

UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

UBC Transportation and Parking

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**UBC PARKING AND
TRANSPORTATION
POLICY
REPORT**

POLI 533 - Policy Report
UBC Transportation and Parking

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Table of Contents

Executive Summary..... i

Introduction and Context..... 1

Problem Definition..... 3

Policy Objectives..... 4

Evaluation Criteria..... 4

Policy Options..... 6

Policy Evaluation & Recommendation..... 12

Policy Implementation..... 14

Conclusion..... 15

Bibliography..... 16

Figures

Figure 1..... i

Appendices

Appendix A..... ii

Appendix B..... iii

Appendix C..... vi

Appendix D..... viii

Appendix E..... xiii

Executive Summary

The University of British Columbia has declared a climate emergency and is actively working to reduce its greenhouse gas (GHG) emissions. The 2020 UBC Climate Action Plan and the 2014 UBC Transportation Plan lay out targets to reduce GHG emissions and identify transportation on and to UBC's Vancouver Point Grey campus (UBCV) as opportunity areas to achieve these targets. An extension of the TransLink Skytrain is expected to reach UBCV in 2030. Until then, policies need to be put in place to reduce GHG emissions and other negative effects related to transportation (such as congestion, noise, safety hazards) to and from UBCV. Policy options include discouraging parking on campus, encouraging the transition to zero-emission vehicles, and encouraging faculty and staff to take public transit. Based on the criteria of environmental impact, equity, community support and cost-effectiveness, this analysis recommends to gradually increase long-term parking permit rates to reach a 40% rates increase for permit applicants living west of Fraser Street in the City of Vancouver.

Introduction and Context

The University of British Columbia's Vancouver Point Grey campus (UBCV) sits at the edge of the Burrard Peninsula, approximately 10 kilometers away from Vancouver's downtown core. With an average daytime population of nearly 80,000 people composed of staff, faculty, students, and visitors,¹ UBC's campus is "like a city within a city,"² larger than most municipalities in the province.³ Although more than two thirds of this population commutes to and from campus daily,⁴ this commuting accounts for 37.7% of UBCV's total greenhouse gas (GHG) emissions.⁵ Although more than half of this population commutes by walking, cycling or using mass transit, between 10,000 and 35,000 people drive motor vehicles that require parking space throughout the day.^{6 7}

The 2010 Climate Action Plan laid out UBC's plans to reduce GHG emissions to reach net zero emissions by 2050—the first university to commit to such a target.⁸ These objectives were reiterated and updated in the more recent UBC Climate Action Plan 2020.⁹ Reducing GHG emissions is also a guiding

¹ The University of British Columbia. 2019. *UBC Vancouver Transportation Status Report Fall 2018*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 5. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-12/REPORT_UBC_2018TransportationStatusReport.pdf.

² *Ibid.*, 9.

³ City of Vancouver. 2020. "Arbutus to UBC SkyTrain Factsheet." *City of Vancouver*. Accessed March 2020. <https://vancouver.ca/files/cov/arbutus-to-ubc-skytrain-factsheet.pdf>.

⁴ *Ibid.*

⁵ UBC Sustainability. 2019. *2018 Carbon Neutral Action Report*. Policy Report, Vancouver: The University of British Columbia, 17. Accessed March 2020. https://planning.ubc.ca/sites/default/files/2019-11/REPORT_UBC_CNAR2018.pdf.

⁶ NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia.

⁷ The University of British Columbia. 2019. *UBC Vancouver Transportation Status Report Fall 2018*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 9. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-12/REPORT_UBC_2018TransportationStatusReport.pdf.

⁸ The University of British Columbia. 2010. *UBC Climate Action Plan 2010-2015*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-12/PLANS_UBC_ClimateActionPlan2010.pdf.

⁹ The University of British Columbia. 2019. *UBC Climate Action Plan 2020: An Update to UBC's Climate Action Plan*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 10. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-11/PLAN_UBC_ClimateActionPlan.pdf.

principle for other projects, including the 2014 UBC Transportation Plan.¹⁰ Additionally, in December 2019 the university's Board of Governors declared a climate emergency, recognizing the threat posed by climate change and committing the university to a process of increasing the scope and speed of actions under the Climate Action Plan.¹¹

Aside from reducing GHG emissions associated with commuting, the objective of UBC's 2014 Transportation Plan is to increase sustainable travel to campus. It sets up targets, including:

- That by 2040, most trips to campus will be made by walking, biking or transit;
- Reducing single occupant vehicles (SOVs) coming to campus, both in absolute numbers and per-capita, below 1997 levels;
- Reducing daily private automobile traffic.¹²

The 2014 Transportation Plan identifies parking availability and pricing as “one of the biggest influences on driving mode share”¹³ and lays out a series of policies designed to reduce SOV usage,¹⁴ while ensuring barrier free parking on campus for persons with disabilities.¹⁵

The objective of the present analysis is to propose parking policies that align with the 2014 Transportation Plan sustainability targets and help the university meet the goals set by the Climate Action Plan 2020, while remaining adaptable to changes as those goals accelerate in accordance with the Declaration on the Climate Emergency. It is based on updated information included in the UBC Vancouver Transportation Status Report Fall 2018 and the results of the 2017 Vancouver Transportation Survey.

¹⁰ The University of British Columbia. 2014. *2014 UBC Transportation Plan*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-11/PLANS_UBC_TransportationPlan.pdf.

¹¹ —. 2019. "Declaration on the Climate Emergency." *Office of the President*. December. Accessed March 2020. <https://president.ubc.ca/letter-to-the-community/2019/12/05/climate-emergency-declaration/>.

¹² The University of British Columbia. 2014. *2014 UBC Transportation Plan*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 12-13. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-11/PLANS_UBC_TransportationPlan.pdf.

¹³ *Ibid.*, 29.

¹⁴ *Ibid.*, 31-32.

¹⁵ *Ibid.*, 33-35.

