UBC Social, Ecological Economic Development Studies (SEEDS) Student Report

UBC Carpool Strategy: Recommended Incentive / Discount Program

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GEOG

UBC CARPOOL STRATEGY

RECOMMENDED INCENTIVE/DISCOUNT PROGRAM

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ABSTRACT

The TREK Program Centre is UBC's Transportation Planning Department. Committed to increasing transportation choices in addition to reducing SOV traffic to and from the UBC community by 20%, the TREK Program Center has embraced several alternative transportation programs. Of these programs, a carpool initiative has been adopted and is currently underway for implementation in September 2001. This report outlines recommendations for implementation of a carpool incentive program, and includes action steps, enforcement, and marketing and outreach strategies.

The recommendations proposed in this report have been developed out of several methodological approaches, including an initial carpool outreach campaign, an analysis of 1997-1999 screen line reports, a North-America wide survey distribution and analysis, and a demand forecast application. These recommendations represent carpool program strategies that are new to the UBC community. Upon implementation, program results may indicate necessary recommendation revisions and updates.

1.0 INTRODUCTION

Second to the downtown core, The University of British Columbia (UBC) is the largest commuter destination in Vancouver's Lower Mainland. With 35,502 full and part time graduate and undergraduate students and 5,475 full time faculty and staff members, approximately 60, 896 vehicle trips are being made to and from the UBC campus over a 24-hour period (Urban Systems, 2001; UBC Planning and Institutional Research, 1999). The ill effects of commuter traffic patterns coupled with the persistent use of the single occupant vehicle (SOV) are far-reaching for the UBC community. Increased pollution, congestion, and land-use contentions are all products of commuter traffic patterns that are facing the campus and its community. With emissions reaching over five tonnes of air pollutants for the average car on an annual basis (Victoria Transport Policy Institute, 2000), the need to reduce single occupancy automobile use is crucial. In addition to pollution, the SOV also demands more road infrastructure and parking spaces than UBC can afford, thus leading to unwanted congestion and unsafe environments.

In reconciling these transportation related concerns, the TREK Program Center has committed to educating people about transportation choices and increasing transportation choices through effective transportation demand management (TDM) strategies. In support of the UBC Trek Vision and Principles for Physical Planning, and as outlined in the UBC Strategic Transportation Plan (STP), these strategies have been embraced in an attempt to provide a policy framework intended to "best serve the transportation needs of the UBC community" (TREK Program Center, 1999). Included in these TDM strategies is a carpool initiative that is currently underway for with implementation planned for September 2001.

2.0 PURPOSE AND SCOPE

In accordance with the UBC Strategic Transportation Plan, the purpose of this report is to outline and make recommendations for an effective carpool TDM strategy, in an effort to help reduce 24-hour Single Occupancy Vehicle (SOV)

traffic volumes to and from the UBC campus by 20%. Under the auspices of the UBC TREK Program Centre, the specific objectives of this report are as follows:

- To ensure that TREK objectives are met by fostering an improvement in transportation choices for staff, students, and faculty of the UBC community.
- To research alternative transportation programs, specifically vanpools, carpools, and ride sharing, in an effort to determine what might be effective in the UBC environment.
- To conduct and report on an alternative transportation survey of other North American Universities' carpool programs.
- To research and report on existing commuter traffic patterns specific to UBC.
- To forecast the expected increase in carpoolers under various discount structures.
- To develop a comprehensive list of recommendations for marketing and outreach strategies of an effective UBC carpool program in addition to developing several potential program implementation strategies.
- To research, develop, document, and begin implementation of a working "UBC Carpool Strategy" report, effective for September 2001.

2.1 OUTLINE OF REPORT

In developing a comprehensive UBC Carpool Strategy Report, it is important to have a fundamental understanding of the current transportation situation at this institution. Specifically, this report offers a section on contextual relevance that highlights the Strategic Transportation Plan, current UBC parking information, and insights on the Jack Bell Foundation – the only vanpool program currently serving the UBC community. In addition to examining UBC's transportation situation, this report also addresses external information regarding alternative transportation programs, specifically focusing on successful carpool and vanpool initiatives across North America.

Several different methodologies, both quantitative and qualitative, have been employed for the purposes of this report. Beyond a contextual relevance, this report highlights and analyzes the results of an initial carpool marketing campaign targeted at UBC staff, students, and faculty during February and

March 2001. In addition, this report also outlines the development, distribution, and results of a North America-wide survey targeted at post-secondary institutions that employ campus carpool initiatives. Furthermore, an analysis of 1997-1999 commuter screen line reports conducted by Urban Systems is included in this report. The screen line data has been used for the purpose of helping to forecast potential carpool demands for the UBC community.

Following these various analyses, recommendations are made in an effort to create an effective carpool implementation strategy that can be employed for September 2001. Included in the recommendations are parking incentive and enforcement options and potential carpool marketing and outreach tactics.

2.2 GOALS OF CARPOOL PROGRAM

As addressed in UBC's Strategic Transportation Plan, the specific goal of the carpool program is to:

> Increase transportation choices by helping to reduce 24-hour single occupancy vehicle traffic to and from UBC by 20% below 1997 levels by November 2002 (TREK Program Center, 1999).

Through a reduction in SOV commuter traffic, a carpool initiative can also help to improve air quality and traffic congestion within the UBC community and beyond. Furthermore, individual carpool participants will reap the benefits of such a program by saving money on parking, gas, and vehicle wear and tear, in addition to experiencing a stress reduction that is often incurred by commuting and parking hassles. As a component of an overall transportation demand management strategy, the carpool program will foster a greater awareness about the merits of alternative transportation, thus helping to create more commuting options for members of the UBC community.

2.3 DEFINITIONS

In order to ensure that semantically derived differences do not affect the interpretations of this report, definitions of ambiguous concepts have been identified. This report proposes the following definitions:

CARPOOL:
A prearranged group of two or more people using a personal motor vehicle for the purposes of commuting to and from the UBC campus. Differences in carpool group sizes will be distinguished as a having members of two, three, or four-plus persons. For the purposes of the report, UBC carpools will be recognized as having three or more people.

VANPOOL:
A prearranged group of seven to fifteen people who share a personal or company-owned vehicle for the purposes of commuting to and from the UBC campus.

RIDEMATCHING:
A free program that helps UBC students, staff, and faculty find people with whom to share a ride to and from the campus. Those people sharing a ride will ideally live within close proximity to each other, or live en route to the UBC campus.

TRANSPORTATION DEMAND MANAGEMENT:
The management of existing transportation systems more efficiently through the employment of a range of measures designed to reduce single occupant vehicle use whilst encouraging a shift to more sustainable transportation practices.

SUSTAINABLE TRANSPORTATION:
A system that:

- Allows the basic access needs of individuals to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- Is affordable, operates efficiently, offers choice of transportation mode, and supports a vibrant economy.
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise. (Victoria Transport Policy Institute, 2000).

3.0 CONTEXTUAL RELEVANCE

In employing a carpool strategy for the UBC community, current transportation issues relevant to UBC must first be addressed. These include the Strategic Transportation Plan, UBC's current parking program and policies, and the operation of the Jack Bell Foundation vanpool program. Information has also

been gathered on external carpool programs across North America in an attempt to develop a fundamental understanding of success stories elsewhere.

3.1 THE STRATEGIC TRANSPORTATION PLAN

On November 18, 1999, UBC's Board of Governors passed the UBC Strategic Transportation Plan (STP). Created by UBC Transportation Planning, the STP recommends a comprehensive and integrated transportation demand management (TDM) strategy in support of the UBC Trek 2000 Vision and Principles for Physical Planning at UBC (TREK Program Center, 1999). The STP recognizes transportation-related commitments for part of Electoral Area A as outlined in the Greater Vancouver Regional District's (GVRD) Official Community Plan (OCP) (TREK Program Center, 1999). Created in partnership with the community through long-term and in-depth consultation processes, the STP "proposes solutions to many of the pressing problems surrounding transportation at UBC" (TREK Program Center, 1999).

Specifically, the STP provides recommendations and guidelines for implementing changes in commuter travel patterns to and from UBC in addition to traffic patterns in and around the UBC campus. Specific to carpooling, the STP has identified the following policy recommendations (TREK Program Center, 1999):

- Priority parking will be provided for registered UBC vanpools with a valid U-TREK Card, allowing them to park at no additional cost in designated preferential areas throughout the campus. Parking Services' costs to provide this 'no-fee' parking for vanpools will be recovered as part of the price of the staff/faculty U-TREK Card. **Until a U-TREK Card program is implemented, priority-parking locations will be considered for carpools and vanpools with valid parking permits.**

- TREK will work with UBC Parking Services to explore affordable, priority parking, for registered three-plus carpools with a valid parking permit, in designated preferential locations throughout the campus.

- TREK will work with providers of rideshare and/or car/van pool programs to promote innovative-shared vehicle, car/van pool, and other local shuttle programs. Where possible this should include the use of existing campus fleet vehicles. TREK will continue with successful partnerships (e.g. Jack Bell Foundation), and pursue opportunities with other organizations (e.g. Co-operative Auto Network and Dynasty Motor Cars) to encourage reduced auto

ownership and use by UBC residents, departments, and commuters. These programs will borrow successful tools from other programs where possible (e.g. new Rideshare Software, San Francisco Shared Vehicles, and Cambie Corridor Consortium Shuttle Program).

TREK has identified several other policies that would help in the development of a successful carpool program. These include the adoption of flexible work hours and a guaranteed emergency ride home program that would allow more opportunity for carpooling. With the development of an effective carpool program, it is hoped that these policy recommendations will be addressed, supported, and implemented.

3.2 UBC PARKING SERVICES

Operating as an ancillary service of UBC, Parking Services currently oversees the operation and maintenance of approximately 10,000 parking spaces on the UBC campus that provides access to over 31, 500 vehicles arriving to campus on a daily basis (UBC Parking Services, 2001). Since 1980, there has been a marked decline of over 3,500 parking spots due to surface lots being replaced with new institution buildings (UBC Parking Services, 2001). Furthermore, as the demand for building and housing space continues to increase, the availability of surface parking will decline. Management strategies such as the promotion of carpooling can therefore help to remedy potential land use conflicts between parking availability and infrastructure additions.

3.2.1 THE MARKET ENVIRONMENT

Falling into four major categories, Parking Services is broken into the following market divisions (UBC Parking Services, 2000):

a) PERMITS

- Faculty/staff permits allow the holder to park either in a parkade or in one of the surface permit lots located throughout the campus.
- Student permits differ in that the holder is only eligible to park in one of the five parkades.
- Special permits are sold for individual reserved parking spaces, and for Jack Bell Foundation carpool participants.

b) ECONOMY B-LOT

- These spaces amount to under half of the spaces available for permit parking. Located on the perimeter of the main campus, these lots are primarily used by students and faculty who do not hold permits.

c) CASUAL PARKADE/METER

- These spaces offer excellent short-term access to campus facilities at a premium price. Most often used by visitors to the campus, these spots tend to be occupied for short periods at a time.

d) SPECIAL NEEDS

- Designed for specific uses, these spots are based on customer needs and include handicapped, delivery, and loading zone spaces.

Parking Services facilities have been allocated to the following parkades and surface lots as outlined in Figure 3.1 and illustrated in Appendix 1.

FIGURE 3.1: UBC PARKING FACILITIES

FACILITY	SPOTS
PARKADES	
Health Sciences	1,114
North	1,009
Fraser River	709
West	1,213
Rose Garden	1,000
TOTAL	5,045
SURFACE "B" LOTS	
B-1 lot	762
B-5 lot	1,225
B-6 lot	250
B-7 lot	485
TOTAL	2,722
PERMIT SURFACE LOTS	
Faculty/Staff & Permit Lots	476
C-2 lot	290
Carpool lot C-4	221
TOTAL	987
METER PARKING	
TOTAL	400
GRAND TOTAL	9,154

UBC Parking Services, 2001

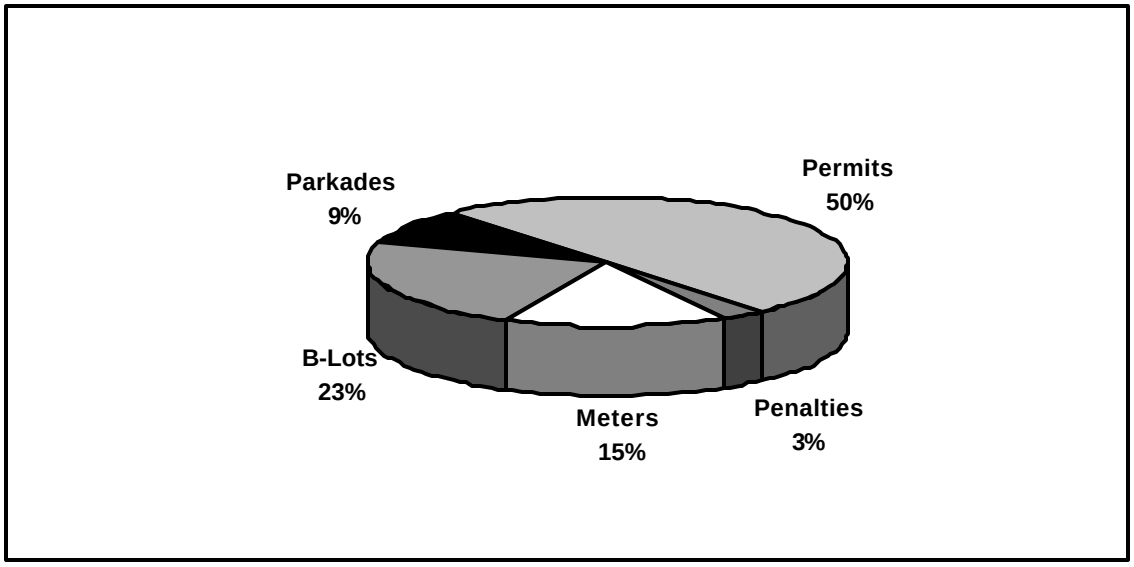
When comparing the supply of parking at UBC to that at other post-secondary institutions, UBC has greater absolute numbers of spaces (Urban Systems, 1999). In terms of parking supply to population ratios, UBC is similar to other institutions, with approximately one parking space for every four persons on campus (Urban Systems, 1999).

