

UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Sustainable Transportation Solutions for UBC Athletics & Recreation

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**[SUSTAINABLE
TRANSPORTATION SOLUTIONS
FOR UBC ATHLETICS &
RECREATION]**

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1.0 Introduction

UBC Athletics and Recreation (UBC A&R) already has a leadership role in maintaining school spirit and modelling positive sportsmanship. The University of British Columbia (UBC) as an institution is striving to be a world-leader in sustainability, so it is fitting that UBC A&R has begun looking for ways to become a leader on campus in this avenue as well. A life-cycle analysis of a UBC basketball event revealed that about three quarters of associated greenhouse gas emissions came from the transportation of team members and spectators (Dolf et al., 2011). Consequently, a focus on transportation is necessary to improve the sustainability of UBC A&R's events. The following study assesses the current state of UBC A&R's transportation solutions and explores four options for reducing associated greenhouse gas emissions. Each of these four options is evaluated with a matrix of indicators to pinpoint the strengths and weaknesses of each option. Finally, UBC A&R is provided with recommendations for leading UBC into a more sustainable future.

2.0 Background

The transportation options available to spectators, staff and participants at UBC Athletics & Recreation events have a large influence on UBC A&R's ability to set and meet sustainability targets for their operations. In order to make changes to the current transportation systems and to set realistic goals around sustainability, an understanding of the current transportation systems for UBC and for UBC A&R is required. This section briefly outlines the current transportation patterns at UBC and for UBC A&R sports events. Some of the current cost implications to both parties are presented, as well as the social and environmental impacts that these transportation systems have on UBC and the surrounding areas. In order to outline the difficulties that may be encountered when attempting to make changes to the current transportation system, a description of the jurisdictions governing transportation to and from UBC and the populations that may be affected by these changes are included.

2.1 UBC Transportation System

The past 13 years has seen significant changes in the modes of travel to and from UBC. According to the UBC Fall 2010 Transportation Status Report, the main modes of transportation include transit, single-occupant vehicles (SOV's), high-occupancy vehicles (HOV's), bicycles, on foot and others such as truck and motorcycle (UBC TP, 2011).

The UBC Fall 2010 Transportation Status Report provides a summary of the transportation data collected between 1997 and 2010 and examines the trends seen over this time. Of particular significance is the increased use of public transit: over 13 years, an increase of 233% was seen with ridership more than tripling. This increase is largely attributed to the introduction of the U-Pass in September 2003, which is a subsidized transit pass for UBC students. A full summary of the transportation modes in 1997 and 2010 are provided in Appendix B.

According to the UBC 2009 Vancouver Transportation Survey (a survey of UBC students, staff, faculty, residents and other employees), the majority of transit users are students. 62% of students and 44% of

staff claimed to use transit everyday, while only 22% of residents and faculty made the same claim. It is noted in the report that faculty and visitors use transit the least, and that the use of transit by students is mostly due to the U-Pass system (UBC TP, 2010). This demonstrates that the mode-share to UBC is affected by the payment structure for transit.

There are currently six express bus routes into UBC (routes 43, 44, 84, 258, 480, and the 99 B-line) which, when combined, make up 63% of trips to and from UBC (TransLink, n.d.; UBC, 2011). According to TransLink's website, five of these routes travel between UBC and a SkyTrain station (TransLink, n.d.), suggesting that a large portion of trips made to UBC originate from far-afield.

2.2 UBC A&R Current Transportation System

Athletics and Recreation at UBC employs approximately 100 persons and manages the over 20 venues which are home to 30 UBC Thunderbirds sports teams (Dolf, 2012). Many of these venues host events that attract 50, 000 spectators annually (Dolf, 2012), resulting in significant volumes of travel to and from UBC.

A survey by UBC Athletics & Recreation of eight UBC Thunderbirds events in found that 66% of staff and spectators travelled an average of 107 km by car, with an average vehicle occupancy rate of 2.7 (Dolf 2012). Approximately one in ten participants arrived by city bus and one in seven chose to walk or cycle to the events.

2.3 Economic Impact Considerations

Below is a table outlining the costs that spectators pay for a one-way trip to a UBC Athletics & Recreation event, based on the average distances travelled. Currently, UBC A&R does not pay for or subsidize spectator travel.

Table 1: Spectator Transportation Costs

Travel Mode	Average Distance (km)	Average Vehicle Occupancy	Cost of Trip per Person	Notes on Cost	Source
Car	107	2.7	\$4.64 (\$12.52 if SOV)	Fuel efficiency: 9.0L/100km Cost of gas: \$1.30/L	
Walk	4	1	\$0.00	No charge	
Bus City	32	1	\$5.00	32 km = 3 zones, Rate applies to adults	Translink, n.d.
Bus Coach	77	1	\$10-15	Greyhound tickets vary depending on time of travel	Greyhound, 2011
Plane	2814	1	\$200- \$400	Using trip from Winnipeg to Vancouver to represent distance of 2800 km Varies with distance and time	Flight Network, 2012
Bike	5	1	\$0.00	No marginal cost; Cost of bike is fixed and variable	
All distances and vehicle occupancies retrieved from Dolf, 2012.					

2.4 Environmental Impact Considerations

The environmental impacts of travel to and from UBC are largely attributable to vehicle traffic. A Life Cycle Analysis of a UBC Thunderbirds basketball game attributed 100% of transportation-related CO₂ emissions to car and bus traffic (SOV's contribute the most per capita emissions). In order to reduce the carbon footprint of transportation to and from UBC games, the number of SOV's must be reduced; increasing car occupancy to people reduces per person emission levels to below that of transit (Dolf, 2012). This is particularly important to note given that 68% of spectators at the basketball game travelled by car (Dolf, 2012). While vehicle traffic is important to target, an analysis of more sports events revealed that a surprising 4.5% of spectators flew to Vancouver to attend the event (Dolf, 2012). Combined, vehicle and airplane travel are responsible for the bulk of the CO₂-equivalent (CO₂e) emissions associated with UBC A&R events.

While CO₂ is a major concern due to its effects on the climate, there are a number of other environmental impacts associated with vehicle transit. These include direct emissions of methane and nitrous oxide, as well as fugitive emissions of HCFCs associated with mobile air conditioning (B.C.

Ministry of Environment, 2011). Other environmental impacts of transport to and from UBC include gradual damage to roadways, particularly associated with heavy trucks (UBC TP, 2011).

