STUDY OF TRAVEL, HEALTH, AND ACTIVITY PATTERNS BEFORE AND AFTER THE REDESIGN OF THE COMOX-HELMCKEN GREENWAY CORRIDOR

Final Report (Phase 2) | February 2016

Prepared for:

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MUSTEL GROUP

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Disclaimer

The City of Vancouver and the UBC Health & Community Design Lab worked collaboratively to conceive and design the study. However, the UBC Health & Community Design Lab independently conducted all analyses. The findings and views expressed in this report are solely those of the authors and do not necessarily reflect the views of the City of Vancouver, The University of British Columbia, the School of Population and Public Health, or the School of Community and Regional Planning.

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MUSTEL GROUP MARKET RESEARCH

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BACKGROUND

This report presents the research findings from the study, Evaluating Changes in Travel Patterns, Perceptions of Pedestrian and Cyclist Safety, Health and Sense of Community from the Comox-Helmcken Greenway: A Pre-Post Assessment. The study evaluates the travel, health, and social activity impacts of the City of Vancouver's Comox-Helmcken Greenway improvements from the year 2012 to 2015. The Comox-Helmcken Greenway is an important east-west connection through the West End neighbourhood and Downtown Vancouver from False Creek to Stanley Park for pedestrians and cyclists of all ages and abilities (AAA). Section 1 of the Greenway includes improvements to Comox and Helmcken Street between Stanley Park Lane and Hornby Street.

The study consisted of three major research components: a Neighbourhood Profile Survey; Trip Diary Survey; and a Built Environment Audit using the Microscale Audit of Pedestrian Streetscapes (MAPS) tool. 524 unique residents of Downtown Vancouver were recruited that participated in both Phase 1 and 2 of the study. The following describes a selection of key findings from the study.

KEY FINDINGS

Neighbourhood Walkability and Bikeability

- The redesign of Comox Street resulted in substantial improvements across standardized and widely accepted measures of neighbourhood urban design that contribute to improved neighbourhood walkability, bikeability, and overall livability.
- The Greenway improvements resulted in **significant improvements to participants' perception of neighbourhood bikeability** during the study period.
- In contrast, the Greenway improvements **did not result in any significant improvements to perception of neighbourhood walkability** during the study period.

Usage of Comox Street

- **Usage of Comox Street went up after the construction of the Comox-Helmcken Greenway.** For participants living on Comox Street, 57.4% of all their downtown trips included a segment on Comox Street. This increased by 9.1% after the Greenway improvements, representing 62.6% of all downtown trips.

Travel Activity

- Participants living near the Comox-Helmcken Greenway had the **greatest increase in bicycle ownership** during the study period compared to those living further away.
- **Bicycle mode share increased by 49.5%** during the study period for participants living near the Comox-Helmcken Greenway. Bicycle trips represented 3.0% of all trips taken before the improvements, increasing to 4.4% after the improvements.
- The **number of daily bicycle trips increased by 32.3%** during the study period for participants living near the Comox-Helmcken Greenway. The trip rate was 0.1 bicycle trips/day before the improvements, increasing to 0.2 bicycle trips/day after the improvements.
- **Automobile mode share decreased by 13.1%** during the study period for participants living near the Comox-Helmcken Greenway. Automobile trips represented 22.8% of all trips taken before the improvements, decreasing to 19.8% after the improvements.
- The **number of daily automobile trips decreased by 22.9%** during the study period for participants living near the Comox-Helmcken Greenway. The trip rate was 0.9 automobile trips/day before the improvements, decreasing to 0.7 automobile trips/day after the improvements.
- Participants living near the Comox-Helmcken Greenway reported **travelling 35.5% less and spending 35.1% less time travelling by automobile** during the study period. Before the Greenway improvements, participants travelled a total of 6.3 kilometres per day by automobile for 13 minutes. After the Greenway improvements, participants travelled a total of 4.1 kilometres per day by automobile for 8 minutes.