Problem Definition

The problem this analysis seeks to address is that too many trips to UBCV are made by car. This generates negative effects for the UBC community, including higher GHG emissions, increased traffic congestion, reduced safety and higher noise levels.¹⁶

According to UBC's 2018 Transportation Status Report, over half of the weekday person trips to and from UBC are conducted via transit. Driving accounts for 45.5% of trips, split between SOVs (33%), carpooling (11.5%), and trucks & motorcycles (1%).¹⁷ The 2017 Vancouver Transportation Survey indicates that nearly three quarters of students use transit, with only 5% of students typically driving alone to campus.¹⁸ In contrast, faculty and staff's transit use is lower (27% and 46%, respectively) and driving alone is higher (29% and 36%, respectively).¹⁹

Around two thirds of survey respondents live within the City of Vancouver, with 34% living west of Cambie Street and 13% living within the downtown core.²⁰ Outside of Vancouver, the largest proportion of commuters come from Richmond (9%) and Burnaby (6%). Of those who commute by driving alone, 38% say they mostly do so because their trips have other purposes that require them to drive (e.g. picking up children from daycare and schools), while 36% say they live too far to travel by transit.²¹

One of the next big steps in decreasing the number of cars travelling to campus will be coming with the extension of the Skytrain to UBC, which is expected by 2030.²² In the meantime, policy options are available to discourage driving to campus.

¹⁶ Ibid., 28.

¹⁷ The University of British Columbia. 2019. *UBC Vancouver Transportation Status Report Fall 2018*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 9. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-12/REPORT_UBC_2018TransportationStatusReport.pdf.

¹⁸ NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia, 17.

¹⁹ Ibid., 17.

²⁰ Ibid., 6.

²¹ Ibid.

²² The University of British Columbia. 2020. "FAQ - When will the UBC extension be built?" *UBC Rapid Transit*. Accessed February 2020. <https://skytrain.ubc.ca/>.

Policy Objectives

Our goal is to design policies that fulfill two main objectives: reducing the number of vehicles coming to campus, and reducing the overall GHG emissions generated by commuting to UBCV. Consequently, policies will mainly seek to discourage coming by car to campus and target SOV drivers for conversion into alternative, greener modes of transportation.

Evaluation Criteria

Policy proposals that fulfill the objectives outlined above will be evaluated along four criteria: environmental impact, community support, equity, and cost-effectiveness.

Environmental Impact:

“At UBC’s Vancouver campus, sustainability means simultaneous improvements in human and environmental wellbeing, not just reductions in damage or harm.”²³

-- 2014 20-Year Sustainability Strategy for The University of British Columbia Vancouver Campus

We will want to make sure our policies reduce CO₂ and other pollutant emissions associated with driving. Additionally, they should enhance the environmental quality of UBCV campus. Driving is often seen as a comfortable transportation option, but it generates negative well-being effects including noise, noxious smells, and harmful air pollution. It also uses space that could be transformed into green surfaces. We need to make sure that our policies diminish those negative effects in greater proportion than it diminishes comfort associated with driving, making it more pleasant to work and live on campus. We want to design policies that can be sustained and updated in the long run to generate positive long-term environmental effects for future generations of UBCV communities.

²³ The University of British Columbia. 2014. "2014 20-Year Sustainability Strategy for The University of British Columbia Vancouver Campus." Accessed February 2020.
https://sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/CampusSustainability/CS_PDFs/PlansReports/Plans/20-Year-Sustainability-Strategy-UBC.pdf.

Community Support:

The positions of unions, student associations, and neighbourhood associations will be considered in the design of policy alternatives. Frustrating the UBCV community with new policies—especially staff and faculty organizations—without attaining the intended results runs the risk of reducing the university administration’s tolerance for experimentation and impede future projects. It could also have negative effects on the university’s ability to recruit and retain students, faculty, and staff who are essential to the life of UBCV. On the other hand, the support and input of student, faculty and staff associations focused on climate change and environmental sustainability could be an asset throughout this process.

Equity:

“UBC’s goal is to create a barrier-free environment.”²⁴

-- 2014 UBC Transportation Plan

Insensitive or too stringent policies may have unintended consequences on the lives of persons with disabilities or whose situations require them to drive to campus. It is crucial that the proposed policies do not impede access to campus for students, faculty or staff with disabilities. Nor should people who live very far or whose households are not well-serviced by transit be deterred from coming to campus. The Fall 2017 Transportation Survey points to the fact that many SOV drivers have to pick up children from daycare or school. Sensitivity to particular situations such as this one is also important. Policies will be evaluated on the basis of their effect on already vulnerable and constrained populations.

Cost-Effectiveness:

Policy proposals should fulfill our objectives at the least expense of the UBCV community. They should not incur unnecessary immediate or future costs on our clients, drivers, the community, and the

²⁴ The University of British Columbia. 2014. *2014 UBC Transportation Plan*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-11/PLANS_UBC_TransportationPlan.pdf

various UBC governing, administrative, and regulatory bodies. Policies should also be considerate of parking revenue targets the university may have. Other aspects of efficiency—energy efficiency and efficient use of space for example—cannot be dismissed.

Policy Options

UBC Parking’s pricing policies can be adjusted to make driving a more expensive, less attractive option. After the introduction of U-Pass for students, average weekday transit trips effectively levelled off in 2013.²⁵ Discounting or subsidizing transit passes for faculty and staff could create immediate incentives for people to turn toward public transit. Another option is to incentivize the transition to zero-emission vehicles, notably by introducing more charging stations on campus. These policies could have a significant effect on UBCV’s commuting-related GHG emissions. Several other options were considered, but ultimately excluded from our analysis. More details about them are included in Appendices A and B.

