</td></tr>
<tr><td rowspan="6">Equity</td><td rowspan="5">Horizontal</td><td rowspan="2">Income</td><td>Among Participants</td><td>High</td><td>High</td><td>High</td></tr>
<tr><td>Between Participants and general population</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td rowspan="2">Students</td><td>Within participating schools</td><td>High</td><td rowspan="2">High</td><td rowspan="2">No effect</td></tr>
<tr><td>Between Schools</td><td>Low</td></tr>
<tr><td colspan="2">Alumni</td><td>No effect</td><td>No effect</td><td>High among former U-Pass holders; low for other alumni</td></tr>
<tr><td rowspan="2">Vertical</td><td colspan="2">Income</td><td>High among U-Pass holders</td><td>High among U-Pass holders</td><td>Low across general population</td></tr>
<tr><td colspan="2">Regional</td><td>Medium</td><td>Low</td><td>Medium</td></tr>
<tr><td>Feasibility</td><td colspan="3">Public Acceptability</td><td>High</td><td>Medium</td><td>High</td></tr>
</table>

6.4.1 Status Quo

The status quo is a viable alternative to maintain while considering other options. There are relatively few marginal costs associated with maintaining the existing U-Pass program other

than continued service improvement to meet increasing enrolment at participating schools. The marginal increase in ridership will be relatively low, and is also dependent on increasing enrolment at participating schools.

In terms of equity, horizontal equity is relatively high within participating schools, as everyone pays the same price and receives the same benefits. However, horizontal equity is quite low when comparing students at different schools, both participating and not. This is a result of the revenue neutral aspect of the program, which means students with similar incomes at different schools are treated differently based on previous students' transit usage. Currently, SFU students pay more for their U-Pass than UBC students simply because more SFU students' used transit before the agreement came into place and there are fewer students to spread the revenue over. There is also low horizontal equity when comparing students at participating schools against students at non-participating schools. For this comparison, there are two sides: non-participating students who do not use transit are better off because they do not have to pay for the U-Pass; and transit users at non-participating schools are worse off because they do not receive the benefits of the U-Pass.

Vertical equity follows a similar pattern as horizontal equity in that students at participating schools are treated equally, regardless of income. However, inequities do exist again between participating schools and non-participating schools. Regional inequities do exist for participating schools, even though all students are treated equally, regardless of place of residence. Due to the mandatory nature of the program, students who live in areas that are well serviced by transit are better off than students who live in areas that are not.

The environmental account will likely have a small marginal change to CO_2 emissions from what currently occurs. The feasibility of the status quo is generally high, as the U-Pass exists and is in operation without much public or political objection. Overall, the Status Quo is viable as an interim policy while other policies are considered.

6.4.2 Status Quo *Plus*

The costs associated with expanding the U-Pass program will be significant, however if the costs are shared by the students, schools, and TransLink the burden on TransLink will be decreased. Renegotiating the contracts of existing schools to include service costs will spread the burden over an even larger population. Standardizing contracts across schools would decrease the cost of administrating the program, and would increase the simplicity of the program. Contract renegotiation will be difficult with existing participating student bodies, as students are already paying large sums in tuition and other student fees. Explicit understanding of service improvements may help in achieving acceptance of the new contracts by the student bodies.

Negotiating more schools in the U-Pass program will increase ridership for TransLink both currently and in the future. The U-Pass has had great success in improving ridership levels among students, and has proved to have an impact on post-graduation ridership levels. Although smaller schools might not see the 50% increases in student ridership that UBC and SFU experienced, increases in the 15-20% range could be expected at schools that currently have high ridership levels. This is highly dependent on the ridership levels at the schools prior to the introduction of the U-Pass, as well as transit service to the schools. Results from the Spring 2005 U-Pass Survey give the following information:

Table 7 Base Fare Revenue for Lower Mainland Post-Secondary Institutions

Post-Secondary Institutions	Total Number of Students	Current Transit Mode Share	Current Average Fare Paid by Students	Monthly Base Fare Revenue per Student
Emily Carr Institute	1,268	47%	$1.51	$43.74
Vancouver Community College	5,881	65%	$1.75	$49.48
Native Education Centre	135	66%	$1.67	$54.68
Douglas College	8,296	48%	$1.71	$39.88
Capilano College	5,662	37%	$1.60	$31.20
Kwantlen College	11,343	16%	$2.10	$18.91

(TransLink, 2005)