2.5 Social Impact Considerations

The social effects of transportation vary greatly by mode of travel. Those taking public transit are subject to longer travel times (compared to travel by car), long waits between connections, being passed by full buses, and overcrowding during peak hours (Cato, 2006). Furthermore public transit is not a feasible option for everyone as some individuals are travelling from areas outside the city of Vancouver. In these areas, there may not be adequate accessibility to transit. The ability to have productive time (i.e. reading or studying) on the bus may compensate for the longer travel times associated with this mode, but this is limited by the availability of seating (Cato, 2006). The increased use of public transit since the implementation of the U-Pass has had positive implications in terms of equality; taking transit has come to characterize part of the student experience, as opposed to something only tolerated by those who cannot afford a car (UBC TP, 2011).

It is well documented that cycling contributes to improved fitness. Commuting by bicycle has been associated with decreased levels of obesity and increased cardiovascular fitness (Oja et al., 2011). As walking is also an active form of transportation, it likely has similar effects depending on the distance travelled. Unfortunately, these modes of transportation also leave travellers most susceptible to weather conditions. Additionally, people may not feel safe walking alone at night. To mitigate this UBC's student society, the AMS, have implemented a program called Safewalk (where a co-ed team will walk people to their destinations). However, their services offered by Safewalk are limited to on-campus routes only and visitors to the campus may not be aware of this service (AMS Safewalk, n.d.).

Many people consider travel by car the most convenient and comfortable mode of transportation. Based on high rates of SOV's, most drivers actually have more seats than passengers in their vehicles (UBC TP, 2011). Car travel also provides privacy and flexibility in one's schedule; however, travel by car has many costs that in some cases may outweigh the benefits. Traffic congestion and deliberate limited parking at UBC may contribute to drivers' stress. Both of these have further implications for door-to-door travel time and accessibility (Cato, 2006). In most cases this mode also provides less opportunity for exercise than any other modes of transportation. Car-pooling can alleviate some of these social impacts, as some parking spaces at UBC are reserved for high-occupancy vehicles; however, coordinating with another person on car-pooling reduces the flexibility in the driver's schedule (UBC TP, n.d.).

2.6 Jurisdictions

There are three major jurisdictions that are responsible for UBC Athletics & Recreation's transportation systems. They are as follows: UBC, TransLink and the City of Vancouver (UBC TP, 2005). While these three jurisdictions are distinct from each other, they collaborate to assume the responsibility of moving people to and from the UBC Vancouver campus.

The Strategic Transportation Plan represents UBC's views on the university's transportation. UBC's Board of Governors approved the Strategic Transportation Plan (STP) in 1999 (UBC TP, 2005). Since its conception, the STP has been responsible for portraying "a wide range of transportation initiatives intended to reduce automobile traffic, increase transit ridership and manage travel demand" (UBC TP, 2005).

Collaboration between these three parties is crucial to reduce the carbon footprint of transportation to and from UBC. For example, UBC and TransLink negotiated to produce the aforementioned, widely successful U-Pass program. Currently, all three parties are in round-table meetings to create a rapid-transit plan for the Broadway corridor to UBC (UBC TP, 2005).

When these three parties reach a consensus, they recommend policies to the Ministry of Transportation to be implemented. For example, the STP recommended that the Ministry of Transportation "implement further parking restrictions and prohibitions on Marine Drive and 16th Avenue" in order to discourage UBC commuters from parking off-campus (UBC TP, 2005). UBC, TransLink, the City of Vancouver, and the Ministry of Transportation are the decision-making stakeholders on UBC's transportation matters.

2.7 Effects

Decisions related to UBC's transportation system have an effect on a large portion of the UBC community (students, faculty, staff), the University Neighbourhood Association and the population of the Greater Vancouver Regional District. Moreover, it can be argued that UBC transportation decisions have an effect outside the lower mainland: UBC Athletics & Recreation holds varsity sport events that draw competitors and spectators from across Canada (Dolf et al., 2011). For these reasons, it is crucial that multi-stakeholder meetings take place, so that all stakeholders have an input in making UBC's transportation system sustainable.

3.0 Sustainable Transportation Options

In order to improve the current transportation situation with regards to UBC Athletics & Recreation's events and to promote sustainable transportation options, we put forward a list of four programs and technologies as options for UBC Athletics & Recreation (UBC A&R) to consider. The social and environmental impacts are outlined for each option, as well as the cost for stakeholders. Each of these options shows some potential for research and they all aim to improve the sustainability of UBC A&R and the events they are responsible for. These four options include 1) the introduction of transit discounts, 2) competition between UBC Thunderbirds teams to help promote cycling and to encourage UBC sports teams to act as agents of change towards sustainable practices, 3) biking incentives to increase the number of people cycling to events, and 4) online communication & awareness strategies. These options were selected from a longer list of options considered and the decision was based on which options other groups were developing, the interests of our group members, and the interest of UBC A&R in exploring and investigating these options. We have included a description of three other options in Appendix B for reference.

3.1 UBC Thunderbirds Transit Program

This option is a program to help increase the usage of public transit for transportation to and from UBC Thunderbirds sporting events: the aim is to decrease the greenhouse gas (GHG) emissions associated with UBC Athletics & Recreation. According to a survey of spectators and staff conducted at 8 UBC Thunderbirds home games, only 7% of spectators arrived by bus, while 68% of spectators arrived by car (Dolf, 2012). If the number of spectators using transit can be increased, a positive impact on UBC A&R's GHG emissions could be realized.

In order to encourage the use of public transportation to and from UBC Athletics & Recreation events, spectators who use transit could be rewarded with a TransLink FareSaver ticket. This card would cover the cost of one zone of travel (Translink, n.d.) and would perhaps cover the cost of their ride home after the event. When the spectator arrived at the game, they would present their transit ticket (that had been validated within the previous hour) while purchasing their event ticket and would receive a complimentary FareSaver ticket. This deal would not be available for UBC students or the University Neighbourhood Association since they only pay \$2 per event ticket and students already have a U-Pass (UBC Thunderbirds, n.d.).

Since partnerships with TransLink are difficult to negotiate, the responsibility of implementing and covering the costs of this program will rest primarily with UBC A&R. It is hoped that a discounted rate could be negotiated for the FareSaver tickets due to the volume that would be purchased, but all cost estimations are performed using the prices of FareSaver booklets (\$21.00 and \$17.00 for Adult and Concession 10-ticket booklets, respectively) that can be purchased at retailers around Metro Vancouver (Translink, n.d.). A breakdown of the 2011/2012 Thunderbirds ticket sales and the potential impact on ticket revenue is provided in Appendix B.