Incentivizing Transition to Zero-Emission Vehicles:

This policy option incentivizes the transition of people who drive vehicles with an internal combustion engine to vehicles with low or zero-emission engines. This policy works in tandem with existing federal and provincial rebates²⁶ that incentivize consumers to purchase an electric vehicle. UBCV does not want to increase the number of cars coming to campus, but rather to incentivize the existing car commuting population to choose an electric vehicle for their next vehicle. This policy option includes the possibility of transitioning the current UBCV Fleet vehicles towards low or zero emission vehicles in the

²⁵ The University of British Columbia. 2018. *UBC Vancouver Transportation Status Report Fall 2017*. Policy Report, UBC Campus & Community Planning, Vancouver: The University of British Columbia, 18-19. Accessed February 2020. https://planning.ubc.ca/sites/default/files/2019-11/REPORT_UBC_Transportation_2017.pdf.

²⁶ PlugIn BC. 2020. "Vehicle Incentives." *PlugIn BC*. Accessed March 2020. <https://pluginbc.ca/incentives/vehicle-incentives/>.

future. There is a large body of academic and non-academic research on how transitioning from internal combustion to electric or hybrid vehicles are proven to lower greenhouse gas emissions.²⁷

There are already a small number of electric charging plugs available on campus.²⁸ Under this new proposal UBCV will retrofit parking spots to include additional charging plugs for electric vehicles. No new parking spots would be created for electric vehicles. UBC could make money off of use of these charging plugs. This policy option would also alter the current parking prices to include differential pricing for low-emission vehicles. Parking permit rates would be lower for drivers who prove that their vehicle releases zero emissions than for an equivalent vehicle with an internal combustion engine. The City of Vancouver has implemented similar policies favouring electric vehicles in their parkades and has not encountered violations or pushback against the policies.

This policy option aligns with the goals to be achieved by the expansion of the Skytrain to UBCV campus, because TransLink's Canada Line runs on electric motors, unlike the 99-B line buses that carry the majority of students to UBCV.²⁹ By 2030, UBCV would have a significant reduction in GHG emissions from commuting both by car and by bus. The City of Vancouver is exploring a similar strategy by working with other non-governmental organizations with significant parking capacity which means that UBCV is not acting alone in this endeavour.^{30 31}

²⁷ Lepitzki, Justin, and John Axsen. 2018. "The Role of a Low Carbon Fuel Standard in Achieving Long-Term GHG Reduction Targets." *Energy Policy* 119: 423-440.

²⁸ PlugIn BC. 2020. "Finding Stations." *PlugIn BC*. Accessed March 2020. <https://pluginbc.ca/charging-stations/finding-stations/>.

²⁹ TransLink. 2020. "Fleet and Technologies." *TransLink*. Accessed March 2020. <https://www.translink.ca/About-Us/Corporate-Overview/Operating-Companies/CMBC/Fleet-and-Technologies.aspx>.

³⁰ City of Vancouver. 2020. *Update on Reserved Parking Stalls for Electric Vehicles*. Policy Memorandum, Vancouver: City of Vancouver.

³¹ Government of British Columbia. 2020. *Zero-Emission Vehicle Incentive Workshop Backgrounder*. Backgrounder, Vancouver: Government of British Columbia.

Creating Public Transit Subsidies for Staff and Faculty:

Faculty and staff represent 65% of the commuters driving alone, according to the 2017 UBC Transportation Survey.³² Attracting them to public transit would represent a significant step towards our goals of reducing GHG emissions and traffic on campus. A policy option for UBC would consist of subsidizing an Employee Transit Pass Program (ETPP), which would reduce GHG emissions by more than 2,000 tons annually at a cost of \$3,180,147.

The proposed policy would be distinct from the U-Pass that students currently benefit from. U-Pass is mandatory and costs each student \$164 per academic term, bringing the monthly fee for unlimited transit to \$41. In the case of the ETPP we are proposing, this would not be feasible. Staff members earn significantly less money than faculty and have responsibilities we assume students don't have. In that respect, a policy that would generate mandatory new costs for the staff seems unfair and would probably encounter resistance from unions.

Our policy proposal would be to provide a 30% subsidy for transit passes that cover all three TransLink fare zones (see Figure 1). The policy would not assume every staff and faculty needs a three-zones coverage, however. It would provide subsidies according to the needs associated with the place of residency; staff or faculty living in Zone 2 of TransLink's service, for example, would have access to subsidies for Zone 2 monthly passes. This would tailor the provision to the needs of individuals and would help contain the cost of the policy for UBC. Providing staff and faculty with a 3-zones coverage like U-Pass does for students would prove costly (zone 1 and 2 passes cost \$98 and \$131 respectively, whereas zone 3 costs \$177) and would not respond to the actual needs of the majority (only less than 15% of commuters come from zone 3).

A 30% discount on monthly passes, according to a UBC SEEDS Sustainability Program Student Research Report's estimate of elasticity of demand,³³ would bring about a 15% increase of public transit

³² NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia, 17.

³³ Cooper, Sarah, Anvesha Dwivedi, Matthew Araneta, and Marcus Bockhold. 2018. *Employee Transit Pass Program*. Presentation, Vancouver: UBC Social Ecological Economic Development Studies (SEEDS).

usage among staff and faculty. Together, these 917 changed commuters would save a total of 1,227 hours of driving a day, for a conservative estimate of 2,079.0 tons of GHG annually (see Appendix C for a more complete account of costs and benefits of this ETPP proposal). It would cost UBC an approximated \$3,180,147, or \$1,529.66 for every ton of GHGs saved.

Our proposal for implementation would be to begin with a pilot program of one academic year to assess the actual efficiency of this program. If it proves efficient and is extended in the long term, UBC should initiate negotiations toward a deal with TransLink to limit the costs to UBC, for example by keeping revenues to TransLink fixed (in which case every new commuter from the policy would help reduce the cost to UBC). UBC could also adjust the subsidy to an optimal size. Finally, it must be noted that our project is framed with the extension of the Sky Train in perspective. The effects of this policy, if implemented, would have the advantage of being amplified by the SkyTrain reaching UBC.