3.2.2 PARKING COSTS/REVENUE

Figure 3.2 illustrates the pricing structure of student parking established by UBC Parking Services: (note: staff and faculty permits are priced marginally lower than students permits).

FACILITY	COST
PARKADES	
Health Sciences	**$600.00**
North	**$528.00**
Fraser River	**$528.00**
West	**$528.00**
Rose Garden	**$528.00**
SURFACE "B" LOTS	
B-1, B-5, B-6, B-7	**$3.25**
Charged Per Day	
PARKADES AND METERS	
Per Half Hour	**$1.35**
Maximum (before 5pm)	**$12.50**
After 5pm & weekends	**$3.25**

When comparing the costs of UBC parking to other post secondary institution's parking rates, UBC's prices can be considered high (Urban Systems, 1999). Parkade and surface lots continue to generate revenue despite these relatively high prices and the associated possible impact on demand. Figure 3.3 illustrates the 1999/2000 revenue streams according to facility:



Parking revenues decreased by 8.1% over the period from 1999 to 2000 due to:

- Reduced fine payments
- Per hour and daily maximum parkade rate decrease
- Labour disruption due to rotating strike action which resulted in a loss of revenue at all facilities
- Interest revenue decrease (UBC Parking Services, 2000).

3.2.3 PARKING SERVICE OPERATIONS

In addition to maintenance and responsibilities, Parking Services also performs the following functions (UBC Parking Services, 2001):

- Issuance of parking permits and passes.
- Ticketing and towing of illegally parked cars.
- Operation of a small compound for towed vehicles.
- Meter parking services.
- Campus Security shuttle bus services.

As stated in the Business Summary 2000/01, Parking Services' goals are to:

- Provide efficient and effective parking facilities for its customers to meet the needs of the University community and its visitors in support of the University's TREK 2000 vision.
- Operate the business in a manner that ensures long-term financial viability, including the investment in, and maintenance of, physical assets (UBC Parking Services, 2000).

Parking Services has promised to provide parking facilities for its customers that are both effective and efficient. In doing so, Parking Services strives to

operate the business in a manner that ensures long-term financial viability, including the investment and maintenance of the physical assets, in addition to "encouraging commuting by methods other than private vehicles, especially single-occupant vehicles, through transportation demand management (TDM) programs" (UBC Parking Services, 2000). However, there is currently a lack of concrete incentives in place that foster reductions in SOV travel to and from the University. By building alliances with parking, the TREK Program Centre can implement an effective TDM carpool strategy that will help Parking Services in reaching their goals.

New challenges constantly face Parking Services as land space for parking decreases with future housing and institutional building developments. While serving the University campus access and parking requirements, Parking Services also has a responsibility to ensure convenient access to campus for all members of the UBC community. As UBC implements its Strategic Transportation Plan, the goal of access will be met through a variety of TDM strategies, which Parking Services will have a major role in supporting. This report outlines some specific measures that could be taken to fulfill the mission of Parking Services to encourage commuting by modes other than SOV.

At present, Parking Services has one lot reserved for carpool vehicles with free parking privileges. However, this lot (C-2) is restricted to Jack Bell vehicles only. In addition, there are a number of JBF vanpools that hold the faculty/staff parking permit, allowing them access to all the surface faculty/staff permit lots. To date, there are no special lots or permits for unofficial faculty/staff or student carpool groups, nor any cash subsidies for carpool participants. In addressing this issue, there has been some discussion surrounding the idea of reserved carpool spaces at specific times of the day, however no such program has yet been implemented.

3.2.4 WELCOMING CARPOOLS

In order to create an effective carpool program, unofficial carpool groups must be recognized and rewarded for their behavior. There are several objectives of the proposed incentive program. Firstly, it offers a reward for those who already carpool thereby encouraging them to continue carpooling; secondly,

it increases the transportation options of all commuters, including those currently using public transit who may prefer to carpool; and finally, it may encourage SOV drivers to consider carpooling, thus decreasing SOV traffic to and from the UBC campus. Many different forms of incentive programs could be implemented, including priority parking for carpoolers or discounted permits. This report will address this issue by identifying various incentive tactics and outline recommendations for their implementation.

3.3 THE JACK BELL FOUNDATION

The Jack Bell Foundation (JBF) is a non-profit ride-sharing program that services the Lower Mainland and Vancouver Island. JBF was established in an attempt to help reduce pollution and traffic congestion by reducing the number of SOVs on B.C's roads (Jack Bell Foundation, 2001). The predominant feature of this foundation is its vanpool service – that is, a service that rents out a foundation-owned seven–person passenger vehicle for the purposes of commuting. In addition, JBF offers a free ride matching service for those interested in registering their personal vehicle in a carpool program. Catering to those who work regular hours and live more than 25 km away from UBC with a commute of over 30 minutes in areas ill-served by transit, the JBF vanpool program is not a service well-suited to the needs UBC students.

Specific to the JBF vanpool program, riders must pay a fee for the use of the vehicle – this covers all operating costs, with the exception of parking. The fares paid by riders are contingent upon km traveled per day and the number of passengers per vehicle. Prices may range anywhere from $98.00 to $140.00 per month. In the event that seven passengers occupy the vehicle, the driver is entitled to free fare in addition to personal use of the vehicle for a cost of only 15 cents per km. The vanpool group may elect to share the responsibility of driving and the discount that comes with it. To date, 31 JBF vehicles serve UBC. Of these, two are carpools and 29 are vanpools. In addition, JBF has also launched an Assured Vehicle Pilot Program whereby vehicles are parked on campus and are available to members of the vanpool program for daytime errands that may

require the use of a personal vehicle. Currently, JBF has nine vehicles (two cars, and seven vans) registered for this program.

The UBC staff and faculty registered in JBF vanpools range from senior administrative staff to plant operation labourers (Forin, 2001). Designed for working people, the program requires that drivers be at least 21 years of age with a two-year record of full-time employment. In addition, participants' schedules must be consistent, given that the vanpools run at the same time each day, 22 days a month, five days a week and all participants are billed regardless of rides they may miss (Forin, 2001). The program also requires a commitment for at least one year. Not surprisingly, there are no students currently registered in UBC vanpools. A rideshare program designed to accommodate students as well as UBC faculty and staff would be a beneficial addition to the existing campus vanpool program. Such a program could include the partial subsidization of JBF vehicles to accommodate the typical eight-month student schedule. The age and employment requirements of JBF vanpool participants, however, are dictated by the legislation under which the foundation operates and cannot easily be changed.

JBF also maintains a carpool registry for the UBC community. Registrants specify whether they would like to be a passenger or become a driver that takes carrying paying carpool passengers in their personal vehicle on a full-time or alternating basis. The driver of the carpool solely determines the cost of the carpool program. As suggested by JBF, the cost can be fairly established by dividing the round trip mileage times cost per mile by the number of riders. On average, carpoolers can expect to pay $100.00 or more per month for a commute from Abbotsford to Vancouver (Jack Bell Foundation, 2001).

3.4 TRANSPORTATION DEMAND MANAGEMENT ACROSS NORTH AMERICA

TDM strategies may include programs that either reduce or shift demand in the existing transport system. Carpool programs are demand reduction strategies or commute trip reduction programs that relieve congestion by reducing the number of vehicle trips. Through specific actions within the program, the common objective is to decrease the large number of commuters in

less efficient, single occupancy vehicles and increase the proportion of those using more efficient high occupancy vehicle modes. Carpool programs can adopt other goals such as reducing individual commute costs, peak period vehicle trips, expenses associated with road and parking facilities, and pollution emissions (Victoria Transport Policy Institute, 2000). Suited to University settings, carpooling has proven to be an effective TDM strategy that improves travel options, while increasing equity. Furthermore, carpooling can become an even more significant option to non-drivers such as students or those with disabilities. Most often used by young commuters with lower incomes, limited vehicle access, and longer commute distances, carpool programs have great potential for University communities that fit these characteristics (Baldassare et al., 1998).

3.4.1 VARYING PERSPECTIVES ON INCENTIVES AND DISCINCENTIVES

The objectives of TDM strategies are achieved through various measures within carpool programs. These measures consist of incentives to encourage the use of efficient modes. Some examples of incentives include transportation allowances for using efficient travel modes; preferential facilities such as dedicated traffic lanes and parking spaces that are more accessible; service improvements for transit and other alternative modes; and guaranteed ride home services. Programs can also comprise measures that discourage unwanted travel behavior. These disincentives include higher fees and vehicle restrictions (Litman, 1999).

Addressing the need for strategies to reduce SOV mode shares, Baldassare et al.'s (1998) study determined which policies would affect SOV commuters' likelihood of choosing other commute modes. They concluded that the introduction of carpools is more effective than other incentives such as improving public transit or providing cash bonuses, and disincentives such as charging fees for congestion, smog, or parking. Significant research has been conducted on the impacts of demand reduction strategies on an individual's likelihood to carpool. A survey conducted by Black et al. (1992) found that approximately 48% of respondents who considered themselves SOV commuters would be very likely or somewhat likely to join a carpool program with the

inclusion of a ride match service. The approval of this incentive was found to be slightly greater than others such as flexible work hours, emergency ride home services, and disincentives like higher parking fees (Black et al., 1992). While these show the acceptance of incentives, some studies observed a contrasting situation. Denike's (2000) survey of faculty, staff, and students of UBC asked to rate ten carpool incentives on a scale of one to five, with one being a very weak incentive and five a very strong incentive. Some of the incentives suggested include lower parking rates, reserved parking, ride matching assistance, and a reduction in SOV benefits. The average rating given to these incentives by faculty members is a low 2.8, 3 by staff, and 3.4 by students. A flexible departure time was the most well accepted incentive for all three groups (Denike, 2000). A study by Koppelman et al. (1993) concluded that a demand reduction strategy incorporating a combination of incentives and disincentives resulted in the largest increase in willingness to carpool. The Victoria Transport Policy Institute (2000) also recognizes this combination as the most ideal.

These studies show that the effectiveness of incentives and disincentives is not black and white. We conclude that an appropriate carpool program should strike a balance between the more effective, yet poorly accepted disincentives, and the less effective, yet well accepted incentives.

3.4.2 WHAT'S HAPPENING ELSEWHERE?

With a comprehensive TDM strategy, Stanford University has been able to grow by 18.5%, yet reduce automobile commute trips by 500 per day (Victoria Transport Policy Institute, 2000). The TDM program incorporates a rideshare program with ride matching service. In this program, preferential parking benefits improve in relation to the number of people in the carpool. 'Carpool credits' are also offered, again with accordance to the carpool size, in order to reduce the cost of a parking permit. The school's effort to support alternative transportation has resulted in significant cuts to parking and roadway expenses. It was estimated that each individual no longer commuting in a car saves the school close to $2,000.00 annually (Victoria Transport Policy Institute, 2000).

Another school recognized for successful campus trip management is the University of California, Davis (Markowitz, 1998). At this institution, carpool

benefits include among others, individual temporary parking permits. These complimentary passes provide unrestricted parking for each member after 5 p.m. and daytime parking privileges for occasions when carpooling is unfeasible. Restrictions on daytime parking include a maximum use of twice a month, ineligibility for carpool parking spaces, non-transferable, and location restrictions (UC Davis Transportation and Parking Services, 2000).

Lincoln University offers priority parking spaces and ride matching service for carpoolers. Besides e-mail and temporary booths, advertising for the carpool program is also done by distributing pamphlets to all parked cars throughout the university. A recent review of this program concluded that two years after its introduction, the proportion of university students and staff that carpooled at least once a week grew by 14.2% (Gu, 1999). Concurrently, the number of SOV users decreased by 12.4%. The influence of ride matching on this however, is questionable. The review included a survey that asked carpoolers how they found their fellow carpool members (Gu, 1999). Although 37% of respondents regularly use the ride match service, only 2% formed their group through this. Despite this, it was observed that the number of participants in the database is low which in turn determines its effectiveness (Gu, 1999).

Preferential parking on the other hand has been more popular. Spaces were originally allocated at a ratio of one space to eight carpool parking permits, yet the supply and demand has progressively increased. The occupancy rates of these spaces varied throughout the day, with 10:00 to 12:00 p.m. as the period of peak occupancy, averaging over 90%, and lowest occupancy rates between 8:00 to 10:00 am (Gu, 1999).

4.0 METHODOLOGY

In establishing recommendations for an effective carpool program, several methodological approaches were employed throughout our research. Firstly, a carpool outreach campaign was initiated. In addition to staff and faculty, this campaign was targeted at UBC undergraduate students. Coinciding with the Coast Mountain Bus Company transit strike, the campaign promoted carpooling

as an alternative form of transportation to campus. Using the Vancouver Island based Commuter Connection database, a free ride matching service was introduced in an attempt to encourage students to consider either joining a carpool or offering spaces for carpoolers in their personal vehicles. The information collected from the carpool outreach campaign depicts the current mode split of a sample of undergraduate students in addition to average commute distances. Although not representative of the entire UBC population, this information can help in illustrating a small percentage of mode splits and commuter distances.