From our calculations, the cost of handing out FareSaver tickets could lead to a 22% decrease in ticket revenue if 100% of people attending games used public transit. It is hoped that this program would help increase the number of spectators attending games, but an increase of 29% would be needed to offset the lost revenue. In order to combat this risk, it is suggested that this program be implemented during playoffs when Adult tickets are \$15 instead of the regular \$10 (UBC Thunderbirds, n.d.). It is also highly unlikely that every person attending the games would arrive by bus, so Table 5 in Appendix B shows scenarios for 100%, 50% and 25% transit ridership during both the regular season and the playoffs. To achieve 25% transit usage, UBC A&R would only see a 6% revenue loss during the regular season, or a 4% loss during playoffs.

It is clear that the impact of the FareSaver tickets decreases with higher Adult ticket prices and that the impact is also tied to transit ridership. As stated before, only about 7% of spectators took the bus to 8 UBC Thunderbirds games in a survey by Dolf (2012). Using the data provided by the survey and CO₂e emissions factors from the ecoinvent database (Swiss Centre for Life Cycle Inventories, 2010), an increase in transit ridership to 25% could lead to a decrease in CO₂e emissions of 7% (see Appendix B for

calculations). This decrease in GHG emissions is kept small due to the immense impact of those spectators who fly to Vancouver to attend games at UBC.

The long-term benefits of initiating such a program are primarily the behavioural changes that are hoped to occur in the people travelling to and from UBC Thunderbirds games. If these people can be shown the convenience and affordability of using transit, it may become habitual. This program may also result in increased ticket sales at UBC Thunderbirds games and may provide opportunities to conduct behavioural research, studies on the effects of increased transit usage on the overall impact of Thunderbirds games, or studies on advertising methods and their effectiveness.

While this program will require that UBC A&R incur some costs for purchasing and distributing FareSaver tickets, there is the potential to increase the number of spectators attending UBC Thunderbirds games and to reduce UBC A&R's environmental impact. The economic impacts to UBC A&R to increase transit ridership to 25% are relatively low, but the improvement in GHG emissions could be high – especially if high-emission modes of travel are targeted.

3.2 Thunderbirds as an Agent of Change

UBC's Thunderbirds sports teams are no strangers to competition. This option addresses how to mobilize our Thunderbirds teams to cultivate active agents of change in the UBC community. Specifically, this option will increase the spectator mode share of cyclists from its current rate of 3%.

A point system ("Cycle Points") will harness the competitive spirit of UBC Thunderbirds and encourage them to be leaders and role models in their community. Thunderbirds teams will earn points by promoting cycling to games on campus. Creativity is encouraged. Some examples of strategies they may use are personal interaction, Facebook events, or poster campaigns. Team members will incur any costs for promotion.

Points are recorded when cyclists (including bicycling Thunderbirds) show up to Thunderbirds games and check in with a volunteer at the bike racks where they can demonstrate they arrived on their bikes. They would be asked whether they biked due to a Thunderbirds initiative and if so which team it was (and how they heard about it). Whichever team spurred the change would acquire a Cycle Point. Cycle Points would accumulate throughout the year and would be divided by the number of players on the team at the end of the year. The team with the most Cycle Points per team member at the end of the year wins. Some of the possible prizes that could be provided by UBC A&R are:

- Symbolic title/annual trophy [free to \$100] (Trophy Centre, n.d.)
- All-You-Can-Eat Sushi dinner at BC Sushi [\$20/person] (Urban Spoon, n.d.)
- Westcadia BBQ catered meal [\$26/person + space booking fee] (Westcadia, n.d.)
- 3 hour Bike Kitchen workshop at UBC [\$10/person] (AMS Bike Co-op, 2012)

Sponsorships could be solicited to cover expenses or to donate prizes. If prizes are on a per-person basis (such as with dinner) it is recommended that varsity teams be broken down to a more manageable size (eg. 8-12 people) for the purposes of this competition. For instance, the Varsity Football team would be subdivided into roughly ten sub-teams who would compete against each other and differentiate themselves from each other for their promotion initiatives with sub-team names or colours.

This program can be expanded so Cycle Points can be earned at other Athletics & Recreation events (eg. Storm the Wall) or even on regular school days by setting up check-in points with volunteers (these would be specifically advertised by the teams, perhaps as a “Bike to School Day” with clear directions as to where to check in). Coaches might also track points for Thunderbirds who arrive to team practice on their bicycles for additional Cycle Points. Other non-varsity teams such as UBC Triathlon Club and junior teams could also be invited to opt in.

This program would develop an image of Thunderbirds as people who are enthusiastic about bicycling and eager to lead by example to make travelling to their events more sustainable. The ability of team members to earn Cycle Points regardless of which Thunderbirds team is playing would increase attendance at games in general, as there would be encouragement for fans that would be loyal to one team to check out other teams’ games. It also has true potential to shift regular patterns of travel across campus through the “Bike to School Days” mentioned above, and also through the example Thunderbirds would set. The Cycle Points would make tracking the success of this initiative possible. As cycling becomes a more mainstream part of UBC students’ and Thunderbirds spectators’ culture, A&R can show that they helped lead the way.

3.3 UBC Athletics & Recreation Bicycle Incentives

This option is aimed to increase the likelihood and attractiveness of cycling to UBC games. The main idea is to provide freebies for cyclists to increase motivation to cycle to games and as an added bonus promote these incentives (UBC A&R’s logo could be incorporated in the give-aways). Below are ideas for this option as well as some suggestions for carrying out the idea and cost implications.

Table 2: Bicycling Incentives

Prize	Cost to UBC A&R
“Freebies”	<ul style="list-style-type: none"> ○ LED Tyre tire Valve Caps Neon Lights for bikes: small, can get UBC Thunderbirds colors, increases safety when cycling at night, comes in a variety of colors [Cost: \$0.99- \$3.00 CDN (Ebay)] ○ Food at concession stands (ie. hot dogs, chocolate bars, drinks) [Cost: \$1.50-\$9.00 (depending on venue and item) (Haas, forthcoming)] ○ T-shirts with UBC A&R or Thunderbirds logo and biking incentives on it [Cost: \$3.95-\$4.95/T-shirt (Great West Graphics, 2012, Orion Screen Works, 2012)] ○ Water bottles with UBC A&R or Thunderbirds logo and biking incentives on it [Cost: \$45 for one-time set up charge, \$1.58/bottle (for 150 bottles) (Print A Promo, 2011)]