Restructuring Parking Permit Pricing:

As of today, parking permits for the UBCV Point Grey campus remain quite affordable and massively purchased. For example, a two-term permit for one parkade costs an undergraduate student \$684. One-year permits for graduate students, faculty and staff cost \$1,026.³⁴ According to UBC parking data, 26,231 permits (of all types) were purchased by commuting undergraduate students in 2019. 14,800 permits (of all types) were purchased by faculty members that same year, and 22,905 permits were purchased by members of staff.

According to the 2017 Transportation Survey,³⁵ only 5% of respondents would move away from driving if parking rates—including permit rates—were to rise substantially. Yet it is estimated that a 40% increase in parking rates could decrease the number of daily drivers by up to 12%.³⁶ Based on these

³⁴ The University of British Columbia. 2020. "Permits & Rates." *UBC Parking*. Accessed March 2020. <https://parking.ubc.ca/permits-rates>.

³⁵ NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia, 21.

³⁶ United States Congress - Office of Technology Assessment. 1975. *Energy, the Economy, and Mass Transit*. Assessment Report, Washington D.C.: United States Congress, 145.

numbers, we propose ways to restructure long-term permit rates and eligibility to minimize commutes completed by car to UBCV. Specifically, we consider long-term to be 7-days or more. This is based on the understanding that people buying daily permits or paying by the hour are doing so out of exceptional circumstances. On the other hand, people buying term or yearly permits have an incentive to drive to campus every day; this is what we would want to discourage.

One option would be to differentiate pricing by individual commute time or distance between residence and campus. Both could be estimated from requiring individuals to register their residence's postal code in permit applications. Alternatively, permit applications could be linked to student and faculty and staff service accounts, which may already contain accurate residency information. From postal codes, commute times could be computed using estimates of congestion time, distance to major transit lines, and likeliness of overloaded transit lines at peak hours. Anyone to whom a commute by public transit is estimated to be less than one hour, for example, would face higher permit rates. Alternatively, postal codes could be used to divide residency locations in zones. Anyone living west of Cambie Street—which accounts for 55% of people who purchase parking permits according to UBC Parking data—would face higher permit rates. One caveat with this option is that people could be incentivized to live further away from campus (e.g.: Mount Pleasant) to continue driving at lower rates while also enjoying potentially lower housing costs. Keeping in mind that people value relatively short commutes,³⁷ another option is to increase rates for permit applicants living west of Fraser Street only. Alternatively, permit rates could be further adjusted to different residency zones, with a more substantial permit rates increase for people living west of Cambie Street, a moderate increase in rates for people living in the downtown core or between Cambie and the end of TransLink fare zone 1 (see Fig. 1), and no increase in rates for people residing outside of these zones. Yet another option would be to differentiate parking permit rates by area of residence and level of income of the permit applicant. This option would address equity concerns, and ensure that high income people are just as discouraged to drive to campus as are lower income people.

³⁷ NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia, 6.

Research³⁸ suggests ways to rebalance parking by parkade and bring it to efficient levels (economic, environmental, safety) by differentiating rates by spatial location of the parkade. An option could be to restructure permit rates by parkade or parking lot. Permits for overused parkades or lots (e.g.: North parkade, Health Sciences parkade), close to hot spots on campus, would be increased while current permit rates would be maintained for normally used and underused parkades or lots (e.g.: Botanical Gardens lot, Stadium lot, Fraser River parkade). Other studies³⁹ can be used to estimate optimal occupancy rates—that is the expected level of use of available parking spots at any time of the day—for parkades. Comparing it to estimates of current UBC parkades occupancy rates could therefore help us set efficient rates to reallocate parking use from overused parkades to underused parkades or lots. Such restructuring of permit rates may also move drivers away from the main roads leading to UBCV. Because of the nature of users of the Health Sciences parkade (serving the UBC Hospital), permit rates restructuring may not be applied to it. Instead, transforming the parkade to a doctors, nurses, and visitors-only parkade could ensure that medical staff does not have to wait for parking availability. This may foster their support for policy change. Alternatively, some parts of the Health Sciences parkade could be reserved for medical staff and visitors.

According to the 2017 Transportation Survey, only 5% of all student respondents drive to campus while 29% of faculty members drive, 36% of staff members drive, and 40% of others, visitors and parents do so.⁴⁰ Note that 5% of all UBCV students represents approximately 2,750 people, 29% of faculty members represents approximately 1,600 people, and 36% of staff 3,600 people.⁴¹ Based on these estimates, we could propose an increase in permit prices for students. Doing so may fully deter students from driving to UBCV, especially those whose income is constrained. This poses an issue, however, as these students are often likely to

³⁸ Pu, Z., Z. Li, J. Ash, W. Zhu, and Y. Wang. 2017. "Evaluation of spatial heterogeneity in the sensitivity of on-street parking occupancy to price change." *Transportation Research Part C: Emerging Technologies* (77): 67-79.

³⁹ Willson, Richard, and Aiden Irish. 2016. "Dynamic Parking Pricing." *Transportation Research Record: Journal of the Transportation Research Board* (Transportation Research Board) 2543 (1): 143-151.

⁴⁰ NRG Research Group. 2017. *2017 Vancouver Transportation Survey*. Survey Report, Vancouver: The University of British Columbia, 17.

⁴¹ University of British Columbia. 2020. "UBC Overview & Facts." *The University of British Columbia*. Accessed April 2020. <https://www.ubc.ca/about/facts.html>.

live farther away from the university. Students whose income is not constrained may not be deterred from driving by a price increase. Alternatively, we suggest an increase in permit rates for faculty. Such an increase would have to be substantial to effectively steer faculty away from the wheel, as their income is larger and associated price elasticity for parking lower.