Table 7 shows that Vancouver Community College (VCC) and the Native Education Centre both have a current transit mode share of approximately 65%, however there is a significant difference in the size of the student populations. This size difference also affects the monthly fare revenue per student, where although the Native Education Centre students pay less individually on average, the total revenue divided by the entire student body projects a higher monthly payment than VCC. The opposite is true for the largest school, Kwantlen College, which has only a 16% transit mode share. Although Kwantlen College transit users pay an average fare of $2.10, which is the highest of all the schools, the low mode share and large population make the monthly revenue per student significantly lower than the rest of the schools. Kwantlen College's current transit mode share is likely the result of the location of the school in southern Langley, which is a significant distance from frequent transit service. Therefore, as was previously mentioned, the costs and benefits associated with U-Pass expansion depend heavily on current transit mode share and current transit service. Low current transit mode share may result in a huge increase in mode shift to transit, while infrequent transit service would require a significant investment in transit service to meet U-Pass demand.

The impact of the U-Pass on post-graduation transit use would also depend on previous student transit levels; the results of this study, however, found that post-graduation transit use levels were 17% higher among former U-Pass holders, which is a significant increase. These predicted increases in ridership would also reduce current and future CO_2 emissions by causing students to mode shift to transit, and by influencing their transportation decisions after graduation. With the introduction of more students to the U-Pass program, CO_2 emissions are likely to fall as people shift their transportation habits. The actual marginal change, however, will depend on the pre-U-Pass habits of those students and faculty members. As has been explained before, schools with high rates of transit use before the U-Pass will have a smaller marginal shift to transit.

Horizontal equity among participating schools will be improved over the Status Quo, as more students will have access to the U-Pass and the price will be harmonized across schools. Horizontal equity between participating schools and the general public in the same demographic categories will continue to be low, as the general public does not have access to the U-Pass. Vertical equity will be worsened as the mandatory nature of the pass expands to include more schools in various parts of the region. Service levels around the region are far from being equal, and a mandatory passes requires students to pay for the pass whether they have adequate access to transit or not. Vertical income equity will be redistributed with the rise in pass price to cover costs; all students will continue to benefit from the discounted pass, however low-income students will be worse with the price increase.

In terms of feasibility, objections from the public or political realm are not expected, as this policy option is an extension of an existing program. Status Quo *Plus* is a viable option to increase the mode share of transit among university and college students in the Vancouver area, which will in turn increase in the transit use rates among alumni in the 25-34 age range.

6.4.3 Graduate U-Pass Extension

The graduate U-Pass extension would directly target the 25-34 year old cohort by bridging the gap for recent graduates from the U-Pass to the employer pass. It would be a voluntary, discounted pass designed to encourage continued use of transit through the significant, life-changing period of graduating and beginning to work. As has been explained before, habitual behaviour will likely continue until a large structural change occurs, whether that be a personal change or a societal change (Banister, 1978). Instituting a pass to combat the effects of graduating by encouraging the continued use of transit will result in a higher number of former U-Pass holders remaining frequent transit users.

It would likely be hard to track where alumni settle for service investment, however it is likely that those who choose to take advantage of a program such as this would also choose to live close to a transit access point. This would mean that previously scheduled service investment would likely accommodate the increase in demand. Increased service investment to suburban neighbourhoods could attract more alumni to the program, however if the goal of the program is to encourage density and liveable communities, it would be best to simply offer the pass and improve service along the high intensity service corridors. Increased costs associated with administration would also be incurred initially, however a streamlined system could be put in place that would ease TransLink's identification of alumni.

Ridership rates among the recently graduated age group of 25-35 year olds would increase, but by how much is difficult to determine. It is unlikely that all alumni would take advantage of the program, however it could be assumed that the 43% of former U-Pass respondents who currently purchase monthly passes and FareSaver tickets would buy a graduate U-Pass extension, and that the 28% of former U-Pass holders who went from being frequent transit users in university to infrequent or never using transit after graduation would continue to be frequent transit users. Depending on how the graduate pass is priced, this shift could result in a loss of revenue in the short term, but would likely result in a higher proportion of former U-Pass holders making life decisions based on transit access and continuing to use transit for more years in the future.

