

**TRANSPORTATION DEMAND MANAGEMENT –
UNIVERSITY OF BRITISH COLUMBIA (UBC) U-PASS –
A CASE STUDY**

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Abstract:

This thesis examines the effects of a pre-paid transit program called the U-Pass on the community of University of British Columbia (UBC). Mode split data are examined for UBC and four other universities at which a U-Pass is employed. UBC had the overall highest transit ridership rate but the lowest increase in transit ridership from implementing the U-Pass. Most of the increase in ridership came from previous car-pool riders also known as high occupancy vehicle (HOV) riders. Single occupancy vehicle (SOV) riderhip declined only 9% with the implementation of the U-Pass, less than the goals of the program. A rough survey of 200 people was conducted to look more closely at the effects of the U-Pass on the student body at UBC. There was agreement with the statement that “The U-Pass makes UBC a more attractive university” even among SOV commuters. The most common comment on the survey was that the busses were overcrowded. SOV users tended to live in places where transit was inconvenient (required two or more transfers to get to UBC). With enrolment increasing every year the U-Pass is a helpful program in managing congestion. However it can not be the complete solution to this problem because it does not dramatically increase the level of public transit service nor does it address land use issues.

1.0: Introduction

In September of 2003 the University of British Columbia (UBC) implemented a pre-paid transit fare system for students known as the U-Pass as part of their strategic transportation plan (STP). This system gives unlimited pre-paid access to all students at UBC to all three zones of the Vancouver public transit system. There was a student referendum in 2002 in which students approved a mandatory student fee increase of \$20/month for the U-Pass package. This package included not only fare-free access to transit services across Vancouver but also increased bus service to UBC, especially at off peak times, as well as other transportation infrastructure improvements such as secure bike storage areas. In September of 2003, after U-Pass implementation the busses to UBC were noticeably more crowded than before the U-Pass. The busses were so crowded that it was, and still is, common for an overcrowded bus to pass by people waiting at a bus stop to get to UBC. Some students who commute by car to UBC were, and still are, grumbling about paying \$80/term for a service which they do not use. TREK, the administrative body at UBC in charge of transportation is calling the U-Pass a great success. In this thesis we attempt to examine from a variety of angles a system which affects every UBC student: the UBC U-Pass

There is not an overarching thesis question but rather a number of questions aimed at more closely examining the UBC U-Pass system and its implications.

These questions are:

- What are the stated goals of the TREK program and how do they fit into a global and regional context?

- How have the UBC U-Pass and other TREK initiatives changed the mode split and parking demand of student commuters?
- How does the UBC U-Pass program compare to other U-Pass programs?
- How has the U-Pass affected UBC students' lives?
- Does the U-Pass have other applications outside of the UBC setting?
- Are there better ways than a U-Pass to manage student transportation to school?
- How has the U-Pass changed traffic patterns in Vancouver?

The following methods were used in trying to answer these questions:

- Analyzing mode split data
- Research from journals on other U-Pass systems
- Interviews with Trek and Greater Vancouver Regional District (GVRD)
- Attending a public meeting of GVRD
- Conducting a survey on student thoughts
- Looking at transportation models in the GVRD

The thesis starts with background information on the problems associated with high single occupancy vehicle (SOV) usage, some statistics for the GVRD and some ways in which the city of Vancouver hopes to alleviate these problems. We then look at the theory behind U-Pass systems and why they are implemented. Next we take a more in-depth look at the UBC U-Pass, examining mode split data, conducting a survey on student opinion, looking at parking data, and examining the costs of the program. After

that we look at how UBC compares to other U-Pass Universities. We then ask TREK and Translink a few probing questions, and finish with our analysis of how the U-Pass is affecting life and traffic in the UBC region with some recommendations on what should happen in the future.

1.1 Transportation: Canada in a global context

Cars are so important to the average Canadian household that they spend an average of \$7 600 per year- three months average Canadian wage- just to keep their car operable.¹ Cars are convenient, comfortable, enjoyable, and a quick and easy way to transport people and goods. In a car there are no bus schedules and routes to constrain travel, and no weary legs or rain soaked bicycling gear. They allow access to jobs and amenities that would be harder to reach by other means and have allowed an unparalleled level of mobility.

Canadians have one of the highest rates of car ownership in the world, with close to one vehicle for every two Canadians.² Not only do Canadians own many cars but we use them often. Cars account for 74% of trips in urban areas in Canada.³ This high use of the automobile brings with it certain economic, social, and environmental costs not

¹ “Quick Facts: Cost of Driving” TREK UBC. www.trek.ubc.ca

²“2001 Ontario Road Safety Annual Report
Canadian Motor Vehicle Traffic Collision Statistics 2001”
<http://www.safety-council.org/info/traffic/stats2001.html>

³ John Pucher and Christian Lefevre, The Urban Transportation Crisis in Europe and North America, (London: MacMillan Press 1996.)

covered by the automobile driver such as climate change, car accidents, air pollution and traffic congestion. In many cities in Europe the percentage of trips taken by car is half as large as is customary in North American cities. Below is a table of urban mode-split by country.

Table 1.1

Mode Split in Urban Areas ⁴

	Car	Transit	Cycling	Walking	Other
Austria	39%	13%	9%	31%	8%
Canada	74%	14%	1%	10%	1%
Denmark	42%	14%	20%	21%	3%
France	54%	12%	4%	30%	0%
Germany	52%	11%	10%	27%	0%
Netherlands	44%	8%	27%	19%	1%
Sweden	36%	11%	10%	39%	4%
Switzerland	38%	20%	10%	29%	3%
UK	62%	14%	8%	12%	4%
USA	84%	3%	1%	9%	2%

The design of many European cities is more conducive to public transit, cycling, and walking trips. For this reason, a short term goal of emulating the mode-split of a Swiss

⁴ John Pucher and Christian Lefevre, The Urban Transportation Crisis in Europe and North America, (London: MacMillan Press 1996)

city in a Canadian city might not be realistic. It is useful however to know that there are examples of industrialized countries in which the car plays a more minor role in urban transportation.

1.2: A regional context

In Vancouver where 5.5 to 6 million person trips are made each day, the car plays an important and growing role in urban transportation. The GVRD has the highest car ownership rate in Canada. Forty-five percent of all trips are made by SOV and another 29% are made with private vehicles including at least 1 passenger. This means that 74% of all trips are made by car. The remainder of trips are made by transit (11%) bicycle (2%) and by walking (12%). Of Canada's major cities, Vancouver has the lowest rate of transit ridership.⁵ A poll published in the Vancouver Sun showed that 47% of Lower Mainland citizens considered transportation to be the "most important local issue facing residents"⁶. The political pressure to improve Vancouver's traffic is mounting. Building roads is limited by space. Below are some Vancouver specific statistics taken from the Better Environmentally Sound Transportation (BEST) Fact sheets on our dependence on the automobile and the effect of that dependence.

⁵"Transportation, Air Issues and Human Health" Pollution Probe. April 29th 2003.

<http://www.pollutionprobe.org/Happening/pdfs/transportconf/town.pdf>

⁶"Transportation Facts" Better Environmentally Sound Transportation. <http://www.best.bc.ca/>

BEST fact sheet Greater Vancouver transportation stats:

- There are approximately 5.5 million person-trips per day in the GVRD
- Travel times in the last decade have increased due to worsening congestion.
The average trip time has increased by 33 per cent - 20 minutes instead of 15.
"Rush hours" are 33 per cent longer - four instead of three hours in length.
- 1996 and 1999, rush-hour traffic on main roads and bridges in the GVRD increased by eight per cent - twice the rate of the region's population growth. (Source: TransLink, July 2002.)
- Congestion has caused transit speeds to slow by seven per cent during the past decade. In the rush hour, one 40-foot bus can take the place of 21 cars, which can occupy as much as 1,700 feet of a moving traffic lane. (Source: TransLink, July 2002.)
- There were 1.2 million registered motor vehicles on Greater Vancouver roads as of 1999 and that number is expected to increase by 60% in the next 20 years. (Source: Environment Canada. 2001. Pacific and Yukon Region Environmental Indicators."Smog over the Lower Fraser Valley of British Columbia." http://ecoinfo.org/env_ind/region/smog/smog.htm)
- Transportation is the single largest source of GHG emissions in Canada, accounting for about 25% of Canada's total emissions in 1997. The sector also accounted for the largest share of the growth of emissions between 1990 and 1997. (Source: Government of Canada. Climate Change 2000 Backgrounder.

February 2000; “Vision and Balance: Report of the Canada Transportation Act Review.” June 2001. Minister of Public Works and Government Services Canada.)

- In his latest report on air quality, the Chief Medical Health Officer for Vancouver and Richmond says 15-150 people die every year in the Lower Mainland from air pollution. (Source: CBC British Columbia News Online. 23 February 2001.)
- The City of Vancouver has 2,997 Hectares of roads, streets and alleys. That equals 26.5% of the total land area of the city. In contrast Burnaby’s roads consume 27.8% of its land while Surrey’s consume 23.2%. This does not include parking or other automobile related land uses. (Source: City of Vancouver, Burnaby and Surrey websites.)

These maps from Translink show morning rush hour congestion in Vancouver in 2002 and the predicted congestion in 2021.⁷

⁷“Traffic congestion in Vancouver and surrounding areas” Passe-temps.ca.
<http://www.passe-temps.ca/congestionmaps.html>

Figure 1.1



UBC contributes to the traffic load of Vancouver by about 117,800 person trips a day. This accounts for nearly 2% of the close to six million person trips made in the GVRD every day.⁸

1.3: Transportation Demand Management: an Overview

There has been a fair amount of research on how to mitigate the effects of the car and manage the demand for SOV transportation. Solutions range from changing the design of the city to be more accessible without the use of a car to having pay per use roads. Measures, actions and policies that try to change people's travel behavior to reduce the amount of vehicle traffic and congestion are referred to as Transportation Demand Management (TDM) strategies.⁹ There are three main ways of doing this:

- 1) Shifting the mode of transportation from SOV to High occupancy vehicles (HOV), public transport, or bicycles
- 2) Eliminating trips
- 3) Lowering Peak demand

The methods for accomplishing these goals are broken down into carrot (incentive) and stick (disincentive) measures. The U-Pass is a TDM strategy.

In 1993 as part of a project entitled Transport 2021, the Greater Vancouver Regional District (GVRD) and the Province of British Columbia produced a report

⁸ "UBC TREK Program Centre: Transportation Status Report: Fall 1997-Fall 2003" Prepared by Urban Systems. March 2004. www.trek.ubc.ca

⁹ "Transportation Demand Management Measures and Their Application in Greater Vancouver." Prepared by GVRD and Province of BC. March 1993.

entitled, “Transportation Demand Management Measures and Their Potential for Application in Greater Vancouver.” In this report fourteen promising TDM measures were identified for use in the Vancouver region to help alleviate some of the forecast traffic increase in 2021 caused by population growth and demographic change in Vancouver. Many of these measures have since been applied to some extent in Vancouver. Some measures such as education, variable work hours, bicycle lanes and storage, and preferential HOV treatment are implemented in some form at UBC.

Different TDM measures are more suited to tackling different problems. From a traffic management perspective some TDM measures, such as the gas tax, are blunter than others because they act unilaterally and do not distinguish between driving at off-peak and low traffic areas, and driving in peak, high traffic areas. Therefore, depending on the specific goals of the TDM program, different measures will be more useful.

TDM measures including the U-Pass are limited in the change they can bring about in the transportation choices of a region. This is because there are several factors, fixed in the short term, which are important in determining the mode, level, and destination of travel in urban centers. These include:

- Demographic and income of the population
- Physical geography of the city
- Location of jobs, homes, and amenities
- Public Transit infrastructure

The effectiveness of TDM measures is also limited by political feasibility. Canadians

have come to expect free roads, inexpensive parking, and affordable gasoline. “Stick” policies often put price tags on commodities such as rush hour road space which were previously free. Even though transportation is often cited as the #1 problem facing Vancouver, there is still public resistance to more taxes, road pricing, and increases in parking costs.

The GVRD estimates that even if they implement a dramatic package of TDM measures, these measures would only handle between one-third and one-half of the expected growth in vehicle-trips by 2021.¹⁰ Therefore, TDM measures such as the U-Pass can not be used exclusively to maintain current transportation service levels. Other methods such as land use change and increased public transit infrastructure are also needed.

1.4: Traffic Dynamics in Vancouver

The U-Pass’s effectiveness cannot solely be gauged on its ability to increase transit rider ship to UBC in the present, it must also be judged according to whether or not it will prove to be a positive transportation alternative incentive for the future. Can it accommodate increasing student transit loads, and will the necessary changes needing to be made in order to make those accommodations be tolerated by those adversely affected by them.

Currently, the GVTA employs the use of a computer based traffic model, known

¹⁰ Transportation Demand Management Measures and Their Potential for Application in Greater Vancouver: Jan 1993 technical report 2 page 85.

as the EMME/2 model, to monitor vehicle flow rates within the city. It was designed in 1991 in British Columbia and has become world renowned for its flexibility in interpreting traffic dynamics. The fundamental strength of this model is that it allows for the incorporation of accurate local information such as employment, population, roads, bus routes and other specific features of an urban environment. The City of Vancouver regularly consults the EMME/2 when making political decisions that may affect the way in which traffic operates in this city.

An original goal of this project was to incorporate the model into our study of the U-Pass by looking at how its outputs for traffic flow have changed since the program's implementation. It was eventually discovered that a mere comprehension of the EMME/2's structure would have demanded a thesis project of its own. Making things more complicated was the fact that to date there have been no official publications on how the U-Pass has specifically affected the model, a fact verified by a telephone call to the Engineering Services department of the city. Therefore, with nothing concrete to go by, it was decided that a general overview of some of the more obvious factors which do have an effect on the traffic dynamic of Vancouver would be more relevant to the goals of this report. These included:

- Population growth of UBC student body, staff, "university town" residents, and of the GVRD in general
- Political trends & changes in land zoning regulations

- Property value (and consequently rental rate) increases in the area surrounding UBC
- Residential distribution of student body
- Possible changes to the current transportation network infrastructure

Growth of student body & Vancouver populations

It is estimated that with the increasing availability of placements, UBC's student population is increasing at the rate of 2% per year. TREK has also approximated that 60% of the student body residing off campus lives within a 10 kilometer radius of the university¹¹. If that trend continues, and private automobile use disincentives become more severe as planned, the demand on transit loading capacity along the 4 streets leading to UBC (4th, Broadway, 16th, & SW Marine Dr.) will become increasingly more difficult for the city to cope with. The UBC planning document, the OCP, states that the on campus population will double in the next twenty years.¹²

Translink busses operate on the same road network as private and commercial vehicles and therefore are limited in service by the congestion levels of these vehicles, especially during peak hours. If Vancouver's population almost doubles in the next 40¹³

¹¹Dr. Ken Denike and Mr. Andrew Murphy. "UBC Year 2000 Transportation Survey"
Department of Geography, U.B.C. October 18th. (17-18)

¹² UBC Planning, The Official Community Plan, 1997.

¹³ Baxter, David and Jim Smerdon. "Housing Metropolitan Vancouver's Population: Demographics and Long Run Housing Demand, 1999 to 2040". The Urban Futures Institute Report 42, November 1999. (2-3)

years, as it is expected to, there will undoubtedly be higher volumes of non-transit vehicles traveling on sections of the links leading to UBC, particularly on those east of Kitsilano as areas west of this community (under current zoning regulations) exhibit a lower potential to facilitate significant increases in residential densities. Along the current Broadway line, the efficiency of B-Line service might become notably marginalized if the combination of increased numbers of trolleys with increased numbers in personal automobiles continues to amplify congestion levels.

Political Factors

Factoring into this bottleneck traffic-jam problem is the issue that the sandwiched neighborhoods between UBC and east of Granville are composed of some of the most expensive real-estate in Vancouver, making it difficult for the GVRD to make any serious infrastructure changes in the area. It is hard to imagine that someone who has just purchased a home a few blocks off Broadway would be willing to quietly accept a drastic change in transport land use policy that might significantly depreciate the value of their property. This is known as the NIMBY factor, an acronym standing for “Not in my backyard”. The question then is: How much of an increase in UBC-link transport capacities and what methods are property owners in the bottleneck willing to withstand before voicing a collective opinion of opposition? Not very much. Various businesses

located in the upper W.10th business district have already started to express concern about UBC students who drive to the last B-Line stop before UBC (Sasamat & W.10th), and park nearby. Although the problem here does not have to do directly with noisy busses travelling through a quiet neighborhood, it is just as irritating for residents having to deal with a lack of parking in front of their house when a normally available spot is being used by a university student “shuttling” into campus. This is essentially a question of public concern over land-use, which is in turn a concern that may ultimately be addressed by political proceedings.

Land Value Factors & Projected Changes in Land Use

For students choosing to reside off campus, the quest for finding affordable and convenient housing is not easy one. Most prefer to live in the area comprising West Point Grey, Kitsilano, Mt. Pleasant, and Dunbar/Shaugnessy¹⁴.

Property values in these areas are currently experiencing dramatic increases as is exemplified by the fact that a property a few blocks South from the Safeway near the UBC Gates rose in worth by \$100,000 over the past 5 years. As a consequence student rent is also increasing, making the process of choosing a living location more complicated, especially with the initiation of the U-Pass program. It is possible that the

¹⁴Dr. Ken Denike. “Travel Patterns to and from UBC and Response of Market Segments Collected via an Internet Web-based Scenario.” Department of Geography, UBC August 31st, 1998. (4.)

residential distribution of off-campus students will change dramatically with modifications to the quality of rapid transit to UBC.

If transit traveling times from outlying areas of the GVRD are eventually brought down to levels currently experienced within the 10km radius of UBC, there would be more of an economic incentive for students to locate in the cheaper suburbs¹⁵. The downside of this trend is that the relocation could play a role in increasing suburban fringe sprawl which is considered to be taxing on the natural environment for the reason that it takes more energy to supply goods and services to low density communities than high density ones.

Conversely, it is also possible that the West Side will be further re-zoned to allow more neighborhoods with double-lots than are already allowed for in the west Kits neighborhood. This would increase the number of rentable units proximate to UBC and keep rental costs level to a slower increase. Double-zoning typically adds to the value of a property so from a political and economic standpoint, such a reform is positive¹⁶. Doing this would also serve to curtail the spread of fringe sprawl, and increase the potential for more sustainable micro-communities.

¹⁵ Berechman, J. "Public Transit Economics & Deregulation Policy". Elsevier Science Pub. Amsterdam, 1993. (28-30)

¹⁶ Berechman, J. "Public Transit Economics & Deregulation Policy". Elsevier Science Pub. Amsterdam, 1993. (27)

Residential Distribution

The current breakdown of residential distribution for the entire population of UBC is given in the table below¹⁷.

Residence Distribution by Zone (TREK):

Zone	Faculty	Staff	Student	Total	%Faculty	%Staff	%Student	%Total
Campus	209	86	6169	6464	11.1	2.3	17.4	15.7
W.Pt.Grey &Kits	137	238	1658	2033	7.3	6.4	4.7	4.9
Dunbar-Shaugnessy	414	255	2608	3277	22.0	6.8	7.3	8.0
East Kits – Mt. Pleasant	326	565	4838	5729	17.3	15.1	13.6	13.9
Burrard Peninsula	48	138	971	1157	2.6	3.7	2.7	2.8
N.E. of Cambie	237	550	3751	4538	12.6	14.7	10.6	11.0
S.E. of Cambie	57	302	2791	3150	3.0	8.1	7.9	7.7
West Vancouver	16	15	336	367	0.9	0.4	0.9	0.9
North Vancouver	60	134	1214	1408	3.2	3.6	3.4	3.4
North Burnaby		91	826	917	0.0	2.4	2.3	2.2
South Burnaby	25	177	1044	1246	1.3	4.7	2.9	3.0
Port Moody/Coquitlam	40	183	816	1039	2.1	4.9	2.3	2.5
New West.	12	74	406	492	0.6	2.0	1.1	1.2
Pitt/Maple		33	62	95	0.0	0.9	0.2	0.2
Langley		23	324	347	0.0	0.6	0.9	0.8
Richmond	133	451	3679	4263	7.1	12.1	10.4	10.4
East Richmond		3	278	281	0.0	0.1	0.8	0.7
North Surrey/Delta	55	204	2406	2665	2.9	5.5	6.8	6.5
Ladner/Tsawwassen	22	77	346	445	1.2	2.1	1.0	1.1
S.Surrey/	51	53	165	269	2.7	1.4	0.5	0.7

¹⁷ Dr. Ken Denike and Mr. Andrew Murphy. “UBC Year 2000 Transportation Survey”

Department of Geography, U.B.C. October 18th. (16)

White Rock								
Outside Area	7	41	445	493	0.4	1.1	1.3	1.2
No Zone	33	48	374	455	1.8	1.3	1.1	1.1
Total	1882	3741	35507	41130	100	100	100	100

It is apparent that roughly 60% of the total and student commuting populations live in Vancouver within a 10 km radius of the campus. About 5% live in West and North Van, 12% in the municipalities from North Burnaby to Langley, and 23% in Richmond to Surrey/Ladner. Although limited data is available it does appear, according to 1998 and 2000 surveys carried out by TREK and Ken Denike of UBC Geography, that there has been a slight increase in the proportion of students residing in Vancouver and Richmond over the past 5 years. This trend can partly be attributed to the implementation and constant improvement of the B-Line program which has greatly increased the convenience of using public transport to commute to UBC. The 2 main B-Line corridors servicing UBC are the 98 and 99 routes, serving Richmond/Burrard and Broadway Station/UBC respectively. It is however more likely that the proportional increase is primarily the result of general population increase and densification of Vancouver as its capacity to accommodate new recruits has not yet reached a threshold.

Changes to the transportation network infrastructure

Planned Alternatives (to be implemented by 2010) affecting commutes to UBC include:

- The highly controversial construction of a Richmond Airport Vancouver (RAV) rapid transit line.
- New ~120 person capacity fast ferries in Burrard Inlet servicing areas of West Vancouver
- The creation of a new rapid transit corridor extending from New Westminister and Port Coquitlum into the City of Vancouver¹⁸.

The RAV line is being viciously scrutinized as it involves a nightmare of technical planning and problem solving, will cost about \$1.7 billion to complete, will be operated and maintained by a private firm, and poses a threat to the value of residences adjacent to where it is proposed to run. It's construction will also detract from the quality of the Port Coquitlum corridor as costs will far exceed those of a conventional RTL (significant sections of the RAV line will run underground beneath False Creek and the streets of Vancouver.