To set accurate permit rates for students and faculty, econometric models of price elasticity based on income could be used. We acknowledge that collecting information on students' income may be challenging, especially when their source of income is unrelated to the university. For faculty, information on income (in the format of income range rather than precise income) could be collected from UBCV HR services. For staff, increasing parking rates also appears difficult. They are likely to have a high price elasticity as a function of their income, may be heavily reliant on parking if they work unusual shift times when transit is not running, and may live far from UBCV. Permit rates increases for this category of parking users would have to be based on income, but also on shift times that may vary by day, week, month. It appears that a permit rate increase could only easily be applied to staff members whose position requires them to work only during traditional office hours. Creating a divide between different staff members may attract the opposition of unions. Acknowledging all the above mentioned challenges, we propose a restructuring of permit rates based on the occupation and income level of the permit applicant. Such occupation would have to be registered in the permit application process and income level could be collected from UBCV Human Resources . Alternatively, permit applicants could also simply self-declare their income level.

Policy Evaluation & Recommendation

Ahead of the evaluation of our main policy alternatives, the different options to increase parking permit rates were evaluated using the criteria of environmental impact, equity, community support, and cost effectiveness. Details about these evaluations are included in Appendix D. From there, the option of increasing long-term parking permit rates by 40% for applicants living west of Fraser Street is selected to be evaluated against the two other main policy options.

The main policy options included in this report were analyzed using the aforementioned criteria through an evaluation matrix, which is featured in Appendix E. The option with the lowest evaluation is incentivizing a transition to zero-emission vehicles. While an important step to a reduction of GHGs, it does not affect enough of the UBCV car commuter population to make a drastic reduction in emissions, and does not discourage driving to campus. For these reasons this option is not going to be recommended.

The two remaining policies—increasing parking permit rates and subsidizing public transit for staff and faculty—are both likely to achieve our environmental and traffic goals. Increasing parking permit rates would disincentivize driving to campus by making it more costly, whereas an ETPP would incentivize turning to public transit; they are different approaches with comparable results on GHG emissions and the number of cars coming to campus. Thus, in order to decide which option to recommend, evaluation criteria need to be considered.

There are moderate equity challenges to the parking policy option. By targeting drivers living near the UBCV campus, who are likely to be wealthier and have easier access to public transit, it might nonetheless affect vulnerable populations who live there. This option will also generate frustration among these people. The opt-in ETPP would generate positive incentives which might reduce costs to UBCV community (if they don't have a car and already use transit), especially for its least well-off members. That being said, the ETPP, by generating new costs to UBC, is likely to increase tuition or financial contributions by staff and faculty, depending on how it is funded. This poses equity issues and might generate opposition from student associations or from unions. On the other hand, by creating benefits that will incidentally go to less well-off workers, subsidizing public transit might have a slight advantage with regards to both equity and community support criteria.

The decisive trade-off happens when assessing cost-effectiveness (see Appendix E). The subsidy on public transit would have to be designed and likely funded by the university, unless TransLink steps in, and would require new permanent staff. In comparison, increasing parking permit rates costs little to implement. The only costs that such policy could incur pertains to softwares required to verify postal codes

of residence. Additionally, UBC parking would still generate revenues under this policy. These differences in costs also speak to the fact that one policy is simply easier and quicker to implement than the other.

For these reasons, our policy recommendation to reduce GHG emissions and to limit traffic on the UBC Vancouver campus is to increase long-term parking rates by 40% based on the applicant's area of residence—that is, whether they live east or west of Fraser Street in the City of Vancouver.⁴²

Policy Implementation

What follows is suggestions on how to initially implement the recommended policy in order to maximize its likelihood of success. Linking parking permit applications to personal information already available to the university through faculty, staff, and student accounts used for other services (e.g. Faculty & Staff Self-Service portal, the Student Service Centre, Human Resources) would allow UBC Parking to obtain a more accurate record of where permit applicants reside. It would also ease enforcement of the policy by making it harder for people to self-report an incorrect address that exempts them from parking permit rate increases. To further aid in these enforcement efforts, UBC could invest in software systems used by delivery-dependent companies to verify postal codes (e.g. those used by Amazon, Best Buy, etc.). Attention needs to be paid to the terms of parking permit lengths. Permit rates and terms need to be designed in a way that doesn't allow for applicants seeking long-term parking use to buy daily permits in bulk to circumvent increased costs. This could be achieved by imposing limits on the number of daily permits an applicant can purchase during a certain period. As an additional step to ensure that only necessary commutes to campus are made by car, the university could also follow the practices of the City of Vancouver by gradually and marginally decreasing the number of long-term parking permits made available to the UBCV community.

⁴² This recommendations should not stop UBC from taking some steps toward an ETPP. To begin with, gathering more reliable information concerning its potential is crucial. The 2017 Transportation Survey's questions are insufficient and serve other purposes. Creating a survey specifically designed to inform UBC about the potential effects of an ETPP would allow future policy proposals to be more precise and credible.

Breaking up and phasing in the proposed rates increase across four years would reduce community backlash. One suggestion is to achieve an ultimate permit rate increase of 40% across a period of four years, with an increase of 5% in the first year, 10% in the second and third years, and 15% in the fourth. This phase-in period could also be longer, depending on expected community response.⁴³

Conclusion

In response to the climate emergency, UBC's Board of Governors has increased the ambition and materially accelerated the timelines for existing actions under the UBC Strategic Plan and the UBC Climate Action Plan.⁴⁴ The Board has approved clear policy directions to reduce driving to campus through a comprehensive and integrated transportation demand management strategy, in which parking pricing is an important element.⁴⁵ Implementing the policy recommendation outlined in this report would align these objectives while being consistent with a realistic assessment of impact and constraints.

It must be acknowledged that the current wide-ranging disruptions associated with the COVID-19 global pandemic could have very significant implications for all of the contents of this report. With an unprecedented level of university activities suspended and as much work as possible being conducted away from campus for the foreseeable future, implementation may be delayed. Going forward, telecommuting might also become a more common practice, diminishing the number of people driving to campus and the need to discourage this behavior.

