

# Parking policy and fee structure as tools for sustainable transportation planning

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## On Dalhousie's Studley Campus

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**4/13/2010**

## Table of Contents

Introduction.....	4
Background .....	4
Overview of Research Problem.....	5
Purpose .....	6
<b>Methods.....</b>	<b>7</b>
<b>Research Design .....</b>	<b>7</b>
<b>Survey.....</b>	<b>8</b>
<b>Sample .....</b>	<b>8</b>
<b>Instrumentation.....</b>	<b>9</b>
<b>Procedure.....</b>	<b>10</b>
<b>Observation.....</b>	<b>10</b>
<b>Instrumentation.....</b>	<b>10</b>
<b>Procedure.....</b>	<b>11</b>
<b>Interview .....</b>	<b>11</b>
<b>Instrumentation.....</b>	<b>11</b>
<b>Procedure.....</b>	<b>11</b>
<b>Quantitative Analysis.....</b>	<b>12</b>
<b>Reliability &amp;Validity .....</b>	<b>12</b>
Results.....	13

Survey.....	13
Observations and Quantitative Analysis.....	19
Discussion.....	21
Conclusion.....	29
Recommendations.....	29
Further Research.....	29
Action.....	30
References.....	32
Appendix B.....	34
Appendix C.....	35
Appendix D.....	36
Appendix E.....	37

## **Introduction**

### **Background**

Driving and parking are part of the transportation landscape of Dalhousie University, and commuting by personal vehicle will likely continue to be a necessity for some portion of the campus population. As an institution providing employment, facilities, education, and residential space to the community of Halifax and surrounding regions, transportation is an important consideration for the University. Planning, management, and operation of transportation facilities and services largely fall under the jurisdiction of the Security Services group of Facilities Management.

However, transportation is increasingly becoming relevant in other, larger contexts on campus. In January 2006, the Dalhousie UPASS program was introduced in conjunction with Metro Transit (Dalhousie University, nd). In 2008, research into Studley campus vehicle commuters was done by students in the Greening the Campus course (ENVS3502), which identified several reasons why drivers were dissatisfied with the current policy and infrastructure dictating their parking activity. The information they collected from students, staff and faculty showed gaps in existing policy and perceived barriers to using alternative modes of transportation. With the release of the Campus Master Plan, there was again recognition that transportation plays a vital role in campus aesthetics, accessibility, safety, and meeting the needs of the community. The plan's vision includes designs for transportation corridors, enhancing active transportation and public transit, and addressing parking (IBI Group, 2009). The link between sustainability and transportation on campus became explicit in 2009 when the Office of Sustainability initiated their Sustainable Transportation Planning process. The extensive surveys, literature reviews, comment periods, public participation, and consultations with experts resulted in a draft plan. The objectives of successful implementation of the plan include reductions in greenhouse gas (GHG) and criteria air contaminant (CAC) emissions, increased employee and student satisfaction and personal savings,

and raising Dalhousie's profile as a recognized leader in sustainable transport. Clearly the time and resources that have been invested demonstrate that the university administration is interested and committed to making much needed improvements to the current transportation reality, with an emphasis on sustainability. These efforts also illustrate the importance of parking under the heading of campus transportation.

### **Overview of Research Problem**

The existing parking policies at Dalhousie do not reinforce their commitment to sustainability. There are currently 2800 parking spaces throughout Dalhousie University and 2266 of those spots are for unreserved parking passes. Existing policies do limit the number of non reserved passes sold resulting in 18% more passes sold than spots. This creates a high demand for these spots, and often forcing many to spend time searching for a spot while emitting GHG in the process. It is imperative to manage this problem as it also has a burden on road infrastructure, pedestrian safety, and satisfaction of those who have no other option but to drive to campus.

The current 'Rideshare' carpooling program which offers a reserved spot to groups of three or more (for students, eligibility depends on residing outside of the Halifax Peninsula) is poorly advertised, and offers only minor incentives. The proposed campus master plan does set forth a large effort to increasing sustainable transportation options, and creating an opportunity to implement improved parking policies in structures. Considering current parking fee prices does not recover operating costs, new parking policies can help in relieving the economic laden of parking facilities. The current state of parking at Dalhousie is in need of improvement and proper management to help develop towards sustainable parking and transportation.

Current parking lots on Studley campus run a deficit and are subsidized by students that do not use parking facilities. The cost incurred by Dalhousie Facilities to maintain the parking lots, as well as snow removal security far surpasses the revenue generated by pass sales (Owen, 2010). Current parking pass fees are cheaper than a monthly bus pass encouraging faculty and staff commuters to select driving rather than public transit. Vehicle usage is a feasible target for reducing GHGs and CACs associated with Dalhousie related activities. The number of single occupancy vehicles and widespread access to viable alternatives illustrate the presence of 'low-hanging fruit' that can be addressed to produce noticeable change with relatively minor investments of time and money.

## **Purpose**

This study is intended to support the implementation of an effective sustainable transportation strategy for Dalhousie. In 2009, through extensive surveys, literature review and consultation with experts, a transportation planning team assembled a list of program options. With limited time, personnel and financial resources, the Office of Sustainability and the university administration must prioritize implementation of activities and spending. This requires weighing costs against expected benefits to evaluate and justify decisions. The research done here provides descriptive information and representative data on the actual behavioural change that could be expected with implementation of selected parking fees and policy program options.

The overall aim of this project is to make a contribution to achieving sustainable parking for the Dalhousie campus. We have defined sustainable parking as a set of policies and fee structures that improve the economic, environmental, and social impacts of parking. The results of this study predict the potential environmental or social impacts of changing parking policy, and provide

justification for proposed changes. It will specifically provide data describing the receptiveness, and potential for triggering behavioural changes, of fee increases, carpooling facilitation and incentives, and a vanpool/shuttle program.

This report outlines the methods used to collect data on the demographics and current behaviours of parking pass users, as well as responses to proposed solutions. Results from surveys, interviews, and observations are presented both quantitatively, and qualitatively, in order to effectively portray the gathered information. The results are then discussed, and their relevance to sustainable transportation planning on campus is illustrated. Conclusions are drawn, including suggestions for further research and recommendations for action by Facilities Management and the University administration, likely in conjunction with partners such as the Office of Sustainability, Metro Transit, HRM, and other universities.

## **Methods**

### **Research Design**

Our population of interest included reserved and non-reserved parking pass holders on Dalhousie's Studley campus. Due to the qualitative nature of our research, we chose to use several methods of data collection in order to enhance the reliability and validity for our results. These methods included observations, surveys and interviews. Quantitative research which was conducted includes data collection and analysis. The most substantial portion of time was spent administering surveys, as they were concise, and we anticipated that the feedback from the surveys would be crucial in determining how parking policies and fees influence the current behaviours of parking pass holders. Observations were used to supplement and validate the survey findings,

while interviews were used to involve members of the Dalhousie community with an influence, or interest in parking policies on campus.

## **Survey**

### **Sample**

In order to determine the current transportation behaviours and opinions of parking pass holders on Dalhousie Universities' Studley Campus we chose to distribute self-administered surveys; our survey sample consisted of reserved and non-reserved parking pass holders. The size of this population was 2502, according to 2008-2009 parking pass sales data collected from Security Service (see Table 9) We used a non-probabilistic, haphazard random sample from our predetermined population for our survey distribution; administering the survey's as participants walked from their vehicles to class/work if given consent. This sampling technique was chosen because; there was limited time to perform surveys, privacy constraints restricted randomization of participants and .