Provide a bike valet service	○ Offer a secure place for cyclists to park their bikes during the game [Cost: ~\$400 on average—amount can be subsidized if we found sponsors, had volunteers, provided fencing, etc. (The Bicycle Valet, 2012)]
Incorporate a stamp system to trade for freebies	○ The first time someone cycles to an event, they will be given a stamp card, where they can accumulate stamps each time they cycle to attend an event. After accumulating a certain amount of stamps (i.e. 10) can obtain a prize. [Cost: aside from cards and stamps (which should cost less than \$50 altogether), it will vary depending on the prizes given out]
Draws at the end of each game/season for prizes (draw tickets given to cyclists)	○ Cyclists to events will be entered in a draw, to be drawn at the end of each game or accumulated to draw for a prize at the end of a season [Cost: depending on the demand for these ticket stubs, may not be very costly, again, probably less than \$50, and extra cost will be dependent on the prize]

The above options can be implemented alone or in combination. Although it is mainly aimed at the individual level, it may spread to a community level as it gets passed around by personal communication or by promotion (seeing the logos). This aims to promote positive ideas about cycling to events, and in some cases, increases the safety of cyclists outside of events (eg. bike lights). This works well with the UBC sustainability and GHG emission goals, since cycling may decrease the number of people driving to events, promote healthier lifestyles, and spread the idea of sustainability throughout the UBC community.

3.4 UBC Athletics & Recreation Communication & Awareness Strategies

UBC A&R has indicated that they would like a bigger online presence. In this option, the goal is for UBC A&R to fully integrate sustainability education into their online platform. This option will have many steps. First, UBC A&R should begin to sell their tickets online. As potential spectators buy their ticket, the various sustainability initiatives (i.e. transit fare rebate, bike valet) will be advertised. Second, as the event approaches, ticket-holders will receive a reminder newsletter. In this newsletter, there could be a “How to Get Here” section that encourages sustainable modes of travel (transit, bike, walk) by summarizing personal benefits of choosing a sustainable mode of travel. Some examples are below:

- You will save \$10 on parking
- You will have “productive time” on the bus (i.e. time to read)
- You will get your daily exercise - did you know that biking for 30 minutes burns 300 calories?

Furthermore, this section may include facts regarding climate change. For example:

- Cars are the leading source of GHG emissions in Canada – help UBC A&R reduce its impact on the environment by taking an alternate mode of transportation

Online advertising on UBC A&R's website has the potential to reduce the environmental impact that is associated with spectators' transportation. This option is attractive as it has very low capital costs to UBC A&R (mainly hiring a Web Developer to launch a new website and send out e-newsletters). Moreover, there are lots of advertising options on the newsletter, which may be a source of revenue for UBC A&R.

4.0 Sustainability Indicator Matrix

In order to compare the feasibility of our options and their potential benefit in terms of sustainable modes of transportation, we have developed 10 indicators. We compared each of our proposed options against our matrix of indicators to obtain the best option for UBC A&R to implement. These indicators aim to evaluate the social, environmental and economic aspects of our options to ensure that they are feasible and that they help UBC A&R achieve their sustainability goals.

In order to judge the suitability of our indicators for UBC Athletics & Recreation to consider when trying to increase the sustainability of their events, we used a relative ranking system. Due to lack of data and the variability of our options, in terms of their individual target populations and objectives, it was decided that an absolute determination of our options' rank in terms of sustainability was both unattainable and impractical. Our ranking system required that our options were ranked relative to each other (from first to last) for each indicator, with the first place option being the one that most effectively met the objective for the individual indicator. Some of our indicators were weighted more heavily than others due to their relative importance (e.g. economic cost to UBC A&R was weighted more heavily). To achieve a final determination of our most effective option, the rank was multiplied by the weight for each indicator and all ranks were summed for each option. The option with the lowest score was deemed to be our best option.

In order to compare our options, we assumed that each one would be a "resounding success" and we ranked them according to what we believe to be their maximum potential. Our indicators were chosen to reflect our interpretation of the vision UBC A&R presented to us and to highlight the relative strengths and weaknesses of our options. This method still included an analysis of negative consequences (e.g. more people taking transit may reduce the number of cyclists) while allowing us to focus on the (anticipated) impacts of each of our options. While our options are almost entirely choice-based and behaviour-oriented, we approached them with the assumption each will have an impact on sustainable transportation to and from UBC A&R events.

It should be noted that this ranking system reflects our opinions of the options and our interpretations of the individual indicators. This is by no means the only interpretation of the Options; others may have slightly different rankings and rationale for those rankings. This is one of the main drawbacks of this approach: the results of the Sustainability Indicator Matrix are based on speculation and are quite subjective. It is entirely possible that our matrix could provide different results if more information became available, or if another person or group of people evaluated our options using this matrix.

However, we think that with the information available, the results of our analysis are reasonable. The Sustainability Indicator Matrix that we have completed for our options can be found in Appendix A.

5.0 Our Findings

Our feasibility matrix demonstrated that Communication & Awareness Strategies is the most feasible option for UBC A&R to implement because it is the least costly and is available to nearly all users. It provides information to decrease travel times and increase ease of travel while promoting sustainable modes of travel to and from UBC A&R events. Because it will enumerate various options for each person, and each person in turn can account for their personal barriers to various forms of transit (e.g. travelling with children, needing wheelchair accessibility, etc.), it scored the highest for equity and safety; none of the other options are as accommodating to such diverse needs.

Second place was given to the Bicycling Competition option because it has the potential to increase overall game attendance while increasing the cycling mode-share. However, it may not be accessible or available to all spectators. Bicycling Incentives came in at a close third, for similar reasons to the competition option, but it may not reach out to such a large population and may involve a greater cost. The Thunderbirds Transit Program was deemed the least feasible, mainly because of the high cost implications for A&R.

6.0 Recommended Action for UBC A&R

We recommend that UBC A&R implement the Communication & Awareness Strategy as soon as possible. We recommend the following steps:

1. Re-launch a new UBC A&R website that allows:
 - a. Online purchasing of tickets
 - b. Newsletters to ticket holders
2. Clearly list all the transportation options available to spectators on the website
 - a. Emphasize the benefits of more sustainable modes of travel (i.e. walk, bike transit) by talking about health benefits and the productive time
 - b. Discourage unsustainable modes of travel (SOV's) with high parking rates and carbon footprint information
3. Launch interactive infographics, graphs and maps to help spectators visualize their transportation impact on the environment

We believe that a robust new website that can communicate transportation options is necessary in order for UBC A&R to achieve sustainability. Furthermore this option is very feasible because it has a low capital cost. By communicating this valuable information to people, UBC A&R will be able to encourage spectators to choose more sustainable modes of travel.