⁴³ Horne, Matt, interview by Rolando Hinojosa, Maia Tarvydas Chloé Boutron. 2020. *Climate Policy Manager* (April 9).

⁴⁴ The University of British Columbia. 2019. "Declaration on the Climate Emergency." *Office of the President*. December. Accessed March 2020.
<https://president.ubc.ca/letter-to-the-community/2019/12/05/climate-emergency-declaration/>.

⁴⁵ UBC Campus and Community Planning. 2020. *UBC Vancouver Transportation Plan Implementation Update: Emerging Trends and Opportunities*. Policy Report, Campus and Community Planning, University of British Columbia, Vancouver: University of British Columbia, 2.

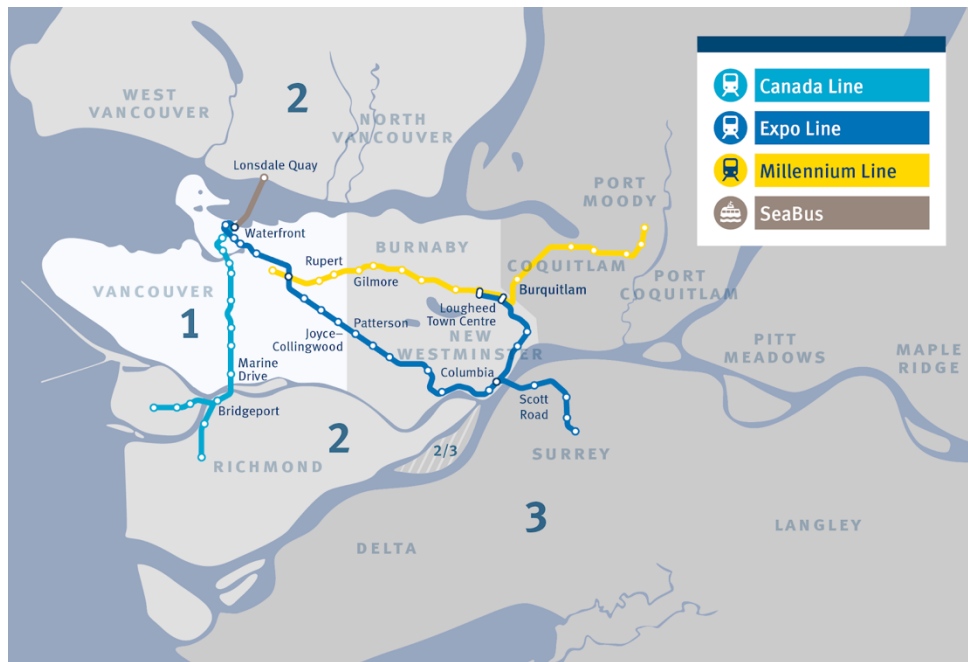
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Figures

Figure 1: TransLink Fare Zones



Source: TransLink - Fare Pricing & Zones⁴⁶

⁴⁶ TransLink. 2020. "Fare Pricing & Zones." *TransLink*. Accessed April 2020. <https://new.translink.ca/transit-fares/fare-pricing-and-zones>.

Appendix A: Alternative approaches to our proposed policy options

Public transit subsidies for staff and faculty: The 2017 Vancouver Transportation Survey evaluates some incentives for staff and faculty to switch to public transit, most of which point to the quality of its service. Potential users could be attracted by increased speed, comfort, and proximity of access. Creating these incentives would require policies by TransLink (increasing the number of buses, changing itineraries, etc.). Formulating such policies being out of the scope of our clients' demands, we discarded this approach for the more feasible, but still ambitious, Employee Transit Pass Program policy.

Zero-emission vehicles: We considered the option of subsidies, or bonuses to faculty and staff for new zero emission vehicles, but ultimately discarded this option for fear of increasing cars on UBC Vancouver's campus.

Permits and parking structure: Reserving stalls per type of users (student, faculty, staff) was considered but ultimately discarded. Indeed, reserved stalls most often lead to underused parking in some locations and prevent members of staff, notably, from parking where they are operating. Such could disturb activities on UBCV campus, create inefficiencies, and generate opposition among staff, faculty, and students.

Appendix B: Other policy options

Outside of the options considered in the body of this report, other policy avenues were considered but put aside for various reasons after discussion with the project client. However, the information compiled on the reasons for or against them might prove useful in the future, even if it was ultimately not included in the analysis for this specific policy development process. For that reason they are briefly listed and detailed, in no particular order, in this appendix.

Bike lanes and associated facilities: Creating new bike lanes, altering existing ones to make them more exclusive or providing associated facilities for cyclists who bike to campus (e.g. more bike racks, more convenient showers, etc.) would all be ways to incentivize more commuters to choose this transportation alternative by reducing the friction associated with it. Examples in other locations have demonstrated that a marked increase in bike use is associated with the implementation of more dedicated bike lanes. However, a significant portion of these interventions to physical infrastructure would still need to happen outside of UBCV and therefore outside the jurisdiction of the project clients. It would also require extensive coordination with numerous external parties (e.g. municipal governments, neighbourhood communities and associations, etc.).

Preventing development of new parkades or expansion of existing parking facilities: An outright ban on the development of new parkades and on the increase of parking stalls could limit the adaptability required by UBCV's campus growth. In the meantime, it is important to ensure that any new parking development will not generate undesirable side effects, such as more congestion on main roads leading to UBCV. As such, we considered restricting locations on which new parking developments could be built. Because such restrictions would require long term planning and zoning, which is out of the scope of this project, this alternative was also discarded.

Carpooling app or service: Several existing initiatives have been implemented to encourage people in the UBCV community to carpool. These include the Liftango platform for faculty and staff to organize carpooling. However, although UBC is interested in encouraging this transportation mode, especially if it decreases SOV use, it's been made clear that the university is not interested in becoming a direct player in the carpooling service industry. Rather, UBC would like to leave direct service provision to other partners, while perhaps providing incentives for commuters to choose those alternatives over driving alone.