The proposed fast ferries on the other hand may prove to be very effective in alleviating some of the peak hour down-town and bridge traffic caused by students commuting from North and West Van. The drawback to this type of transit though is that because of trip time and frequency limitations, the new boats may only be really useful for those students having relatively flexible schedules.

*Both the RAV line and the fast ferries have just been approved for funding under a 4

¹⁸ GVRD. "2005 - 2007 Three-Year Plan& 10-Year OutlookStrategic Transportation Plan Amendment December 2003" (6-7)

billion dollar federal grant authorized by Prime Minister Paul Martin.

Unplanned Options for rapid transit to UBC:

There are three generally accepted alternative mode options for rapid transit to UBC:

- Existing articulated bus rapid transit vehicles
- Guided surface light rail transit (LRT)
- An underground extension of the skytrain (essentially a subway link)

Comparison of these modes by cost is shown in the following table¹⁹:

Mode	Capital Costs	Operating Costs per Vehicle Hour	Operating Costs per Passenger Km	Max Daily Rider Capacity
Articulated Bus	~\$90 million	\$69	\$0.051	97,000
LRT	~\$800 million	\$100	\$0.025	140,000
Skytrain ext.	~500 million	\$125	\$0.023	150,000

The GVRD 10-year outlook report has stated that while the transportation authority is not currently planning an upgrade to either LRT or Skytrain ext. from the B-Line system, it does acknowledge that by 2013 the demand for transit loading along links to UBC may exceed the supply at which time a switch will need to be made from the existing method of constantly increasing B-Line service. From a NIMBY standpoint the most desirable of these options would be the underground skytrain

¹⁹ City of Vancouver. "Skytrain Expansion in Vancouver: A City Perspective":
http://www.city.vancouver.bc.ca/tran/compare_options.htm

extension. It also seems like this would be the best choice in terms of being able to buffer higher volumes of students commuting to UBC for a longer period of time as its max rider capacity exceeds those of the other two modes.

1.5: Unlimited Access Programs

Unlimited access programs, an innovative TDM measure, provide unlimited, pre-paid use of a public transportation system at a low cost to the user. There are over 70 universities and colleges across North America which currently have an unlimited access program. The programs are growing rapidly with only a handful of programs in existence 10 years ago.

Jeffrey Brown et al. conducted a survey on university administrations who chose to implement a U-Pass program. He found that the main reasons universities chose to implement a U-Pass program were to:

- 1) Reduce the demand for parking,
- 2) Increase students' access to housing and employment,
- 3) Help universities recruit and retain students,
- 4) Reduce the cost of attending college,
- 5) Increase transportation equity.²⁰

There are other factors that can be at play in choosing to implement an unlimited access

²⁰ Fare-free public transit at universities - An evaluation Brown J, Hess DB, Shoup D JOURNAL OF PLANNING EDUCATION AND RESEARCH 23 (1): 69-82 FAL 2003

program. These include:

- 1) Improving town-gown relations -traffic congestion in the neighborhoods surrounding a campus often leads to conflict between the town and the university.
- 2) City by-laws coupling development with transportation amelioration- Universities that wish to expand might face pressure from the local government to provide measures to alleviate traffic congestion.
- 3) Green image and environmental concerns- The image of a university is important in recruiting students and obtaining government funding. If the Kyoto protocol is ratified, universities would be able to trade carbon credits from the reduction of GHG emissions associated with the U-Pass program.

The most common reason given for implementing an unlimited access program remains to reduce parking demand. There are several problems associated with parking supply. Parking is expensive to build, it takes up valuable space, and it is not visually appealing. The costs associated with increasing the parking supply are not trivial. The following example from the University of Colorado demonstrates how an expensive staff U-Pass program can be cost effective.

“The faculty/staff bus pass program at the University of Colorado provides an instructive example of reduced parking supply costs. This program allows each permanent faculty or staff member who is eligible for benefits to ride local and regional buses and light rail by showing his or her university identification.

Because some employees have reduced the number of times they drive to campus or stopped driving to campus because of the availability of free transit, some parking spaces are freed up—a total of 350. The annual cost of the bus pass program is \$393,400; it costs \$1,125 per parking space left open. For comparison, the annual debt service to provide one additional parking space is \$2,723. Thus, it is 2.5 times as expensive to provide one additional parking space compared to reducing demand by one space. The net annual savings to campus, compared to providing 350 new spaces, is thus \$560,000”
(University of Colorado Environmental Center 2002, pp. 18–19)²¹

See also figure 3.4.2 later in the paper which further analyzes parking demand savings by starting a U-Pass program.

The University administration is not the only organization which benefits from having a fare free transportation system. The Transportation provider benefits as well. It benefits by:

- 1) Increased transit ridership
- 2) A source of guaranteed revenue
- 3) Overall improvements to transit service which benefit and attract non U-Pass customers.

²¹ Toor, Will. “The Road Less Traveled: Sustainable Transportation for Campuses.” Published on line at http://www.colorado.edu/cuenvironmentalcenter/temp/The_Road_Less_Traveled.pdf

In 1997 a survey by Donald Shoup et al. looked at the average cost and change in ridership of the 70 programs in existence in North America at the time.

The universities' average cost for Unlimited Access was \$30 US per student per year. Student transit ridership increased between 50 percent and 200 percent during the first year of Unlimited Access, and continued to increase 2-10% annually in subsequent years.²²

How are the universities able to offer such low per student costs on a universal bus pass when monthly equivalents available to the public are so much higher?

The U-Pass can maintain its low cost relative to monthly bus passes because in most programs the U-Pass card is given to all students whether or not they will use the bus, whereas a monthly bus pass is purchased only by people who intend to use the bus frequently. An average student will use the bus less frequently than the average bus pass holder and so a U-Pass system can have a lower cost per student than a regular bus pass.

The list of universities and colleges that have implemented the U-Pass is diverse. Some institutions are in a large city, others are in a small town or a suburb. Some of the institutions are large others are small. Some of the universities are responding mainly to traffic congestion when implementing the U-Pass while others are concerned about parking space.

²² Brown, Jeffrey et. al., "Unlimited Access" Transportation 28: 233-237, 2001. Netherlands, Kluwer Academic Publishers.

1.6: UBC specific Background information:

As part of the Official Community Plan (OCP) TREK, the transportation body at UBC-which is responsible for implementing the U-Pass was founded in 1997. Their mission and mandate appear below.²³

- Our **mission** is to:
 - Improve your transportation choices by promoting sustainable transportation at UBC.

- Our **mandate** is to:
 - Reduce Single-Occupant Vehicle (SOV) trips and increase transit ridership by 20%;
 - Make UBC the lead agency in implementing a 'U-TREK Card', a universal transportation pass for students, faculty, and staff;
 - Coordinate goods movement and reduce truck traffic to and from campus; and
 - Act as a resource for UBC students, faculty, staff, & visitors.
 - TREK: **T**rip **R**eduction, **R**esearch, **E**ducation, and **K**nowledge.

TREK was born out of the OCP's section outlining the transportation element of

²³ "TREK UBC: About Us" www.trek.ubc.ca

the development plan. Below is a copy of the transportation portion of the Memorandum of Understanding, a document which contains specific goals in the areas set out by the OCP.²⁴

Transportation:

UBC WILL:

1.1 Transportation Demand Management

Building on its Transportation Demand Management (TDM) success to date and placing emphasis on strategic partnerships, UBC will pursue the GVRD's goal of reducing SOVs by 20%. UBC will also pursue a complementary goal of increasing ridership on BC Transit to UBC by 20% by the date of the first OCP review.

The University is prepared to be the lead agency in creating a U-Pass system in collaboration with the City of Vancouver, BC Transit and UBC neighbours.

UBC will develop and implement, as a top priority, a comprehensive and integrated transportation management strategy. This strategy will include a staged implementation plan and will be completed prior to adoption of the first area plan.

In order to accomplish these goals, UBC will immediately take the following actions:

- a) Develop and implement, with the cooperation of BC Transit, a U-Pass system

²⁴ “Memorandum of Understanding: Transportation” from the Official Community Plan at UBC.
www.ocp.ubc.ca

specifically for UBC and commit initially \$250,000 per year towards this system, starting with the 1998/99 fiscal year. These revenues will come from increases to the parking fees beyond those in the recently approved parking and transportation business plan for the University. As the U-Pass system is defined and funding requirements determined, UBC will pursue additional necessary resources to achieve the 20% reduction in single occupant vehicles, with disputes as to what is required referred to the GVRD-UBC Task Force.

b) Research and define the "markets" for a U-Pass system at UBC by identifying and quantifying the travel requirements of University students and personnel. This work will be carried out by a transportation expert drawing on the expertise and experiences of the University of Washington's U-Pass System. This study could be undertaken jointly with the City of Vancouver, the GVRD and BC Transit as an example for the rest of the region and as a test of the validity of the "20%" targets described above. UBC expects to share the significant databases currently available to their strategic partners in this initiative.

c) Open negotiations immediately with BC Transit to design a unique U-Pass system for UBC that can be put into operation by September 1999. This should give BC Transit adequate time to secure additional buses or to reallocate resources to take advantage of the resultant increased demand on UBC destination routes.

d) Hire, by July 31, 1997, a Transportation Director to create and implement a transportation management strategy and to aggressively pursue these goals with BC Transit, the City of Vancouver, local resident groups, the GVRD, the Ministry of Transportation and Highways and other interested parties,

e) Investigate the feasibility of changing class scheduling, in conjunction with transit scheduling, to reduce peak traffic flows in the long term.

f) Request the Ministry of Transportation and Highways proceed, in consultation with GVRD Parks in recognition of previous commitments and with UBC, with the removal of all free parking along roads adjacent to UBC, but controlled by MoTH by June 30, 1997. This will reduce the parking supply in and around UBC by about 600 spaces.

g) Utilize the University's purchasing power to acquire bicycles and make them available at favourable purchase prices to University personnel who commit to riding the bicycle for all or part of their commute to and from campus. In addition, UBC will consider measures to improve the bicycle network and bicycle storage, including "white bikes" for free internal circulation, provision of ample free covered bike racks in secure areas, and improved bikepaths.

h) Investigate the feasibility of using the recently formed Co-operative Auto Network as a means of reducing automotive ownership and promoting car sharing.

- i) Continue promotion of telecommuting by University personnel.

- j) Continue UBC's Transportation Committee and ensure that it has representation from neighbouring communities.

- k) Establish, as part of the transportation planning process, specific benchmarks for the mutually supportive transportation goals of reducing single occupant vehicles by 20% as set out in the OCP and increasing transit ridership by 20%, through development of a methodology and travel surveys during the fall of 1997. This work will be carried out in consultation with GVRD, the City of Vancouver, BC Transit, the Ministry of Transportation and Highways, and other interested parties.

2.0 A Closer Look at the UBC U-Pass Program

2.1: Transportation Programs at UBC

Since the adoption of the OCP in 1997, UBC has implemented a number of other transportation programs and modifications intended to achieve the OCP objectives, including carpooling programs, modification of class start-time, bicycle lanes/racks on campus, and a guaranteed ride home program.

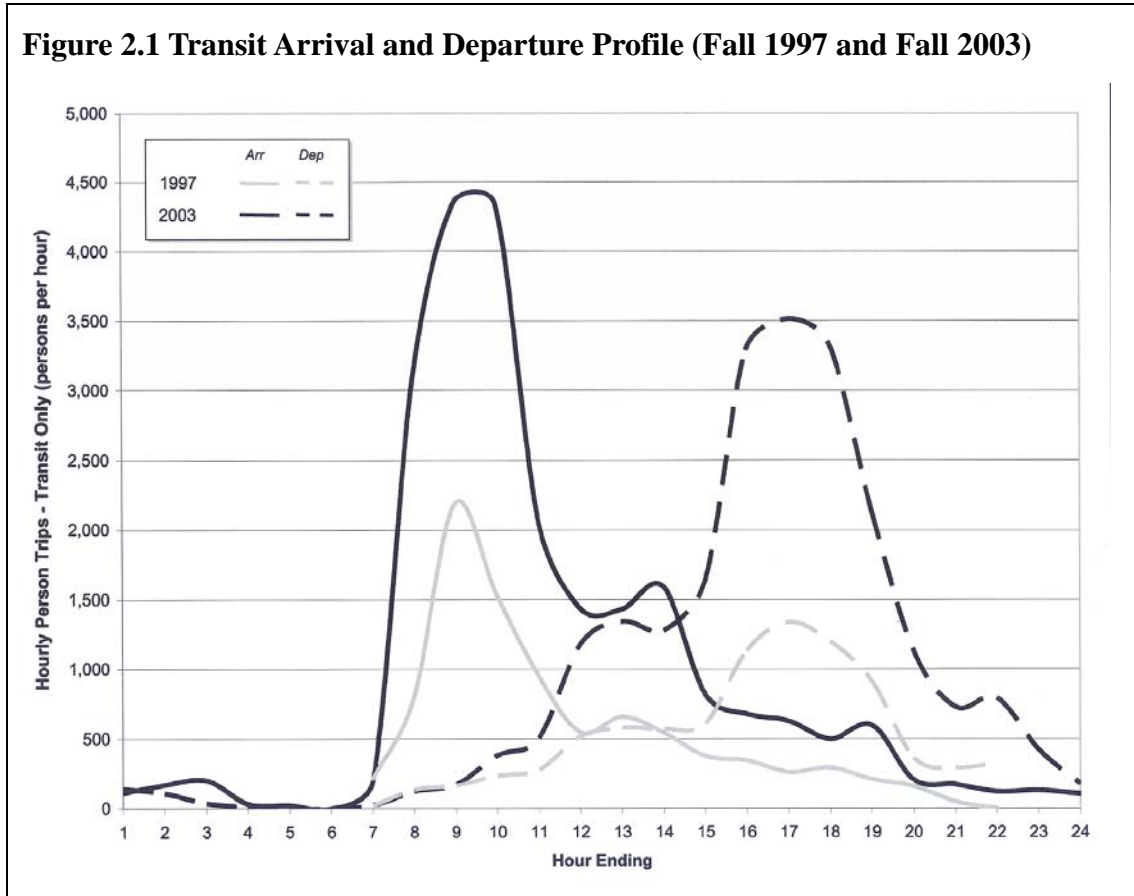
- **Modification of Class Start-time in September 2001**

In order to spread transit demand in the morning peak hours, UBC has spread out the morning class start-times from the previous existing campus-wide 8:30am start-time to classes beginning at 8:00am, 8:30am and 9:00am. Since the implementation of this modification, the peak is now spread over a longer period in the morning (shown in Figure 2.1) and spreads out the overcrowding situation on buses.

- **Parking Supply and Costs**

UBC has implemented a number of changes in parking supply and costs since 1997: (1) roadside parking on SW Marine Drive, 16th Avenue and other roadways leading into campus has been decreased; (2) part of the B-lot parking area was removed for housing construction; (3) B-lot parking cost has increased from \$2.00 to \$4.00 per day.

Figure 2.1 Transit Arrival and Departure Profile (Fall 1997 and Fall 2003)



- Increase of Transit Service Since 1997

Transit service to and from UBC each day has increased since 1997, including increase service in Route 99-B Line, Route 44 express from downtown, and all day service on Route 480 from Richmond Center.

- Improvements to Bicycle Facilities and Services

In order to increase the number of cyclists riding to and from UBC, new bicycle lanes have been constructed on several roadways leading to UBC and new bicycle racks and lockers have been added on-campus.

- UBC Carpooling/Vanpooling Program

The UBC Carpooling Program was implemented in 2001 to help commuters organize carpools in an effort to reduce the number of SOV coming to campus. Discounts on parking permits and rewards such as gift certificates and vehicle maintenance vouchers are given to drivers who join the program. There is also a vanpooling program available at UBC through the Jack Bell Foundation.

2.2: Analysis of the Traffic Count Data

2.2.1: UBC Population and Growth

Based on the full- and part-time enrollment, staff and faculty, UBC's daytime population has increased from 42,300 in 1997 to 50,800 in 2003, a 20% increase in the UBC population (shown in Table 2.1)

	1997	1998	1999	2000	2001	2002	2003
Total Population at UBC (headcount)	42,300	43,430	44,750	44,700	46,100	49,000	50,800
Overall Growth	20%						

²⁵ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

2.2.2: Analysis of Travel To and From UBC

To represent how people are traveling to/from UBC, person trips are used. A person trip is a one-way trip, to/from UBC, made by a single person. For example, a student traveling to and from UBC once per day would count as two person trips. From 1997 to 2003, there has been an increase of 11,700 person trips (11%), but part of this increase is due to population growth. Therefore, in order to take into account the growth of the UBC population, trip rates are used when comparing changes in travel patterns. The trip rate is the number of person or vehicle trips per person at UBC. From 1997 to 2003, the trip rate to/from UBC has decreased 7.6%. This means that fewer person or vehicle trips were made per person in the Fall of 2003. The data is summarized in Table 2.2.

Table 2.2 Analysis of Total Trips To/From UBC by Year (24-hour period) ²⁶									
	Fall 1997	Fall 2002	Fall 2003	Change from 1997 to 2002		Change from 2002 to 2003		Change from 1997 to 2003	
Total Daily Number of Person Trips	106,100	113,500	117,800	7,400	7.0%	4,300	3.8%	11,700	11.0%
Annual Daytime Total Population at UBC	42,300	49,000	50,800	6,700	15.8%	1,800	3.7%	8,500	20.1%
Trip Rates To/From UBC (24-hr person trips per capita)	2.51	2.32	2.32	-0.19	-7.7%	0.0026	0.1%	-0.19	-7.6%

2.2.3: Analysis of Person Trip by Mode To and From UBC

To determine how people have changed their mode of transportation to/from UBC campus, it is necessary to compare the yearly travel mode data (summarized in Table 2.3). Changes in person trips by mode to/from UBC show whether or not UBC has achieved its OCP commitments (further discussed in Section 2.5). The following are person trip changes by mode from 1997 to 2002, from 2002 to 2003 (before and after implementation of the U-Pass), and, overall, from 1997 to 2003:

- Single-occupant vehicle (SOV) person trips have increased 2,400 (5.2%) from 1997 to 2002, decreased 3,400 (7.0%) from 2002 to 2003, and, overall,

²⁶ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

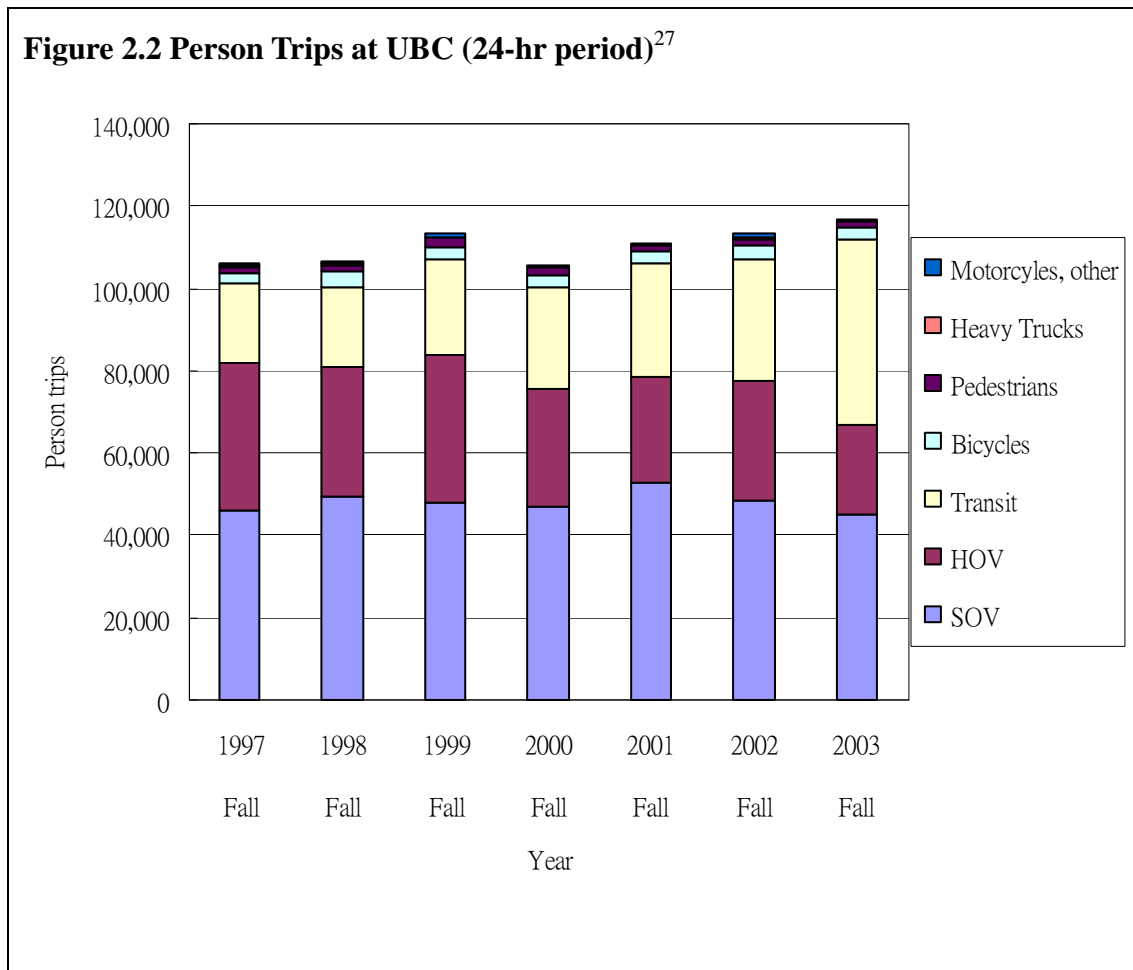
decreased 1,000 (2.2%) from 1997 to 2003.

- High occupancy vehicles (HOV) person trips have decreased 7,000 (19.4%) from 1997 to 2002, decreased 7,400 (25.4%) from 2002 to 2003, and, overall, decreased 14,400 (39.9%) from 1997 to 2003.
- Transit ridership person trips have increased 10,700 (56.3%) from 1997 to 2002, increased 15,700 (52.9%) from 2002 to 2003, and, overall, increased 26,400 (138.9%) from 1997 to 2003.
- Bicycle person trips have increased 600 (22.2%) from 1997 to 2002, decreased 500 (15.2%) from 2002 to 2003, and, overall, increased 100 (3.7%) from 1997 to 2003.
- Walking person trips have increased 200 (14.3%) person trips from 1997 to 2002, decreased 100 (6.3%) person trips from 2002 to 2003, and, overall, increased 100 (7.1%) person trips from 1997 to 2003.