Population Health

- Participants living near the Comox-Helmcken Greenway reported a **16.1% increase in the number of days they engaged in moderate physical activity**, such as bicycling at a regular pace. Before the improvements, participants had a mean of 2.3 days a week of moderate physical activity. After the improvements, participants had a mean of 2.7 days of moderate physical activity.
- Participants living near the Comox-Helmcken Greenway reported an **8.0% decrease in the time spent sitting and being sedentary**. Before the improvements, participants had a mean of 7.9 hours a week sitting. After the improvements, participants had a mean of 7.2 days of moderate physical activity.
- Participants living near the Comox-Helmcken Greenway reported a **9.8% decrease in the number of days of poor physical and mental health** that kept them from doing their usual activities. Before the improvements, participants had a mean of 2.3 days a month of poor physical and mental health. After the, participants had 2.0 days a month.

Social Interactions

- There were no significant changes for social interactions detected for participants living near the Comox-Helmcken Greenway compared to those living further away.

1.0 INTRODUCTION AND BACKGROUND

1.1 STUDY PURPOSE

This report presents the findings from the study, E***valuating Changes in Travel Patterns, Perceptions of Pedestrian and Cyclist Safety, Health and Sense of Community from the Comox-Helmcken Greenway: A Pre-Post Assessment***. The UBC Health & Community Design Lab was retained by the City of Vancouver to conduct the study from 2012 to 2015. The study evaluates the travel, health, and social activity impacts of the City of Vancouver's Comox-Helmcken Greenway improvements.

The Comox-Helmcken Greenway is an important east-west connection through the West End neighbourhood and Downtown Vancouver from False Creek to Stanley Park for pedestrians and cyclists of all ages and abilities (AAA). Section 1 of the Greenway includes improvements to Comox and Helmcken Street between Stanley Park Lane and Hornby Street. Section 2 will see the completion of the remainder of the Greenway, and include improvements to Helmcken Street from Hornby Street to False Creek. The study's scope evaluated changes only from Section 1 of the Greenway.

The City of Vancouver commissioned the study in 2012 in order to document and determine if their active transportation improvement projects are realizing their intended health promoting

1.0 | INTRODUCTION AND BACKGROUND

purposes in the urban core. The study's findings will allow the City to better understand how future transportation projects may be better designed. The research will be directly applicable to other transportation improvements currently being planned elsewhere in Vancouver.

The study employs a longitudinal pre-post research design, which allows researchers to evaluate changes in behaviour before and after an intervention—in this case, the construction of the Comox-Helmcken Greenway. The vast majority of studies are cross-sectional, meaning that they compare the behaviour of individuals living in different environments at the same time in order to identify associations between the built environment and behaviour. In contrast, a longitudinal pre-post research design provides much stronger evidence of causal relationships between the built environment and behaviour. Specifically, the research design tracks the same group of individuals before and after they are exposed to an intervention, i.e., a change in the built environment. This approach allows researchers to control for individuals' attitudinal pre-disposition and preferences, which is difficult to do within a cross-sectional study design.

Furthermore, the study's research design approximates a randomized control trial (RTC), which is the gold standard in public health research. An RCT is a "case-control" design where a group of participants (case/treatment group) experience a change in stimulus from an intervention, and other participants (control group) do not. The two groups are then compared with each other after exposure to the stimulus in order to determine if the intervention was successful.

In summary, the purpose of the study is to determine if the construction of the Comox-Helmcken Greenway realized transportation, health, and social benefits for residents living near the Greenway and in the West End neighbourhood in general.

1.2 STUDY BACKGROUND

The study consisted of three major research components:

1. Neighbourhood Survey;
2. Trip Diary Survey; and
3. Microscale Environment Audit.

The Phase 1 Report (July 2014) provided a cross-sectional analysis of the Neighbourhood Profile Survey and the Trip Diary Survey conducted in the fall of 2012. This provided a baseline of travel, health, and social activity patterns before the construction of the Comox-Helmcken Greenway. In total, 1,113 residents of the West End and Downtown Vancouver were recruited for the study during Phase 1 (see Figure 1-1 for the study area).