Preventing expansion of modes of transportation that may affect livability and safety: New modes of transportation, such as e-scooters, are associated with higher safety risks. Given that on campus trips are mostly made walking, their introduction on campus would not even create significant changes in GHG emissions. Prohibiting the introduction of such modes of transportation was considered, to make sure campus transportation remains in line with liveability and safety principles. However, this alternative was discarded as it falls out of the main targets for the present project.

Restricting parking stalls to certain uses and gradually decreasing the number of stalls available: UBC could gradually restrict the use of parking stalls to certain subpopulations (e.g. making parking available for faculty and staff only) with the aim of eventually cutting down significantly on the number of available parking spots. What spots do remain throughout this process could also be allocated via lottery so as to further increase friction and curb demand. However, these alternatives raise questions of equity and community backlash that would likely impede their implementation and could result in distrust of future efforts.

Road tolls: In order to discourage commuters using individual motor vehicles, UBC could institute a road toll system at campus access points. Unlike parking permits and stalls, which are currently commodified, tolls could respond dynamically to manage demand according to UBC's objectives. This could include charging higher rates during peak demand hours or at more convenient access locations, as it has

been done in the City of London, for example. However, this alternative is too ambitious for the present project.

Appendix C: Costs and benefits of Employer Transit Pass Program

We assume here that the 2017 UBC Transportation Survey's numbers have remained constant. If that were the case, 27% of 5,531 faculty members would be using public transit to come to campus, for a total of 1,439; 46% of the 10,174 staff, or 4,680, would do so as well. Assuming these 6,119 commuters using public transit are distributed across the Vancouver metropolitan area as the overall commuters to UBC are (which is unlikely, but we will have to assume as data is deficient), then 66% of them (4,038) will be travelling from Zone 1, 22% from Zone 2 (1,346) and 12% from Zone 3 (734).

Our policy proposal would be that UBC subsidizes 30% of the monthly passes for its staff and faculty. For Zone 1 passes, this would represent $30\% \times \$98 = \29.40 ; for Zone 2, $30\% \times \$131 = \39.30 ; for Zone 3, $30\% \times \$177 = \53.10 . If all the public transit commuters were to benefit from the policy, it would imply a monthly cost approximating the following:

$$(4,038 \times \$29.40) + (1,346 \times \$39.30) + (734 \times \$53.10) = \$210,590$$

Assuming staff and faculty continue buying passes during the summer, this would amount to a minimal annual cost of \$2,527,084, if there is no change in the staff and faculty numbers commuting with public transit.

The goal of the policy being to increase the number of individuals using public transit, we should assume that they will increase in number. If we draw from the UBC SEEDS Sustainability Program Student Research Report predictions, based on their assessment of elasticity of demand, a 30% discount on transit passes would generate 15% increase in demand, increasing the number of staff and faculty taking public transit by 917, from 6,119 to 7,036, thus increasing the price of the program to \$2,906,147.⁴⁷ Drawing once more from the same report, which draws from previously existing programs at SFU, implementation costs would approximate \$274,000 a year. It is therefore possible to estimate, very roughly, the cost of the

⁴⁷ Cooper, Sarah, Anvesha Dwivedi, Matthew Araneta, and Marcus Bockhold. 2018. *Employee Transit Pass Program*. Presentation, Vancouver: UBC Social Ecological Economic Development Studies (SEEDS), 19.

proposed policy to \$3,180,147. If this cost was to be covered by students alone, it would cost each of them \$52 a year.

It is also possible to get an approximate of the amount of GHG emissions that would be avoided with this policy. According to the 2017 Survey, people who drive alone travel on average 40.1 minutes on their way to campus, one way, for 80.2 minutes both ways. If these 80 minutes are driven at an average of 50km/h, they would consume 6L of fuel and generate 13.74kg of CO₂ a day.^{48 49} Considering our policy would convert some 917 drivers to public transit, it would save 1,227 hours of driving, or 5,502L of fuel, and 12,600kg of CO₂ a day. Over the course of two semesters, this amounts to 2,079 tons of GHG, which is probably a low estimate considering summer months are discounted and we only counted transit to work, and would as a result cost \$1,529.66 for every ton of GHGs saved.

⁴⁸ Natural Resources Canada. 2014. "Learn the Facts: Fuel Consumption and CO₂." *Natural Resources Canada*. Accessed April 2020. https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oe/pdf/transportation/fuel-efficient-technologies/autosmart_factsheet_6_e.pdf.

⁴⁹ Natural Resources Canada. 2020. "2020 Fuel Consumption Guide." *Natural Resources Canada*. Accessed April 2020. <https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-transportation/fuel-consumption-guide/21002>.

Appendix D: Parking policy options matrix

	Does it reduce GHG emissions?	Does it reduce driving to UBCV?	Environment	Equity	Community	Cost-effectiveness
Modify Parking permit rates by applicant <u>commute time</u>	Imprecise estimates, conditional on implementation.	Imprecise estimates, conditional on implementation.	Moderate	<p>Moderate to Good</p> <p>All drivers would be subjected to the same policy regardless of personal characteristics such as job, occupation. This option provides reasonable alternative commute options (transit, biking) to people impacted by the policy. Nonetheless, this policy option would have much less impact on high income drivers than on low income drivers.</p>	<p>Good</p> <p>Frustration may arise, but it is less likely that interest groups will mobilize (we do not know of university groups based on area of residence). This option also features an alternative for frustrated commuters (i.e.: commute options map).</p>	<p>Low</p> <p>High costs of implementation (software to understand commute times, costs to communicate them to permit applicants). Moderate results.</p>