Surveys were conducted between 7:15AM and 10:00AM, Monday through Friday until achieving our goal of 181 completed surveys, which enabled our sample to have a 95% confidence interval with a confidence level of 7.0 this was important in order to achieve a sample which was representative of our population. The survey was cross-sectional; data was collected from the sample at one point in time. It was conducted in a questionnaire interview format. Surveys were distributed among parking pass holders who park on the Dunn/Howe surface parking lot, Oxford Street/Coburg Street surface parking lot and the McCain underground reserved parking lot. These lots were chosen because they provide a representative sample of parking patrons who own reserved and unreserved parking passes. Conducting the survey in both surface and underground



parking lots enabled us to provide a reasonably representative sampling of sub-groups within the university community: students, faculty and staff.

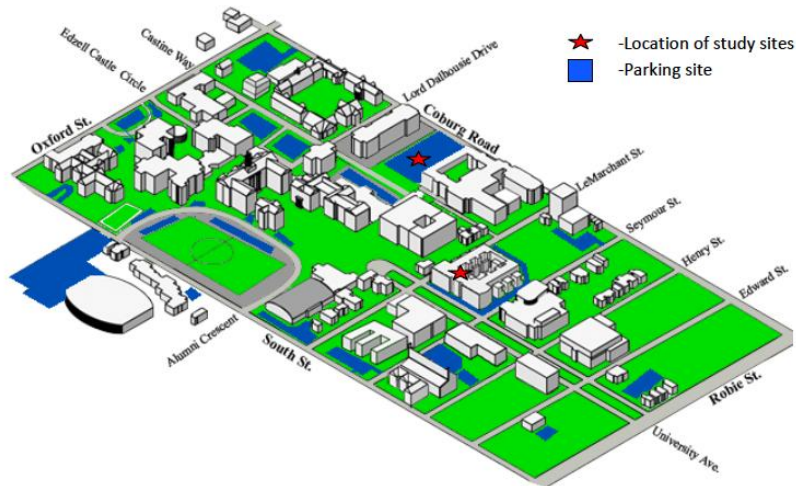


Figure 1 Parking on Dalhousie Studley Campus

## Instrumentation

The rationale for choosing surveying as a method includes its economy of design and rapid turnaround of data. There are advantages to identifying attributes of a large group from a small group of individuals, such as reduced time and scope. Specifically we chose to self-administer surveys. This method gave us the ability to; explain the meaning behind survey questions if need be, give participants certainty in the anonymity of their responses and ensure immediate turnaround for the data. Self administering surveys was also a method of saving paper; we were able to print four surveys per sheet of legal sized paper, as the participants would not be seeing the paper which had responses of previous participants. The purpose of the survey was to generalize from a sample to a population so that some inference could be made about the attitudes and behaviours of the population [7]

## **Procedure**

To begin the surveying process we developed a list of proposed survey questions, each group member administered pilot surveys in order to narrow down the survey to questions which were relevant to our research question, and to re-word any questions which may have caused confusion among participants. Once the survey was finalized (see Appendix B for final draft of survey) we met at the Dunn/Howe parking lot at 7:30AM and began approaching drivers as they walked away from their cars. We asked the drivers' to participate in our survey, and once given consent, walked with them if they were in a hurry to get to class or work. The survey took approximately 4 minutes for each participant to finish the survey. After 8 week days of surveying we had administered 181 surveys, giving us a confidence interval of 95% and a confidence level of 7.0.

## **Observation**

### **Instrumentation**

Observations (see Appendix C for observation checklist) included average sizes of the cars arriving to campus; used to determine average CO<sub>2</sub> emissions per parking pass holder.

In order to accumulate reliable and valid data we developed a coding scheme to give observers a clear distinction between observed variables (Palys & Atchison, 2008) For example we developed a coding system for categorizing observed cars, from which average car sizes was derived. Using published emission factors, we were then able to estimate average CO<sub>2</sub> emissions per car parked at Dalhousie. We chose to limit the number of categories to four, in order to ensure high reliability (Palys & Atchison, 2008)

## **Procedure**

In order to validate the results from the surveys, observations were conducted in the Dunn/Howe parking lot, each member of the research group observed cars arriving in the Dunn/Howe parking lot between 7:30 and 8:30, totaling 76 observations.

## **Interview**

### **Instrumentation**

The intended rationale behind conducting interviews was to develop a clear understanding of the feasibility and intentions behind changes to parking policies and fees in order to have valid recommendations from our research. Although we discovered many ways in which Dalhousie's parking policies can be improved, their feasibility and intentions of implementation of such programs are unknown. The interviews we conducted did however help to guide our research and gave us several perspectives on parking policies.

### **Procedure**

Interviewees were chosen by determining; which groups and individuals were concerned with campus parking, who on campus plays a role in determining parking policy and who is involved with the operations of the parking facilities.

Many interview subjects (see Appendix D for proposed interview subjects) were contacted with a brief description of the course, assignment, focus of the study and specific reason or focus of the proposed interview. Four of the subjects were able to meet for an interview; Rochelle Owen (Director of Sustainability, Dalhousie Office of Sustainability), Steven Mannell (Director, College of Sustainability), Bonnie Neuman (Vice-President, Student Services), and Emily Rideout (DSU Sustainability Office).

During the interview itself, notes were carefully taken on the responses on pre-selected topics for each interviewee (see Appendix E for specific topics corresponding to interviewees).

### **Quantitative Analysis**

After data collection from the surveys, interviews and observations on campus, the group compiled the survey results graphically in order to determine trends. Comparisons were made between sample subgroups, and some parameters such as mean values, ranges, and proportions were calculated.

### **Reliability & Validity**

In order to ensure reliability and validity in our results our methods consisted of several components, including; survey questionnaires, observations and interviews. We reduced bias in our sample population by using three different parking lots for survey distribution; each of which was located in different areas on campus which allowed for members of all faculties to have equal opportunities to participate in the survey. We chose to administer surveys in an underground parking lot as well as two surface level parking lots which reduced by bias by incorporating members of different parking pass fee levels. Surveys were administered Monday through Friday, which allowed for people who commute to campus once a week to be incorporated into the sample population. In addition results were not affected by weather patterns, which may influence driving patterns, because surveying took place under different weather conditions each day. Considerations for possible biases during the survey process enhanced the validity of our results.

## Results

### Survey

The survey conducted by our group was the main source of insight into the transportation patterns and behaviours with regards to Dalhousie parking policy. The surveys were carried out on Studley campus, in the Dunn/Howe, McCain Parkade, and Oxford/Coburg parking lots. The time of day ranged between 7:30am to 12:30pm and took place during 8 weekdays, over a span of 2 calendar weeks. In total, 181 respondents filled out our questionnaire, making up 7.2% of the overall population of pass holders and giving our results a 7.0% confidence interval. The survey itself can be seen in Appendix B, while responses to the 17 questions are summarized below in table and graphical form.

**Table 1** contains the results from the first three questions, which are in regards to (1) the person's gender, (2) their role within the Dalhousie community, and (3) the type of parking pass that they have. **Figure 2** shows that 10% more females than males participated in our survey, while the representation by role within the university (**Figure 3**) showed students to hold the largest proportion of parking passes (44%), followed by staff (38%) and faculty (18%). With regards to the type of parking pass, the majority of those surveyed had purchased a non-reserved pass (81%).