Due to the growth of UBC population, the person trips of each mode should steadily increase. From 1997 to 2002, all modes of person trips have increased except HOV. One possible reason for causing the decrease in HOV is the modification of spreading out class start-times in September 2001. After the implementation of the U-Pass, all modes of person trips have decreased except transit, which is what is expected.

Figure 2.2 highlights the person trips changes in the three main transportation modes (SOV, HOV, and transit) from 1997 to 2003.

Figure 2.2 Person Trips at UBC (24-hr period)²⁷



2.2.4: Analysis of Trip Rates by Mode To and From UBC

The following are trip rate changes by mode from 1997 to 2002, from 2002 to 2003 (before and after implementation of the U-Pass), and, overall, from 1997 to 2003:

- SOV trip rate has decreased 9.2% from 1997 to 2002, increased 10.3% from 2002 to 2003, and, overall, increased 18.5% from 1997 to 2003.

²⁷ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

- HOV trip rate has decreased 30.4% from 1997 to 2002, decreased 28.1% from 2002 to 2003, and, overall, decreased 49.9% from 1997 to 2003.
- Transit ridership trip rate has increased 34.9% from 1997 to 2002, increased 47.4% from 2002 to 2003, and, overall, increased 99.0% from 1997 to 2003.
- Bicycle trip rate has increased 5.5% from 1997 to 2002, decreased 18.2% from 2002 to 2003, and, overall, decreased 13.6% from 1997 to 2003.
- Walking trip rate has decreased 1.3% from 1997 to 2002, decreased 9.6% from 2002 to 2003, and, overall, decreased 10.8% from 1997 to 2003.

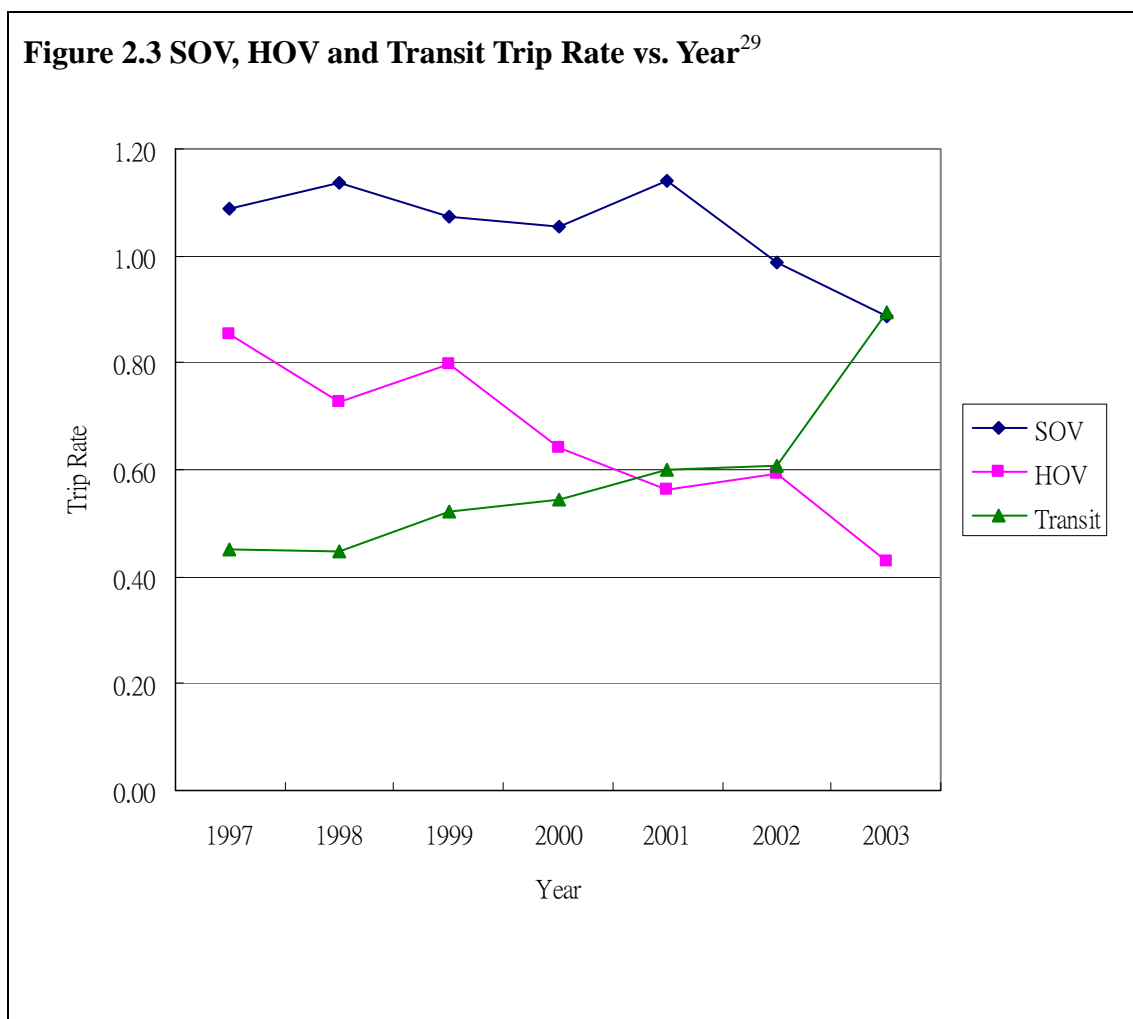
From 1997 to 2002, the numbers of SOV and HOV trips per person has decreased, and the number of transit and bicycle trips per person has increased. This is due to people increasingly using transit and bicycle instead of SOV and HOV. From 2002 to 2003, all modes of transportation have decreased except transit. Even though the implementation of U-Pass has caused SOV and HOV trip rates to decrease, it has also decreased bicycle and walking trip rates, which is not what was intended.

	Mode	Fall	Fall	Fall	Change from		Change from		Change from	
		1997	2002	2003	1997 to 2002		2002 to 2003		1997 to 2003	
Person trips	SOV	46,000	48,400	45,000	2,400	5.2%	-3,400	-7.0%	-1,000	-2.2%
	HOV	36,100	29,100	21,700	-7,000	-19.4%	-7,400	-25.4%	-14,400	-39.9%
	Transit	19,000	29,700	45,400	10,700	56.3%	15,700	52.9%	26,400	138.9%
	Bicycles	2,700	3,300	2,800	600	22.2%	-500	-15.2%	100	3.7%
	Pedestrians	1,400	1,600	1,500	200	14.3%	-100	-6.3%	100	7.1%
	Heavy Trucks	300	400	300	100	33.3%	-100	-25.0%	0	0.0%
	Motorcycles, other	600	1,000	1,100	400	66.7%	100	10.0%	500	83.3%
	Total	106,100	113,500	117,800	7,400	7.0%	4,300	3.8%	11,700	11.0%
	Daytime campus population	42,300	49,000	50,800	6,700	15.8%	1,800	3.7%	8,500	20.1%
Trip rates	SOV	1.09	0.99	0.89	-0.10	-9.2%	-0.102	-10.3%	-0.20	-18.5%

²⁸ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004.
<<http://www.trek.ubc.ca/>>

HOV	0.85	0.59	0.43	-0.26	-30.4%	-0.17	-28.1%	-0.43	-49.9%
Transit	0.45	0.61	0.89	0.16	34.9%	0.29	47.4%	0.44	99.0%
Bicycles	0.064	0.067	0.055	0.0035	5.5%	-0.012	-18.2%	-0.009	-13.6%
Pedestrians	0.033	0.033	0.030	-0.00044	-1.3%	-0.003	-9.6%	-0.004	-10.8%

Figure 2.3 highlights the trip rate changes in the three main transportation modes from 1997 to 2003. As shown in the figure, the transit trip rate has increased steadily from 1997 to 2002 and significantly after implementation of U-Pass, while SOV and HOV trip rates have fluctuated (but overall decreased) from 1997 to 2002 and decreased after implementation of U-Pass.



²⁹ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

2.2.5: Analysis of Mode Split To and From UBC

While person trips and trip rates analysis show the approximate number of trips taken per person over a 24-hr period, the mode split give the relative proportions of each travel mode used in a particular time period. The mode split data to/from UBC (Table 2.4) shows how travel pattern to/from UBC has changed since 1997. The following are the major changes in travel patterns:

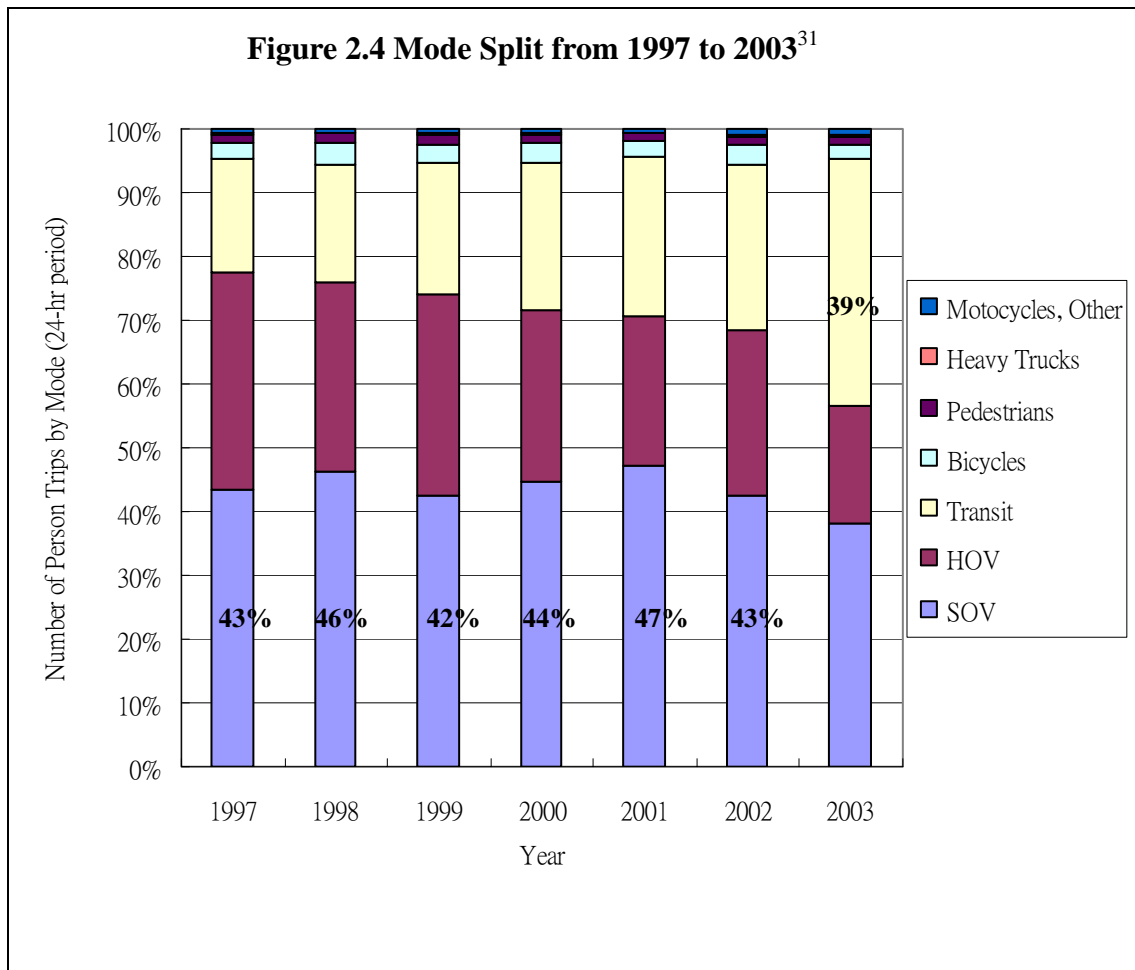
- From 1997 to 2002, there was a shift of approximately 8% of total trips from using the HOV as main mode of transportation to using the transit as the main mode of transportation. Other mode shares stayed approximately the same.
- From 2002 to present, the dominant mode of transportation has changed from the SOV to transit. Mode shares of SOV, HOV, bicycles, pedestrians, heavy trucks, motorcycles, and other, have decreased since 2002, and the transit mode share has increased by 12.7% since 2002 and 21.0% since 1997.

Mode	Fall 1997		Fall 2002		Fall 2003	
	Trips	Mode Share	Trips	Mode Share	Trips	Mode Share
SOV	46,000	43.4%	48,400	42.6%	45,000	38.2%
HOV	36,100	34.0%	29,100	25.6%	21,700	18.4%
Transit	19,000	17.9%	29,700	26.2%	45,400	38.5%
Bicycles	2,700	2.5%	3,300	2.9%	2,800	2.4%
Pedestrians	1,400	1.3%	1,600	1.4%	1,500	1.3%
Heavy Trucks	300	0.28%	400	0.35%	300	0.3%
Motorcycles, other	600	0.57%	1,000	0.88%	1100	0.9%
Total	106,100	100.0%	113,500	100.0%	117,800	100.0%

Figure 2.4 gives a graphical picture of the change in travel patterns by transportation mode split, and the main transportation mode of that year is shown as a percentage on the graph.

³⁰ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

Figure 2.4 Mode Split from 1997 to 2003³¹



2.3: Comparison of UBC Transportation Patterns with UBC OCP Commitment

As stated in the OCP in 1997, UBC is committed to

- reduce SOV travel to/from UBC by 20% (as compared with the 1997 levels) by 2002 (year of the first OCP review),
- increase transit ridership to/from UBC by 20% (as compared with the 1997

³¹ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

levels) by 2002 (year of the first OCP review),

- reduce heavy truck (defined by the City of Vancouver’s bylaw as vehicle that has a gross vehicle weight greater than 4500 kg and three or more axles in tandem) travel to/from UBC,
- implement a U-Pass program.

The Fall 1997 benchmark levels and the targets and actual travel pattern for Fall 2002 are listed in Table 2.5. The Fall 2002 targets are found by calculating a 20% reduction in SOV trips and a 20% increase in transit trips from the 1997 levels. For reducing heavy truck travel, UBC has set a limit of 300 truck trips per day. The heavy truck trips per 24-hr period data are summarized in Table 2.6 and Figure 2.5.

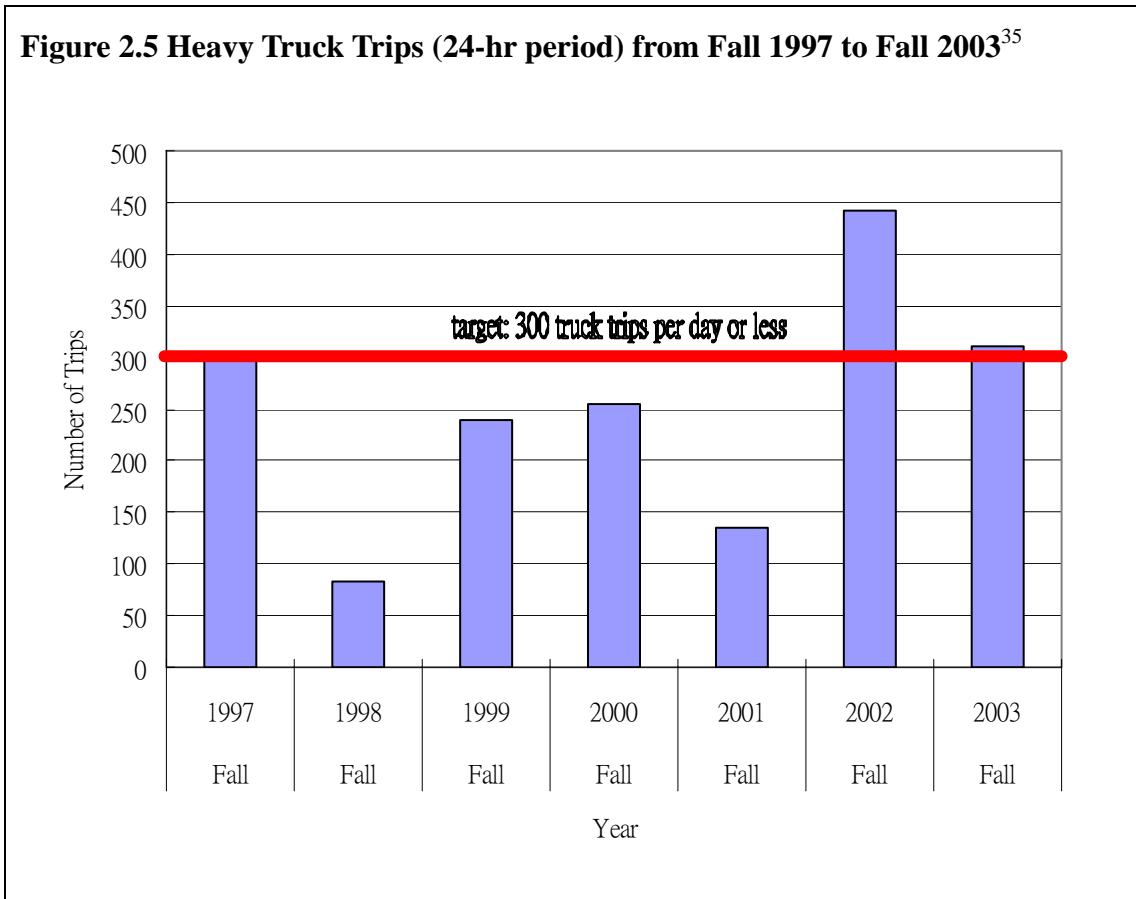
Mode	Fall 1997	OCP Fall	Fall	Difference between	
	Benchmark	2002 Targets	2002	2002 and OCP Targets	
SOV	46,000	36,800	48,400	11,600	31.5%
Transit	19,000	22,800	29,700	6,900	30.3%

³² UBC TREK Program Center. UBC Strategic Transportation Plan. Nov. 1999. 20 Jan 2004
 <<http://www.trek.ubc.ca/>>

³³ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

	Fall 1997	Fall 1998	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Heavy Trucks Trips	298	83	240	254	136	443	311

Figure 2.5 Heavy Truck Trips (24-hr period) from Fall 1997 to Fall 2003³⁵



³⁴ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

³⁵ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

By Fall 2002, UBC has accomplished its goal of increasing transit ridership by 20% from the 1997 levels, but has not successfully reduced SOV by 20% nor implemented the U-Pass or reduced heavy truck travel. By Fall 2003, UBC has implemented the U-Pass, but still has not reduced SOV by 20% and heavy truck travel. Table 2.8 summarizes the status of UBC OCP objectives in 2002 (the year that the targets are supposed to be achieved) and 2003. The Fall 1997 benchmark levels and the targets and actual travel pattern for Fall 2003 are tabulated in Table 2.7. The SOV person trips in 2003 is only 1000 below the 1997 level and is still 8,200 (22.2%) higher than the OCP target. Figure 2.6 gives a graphical representation of the 1997 benchmark, OCP 2002 targets and 2003 actual travel patterns. The travel patterns and changes will be further discussed and analyzed in Section 5.0.

Mode	Fall 1997	OCP Fall	Fall	Difference between	
	Benchmark	2003 Targets	2003	2003 and OCP Targets	
SOV	46,000	36,800	45,000	8,200	22.3%
Transit	19,000	22,800	45,400	22,600	99.1%

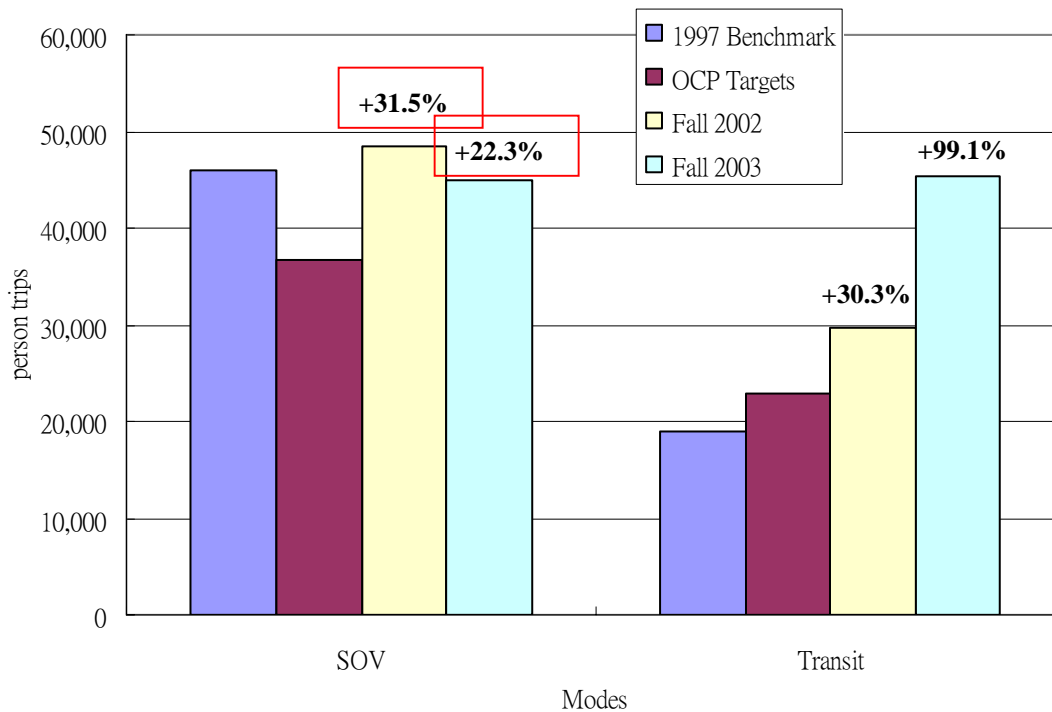
³⁶ UBC TREK Program Center. UBC Strategic Transportation Plan. Nov. 1999. 20 Jan 2004
<<http://www.trek.ubc.ca/>>

³⁷ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

OCP Objective	Status as of Fall 2002	Status as of Fall 2003
20% reduction in SOV	✗	✗
20% increase in transit ridership	✓	✓
Reduction in heavy truck travel	✗	✗
U-Pass implementation	✗	✓

Figure 2.6 SOV and Transit Rider-ship Benchmark, Targets, and 2002 and 2003

Travel Patterns^{39,40}



³⁸ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program Center. Mar. 2004. 10 Mar 2004. <<http://www.trek.ubc.ca/>>

³⁹ UBC TREK Program Center. UBC Strategic Transportation Plan. Nov. 1999. 20 Jan 2004 <<http://www.trek.ubc.ca/>>

⁴⁰ Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003. UBC TREK Program

3.0: Other U-Pass Programs

The UBC U-Pass is very similar to the systems that will be analyzed in the following sections. After a brief outline of some of the other U-Pass programs, a comparison of the different passes will be made.