Construction of Section 1 of the Greenway took place in 2013. Following construction completion, the same 1,113 residents from Phase 1 were re-recruited two years later in the fall/winter of 2014 and early 2015 for Phase 2. Residents were asked to repeat the same Neighbourhood Profile Survey and Trip Diary Survey. In total, 557 residents participated in both Phase 1 and Phase 2 of the study, providing a sufficient sample size to conduct a pre-post assessment. After study participants were validated and inclusion criteria were applied, a total of 524 unique participants were eligible for analysis.

Figure 1-1. Study area context: West End and Downtown Vancouver.

In addition to the Neighbourhood Profile Survey and Trip Diary Survey, a built environment audit was conducted using the Microscale Audit of Pedestrian Streetscapes (MAPS) tool before and after the construction of the Greenway. The MAPS tool provides an objective and standardized way to collect information about the design features of the built environment, allowing the study to measure and quantify the actual changes made by the Greenway improvements. The tool has been published and is widely distributed for researchers and practitioners to use.

1.0 | INTRODUCTION AND BACKGROUND

1.3 RESEARCH BACKGROUND

Physical activity is one of the most significant modifiable health risk factors across a person's life course. Researchers have documented positive associations between the built environment and travel patterns, including health-related outcomes such as physical activity.[1-2] For example, preliminary evidence suggests that the development of neighbourhood greenways is associated with and may lead to higher levels of physical activity.[3] As a result, the built environment professions, including planners, engineers, and landscape architects, can play an important role towards creating healthier communities.

However, there is limited evidence to date of a causal impact of how changes in community design affect travel, environmental, and health outcomes. Most studies remain cross-sectional, and for this reason, natural experiments are a priority among researchers to establish causality between the built environment and travel-related outcomes such as physical activity.[4] Natural experiments, including quasi-experimental studies, offer an empirical way to estimate the causal impact of a built environment intervention on a target population.

A systematic review of the literature examining the link between urban greenways and physical activity identified twelve peer-reviewed scholarly studies: nine in the United States and three in Australia.[5] As a result, this study of the Comox-Helmcken Greenway represents the first known quasi-experimental longitudinal pre-post assessment of an urban greenway in Canada, and is among the world's first studies in this area—a notable achievement for the City of Vancouver.

1.4 ABOUT THE REPORT

This report functions as a standalone, but companion document to the **Phase 1 Report (July 2014)**. The **Phase 1 Report** provided a cross-sectional analysis of the Neighbourhood Profile Survey and Trip Diary Survey data collected from all 1,113 participants during Phase 1.

The **Phase 2 Report (December 2015)** only analyzes data from 524 residents who participated in both Phase 1 and Phase 2 across the Treatment and Control Groups. As a result, the results presented for Phase 1 in this report (**Phase 2 Report**) will differ from what is found in the **Phase 1 Report**.

[1] Frank, L.D., Engelke, P.O., Schmid, T.L. (2003). *Health and Community Design: The Impact of the Built Environment on Physical Activity*. Washington, DC: Island Press.
[2] Ewing, R., & Cervero, R. (2010). "Travel and the Built Environment: A Meta-analysis." *Journal of the American Planning Association, 76*(3), 265–294.
[3] Fitzhugh, E.C., Bassett, D.R., & Evans, M.F. (2010). "Urban Trails and Physical Activity: A Natural Experiment." *American Journal of Preventive Medicine, 39*(3): 259-262.
[4] Sallis, J.F., Story, M., & Lou, D. (2009). "Study Designs and Analytic Strategies for Environmental and Policy Research on Obesity, PA, and Diet: Recommendations from a Meeting of Experts." *American Journal of Preventive Medicine, 36*(2S): S72–S77.
[5] Hunter, R.F., Christian, H., Veitch, J., Astell-Burt, T., Hipp, J.A., & Schipperjin, J. (2015). "The Impact of Interventions to Promote PA in Urban Green Space: A Systematic Review and Recommendations for Future Research." *Social Science & Medicine, 124*: 246–256.

2.0 METHODOLOGY

2.1 RESEARCH DESIGN

The study employed a quasi-experimental longitudinal pre-post case-control research design, allowing the study to evaluate changes before and after an intervention (construction of the Greenway) in comparison to a control group that did not receive the intervention.