That being said, one limitation of our relative ranking system is that it is not conducive to identifying a particular threshold beyond which our options are considered worthwhile to implement. By highlighting the strengths and weaknesses of each individual option, we have provided UBC A&R with the tools required to make their own decisions regarding our proposed options. Each one of our options has significant strength and potential for creating positive change on campus. None of our options require infrastructural changes or large initial capital investments. Furthermore, all four options would work very well with one another. Therefore we recommend that UBC A&R consider implementing a combination of these options. The Communications & Awareness Strategy can actively promote the other three options (Bicyclings Competition, Biking Incentives, and FareSaver ticket rebates). UBC A&R should run a trial period where at least one other option is advertised through their website and email newsletter.

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Appendix A: Sustainability Indicator Matrix

Category	Criteria	Indicators	Objectives	Justification	Indicator Ranking
Social	Health	Participant physical activity [increase/decrease compared to business as usual levels (before these incentives were put in place)]	Improve health of participants and community.	UBC must take initiative to be a leader in promoting health in the community in order to "promote the values of a civil and sustainable society", in line with UBC's TREK 2010 vision.	1
Social	Safety	Feeling of security [increase/decrease, low/med/high]	Improve the safety of people travelling to/from UBC A&R events.	Compromised safety of users not only increases the cost of our transportation Options, but will also reduce the likelihood people will want to use them.	1
Social	Morale/school spirit	# of spectators [increase/decrease compared to BAU/before these incentives/programs were put in place]	Sustain or enhance current levels of community participation and engagement at games.	Attendance at the games enables community members to experience entertainment and inspiration. It also motivates the team members. Spectator presence is seen as an essential component to Thunderbirds games.	1
Social	Sustainability education	Promotes involvement & awareness [low/medium/high]	Increase sustainability awareness to UBC community	Since UBC has goals set for sustainability in their policies, raising awareness will allow for increased support and eventually lead to practice by the community.	1
Social	Accessibility/equity	Available to everyone [Fully, partially, not accessible]	Provide services for all persons.	We believe equity to be a vital component of social sustainability, and acknowledge that UBC upholds equity as a value as evidenced by their Equity Office.	1
Social	Demand on personal time	Projected travel time [increase/decrease]	Provide viable and sustainable method of travel that do not burden consumers unnecessarily by taking up a lot more of their time.	Bears on the feasibility of the project - users may not opt for Options that dramatically increase demands on personal time.	1
Environmental	GHG's & air pollution	Projected mode-share distribution relative to other Options [increase/decrease of various modes]	Decrease use of SOVs and airplanes, increase cycling and walking and help UBC meet targets for GHG emission reductions.	UBC has commitments to reduce GHG emissions. The mode-share distribution should show higher numbers for HOV, cycling, walking and/or transit in order to be seen as helping UBC meet those targets.	2
Economic	Cost to A&R	Cost implications relative to other Options	Provide Options that are affordable for UBC A&R to implement, and are thus feasible.	If costs of implementation are too large, they may pose an insurmountable obstacle. We would like to ensure the Options we propose are feasible to implement.	2
Economic	Profit	Revenue from ticket sales [increase/decrease]	Maintain or increase profit while increasing sustainable practices.	Allows A&R to continue to operate and undertake further sustainability initiatives.	2
Economic	User affordability	Potential cost savings for user? [Y/N, low/medium/high]	Provide sustainable travel methods that are also affordable.	People will not use a method of travel if it doesn't have a benefit, which is often cost (but can be in terms of time or health improvements).	1

Category	Criteria	Indicators	Transit Ticket Option		Communication/Awareness Strategy	
			Ranking	Reasons	Ranking	Reasons
Social	Health	Participant physical activity [increase/decrease compared to business as usual levels (before these incentives were put in place)]	4	This Option may improve the physical activity of those who forgo driving, but we fear it may deter people from walking or cycling to the events.	3	Includes information for all modes of travel, so may not directly influence users' choices with regard to healthy travel modes.
Social	Safety	Feeling of security [increase/decrease, low/med/high]	1	If more people are walking back and forth between the venue and the nearest bus stops, spectators should feel a greater sense of security in numbers.	2	Information online does not threaten security and may encourage behaviors outside of someone's comfort zone, but consumer makes the ultimate decision.
Social	Morale/school spirit	# of spectators [increase/decrease compared to BAU/before these incentives/programs were put in place]	3	This Option may not specifically promote an increase in spectators, but an increase will be required to offset the revenue loss per ticket.	1	Online ticket sales may increase the number of spectators attending and may make it easier to buy tickets and plan for events and nights-out at games.
Social	Sustainability education	Promotes involvement & awareness [low/medium/high]	4	No promotion of sustainability education is included, but this Option could be used to show the positive impact caused by switching from driving to using transit.	3	Educational information can be presented via this Option, but it is expected that retention of or interest in that information will be limited.
Social	Accessibility/equity	Available to everyone [Fully, partially, not accessible]	2	TransLink has made transit use available to nearly everyone: all buses can transport riders in wheelchairs and scooters, and are accessible to the elderly with priority seating. Transit service decreases further inland, but service is still available.	1	Most people have internet in their homes or have access to the internet. Of all our Options, this will likely be the most accessible.
Social	Demand on personal time	Projected travel time [increase/decrease]	2	Transit is faster than cycling or walking, and provides significantly more productive time than driving.	1	The information provided will save users time in terms of finding venue locations and planning the best travel routes.
Environmental	GHG's & air pollution	Projected mode-share distribution relative to other Options [increase/decrease of various modes]	2	Has the potential to significantly decrease the number of SOVs because buses serve a large portion of Metro Vancouver. It may slightly decrease the number of people walking and cycling, since they will want to get a discounted rate as well.	1	Provides the opportunity for A&R to advertise the modes that they see as most sustainable and encourage their use, through statistics against unsustainable modes and improved access to information about sustainable ones.
Economic	Cost to A&R	Cost implications relative to other Options	4	The cost of purchasing FareSavers will be much more than the cost of any of our other Options. This cost may be too much for UBC A&R to consider this Option.	2	Development and maintenance of the website will cost money, but there is a wealth of student and professional talent around campus to help in its creation. A new website may not be required, just changes to the current web page.
Economic	Profit	Revenue from ticket sales [increase/decrease]	4	The cost of purchasing FareSavers could be high, and may reduce the total revenue from ticket and season's pass sales by 20%. A large increase in spectators would be required to compensate for these losses.	2	Online ticket sales will make UBC Thunderbirds games more accessible and may increase the number of people attending.
Economic	User affordability	Potential cost savings for user? [Y/N, low/medium/high]	3	Users will get a cost savings on their tickets in the form of a TransLink FareSaver.	4	The use of systems like Ticketmaster or Eventbrite cost money for the consumer and could result in higher ticket prices.
			39	Rank: 4th	25	Rank: 1st