Question #	Table 1: Descriptive information on participants			
1	<u>Gender</u>			
	<u>Male</u>	<u>Female</u>		
	45%	55%		
2	<u>Role Within University</u>			
	<u>Full-Time Student</u>	<u>Part-Time Student</u>	<u>Faculty</u>	<u>Staff</u>
	40%	4%	18%	38%
3	<u>Type of Parking Pass</u>			
	<u>Reserved</u>	<u>Non-Reserved</u>		
	19%	81%		

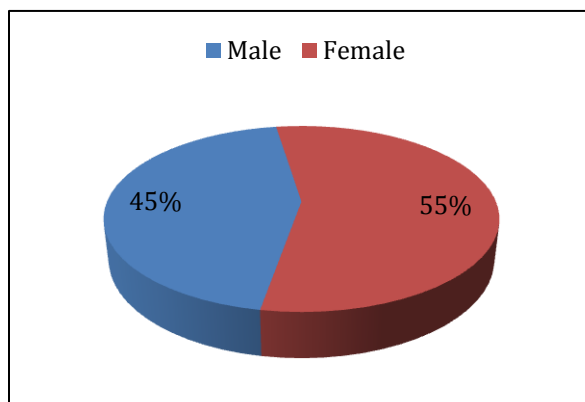


Figure 2: Breakdown of survey respondents by gender

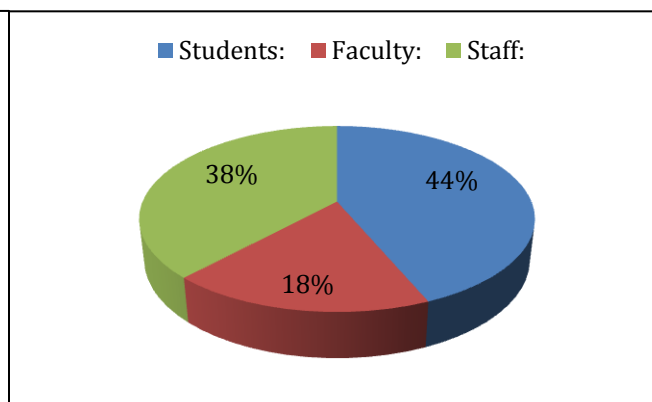


Figure 3: Breakdown of survey respondents by role in university community

The number of years attending or working at Dalhousie compared to the number of years driving to campus was also an area of interest for our research. The results for these questions are summarized in **Table 2**, with the percentage of the population represented by each range of years, and average of all responses indicated. This data is valuable in order to better understand the time span of existing commuting behaviours. Although the majority of respondents (65%) have been

driving to campus for 5 years or less, there are still a sufficient number of long-term pass holders to bring the average up to 7.1 years.

**Question #** Table 2: Temporal characteristics of participants

4	<u>Number of Years Attended/Worked at Dalhousie</u>					<u>Average</u>
	<u>&lt;=5</u>	<u>5&gt;=10</u>	<u>10&gt;=15</u>	<u>15&gt;=20</u>	<u>&gt;20</u>	
	60%	14%	7%	7%	12%	8.4 years
5	<u>Number of Years Driving to Campus</u>					
	<u>&lt;=5</u>	<u>5&gt;=10</u>	<u>10&gt;=15</u>	<u>15&gt;=20</u>	<u>&gt;20</u>	
	65%	13%	9%	4%	9%	7.1 years

**Table 3** indicates that the amount of time spent locating an available parking space was quite low, with 83% of respondents claiming a search time of less than five minutes. In fact, the average search time was found to be only two minutes. Question #7 reinforces these as typical lengths of search time, with 65% saying that it was the same as an average day.

**Question #** Table 3: Locating parking spots

6	<u>Number of Minutes Searching for Parking Spot</u>			<u>Average</u>
	<u>&lt;5</u>	<u>5=&gt;10</u>	<u>&gt;=10</u>	
	83%	7%	10%	2 minutes
7	<u>Relative Comparison of Search Time to Average Day</u>			
	<u>Same</u>	<u>Longer</u>	<u>Shorter</u>	
	65%	6%	30%	

**Table 4** helps to gain an accurate portrayal of the weekly frequency of pass holders commuting to campus, as well as the number of passengers they carry. Between question 8, asking the number of people arriving in the vehicle on the day surveyed, and question 9, which asks the average number of people traveling in the vehicle to campus, there is a large majority of single occupancy vehicles parking at Dalhousie. The results indicate that 54% of survey respondents typically drive by themselves, and 70% of respondents were observed driving to campus alone. The averages differ by only 0.2, with an observed average of 1.4 people per car and a reported average of 1.6 people per car. As far as weekly frequency of parking on campus is concerned, the majority of pass holders (78%) drive to campus an average of 5 days a week.

<b>Question #</b>	<b>Table 4: Commuting behaviour</b>				
<b>8</b>	<b><u>Number of People that Traveled in Vehicle to Campus</u></b>				<b><u>Average</u></b>
	<b><u>1</u></b>	<b><u>2</u></b>	<b><u>3</u></b>	<b><u>4</u></b>	
	70%	23%	6%	1%	1.4 people
<b>9</b>	<b><u>Average Number of People Travelling in Vehicle to</u></b>				
	<b><u>Campus</u></b>				
	<b><u>1</u></b>	<b><u>2</u></b>	<b><u>3</u></b>	<b><u>4</u></b>	
	54%	35%	7%	4%	1.6 people
<b>10</b>	<b><u>Average Number of Days per Week Driving to Campus</u></b>				
	<b><u>≤4</u></b>	<b><u>4</u></b>	<b><u>5</u></b>	<b><u>≥5</u></b>	
	9%	9%	78%	3%	4.7 days/week

The time taken for Dalhousie parking pass holders to drive to campus was found to vary considerably, with sample population values ranging from 5 to 130 minutes. The proportional distribution of survey respondents by time category can be seen in **Table 5**, with the two largest



ranges being 10 to 15 and 21 to 30, with 27% and 29% of the population respectively. The average travel time of all survey respondents was 26.3 minutes.

**Question #** **Table 5: Description of commute**

11	<u>Estimated Number of Minutes Driving to Campus</u>								<u>Average</u>
	<u>&lt;10</u>	<u>10-15</u>	<u>16-20</u>	<u>21-30</u>	<u>31-40</u>	<u>41-50</u>	<u>51-60</u>	<u>&gt;60</u>	
	3%	27%	17%	29%	12%	9%	3%	1%	26.3
									minutes

Pass holders responses to questions 12 and 13 are presented in **Table 6**. These summarize our findings for reported benefits and challenges of the Dalhousie parking facilities, along with the respondents’ degree of favourability towards proposed alternatives. Convenience was the most frequent benefit to having a parking pass, as expressed by 66% of our sample population. Twelve percent of respondents said the freedom of having a car on campus was either valued or required for their job, while another 10% said they were lacking in any alternative means of commuting. The challenges to parking on campus also had a dominant theme, which has to do with the availability of non reserved parking space. However, these responses came in different forms, and are quantified in table 6, Q# 13. Of the most significant challenges reported by parking pass holders, 42% were about finding a spot, 24% having to arrive early, and 5% said finding a spot after they leave for their lunch break.