The study consisted of three major research components:

1. Neighbourhood Profile Survey;
2. Trip Diary Survey; and
3. Built Environment Audit.

The market research firm Mustel Group was retained to conduct the Neighbourhood Profile Survey and Trip Diary Survey. Working collaboratively with the UBC Health & Community Design Lab and the City of Vancouver, Mustel Group was responsible for the survey design, sampling plan, and data collection for Phase 1 and 2. The UBC Health & Community Design Lab was responsible for data collection for the Built Environment Audit, and data analysis for all three components of the study.

2.0 | METHODOLOGY

The following software applications were used to prepare and analyze the data: Stata (Version 12), SPSS Statistics (Version 23), and ArcGIS (Version 10.3). Additional datasets necessary to complete the analysis were obtained from the City of Vancouver, Statistics Canada, and Esri.

2.1.1 EXPERIMENTAL DESIGN

For the purposes of the study, only residents living within half a kilometre (500 metres) were considered to have benefitted from the Greenway; this group of individuals constituted the study's target population. Participants were categorized into three study groups based on their geographic proximity to the Greenway:[6]

1. **Treatment Group A:** participants living within one-block of the Comox-Hemcken Greenway;
2. **Treatment Group B:** participants living within 500 metres of the Comox-Helmcken Greenway, but not within one-block of the Greenway; and
3. **Control Group:** participants living further than 500 metres away from the Comox-Helmcken Greenway—outside the Greenway's range of influence.

Statistical tests were conducted either comparing the combined Treatment Group A and B to the Control Group, or isolating Treatment Group A and comparing it to the Control Group.[7]

For further clarity, when referring to participants "within one-block" or "within the one-block area" (Treatment Group A), those participants are also within 500 metres of the Greenway. Thus, when the report refers to participants living within 500 metres of the Greenway, it is inclusive of both Treatment Group A and B. "Treatment Group" is used as a shorthand specifically for Treatment Group A, as it is the focus of this report. When the report refers to the "study area" or the "study groups" generally, it refers to the collective Treatment Group A and B, and the Control Group.

2.1.2 SAMPLING PLAN

Residents that met the following criteria were considered eligible for participation in the study:

- Living in Downtown Vancouver;
- Living within a kilometre of the Comox-Helmcken Greenway;
- Had no plans to move to a new address during the time of the study; and
- Was 18 years of age or older by the next birthday.

An address-based sampling method was used, whereby a random sample of household addresses was geographically defined within the kilometre study area. The sampling frame used was the Canada Post address-based data file.

[6] Defining the treatment and control groups was determined by using the Euclidean/crow-fly buffer distance method in GIS.
[7] The Repeated Measure Mixed ANOVA tests (see Section 2.1.4: Analysis Method) take two specific forms: 2x2 (Treatment Group A+B x Control Group from Phase 1 to 2) and 2x2 (Treatment Group A x Control Group from Phase 1 to 2). The first number represents the number of groups while the second number represents the number of time periods.

2.1.3 RECRUITMENT PLAN

Mailings were sent to households requesting their participation in the study. A specific connection to the Comox-Helmcken Greenway as the primary rationale for the study was not specified in order to avoid any potential bias in participation. The mailing contained a notification letter that described the following:

- Description of the study;
- Privacy protections for participation;
- Incentives for participation;
- Instructions for respondent selection within the household;
- Unique PIN number; and
- Link to the online electronic survey registration where participants completed the Neighbourhood Profile Survey and Trip Diary Survey.

2.1.4 ANALYSIS METHOD

A Repeated Measure Mixed Analysis of Variance (ANOVA) was used to analyze the changes from Phase 1 to Phase 2, and to determine if the measured changes were attributable to the construction of the Greenway. Repeated Measure Mixed ANOVA is an advanced statistical technique that can determine if the changes produced by an intervention (construction of the Greenway) were different for one group of individuals (treatment—residents living near the Greenway) compared to another group (control—residents not living near the Greenway).