Category	Criteria	Indicators	Bicycling Competition		Bicycling Incentives	
			Ranking	Reasons	Ranking	Reasons
Social	Health	Participant physical activity [increase/decrease compared to business as usual levels (before these incentives were put in place)]	1	This has the potential to create a culture of cycling around campus that promotes active, healthy lifestyles.	2	This will involve a bike valet, and is more individual based (rather than attracting a group effort to bike).
Social	Safety	Feeling of security [increase/decrease, low/med/high]	3	Cycling imposes dangers on its own, but since the majority of the target population will likely be on campus or near campus, these dangers may be diminished. The possibility of group travel may also increase security.	4	Cycling imposes dangers on its own (ie. other cars, unevenly paved roads, etc), and when cycling at night or in the dark, increases the risk (especially for people cycling alone).
Social	Morale/school spirit	# of spectators [increase/decrease compared to BAU/before these incentives/programs were put in place]	2	All varsity athletes promote any game on campus, regardless of who is playing.	4	There will be no direct monetary ticket discount, but rather a freebie, unsure of turnout/attractiveness of freebie incentive (therefore, may not increase # spectators).
Social	Sustainability education	Promotes involvement & awareness [low/medium/high]	2	Athletes can choose to incorporate sustainability education into their promotion campaigns.	1	Can use freebies given at games as a promotion of the existence of these incentives (ie. print incentive reason on the item or just have logo, etc).
Social	Accessibility/equity	Available to everyone [Fully, partially, not accessible]	4	Not everyone who attends games go to the UBC campus where varsity athletes will likely focus their campaign.	3	Not everyone has access to a bike, and only those who are physically capable of riding a bike can take part.
Social	Demand on personal time	Projected travel time [increase/decrease]	3	Travel by bike is not "productive time" (though it counts for exercise) and takes longer than driving. It's faster than walking and similar to riding buses, depending on transfers and timing. [Same for both cycling Options]	3	Travel by bike is not "productive time" (though it counts for exercise) and takes longer than driving. It's faster than walking and similar to riding buses, depending on transfers and timing. [Same for both cycling Options]
Environmental	GHG's & air pollution	Projected mode-share distribution relative to other Options [increase/decrease of various modes]	3	This Option promotes cycling, and the promotion of other teams' games by varsity athletes will bring cyclists who wouldn't otherwise come, so the biking mode share will increase.	4	This option promotes cycling, and gives cyclists incentive to pass on the message, or will attract new cyclists to bike to games, thus increasing the biking mode share
Economic	Cost to A&R	Cost implications relative to other Options	3	Most costs are minimal (eg. photocopying) and incurred by team members. UBC A&R only needs to provide a prize, such as dinner for the team.	1	The money for freebies should be relatively inexpensive and we could also get sponsors for these items (therefore free for UBC A&R).
Economic	Profit	Revenue from ticket sales [increase/decrease]	1	There is projected to be at least some increase in the number of people to attend, and ticket prices are unaffected.	3	Doesn't affect ticket sales, since there is no discount on the tickets (unless one of the incentives we decide to use is a discounted sale price). # people may increase, attracted by the freebies/incentives.
Economic	User affordability	Potential cost savings for user? [Y/N, low/medium/high]	2	Assuming people don't buy a bike specifically to attend the game, costs to the user are negligible (bike maintenance).	1	Virtually no user costs (except for the initial purchase of a bike) and all incentives are of benefit to the user (supported by UBC A&R or other sponsors).
			31	Rank: 2nd	34	Rank: 3rd

Appendix B: Tables & Figures

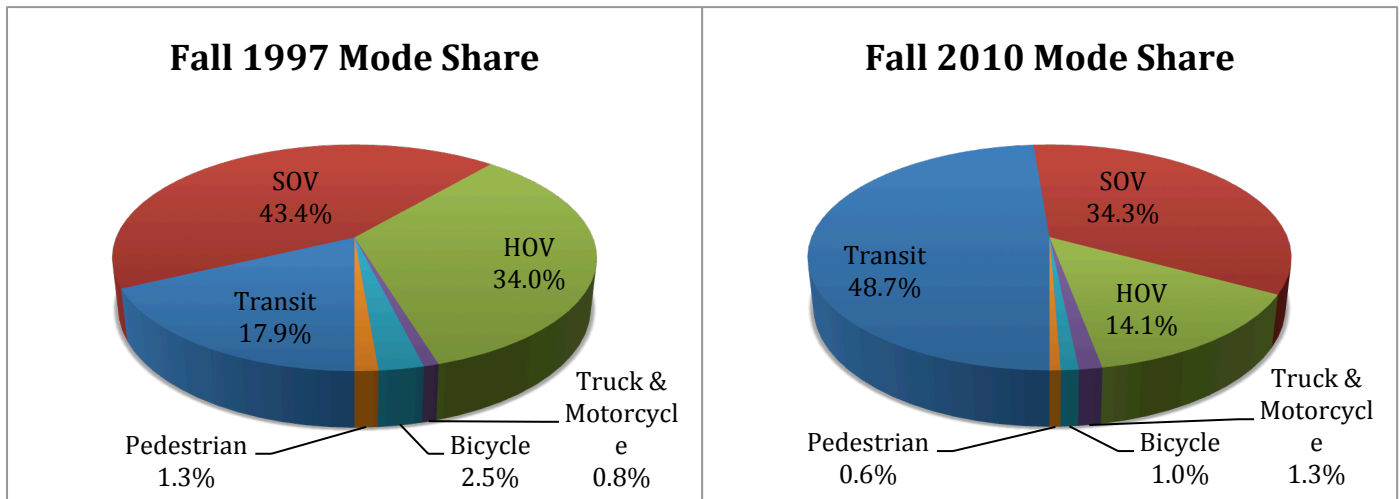
Table 3 below shows the changes in the number of person trips by travel mode from 1997 to 2010 as described by the UBC Fall 2010 Transportation Status Report. The same information is displayed in Figure 1 as mode share distributions for 1997 and for 2010.