While there are a large amount of universities that employ some type of U-Pass, in one form or another, it is interesting to note that a very limited amount of study has gone into analyzing the effects of these systems. Many of the programs have only recently been implemented and perhaps, as in the case of UBC, there has not been time for detailed analysis. Also, studies done by administrative bodies such as TREK, are not often published and are difficult to locate. There are benefits to studying the effects of a U-Pass program. The information gathered can be used to implement new programs in a more effective manner, to identify the main issues underlying student transportation decisions, and to help increase transit ridership at universities which already have a U-Pass

Although there is no typical way to evaluate a U-Pass program, there are several commonly used indicators of effectiveness. Modal shift patterns are of great interest in the studies encountered while researching this paper. Also common are parking changes, such as decline in permit purchases, spaces saved or money saved by not needing to create more parking. Environmental effects are also briefly mentioned in most of the studies, usually converting trips saved into a reduction in emissions of greenhouse gas, volatile organics and particulate matter.

The quality and validity of surveys is also a matter of importance. Most of the studies cited in this thesis conducted studies which are representative of the student body and pose questions which can be analyzed with statistics. However, due to a lack of time and statistical expertise, our survey is very limited in terms of its statistical validity. The TREK survey that is currently being run will be analyzed professionally and the results will not be available for a few years. Also, a number of the studies show results collected at much earlier dates than would be desirable. The up-to-date versions of these studies may not have been published yet or may not have even been conducted. Following is an outline of 4 universities experiences with a U-Pass program.

3.1: University of Wisconsin, Milwaukee

The University of Wisconsin is located near Lake Michigan and a few miles from the central business district. There are 11 transit routes to the University, 5 of which are express buses. In addition to transit, the campus offers a UPARK program. This is when a student drives to a satellite parking lot 3-5 miles away from campus and is then shuttled to central campus. There are approximately 24,000 students attending classes at the University. Of these, 2100 live on campus dorms while the rest live varying distances from the university. The majority (approximately 55%) of these students drive to school alone⁴¹. This reliance on cars has caused a lot of parking problems at

⁴¹ James Meyer and Edward A. Beimborn, "An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass Program", January 14, 1998

the university.

In the fall of 1994, the University introduced its U-Pass program. This pass allowed students unlimited access to the Milwaukee County Transit System (MCTS) during school semesters. The program's goals were to reduce single occupant vehicle (SOV) trips, reduce parking strain and reduce the effects of traffic congestion and air pollution. The pass fee is currently \$31 US per student per semester. In order to maintain the low per student price of the pass, students cannot opt out of the program. Student support for the pass is very high. A survey taken in the fall of 1994 (after implementation) shows that 90.4% of students strongly or somewhat support the U-Pass⁴². In spring 1995 a follow up survey reports this dropped to 86.9%. Of all survey respondents (from both 94 and 95) 90% said that the program should continue to run.

There was a significant switch in mode shares (or mode split) to campus after the implementation of the U-Pass. As can be seen by table 3.1.1, there was a large change in transit mode split. Prior to U-Pass, 12% of students used transit whereas after the U-Pass this rose to 26%, a 116% increase in ridership ($26-12/12 \times 100\% = 116\%$). SOV use also dropped significantly. Prior to the U-Pass, 54% of students drove to school alone this dropped to 41% after the U-Pass was implemented. Of SOV drivers, this is a 24% reduction.

⁴² James Meyer and Edward A. Beimborn, "An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass Program", January 14, 1998

Table 3.1.1: Changes in mode-split after U-Pass implementation⁴³

Mode Split	Spring 94	Fall 94	%change
Car (SOV)	54%	41%	-24%
Transit	12%	26%	116%
UPARK	17%	15%	-12%
Walk	14%	16%	14%
Bike	3%	2%	-33%

Table 3.1.2: Breakdown of mode split⁴⁴

<i>Spring 1994</i>	Drive Alone	MCTS	Drive/ MCTS	UPARK	Car pool	Walk/Other
Drive Alone	75.3	10.3	2.1	8.2	1.5	2.6
MCTS	9.8	70.5	1.6	3.3	4.9	9.8
Drive/MCTS	7.1	0	78.5	14.3	0	0
UPARK	19.0	8.6	3.4	58.6	1.7	8.6
Car pool	16.7	12.5	0	8.3	62.5	0
Walk/Other	5.4	27.7	0.9	2.7	0.9	62.5

The above table (3.1.2) indicates the percentage of each group that switched to another mode. For example, the “Drive alone” row on the upper left indicates that: 75.3% remained drive alone commuters, 10.3% switched to MCTS (transit), 2.1% chose a combination of driving and transit, etc.

⁴³ James Meyer and Edward A. Beimborn, “An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass Program”, January 14, 1998

⁴⁴ James Meyer and Edward A. Beimborn, “An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass Program”, January 14, 1998

The major trends to notice are the switches from the drive alone section. 10.3% changed from driving to using transit, 8.2% began using the UPARK and another 5% or so switched to other options. This was a 22% decrease in SOV mode split in the first semester of the U-Pass program. 8.6% of UPARK users began using transit alone as well. Another significant switch is the 28% of walkers who began using transit. This trend is similarly noticed at UBC.

There are also some significant benefits to the environment as a result of the U-Pass. From the mode split change, an estimated 221,055 vehicle trips were eliminated to and from campus (due to drivers switching to transit). Taking into account the average travel distance of students to the university, this reduced the vehicle miles traveled by 5,084,265. This is only to and from campus, which fails to take into account non-school trips made using the U-Pass, which may have been made by car before. This reduction in car usage prevented 244 pounds of volatile organic compounds, 264 pounds of nitrogen oxides and 1662 pounds of carbon monoxide from being emitted daily. The emissions decrease may be slightly lower since more buses were needed to meet increased demand. This also amounts to 242,108 gallons or \$295,371 worth of fuel saved per academic year. Based on the number of drivers switching to transit, the U-Pass saved \$1,490,000 needed for fuel, insurance and repair costs. All of these benefits were realized by implementing the U-Pass at a cost of \$1.2 million.

Students also felt that parking was easier to find. 19% said on campus parking was easier to find and 16% said the same was true for off campus parking. Therefore not

only transit users benefit from the U-Pass but also drivers.

3.2: University of Washington, Seattle

The University of Washington in Seattle had an enrolment of 39,196 students in 2003. The U-Pass has been in place for a long time at the University. It was implemented 13 years ago in 1991. The pass includes a late night shuttling service, discounts at merchants near the campus, free carpool and vanpool parking, vanpool subsidies and bicycle incentives. A major difference from many Universities is that the pass at the University of Washington is not mandatory. This is because the program is mostly funded by parking revenues, taxes and fines. The cost of the U-Pass for students in 1990 was \$20 US per academic quarter and as of 2002 was \$35 US. The U-Pass sales are shown below. This table does not take into account population growth.

Table 3.2.1: U-Pass sales⁴⁵

SALES:	Year 1991	Year 2002	% change
Student	24,289	31, 367	29
Faculty	6062	9800	62
Total*	36,518	46,737	27

(*) includes complimentary passes

⁴⁵ 2001-02 Washington U-PASS Annual Report
http://www.washington.edu/U-Pass/news_and_reports/reports.html

As of 2002, 86% of U-Pass holders were pleased. Of this 59% were very satisfied and 26% somewhat satisfied.

The campus also had a problem with parking and high traffic volumes. One of the program's major goals was to alleviate parking and traffic troubles. By increasing parking fees, introducing the pass and promoting telecommuting and compressed work weeks, these goals were accomplished. Parking fees were increased by 50% in the first year of implementation and an additional increase of 35% over the next 3 years. As of 1990 parking passes were \$72 US per quarter and in 2002 rose to \$196.32 US. As a result, many people decided to switch to the U-Pass. The net result since the introduction of the program was a decreased total use in parking spaces with an increased campus population. These points are shown in table 3.2.2.

Table 3.2.2: Parking statistics⁴⁶

SOV permits	Year 1990	Year 2002
Faculty and Staff	6440	4392
Students	1027	633

Commuter Parking Utilization	Year 1990	Year 2002
Spaces available	11,525	11,400
Average Vacant	1446	1720
Average Used	10,079	9680
Parking utilization	87%	85%

⁴⁶ 2001-02 Washington U-PASS Annual Report
http://www.washington.edu/U-Pass/news_and_reports/reports.html

The university also introduced pay-per-use parking, like that at UBC, where you pay each time you park. Drivers do not receive the savings they would on a pass, but if they drive less often, they pay less per term for parking. If a student buys a parking pass they also receive a free U-Pass card. This is in hopes that a driver will use the pass on days when there is construction, bad weather or other bad driving conditions. Drivers who are part of the U-Pass program and do not have a parking pass, can buy a booklet of tickets that lets you pay less on parking 2 times a week. Thus drivers have an incentive to use their cars only twice a week and take transit on the other days. To further persuade drivers to switch, the “Hold That Spot” program was created. If a student with a parking pass wishes to try the U-Pass, they can have their spot held for up to 6 months in case they want to switch back to driving. This alleviates the stress of having to re-wait through the waiting list if the U-Pass option does not work out.

Vanpools are also advertised and encouraged. All car and vanpools receive free parking on campus at priority spots. There are numerous monetary incentives to encourage the program including, amongst others, \$40 per month for gas.

Another interesting portion of the program was that sports tickets could be used as a transit ticket. Before this transit ridership to Husky stadium was 4.2% in 1984 and by 1997 rose to 20.6%.

Bicycle trips are also highly encouraged at the university. The U-Pass allows students, faculty and staff discounted rates on helmets, lights, parts and repairs.

As with the Wisconsin U-Pass, there were large modal shifts at the University of Washington following the implementation of a U-Pass.

Table 3.2.3: Percentage changes in mode from 1989 to 2002⁴⁷

Mode	Faculty	Staff	Students*
Transit	11 to 24	25 to 36	21 to 39
Carpool/Vanpool	11 to 16	15 to 15	9 to 9
Bicycle	9 to 9	6 to 5	9 to 4
Walk	7 to 6	6 to 4	31 to 31
Other	2 to 2	4 to 2	4 to 2
Drive	60 to 43	44 to 38	25 to 16

*Note: the student mode switch to transit is not fully accounted for by switches from other modes. This table was taken directly from the annual report where no explanation is given. The remainder may be due to increased school population.

Note the significant decrease in all areas of SOV travel. Among faculty a 23% reduction was noted. Staff reduced SOV travel by 6% and students decreased by 9%. Conversely, student transit ridership was up 18%, staff up 11% and faculty up 13%. From these modal shifts, an estimated 91 million car trips have been eliminated since 1991. Faculty car and vanpools have also increased since the U-Pass was implemented. Carpool participation has almost doubled and vanpool participation has almost tripled since the implementation of the U-Pass in 1990.

Despite the increased transit usage and decreased percentage of drivers, actual vehicle trips have been increasing. This is illustrated in table 3.2.4. This counter-intuitive fact is due to population growth. More people are attending classes

⁴⁷ 2001-02 Washington U-PASS Annual Report

than they were in 1991, but the percentage of SOV drivers amongst them has decreased. While this represents an increased amount of pollution, it would be a larger amount if the U-Pass was not implemented.

Table 3.2.4: Vehicle trips to and from campus⁴⁸

	Year 1991	Year 2002
Trips to Campus (7-9am)	6628	6738
Trips from campus (3-6pm)	8205	8951
Total Trips (24hrs)	56,316	60,010

As previously mentioned a large portion of the funding from the U-Pass is derived from the parking fees and fines. The list of costs is shown in table 3.2.5 and the funding in table 3.2.6⁴⁹.

Table 3.2.5: U-Pass costs

Operating costs	\$ Amount	% of Cost
Admin and monitoring	341,286	3
Marketing and PR	228,814	2
Transit service contracts	10,277,761	91
Car/vanpool and ridematch	149,447	1
Night ride shuttle	198,755	2
Pedestrian/bike improvements and other	127,160	1
TOTAL	11,323,223	100

http://www.washington.edu/U-Pass/news_and_reports/reports.html

⁴⁸ 2001-02 Washington U-PASS Annual Report

http://www.washington.edu/U-Pass/news_and_reports/reports.html

⁴⁹ 2001-02 Washington U-PASS Annual Report

Table3.2.6: U-Pass funding sources

Funding	\$ Amount	% of Cost
User fees	5,661,155	50
Parking Fees	4,128,578	37
Parking fine revenues	700,000	6
Other	833,490	7
TOTAL	11,323,223	100

As can be seen above, the vast majority of the cost goes to the transit authority for providing service. In total, the U-Pass costs the University approximately \$11.5 million. Half of the funding from this program comes from pass purchases. A large portion comes from parking fines and fees. It has been a very successful system to date in terms of reducing SOV use and increasing transit ridership and has received numerous local and national rewards.⁵⁰

3.3: University of California, Los Angeles (UCLA)

Los Angeles is famous for its air pollution and traffic congestion. The thought of dissuading people from driving their cars in LA would seem a daunting challenge. However, the BruinGO program was implemented in UCLA as a trial U-Pass system. The region has a number of transit companies, but for the BruinGO program only one of them participated. The Santa Monica Municipal bus lines serve most of Santa

http://www.washington.edu/U-Pass/news_and_reports/reports.html

⁵⁰ 2001-02 Washington U-PASS Annual Report

http://www.washington.edu/U-Pass/news_and_reports/reports.html

Monica, California and western Los Angeles. This network is referred to as the Blue Bus system.

The pilot project was run for eight months. Students, staff and faculty within the service area of the Blue Bus received electronic ID cards (similar to the UBC cards) which could be swiped into an electronic counter on the buses⁵¹. Cardholders received unlimited access to all Blue Bus routes. UCLA paid the Blue Bus 45 cents every time a card was swiped. For the trial period 1.4 million rides were counted and a total of \$640,000 was paid to the Blue Bus. With 62,700 eligible riders, this came out to \$1.27 per person per month, a significant discount from regular fair prices.

The transit company did not lose money but in fact increased its revenue. There was a significant rise in ridership on the Blue Bus system to UCLA.

Table 3.3.1: Ridership change at 5 other Southern California Universities⁵²

University	Ridership Change
CSU Los Angeles	+7%
CSU Northridge	-1%
CSU Long Beach	0%
SMC	-5%
UCLA	+73%

⁵¹ Jeffrey Brown, Daniel Hess, and Donald Shoup, "Fare-Free Public Transit at Universities: An Evaluation," *Journal of Planning Education and Research*, Vol 23, No. 1, Fall 2003.

⁵² Jeffrey Brown, Daniel Hess, and Donald Shoup, "Fare-Free Public Transit at Universities: An Evaluation," *Journal of Planning Education and Research*, Vol 23, No. 1, Fall 2003.

The other Universities were monitored as control groups to compare against UCLA. From this table it can be seen that a 73% increase was observed on the Blue Bus. Compared to other Universities nearby that experienced no or slight change, this increase is clearly the effect of the BruinGO program, since no other factors were changed in the other Universities. After the BruinGO program was introduced, the percentage of staff and students arriving by bus rose from 7.6% in 2000 to 13.1% in 2001. This is even more significant considering that this percentage had been falling for the previous years.

As with the other U-Pass programs seen in this paper, the mode split change after implementation demonstrates the effectiveness of the program.

Table 3.3.2: Mode split at UCLA inside the Blue Bus service area⁵³

FACULTY AND STAFF:	% Before BruinGo	% After BruinGo	% Change
Bus	9	20	134
Drive alone	46	42	-9
Car pool	13	9	-28
Vanpool	3	0	-85
Bike	4	3	-8
Walk	26	25	-5
STUDENTS:			
Bus	17	24	43
Drive alone	17	12	-33
Carpool	5	4	-16
Bike	5	3	-42
Walk	43	45	3

From the above table it can be seen that a 134% change in transit ridership for faculty and staff was observed. This large increase has promising implications for an Eco-Pass program, which will be discussed in a later section. However, the van pool participation at the school dropped drastically. This finding is similar to what has occurred at UBC. Student ridership increased by 43%. Also encouraging are the reduced number of drive alone travelers.

⁵³ Jeffrey Brown, Daniel Hess, and Donald Shoup, "Fare-Free Public Transit at Universities: An Evaluation," *Journal of Planning Education and Research*, Vol 23, No. 1, Fall 2003.

The study points to three reasons for ridership increase. The increase in transit agencies revenue allows them to invest in more bus service. This increased service then attracts more riders. Also, as people become more familiar with a bus system, they are more likely to use it to get to destinations which they may not have before. Lastly, some residential properties have found that properties advertising close access to the Blue Bus are selling well to students. This supports the suggestion that the U-Pass can affect where students choose to live. Therefore, after the implementation of the U-Pass, there are short and long term benefits for riders, the transit system and residential areas.

Those who drive also receive benefits from the BruinGO program. During the program, parking usage decreased significantly. 1000 parking spaces were freed up after implementation and the parking pass waiting list decreased. Most of the program is funded by parking fees, permits and fines. The costs and benefits are outlined in table 3.3.3.

Table 3.3.3: Costs and benefits of the BruinGO program⁵⁴

	Students	Faculty and Staff	University Departments	Visitors	Total
Total Cost	\$137,700	\$202,500	\$32,400	\$437,400	\$810,000
% of Cost	17	25	4	54	100
Reduced fare benefits	\$399,000	\$125,000	0	0	\$524,000
Reduced parking Demand	\$463,000	\$682,000	\$109,000	\$1,472,000	\$2,726,000
Total Benefit	\$862,000	\$807,000	\$109,000	\$1,472,000	\$3,250,000
% of benefit	27	25	3	45	100
Net Benefit	\$724,000	\$605,000	\$77,000	\$1,035,000	\$2,440,000

As can be seen from this table the benefits significantly outweigh the costs for all of those involved, especially students. Benefits in terms of reduced parking demand were calculated as follows.

UCLA recently built a 1500 capacity parking structure at a cost of \$47.3 million. This comes out to \$31,500 per parking space. It was thereby inferred that the university would be willing to spend this amount per space. The BruinGO program decreased parking demand by 1020 spaces. The percentage of spaces used by student, faculty and staff, visitor and department parking, gives the reduced demand benefit per

⁵⁴ Jeffrey Brown, Daniel Hess, and Donald Shoup, "Fare-Free Public Transit at Universities: An Evaluation," *Journal of Planning Education and Research*, Vol 23, No. 1, Fall 2003.

group of the 1020 spaces.

The environment benefited greatly from the BruinGO program. By saving 1020 spaces, an estimated 1.5 million trips were eliminated. Using average car output, travel distance etc. the emissions were reduced annually as follows:

- 87 tons of carbon dioxide
- 9 tons of nitrogen oxide
- 14 tons of reactive organic compounds
- 7 tons of particulate matter.

In LA this system was very successful since the transit system was running with very low ridership levels. Therefore, the increased ridership was easily accommodated on the existing buses. There was almost no need to increase bus service and therefore, the emissions saved are much more realistic than seen in Milwaukee.

The system has been very well received. Student, staff and faculty comments support this:

- *“BruinGO is one of the smartest things UCLA has done in years. With this program, I feel UCLA is finally showing it cares for students.”*
- *“I love the BruinGO system. I gave up my parking permit because of it!”*
- *“I save about 10\$ weekly, getting back and forth from school. 40\$ a month buys a lot of groceries.”*
- *“I use the Blue Bus for meetings in Wilshire Center at least three days a week. BruinGO saves a lot of time since I don’t have to find parking and also saves*

UCLA money because I don't need validation. Not to mention the Wilshire traffic!"

3.4: University of Colorado, Boulder

3.4.1: Student U-Pass

The University of Colorado at Boulder has a student U-Pass and a faculty/staff Eco-Pass. First, the student U-Pass will be briefly summarized. The following information comes from Poinatte and Toor⁵⁵.

The student bus pass program arose after the University proposed two new parking structures for 1990-91 without student notification and input. In response to this action, an alternative transportation group emerged and set goals to increase pedestrian, bike and transit use. Working together with the University and the city, the group began collaborating to form a student bus pass program.

After an initial plan was created a poll was conducted to estimate student support. A 4 to 1 ratio was observed in favour of establishing the pass. After the survey a \$10 fee was imposed on students to raise the needed \$550,000 for the program. The regional transit district (RTD) argued that more funding would be needed. This was negated when it was shown that student use would not coincide with peak hour travel.

Six years after implementation, transit ridership has increased from 300,000 to 1,500,000 trips. According to a survey, 42% of these new rides would have been

⁵⁵ Poinatte, Francois and Toor, Will, "Finding a New Way: Campus Transportation for the 21st Century", April 1999

made by car if not for the pass. Biannual surveys indicate that from 1990 to 1998 student ridership has increased 550%. The program has received awards for increasing student mobility and decreasing pollution. An estimated 3.2-6.5 million trips by car have been eliminated per year, preventing 1700-3000 tons of greenhouse gases from entering the atmosphere, not taking into account the increased number of buses.

The increased financial support of the program allowed expansion. The HOP and SKIP shuttle bus systems were created with funding from the U-Pass program. The HOP shuttle bus runs frequently from the University to downtown and the major commercial shopping area in an efficient loop. SKIP shuttle buses travel north and south spanning the city and stopping at the university along the way. These services have since been increased when students voted 16 to 1 in favour of a \$5 increase in fees (bringing the total to \$19.42). Now students receive free transit service to the Denver international airport, local ski mountains and other regional trips that would cost a significant amount if normal fares were paid.

As seen in other U-Pass systems, student driving rates decreased. At \$72-\$120 per semester for parking, the students found it cheaper to use transit or other means. This reduced the need for more parking spaces and structures as the campus population grew, not to mention the need to purchase additional land for parking.

The mode split data from Boulder tells the story:

In 1990, 35.9 % of all trips were on foot, 17.6% of all trips were taken by bicycle; 18.9 % by carpool; 23.8% by single occupant vehicle (SOV); 2.3 % by dorm shuttles, and

1.5% by transit. After five years of program operation, these numbers shifted significantly. In 1996 39.8% were on foot; 19.9% by bicycle; 18.3% by carpool, 14.6% by SOV, 4.2% by transit, and 3.2% by dorm shuttle. Note the large decline in SOV use, and the significant increases in walking, biking and transit. (Poinsatte and Toor 1999)

This vastly successful program was achieved because of the co-operation of students, the University, the city and the RTD. Due to the effectiveness of the student program, the Eco-Pass was developed for faculty and staff.