In addition to the carpool outreach campaign, several screen line reports conducted by Urban Systems were analyzed. This information illustrates trends in commuter patterns to and from the UBC campus. Furthermore, this information can help in determining a demand forecast of potential carpool participants.

In an effort to understand how an effective carpool program could be structured, a North America-wide survey, targeted at post-secondary institutions with carpool programs, was conducted. The survey asked several questions regarding program details, strategies, and structure and funding mechanisms, in addition to program implementation, results, and evaluation. The responses from each survey were complied and reviewed in an attempt to determine optimum program strategies. This information will be used in helping to determine possible program strategies for UBC.

Beyond market information and program strategies, an effective carpool program must also consider demand. To address this, a demand forecast was employed in order to assess the expected increase in vehicles with occupancy of three or more under various levels of discount.

4.1 CARPOOL OUTREACH CAMPAIGN

In an effort to promote carpooling as one of the STP's TDM strategies, the TREK Program Centre conducted a carpool outreach campaign from late February 2001 through to March 2001. This campaign targeted undergraduate students across campus in order to inform people about carpooling as an

alternative form of transportation. A free ride matching service was introduced and the merits of carpooling as a viable and flexible commuting option were promoted. During lecture start and finish times, a brief three minute presentation was given to students, wherein the merits of alternative transportation were discussed, and the importance of increased transportation alternatives both in the face of a transit strike, and beyond were stressed. Given that time was limited to breaks between lecture starts, an information booth was set up outside of classrooms. This served as a venue where students and passersby could learn more about carpooling and the free ride matching service. Appendix 2 illustrates the forms that were handed out to those interested in joining a carpool. This information was entered into the ride matching database, whereby participants would be emailed a match report of those people living within a three-km radius of them. Participants could then contact their matches in order to organize a carpool group. In addition, the forms also provided information on current mode splits and commuter distances.

By determining a sample of students' travel characteristics, a carpool program can be improved to better address commuting needs of the UBC community. Understanding this population sample can also be used in comparison with UBC's entire population of student commuters to identify market groups uninterested in the existing program. It is also one step beyond identifying attitudinal willingness to carpool. An assessment of the participants of a carpool database avoids possibly inaccurate inferences that individuals expressing their willingness to carpool will actually do so.

4.1.1 SAMPLE CLASSIFICATION

Given that the carpool outreach campaign coincided with the pending transit strike, it is not surprising that most of the registrants are those who commute by bus. The registrants are segmented based on mode choice to address this bias. This mimics a procedure done in an earlier transportation analysis (Denike, 1998).

4.1.2 ANALYSIS

Each mode group is normalized to account for biases. This also allows for comparisons between the mode groups. A frequency analysis of different trip

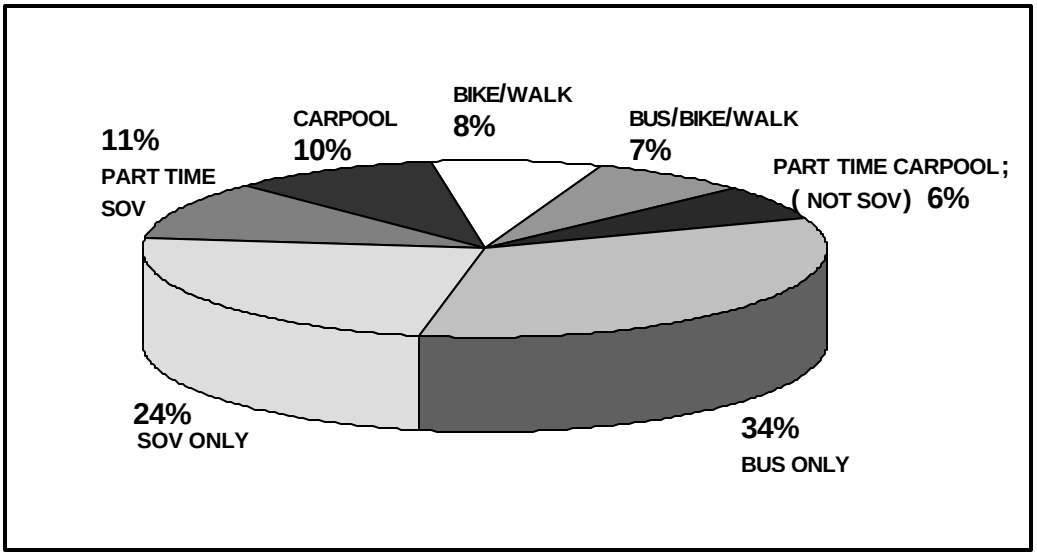
distances describes the distribution of the students as grouped by their commute mode. The average commute times of some mode groups are also calculated to elaborate further on the travel characteristics of each mode group.

4.1.3 RESULTS

1. MODE SPLIT OF RIDE MATCHING REGISTRANTS

Figure 4.1 describes the mode choice breakdown of the sample population. As mentioned, the largest group, accounting for 34% of registrants, is bus patrons. Part-time single occupancy vehicle (SOV) commuters are students who not only drive alone, but also either carpool, take the bus, bike, or walk to get to school. The survey gathered unanticipated participation from students who bike or walk (8%). The smallest group are those who not only carpool but also use modes except driving alone to get to school (6%). It is interesting to note that the two largest groups are those who use only one type of mode, either bus or drive alone.

FIGURE 4.1: SAMPLE MODE SPLITS



With the exception of bike/walk commuters, these numbers match the expected proportions. They imply that the target markets were indeed reached. These results serve as positive feedback on the impact of TREK's outreach efforts. During the transit strike, the daily average of SOV trips to UBC decreased by 1,860. High occupancy vehicles on the other hand increased by

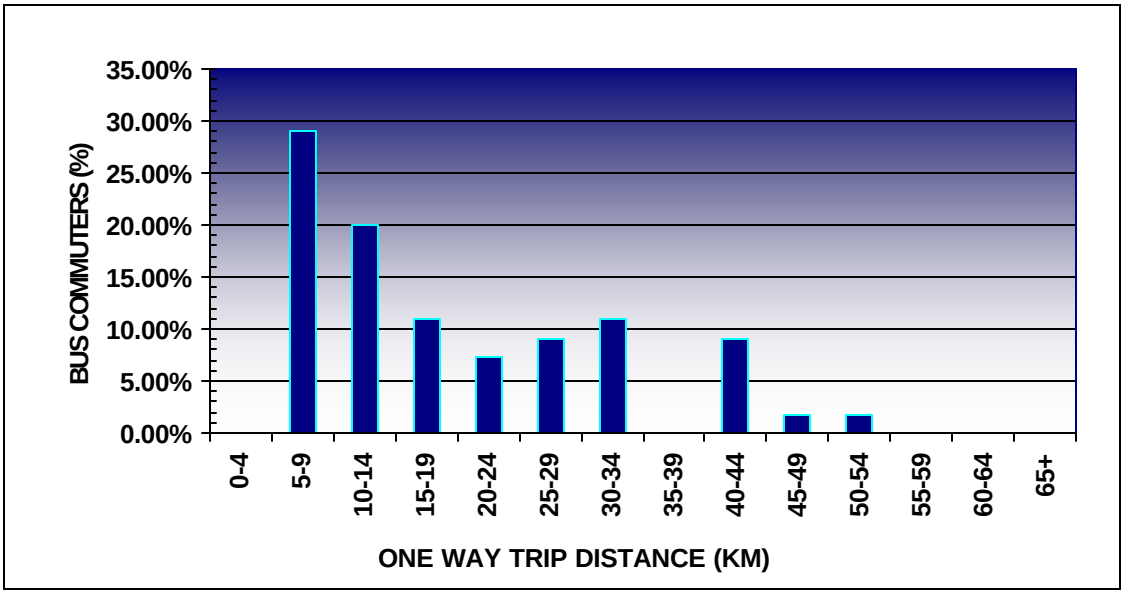
8,000 two-person and 2,000 three-person carpools (Urban Systems, 2001). This is a possible indication of the ride matching system's effectiveness.

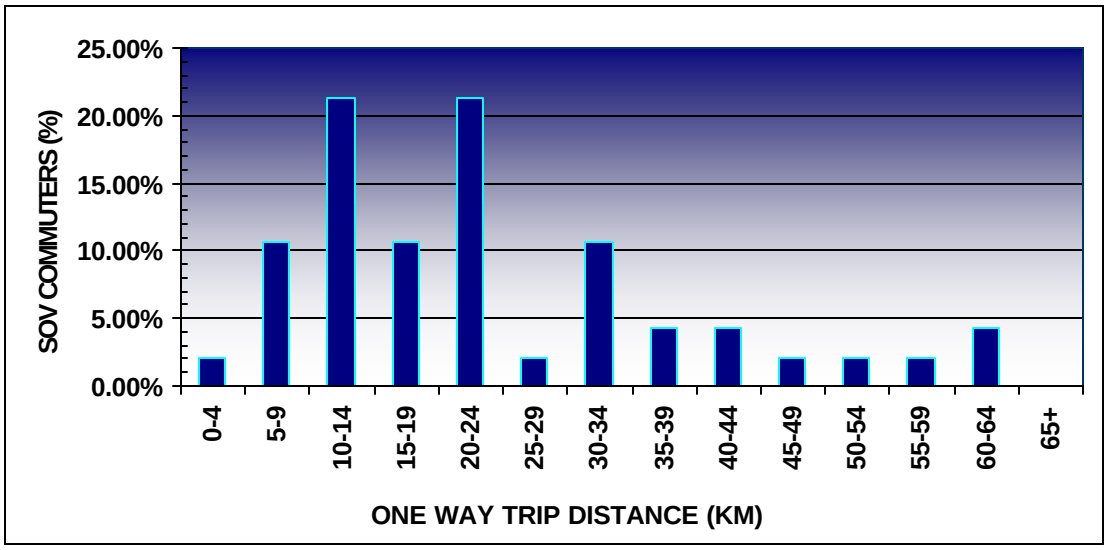
2. DISTRIBUTION OF REGISTRANTS BY COMMUTE MODES

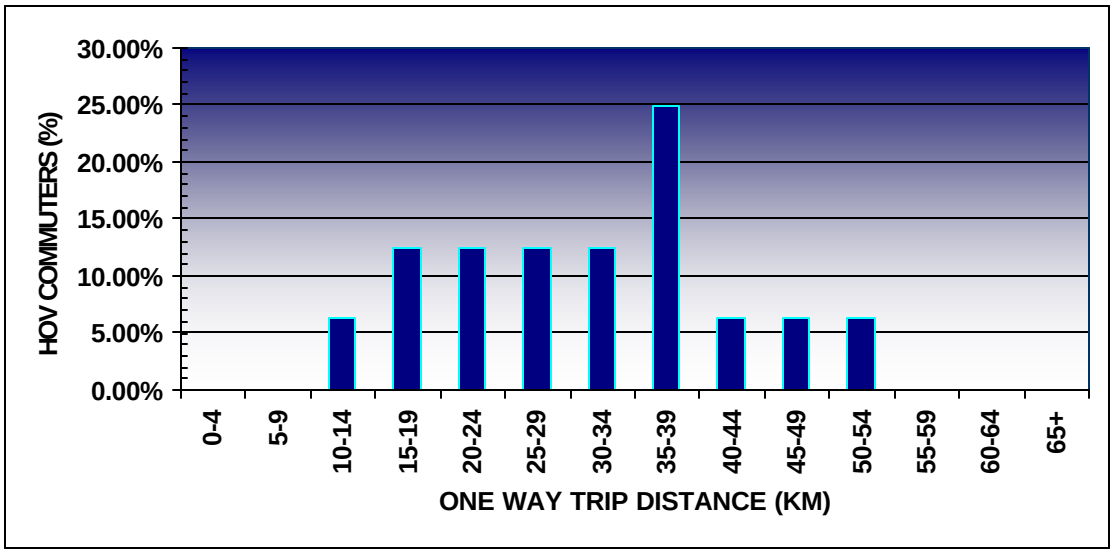
Figures 4.2 through 4.4 show the frequency distribution of various trip distances for registrants with only one mode of travel. Most of the commuters live less than 24 km from UBC. Almost 30% of students who commute only by bus live less than 15 km away. For this group, there is a general trend of decreasing participation with increasing commute distance. The greater probability for students residing relatively close to travel by bus was also observed in Denike's 1998 survey**.**

Like bus-only commuters, a large percentage of students who always drive alone live less than 24 km from campus. Compared to the distribution of bus only commuters, SOV commuters travel from a wider range of distances. Vehicle-only users can be found commuting from less than 4 km to over 60 km each way. This attests to the mobility advantage of SOV commuters.