There would be equity issues with the introduction of a program like this, primarily between former U-Pass holders and members of the general public who did not go to a college or university that had a U-Pass. Many of the people who would not be able to access the alumni pass would be low-income people who would probably benefit the most from it. However, the goal of the policy is to influence post-graduation transportation decisions by enticing alumni to continue to use transit rather than using personal vehicles for their daily commute. Low-income people are

likely already using transit on a frequent basis; university graduates tend to be the people who buy cars and move to the suburbs. For this reason, this particular policy is targeted at increasing the transit mode share among university graduates.

Regional inequality will not as great of a factor as in Status Quo and Status Quo *Plus* because the program would not be mandatory. The obvious regional transit service inequalities will continue to exist, however alumni will have the choice of participating in the program.

The environmental account has a rating of medium, but is highly dependent on the number of alumni who will make walking, cycling, or taking transit their primary mode of transportation. If students maintain their walking, cycling, and transit habits after graduation through the program, there will likely be very little marginal change to regional CO_2 emissions. However, if the above mentioned 28% of former U-Pass holders remain frequent transit users and can put-off, or never buy, a personal vehicle, the long term reduction in CO_2 emissions could be significant.

The feasibility of an alumni pass would have high public acceptance because this is an optional product for a particular segment of the population. There may be equity issue backlash, which may require attention from TransLink.

6.4.4 Recommendation

To achieve the goal of increasing transit usage among 25-34 year olds, it is recommended that a pilot graduate U-Pass extension program be implemented. The graduate U-Pass extension targets the 25-34 year old cohort the most effectively, and could be implemented almost immediately with little incremental service investment required. A pilot program with UBC and SFU alumni would enable TransLink to see how successful such a program would be. This program could be introduced retroactively for equity purposes, although the population of interest are those who have recently graduated. It is recommended that the pilot enable alumni to access

the graduate pass for three years after graduation so that TransLink can monitor the uptake rate. If uptake is substantial in year three, extending the program length may be considered to a maximum of five years. This program depends heavily on the U-Pass program, and if the pilot graduate pass program is successful, expanding the U-Pass and graduate pass program should be considered.

In the interest of creating a more liveable region and a sustainable transit system, it is recommended that the U-Pass be extended to other post-secondary institutions. The U-Pass has been successful in increasing transit mode share among students, and this study has shown that the U-Pass has had significant impact on post graduation transit use. To reduce the costs associated with doing this, it is recommended that TransLink renegotiate existing U-Pass contracts to recover some costs and/or unify the price paid by all students.

7 Next Steps

It is recommended that steps be taken to introduce a structural policy to affect driving habits in the region. The U-Pass has been an effective Deep Discount Group Pass, however the benefits are only applicable to the participants in the program. It is with this in mind, and with the understanding that Deep Discount Group Passes increase ridership and revenue, that I propose that the U-pass and the graduate U-Pass extension be used as segues to introducing a region wide Deep Discount Group Pass. Through the survey conducted for this study as well as other research conducted on Deep Discount Group Passes, there is proof that when a pass is made mandatory for a group of people, not everyone in the group will use the pass, but almost everyone in the group will benefit, either from the use of transit or from decreased congestion on the roadways. If this idea were extended to include the entire TransLink service area, TransLink could receive a reliable source of revenue from every household, increase transit usage, and reduce the number of single occupancy vehicles on the roadways. A program such as this would make TransLink, the Vancouver area, and British Columbia leaders in sustainable transportation. There are no other jurisdictions this large that have enacted such a program.

In order to meet the increased service demand of a policy such as this, TransLink would need to determine the correct amount to charge households to cover expenses, yet also be acceptable to the public. A probable method of payment for a program like this could be through property taxes or income taxes, both of which would require provincial government leadership and support, as well as municipal government support for property tax increases. Current legislation restricts the amount that TransLink can collect from households and through levies.

The proposed method of initial implementation is providing residents with a few day passes per month in exchange for a mandatory fee. This will encourage residents who are not