While posing questions 14 and 15 to parking pass holders, our group inquired about the proposed transportation alternative based on a rating scale. For the shuttle service, respondents were asked how likely they would be to utilize a Dalhousie shuttle service if it operated with a pickup and drop off location close to their homes. 25% said they would be very likely, 36% would

be likely, 11% somewhat unlikely, and 28% very unlikely to use this service if it became available. For question 15, those surveyed were asked their propensity toward a carpooling program set up by the school to assist with ride matching while providing discounted parking passes. Of our sample population, 15% said very likely 32% said likely, 21% said somewhat unlikely, and 32% very unlikely to take part if Dalhousie were to initiate such a program.

**Question # Table 6: Response to current and potential future use scenarios**

<b>12</b>	<b><u>Most Significant Benefit to Parking on Campus</u></b>			
	<u>Convenience</u>	<u>Freedom</u>	<u>No Alternative</u>	<u>Other</u>
	66%	12%	10%	12%
<b>13</b>	<b><u>Most Significant Challenge to Parking on Campus</u></b>			
	<u>Finding Spot</u>	<u>Coming Early</u>	<u>Unable to Leave</u>	<u>Other</u>
	42%	24%	5%	29%
<b>14</b>	<b><u>Likelihood of using Proposed Shuttle Service</u></b>			
	<u>Very Likely</u>	<u>Likely</u>	<u>Somewhat Unlikely</u>	<u>Very Unlikely</u>
	25%	36%	11%	28%
<b>15</b>	<b><u>Likelihood of Carpooling with Assistance/Incentives</u></b>			
	<u>Very Likely</u>	<u>Likely</u>	<u>Somewhat Unlikely</u>	<u>Very Unlikely</u>
	15%	32%	21%	32%

The sample population was also asked what increase in parking pass fees would cause them to no longer purchase a Dalhousie parking pass. **Table 7** summarizes their responses by proportion

of the sample population. The largest number of people (38%) said their ceiling was \$250 above current Dal parking fees, while the second most frequent response was a \$100 increase. The average of our sample population's responses for price increase threshold was \$165.75.

**Question #** Table 7: Response to potential change in fee scenarios

16	<u>Maximum Tolerable Increase in Parking Fees</u>						<u>Average</u>
	<u>\$ 25</u>	<u>\$ 50</u>	<u>\$ 100</u>	<u>\$ 150</u>	<u>\$ 200</u>	<u>\$ 250</u>	
	6%	11%	23%	8%	14%	38%	\$ 165.75

**Table 8** is a summary of what respondents would do if on campus parking facilities were no longer available. The most frequent response, coming from 41% of those surveyed, was that they would find parking accommodations elsewhere. 35% said they would switch to alternative means of transportation (30% would take the bus, 4% walk, 1% bike), while 6% said they would quit their job or leave the school.

**Question #** Table 8: Response to potential change in facilities

17	<u>Alternative in Absence of On-Campus Parking</u>					
	<u>Alternative Parking</u>	<u>Other</u>				
		<u>Bus</u>	<u>Walk</u>	<u>Bike</u>	<u>Quit</u>	
	41%	30%	4%	1%	6%	18%

### Observations and Quantitative Analysis

Table 9 shows the number of parking passes sold for access to Studley Campus lots during the period from September 2008 to August 2009, the most recent period for which there is complete

data. This information was collected in hard copy documentation from Leigh Horne of Security Services, Facilities Management, Dalhousie University.

**Table 9: Parking passes sold for period of September 2008 - August 2009 (from Leigh Horne, Security Services, Dalhousie University)**

<b>Location</b>	<b>Group</b>	<b>Type</b>	<b>Number of passes</b>
DAL	F/S	FALL	31
DAL	F/S	WINTER	10
DAL	F/S	YEAR	1327
DAL	STUDENT	FALL	27
DAL	STUDENT	WINTER	76
DAL	STUDENT	YEAR	703
<b>UNRESERVED TOTAL</b>			<b>2174</b>
DAL		RESERVED	22
MCCAIN PARKADE		RESERVED	86
OUTDOORS		RESERVED	39
RISLEY PARKADE		RESERVED	34
CENTRAL SERVICES BLDG		RESERVED	143
		RIDESHARE RESERVED	4
<b>RESERVED TOTAL</b>			<b>328</b>
<b>TOTAL</b>			<b>2502</b>

Table 10 summarizes results collected from conducting observations of Dunn/Howe parking lots users. Although the sample size used is not representative, these results suggest that compact cars are the most prevalent type of vehicle, the largest proportion of users arrives between 8:01 and 8:15, and support the conclusion that the vast majority of commuters travel alone in their vehicles.

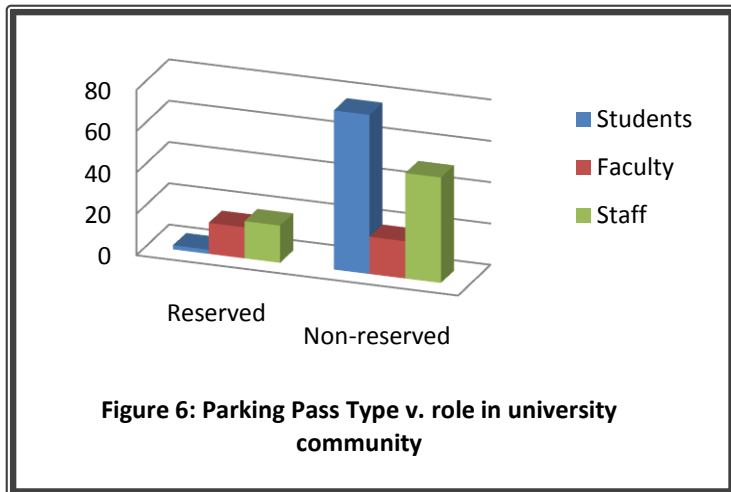
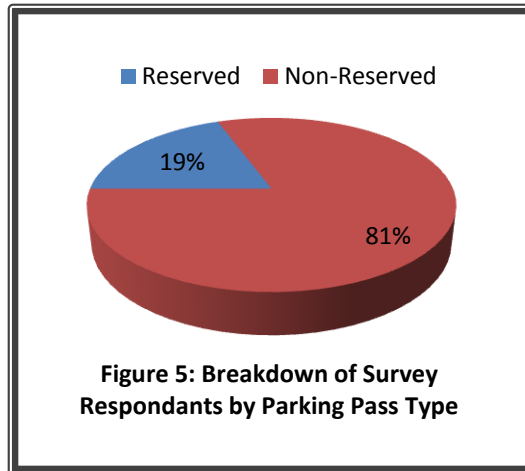
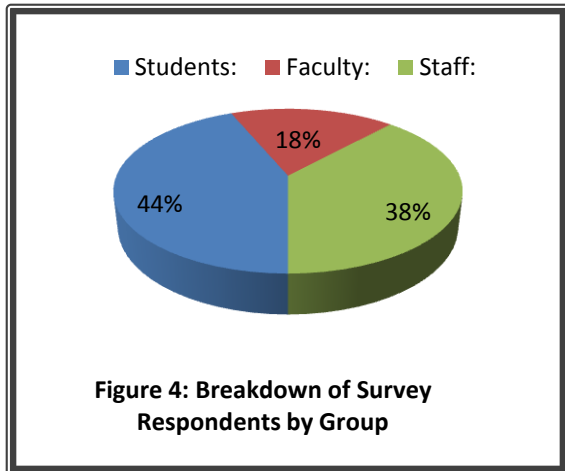
**Table 10: Categorized results from observations of 76 vehicles in Howe/Dunn parking lot**