3.4.2: Faculty and Staff Eco-Pass

The initial implementation of the faculty and staff eco-pass was slow, due to legal restrictions. Laws needed to be changed to remove limitations on employee benefits. The pass can be obtained by all permanent position employees and entails the same benefits of the student pass: free transit on all RTD routes, HOP and SKIP shuttles and even free taxi rides in the case of an emergency.

Parking revenues were proposed as a funding source but doubts were raised and a feasibility study was conducted. The cost was estimated to be \$500,000: \$380,000 for RTD contracts and \$120,000 for administrative fees. In order for the program to proceed, the parking net revenue needed to be \$1.58 million. Changes in parking behavior needed to be taken into account if the pass was to be implemented. At the time 62% of faculty and staff drove to school (55% having parking permits), 13% on transit and the remainder by carpool, bike or walking. The price elasticity of parking

was also calculated. Results showed that even a 25% increase in parking cost would only cause a 4% decrease in parking use. Therefore, the study suggested a 10% increase in parking in the first year and a 15% increase over the next 3 years to fund the program. The study estimated that ridership would increase by 68% with 320,000 trips increasing to 540,000 after Eco-pass implementation. Parking demand would also decrease, freeing up 320 spaces and saving the University \$2.6-3.2 million in parking structure costs that would normally have been needed in the next 5 years.

Even though parking revenue would have been sufficient to fund the program, complaints were made by some faculty members and the net result was that 30% of the program was covered by parking revenue. 49% was covered by the general university fund and the remaining 21% from a head tax. The total budget for the first year was \$110,000 lower than anticipated since RTD decreased its fee. Furthermore, the city of Boulder contributed 25% of the total contract, to be phased out over the next five years.

After implementation 500 of the 5600 faculty and staff were surveyed. Bus ridership increased from 4935 to 9090 after implementation of the Eco-pass. This was an 84% increase, greater than the 68% predicted by the feasibility study. Parking rates had also lowered, freeing up 147 spaces per day, a 5.69% decrease. The savings of these spaces are compared to a structure that would carry an additional 147 spaces in figure 3.4.2.

COMPARATIVE ANNUAL COST ANALYSIS: THE UNIVERSITY OF COLORADO EMPLOYEE BUS PASS COMPARED TO ALTERNATIVE STRATEGY OF INVESTING IN ADDITIONAL PARKING STRUCTURES.

This analysis was performed by the Parking and Transit services division at CU-Boulder as an analysis of the first year of the new employee bus pass program. The technique should be applicable at other schools.

Summary:

Parking demand was reduced by approximately 147 spaces via the faculty/staff Eco Pass program at a cost of \$1,354/yr./parking space. A new parking structure to accommodate the same demand would cost an estimated \$1,866 in principal & interest per additional space.

In its first year, by reducing parking demand by 147 spaces, the Eco Pass program appears to yield net savings of \$512 per parking space, or \$74,889 gross savings over the cost of adding 147 new parking spaces.

TOTAL 1998 F/S ECO PASS COST TO CU **\$199,606**

Now let us consider the cost of meeting this demand through constructing a parking structure. The costs shown in the following table are to construct a two-story parking garage over an existing surface parking lot. These costs do not include cost of land, operation, maintenance, repair, or demolition. Also, these numbers may change substantially in the following year, as costs and ridership are both projected to increase.

Costs to Reduce Parking Demand

Number of parking spaces "freed up" by the the faculty/staff pass	147
Cost to free up each parking space using the eco-pass program	\$1,351

Cost to Provide Same Number of Additional Spaces in a New Parking Structure

Number of spaces in existing lot	147
Number of spaces in new structure	294
Net number of parking spaces added	147
Cost per space for construction	\$8,200
Architectural & Engineering Contingency and Bond Issue per space	\$2,050
Cost per space to build	\$10,250
Projected construction cost	\$3,013,500
Cost for Interest	\$2,456,388
Total Cost to Build and Finance including P&I	\$5,469,888
Annual Debt Service Payments	\$273,494

Savings from Eco-Pass Program

Annual cost for new parking space	\$1,866
Annual cost to free up space using eco-pass	\$1,351
Annual savings per space using Eco-pass program	\$512
Annual Debt Service for Garage	\$273,495
Annual savings per space using Eco-pass program	\$199,606
Net Annual Eco-Pass Savings	\$73,888

Figure 3.4.2: Comparing cost of Eco-pass to parking garage of similar capacity.

3.5: Eco-Pass in Santa Clara Valley (Silicon Valley)

The Eco-Pass at Santa Clara Valley is different from that in Boulder, Colorado. This Eco-pass was implemented by a number of companies in the region. The motivation here is for a different reason but achieves the same effect.

Businesses are required by law (throughout North America) to provide parking spaces for their employees. A company has the option to pay an “in-lieu” fee instead of building/providing parking. Donald Shoup suggests that an alternative of this in-lieu fee could be managing parking demand through the implementation of an Eco-pass system.⁵⁶

The cost of the Eco-pass per employee annually depends on the size of the company, since larger companies may require the transit agency to increase bus coverage. Likewise, the price is also dependent on the service received by the commuters. The transit agency must negotiate this price with the employer. Table 3.5.1 summarizes the prices in the Santa Clara Valley.

⁵⁶ Shoup, Donald. "In Lieu of Required Parking", *Journal of Planning Education and Research*, Vol. 18, No. 4, Summer 1999, pp. 307-320.

Table 3.5.1: Price per employee per year in Santa Clara Valley Transport Authority (SCVTA)⁵⁷

Service	Number of Employees		
	1-99	100-4999	5000+
Downtown San Jose (heavy transit coverage)	\$80	\$60	\$40
Bus and Light rail	\$60	\$40	\$20
Bus only	\$40	\$20	\$10

The study found that after eco-pass implementation, SOV use in the region decreased from 76% to 60%. Consequently transit usage increased from 11% to 27%. These modal shifts caused a 19% decrease in parking demand. Again, this decrease in parking demand saves space and money. Shoup calculates that a \$1/year investment in an eco-pass can save \$23-337.

Currently in Silicon Valley, 40,000 eco-passes are in use while in Denver 38,000 are in use. An eco-pass could also be used for events such as concerts, plays in large theatres and sporting events. As mentioned previously, Seattle Husky fans are able to use game tickets as a transit pass. Eco-pass also has implications for large scale residential complexes. The buildings could use the pass as a marketing strategy, to attract transit users. This tactic would be especially effective in areas with good transit

⁵⁷ Shoup, Donald. "In Lieu of Required Parking", *Journal of Planning Education and Research*, Vol. 18, No. 4, Summer 1999, pp. 307-320.

service (such as downtown cores). Hotels could even give temporary eco-passes to visitors, eliminating the need to build large parking lots. This could also attract visitors who do not wish to drive. Many hotels across the world already offer shuttles to tourist locations nearby.

However, as of now using an eco-pass does not allow companies to avoid the in-lieu fee of providing parking. In order to make the eco-pass more appealing the laws in North America regarding required parking and in-lieu fees must change to allow reducing parking demand to be another alternative.

3.6: How Should U-Pass Programs Be Compared?

What makes a good U-Pass? Does a good U-Pass: increase ridership on transit, decrease SOV use, improve traffic congestion, reduce harmful emissions and promote alternative transit methods? It may be a combination of these factors since they are all important. How should one go about comparing these factors?

To effectively compare systems, they must actually be comparable! For this reason modal split is usually used. Actually reducing SOV trips appears to be the main goal of many of the U-Pass programs, since by doing so traffic congestion is lessened, air pollution lowered and parking demand reduced. Yet actual SOV trips eliminated may not be a comparable statistic, due to the fact that Universities are of different size. Since mode split is a percentage, it makes comparison more valid. As can be seen with some of the universities studied, SOV modal percent dropped while actual vehicle trips increased. If vehicle trips were used instead of modal split, it would appear that SOV

use is continuously increasing, despite any U-Pass incentives to use transit. Yet the modal split percentage can also be deceiving. A “low” 2% reduction in SOV mode split may actually mean thousands of less vehicle trips for a large university, whereas a 20% reduction at a smaller university may account to only hundreds less vehicle trips. An alternative to vehicle trips or modal split is person trips. A person trip is a one way trip to a destination made by a certain mode. Thus it effectively allows one to compare mode and actual trip data.

Another issue that arose in comparing the universities was the different criteria used to measure the U-Pass effect on parking. Some studies showed how parking utilization changed, others put a monetary value on reduced demand and others simply stated the number of spots saved. It should be possible to convert the different data into each other since the demand is per space based. Since monetary values may differ by location (due to parking construction costs, space availability etc.) it should not be used as a comparison. Since size of schools is also variable, this would make spaces saved somewhat misleading. The criteria used to study the effects of the U-Pass should therefore be measured in terms of utilization. For example, if parking spaces were being used at 90% of capacity before U-Pass and then 85% after U-Pass, it can be a valid comparison between universities of all size. One flaw in using utilization is that sometimes Universities remove parking lots because of a successful U-Pass. This would make the parking utilization increase since more people would be forced into a different lot. Perhaps it should be noted if any parking lots were removed, this would allow the necessary adjustments to be made. Overall, utilization appears to be the most

valid form of comparison in regards to parking effects of the U-Pass.

3.7: Comparisons of Other U-Pass programs to the UBC U-Pass

The UBC U-Pass has displayed a number of changes similar to those found in other studies. Transit ridership, SOV modal changes and parking aspects will be compared in this section. A summary of the transit ridership changes in the first year after implementation of a U-Pass is presented below in figure 3.7.1. While person trips may be the best form of comparison, they were only used at UBC, so modal split is used instead.

Figure 3.7.1: Transit ridership, as a modal percentage at selected locations

Location	Pre-U-Pass	Post-U-Pass	% change
University of Wisconsin, Milwaukee	12%	26%	116%
University of Washington, Seattle (students)	21%	39%	86%
UCLA (students)	17%	24%	43%
University of Colorado, Boulder ⁵⁸	1.5%	4.2%	180%
Santa Clara Valley Eco-pass	11%	27%	145%
UBC	26%	39%	50%

⁵⁸ Miller J, “Transportation on College and University Campuses: A Synthesis of Transit Practice”, TCRP Synthesis 39, Transit Cooperative Research Program, Transportation Research Board, 2001

As can be seen by the graph, the UBC U-Pass has increased ridership by 50%, however this is one of the lowest percentages amongst the studied universities. It must be mentioned that the goal target was a 20% change, so according to this, the U-Pass has been effective. In addition, prior to U-Pass fare-free cards, other incentives have increased transit ridership, so this must be taken into account. A comparison of SOV modal percentages follows (again, person trips would have been optimal but is impossible due to lack of this data from other universities).

Figure 3.71: SOV modal split as a % before and after U-Pass.

Location	Pre-U-Pass	Post-U-Pass	% change
University of Wisconsin, Milwaukee	54%	41%	-24%
University of Washington, Seattle (students)	25%	16%	-36%
UCLA (students)	17%	12%	-29%
University of Colorado, Boulder	24%	15%	-60%
Santa Clara Valley Eco-pass	76%	60%	-21%
UBC	43%	39%	-9%

Again, modal change in SOV at UBC was the lowest change recorded amongst the studied Universities. This shows that the U-Pass has so far not been very effective

at dissuading SOV travel.

Parking pass statistics were also commonly analyzed amongst the studied universities. This portion of comparison is difficult to compare since the studies employed different gauges to measure the effects on parking, such as reduced usage, monetary savings or surveys reflecting driver’s opinions on the change in parking availability. However, the most comparable statistic is parking utilization, figure 3.72 shows how utilization changed immediately after U-Pass implementation.

Figure 3.72: Parking utilization

Location	Pre-U-Pass	Post-U-Pass	% change
University of Washington, Seattle (students)	87	79	-9%
UBC			
Parkades:	87%	78%	-10%
B-Lots:	90%	71%	-21%
UCLA	100%	100%	0%
Santa Clara Valley Eco-Pass	NA	NA	-19%*

* % of reduced parking demand, not a direct measurement of utilization.

We were unable to find parking utilization rates for many of the Universities. However, compared to the University of Washington, UBC appears to be right on track and is doing quite well in regards to the B-Lot parking. However, it must be noted that

due to construction on campus some of the B-lot is closed and people cannot park there. This fact may not have been taken into account when data was collected.

An unforeseen effect of the U-Pass has been to decrease HOV travel. Compared to 1997 levels, HOV trips per person (taking into account population and enrolment growth) have decreased by 50%. This result was similarly seen in some other U-Pass programs.

Looking at the charts, the UBC U-Pass has low modal shift changes. While the net effects are positive, the results are not as significant as those observed at other universities. (Perhaps the survey will help to explain these results.) However, the university is very close to achieving some of the goals set out in 1997. But could we be expecting more from UBC?

4.0 UBC U-Pass Program Survey

4.1 Survey on UBC Students' Responses On The UBC U-Pass Program

4.1.1 Method

Subjects will be approached randomly at a UBC parking lot, the UBC bus loop, and near on-campus student housing during the hours of 9am-5pm on a school day. Subjects will be asked to read the cover letter on the survey and to complete the attached questionnaire if they consent to participating in the study. A minimum of sixty questionnaires will be given to people whose main mode of transportation to UBC is the bus. A minimum of sixty questionnaires will be given to people whose main mode of transportation to UBC is a car. A minimum of thirty questionnaires will be given to people who live on campus. No identifying information such as a name or an address will be asked on the questionnaire. The information gathered by the survey will be compiled into graphs and charts and compared with similar data gathered at other universities with fare-free student transportation plans.

4.1.2 Survey Design

Although the survey design went through many revisions, the final copy still had some features which made analysis difficult. A copy of the survey form is in appendix D.

In the first question the survey failed to distinguish between calendar year and school year when asking for the student's main mode of transportation during the previous year.

The next question asked the students why they chose their current mode of transportation. Many people circled more than one answer making analysis of this question difficult.

Later in the questionnaire respondents were asked to answer questions on a one to five basis. According to some survey design experts our numbering should have been the other way around to promote ease of understanding. These question stems were positively framed which has been shown in other surveys on the u-pass to positively skew the data⁵⁹. In many questions the survey failed to provide a not applicable or don't know choice. As a result many people who lived on campus had difficulty answering these questions.

"I live on campus" was included as a mode choice as well as a living location. This led to complications later on when not everyone who lived on campus chose the I live on campus option on how they travelled to school.

An additional last question, asking for other comments was added half way through our survey.

Too little space was left for responses where writing was required.

The location of administering the survey most likely skewed the results. The survey was conducted inside the Student Union Building, at the bus loop, at parking facilities and at other locations around campus. The vast majority of people surveyed however were either at the bus loop or at the SUB. In these places the overwhelming majority of respondents were bus riders.

The posters advertising the survey to possible respondents were cheery, had lots of colour and designs and were placed on bright pink and blue posters. The happy appearance of the posters might have encouraged pro-U-Pass people to fill out a survey while deterring anti-U-Pass sentiment. The survey administrators were repeatedly asked whether they worked for Translink. This might have influenced some people to include or exclude certain commentaries on their experiences with the U-Pass. In conducting the survey candy was used as an incentive. Although no data on the gender of the respondent was gathered, through observation the majority of the respondents were female. If women and men have different responses then this could also slant the data.⁶⁰

For all of the above reasons, this survey is not useful to examine statistically. We do however feel that brief comparisons between groups of people in the survey are cautiously useful and so we have included a brief report below of our findings of student responses for different travel modes and living location. The results reported in the tables below are rounded means.

4.2: Summary of Responses

4.2.1: Responses for different modes

The following overview of our survey results is based both on median reported answers and on answer distribution. The medians are presented in appendix

⁵⁹ Dowlatabadi Interview

⁶⁰ Dowlatabadi Interview

A and the distributions in appendix C.

Students driving to school responded, on medium, that the nearest bus stop to their residences was between 5 and 10 blocks away. 50% of drivers also responded that they had to make an average of 2 transit transfers in order to get to UBC while for all other modes the majority of the responses fell within the 0 to 1 transfer range. These results suggest that car drivers may choose to use their mode as the overall convenience of walking a substantial distance in order to get to a bus stop, and then having to transfer between busses, is outweighed by the convenience of driving a vehicle from doorstep to doorstep (despite the higher costs associated with driving).

This is probably the same reason for why 14 out of 21 car respondents answered “no” when asked if they used the U-Pass for trips other than those to UBC. In all other modes at least 75% of the respondents answered “yes” to this question. All modes, aside from the more evenly distributed answers of campus residents, tended to disagree with the statement: “I go home more often during breaks at UBC because of the U-Pass.” For the bus mode this result is somewhat surprising as 73% of riders said that they did not need to make more than 1 transfer in order to get to school, while 44% said they did not need to make any transfers. 71% of bus riders also reported that less than 5 blocks needed to be walked in order to get to the nearest bus stop. These two factors might suggest that going home by transit between classes should be relatively easy. However, considering the frequency and duration of breaks between classes, combined with the time needed for waiting for busses and walking to and from the bus stop, even short trips may be more hassle than they are worth. This inconvenience is further

amplified by the fact that 58% of riders reported their estimated travel time to UBC to be between 30 minutes and over 1 hour.

On the issue of influence of the U-Pass on choice of next year's location of residence, 80% of car drivers and 75 % of bikers disagreed (disagreed to strongly disagreed) with the statement: "I expect the U-Pass to influence where I live next year." Answers from bus riders were a little more evenly distributed, although, still, 48% disagreed, while 34% agreed or strongly agreed, and 18% remained neutral. In preliminary discussions amongst our project group members we had a strong hunch that U-Pass implementation would likely have a significant influence over where people chose to live next year, however, these results suggest otherwise. There are a few possible explanations for this, one being that the availability of affordable student housing on and off campus is significantly limited in Vancouver, making it difficult for a renter to be particularly choosy about where to live. "Particularly choosy" in this case should be loosely defined as trying to find an apartment/house with the specific condition of it being close to a direct to UBC serviced bus stop, or B-Line stop. It is probably of paramount important to choose a location within a radius of convenience from the university campus. That radius has been suggested by some to be about 10 km, so it could be hypothesized that as long as a reasonably affordable place of residence is found within this radius, the subordinate criteria for choice of dwelling become significantly less important.

There also may not yet exist significant enough of incentive for living near a transit stop as during this first year of the U-Pass implementation, the Translink

network has been plagued with overcrowded busses passing waiting passengers during peak time periods.

It is likely however, that these problems will be dissipated with the addition of more busses and expansion of rapid transit routes like the B-Line, or any spin off alternative modes of rapid transit to UBC. When that happens, the trend observed in our survey might change dramatically in terms of the U-Pass being able to play a bigger influence in choices of housing location. Conversely, it may happen that if commuting by transit along rapid corridors becomes much more efficient than along other subordinate routes, rental rates for dwellings near these corridors could increase. It is beyond the scope of our study to investigate whether or not this is already happening, or could possibly happen, but if this was the case, it could be interpreted as one negative implication of the U-Pass program.

A final explanation to consider is that a large proportion of students living off campus, especially those in undergraduate programs, still live at home with their parents. It would be very unlikely that U-Pass availability would influence a change in their residential distribution, or play a major role in a decision made to move out

To the statement: “U-Pass will make or has made me less likely to own a car in Vancouver”, drivers were the only group to disagree by large majority (76%), carpoolers’ answers were evenly distributed, while bus, bike, and campus modes unanimously agreed (60% or greater agreement). Disagreement by drivers may also partially be explained by the previously suggested argument that as long as a car owner’s residence is inconveniently out of range of a transit stop, this mode of

transport will continue to be relied upon for commuting to UBC. The same reasoning can be applied for the more subjective question-statement: “U-Pass makes it more convenient/pleasant to get to campus.”, to which only drivers did not agree with, although 35% of driving respondents answered neutrally to this question. This may suggest that a certain proportion of drivers are entirely unaware of the implications of transit use.

As for the U-Pass’s influence on trips made not for the purpose of attending classes at UBC, it was clear that the bus, bike and campus modes benefited from it’s implementation as all agreed by majority that the pass made it easier to access amenities, and off and on campus entertainment events. Drivers and carpoolers (less strongly) disagreed with statements 13-16 that the U-Pass makes non school related activities more accessible. In hindsight it would have been interesting to have included a question to get an idea of, on average, how many times a month drivers use their mandatory-issue U-Passes. Their argument for making the subscription optional, and their responses to this survey, might carry significantly less clout if it happened that their pass usage came close to, or exceeded 10 individual trips, which equals the monthly cost of \$20 for the U-Pass. It would probably be unlikely that a driver, especially for aforementioned reasons, would bother to do things like go grocery shopping or banking, etc. on transit. But, for activities such as going out downtown, it might make more sense to take bus or skytrain in order to avoid the associated inconveniences with having to park, and possibly leave an automobile in the city center.

The statement: “the U-Pass influences, or will influence my choice of job, or whether or not to take a job at all, while going to UBC.”, did not elicit a clear majority response from bus riders with 40% in agreement, 35% in disagreement, and 24% neutral or indifferent.

A similar answer distribution was observed for on campus residents, while, surprisingly, carpoolers agreed with a majority of 62.5% to the statement. Car drivers were in general disagreement of 75% (strongly 60%). It may still be too early for people to consciously be taking into consideration the U-Pass when looking for employment. It would make sense that there exists more of an incentive for campus residents to consider taking a job off campus if the former transportation cost of \$64 for a monthly bus pass, is no longer a limiting factor. For the rest of the modes, likely explanations for the responses could simply be that once again drivers experience significant inconveniences in using transit to commute to more serious engagements, and that bus riders have the same incentives as they do in traveling to school, as they do to work through use of the U-Pass.

Question 17, the statement of: “The U-Pass has made it easier to find parking on campus.”, is flawed in that it contains no response for “not applicable” and thus forces respondents who’ve already committed to the mode of bus, to answer based on an assumed part-time alternate mode use of car. However, the fact that UBC is continually expanding residential housing complexes into the B and C lots, and using the U-Pass, to partly justify this decreased parking convenience, is evident in the response of the drivers who disagreed with the statement by a 57% majority. Still 19% of them said

they “didn’t know”, so it will be interesting to see how that number changes as the effects of dwindling parking lot availability become more pronounced. It is also interesting to report that of those bus riders this year who drove to school last year, there was strong disagreement (still need this chart) to the statement that U-Pass has made on campus parking more convenient.