current transit users to acquaint themselves with the transit system and use it periodically, while giving TransLink a dependable source of revenue. This would likely benefit non-transit users and infrequent transit users the most, however some sort of redemption could be put in effect for frequent transit users who use monthly or annual passes. A program such as this could entice non-transit and infrequent users to mode shift a couple of times per month, and introduce them to the system. As Fujii and Kitamura (2003) found in their study, strong structural changes can affect habits and can encourage a modal shift. As they become more familiar with the services, they become more likely to use transit on a more frequent basis. Fujii and Kitamura proved in their research on the use of temporary structural changes that most car drivers need a reason to get out of their cars and get on to transit. The study tested the effect of giving drivers a free month transit pass and found that the pass weakened the habit of driving and that the effect lasted one month after the end of the free pass. (Fujii, 2003) It is probable that if people know they are paying for a few day passes, perhaps they will use them if only to 'get their money's worth'. This too could have the effect of weakening the habit of driving. The introduction of the program in small increments such as this would also give TransLink time to increase service to meet future demand while having a reliable source of revenue. The program could then be ramped up as desired to reach the pinnacle of a region wide universal pass. A region wide universal pass could be introduced as an integral component of a sustainable region, along with land use changes and other policies targeting a reduction in personal vehicle use.

In an idealistic world, this program would be coupled with a complete shift in transportation policy as a whole, which would see public transit truly become a public good that everyone would directly subsidise and have access to, and roads would become user pay systems. The way our transportation systems are set up currently allows people to use roads freely as they wish, which encourages urban sprawl and reliance on vehicles, while transit users pay (albeit a highly subsidized rate) every time they use the system. Through this, public transit has been given

a reputation of being a mode of transportation for those who cannot afford vehicles, rather than a mode of transportation for everyone. This way of thinking has been perpetuated by policy makers who have worked on the assumption that fossil fuels are an endless resource, that it is ok for single-family homes to replace farmland, and that streets and roads should prioritize single occupancy vehicles instead of buses. It is time we shift this way of thinking to create higher density urban centres, better, more efficient transportation, and more liveable communities. Getting people out of cars is one step towards this.

8 Conclusion

The data collected through the survey provided an excellent first glimpse of how the U-Pass has impacted transit use after graduation. It was revealed that former U-Pass holders who used transit frequently during university tend to remain frequent or infrequent transit users. The regression results indicated that the U-Pass, proximity to a transit access point, and current primary mode of transportation are all significant influences on the frequency of current transit use. These pieces of information led to the formation of three policy options that are intended to increase the transit ridership levels among 25-34 year olds.

The policy options presented target the 25-34 year old cohort in different ways; expanding the U-Pass program to more post-secondary institutions in the Vancouver CMA will increase the number of U-Pass holders, and thus, as the survey results revealed, increase the number of graduates who continue to use transit after graduation. Introducing a graduate U-Pass extension will provide a voluntary discounted pass for former U-Pass holders to encourage the continued use of transit through the life-changing event of graduation and being employed.

Further research is recommended on this subject to better understand the impacts of the U-Pass on post-graduation transit usage. A broader study with a random sample of alumni from all three schools currently involved in the program would give a better representation of what is happening. Also, further analysis could be conducted using the census information, such as controlling for education and comparing post-graduate behaviour in Vancouver to other cities. TransLink could begin to track U-Pass holders in the Trip Diary surveys to get a sense of transit behaviour, both before and after graduation, and the universities could integrate a time series element to their undergraduate surveys to track behaviour beyond graduation. The introduction of

a Smart Card by TransLink would also make trip tracking much easier and would allow for excellent data gathering.

Overall, this study has been successful in identifying the U-Pass as an effective tool for increasing transit use beyond the participation in the program. Programs that build on this success and support students as they leave university should only improve the success achieved by the U-Pass.

Appendices

Appendix A: Survey Instrument

Introduction

Thank you for taking a few minutes to complete this survey. This survey is being administered by Caitlin Cooper, Master of Public Policy candidate, and is meant to inform a study on the travel behaviours of adults in the Vancouver region. You will be asked a series of questions regarding your transportation behaviours; please be as honest as possible. There are no inherent risks to you associated with your participation in this survey. This survey is completely confidential and anonymous; the SFU WebSurvey is a secure and encrypted website. By filling out this survey, you are consenting to participate. You may stop the survey at any time by closing the browser window. If you wish to enter the draw for $500.00, you will be directed to a separate, secure WebSurvey website upon completion of the survey. One entry per person will be counted. If you have any questions or concerns, please contact Dr. Hal Weinberg, Director, Office of Research Ethics: hal_weinberg@sfu.ca. If you wish to receive the results of this study, please contact Caitlin Cooper at: ecc7@sfu.ca. Thank you very much.

Q1 . In what year did you graduate? A: (respondents filled in a blank)

Q2 . While at SFU, what was your primary mode of transportation?