<p>Modify Parking permit rates by applicants' area of residence: west of Cambie Street</p>	<p>An increase in permit rates for permit applicants living west of Cambie St. could <u>reduce GHG emissions between 1,432 to 5,012 tons yearly.</u></p>	<p>55% of permit applicants live <u>west of Cambie St.</u> A 40% increase in rates for them would deter <u>between 660 and 2310 less drivers daily.</u></p>	<p>Moderate to Good</p> <p>This option may incentive some people to move to areas past Cambie St. that remain relatively close to UBCV.</p>	<p>Moderate to Good</p> <p>All drivers would be subjected to the same policy regardless of personal characteristics such as job, occupation. This alternative would not impact lower income drivers negatively, or without providing them with reasonable alternative commute options (transit, biking). Nonetheless, this policy option would have much less impact on high income drivers than on low income drivers.</p>	<p>Good</p> <p>Frustration may arise, but it is less likely that interest groups will mobilize (we do not know of university groups based on area of residence).</p>	<p>Good</p> <p>Low costs of implementation, moderate costs of enforcement (software needed to verify area of residence). Good results.</p>
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<p>Modify Parking permit rates by applicants' <u>area of residence:</u> <u>west of Fraser Street</u></p>	<p>Based on estimates computed for Cambie St. (see above), an increase in permit rates for permit applicants living west of Fraser St. could <u>reduce GHG emissions between 1,432 to roughly 5,425 tons yearly.</u></p>	<p>Based on estimates computed for Cambie St. (see above), a 40% increase in rates for them would <u>deter between 660 to roughly 2500 less drivers daily.</u></p>	<p>Good</p> <p>Indeed, driving commutes from areas past Fraser street are likely too long for UBCV commuters currently living west of Fraser St. to be attracted to live east of Fraser St.</p>	<p>Moderate to Good</p> <p>All drivers would be subjected to the same policy regardless of personal characteristics such as job, occupation. This alternative would not impact lower income drivers negatively, or without providing them with reasonable alternative commute options (transit, biking). Nonetheless, this policy option would have much less impact on high income drivers than on low income drivers.</p>	<p>Good</p> <p>Frustration may arise, but it is less likely that interest groups will mobilize (we do not know of university groups based on area of residence).</p>	<p>Good</p> <p>Low costs of implementation, moderate costs of enforcement (software needed to verify area of residence). Good results.</p>
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<p>Modify Parking permit rates by applicants' <u>income level</u></p>	<p>Uncertain estimates. This option could reduce GHG emissions associated with faculty commutes, as their income makes them most likely to be affected by rate changes based on income. <u>Maximum decrease of GHG emissions = 540 tons yearly.</u></p>	<p>Assuming faculty and a few members of staff and students are affected by this method, it could <u>reduce the number of daily drivers by up to 250.</u></p>	<p>Moderate</p>	<p>Good</p>	<p>Moderate</p> <p>Higher income drivers would be the most impacted by this alternative. They are also the most likely to mobilize against policies negatively affecting them (through unions, direct links with the administration).</p>	<p>Moderate</p> <p>Low costs of implementation, moderate costs of enforcement. Moderate results.</p>
<p>Modify Parking permit rates by applicants' <u>area of residence and income level</u></p>	<p>Imprecise estimates. Likely low impact due to much fewer people being affected.</p>	<p>Imprecise estimates. Likely low impact due to much fewer people being affected.</p>	<p>Low</p>	<p>Good</p>	<p>Good</p>	<p>Low</p> <p>Costly to implement and enforce. Could lead to economic inefficiency. Results are uncertain.</p>

<p>Restructure parking permit rates by parkade</p>	<p>Imprecise estimates. This option is most likely to reduce GHG emissions associated with congestion and time spent driving to find a parking stall. Indeed, it would likely reallocate drivers to less busy campus roads.</p>	<p>Unlikely to reduce number of daily drivers.</p>	<p>Low</p>	<p>Low</p> <p>Lower income drivers may be willing to park much further and walk to face lower costs.</p>	<p>Moderate</p> <p>People using the main parkades may be opposed to price increase. Faculty, administrative staff could oppose this alternative.</p>	<p>Low</p> <p>Implementation can be costly (need to create permits for each parkade, and different bundles of permits). Results are uncertain.</p>
<p>Modify Parking permit rates by applicant occupation (students or faculty)</p> <p>NB: staff is not included for reasons mentioned on p.11)</p>	<p>Increasing permit rates for <u>students</u> only could lead to up to <u>719 fewer tons of GHG emitted yearly.</u></p> <p>Increasing permit rates for <u>faculty</u> only could lead to up to <u>414 fewer tons of GHG emitted yearly.</u></p>	<p>Increasing permit rates for <u>students</u> only could lead to up to <u>330 fewer drivers daily.</u> However, wealthy students who are likely to constitute the majority of the student driving population may not be deterred from driving by rates increase.</p> <p>Increasing permit rates for <u>faculty</u> only could lead to up to <u>190 fewer drivers daily.</u></p>	<p>Moderate</p>	<p>Moderate</p> <p>Low equity concerns with increased rates for faculty as they are likely to be able to afford it, or afford services such as babysitters. Students who drive from far may be negatively impacted by this option, raising equity concerns.</p>	<p>Low</p> <p>Students groups and faculty unions are likely to oppose this alternative.</p>	<p>Moderate</p> <p>Low costs of implementation and enforcement. Moderate results.</p>

Appendix E: Policy evaluation matrix

The main policy options included in this report were analyzed using the aforementioned criteria in the following matrix. Each option was ranked from 1-3, with 1 being the best, across each factor.

	Does it reduce GHG emissions?	Does it reduce driving to UBCV?	Environment	Equity	Community	Cost-effectiveness
Incentivizing transition to zero-emission vehicles	3	3	2	3	1	2
Creating public transit subsidies for faculty and staff [ETPP]	1.5	1.5	2	1	2	3
Increasing parking permit rates by applicants' area of residence: west of Fraser Street	1.5	1.5	2	2	3	1