For the final all-mode-inclusive question, both bus, and bike (strongly), agreed by majority of 75% or more that overall, the U-Pass makes UBC a more attractive university. Campus residents also agreed with a majority of 62% and car drivers responded the following: agree (agree & strongly agree) = 38%, neutral = 10%, disagree (disagree & strongly) = 33%, don’t know = 19%. Considering the number of times in this survey that drivers responded negatively to U-Pass implementation, this result was surprising. It is somewhat of an acknowledgement that programs like the U-Pass are important attributes of a quality academic institution, regardless of whether it is applicable to everyone it includes.

Many respondents with whom we casually spoke to while conducting the survey griped about the fact that busses have become unbearably full since the U-Pass program’s implementation last September. Therefore it was interesting to see that these complaints were validated through the last two survey questions. Bus and bike reported that they experienced a seat-less bus ride to UBC about 50% of the time, this percentage was significantly less for trips from UBC (bus=25%, bike, 10%). For bike this also could have been interpreted as percentage of time the forward bike racks were full upon pickup, but our survey, in it’s scope, fails to make this distinction. It is

definitely true that departures from campus are more leisurely in time restriction to arrivals, making transit loading much more staggered and not in the form of sharp “waves” of students.

A major problem with this question is that it leaves no room for car drivers who occasionally use the bus for trips other than to UBC to comment on the level of crowding they experience on those occasions. Since most of the car and campus and bike respondents answered this question anyway, it is worth looking at their responses keeping in mind that trip purpose is very unclear here.

Since car and campus modes probably use the U-Pass more for leisurely activities, and shopping on their own time (especially in the case of campus residents going to upper w. 10th and kits for groceries), they are less likely to experience the crunch of peak hour transit loading. For this reason it is understandable that on both trips to and from campus (which are not necessarily trips to and from campus for lack of an alternate wording of the question) percentage of seatless trips was at the most 25%.

4.2.2: Summary of mode splits for different residential areas

In order to get an idea of the mode split for different residential areas in the GVRD, we classified our survey respondents by their area codes in the following manner:

Burnaby: V5C, V5J, V5K, V3M, V3N, V5B, V5E, V5G, V5H

Campus: V6T

Coquitlam: V3B, V3L, V3H, V3J

Downtown: V6B, V6E, V6G, V6H

East Vancouver: V5S, V5P, V5X, V5N, V5R, V5V, V5W, V5L, V5M, V5T, V5Y

North Vancouver: V7N, V7S, V7J, V7L, V7P, V7R

Richmond: V6V, V6X, V7E, V7A, V4L, V4M, V7C, V4K, V6W

South of 33rd Avenue: V6M, V6P, V9C, V6M, V6N

Surrey: V3R, V3W, V4C

UBC to Granville (N. of 33rd): V6L, V6R, V6S, V6K, V6J

It was then possible to calculate the relative proportions of students traveling by car, carpool, bus, or bike, from each of these commuting-source areas.

For the downtown area all 7 respondents reported using public transit as their current mode for commuting to UBC. This was not surprising considering the inconveniences associated with keeping a car either downtown or on campus. For the residential area located immediately next to UBC to the North of 33rd Ave. the mode split was predominated by bus riders (89%), with an N=43. Only 2% drove, likewise for carpoolers, while 7% or 3 respondents rode a bike to school. Out of the total 211 survey respondents, only 4 said they used a bike as current mode of transportation, and it seemed to make sense that 3 of those riders lived relatively close to campus. Under the 10 year GVRD outlook plan the amount of money spent annually on maintaining, and improving bike routes will be raised from \$2 million, to \$6 million, which many pro-bike lobby groups suggest is still not enough of a funding increase. Still, it should

be interesting to track changes in the proportion of those students biking to school, when the new money is pumped into better facilities.

East Vancouver saw a slightly lower proportion of bus riders than the UBC to Granville area, although it was still quite high at 84%. Car use was up at 9%, carpool at 5% and the only other biker to answer our survey also came from this area.

Burnaby exhibited mode split proportions similar to East Van with a slightly lower percentage of bus riders and slightly higher percentages of car and carpoolers.

For the area within the city of Vancouver from 33rd Ave. southwards, the proportion of riders dropped to 79%. Car drivers and poolers increased (14% & 7% respectively) while there were no bikers for this or the rest of the other residential areas studied. Currently there are no rapid transit routes in this area, and service on the alternative routes, 25th Ave, and 41st/S.W. Marine Dr. is below adequate standards. Over the past two terms, the frequency at which the #25 bus has been passing students waiting to go to school has even caused some frustrated individuals to dub the U-Pass as the “Pass-U” program. During off peak hours busses along this route come every 30 minutes, which can cause simple trips from UBC to Oak St. to last sometimes more than an hour in duration. For these reasons the increase in car ridership for this area is easily understood.

Getting out of the city of Vancouver, dramatic increases in the car mode are observed. For the Richmond area there were 5 drivers and 2 carpoolers out of 20 respondents. Still, 65% of students living there took the bus to school a result most likely attributed to the 98-BLine service which acts as a rapid transit link between

Richmond and the Broadway 99BLine route.

Farther south there were only 4 respondents living in Surrey, with 2 driving and 2 using transit. Because the N is so low, it is hard to make any worthy explanations about this mode split.

North Vancouver residents are plagued by traffic bottle necks of both the Lion's Gate, and Second Narrows bridges. Despite the existence of bus-priority lanes leading up to these bridges, most transit commutes from North Van to UBC require at least 2 transfers. This significantly hinders the convenience of using this mode, not to mention the heavy traffic congestion that busses and private alike experience when battling through the city center during peak commuting hours. In this area, out of 9 respondents, 4 reported a mode of car and the rest transit.

Finally in Coquitlam from a total of 8 respondents 2 drove, 2 carpooled, and 4 bussed in. Though the N is small here, it seems bus mode proportion of 50% is still significant considering the distance of this area from UBC. Despite the fact that Coquitlam has been promised a new rapid transit link into Vancouver for years, any money that would have potentially been used for this project over at least the next 5 years will be diverted into the costly RAV project. This has left local MLA's questioning the integrity of the GVTA's decisions as Coquitlam has much more potential to increase its population density than Richmond does. Under the Agricultural Land Reserve act of British Columbia, Richmond's urban expansion into existing farmlands is now heavily restricted.

Below is a table summarizing the differences in proportion of students using the

mode of public transit between this year and last year, for each of the nine examined areas. Calculations for last year's mode discluded those students who were not present at UBC at that time.

% Bus riders	Last year	This year	Change
UBC to Granville	60	89	+29%
Vancouver south of 33 rd	50	79	+29%
Downtown	83	100	+17%
East Vancouver	74	84	+10%
Burnaby	17	80	+63%
North Vancouver	0	56	+56%
Coquitlam	29	50	+21%
Richmond	33	65	+32%
Surrey	50	50	0%

When the percent increases from this table are averaged, we attain a general transit ridership increase of 28.55%. This increase is substantially greater than TREK's reported ridership increase of 13%. Reasons for this difference most likely lie in the inherent flaws of our survey as previously mentioned. However, despite the small scale of our study, the increases we see here are not trivial. If the U-Pass's key aim was to dramatically increase the number of students traveling to UBC by bus, it has most likely succeeded.

5.0: Analysis

5.1: Brief summary of findings

Immediately after U-Pass implementation there was a large change in modal shares. Transit ridership increased 50% while SOV decreased 9% and HOV decreased 31%. The transit increase is relatively low compared to other universities. This low percentage increase is misleading, UBC's transit mode share is, in absolute terms, the highest observed in our study. Buses are crowded and would not allow further increases in ridership at peak times. The SOV decrease is the smallest observed in all of the studied universities. HOV mode share decreased due to participants switching to transit. The UBC U-Pass costs students \$20/month. The full price paid to Translink per student is \$23/month. This is higher than any other school we looked at.

5.2: Possible explanations

There is no Skytrain, or subway service to UBC and UBC is located on a peninsula away from the city center. The geography of the different universities may not be the same and could account for some of the differences observed. When comparing UBC mode split to that of other schools this needs to be kept in mind. Also, this is the first year of implementation of the U-Pass at UBC. Other schools have seen increases in transit use, decrease in SOV etc. over the course of a few years after implementation. Keeping this in mind, here are some explanations for the trends that we found:

Low transit ridership increase:

According to TREK this low percentage increase is explained by the high ridership prior to the U-Pass⁶¹. Due to this high ridership, peak hour buses were already at capacity and could not meet the increased demand caused by the fare free U-Pass. Although bus service to UBC has increased, Translink must remain revenue-neutral and so cannot immediately provide all of the needed buses. Other issues include that SOV users are inconveniently located away from major bus routes to UBC. Over time, this ridership may further increase as more buses are added and people become more familiar with the transit system.

Low SOV decrease:

There are a number of factors contributing to the low decrease. Many students at UBC travel from places such as New Westminister and North Vancouver. Of the people surveyed, those whose primary mode of transportation to UBC was an SOV replied that they required on average 2 transfers to get to UBC by bus.

High HOV decrease:

Most of the increase in transit ridership is matched by a decrease in HOV ridership. The main effect of the U-Pass in terms of mode split is that it switched HOV riders into bus riders. There are a number of possible explanations for why HOV riders have been

more sensitive to the U-Pass than have SOV riders:

- 1) HOV riders have to co-ordinate a carpool. There is a certain amount of hassle involved which is avoided if one takes the bus.
- 2) HOV riders are less likely to have unlimited access to a car than are SOV riders. They are also likely under more financial pressure as they opt for the hassles of a carpool over having to pay single-handedly for the operation and maintenance of a car. The U-Pass as a pre-paid system offers the thrifty student a free way to get to and from school.

Cost of U-Pass:

Transit has a large mode share at UBC which means that Translink has to be compensated for more trips per U-Pass holder than do other service providers at other universities. Also, before the U-Pass many students already took transit. The busses were at capacity. It is much more expensive to provide additional service than it is to simply pick up more passengers in an empty bus.

5.3: Shortcomings of our study

Research:

Most of our data was taken from TREK and other administrative bodies at other universities. These bodies have an interest in favorably portraying their transportation

⁶¹ Carol interview

system. An independent monitoring agency would be ideal for monitoring both the suitability of their goals and their progress towards them. There is not, however, such a body and so we used TREK, and the other administrative bodies' data without questioning its veracity. One possible problem with the TREK's vehicle count data is the location of the count. An estimated 100 commuters per day drive to just outside of the count perimeter, park there to avoid parking fees, and take the bus from there. These people are counted as bus riders even though their main form of transportation to UBC is a car. Another problem with TREK's vehicle count data is that they include the trips taken by non-student on-campus residents, which are not accounted for in the daytime UBC population. The data collected from these administrative bodies is not always in a comparable form. This makes comparison of the results of different universities transportation programs difficult. Also, there are many external influences such as location of the university and quality of the transit service provided to the university that we did not take into account when comparing their experiences with the U-Pass. Taking these factors into account are beyond the scope of this thesis. There is a lack of analysis and data collection on the effect of U-Pass systems. This severely limited our choices of which U-Pass systems to examine.

Survey:

The survey had problems both in its format and in its administration. The people surveyed are not representational of the UBC population. A more in-depth and statistically significant study is being conducted by TREK. The results of this survey

will likely be much more useful in assessing the impact of the U-Pass on UBC students. This data however will not be available for a few years. For deadline reasons, their survey data could not be used in this thesis.

5.4: Further Research

TREK is one of the administrative bodies which has undertaken the most analysis and data collection of any U-Pass. There is limited availability of similar in-depth data from most other universities using a U-Pass system. A standard way of recording mode-split data and a standard survey questionnaire form would enable more meaningful comparisons between universities. Likewise, a common set of criteria for evaluating a transportation program would help to clarify the objectives of these programs. A good next step in this study would be to examine the number of buses provided for service to UBC in 2003, 2004 and Translink's plans for expansion in the coming years. This would provide some information to help understand the problem of over crowdedness on the busses. A closer examination of why SOV ridership has not dropped as expected with the U-Pass would be an interesting further course of study. Continued monitoring both in the form of surveys and in vehicle count data is critical to being able to better understand the effects of a U-Pass system.

5.5: Recommendations for transportation at UBC

Switching SOV riders to transit riders has proven to be a difficult task. Many SOV riders live outside the reach of easily accessible transit. Perhaps strategies aimed

at increasing HOV participation would be more effective at reducing SOV usage than more transit benefits.

This raises the issue of the OCP goals. Transit ridership was at near capacity prior to U-Pass implementation. The 20% increase in transit mode was met prior to implementation of the U-Pass. Therefore, more focus should be aimed at converting SOV's to HOV's.

Any initiatives aimed at decreasing the crowdedness on peak time busses to UBC would meet with great approval from bus riders.

6.0: Conclusion

Transportation Demand Management strategies such as the U-Pass are limited in the amount of change they can effect on mode split by land use patterns and public transit infrastructure. UBC may be approaching that limit.

UBC has the highest transit mode share but one of the lowest increases in transit mode share after U-Pass implementation observed in our study. Most of this increase is due to former HOV users who now take the bus. The most common complaint expressed on our survey was that the busses were too crowded. The average SOV riders had to take two transfers- 3 buses- to get to UBC and lived more that 5 blocks away from a bus stop. This makes transit inconvenient, a fact that can not be overcome by a pre-paid ststem like the U-Pass.

The growth predictions from the OCP state that the on-campus population at UBC will double within the next 20 years.⁶² This, when combined with increased enrollment at UBC will mean a lot more traffic. The U-Pass was required by the OCP to mitigate the congestion caused by growth. The U-Pass will not however be able to completely solve the problem. This in not to say that it is useless only that other programs, such as dedicating large portions of the increased housing on campus to students and increasing the public transit infrastructure which services UBC, are also needed.

⁶² OCP document

APPENDIX A:

Survey responses by mode split (median reported values). *(questions 9-17 are answered on a scale of 1-5 where 1 represents strong agreement and 5 strong disagreement, questions 16 and 17 include a response option #6 for “don’t know”)

Question #:	3.	6.	7.	8.	9.	10.
Mode	What is your average travel time to UBC?	How many transfers needing to be made to get to UBC?	Nearest bus stop to your home with direct service to UBC	Do you use transit trips not to UBC?	I go home more often during breaks at UBC because of the UPass	I expect UPass to influence where I live next year
Car	30-60 minutes	Over 2	5-10 blocks away	No	5	5
Bus	30-60 minutes	1	<5 blocks away	Yes	4	3
Bike	<10 minutes	1	<5 blocks away	Yes	4.5	4.5
Campus	N/A	1	<5 blocks away	Yes	3	3
Question #:	11.	12.	13.	14.	15.	
Mode	UPass will make or has made me less likely to own a car in Vancouver	UPass makes it more convenient & pleasant to get to campus	UPass makes it easier to attend entertainment events off campus	UPass makes it easier to attend entertainment events on campus	UPass has enabled easier access to amenities (eg. Grocery stores)	
Car	5	3	4	4	5	
Bus	2	2	2	2	2	
Bike	1.5	1.5	1.5	1.5	3	
Campus	2	1	1	3	1	
Question #:	16.	17.	18.	19.	20.	
Mode	The UPass influences or will influence my choice of job, or whether or not to take a job at all, while going to UBC	The UPass has made it easier to find parking on campus	Considering cost & convenience, the UPass makes UBC a more attractive university	(bus riders only): What fraction of time do you ride TO without a seat?	(bus only): What fraction of the time do you ride FROM UBC without a seat?	
Car	5	5	4	25%	10%	
Bus	3	6	2	50%	25%	
Bike	3.5	4	1	50%	25%	
Campus	3	6	2	25%	25%	

Survey responses by residential distribution (median reported values). *(same conditions for above table apply)

Question #:	3.	6.	7.	8.	9.	10.
Area	What is your average travel time to UBC?	How many transfers needing to be made to get to UBC	Nearest bus stop to your home with direct service to UBC	Do you use transit trips not to UBC	I go home more often during breaks at UBC because of the UPass	I expect UPass to influence where I live next year
East Van	30-60 minutes	1	<5 blocks away	Yes	4	4
Burnaby	30-60 minutes	Over 2	5-10 blocks away	Yes	5	4
Campus	N/A	0	<5 blocks away	Yes	3	2
Coquitlam	>1 hour	Over 2	5-10 blocks away	No/Yes (even)	4.5	3.5
Downtown	30-60 minutes	1	5-10 blocks away	Yes	5	3
North Van	>1 hour	Don't know	5-10 blocks away	Yes	5	4
Richmond	30-60 minutes	Over 2	5-10 blocks away	Yes	4.5	4.5
Van. S. of 33rd	10-30 minutes	1	5-10 blocks away	Yes	3	4
Surrey	>1 hour	Don't know	5-10 blocks away	No/Yes (even)	5	3
UBC to Granville	10-30 minutes	0	<5 blocks away	Yes	4	3

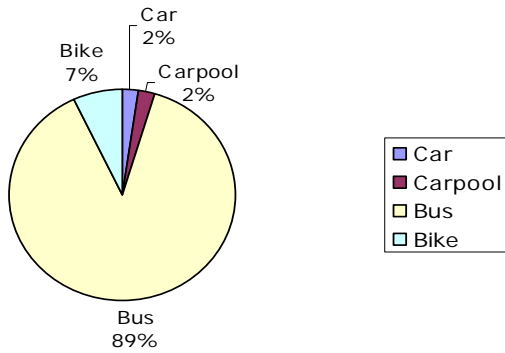
Question #:	11.	12.	13.	14.	15.
Area	UPass will make or has made me less likely to own a car in Vancouver	UPass makes it more convenient/pleasant to get to campus	UPass makes it easier to attend entertainment events off campus	UPass makes it easier to attend entertainment events on campus	UPass has enabled easier access to amenities (eg. Grocery stores)
East Van	2	2	3	2	2
Burnaby	3	2	2	2	3
Campus	2	1	1	3	2
Coquitlam	2	3.5	3.5	2.5	3
Downtown	1	3	2	2	2
North Van	3	3	2	2.5	2
Richmond	3	2	3	3	3
Van. S. of 33rd	2	2	2.5	2	2
Surrey	3.5	3.5	3.5	4.5	4.5

UBC to Granville	2	2	2	2	2
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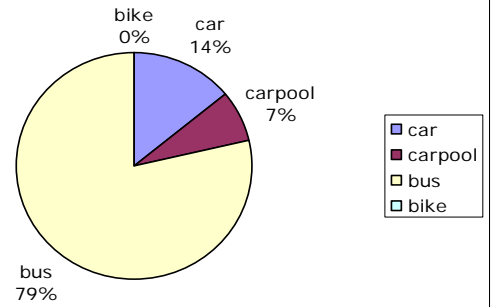
Question #:	16.	17.	18.	19.	20.
Area	The UPass influences or will influence my choice of job, or whether or not to take a job at all, while going to UBC	The UPass has made it easier to find parking on campus	Considering cost & convenience, the UPass makes UBC a more attractive university	(bus riders only): What fraction of time do you ride TO without a seat?	(bus only): What fraction of the time do you ride FROM UBC without a seat?
East Van	2	6	2	25%	10%
Burnaby	3	6	2	10%	10%
Campus	3	6	2	25%	25%
Coquitlam	2	4	2	25%	25%
Downtown	3	6	2	25%	25%
North Van	2.5	4	2	25%	10%
Richmond	3	3	2	25%	50%
Van. S. of 33rd	4	5.5	2	50%	25%
Surrey	4.5	5	4	50%	25%
UBC to Granville	3	6	2	50%	25%

Appendix B:

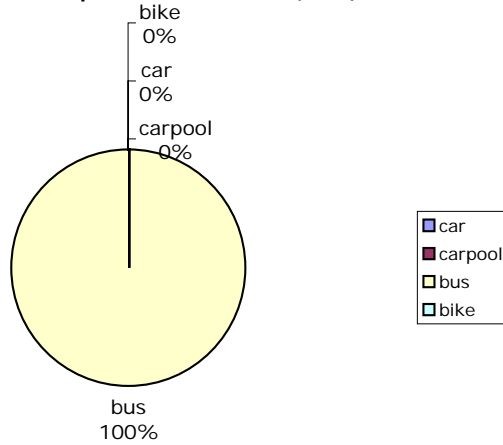
Mode Split for UBC to Granville THIS YEAR (N=43)



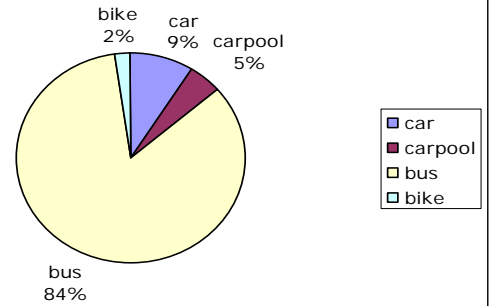
Mode Split S. of 33rd (N=14)



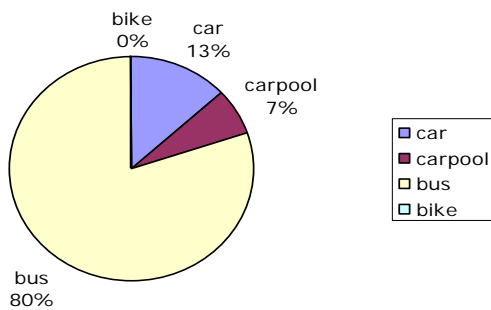
Mode Split for Downtown (N=7)



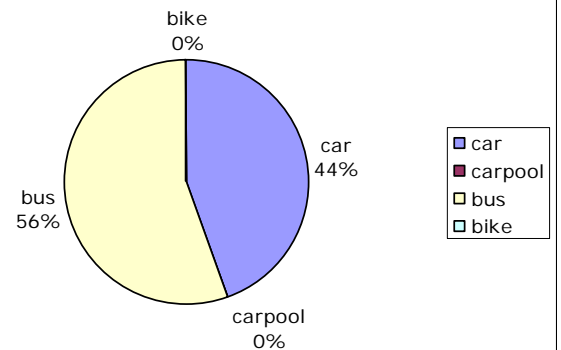
Mode Split East Van (N=42)



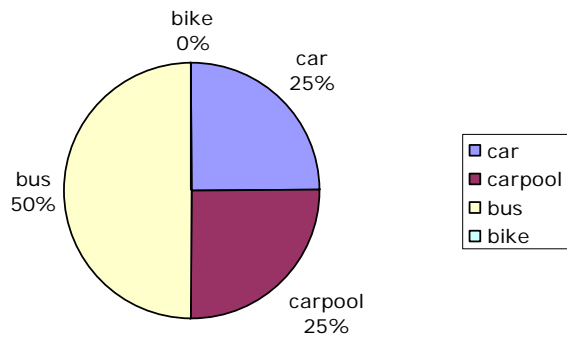
Mode Split Burnaby (N=15)