Criterion	Number of observations
Type of Car	
Large	17
Midsize	18
Compact	32
Subcompact	9
Time of arrival	
Before/or at 7:45 AM	9
7:46 – 8:00 AM	24
8:01 – 8:15 AM	31
After 8:15 AM	4
Number of occupants	
One	66
Two	9
Three	1

## **Discussion**

Through conducting interviews and surveys, it was possible to gain insight into the current behaviours and perceptions among users of Dalhousie parking facilities. The same means of data collection have also provided us with some degree of accuracy in projecting how transportation behaviours might shift in response to certain parking policy changes. It is the objective of this section to analyze the data gathered and highlight the underlying trends, while identifying an optimal approach to policy adjustments to bring them more in line with the school's sustainability

goals. Due to the ongoing efforts made by Dalhousie to decrease the institution’s environmental impact, it makes perfect sense to target a reduction in the number of greenhouse gas emitting vehicles driving to campus every day. The difficulty comes in how to effectively deter those who have viable alternative means of transportation, while still accommodating those who do not. Through extensive data analysis, more detailed information can be interpreted from the raw data gathered to assist in the decision making process.



It is important to identify the 3 different groups of people using the parking facilities, who each play a different role within the Dalhousie community. These groups, and their proportionate representation of parking pass holders, can be seen in **Figure 4**. Students represent the

largest portion of parking pass holders in our sample (44%), followed closely by staff (38%) and faculty (18%). However, these proportions are not evenly represented between the different

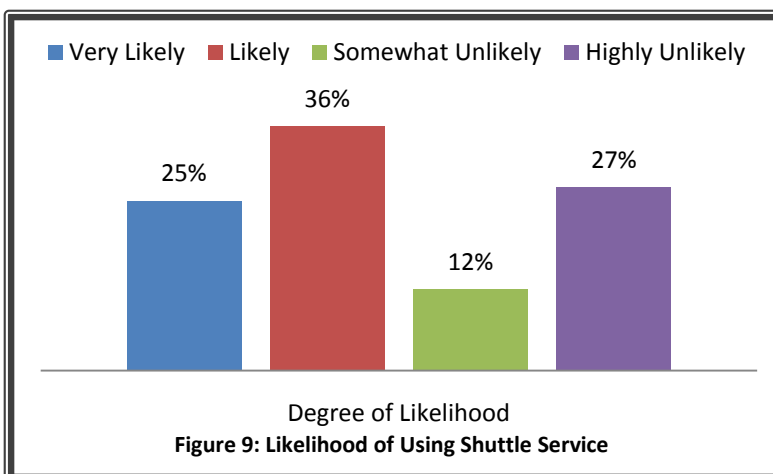
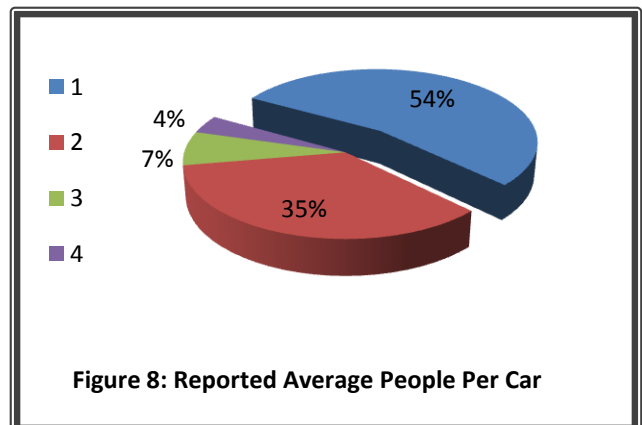
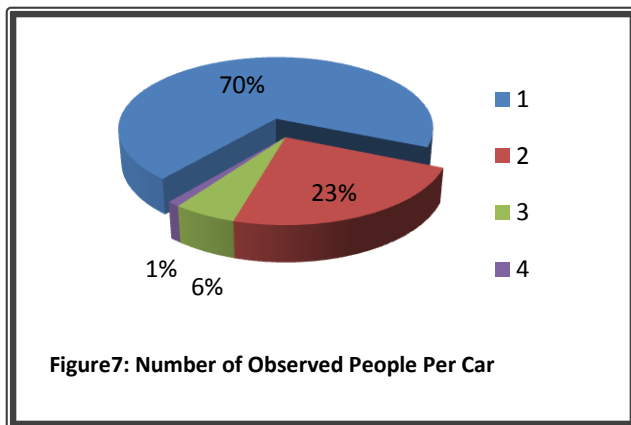
parking pass types. **Figure 5** gives a good indication that non-reserved parking passes greatly outnumber reserved passes. When observing the allocation of parking pass type based on university grouping shown in **Figure 6**, it is evident that there is an uneven distribution. Reserved parking passes are not distributed in relative proportion to each group's representative population, but heavily favour the faculty.

Some of the factors likely contributing to this distribution pattern include: high turnover rate of students (many programs 4 years at most); long waiting lists to get a reserved parking space; higher cost of reserved parking pass; lower disposable income of students; higher salaries of faculty. These possible factors aside, those members of the Dalhousie driving community that do not hold a reserved parking pass are sometimes left without parking accommodations due to 17.5% overselling of non-reserved parking passes. A handful of those surveyed even joked that their parking pass was simply a 'license to hunt'.

In fact, our survey results find that a majority of respondents (66%) indicated the availability of parking to be their most concerning issue with the existing parking system. This is broken down into 42% citing 'finding a spot', and 24% indicating 'arriving early enough to get a spot' to be their most significant challenge with the existing system. Considering 19% of our sample population had a reserved parking pass, that leaves only 15% of non-reserved pass holders whose main concern was finding available parking. A third of the remaining 15% felt unable to drive off campus for lunch for fear of not getting a spot upon returning. These results indicate that current discontent is, in part, related to the volume of overselling non-reserved parking passes. Regardless, in order to satisfy the requirements of both improved user benefit and reduced environmental impact, there must be a reduction in the number of parking passes sold to curb the motor vehicle traffic commuting to campus.

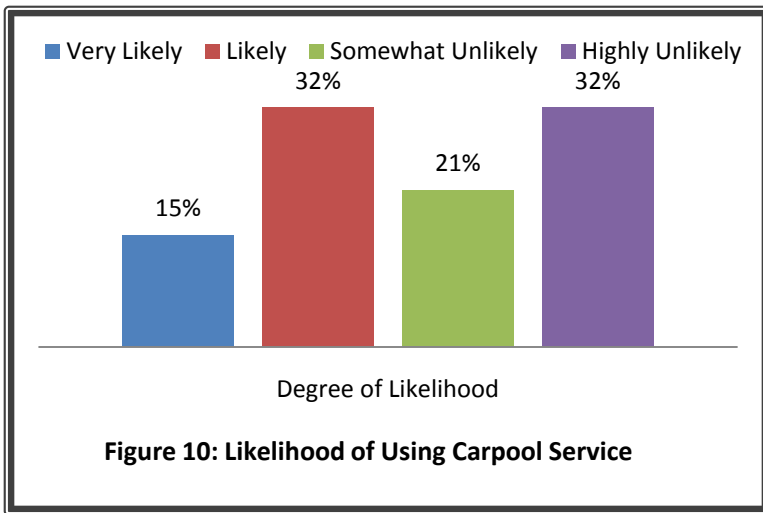
The number of people per vehicle is one example of overall transportation behaviour that shows a significant area for improvement. **Figure 7** shows the proportions of vehicles based on the number of people accompanying them the day the passholders were surveyed. **Figure 8** shows the respondents' reported average number of people travelling to campus in their vehicle.