Specifically, the ANOVA is measuring the **difference in change over time** between the treatment and control group, and not measuring the **difference** between the treatment and control group. For example:

- In Phase 1, participants in the Treatment Group had a mean of 3.0 daily bicycle trips, and participants in the Control Group had a mean of 2.0 daily bicycle trips.

- In Phase 2, participants in Treatment Group increased their daily mean bicycle trips by 5.0 trips to 8.0 trips in total, and participants in the Control Group increased their daily mean bicycle trips by 1.0 trip to 3.0 trips in total.

In both the Treatment and Control Group, daily bicycle trips increased. However, the effect was greater in the Treatment (increase of 5.0 trips from 3.0 trips in Phase 1 to 8.0 trips in Phase 2) compared to the Control (increase of 1.0 trip from 2.0 trips in Phase 1 to 3.0 trips in Phase 2). The ANOVA test would be able to detect the larger magnitude of change over time in the Treatment compared to the Control. If the measured change were statistically significant, we would conclude the impact of increased bicycle trips was a result of the Greenway.

For further clarity, the ANOVA test would not be measuring if the 8.0 daily bicycle trips in the Treatment Group differed with the 3.0 trips in the Control Group at the end of the study during Phase 2. Instead, it would be analyzing the **difference in change over time** (+5.0 trips in the Treatment compared to +2.0 trips in the Control) from Phase 1 to 2 between the Treatment and Control Group.

The use of the Control Group allows the research design to partially control for background trends. For example, the increase in bicycle trips in both the Treatment and Control Group may have been indicative of a city-wide increase in bicycle trips due to city-wide bicycle infrastructure improvements. The ANOVA test is able to detect the additional positive benefit conferred by the Greenway. Without the presence of the Control Group, we would have erroneously overstated the benefits of the Greenway as we would have been unable to statistically distinguish between the city-wide increase in bicycle trips *and* the increase in bicycle trips directly as a result of the Greenway.

Analysis using the ANOVA test is conducted at the individual-level. This means that the individual must have completed a trip in both Phase 1 and 2 in order to be eligible for analysis. The study uses a 95% confidence level (alpha of 0.05) and 90% confidence level (alpha of 0.10) to reject the null hypothesis that there is no effect of the Greenway. In other words, when a statistically significant difference between the Treatment and Control Group is detected using the ANOVA test, we are 90% to 95% certain that the result was not due to random chance. In the report, statistically significant results are assumed to be at the 95% confidence level; if the result is statistically significant at the 90% confidence level, it is explicitly reported.

2.2 RESEARCH METHODS

2.2.1 NEIGHBOURHOOD PROFILE SURVEY

The Neighbourhood Profile Survey was administered to participants in order to understand the characteristics of the residents, their activity levels, and their perceptions of various neighbourhood and community characteristics. The Neighbourhood Profile Survey consisted of 44 questions that were grouped into six main sections:

- Neighbourhood;
- Community Interactions;
- Travel Preference and Usage;
- Physical Activity;
- Health; and
- Demographics.

Data was collected from October to December 2012 (Phase 1), and from October 2014 to March 2015 (Phase 2). The Neighbourhood Profile Survey was prepared and analyzed using the statistical applications Stata and SPSS. See **APPENDIX A: NEIGHBOURHOOD PROFILE SURVEY** for a copy of the Neighbourhood Profile Survey.

2.2.2 TRIP DIARY SURVEY

The two-day Trip Diary Survey was administered to participants in order to understand the travel and social interaction patterns of residents. Standard and novel trip diary questions included:

- Origin of trip;
- Destination of trip;
- Type of destination;
- Purpose of trip;
- Start and end time of trip;
- Modes of travel used for trip;
- Number of people in trip party;
- Number and type of non-party members spoken with during trip; and
- Specific route travelled for any downtown portion of trips.