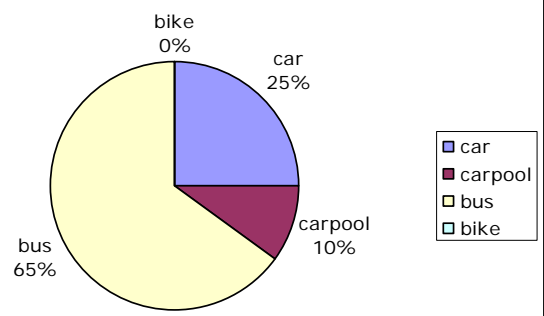
Mode Split North Van. (N=9)



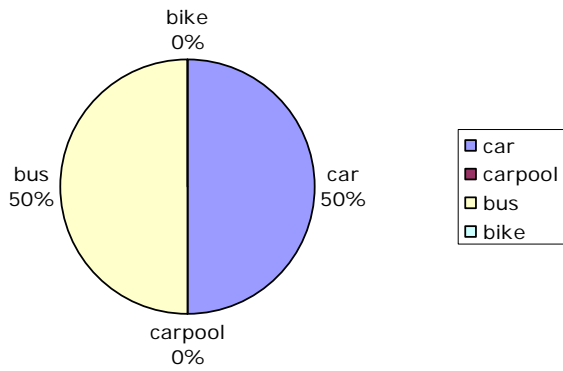
Mode Split Coquitlam (N=8)



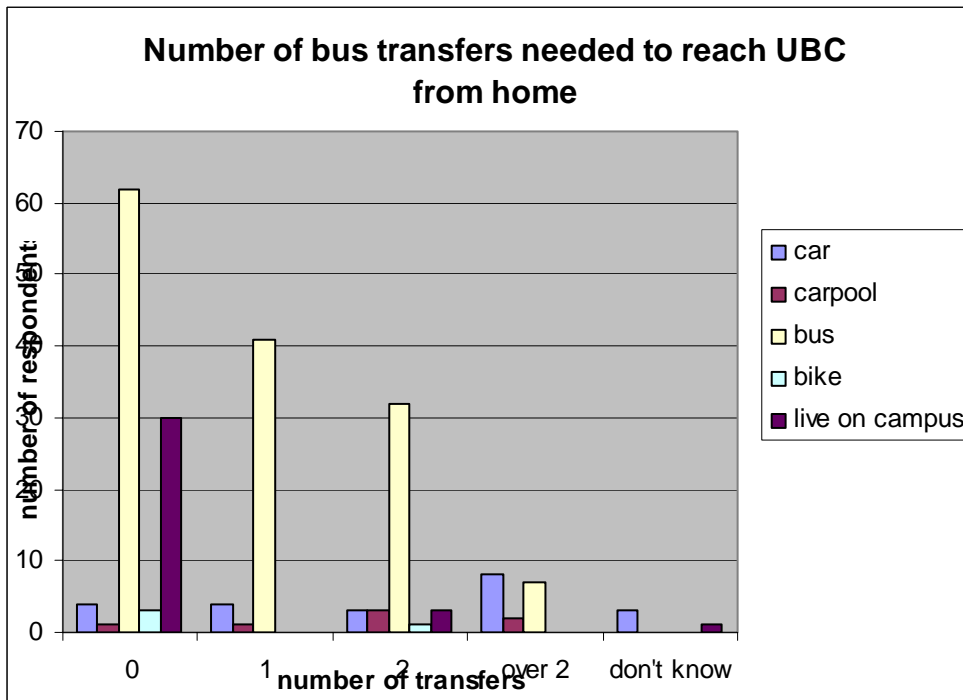
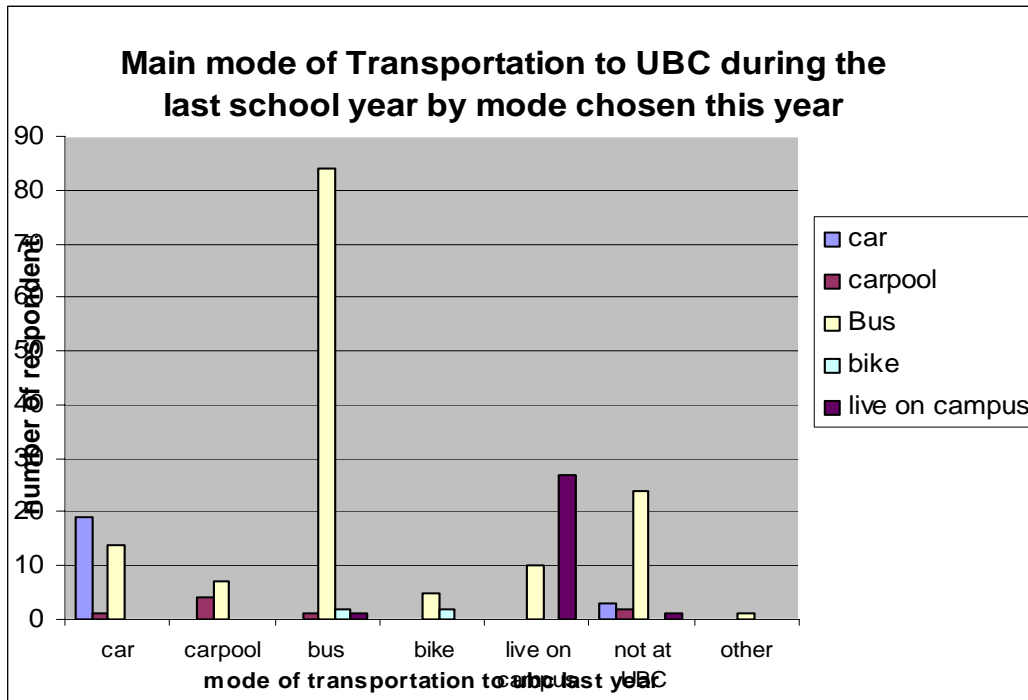
Mode Split Richmond (N=20)

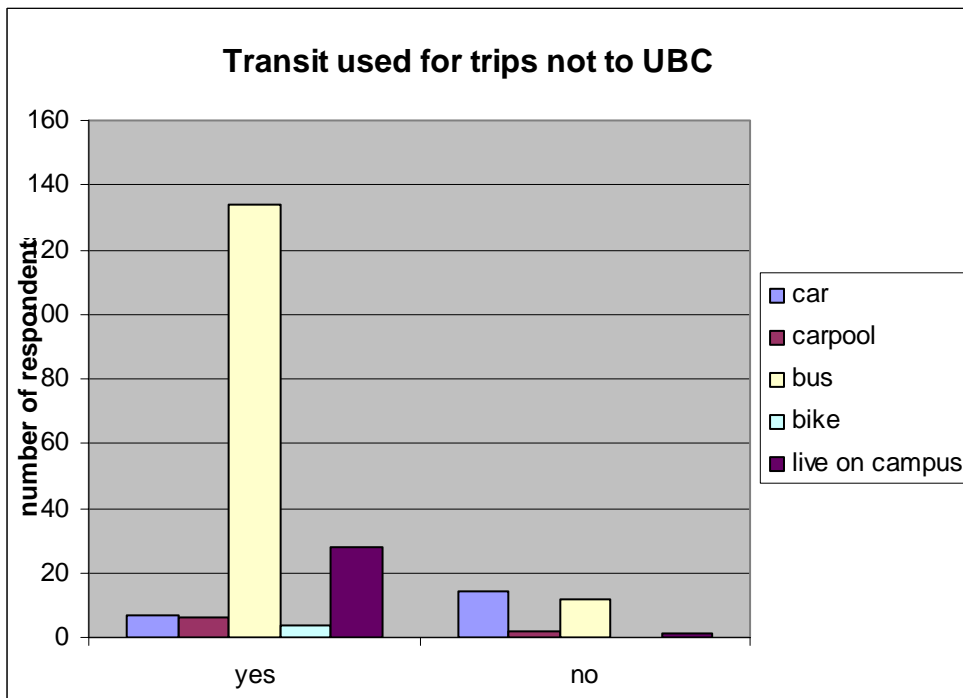
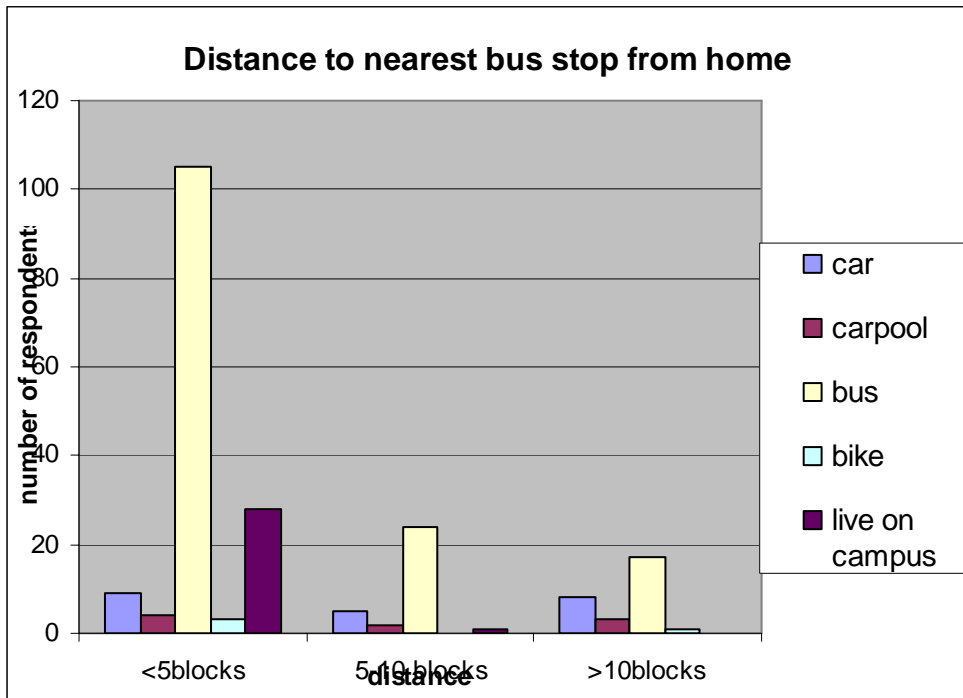


Mode Split Surrey (N=4)

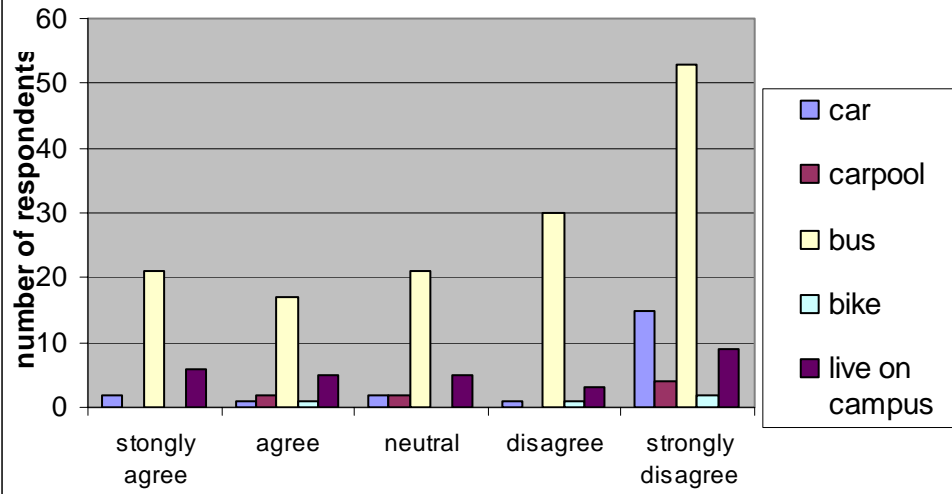


Appendix C:

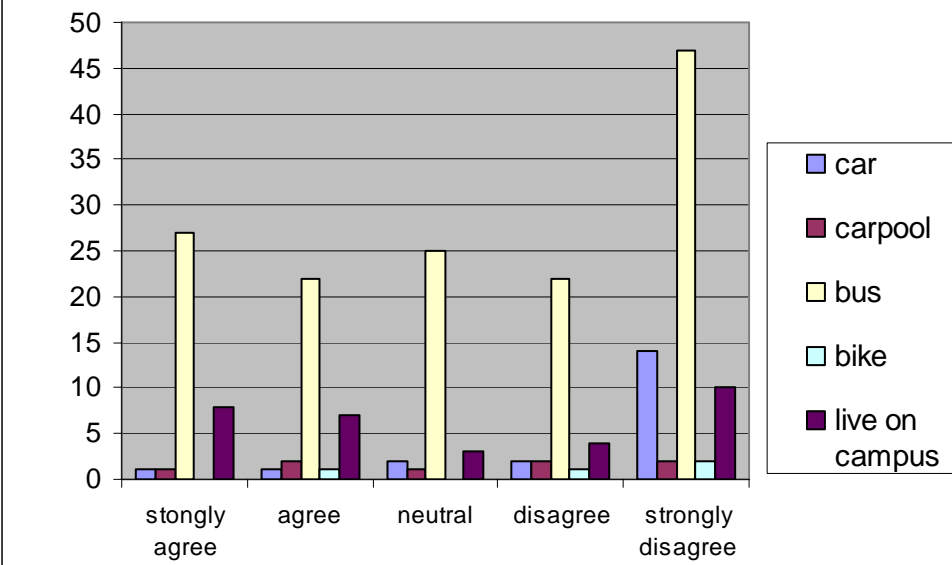


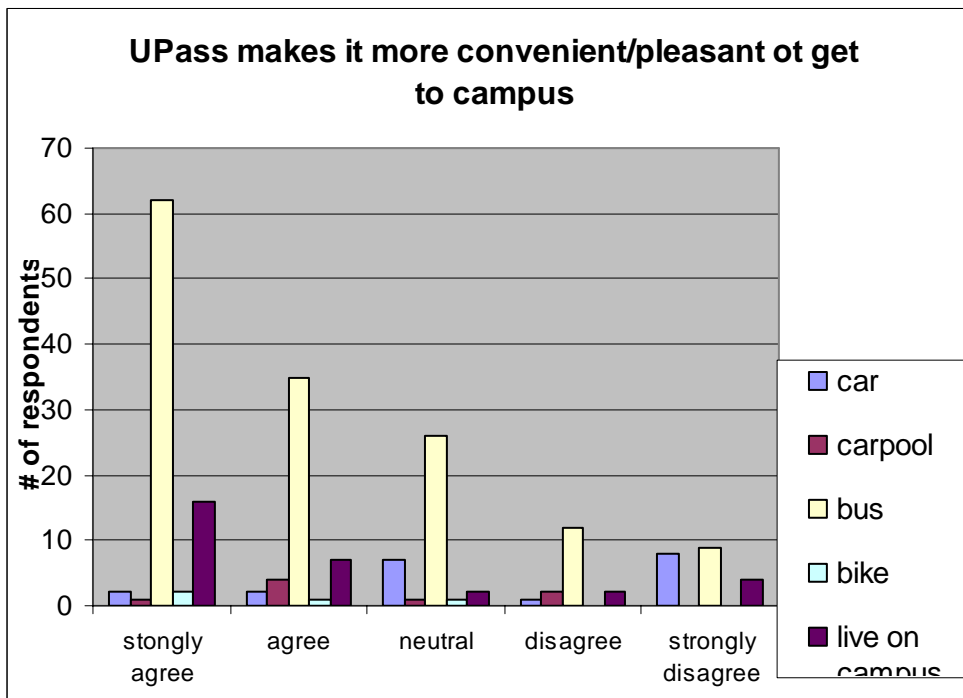
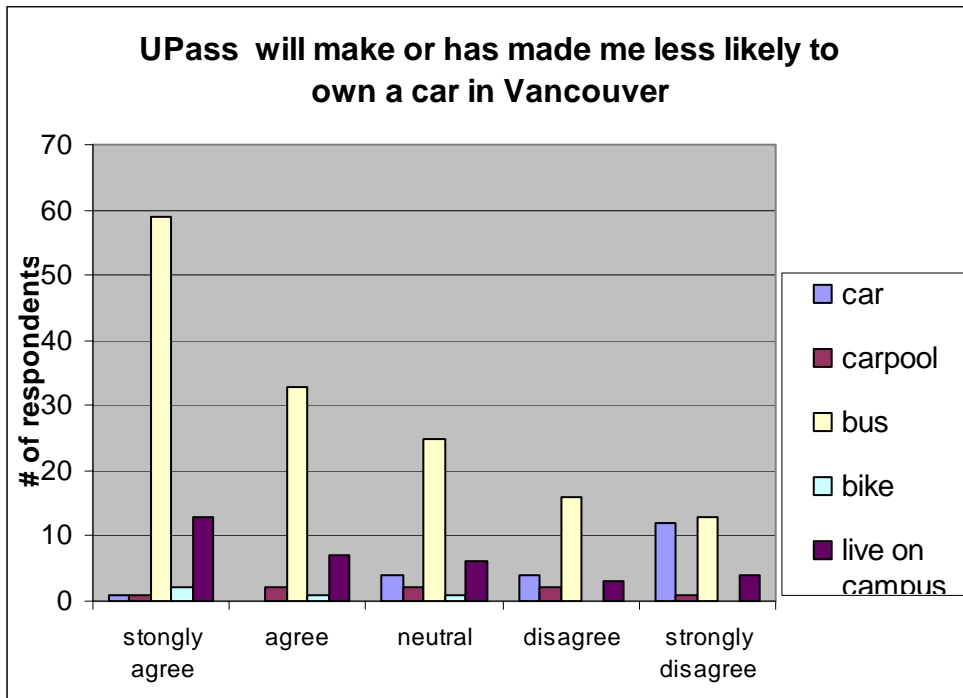


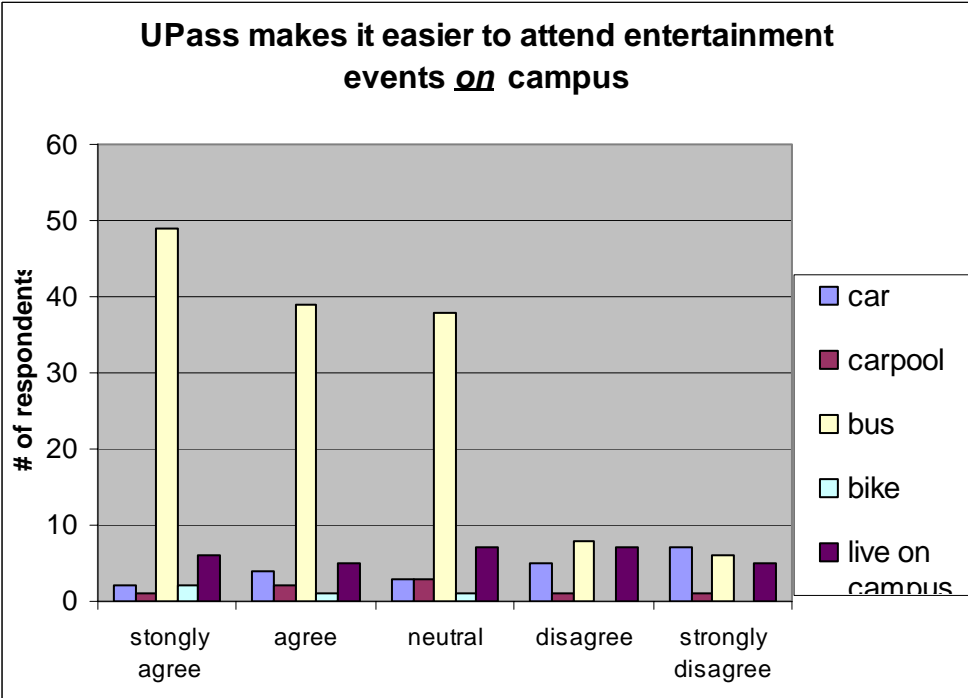
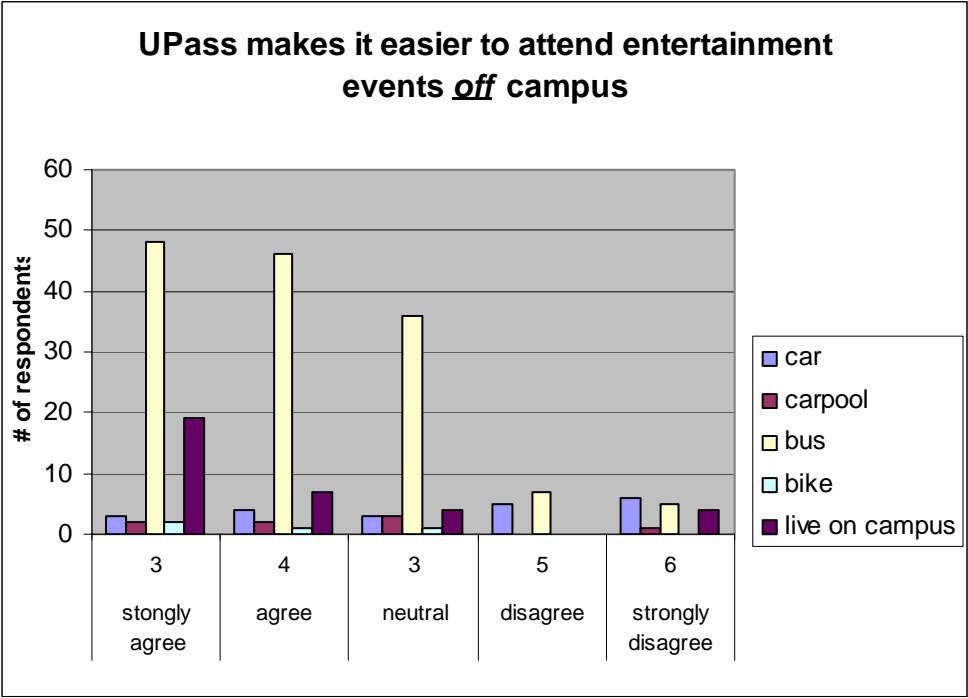
I go home more often during breaks at UBC because of the U-Pass