Despite the 16% discrepancy in single occupancy vehicles between Figures 6 and 7, there are still a large number of under utilized vehicles travelling to and from the Dalhousie parking facilities every day. Based on the observed carpooling tendencies of the sample population, 70% of vehicles had only 1 person and 93% had 2 or fewer. This does not demonstrate efficient use of vehicle space but indicates an opportunity for policy changes to improve the sustainability of transportation to and from Dalhousie.





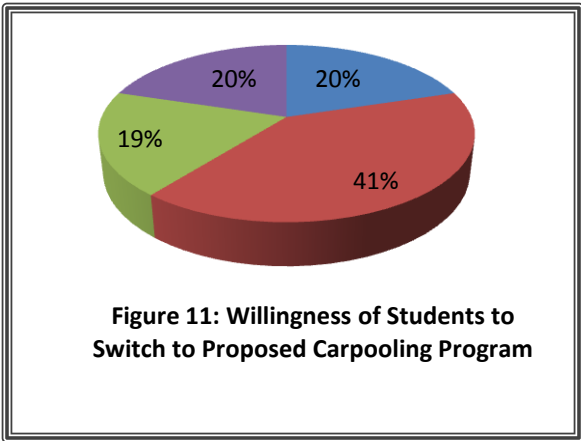
Despite this abundance of single occupancy vehicles, it doesn't mean that parking pass



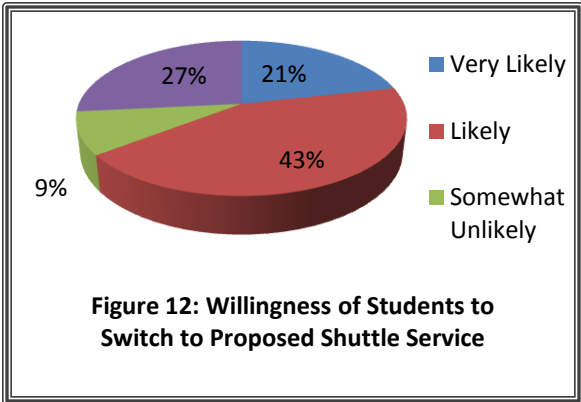
holders are not interested in improving their transportation efficiency and decreasing their ecological footprint. In fact, our survey results have shown that there is a large portion of the sample population that expressed a distinct possibility that they would partake in one of the

proposed alternatives if it were implemented on campus. **Figure 9** shows the distribution of interest levels in a proposed shuttle service. There is a combined 59% of the sample population that said they would be likely or very likely to take advantage of such a service. Although the proposed carpooling program with incentives did not receive the same degree of popularity, there was still a combined 47% as seen by **Figure 10** that said they would be likely or very likely to utilize it if the program and incentives were implemented by the school. So given that both proposed alternatives were well received, the questions that remain are: what initiatives to proceed with, who to target, and what policy adjustments must be made to ensure people do make positive adjustments to their transportation behaviour. These questions can be addressed through further data analysis.

The group that showed the most interest in both proposed alternatives was students, who also make up the largest proportion of our sample population (44%). As can be seen in following figures, 64% of the students surveyed said they would be likely or very likely to use a shuttle service (**Figure 11**), and 61% said they would be likely or very likely to take part in the carpooling program (**Figure 12**). This expressed willingness to switch modes of commuting, or increase transportation efficiency is very encouraging, especially coming from the largest group of passholders surveyed.

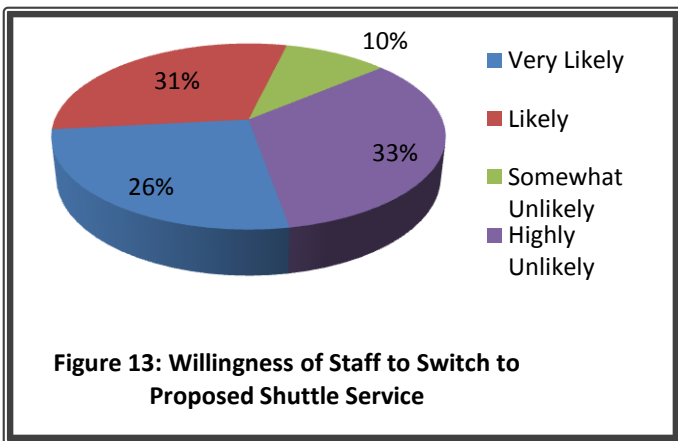


**Figure 11: Willingness of Students to Switch to Proposed Carpooling Program**

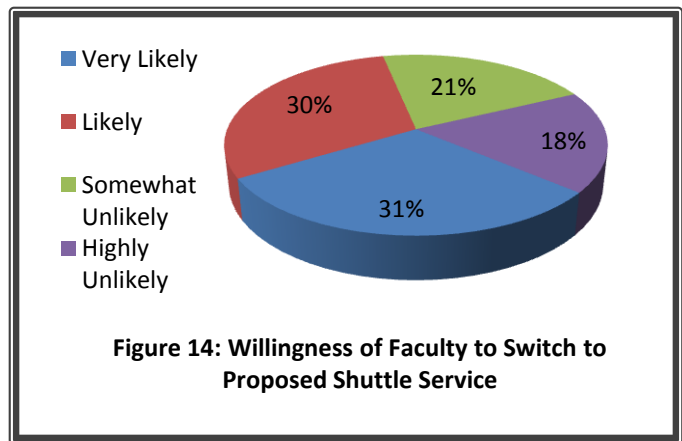


**Figure 12: Willingness of Students to Switch to Proposed Shuttle Service**

Although staff and faculty do not show as much interest in the proposed carpooling program as the students, with only 24% of faculty 42% of staff claiming it likely or very likely they would partake, there was still a majority of those surveyed from both groups who were interested in the proposed shuttle service. The staff level of interest, displayed in **Figure 13**, shows a total of 57% who said they would be likely or highly likely to utilize a shuttle service. The willingness of the faculty sample population to make use of a shuttle service can be seen in **Figure 14**. Of these respondents, 31% said they were very likely and another 30% said they were likely to use such a service if it became available. These responses are indicative of high probability of changed behaviour patterns if proper policy changes are made.