FIGURE 4.2: DISTRIBUTION OF BUS COMMUTER TRIP DISTANCES (KM)





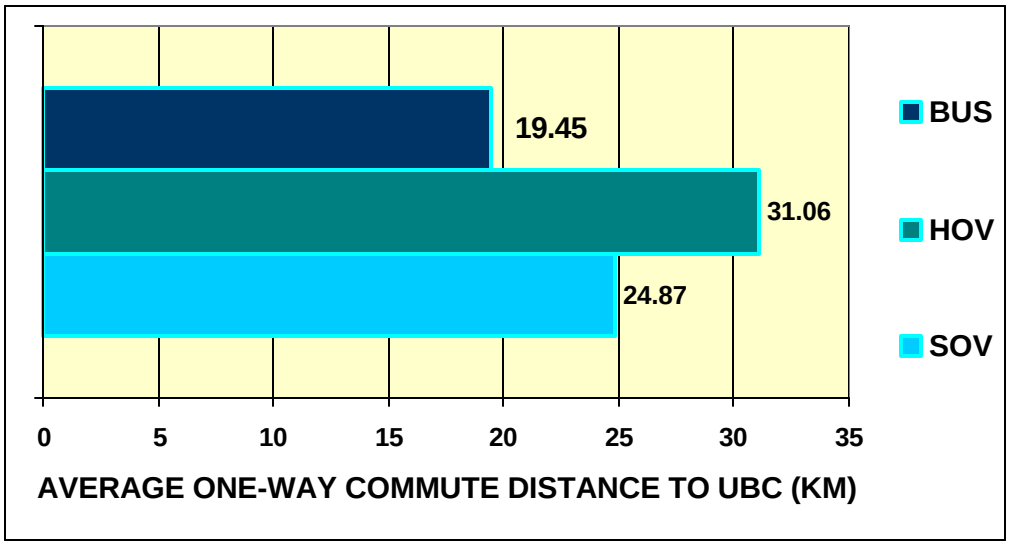


Over 15% of registrants who commute only by carpool travel between 35 and 39 km each way, reflecting much greater distances than the mode values of bus-only and SOV-only commuters, at 5 to 9 km and 10 to 14 km/20 to 24 km respectively. Unlike the distributions of the other mode groups, there is little variation in distributions of carpoolers traveling less than 35 km. There are less carpool groups traveling over 39 km each way but they also show little variation.

3. AVERAGE COMMUTE DISTANCES

Figure 4.5 compares the average commute distances of the three single

mode groups. While it may appear on the trip distribution comparison that SOV only commuters come from more distant origins, students who get to school only by carpools tend to travel over 6 km more than the former SOV only commuters. This can be attributed to the commute expenses reduced by ridesharing. With the larger travel costs of farther commutes, carpooling's financial benefits appear more attractive to students who travel farther (Victoria Transport Policy Institute, 2001). This graph again supports the greater likelihood of shorter-distance commuters to take the bus.



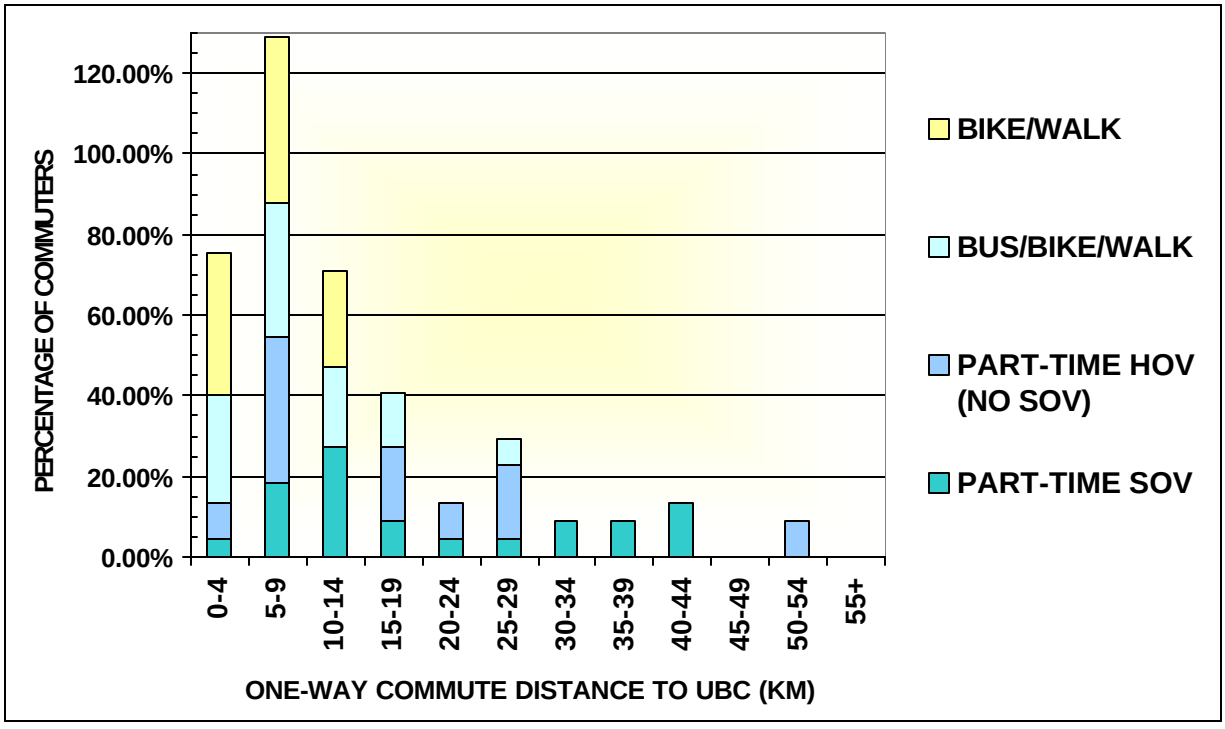
4. DISTRIBUTION OF REGISTRANTS BY MIXED COMMUTE MODES

Figure 4.6 shows the frequency distribution of various trip distances for registrants with more than one mode of travel. Most of the commuters live less than 15 km from UBC, closer than those with only one commute mode. For example, over 45% of part-time SOV commuters travel no more than 15 km each way between school and home. Individuals in this group show a smaller variation of distances and shorter trips than those who only commute in SOV's.

The group of bus/bike commuters shows both the least spatial distribution and reside closest to UBC. Like bus-only commuters, the participation of students who not only bus but also either bike or walk shows a negative

relationship with increasing commute distance. Part-time carpoolers are the largest mixed mode group of registrants living between 15 and 29 km from UBC.

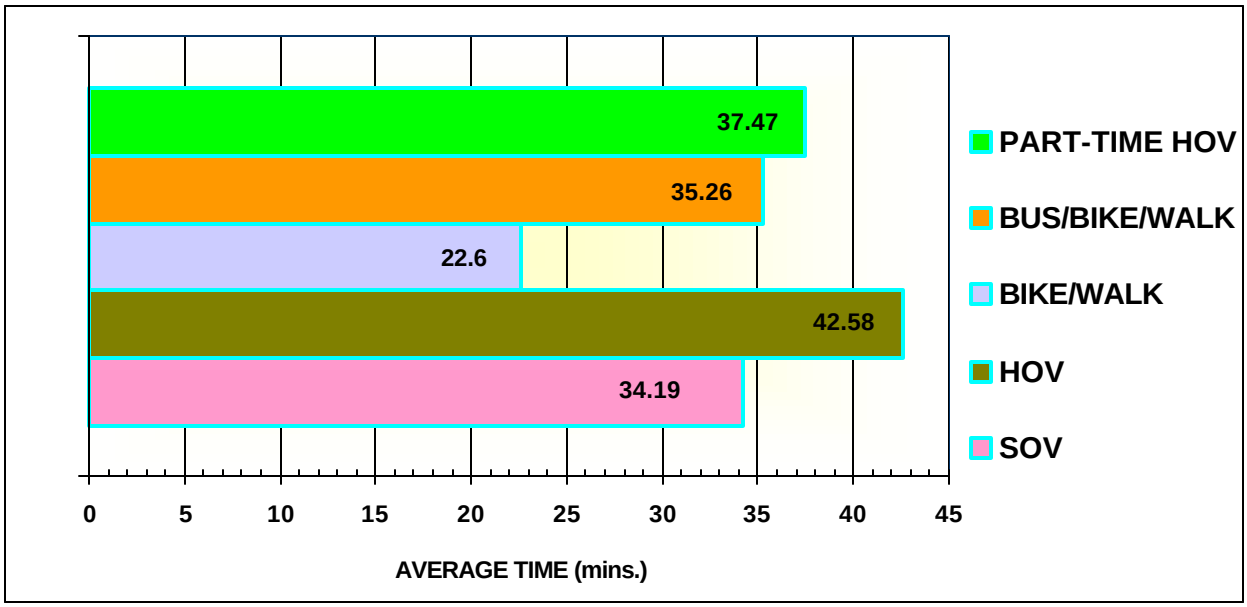
The willingness of these students to participate in a transportation demand management program has implications not only for understanding the market of UBC's ride matching service but also for other initiatives supporting carpooling such as the campus shuttle. The demand for accessibility throughout campus and its immediate surroundings can be forecasted. One example looks at the current transit strike. This market information can guide the effective implementation of UBC's temporary off-campus shuttle service.



5. AVERAGE COMMUTE TIMES

Figure 4.7 shows the students' average travel times based on their commute modes. Although they travel a shorter average distance than current carpoolers and SOV-only commuters, bus-only commuters spend the most time commuting. This relationship explains the UBC community's perspective on alternative transportation incentives. Faculty, staff, and students responded

more positively to transit than to both carpool and cycling incentives (Denike, 2000).



This time-space inconsistency also accounts for the observation that registrants living relatively farther away do not commute by bus (shown in Figure 4.5). Current carpoolers also spend a relatively longer time commuting. This is most likely because on average, they travel the farthest distance. A common belief when comparing driving alone and carpooling trends is that the latter includes significant temporal inconveniences (Baldassare et al., 1998). A qualitative comparison of average commute times (Fig.4.7) and average distances (Fig.4.5) between the two groups does not support this. This however, should not be taken as a thorough examination. Applying a quantitative approach can provide a more valid conclusion.

4.1.4 CONCLUSIONS

A descriptive analysis of students registering in UBC's ride matching database reveals that:

- Grouped by commute mode, the largest proportion of registrants are those who travel only by bus, followed by those who always drive to campus alone;

- Most of the bus-only and SOV-only commuters live less than 25 km from campus;
- Carpool-only commuters travel the farthest distance on average; and,
- Registrants who commute in more ways than one live less than 15 km from campus;
- Despite their general proximity to campus, bus-only commuters have the longest average one-way commute time.

These characteristics can guide decisions made to enhance UBC's carpool program. More specifically, the demand for vanpools and the allocation of preferential parking spaces can be better forecasted with this information. The results of this study can also be applied to understanding other transportation issues such as public transit. While many of the observations of this study conform to previous surveys, the sample does not include all the registrants of the ride matching service. There are other ways of registering data on students not included. Accounting for these other registrants, in future market analyses may reveal more information.

4.2 SCREEN LINE REPORTS

Urban Systems Limited has created partnerships with UBC and the TREK Program Centre through transportation consulting contracts. With the development of screen line reports and ground traffic analyses, commuter patterns have been identified for all UBC campus entrances. In addition, screen line reports have been conducted over a time continuum, thus indicating commuter traffic trends and growth patterns over recent years.

Table 4.8, and Figures 4.9 and 4.10 illustrate the results of a series of screen line reports conducted over a time continuum from 1997 to 1999. Although the screen line reports include traffic patterns for all modes, only single occupancy and high occupancy vehicle modes have been included for the purposes of this report. It is important to note that the screen line reports are based on characteristics of travel patterns to and from all UBC entrance corridors to include:

- NW Marine Drive

- Chancellor Boulevard
- University Boulevard
- 16th Avenue
- 41st Avenue
- SW Marine Drive

Given that there are residential areas surrounding these corridors, the results of the screen line reports may not reflect traffic patterns exclusive to the UBC campus. However, the figures portray proportionate values of SOV and HOV traffic volumes, thus reflecting overall traffic patterns in and around the UBC campus.