A: Car, truck, or van- as driver
Car, truck, or van- as passenger
Public transit
Walk
Bicycle
Motorcycle
Taxicab
Other

Q3 . Did you have a U-Pass while at SFU? A: Yes / No

Q4 . While at SFU, did you use your U-Pass? (If you did not have a U-Pass, click next)

A: Yes / No

Q5 . What was the main reason why you did not use your U-Pass? (If you did not have a U-Pass, click next)

A: Had a car/ driver's license and access to a car
Transit is slow/ faster by car
Poor transit service in your area
Wait times for transit were too long
Too many transfers/ no direct transit route

Walked to school
Carpooled to school
Required a vehicle for transporting children
Other

Q6 . Approximately how many round-trip public transit trips did you make while at SFU?

A: Never
1-2 times/ month
1-2 times/ week
3 or more times/ week

Q7 . Approximately how many round-trip public transit trips do you make now?

A: Never
1-2 times/ month
1-2 times/ week
3 or more times/ week

Q8 . What is your most common public transit mode? (If you do not use transit at all, click next)

A: West Coast Express
Bus
Skytrain
Sea Bus

Q9 . How do you currently pay for public transit?

A: Cash
FareSaver ticket
Monthly FareCard
Annual Pass (e.g. Employer Pass)

Q10 . In your opinion, what were the top three benefits of having a U-Pass? Please rank your top three choices: (If you did not have a U-Pass, click next)

Cheaper/ more cost efficient than the regular fare options :	1	2	3
Better for the environment/ reduced Green House Gas emissions :	1	2	3
Easier/ faster than getting a monthly pass/tickets :	1	2	3
You could use it to go anywhere within the three zones :	1	2	3
Did not need to find/ pay for parking :	1	2	3
Did not need to carry change :	1	2	3
Less traffic congestion :	1	2	3
Promotes the use of public transportation :	1	2	3
Cheaper than operating and maintaining a vehicle :	1	2	3
Ability to do other things while commuting (e.g. sleep, read, work) :	1	2	3
Good for people without access to a vehicle :	1	2	3
No benefits :	1	2	3
Other :	1	2	3

Q11 . In your opinion, what were the top three drawbacks of having a U-Pass? Please rank your top three choices: (If you did not have a U-Pass, click next)

Mandatory/ unable to opt-out :	1	2	3
Overcrowded buses/ bus stops :	1	2	3
Long wait times due to infrequent service :	1	2	3
Cost of the U-Pass :	1	2	3
Transit is slow/ faster by car :	1	2	3
No drawbacks :	1	2	3

Q12 . Were you able to avoid buying or owning a car as a result of the U-Pass? (If you did not have a U-Pass, click next)

A: Yes / No / The U-Pass was not a factor in my decision

Q13 . Were you able to reduce your reliance on a car as a result of the U-Pass? (If you did not have a U-Pass, click next)

A: Yes / No

Q14 . Did the U-Pass influence the following decisions while you were a student: (If you did not have a U-Pass, click next)

Where you lived :	Yes	No
Where you worked :	Yes	No
Which school/ classes you could attend :	Yes	No
Where you shopped :	Yes	No
Where you could socialize :	Yes	No

Q15 . Did the ability to take transit/ walk influence the following decisions after graduation:

Where you lived :	Yes	No
Where you worked :	Yes	No
Which school/ classes you could attend :	Yes	No
Where you shopped :	Yes	No
Where you could socialize :	Yes	No

Q16 . Did the U-Pass influence your choice of transportation after graduation? (If you did not have a U-Pass, click next)

A: Yes / No

Q17 . What is your current primary mode of transportation to work/ school?

A: Car, truck, or van- as driver
Car, truck, or van- as passenger
Public transit
Walk
Bicycle
Motorcycle
Taxicab
Other

Q18 . Please choose the top 5 reasons for choosing your typical mode of transportation: (1= most important, 5= least important)

Concern for the environment :	1	2	3	4	5
Cost of transit :	1	2	3	4	5
Total travel time :	1	2	3	4	5
Convenience/ accessibility :	1	2	3	4	5
Parking cost :	1	2	3	4	5
Development of transit habits from having the U-Pass :	1	2	3	4	5
Family requirements :	1	2	3	4	5
Cost of operating and maintaining a vehicle :	1	2	3	4	5

Q19 . On average, how long does it take to get to work (in minutes)?