**Figure 13: Willingness of Staff to Switch to Proposed Shuttle Service**

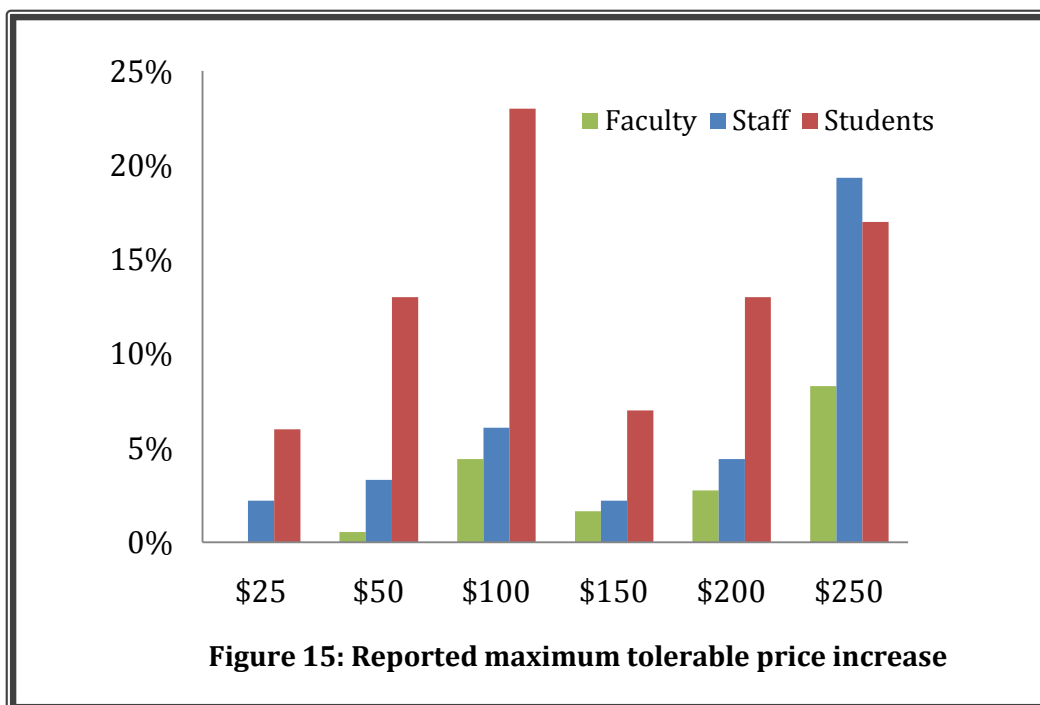


**Figure 14: Willingness of Faculty to Switch to Proposed Shuttle Service**

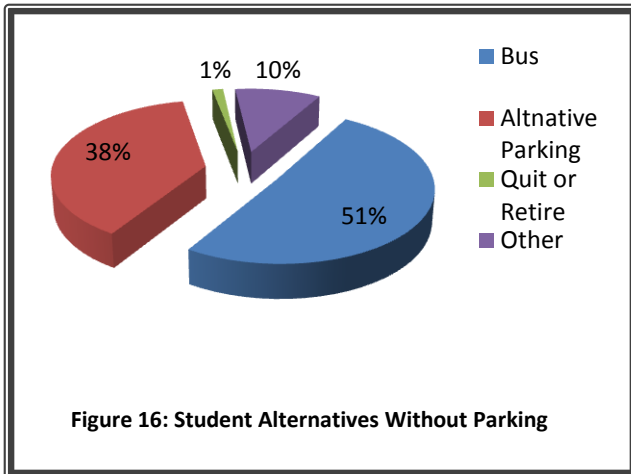
Seeing as Dalhousie is not making enough from parking fees to cover the facilities' operating costs, it would be appropriate to increase in the cost of parking passes as a means to minimizing excess ridership. As part of our survey, we asked pass holders what increase in parking pass fees

would deter them from continuing to purchase a parking pass. The findings of this question are summarized in graphical form in **Figure 15**.

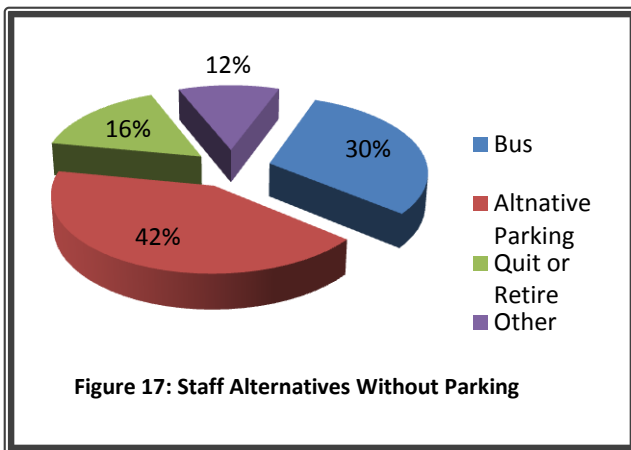
An important trend found in this graph is the noticeable peak at \$100 above current parking pass fees. Although many staff and faculty members highly value their parking passes, and a large portion of these groups would be willing to pay as much as \$250 above current costs, there is still a significant portion of the sample population that would not pay more than \$100. If these sample population responses are an accurate reflection of the total population parking at Dal, then 40% of current pass holders could be shifted towards alternative means of transportation with a \$100 increase in pass fees. In fact, of this 40% of the sample population not willing to pay \$100 above current parking pass fees, 68% said they would be likely/very likely to use the proposed shuttle service, 58% said they would be likely/very likely to carpool, and only 21% said they would not be likely to do either. Seeing as Dalhousie parking services would not want to lose 40% of their pass holders, it should be considered that a carpooling program with financial incentives for participation would make the parking pass more affordable for users. This would imply that not all of those deterred by a \$100 increase would stop purchasing a parking pass, but instead improve the efficiency of their commute by carpooling.



Although decreasing the number of parking pass holders was suggested as a means to decreasing the ecological footprint of the Dalhousie community, it would only be truly effective if those no longer purchasing a pass switched to more environmentally friendly means of transportation. In the following figures is a summary of how the behaviours of students, faculty, and staff would change if they were without campus parking accommodations. In **Figure 16**, we see how students



responded when asked how they would get to campus if they no longer had a parking pass. Although 38% said they would seek out alternative parking accommodations, 51% of students surveyed said they would take the bus, while another 10% would walk or bike to school. Seeing as students make up the largest portion of



parking pass holders, as well as the largest proportion of pass holders who would be deterred by a \$100 increase in parking fees, these results suggest that they would indeed adopt a more environmentally friendly mode of transportation in the absence of a parking pass. The staff and faculty behaviours, summarized in **Figure 17** and

**Figure 18** respectively, did not follow the same trend. These two groups seemed much more adamant to continuing driving to work, with 42% of staff and 49% of faculty saying they would find alternative parking accommodations if they could no longer purchase a parking pass. One interesting trend found in the staff and faculty survey responses was that despite their inclination towards the shuttle service over carpooling, only 30% of staff and 33% of faculty said they would take the bus if they couldn't park on campus. This is significantly lower than the 51% of students who indicated the

bus as their next alternative to parking. This discrepancy brings to mind the discounted bus pass made available to all students, but not faculty and staff. It is quite possible that if a similarly priced annual bus pass offer were extended to the faculty and staff, that they might see public transit as a more attractive alternative to driving.

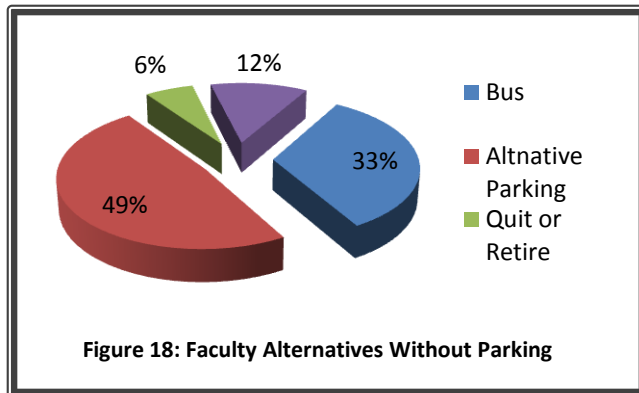


Figure 18: Faculty Alternatives Without Parking

To summarize our analysis, there is a great deal of room for improvement with regards to the Dalhousie parking facilities. Between the high proportion of single occupancy vehicles and the willingness of pass

holders to switch to more environmentally friendly means of transportation, the onus is on the university to make modifications to the existing system to initiate behavioural changes. The results of our data collection have yielded a high probability of positively influencing the behaviours of parking pass holders if proper policy adjustment are made.