TABLE 4.8: HOV AND SOV TRAFFIC VOLUMES (DAILY PERSON TRIPS: TWO-WAYS)

MODE	TOTAL	PERCENT SPLIT
1997		
SOV	46000	43.36%
HOV (2 person)	27947	26.34%
HOV (3 person)	5690	5.36%
HOV 4+	2485	2.34%
TOTAL HOV	36122	34.05%
ALL MODES	106097	100.00%
1998		
SOV	49316	46.40%
HOV (2 person)	24717	23.25%
HOV (3 person)	4437	4.17%
HOV 4+	2405	2.26%
TOTAL HOV	31559	29.69%
ALL MODES	106295	100.00%
1999		
SOV	47999	42.34%
HOV (2 person)	27596	24.34%
HOV (3 person)	4792	4.23%
HOV 4+	3300	2.91%
TOTAL HOV	35688	31.48%
ALL MODES	113372	100.00%

Urban Systems, 1997-1999

TABLE 4.9: HOV AND SOV TRAFFIC VOLUMES TRENDS (1997-1999)

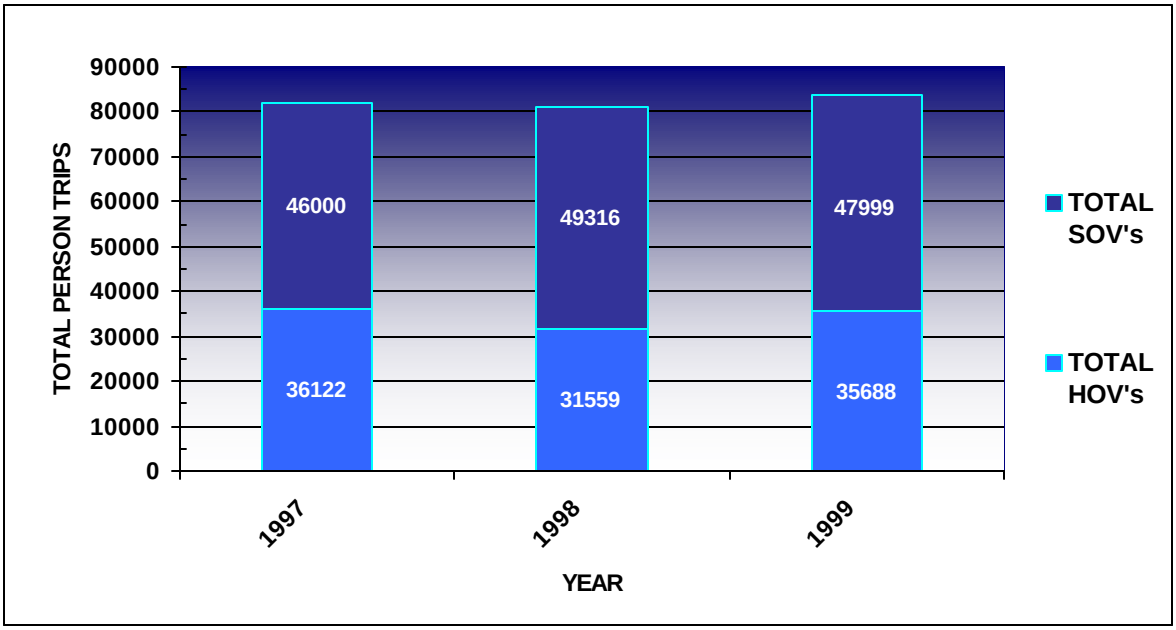
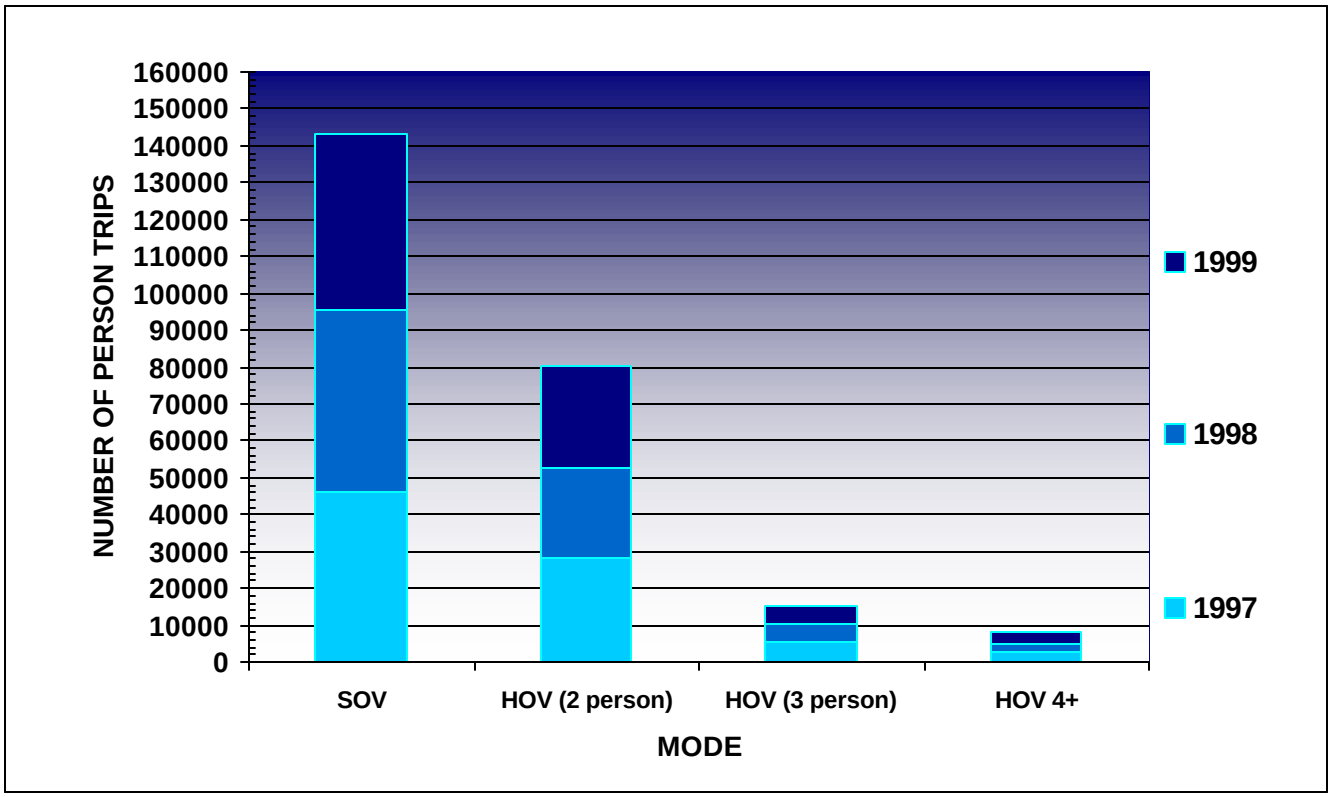


TABLE 4.10: COMPARING TRENDS IN HOV AND SOV TRAFFIC VOLUMES (DAILY PERSON TRIPS: TWO-WAYS)



The results of the screen line reports are summarized as follows:

- Given that total traffic volumes have steadily increased from 1997 to 1999, it can be expected that this trend will continue with increases in admissions and surrounding population growth.

- HOV volumes have actually decreased since 1997, however, with the implementation of an incentive carpool program, it is hoped that these numbers will begin to increase.

- SOV volumes have continued to grow since 1997. This indicates the need for an effective carpool program that may help to deter this growth trend.

- Although there have been marginal changes in SOV and HOV traffic patterns, there have been no major disruptions to growth and decline trends. This may indicate that with the implementation of a carpool incentive program, major changes in traffic patterns could occur with a marked increase in HOV trends and a steady decline in SOV trends.

Based on previous screen line reports, it is known that traffic volumes in all modes increase dramatically during A.M and P.M peak hours. Past studies have also concluded that traffic volumes experience increases during lunch hours when people may be leaving and returning to campus within a short period of time.

4.3 NORTH AMERICA-WIDE SURVEY

In developing an effective carpool program for UBC, it is important to understand what has made carpool programs successful elsewhere. Past studies predominantly focus on carpooling as an employee-based TDM strategy. Although these findings can be applied to the staff and possibly faculty, they are less relevant to the student community. This is because of students' schedules and financial status. Unlike the regular work schedules of most employees, students' commitments have greater variation in time and frequency. Their financial statuses also vary widely from those solely reliant on loans and bursaries to those fully supported by their parents or guardians. In an effort to obtain up-to-date information about external carpool programs relevant to students, a survey was written (Appendix 3) and distributed across North American post-secondary institutions with carpool programs. The survey was

designed in order to address both internal and external structures of programs. The following factors were considered:

- Program eligibility requirements,
- Effectiveness of program strategies, including incentives and rewards,
- Program management and enforcement strategies,
- Program marketing and outreach tactics.

Recognizing that no two campuses are alike, questions on contextual factors and local internal and external influences were included. The survey was distributed by e-mail to campus's transportation and parking managers throughout the United States and Canada. Registrants of an online transportation management group also received the survey. To encourage participation, the contacts were promised full access to the findings of the survey.

In total, the survey collected responses from four American and two Canadian schools. Most of the questions required little analysis beyond determining the mode response.

4.3.1 PROGRAM REQUIREMENTS

Most of the carpool programs are supported by an annual budget of over $50,000.00 generated from general operations funds. Most schools have a combined program for faculty and staff. Some also include a combined program for undergraduate students. The most common minimum carpool requirement is two people. Less than half the schools included restrictions on participants of the carpool program. Other participant prerequisites include:

- Living within close proximity of each other,
- Ineligibility for other parking permits,
- Full-time status for faculty, staff, and students,
- Residing beyond a designated radius from campus,
- Commuting by carpool at least 3 days each week,
- Traveling a logical commute path,
- Having no outstanding parking fines, and
- Registered automobile ownership.

4.3.2 PROGRAM STRATEGIES AND STRUCTURE

The most common objectives of campus carpool programs are to reduce SOV commutes, and to reduce the demand for parking. Air quality and traffic

concerns were also raised. All but one respondent have programs that have been in effect for at least three years.

Survey Question
"The following is a list of program strategies. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives."

Rank Values
1: not effective at all
2: somewhat effective
3: very effective

PROGRAM STRATEGY	*Percentage of schools implementing strategy (%)*	*Average rank of effectiveness*
Cash subsidy	17	3
Raising regular parking prices	50	3
Limited one-day parking permits	67	2.5
Guaranteed emergency ride home	67	2.5
Preferential carpool parking spaces	83	2.4
Reduced carpool parking fees	83	2.3
Flexible work arrangements	50	2.2
Motorist assistance	33	2
Ride matching service	100	1.6
Use of fleet vehicles off-campus	0	

67% of the schools enforce a combination between six and eight of the ten listed strategies. The other two both enforce only ride matching service and one other strategy.

Though implemented by only half of the schools, raising regular parking prices was perceived as a very effective strategy. Ride matching service on the other hand, while the only strategy provided by all the schools, received an average rating below 'somewhat effective.' The effectiveness of raising regular parking fees is also supported by the interest of some schools in introducing this strategy into their program. This comparison of program strategies shows that a disincentive for commuting by SOV is more effective than incentives for traveling by HOV. Furthermore, these results show that incentives that allow flexibility in

carpooling such as limited one-day parking permits and a guaranteed ride home program are more effective than incentives related to parking carpool vehicles. Therefore, accommodating for instances when carpooling is unfeasible may attract more SOV commuters.

When asked which strategies schools would like to implement, the responses included raising regular parking fees, preferential parking, parking discounts and part-time carpooling. The most common restriction on program incentives related to temporal limitations on parking space.

4.3.3 PROGRAM MANAGEMENT

For half of the schools, the responsibilities of developing, implementing and managing the program are shared with the transportation and parking offices.

Survey question
"The following are some penalties enforced for misuse of the program.
Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives."

Rank Values
1: not effective at all
2: somewhat effective
3: very effective

Program Misuse Penalty	*Percentage of schools implementing strategy (%)*	*Average rank of effectiveness*
Revoking privileges	67	2.8
Fines	67	2
Towing	33	2

Although the same proportions of schools enforce both, revoking privileges is perceived as a more effective penalty than fines. With regards to the abuse of carpooling privileges, how to check for misuse has been the issue of greater concern. Some schools suggest consistent monitoring of the parking facilities. University of Washington's experience however has led to the discontinuation of carpool monitors. These systems involved staff "whom observed permit carpools, identified those without the requisite number of passengers, filled out a form which was collated back at an office and followed

up if repeated". It was "intrusive and inconclusive so dropped". They have since adopted a new system whereby a "regular re-certification of permit carpools is required, with participants signing a statement which outlines requirements." The University of Washington also proposes "no cash incentives, providing locational preference and ride matching only, and letting the natural economic incentive of sharing the cost of an SOV permit act as the pricing". They have also considered making carpool registrants ineligible for other parking permits.

Along with the carpool program, the schools also implemented other TDM strategies. The number of strategies per school ranged from two to seven with the most common being transit discounts or passes, followed by shuttle service and improvements in bicycle facilities. Similarly, improvement in transit service is the most common external factor that affects the program's effectiveness.

4.3.4 PROGRAM OUTREACH

Survey question
"The following is a list of marketing tools. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives."

Rank Values
1: not effective at all
2: somewhat effective
3: very effective

Marketing Tool	*Percentage of schools implementing tool (%)*	*Average rank of effectiveness*
E-mail	33	3
Registration prizes	33	2.5
First year students' orientation day	67	2
Faculty and staff orientations	67	2
Advertisements in campus newspapers, flyers, and posters	100	1.7
On-campus transportation fairs	67	1.6
Classroom and office presentations	17	1
Transit advertisements	0	
Roadside signboards	0	
Other: direct mail, internet, regional program		

The most commonly implemented marketing tool, textual advertisements, are regarded on average as slightly below 'somewhat effective.' E-mail advertising on the other hand, while carried out by only 33% of the schools, is rated as very effective. Marketing tools that some schools are interested in include orientations for faculty and staff, transportation fairs, and e-mail.

The most common form of measuring program success is through counts of carpool parking registrants and HOV commuters.

Survey question
"What are the significant obstacles of the program's effectiveness?"

Program Obstacle	***Percentage of schools affected by this (%)***
Communication	67
Budget	50
Politics	50
Logistics	50
Collective agreements	33
Free parking	17
Other: lack of HOV infrastructure near campus, ineffective ride matching, and ambivalence among management because of program misuse.	

As reflected in the evaluation of marketing tools, communication is a significant obstacle in the effectiveness of the carpool programs.

4.3.5 CASE STUDIES

The University of Washington's (UW) student carpool program works without a registration component. Carpools of three or more students are entitled to free parking, first come, first served, in three lots. Carpools of two students are eligible for these spaces on weekdays after 4 pm and on Saturdays before noon (UW Transportation Office, 2001). All carpool members are required to present their U-pass card to an attendant upon which entry is electronically configured to disable the purchase of parking permits within one or two hours from entry. There is also a separate lot available during weekdays for carpools of two or more, again on a first come, first served basis. The UW faculty program provides a registered carpool parking permit valid everyday with no time restrictions for two-plus carpools. Part-time

carpools are also recognized with benefits similar to the student three-plus carpool program (UW Transportation Office, 2001).