A: (Respondents filled in a blank)

Q20 . Your closest transit access point is:

A: Within a 5 minute walk
Within a 10 minute walk
Within a 15 minute walk
Park n Ride
Don't know

Q21 . What would you be willing to pay to have an unlimited use, three-zone ANNUAL pass after graduation? (Currently, an annual 3-zone Employer Pass costs $1500)

A: $1251-$1499
$1001- $1250
$751- $1000/ year
$501- $750
$251- $500/ year
$1- $250
$0

Q22 . Sex A: Male / Female

Q23 . Marital Status

A: Never legally married (single)
Legally married (and not sparated)
Separated, but still legally married
Common Law
Divorced
Widowed

Q24 . In what municipality did you live during university?

A: Vancouver

West Vancouver
North Vancouver
Burnaby
New Westminster
Coquitlam
Port Coquitlam
Port Moody
Belcarra/ Anmore
Pitt Meadows
Maple Ridge
Richmond
Delta
Surrey
Langley
White Rock

Q25 . What level of education did you complete at SFU?

A: Undergraduate
Graduate
Doctorate

Q26 . In what municipality do you currently live?

A: Vancouver
West Vancouver
North Vancouver
Burnaby
New Westminster
Coquitlam
Port Coquitlam
Port Moody
Belcarra/ Anmore
Pitt Meadows
Maple Ridge
Richmond
Delta
Surrey
Langley
White Rock
Outside of the Lower Mainland

Q27 . In what municipality is your work located?

A: Vancouver
West Vancouver
North Vancouver
Burnaby
New Westminster
Coquitlam
Port Coquitlam

Port Moody
Belcarra/ Anmore
Pitt Meadows
Maple Ridge
Richmond
Delta
Surrey
Langley
White Rock
Outside of the Lower Mainland

Q28 . What is your gross annual household income?

A: $0- $19,999
$20,000- $34,999
$35,000- $49,999
$50,000- $64,999
$65,000- $79,999
$80,000- $100,000
$100,000 +

Q29 . Please provide any comments you may have. Thank you.

Appendix B: Variable Correlations

		Frequency of Current Transit Use	Have a U-Pass	Frequency of Transit Use in University	Walk/bike as Primary Mode of Transportation	Personal Vehicle as Primary Mode of Transportation	Walk/bike Mode Multiplied by Commute Time	Personal Vehicle Mode Multiplied by Commute Time	Natural Log of Commute Time	Transit Access Proximity	Gender	Marital Status	Household Income
Frequency of Current Transit Use	Pearson Correlation	1											
	N	204											
Have a U-Pass	Pearson Correlation	0.149	1										
	N	204	204										
Frequency of Transit Use in University	Pearson Correlation	0.305	0.279	1									
	N	204	204	204									
Walk/bike as Primary Mode of Transportation	Pearson Correlation	0.047	0.065	0.126	1								
	N	204	204	204	204								
Personal Vehicle as Primary Mode	Pearson Correlation	-0.666	-0.094	-0.381	-0.346	1							
	N	204	204	204	204	204							
Walk/bike Mode Multiplied by Commute Time	Pearson Correlation	0.066	0.064	0.125	0.982	-0.340	1						
	N	204	204	204	204	204	204						
Personal Vehicle Mode Multiplied by Commute Time	Pearson Correlation	-0.616	-0.059	-0.368	-0.331	0.957	-0.326	1					
	N	204	204	204	204	204	204	204					
Natural Log of Commute Time	Pearson Correlation	0.292	0.053	0.077	-0.118	-0.223	-0.071	-0.037	1				
	N	204	204	204	204	204	204	204	204				
Transit Access Proximity	Pearson Correlation	0.171	-0.032	0.208	0.145	-0.11	0.143	-0.128	-0.153	1			
	N	204	204	204	204	204	204	204	204	204			
Gender	Pearson Correlation	0.051	0.019	-0.04	-0.178	0.008	-0.162	-0.025	-0.032	0.097	1		
	N	204	204	204	204	204	204	204	204	204	204		
Marital Status	Pearson Correlation	0.057	-0.121	-0.117	0.017	-0.035	0.031	-0.061	0.022	0.027	-0.002	1	
	N	204	204	204	204	204	204	204	204	204	204	204	
Household Income	Pearson Correlation	-0.042	-0.265	-0.211	-0.059	0.044	-0.06	0.026	-0.017	-0.001	-0.106	0.456	1
	N	204	204	204	204	204	204	204	204	204	204	204	204
Semesters with U-Pass	Pearson Correlation	0.112	0.802	0.291	0.003	-0.109	0.002	-0.086	0.063	-0.084	-0.012	-0.155	-0.276
	N	204	204	204	204	204	204	204	204	204	204	204	204

Bibliography

Interviews

Leicester, Glen. Interviewed by Caitlin Cooper for TransLink. June 26, 2008.