Table 3: Change in Person Trips by Mode from 1997 to 2010

Travel Mode	Fall 1997		Fall 2010		Change from 1997 to 2010	
	Person Trips	% of Total	Person Trips	% of Total		
Transit	19000	17.9%	63300	48.7%	44300	233.2%
SOV	46000	43.4%	44500	34.3%	-1500	-3.3%
HOV	36100	34.0%	18300	14.1%	-17800	-49.3%
Bicycle	2700	2.5%	1300	1.0%	-1400	-51.9%
Pedestrian	1400	1.3%	800	0.6%	-600	-42.9%
Truck & Motorcycle	900	0.8%	1700	1.3%	800	88.9%
Totals	106100		129900		23800	22.4%

Source: UBC Fall 2010 Transportation Status Report (UBC TP, 2011)

Figure 1: Mode Share Distributions



Source: UBC Fall 2010 Transportation Status Report (UBC TP, 2011)

The impact of handing out FareSaver tickets as part of the UBC Thunderbirds Transit Program is outlined below. The information for gate sales came from personal communication with Andrew Haas (Facilities Coordinator for Thunderbird Park and Stadium), consisting of numbers from the 2011/2012 season. These numbers were not used to obtain absolute revenue, but rather to calculate relative decreases in revenue; the numbers provided a sample of the distribution of ticket sales. It should be noted that Youth, Seniors, Visiting Students and UBC Faculty & Staff were all counted together, so in order to estimate the revenue losses, their numbers have been split evenly (as seen in Table 4). Table 4 also assumes that 100% of spectators would be using transit and would receive a FareSaver ticket.

Table 4: Impact of FareSaver tickets on Revenue

Individual Game Tickets	Ticket Cost	Proposed FareSaver Discounts	Revenue Per Ticket	% Revenue Loss	Number of Tickets Sold	Revenue w/o FareSavers	Revenue w/ FareSaver Discounts	
Adult	\$10.00	1 adult	\$2.10	\$7.90	21%	3418	\$34,180.00	\$27,002.20
Youth, Seniors, Visiting Students	\$5.00	1 concession	\$1.70	\$3.30	34%	1488	\$7,440.00	\$4,910.40
UBC Faculty/Staff	\$5.00	1 adult	\$2.10	\$2.90	42%	1488	\$7,440.00	\$4,315.20
UBC Students, UNA	\$2.00	No discount	\$2.00	0%	4198	\$8,396.00	\$8,396.00	
Family Pass (max 2 adults)	\$20.00	2 adult	\$4.20	\$15.80	21%	169	\$3,380.00	\$2,670.20
Approximate Required Spectator Increase:		29%			22%	10761	\$60,836.00	\$47,294.00

Sources: (A. Haas, personal communication, March 7, 2012; TransLink, n.d.; UBC Thunderbirds, n.d.)

Table 4 assumes that 100% of spectators will receive FareSaver tickets. Table 5 outlines the revenue scenarios for regular season and playoff games for varying success of the program. "Transit Ridership" means the percentage of total spectators who would receive FareSaver tickets.

Table 5: Impact on Revenue for Regular Season and Playoff Games

	Adult Ticket Cost	Transit Ridership	% Revenue Loss	Required Spectator Increase
Regular	\$10.00	100%	22%	29%
Playoffs	\$15.00	100%	17%	21%
Regular	\$10.00	50%	11%	13%
Playoffs	\$15.00	50%	9%	10%
Regular	\$10.00	25%	6%	6%
Playoffs	\$15.00	25%	4%	5%

Sources: (A. Haas, personal communication, March 7, 2012; TransLink, n.d.; UBC Thunderbirds, n.d.)

In order to estimate the reduction in CO₂e emissions associated with 25% transit ridership to UBC Thunderbirds games the transportation survey data from Dolf (forthcoming) was used. The emissions factors used were taken from the ecoinvent database v2.2 provided by the Swiss Centre for Life Cycle Inventories, and were used assuming an average vehicle occupancy rate of 2.6 for cars traveling to UBC Thunderbirds games. As can be seen, the majority of the emissions are caused by those flying, while those driving cars cause bulk of the rest. It is assumed in this estimation that all of the spectators switching to transit use would normally have driven to the games. This assumption may not be completely realistic, since spectators who would normally walk or cycle to events may be inclined to take transit to get a FareSaver ticket.

Table 6: CO₂e Emissions Reduction

Travel Mode	25% Transit Ridership		Business As Usual		Emissions Factors	
	% People	t CO ₂ eq	% People	t CO ₂ eq	Occupancy	kg CO ₂ eq / pkm
Bike	2%	0.0	2%	0.0	1	0.0096
City Bus	25%	0.7	7%	0.2	Ave.	0.1040
Coach Bus	6%	0.2	6%	0.2	Ave.	0.0520
Car	51%	5.8	68%	7.8	2.6	0.1215
Motorbike	0%	0.0	0%	0.0	1	0.1218
Plane	5%	14.9	5%	14.9	Ave.	0.1258
Walk	10%	0.0	10%	0.0	1	0.0000
Totals	100%	21.6	100%	23.1	Reduction:	7%

Source: (Dolf, forthcoming; Swiss Centre for Life Cycle Inventories, 2010)

Appendix C: Alternate Sustainable Transportation Options

Over the course of this project, a number of possible Options were brought to the table. Due to the high capital costs of some and the close cooperation required by TransLink for others, we decided not to investigate these options any further and to concentrate on those seen in the main body of this report. We have decided to include our extra options in the Appendices so that UBC A&R will have more ideas to draw from than just those presented in the report.

Appendix C.1 Alternate Option: Webcasting UBC Sports Events

Webcasting UBC sporting events will be a sustainable way to support UBC Thunderbirds without having to travel to UBC via unsustainable modes of transportation. In his on-going research, Dolf (forthcoming) found that in a study of eight UBC basketball games, forty-two spectators traveled on airplanes (4.5%) to see the games at UBC. Compared to other transportation modes (i.e. coach bus, transit, bike, car), airplanes have the highest carbon footprint. Webcast refers to a process of streaming media on-line for viewing on a web browser on a personal computer (Baecker et al., 2007). If UBC A&R were to webcast sports events, there is the potential that spectators will not board airplanes to watch games as webcasts provide a way to be a spectator at UBC A&R events without having to travel to UBC. Table 7 summarizes the costs and benefits of webcasting sports events.