Simon Fraser University's carpool program is described by the GVRD as one of the two most successful carpool programs in Greater Vancouver. Student carpools gain access to reserved parking spaces in the cheapest permit lot. Registration is required for these carpools of three or more people commuting at least four days a week. Faculty and staff carpools are given a limited number of one-day parking passes as well as unlimited evening/weekend parking access (SFU Parking Services, 2001).

The University of Victoria offers carpool commuters designated reserved parking spaces and a reduction of parking fees by 50%. Giving each registered carpool one permit enforces this program and carpool members are not allowed to purchase other parking permits (University of Victoria, 2001). However, a transportation audit observed that this "system has been hardly used and highly abused" (Hocking, 2000). One suggested reason for this is the lack of a ride matching service (Hocking, 2000).

Like the University of Washington's, Cornell University's (CU) carpool program is also recognized as a model example (Victoria Transport Policy Institute, 2000). The faculty and staff ride share program of Cornell University is organized in a tiered system with different degrees of benefits depending on the number of people in the carpool. The minimum, a two-person carpool, is eligible for saving between 45 to 100% of regular parking permit fees. Carpools of three or more people receive a combination of parking discounts, rebates, and reserved spaces, depending on the type of permit they are eligible for (CU Commuter and Parking Services, 2001). Other program benefits include a 30-day risk-free trial period, one-day parking permits, guaranteed ride home, ride match service, as well as additional concessions for carpoolers with child-care responsibilities (CU Commuter and Parking Services, 2001).

The University of California at Irvine operates a student program wherein all commuters with a parking permit, entering before 10 a.m. with at least two people, are given 'Student Carpool Dollars' by the parking attendant. These currencies are valid for purchases at local businesses and are advertised as cash subsidies for parking

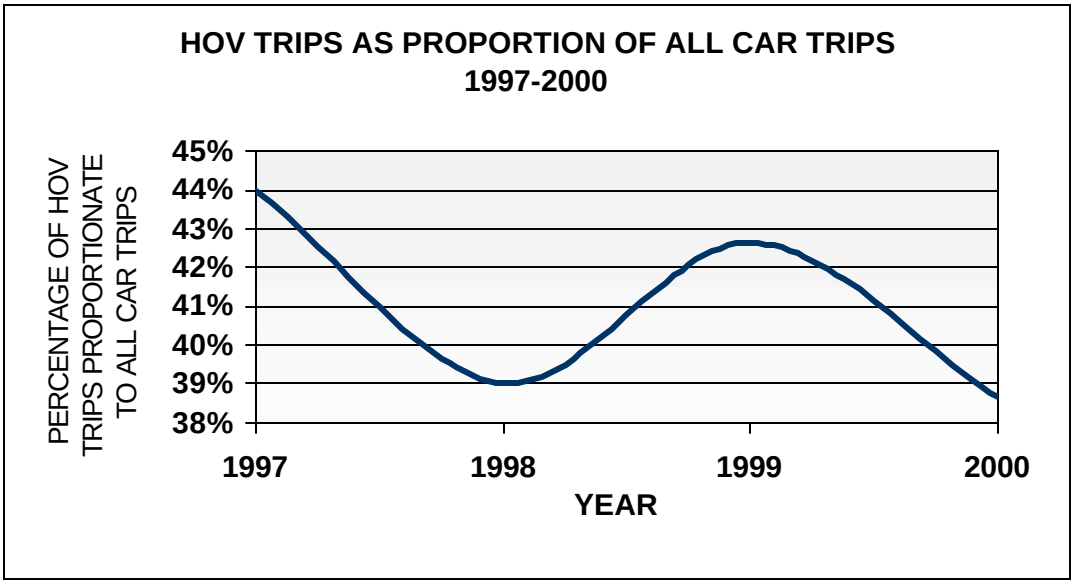
permits. More carpool incentives are offered for graduate students and employees such as access to preferred parking in more than one parkade, regular prize draws, and limited one-day parking permits (CU Commuter and Parking Services, 2001).

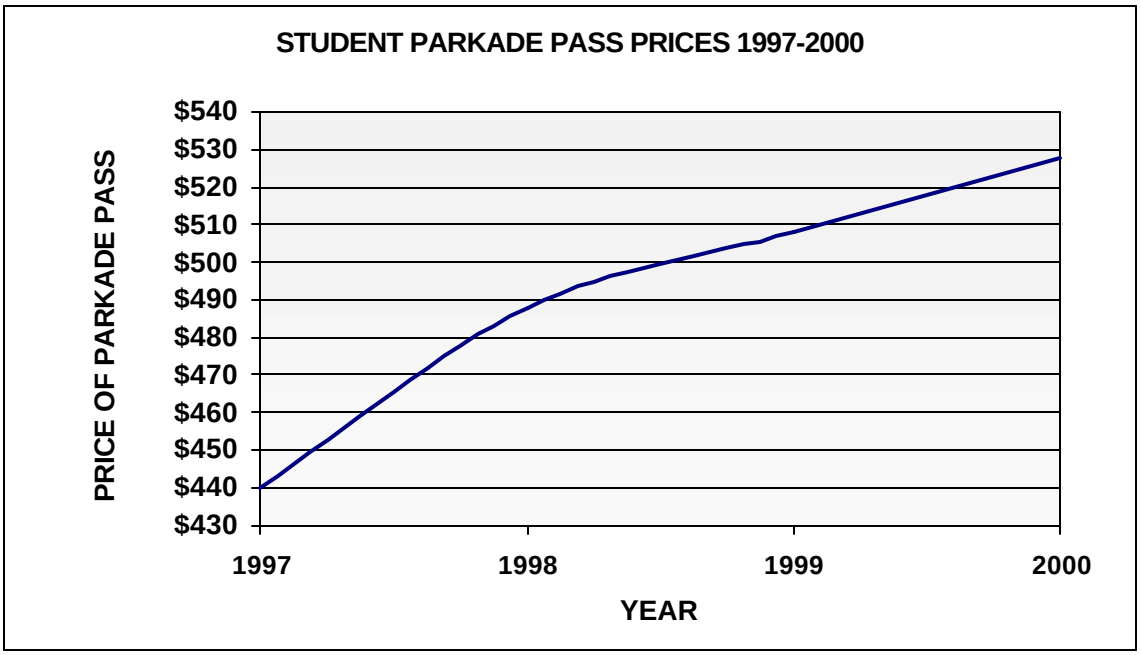
4.4 DEMAND FORECAST

In order to plan an effective and affordable carpool incentive program, it is necessary to predict the magnitude of demand for discounted HOV parking spaces. In this section, we consider the likely change in travel behaviour and associated demand under various rates of discount for HOV parking passes.

4.4.1 UBC DATA

A forecast of future demand should make as much use as possible of observations of the target population's past behaviour. Unfortunately, because parking rates have not changed dramatically from 1997 to 2001, no meaningful relationship between parking rates and carpooling behaviour can be drawn. This fact is illustrated by the following two graphs. The first graph shows the change in HOV trips as a proportion of total car trips to UBC over time. The second shows the price of student parking passes over the same period. It is clear that while the proportion of HOV trips has fluctuated over the past four years, this is not directly related to changes in the cost of parking. Fluctuations may be attributable to bus service changes, data collection methods, or other factors.





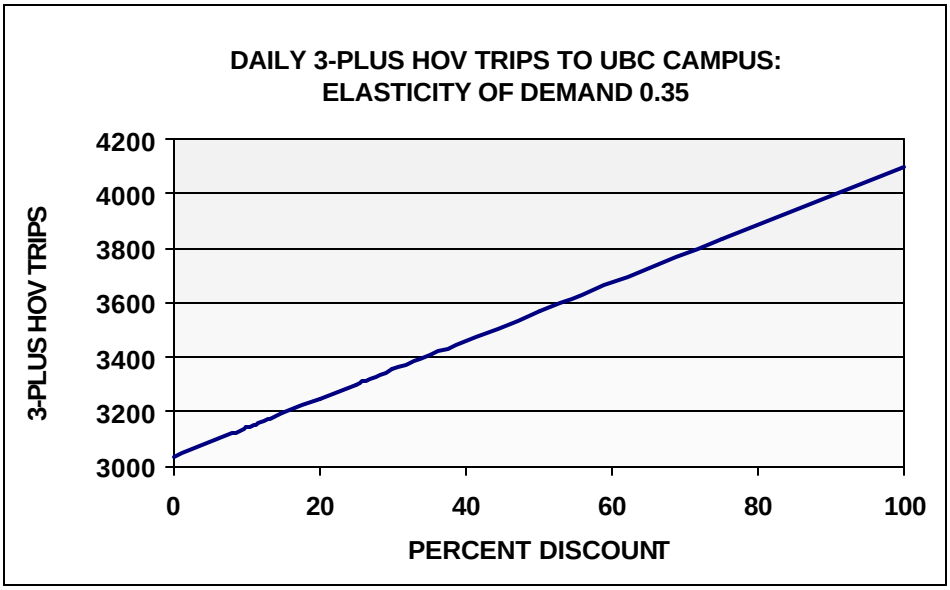
4.4.2 FORECASTING METHODOLOGY AND RESULTS

Because of the limitations of UBC-specific data relating HOV use to parking rates, the following demand forecast draws upon general observations of travel behaviour in other settings, and a GVRD-specific occupancy model. We use two distinct methods to forecast the demand for new carpool parking spaces that might be expected.

The first method is to use the elasticity of demand found in studies of mass transit to the demand for HOV parking spaces. Elasticity of demand is defined as the percentage change in demand accompanying a one percent change in price. The large numbers of studies that have estimated this value for mass transit show that transit fares have elasticity in the range of -0.3 to -0.4 (Wachs, 1999). In other words, a one percent change in transit fares leads to a change in ridership of 0.3% to 0.4 % in the opposite direction. It should be noted that while this range is consistent for most transit price changes, very large fare changes, or outright elimination of fares, have been known in certain circumstances to bring about much larger, though often highly localized, changes in ridership (Wachs, 1999).

In the following projection, we use the median elasticity of -0.35, meaning that a 10% decrease in the price of parking will induce an increase in 3-plus HOV use of 3.5%.

% discount	3-plus HOV trips
0	3063
10	3170
15	3224
20	3277
25	3331
30	3385
50	3599
75	3867
100	4135



The second set of projections is based on a multi-level logit function HOV / SOV model for Greater Vancouver (Appendix 4) (Hoff and Hull, 1998). This model includes parameters derived specifically for post-secondary trips and for work trips. We use the post-secondary parameters to model the student population and the work trip parameters for faculty and staff commuters.

Inputs to the model include a 'generalized cost' value of SOV and HOV trips calculated through the EMME/2 transportation model, area of the trip destination, value of commuters' time, and parking rates for SOV, HOV (two-person), and HOV three-plus.

For the generalized cost input, we use values for the average commute distance to UBC of approximately 17 kilometers (Hoff, 2001). We use three hectares as the area of UBC. This approximates the extra distance a carpool participant would walk to his or her destination from a "compromise" parking lot (as opposed to distance from the individual's preferred lot).

For the value of commuters' time, we use $9.50 per hour for faculty and staff. This is the standard rate used in GVRD models, and is approximately half the average

wage of GVRD residents. Students' time is valued at the lower rate of $5.00 per hour because students generally earn lower wages than the average worker, and because students' schedules are generally more flexible than those of working people (we reason that students have fewer family and other commitments).

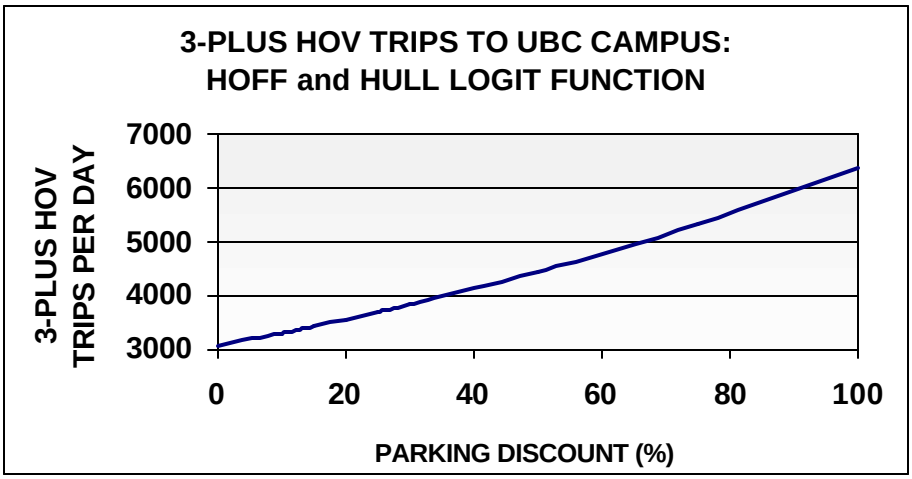
Using these values, and the parameters and bias values derived by Hoff and Hull, we obtain an SOV / HOV mode split that is fairly close, overall, to current screen line totals (Urban Systems, 2001), but significantly under-predicts faculty and especially staff carpool rates (Denike, 2001). We adjust the bias values for staff and faculty to achieve the approximate population split of carpoolers (proportion of carpoolers who are faculty, staff and students).

Applied to the UBC population, Hoff and Hull's model, using their original parameters and modifications as stated above, accurately predicts the split between HOV and SOV. Just fewer than 65% of car trips to UBC are SOV trips, and 35% are made in HOV's. The most recent screen line data shows HOV trips at 38% of all car trips. During the four years for which data exist, this value was highest in 1997, at 44%.