Works Cited

Ajzen, Icek. (2002). "Residual Effects of Past on Later Behaviour: Habituation and Reasoned Action Perspectives." *Personality and Social Psychology Review*. Vol. 6, No. 2. P. 107-122.

Banister, David. (1978). "The Influence of Habit Formation on Modal Choice- A Heuristic Model." *Transportation Journal*. Vol. 7, No.1. P. 5-33.

Barbier, E. (1987). "The Concept of Sustainable Economic Development." *Environmental Conservation*. Vol. 14, No. 2, P. 101-110.

Brown, Jeffrey, Daniel Hess, and Donald Shoup. (2002). *BruinGo: An Evaluation*. Prepared for the Faculty Welfare Committee UCLA Academic Senate. UCLA.

Cain, Alasdair, et al. (2005). "Teenage Attitudes and Perceptions Regarding Transit Use." National Centre for Transit Research and the Centre for Urban Transportation Research. University of South Florida. Tampa, FL.

Cato, Nathan. (2006). *Social Sustainability of Alternate Transportation Modes at The University of British Columbia.* Land and Building Services. University of British Columbia. Vancouver, BC.

Cervero, Robert. (1990). "Transit Pricing Research: A Review and Synthesis." *Transportation.* Vol. 17. P. 117-139.

Clement, Basse, et al. (2004). *The 2004 Greater Vancouver Trip Diary Survey*. South Coast Transportation Authority (TransLink). Burnaby, BC.

European Commission on Transport Research. (1996). *Effectiveness of Measures Influencing the Levels of Public Transport Use in Urban Areas.* European Commission on Transportation Research. Luxemburg.

Fuhrer, Jeffrey C. (2000). "Habit Formation in Consumption and Its Implications for Monetary-Policy Models." *The American Economic Review*. Vol. 90, No. 3. P. 367-390.

Fujii, Satoshi and Ryuichi Kitamura. (2003). *What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change.* Kyoto Institute of Technology and Kyoto University. Kyoto, Japan.

Garling, Tommy, and Kay W. Axhausen. (2003). "Introduction: Habitual travel choice." *Transportation*. Vol. 30. P. 1-11.

Goodland, R. (1995). "The Concept of Environmental Sustainability." *Annual Review of Ecology and Systematics.* November. Vol.26. P. 1-24.

Gomez-Ibanez, Jose A. 1996. "Big-city transit, ridership, deficits, and politics." *Journal of the American Planning Association*, Vol. 62(1), p. 30-50.

Gordon, Peter et al. (1989). "Gender Differences in Metropolitan Travel Behaviour." *Regional Studies.* Vol. 23:6. P. 499-510.

Leicester, Glen. (2005). *Development of the Accessible Transit Strategic Plan*. Prepared for the GVTA Board of Directors. TransLink. Burnaby, BC.

Litman, Todd. (2004). "Transit Price Elasticities and Cross-Elasticities." *Journal of Public Transportation.* Vol.7, No.2. P. 37-58.

Metro Vancouver. (2007). *2005 Lower Fraser Valley Air Emissions Inventory.* Produced by Metro Vancouver Policy and Planning Department. Burnaby, BC.

Nuworsoo, C.K.. (2004). *Deep Discount Group Pass Programs as Instruments for Increasing Transit Revenue and Ridership*. University of California, Berkeley, CA.

Pendick, R. and D. Rubinfeld. (2004). *Microeconomics*. 6th Edition. Prentice Hall.

Pollak, Robert A. (1970). "Habit Formation and Dynamic Demand Functions." *The Journal of Political Economy*. Vol. 78, No. 4. P. 745-763.

Sanchez, Thomas W. (1999). "The Connection Between Public Transit and Employment." *Journal of the American Planning Association.* Vol. 65:3. P. 284-296.

Sathaye, J., et al. (2007). "Sustainable Development and Mitigation." In *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. New York, NY.