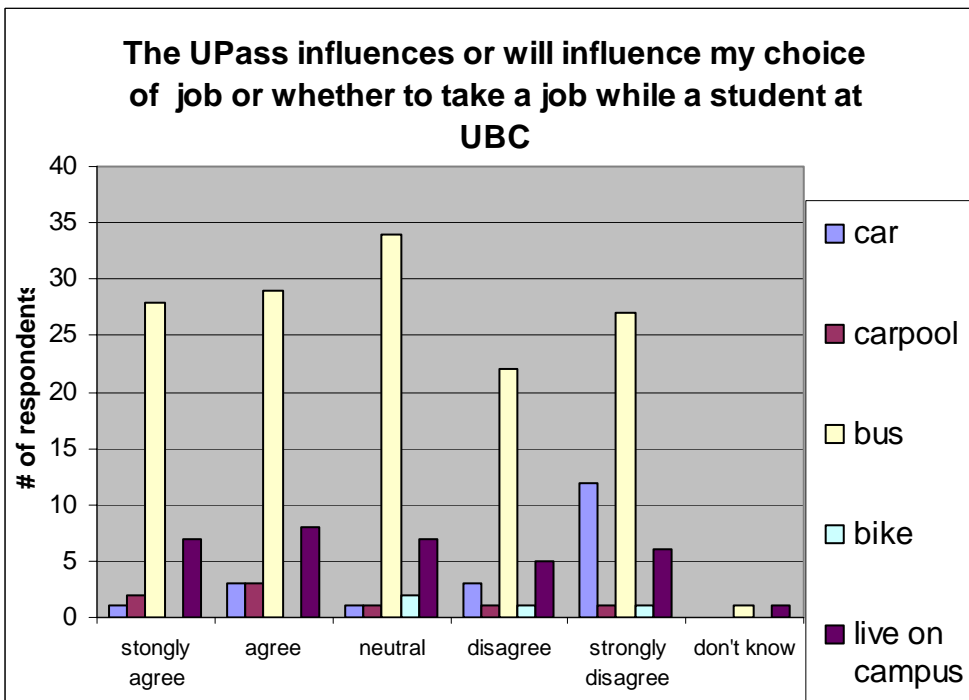
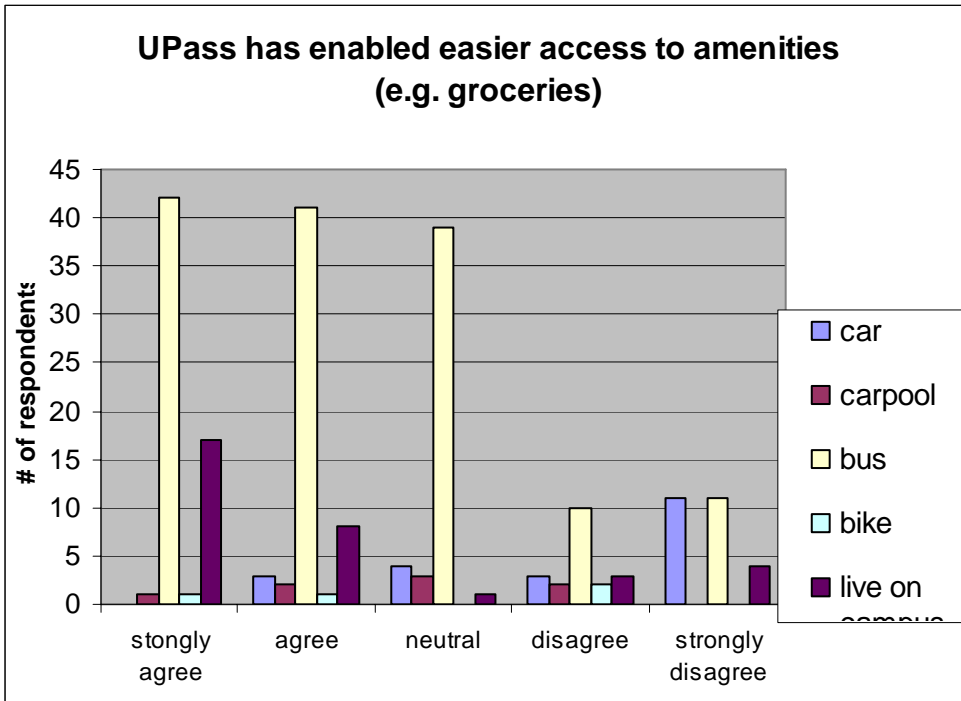


I expect UPass to influence where I live next year

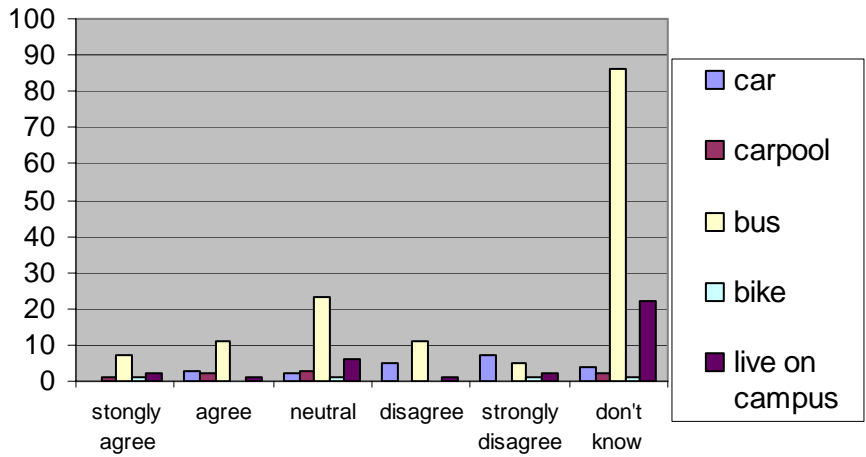




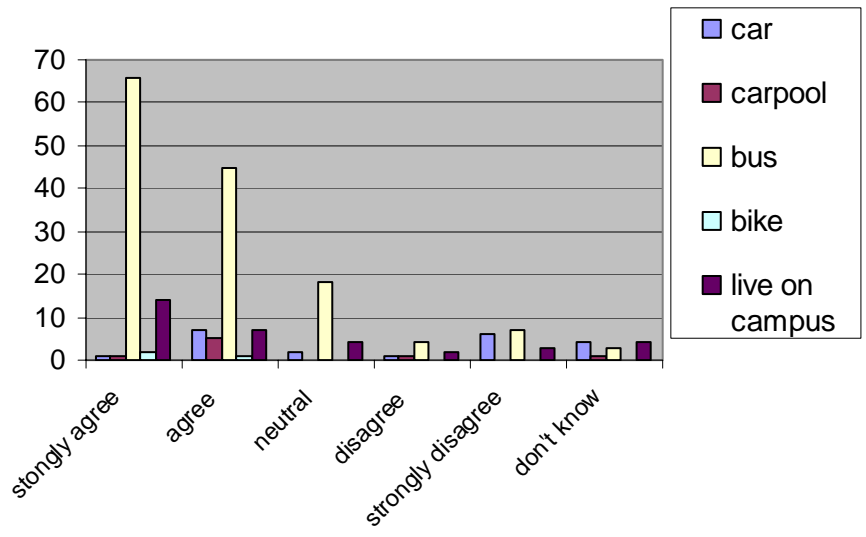


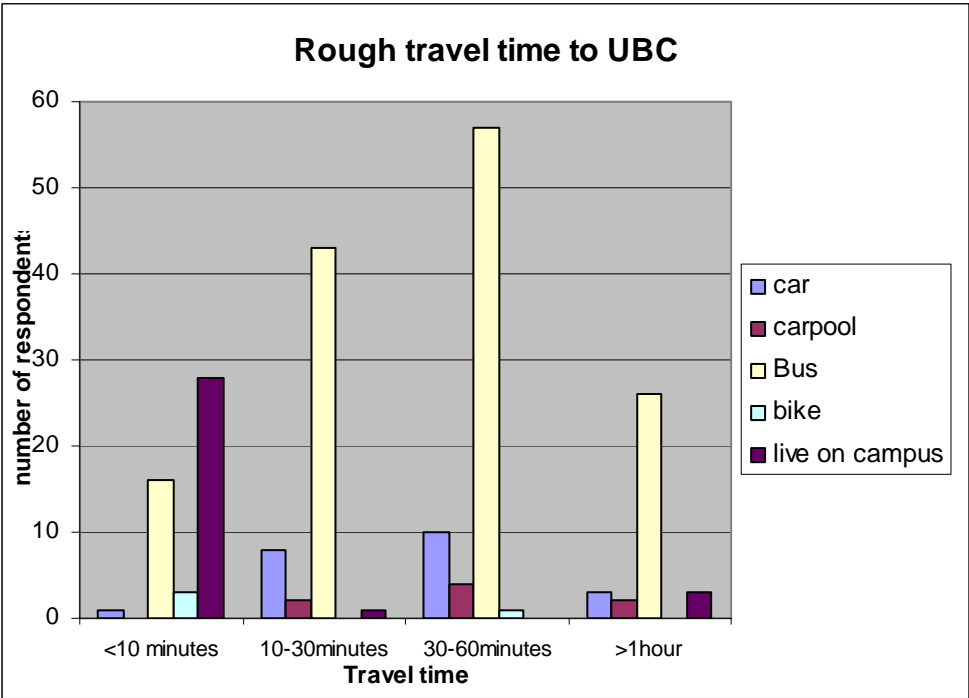
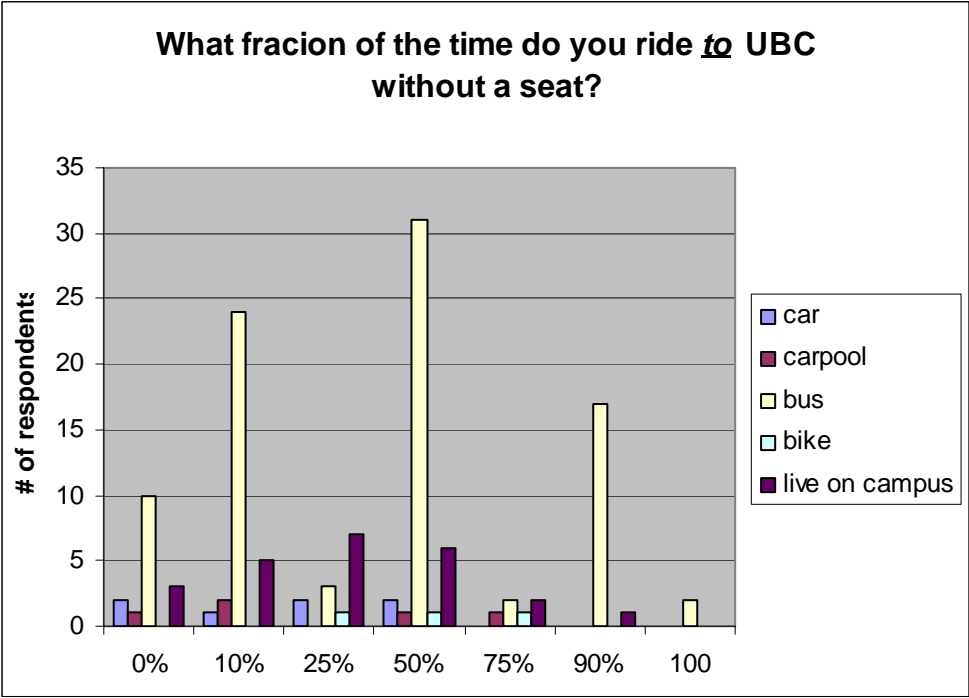


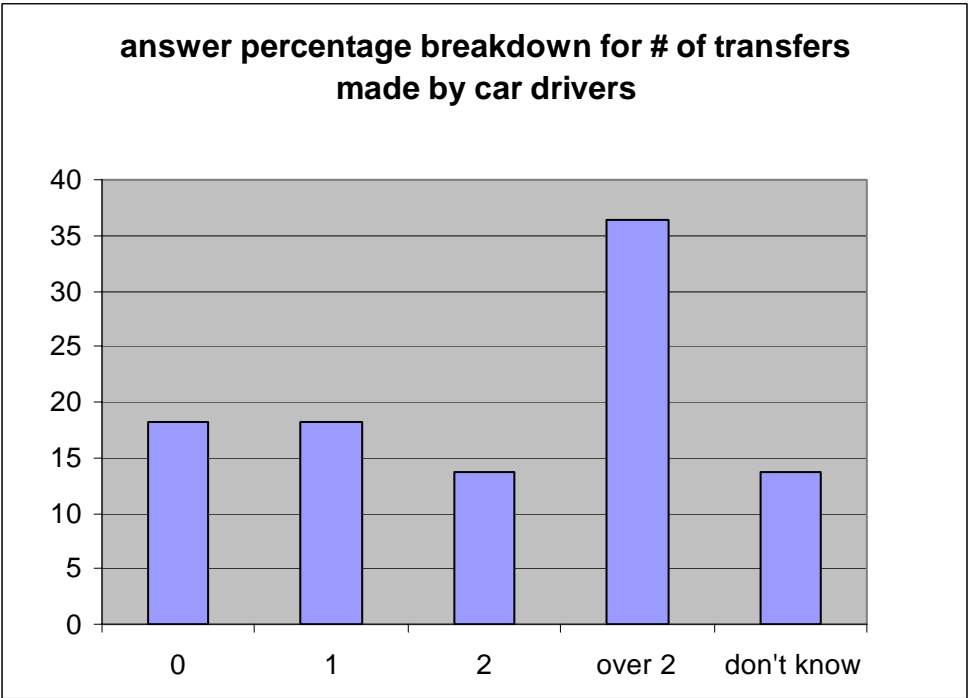
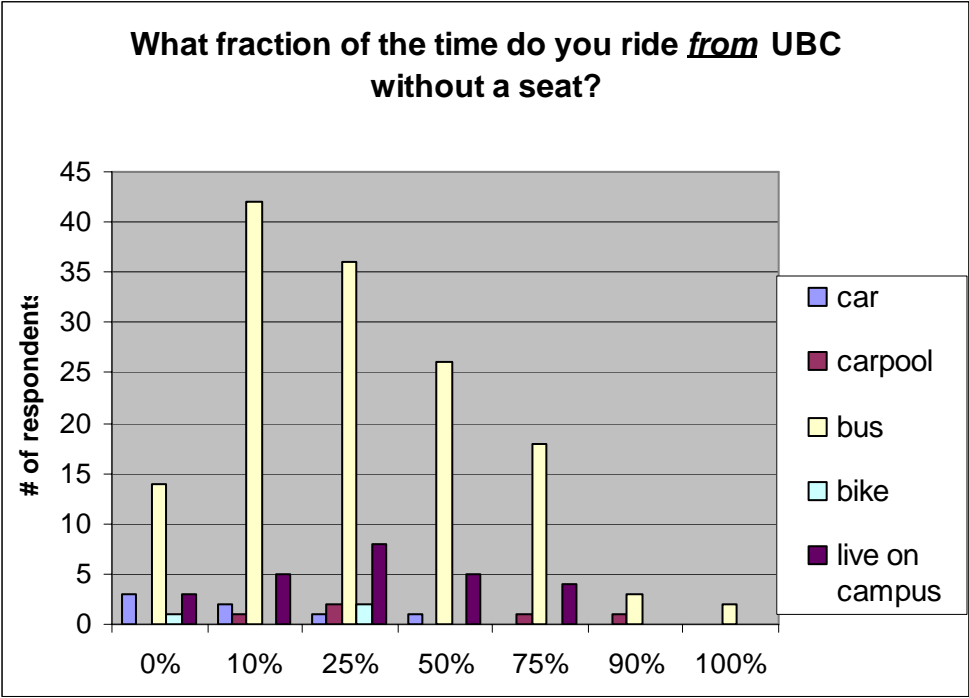
The UPass has made it easier to find parking on campus



Considering cost and convenience, the UPAs makes UBC a more attractive university







Appendix D:

Please indicate your response to the following questions by circling the option that best applies to you.

1. What was your main mode of transportation to UBC last year?
Car Carpool Bus Bike I live on campus I was not at UBC last year Other
2. What is your main mode of transportation to UBC this year?
Car Carpool Bus Bike I live on campus Other
3. What is the main reason for choosing your current mode of transportation?
Time Cost Convenience Comfort Other
4. What is your rough travel time to UBC?
 ≤ 10 minutes 10-30 minutes 30minutes- 1hour ≥ 1 hour
5. What are the first three characters in your postal code? (for example if you live on campus they are V6T) V7R
6. How many bus transfers do you need to make to get to UBC?
0 1 2 Over 2 transfers Do not know
7. The nearest bus stop to your home with direct service to UBC is:
< 5 blocks away 5-10 blocks away >10 blocks away
8. Do you use transit for trips not to UBC?
Yes No

Please respond to the following statements by indicating on a scale of 1-5 whether you agree or disagree.

9. I go home more often during breaks at UBC because of the UPass.
(Strongly agree) 1 2 3 4 (Strongly disagree) 5
10. I expect UPass to influence where I live next year.
(Strongly agree) 1 2 3 4 (Strongly disagree) 5
11. UPass will make or has made me less likely to own a car in Vancouver.
(Strongly agree) 1 2 3 4 (Strongly disagree) 5
- 7a. UPass makes it more convenient/pleasant to get to campus.
(Strongly agree) 1 2 3 4 (Strongly disagree) 5
- 7b. If the UPass makes your commute less convenient/pleasant, please explain.
NO

12. UPass makes it easier to attend entertainment events off campus.
(Strongly agree) (Strongly disagree)

1 2 3 4 5

13. UPass makes it easier to attend entertainment events on campus.
(Strongly agree) (Strongly disagree)

1 2 3 4 5

14. UPass has enabled easier access to amenities (e.g. groceries).
(Strongly agree) (Strongly disagree)

1 2 3 4 5

15. The UPass influences or will influence my choice of job or whether to take a job while a student at UBC.

(strongly agree) (strongly disagree)

1 2 3 4 5

16. The UPass has made it easier to find parking on campus.

(Strongly agree) (Strongly disagree)

1 2 3 4 5 Don't know

17. Considering cost and convenience, the UPass makes UBC a more attractive university.

(Strongly agree) (Strongly disagree)

1 2 3 4 5 Don't know

For bus riders:

18. What fraction of the time do you ride **to** UBC without a seat?
0% 10% 25% 50% 75% 90% 100%

19. What fraction of the do you ride **from** UBC without a seat?
0% 10% 25% 50% 75% 90% 100%

Other Comments :

Appendix E



Map of GVRD

Bibliography

- “2001 Ontario Road Safety Annual Report Canadian Motor Vehicle Traffic Collision Statistics. 2001.” Canada Safety Council. 16 November 2003. <<http://www.safety-council.org/info/traffic/stats2001.html>>
- “Traffic congestion in Vancouver and surrounding areas” Passe-temps.ca. 16 January 2004. <<http://www.passe-temps.ca/congestionmaps.html>>
- “Transportation Facts.” Better Environmentally Sound Transportation. 10 November 2003. <<http://www.best.bc.ca/>>
- “Transportation, Air Issues and Human Health.” Pollution Probe. 29 April 2003. 1 December 2003. <<http://www.pollutionprobe.org/Happening/pdfs/transportconf/town.pdf>>
- Baxter, David and Jim Smerdon. “Housing Metropolitan Vancouver's Population: Demographics and Long Run Housing Demand, 1999 to 2040”. The Urban Futures Institute Report 42 November 1999: 2-3.
- Berechman, J. Public Transit Economics & Deregulation Policy. Amsterdam: Elsevier Science Pub. 1993: 27.
- Brown, J., D. B. Hess and D. Shoup. “Fare-free public transit at universities - An evaluation.” Journal of Planning Education and Research. 23.1 (2003 Fall): 69-82.
- Brown, Jeffrey et. al. “Unlimited Access.” Transportation. Netherlands: Kluwer Academic Publishers. 28(2001): 233-237.
- Brown, Jeffrey, Daniel Hess, and Donald Shoup. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning Education and Research 23.1 (2003 Fall)
- City of Vancouver. Skytrain Expansion in Vancouver: A City Perspective. 16 February 2004. <http://www.city.vancouver.bc.ca/tran/compare_options.htm>
- Denike, Ken and Andrew Murphy. UBC Year 2000 Transportation Survey. Department of Geography, U.B.C. October 18th, 2000: 16.
- Denike, Ken. Travel Patterns to and from UBC and Response of Market Segments Collected via an Internet Web-based Scenario. Department of Geography, UBC.
- GVRD and Province of BC. Transportation Demand Management Measures

- and Their Application in Greater Vancouver. March 1993.
- GVRD Transportation Demand Management: 3 Forecast Modelling. November 1994: 15.
 - GVRD. 2005 - 2007 Three-Year Plan & 10-Year Outlook Strategic Transportation Plan Amendment. December 2003: 6-7.
 - GVRD-UBC Task Force. Memorandum of Understanding: Transportation. 25 October 2003. <www.ocp.ubc.ca>
 - Meyer, James and Edward A. Beimborn. An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass Program. 1998.
 - Miller, J. Transportation on College and University Campuses: A Synthesis of Transit Practice. TCRP Synthesis 39, Transit Cooperative Research Program, Transportation Research Board. 2001.
 - Ortuzar, Juan. Modelling Transport. UK: Wiley. Sussex. (2002): 287-289.
 - Poinsette, Francois and Will Toor. Finding a New Way: Campus Transportation for the 21st Century. 1999.
 - Pucher, John and Christian Lefevre. The Urban Transportation Crisis in Europe and North America. London: MacMillan Press, 1996.
 - Shoup, Donald. "In Lieu of Required Parking" Journal of Planning Education and Research. 18.4 (1999 Summer): 307-320.
 - Toor, Will. "The Road Less Traveled: Sustainable Transportation for Campuses." Planning for higher education. March-May 2003. 14 January 2004. <http://www.colorado.edu/cuenvironmentalcenter/temp/The_Road_Less_Traveled.pdf>
 - Transportation Demand Management Measures and Their Potential for Application in Greater Vancouver. Jan 1993 technical report 2 page 85.
 - Transportation Office of University of Washington. 2001-02 Washington U-Pass Annual Report. 12 January 2004. <http://www.washington.edu/upass/news_and_reports/reports.html>
 - TREK UBC. Quick Facts: Cost of Driving. 5 January 2004. <www.trek.ubc.ca>
 - TREK UBC. TREK UBC: About Us. 9 January 2004. <www.trek.ubc.ca>
 - UBC TREK Program Center. UBC Strategic Transportation Plan. November 1999. 20 January 2004. <<http://www.trek.ubc.ca/>>

- Urban Systems Ltd. Transportation Status Report – Fall 1997 to Fall 2003.
UBC TREK Program Center. March 2004. 10 March 2004.
<<http://www.trek.ubc.ca/>>