There are problems with the model's prediction of two-person versus three-plus HOV's. According to the parameters used above, three-plus HOV trips are predicted to make up 40% of all HOV trips. However, screen line data from 1997 to 2000 shows the proportion of HOV trips in carloads of three or more to be between 21% and 23%. In order to bring this value down to its observed value, we adjust the "penalty" parameter for carpools of three or more. This gives us the correct split between three-plus and two-person HOV's, but reduces the proportion of HOV's relative to SOV's somewhat, bringing this value to down from 35% to 31%.

Because it is the growth of three-plus HOV's we are most interested in, the results shown here use the adjusted three-plus penalty parameter. We then adjust the number of trips predicted to reflect the actual starting point of 3063 HOV three-plus trips per day from the 2000 screen line by adding 222 trips to each result. We note that the elasticity of demand predicted by this model, at –1.08, is significantly higher than that used in our previous forecast.

% discount	3-plus HOV trips
0	3063
10	3293
15	3422
20	3551
25	3683
30	3827
50	4439
75	5317
100	6381



4.4.3 DISCOUNT PROGRAM COST

In this section, we estimate the cost to UBC of offering a discounted three-plus HOV parking permit. We show the cost of the various discount strategies under both a high and low demand scenario, using the elasticity-based results from above as our 'low' demand projection, and the results Hoff and Hull's logit function model as the 'high' estimate.

The projected number of three-plus carpool parking spaces is simply three-plus HOV trips divided by three. The cost of the parking discount will vary depending on whether Parking Services charge the reserved or regular rate for these spaces. Carpool passes will likely allow holders to use particular parking spaces, for reasons of both enforcement and pass-holder convenience. The definition of privileges associated with carpool passes, and the associated administrative and enforcement costs will likely play a role in the price charged for these spaces.

'Regular' cost in the tables below is based on the weighted average of current parkade pass prices, at $608.00. This average assumes, based on a rough estimate by Steve Briggs, Parking Office Supervisor, that half of the passes are eight-month student passes and half are full-year faculty and staff passes. 'Reserved' cost is based on the average reserved parking rate of $1,250.00. The appropriateness of the regular parking pass price will be decided based on discussions with UBC Services.

Recognizing that not all carpoolers will take advantage of the discount program, the predicted costs below may be interpreted as representing an upper bound of how much the discount program is actually likely to cost. Table 5.1 shows the cost of

offering an ongoing year-round discount on three-plus HOV parking permits. As can be seen, the cost of even a small year-round discount is substantial.

TABLE 5.1: ONGOING PARKING DISCOUNTS FOR 3-PLUS HOV VEHICLES

Discount (%)	Regular (low)	Regular (high)	Reserved (low)	Reserved (high)
0	-	-	-	-
10	57,317	59,540	132,092	137,214
15	87,430	92,809	201,488	213,885
20	118,511	128,393	273,118	295,892
25	150,562	166,460	346,980	383,619
30	183,582	207,591	423,077	478,408
50	325,352	401,320	749,797	924,871
75	524,370	720,944	1,208,449	1,661,468
100	747,617	1,153,620	1,722,938	2,658,600

Table 5.2 shows the cost of offering a one-month incentive discount to newly registered carpools.

TABLE 5.2: ONE-MONTH INCENTIVE DISCOUNT TO ALL NEWLY REGISTERED HOV VEHICLES

Discount (%)	Regular (low)	Regular (high)	Reserved (low)	Reserved (high)
0	-	-	-	-
10	5,732	5,954	13,209	13,721
15	8,743	9,281	20,149	21,388
20	11,851	12,839	27,312	29,589
25	15,056	16,646	34,698	38,362
30	18,358	20,759	42,308	47,841
50	32,535	40,132	74,980	92,487
75	52,437	72,094	120,845	166,147
100	74,762	115,362	172,294	265,860

Offering an initial discount to promote a change in consumer behaviour is a widely used marketing strategy that has been adopted with success by some ride-sharing programs. The values presented here are simply the full-year costs divided by

ten (again assuming half of the passes sold are eight-month student passes, and half are full-year staff and faculty passes).

Note that although the predicted increase in three-plus HOV trips varies widely depending upon the model used, the cost of a discount program is not so sensitive to these results, because much of this cost is associated with current, rather than predicted, carpoolers.

5.0 SUMMARY OF RESULTS AND FINDINGS

The main objective of the carpool program is to increase transportation choices by helping to reduce 24-hour single occupancy vehicle traffic to and from UBC by 20% below 1997 levels by November 2002 (TREK Program Center, 1999). In achieving this goal, several recommendations for implementation have been included in this report and have been created from the methodological results and findings.

The carpool outreach campaign revealed a sample profile of potential carpool commuters, which helps in illustrating a small percentage current UBC mode splits and commuter distances. Findings show that the largest proportion of mode splits are bus riders (34%) followed by SOV drivers (24%). This indicates that there is a large SOV population that could potentially become carpool participants. Given that a large market of SOV drivers exist, this market could change with the development of a desirable carpool program. In addition to mode splits, the results of the outreach campaign also indicate that as students live closer to campus, they are more than likely to drive alone or take the bus. However, as distance increases, so too does the cost of driving an SOV, therefore students are more inclined to carpool. As the cost of owning and operating a vehicle becomes more costly, students become more willing to consider alternatives, such as carpooling.

The screen line reports revealed commuter traffic pattern trends specific to HOV and SOV users. This helps in developing an understanding of commuter market characteristics. From 1997 to 1999, fluctuations in HOV and SOV mode splits have been observed. In 1997, there is a 9.31% difference between HOV and SOV users. In 1998, this difference increases to 16.71%, with SOV users growing and exceeding the amount of HOV users. The reason for this large decrease in HOV users and

increase in SOV users is unknown. In 1999, there is an increase in HOV users from 1998 levels and just below 1997 levels. The mode split between HOV and SOV users is just over 10%. The screen line reports also indicate that as carpool participants' increase to three and four-plus groups, the number of vehicles decrease. It is assumed that two people in a carpool can be considered convenient, while three or more people require more effort. Therefore, if an effort is made to form a three-plus carpool group, these participants should be rewarded through cash incentives or preferential spaces that give some convenience back. By doing so, it is hoped that more people will be willing to form a three plus carpool group.

The results of the North-America wide survey help to identify successful aspects of carpool programs that may be employed at UBC. It has been found that offering preferential parking spaces in addition to a free ride matching service are the most effective program strategies. Cash subsidies are not deemed as effective because there is a natural cash subsidy to carpooling given that parking prices are immediately divided by the number of carpool participants in any given vehicle. In addition to HOV incentives, SOV disincentives are also seen as an effective means in reducing SOV traffic. Although UBC cannot raise the cost of SOV parking stalls while decreasing the cost of HOV stalls, preferential spaces can be employed for HOV users. This may be seen as a disincentive to SOV users because they will not be given access to any preferential carpool spaces. In addition to logistical aspects of the carpool programs, the survey also addressed marketing and outreach tools. The results indicate that the most effective marketing tools are e-mail notices and advertising campaigns, followed by transportation fairs and orientation days. These techniques will be addressed and employed by UBC in an effort to effectively market the introduced carpool program.

Demand forecasting of the increase in HOV trips generated by an HOV parking discount shows that current carpool trips to UBC could as much as double. There is a wide range in the predictions of the two models used. The projected cost of a discount program does not vary too widely with this result, however, because much of the total cost is associated with current rather than predicted carpoolers.

6.0 RECOMMENDATIONS

Based on several methodological approaches and literature reviews, this report proposes the following recommendations for a UBC carpool program. These recommendations have been broken down into implementation strategies, action steps, enforcement strategies, and marketing and outreach tactics.

6.1 IMPLEMENATATION STRATEGIES

HOV PARKING INCENTIVE:

An HOV parking incentive program should ideally include both a price discount and access to preferred parking locations. The program should allow some flexibility to provide options for those commuters who are not able to commit to exclusive carpooling. The following are suggestions of how such an incentive program may be structured.

1. ELIGIBILITY

Carpool vehicles are defined as vehicles with occupancy of three or more at least three days per workweek.

2. PREFERRED PARKING SPACES

Blocks of parking spaces in prime locations in campus parkades and surface lots are set aside for carpool-only use during peak arrival time (before 9:30 am). After that time, these spots become available to SOV drivers. In parkades, a carpool decal is required to park in designated carpool spaces. A block of B-lot spaces is reserved before 9:30 am for carpoolers without a carpool permit.

3. CARPOOL PERMIT

A carpool permit is valid for any parkade space on campus, and carpool groups are exempt from the parking lottery. Faculty and staff may also use carpool permits in faculty/staff reserved surface lots.

When using a carpool permit to enter through one of the automated parkade gates, vehicle occupancy of at least three is required. On days when occupancy is less than three, carpool permit-holders must enter through the 'visitor' gate, take a ticket, and show the parkade attendant a carpool permit upon exit in order to waive the daily parking fee. The attendant then notes the use of one 'SOV-day'. Each carpool group is allowed two such 'SOV-days' per workweek.

Carpool permits allow use of reserved carpool parking spaces in parkades and surface lots before 9:30 am.

The cost of a carpool permit is pro-rated according to the month of purchase.

Regular permit holders may exchange their permit for a carpool permit at any time upon which a refund will be given equal to the cost of one month of free parking.

4. RISK-FREE TRIAL PERIOD

Parking is free for the first month that a carpool of three or more participants is registered. Carpool participants may reserve, without cost, a regular parking permit until the end of this one-month trial period.

After the trial period, the carpool group may purchase a carpool permit for the remainder of the academic or calendar year (on a pro-rated basis). If one or more carpool members choose to leave the carpool, those individuals may purchase their reserved regular parking permits, also at pro-rated price.

Subject to availability of parkade space, a new carpool group may initiate the trial period at any time during the year, and a carpool pass may be subsequently purchased.

5. FLEX VOUCHERS

Each carpool permit includes ten flex vouchers for a free day of single occupancy vehicle (SOV) parking in B-lots. Vouchers are marked with the license plate numbers of the carpool group and are non-transferable outside the group. The vouchers must be marked with the day of use to be valid.

HOV PRICE DISCOUNT:

Based on the implementation recommendations and the demand forecast and cost projections presented in section 4.4, a temporary parking discount for first time carpoolers may be considered. A common marketing strategy is to offer an initial discount as an incentive for consumers to change their behaviour or try something new. This may be particularly appropriate for a carpool incentive program, as attitude towards ride sharing is positively influenced by having previous carpool experience (Ozanne and Mollenkopf, 1999). Costs in the table below assume a one-month discount period. Half of those who try carpooling as a result of the parking incentive program are assumed to continue carpooling after the discount period is over.

Discount (%)	Cost ($)		New Carpoolers		$ / New Carpooler	
	LOW	HIGH	LOW	HIGH	WORST	BEST
50	32,535	40,132	268	688	121	58
75	52,437	72,094	402	1127	130	64
100	74,762	115,362	536	1659	139	70

6.2 ACTION STEPS

1. Establish partnerships with UBC Parking Services in order to define recommendations as per section 6.1, and 6.3

2. Collaborate with UBC Parking Services in order to implement defined recommendations effective September 2001.

3. Develop an HOV parking incentive carpool outreach strategy to promote recommended incentive program (refer to section 6.4)

6.3 ENFORCEMENT

In establishing an effective carpool program for the UBC community, it is important to also create an enforcement system. This helps to ensure the program is being used to its fullest capacity, in addition to monitoring the program's effectiveness. Given that the recommended carpool strategy is an introductory program, the suggested mechanism for enforcement may be subject to change.

1. REGISTRATION

REGISTRATION AGREEMENT FORMS: All carpool participants must fill out a registration form that includes a UBC identification number, proof of address, and license plate numbers of each registered car that may be used by the carpool group. Registration can occur at any time during the school year.

REMOVABLE DECALS: Each carpool group will receive one removable carpool permit decal. These decals must hang from the vehicle's rear view mirror while the vehicle is parked so that the permit is clearly visible through the windshield. The decal may be transferred among registered carpool members within a group.

2. BASIC RULES

CARPOOL COMMITMENT: Carpool permits may be used by a registered carpool vehicle containing less than three persons no more than two days per workweek.

ONE-AT-A-TIME: Only one vehicle registered to a carpool group may use the carpool permit at any one time.

DROP OFF AND PICK UP: All registered carpool participants must arrive and leave from the same location, i.e. carpool vehicles cannot drop off or pick up registered passengers before arriving to, or departing from, the carpool stall. In the event that drop-off's or pick-up's are necessary, the carpool participants must notify parking services and may be given a special appeal.

PARK VEHICLE AND DISPLAY PERMIT: The carpool permit must be clearly displayed and visible to Parking Enforcement Officers from outside the vehicle.

MEMBERSHIP CHANGES: Carpool groups should report changes in membership to Parking Services immediately. New participants must complete a registration agreement form. Notice must be given to Parking Services within seven days after a participant leaves a carpool. The carpool group shall be given an additional 14 days to recruit additional members as necessary in order to maintain vehicle occupancy of at least three, or carpool privileges will be revoked.

ACCESS TO SPACE: Carpool parking areas will be exclusively for registered carpool vehicles until 9:30 am. After this time, these spaces are available to non-carpool vehicles. A carpool arriving later than 9:30 is responsible for finding alternative parking if no designated carpool spaces are available.

DROP OFF AND PICK UP: All registered participants within a group must arrive at and leave from the same location at least three days per work week, i.e. carpool vehicles cannot drop off or pick up registered passengers before arriving at, or departing from, the lot in which the carpool is registered. In the event that drop-offs or pick-ups are necessary, a carpool group should appeal to Parking Services and may be granted a special exemption.