Statistics Canada. (2008). *2006 Census of Population*. Statistics Canada catalogue no. 97-561-XCB2006012

Taylor, Brian D., et al. (2008). "Nature and/or nurture? Analyzing the determinants of transit ridership across US urbanized areas." *Transportation Research Part A.* Vol. 43. P. 60-77.

TCRP. (2007). *Elements Needed to Create High Ridership Transit Systems: Report 111.* Transit Cooperative Research Program. Sponsored by the Federal Transit Administration in cooperation with the Transit Development Corporation. Washington, D.C.

Toronto Transit Commission. (2003). *Ridership Growth Strategy*. Toronto Transit Commission.

TransLink. (2008). "Funding Transportation Improvements in Metro Vancouver." *Transport 2040*. South Coast Transportation Authority (TransLink). Burnaby, BC.

_____. (2008). "Metro Vancouver 2040 Employment and Population Projection." *Transport 2040*. South Coast Transportation Authority (TransLink). Burnaby, BC.

_____. (2005). " Base Fare Revenue Summary." *Spring 2005 U-Pass Survey*. South Coast Transportation Authority (TransLink). Burnaby, BC.

_____. (2003). *2003 Annual Report*. South Coast Transportation Authority (TransLink). Burnaby, BC

_____. (2002). *University Transit Pass Agreement*. South Coast Transportation Authority (TransLink). Burnaby, BC

UBC. (2008). *Fall 2007 Transportation Status Report.* University of British Columbia. Vancouver, BC. February 2008.

____. (2007). *2007 Transportation Survey.* University of British Columbia. Vancouver, BC. September 2007.

Urban Systems. (2005). *U-Pass Review: Final Report.* Developed for TransLink by Urban Systems. Richmond, BC.

Wachs, Martin. (2003). "Improving Efficiency and Equity in Transportation Finance." Centre on Urban and Metropolitan Policy. The Brookings Institution. Washington, D.C.

_____. (1976). "Consumer Attitudes Toward Transit Service: An Interpretive Review." *Journal of American Planning Association.* Vol.42. P. 96-104.

World Commission on Environment and Development . (1987). *Our Common Future: Report of the World Commission on Environment and Development: "The Brundtland Report"*. Geneva.

Works Consulted

Aarts, Henk, Bas Verplanken, and Ad Van Knippenberg. (1998). "Predicting Behaviour From Actions in the Past: Repeated Decision Making of a Matter of Habit?" *Journal of applied Social Psychology*. Vol. 28, No. 15. P. 1355-1374.

_____. (1997). "Habit, information acquisition, and the process of making travel mode choices." *European Journal of Social Psychology*. Vol. 27. P. 539-560.

Bamberg, Sebastian, Icek Ajzen, and Peter Schmidt. (2003). "Choice of Travel Mode in the Theory of Planned Behaviour: The Roles of Past Behaviour, Habit, and Reasoned Action." *Basic and Applied Social Psychology.* Vol. 25, No. 3. P. 175-187.

Bonsall, Peter. (2000). "Legislating for modal shift: background to the UK's new transport act." *Transport Policy*. Institute for Transport Studies, University of Leeds. Leeds, UK.

Boyle, Daniel K. et al. (2006). "Public Transportation Marketing and Fare Policy. *Transportation in the New Millenium.*

Cervero, Robert and Bambang Susantono. (1999). *Rent Capitalization and Transportation Infrastructure Development in Jakarta.* Department of City and Regional Planning, University of California, Berkeley, CA.

Calthrop, Edward, et al. (1998). *Parking Policies and Road Pricing.* Urban Studies Journal, Vol. 37, No. 1. Pages 63-76.

Karlenzig, Warren. (2008). *Major US City Preparedness For and Oil Crisis: Which Cities and Metro Areas are Best Prepared for $4 a Gallon Gas and Beyond?*. Common Current.

Pucher, John and Ralph Buehler. (2002). *Making Transit Irresistible: Lessons from Europe*. Rutgers University and the University of Sydney.

Storchmann, Karl. (2003). "Externalities by Automobiles and Fare-Free Transit in Germany-A Paradigm Shift?" *Journal of Public Transportation*. Vol. 6, No. 4.

Topp, Hartmut H. (1993). "Parking policies to reduce car traffic in German cities." *Transportation Reviews: A Transnational Transdisciplinary Journal.* Vol. 13, No. 1. Pages 83-95.

Van Wee, Bert. (2002). "Land use and transport: research and policy challenges." *Journal of Transport Geography.* Vol. 10. Pages 259-271.