Table 7: Webcasting Impacts & Implications

Economic cost implications	Environmental impacts	Social impacts/potential community response
<p>Low capital costs</p> <ul style="list-style-type: none"> Armstrong Atlantic University spent \$5000 in start-up costs in website construction, camera, and camera operators (Carnevale, 2007) 	<p>Virtually no GHG emissions</p>	<p>An effective way to keep a dedicated fan base (Carnevale, 2007)</p> <ul style="list-style-type: none"> Engages UBC fans who cannot physically travel to the games to be able to watch the sports events live
<p>Very low projected operating costs</p> <ul style="list-style-type: none"> The consumer bears the cost of accessing a computer, internet A&R staff costs (i.e. camera operator, web master) Potential for generating money: Abilene Christian University in Texas charges \$89.95 for a 1-year subscription to their sports webcasts (Carnevale, 2007) 	<p>UBC A&R’s energy used to stream the sports events on-line</p>	<p>Positive community response</p> <ul style="list-style-type: none"> Saves the spectators time and money because they are not traveling to the sports event (Carnevale, 2007) Webcasts still offer a forum for interactive engagement. E.g. instant messaging/virtual chatting with other fans (Baecker et al., 2007)
	<p>By in large, the consumer bears the energy requirements to watch the sports events</p>	<p>Potential controversy</p> <ul style="list-style-type: none"> May decrease attendance at sports events; UBC A&R loses money in ticket sales

Webcasting sports events is an attractive option for UBC A&R when looking for ways to reduce the number of spectators traveling by airplane to sports events. Furthermore, investment into webcasting technology provides a valuable research opportunity in the field of community engagement and marketing. UBC can spearhead an exciting field in academia: webcasting to achieve sustainability.

Appendix C.2 Alternate Option: Ride-Sharing App

UBC Transportation Planning is seriously considering developing a real-time ride-sharing app in order to transform SOV trips into HOV trips. The idea of a mobile device app that allows carpooling is nothing new (Cozza, 2011). This app, called Carsurfing, will match a driver and rider(s) who are traveling along the same route. Carsurfing is unique in that it will have “a fully automated cashless payment system, safety features, real-time passenger information and commute reporting to enable more flexible and verifiable carpooling” (Heartline, 2012). Table 8 summarizes the costs and benefits of webcasting sports events.

Table 8: Ride-Share App Impacts & Implications

Economic cost implications	Environmental impacts	Social impacts/potential community response
<p>Medium capital costs</p> <ul style="list-style-type: none"> ○ UBC A&R needs to develop the App and market it ○ The consumer bears the cost of buying the app, using the app on a mobile device 	<p>Reduction in GHG by reducing the number of SOV</p>	<p>Builds a stronger community</p> <ul style="list-style-type: none"> ○ People sharing their cars, creates an opportunity for people to interact <p>Positive feedback (Heartline, 2012).</p> <ul style="list-style-type: none"> ○ Saves money ○ Convenient: doesn't have to conform to rigid carpooling schedules well-in-advance of their travels <p>Potential controversy (Geraci, 2012).</p> <ul style="list-style-type: none"> ○ It may be too hard to find a ride to/from the desired destination ○ Lack of trust/friend network may be a barrier for people to use this app

In order for this app to be successful it needs to consider some of the changes below:

- Ride-sharing needs to have more of an incentive (i.e. cheaper parking for HOV than SOV on UBC campus)
- Marketing this app towards people who make a long commute/an inter-city travel; people are more likely to plan more for a long trip than if it were a short-distance trip or where transit is abundant (Geraci, 2012).
- “Users can only see information for the trips that they are interested in. This eliminates unnecessary noise and creates community around specific routes that people drive frequently” (Geraci, 2012).

If UBC Transportation Planning were to commit to implementing this Carsurfing app, then the UBC community’s transportation habits could become more sustainable. Carsurfing will provide ample research opportunities in the field of behaviour change in transportation.

Appendix C.3 Alternate Option: UBC Thunderbirds Shuttle Services

The shuttle option is aimed to help decrease the number of cars travelling from one side of campus to the other, and to encourage usage of public transit to UBC Thunderbirds sporting events. As mentioned, most spectators are arriving by car to the southern campus events and we aim to decrease these numbers in order to make UBC A&R events more sustainable.

Some of the UBC A&R facilities are located south of the main body of the UBC campus. These facilities include the Doug Mitchell Thunderbird Sports Centre, the Tennis Centre, Thunderbird Park, and Thunderbird Arena. According to a beta program from Google Maps, these facilities are on average 1.5 km from the UBC Loop bus station and would take approximately 17 minutes to walk to. This may be an unacceptable distance for some users (parents with children, people with disabilities, etc.), or may be inconvenient for others, and as such a high number of people have been seen to arrive by car to UBC Thunderbirds games (as indicated by surveys taken by Dolf (forthcoming)).

In order to make the use of transit, walking, and cycling more appealing, we propose the following options for a shuttle service from the UBC Loop bus station to some of the more distant facilities, namely Thunderbird Stadium.

1. Run a shuttle bus from UBC North Loop to Thunderbird Stadium (and perhaps have a few pick-up stops along the way)
2. Runs for 1 hour before kickoff until 15 minutes after kickoff
3. Will run for 30-60 minutes (depending on needs of the shuttle) after the game, back to UBC North Loop
4. Shuttle service from event to Mahoney's (maybe also have a combo package to the restaurant with ticket)
5. This will use the existing bus service offered by Mahoney's
6. Encourages people to visit the bar
7. If people don't want to go to the bar, the bus loop is within reasonable walking distance
8. Only enable shuttle service into and out of event areas (mainly to prevent congestion and for safety around the area for pedestrians, cyclists, etc.)
9. Especially for Thunderbird Stadium, if the parking lots will be closed down, people will take the shuttle if the shuttle was the only vehicle mode of transportation allowed into the area (along with walking and cycling)
10. We can add more incentive for using the shuttle option by making it a combo for people who took transit or biked (match up bus times or have priority over those who drove?)

The shuttle itself may not be very sustainable (depending on the type of vehicle we use as a shuttle), but in comparison to the alternatives, may be more convenient and reduces the amount of cars traversing campus if there are events taking place on different ends of campus. In a way, we can also raise awareness of sustainability to a broader audience, in hopes that there will be behavioural changes of the

people who were exposed to this initiative. However, it may be very costly to purchase shuttles to begin this proposal. As well, we don't know for sure what response we should be expecting from users of this shuttle, since it may be inconvenient for individuals of certain age groups (ie. mothers with strollers, young children, elderly, disabled, etc.).