3. MISUSE OF PERMIT

Misuse of permit may result in a citation, vehicle impounds, revocation of the permit, and fines established by parking services. Misuse includes, but is not limited to:

1. Failure to comply with the "Basic Rules" outlined above;
2. Falsifying information on the application or renewal forms;
3. Duplicating a permit;
4. Transferring a permit to persons or vehicles not registered to your carpool.

4. MONITORING

Two monitoring functions are essential to ensure compliance with program rules:

a) **PARKADE GATE:** monitors watch incoming cars to ensure that all vehicles using carpool permits are occupied by at least three people during peak arrival times.

This function could be carried out by TREK work-study students. Intensive gate monitoring will be necessary during the first month of the program, with less frequent spot checks continuing after this period. Penalties should be severe (we suggest immediate revocation of permit without compensation) for violations at the parkade gate, since such violations are difficult to monitor and have the potential to seriously undermine the credibility of the carpool incentive program.

b) **PREFERRED SPACES:** monitors ensure that carpool decals are displayed by vehicles parked in dedicated carpool spaces before 9:30. B-lot carpool spaces (where no decal is required) are monitored daily from 8:00 to 9:30 am to ensure that incoming cars meet the minimum occupancy requirement.

6.4 MARKETING AND OUTREACH

In developing a marketing and outreach campaign, the UBC carpool program will gain recognition in addition to raising the identity of the TREK Program Centre. The marketing and outreach campaign will help in building awareness of alternative transportation strategies and choices through the promotion of the carpool incentive program. It will target the entire UBC community including students, staff, and faculty members in an effort to help reduce SOV traffic volumes to and from the UBC campus. The marketing and outreach campaign will include (but is not exclusive to) the following recommendations:

- TREK personnel will be present at September 2001 parking permit sales to promote and register HOV parking permits.
- Marketing campaign in first week of September 2001 classes to let students and faculty know about the incentive program. Similar campaign outreach strategies will also be considered for future dates.
- Advertise the carpool program through AMS banner boxes and postering and bookmark campaigns.
- Liaise with TREK outreach team to consider further marketing outlets.

7.0 CONCLUDING REMARKS

This report has outlined recommendations for the implementation of a UBC carpool strategy. It is hoped that through the implementation of this program, the TREK Program Center will help to increase transportation choices by helping to

reduce 24-hour single occupancy vehicle traffic to and from UBC by 20% below 1997 levels by November 2002 (TREK Program Center, 1999). The recommendations are based upon several methodological approaches as outlined in the above report. Given that this is a transportation demand management strategy new to UBC, program results may vary from the predicted results suggested in this report. As the program is implemented and developed, revisions and updates to these recommendations will undoubtedly follow.

APPENDIX 1: UBC PARKING FACILITIES (TREK PROGRAM CENTRE, 1999).

This map illustrates the locations of UBC Parking Facilities, including current parkades and surface lots.

APPENDIX 2: CARPOOL OUTREACH CAMPAIGN FORMS

This form was used during the initial carpool outreach campaign. Individuals interested in registering with the free ride match database were asked to fill out this form and hand it back to TREK personnel. In addition to being added to the ride match database, individuals also filled out information pertaining to current commute modes and travel distances. This information was subsequently used as sample data, as illustrated in section 4.1 of this report.

PLEASE FILL IN

Please take a few moments to fill in all of the information below, and hand it to the TREK presenter. This information will be kept strictly confidential, and used only for rideshare demonstration purposes.

1. Your Name: Mr. Mrs. Ms. _____
2. Your phone number: _____
3. Your e-mail: _____
4. Your Home Postal Code: **V** _____
5. How do you normally get to UBC now (check all that apply):

- Drive Alone _____ Carpool _____ Bus _____ Bike __ Walk _
- How much do you spend (roughly) on transportation each month? $ _____
- Roughly what is your travel time **to** UBC (on an average day)? _____ (Minutes)
- (Roughly how many kilometres is it to UBC from your place? _____

6. If TREK could save you 15% or more on your monthly costs getting to UBC, without significant change(s) in your lifestyle, would you consider **it** just one day a week?
   Probably, tell me more about **it** _____ Never _____

Thanks for your time!

This rideshare demonstration project is being sponsored by the UBC TREK Program Centre, rideshare office.
Contact information: e-mail trek@ubc.ca, phone: 827-RIDE

UBC TREK Program Centre

Improving Your Transportation Choices

PLEASE NOTE: To access your rideshare file, go to the TREK website (www.trek.ubc.ca), click twice on Commuter Connections buttons, then logon using your first* name as USER name, and your last name as your PASSWORD.

*We may need to modify your USER name for others with the same user name and/or last name, but whatever it ends up as will be given to you on a match report e-mailed to you.

APPENDIX 3: NORTH-AMEICA WIDE SURVEY FORM

This survey was distributed via e-mail to several North American post secondary institutions that have employed carpool initiatives. The recommendations for a UBC carpool program that have been presented in this report have been partially based on successful aspects of program details elsewhere.

DEAR COLLEAGUE
You have been identified as a contact person on carpooling, and we'd appreciate your help in completing the following carpool survey.

Background:
This cross-Canada university carpool survey has been created and designed by two University of British Columbia Geography and Urban Planning students who are working in conjunction with the UBC TREK Program Centre (Transportation Planning) on ways to implement effective carpool strategies. We understand that you may have a carpool program at your university, and would appreciate knowing more about it. For simplicity, 'carpool' = 'vanpool' as well. We will gladly share the data gathered from this survey, which will be published in a report this Summer, and posted for FREE downloading from our website at www.trek.ubc.ca . To expedite our analysis and report, we'd appreciate if you could get back to us within the next two weeks, by May 4th. If you have reports available on your carpool program that can be e-mailed to us, or have a website containing carpool information, please let us know in the comment section following. If you do not have an active carpool program, you are still welcome to fill this survey out and partake of our published report. This survey should take approximately 5 minutes to complete.

1.0 Programming

1.1 Objectives of the Program

a) What are the goals of your carpool program? (Please put in an X beside those that apply)
___ SOV reduction
___ Increased carpool mode share
___ Reduced demand for (scarce/costly) parking stalls
Other:

b) Which office(s) is/are responsible for the development, implementation, and management of the program (if not you, please provide details for follow-up)?

c) How long has the program been in effect?
Under 1 year____ 3-4 years____
1-2 years____ 4-5 years____

2-3 years ____ Over 5 years____

d) If you have a preferential program (i.e. location, price, etc.), what is the minimum requirement of the carpool?

___1+ ___2+ ___3+ other:

1.2 Program Strategies - Carrots and Sticks

The following is a list of program strategies. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives.

1: not effective at all
2: somewhat effective
3: very effective

___ Cash subsidy
___ Reduced carpool parking prices
___ Preferential carpool parking spaces
___ Ride matching service
___ Use of fleet vehicles off-campus
___ Flexible work arrangements
___ Guaranteed emergency ride home
___ Motorist assistance
___ Temporary parking permits for when carpooling is unfeasible
___ Raising regular parking prices
Other:

a) Are there any strategies that you have taken out of your program? Why?

b) Are there any strategies currently not part of your program, but which you would like to implement? Why?

d) Are there any restrictions included with these strategies (i.e. time restrictions for using carpool parking lots)?

1.3 Program Structure

a) What is the user structure of your program?
___ Separate program for faculty, staff, and students
___ Combined program for faculty and staff, and a combined program for graduate and undergraduate students
___ Students only
___ Faculty and staff only
Other:

b) The following is a list of registration procedures. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives.
1: not effective at all
2: somewhat effective
3: very effective

___ In-person registration at an office
___ Temporary information and registration booths throughout campus
___ Mailing or faxing a registration form
___ Telephone registration
___ E-mail or on-line registration
Other:

c) What are the restrictions for program participants?
___ Student
___ Faculty
___ Staff
___ Automobile ownership
___ Required purchase of a U-pass
___ Carpool members live within close proximity of each other
___ Ineligibility for other parking permits
___ None
Other:

d) The following are some penalties enforced for misuse of the program. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives.
1: not effective at all
2: somewhat effective
3: very effective

___ Fines
___ Revoking privileges
___ Towing
___ None
Other:

e) Are there any penalties that you have taken out of your program? Why?

f) Are there any penalties currently not part of your program, but which you would like to implement? Why?

g) Any advice regarding how we can best minimize abuse of carpool program 'incentives' (i.e. cash discounts)?

1.4 Funding Strategies

a) What is the annual budget of your program? (if possible, please attach a program budget excel spreadsheet)

___ Less than $10,000 ___ $10,000 - $50,000 ___ Over $50,000

b) What is the staff employment (in FTE) of your carpool program?

c) If you offer participant discounts, how is this subsidized?
Type of participant discount:
Source of funding:
___ General operations funds
___ Included in the price everyone pays
___ Grants
___ Historic (i.e. never generated revenue)

2.0 Contextual Factors

2.1 Site size / demand

Please indicate the number of:
_____ Students employed (FTE) at this Campus.
_____ Staff/faculty employed (FTE, non-student) at this Campus.
_____ On-campus beds for student, staff, and faculty
_____ How many drive alone
_____ How many carpool
_____ How many take transit
_____ How many ride bikes, _____walk
Is the campus served well by transit? _____YES _____NO

2.2. Supporting Policies

What other on-campus TDM strategies are implemented to promote alternative transportation?
___ Transit discounts or passes
___ Bicycle facilities improvements
___ Pedestrian improvements
___ Shuttle service
___ Telecommuting
___ On-campus residence improvements
Other:

2.3 External Influences

What local factors outside of the school's jurisdiction have affected the program?

___ Transit service improvements
___ Fuel prices
___ Other municipal or regional carpool programs
___ Prorated insurance, licensing and registration by mileage for auto owners
___ Local vehicle ownership cooperatives
___ HOV lanes on routes to campus
___ Transit strike
Other:

3.0 Implementation

3.1 Marketing approach

a) To which groups do you have specific marketing strategies?

___ Faculty
___ Staff
___ Students

b) The following is a list of marketing tools. Of those implemented in your program, please indicate on a scale of 1 to 3 how effective these are in achieving your objectives.

1: not effective at all
2: somewhat effective
3: very effective

___ On-campus transportation fairs
___ First year students' orientation day
___ Advertisements in campus newspapers, flyers, and posters
___ Classroom and office presentations
___ Faculty and staff orientations
___ Registration prizes such as coupons or raffle draws
___ E-mail
___ Transit advertisements
___ Roadside signboards
Other:

c) Are there any marketing tools that you have taken out of your program? Why?

d) Are there any marketing tools currently not part of your program, but which you would like to implement? Why?

3.2 Results and Evaluation

a) Have your program objectives been achieved? ___ Yes ___ No

b) What is the change in carpool mode share before introduction and since implementation of the program?
___ Not measured ___ No change ___ 10% increase in carpooling ___ 20% increase
___ > 30% increase

c) What measures do you use to determine the success of the program?
___ SOV reduction counts
___ Carpool counts
___ Carpool parking registrants
___ Annual reports
___ Participant surveys (determining changes in travel time, mode,etc.)
Other:

d) What are the significant obstacles of the program's effectiveness?
___ Communication
___ Budget
___ Politics
___ Collective agreements
___ Logistics
___ Free parking
Other:

Thank you very much for completing this survey. Please feel free to include any additional comments on designing and implementing a campus carpool program below.

If you have any comments, questions, or concerns pertaining to the TREK program Centre or this survey, please do not hesitate to contact us.

APPENDIX 4: LOGIT MODEL EQUATIONS (HOFF AND HULL, 1999)

This illustrates the demand-forecasting model that was applied for the purposes of this report. The model depicts the mode split of HOV's compared to SOV's under various incentive scenarios

The splitting of person-trips into SOV and ride-share followed a standard logit function of the form:
PROPsov = 1 / (1+exp(B*(IMPsov – IMPrs)

Where:
PROPsov is the proportion of auto person trips forecast to be SOV person trips
IMPsov is SOV impedance
IMPrs is rideshare impedance

Similarly, ride-share trips were split into 2 HOV and three-plus HOV based on:
PROP2hov = 1 / (1+exp(B*(IMP2hov – IMP3+hov)

Where:
PROP2hov is the proportion of ride-share person trips forecast to be 2HOV person trips
IMP2hov is 2HOV impedance
IMP3+hov is 3+ HOV impedance

Impedences for each occupancy class were calculated as follows:
SOV IMP = (GCsov + PKsov*60/VOT)

Where:
SOV IMP = SOV impedance
GCsov = generalize cost from previous auto assignment
PKsov = parking cost for SOV
VOT = assumed value of time for trip purpose

HOV IMP = WT*(GChov + PN + PKhov * 60/VOT/SH) + (DF/ 1+AT/HA) + bias

Where:
HOV IMP = HOV impedance specific to vehicle classification
WT = Factor representing reduced ride-share opportunity as impedance increases
GChov = Generalize cost from previous model run
PN = Represents inconvenience and additional delay of making a rideshare trip
PKhov = Parking cost for HOV
VOT = assumed value of time for trip purpose
SH = number of occupants sharing the parking charge
DF = density factor to represent impact of trip density on ride-share opportunity
AT = number of trip attractions per trip purpose in destination zone
HA = Destination zone size in hectares
Bias = Sub-modal bias reflecting the desire for privacy

Ride-Share Impedence was calculated as a weighted mean of 2 HOV impedance and three-plus HOV impedance, namely:
IMPrs = ln (exp (-B*IMP2hov) + exp (-B*IMP3+hov)) / B