## Conclusion

## Recommendations

## Further Research

The findings presented here suggest that a substantial proportion of the population currently driving to campus have willingness to switch their mode of transportation. Therefore next steps should be taken to continue examining the potential implementation of the initiatives proposed in this study. These include a financial cost-benefit analysis of a vanpool/shuttle program, and using existing data on geographical distribution of commuters to determine optimal pick-

up/drop-off locations. In terms of improving carpooling participation, some research should be done to determine the costs associated with the set-up of an online ride-matching tool, as well as what methods of communication would best increase awareness of incentives amongst target groups.

To build upon this investigation into travel habits and the feasibility of a carpool or shuttle service, further research should be conducted to better analyze the relationship between commuters carpool habits and other behavioural parameters. Studying how driving correlates to the time of day or distance travelled could provide more complete understanding of the needs and interests of the drivers and the university. Further efforts should be attempted with a more diverse sampling group. The sampling method employed when carrying out the survey for this study primarily gathered data from everyday commuters who arrive in early mornings. This fails to incorporate data on the pass holders arriving at other times of day, or who have more irregular schedules.

Based on our survey results and anecdotal information collected from participants, we found that further research should be conducted into improving access to existing alternative modes of transportation. For example, it may be beneficial to continue pursuing extending the UPASS program with Metro Transit to faculty and staff, as many survey participants pointed out that purchasing a parking pass is currently cheaper than paying for a bus pass.

### **Action**

Policy changes suggested by the results of our study include establishing sustainable alternatives, such as the proposed shuttle service or carpooling program, increasing the cost of parking, making a discounted bus pass available to faculty and staff members, and establishing a more stringent and detailed parking pass application process to ensure that passes are only sold to

those without viable alternative means of transportation. If these, or similar changes are properly implemented, Dalhousie will be closer to achieving sustainable parking as defined in this report.

**Pilot Study for VanPool/Shuttle Service** – because of high initial costs associated with implementing a shuttle service, using a vanpool as a pilot study could establish a good sense of actual usability among the Dalhousie community.

**Shuttle Service** – Implementing a shuttle service to campus would likely have high initial costs (capital investment), however many survey respondents showed interest in the program as an alternative for driving to campus.

### **Carpooling Incentives**

- Ride Matching – to match members of the Dalhousie community who commute to campus from a similar location in order to take give incentive to part in the Dalhousie RideShare program. The HRM SmartRide web-based program could be used as a model for designing the specific Dalhousie program.
- Financial Incentives – reduced cost of a parking pass for commuters who take advantage of the Dalhousie RideShare program

**Fee Increases** – An increase in parking pass fees of \$100, as results show this would act as a disincentive toward purchasing pass for many current pass holders, as well as an incentive to use public transit.

**Parking Pass Criteria Implementation** – Extended requirements for parking pass accessibility, such as location to campus and the availability of alternatives.

**Reduced price on bus passes** for faculty and/or staff

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## Appendix A

### **Introduction for survey participants**

Hi, my name is \_\_\_\_ and I am doing a research project for my 'Greening the Campus' Class on transportation behaviour of people at Dalhousie. Would you mind answering a short questionnaire? It will take only two or three minutes of your time. I can walk with you to your destination if that's more convenient for you.

This survey will be used to look at how transportation policy affects transportation behaviour on Studley campus. This is an anonymous survey, but the results from it will be publicly available. Upon completion of the project in April 2010 the results and full report will be posted on the Dalhousie Environmental Programs website.

## Appendix B

### Survey instrument: interview questionnaire

#### Sample Parking Survey Questions

1. Female / Male
2. Full-time Student / Part-time Student / Faculty / Staff
3. Reserved Parking / Not-Reserved Parking Pass
  
4. How many years have you attended/worked at Dalhousie?
5. How many years have you been driving to campus (either as the primary driver or passenger)?
6. How many minutes did you take searching for a parking spot today?
7. How would you compare that to an average day?  
Shorter                  Same                  Longer
8. How many people traveled in your car to campus today?
9. How many people regularly travel in your car to campus?
10. How many days in an average week do you drive to campus?
11. Approximately how much time does it take you to drive to campus one-way?
12. What is the most significant benefit to parking on campus for you?
13. What is the most significant challenge to parking on campus for you?
14. How likely would you be to use a shuttle service to campus from a pick-up location close to your home (circle one):  
Highly unlikely    Somewhat unlikely    Likely    Very likely  
Explain: \_\_\_\_\_
15. How likely would you be to carpool if Dalhousie helped you locate partners and decreased the cost of your pass?  
Highly unlikely    Somewhat unlikely    Likely    Very likely  
Explain: \_\_\_\_\_
16. What increase in the price of a parking pass would make you switch your mode of transportation?  
+\$25                  +\$50                  +\$100                  +\$150                  +\$200                  +\$250
17. If no parking was available on the Dalhousie campus, what would you do?

## Appendix C

### Observation Checklist

Car Type	Hybrid?		Time of.....		Find a Parking Spot?		How many people get out of the car?					
	Yes	No	Arrival	Departure /Parking	Yes	No	1	2	3	4	5	5+
Large												
Midsize												
Compact												
Subcompact												
Large												
Midsize												
Compact												
Subcompact												
Large												
Midsize												
Compact												
Subcompact												
Large												
Midsize												
Compact												
Subcompact												

Categories:  
 Large: Truck, Van, SUV (holds 5+ passengers)  
 Midsize: Sedan [Honda Accord, Toyota Camry, or Ford Fusion] or Sports Car  
 Compact : Toyota Corolla,

Ford Focus, Honda Civic, Volkswagen Golf  
 Subcompact: Toyota Yaris, Kia Rio, Honda Fit, Chevrolet Aveo

## **Appendix D**

### **Proposed List of Interviewees**

- Rochelle Owen, Office of Sustainability
- Steve Manell, Dean, College of Sustainability
- Dave McCusker, Director, HRM Traffic and Transportation Services
- Alan Shaver, VP Academic, Dalhousie University
- Sue Uteck, HRM Councillor, District 13
- Jeff Lam, Manager Facilities Management, Dalhousie University
- Sandy MacDonald, Parking & Security, Facilities Management, Dalhousie University
- Director, Dalhousie Faculty Association
- Dean of Dentistry, Dalhousie University
- VP Finance, Dalhousie University
- Dr. Eric Rappaport, Faculty of Planning, Dalhousie University
- Dr. Muhammad Habib, Faculty of Planning, Dalhousie University
- Any recommendations provided in interviews

## **Appendix E**

### **Interview topics and corresponding interviewees**

Rochelle Owen – How parking fees, technology and infrastructure support Dalhousie’s sustainability goals

Steven Mannell – Existing policies and issues concerning parking on Dalhousie’s Studley campus

Bonnie Neuman – Informal discussion on the administration’s perspective on parking and future plans for parking

Emily Ridout – Student perspective and campus transportation (active, public and private)