Study participants were randomly assigned two days of the week to complete their Trip Diary Survey in order to ensure an equal distribution of days, including weekday and weekend travel. Participants could print out a trip recording form to assist them during their diary days. Participants would then log back on after their two diary days were completed in order to input the information online. Participants had an option of indicating 11 different travel modes:

1. Walking (including running);
2. Cycling;
3. Bus;
4. Bus (school);
5. SkyTrain;
6. Ferry (SeaBus);
7. Ferry (False Creek Ferry/Aquabus);
8. Auto (driver);
9. Auto (passenger);
10. Taxi; and
11. Other.

All SkyTrain, bus-related, and ferry-related modes were collapsed into transit trips. Auto-related and taxi trips were collapsed into auto trips. Trips made by an "Other" mode were excluded from the analysis. Expansion factors were not applied to the dataset.

Data was collected from October to December 2012 (Phase 1), and from October 2014 to March 2015 (Phase 2). The Trip Diary Survey was prepared and analyzed using the statistical applications Stata and SPSS. GIS-based travel data was prepared and analyzed in ArcGIS, including the use of a novel method for travel distance and time estimation using the shortest path route (see **Appendix F: Travel Distance & Time Estimation Method**). See **Appendix B: Trip Diary Survey** for a copy of the Trip Diary Survey.

Analysis of the Travel Diary Survey used two types of trips defined below. Analysis of both trip types is required in order to reveal the complex changes in travel patterns.

- **One-way trip: a trip with a unique trip purpose from origin to destination.**
  If multiple transportation modes were used to complete the trip, the trip is assigned a primary mode (i.e., aggregated/collapsed) based on the following priority order: 1) ferry; 2) SkyTrain; 3) auto; 4) bus; 5) cycling; and 6) walking.

- **Partial trip: a trip defined by the travel mode(s) used in completing the one-way trip.**
  For example, in completing a one-way trip for a personal errand, the traveller may have walked to a bus stop, taken the bus to a SkyTrain station, taken the SkyTrain to another station, taken a Car2Go vehicle, and walked to their destination in order to complete the personal errand. This would be considered a single one-way trip by SkyTrain, but when broken down by partial trips, it consisted of five distinct partial trips: two walking trips, one bus trip, one SkyTrain trip, and one auto trip.

2.2.3 BUILT ENVIRONMENT AUDIT

The Microscale Audit of Pedestrian Streetscapes (MAPS) tool is an objective and standardized environmental audit tool that measures microscale features of the built environment.[8] Microscale features include aspects such as street, sidewalk, intersection, and design characteristics (e.g., road crossing features, presence of trees), and social environment characteristics (e.g., presence of graffiti and trash). The tool has been validated to predict neighbourhood walkability, and has been used in several published studies.

Data was collected during May and August of 2012 (Phase 1), and June to July 2015 (Phase 2). The MAPS data was prepared and analyzed using the statistical applications Stata and SPSS. GIS-based data was prepared and analyzed in ArcGIS. See **Appendix C: Microscale Audit of Pedestrian Streetscapes SURVEY** for a copy of the MAPS tool.

[8] Cain K.L., Millstein R.A., & Geremia C.M. (2012). *Microscale Audit of Pedestrian Streetscapes (MAPS): Data Collection & Scoring Manual*. San Diego, CA: University of California, San Diego. Retrieved from: http://sallis.ucsd.edu/Documents/Measures_documents/MAPS%20Manual_v1_010713.pdf

3.0 | RESULTS

3.0 RESULTS

This section provides an overview of the study results. Percentage changes are used when comparing Phase 1 and Phase 2 results when appropriate.

Generally, this report evaluates the target population living nearest to the Greenway. Statistics presented are generally for the study sub-sample of residents living within one-block of the Greenway (Treatment Group A). Statistics for residents living further than 500 metres of the Greenway (Control Group) are provided when necessary for comparison purposes.

3.1 STUDY SAMPLE

3.1.1 PARTICIPATION RATE

- For Phase 1, 1,113 residents participated in the study. Of the 1,113 residents, 993 participants lived within 500 metres of the Greenway (89.2% of the total sample).
- For Phase 2, 557 of the original 1,113 residents returned, representing an attrition rate of 50.0%. Of the 557 residents, 549 were validated to be the same participants for both phases by examining reported gender and age.
- The following inclusion criteria were applied to obtain the final study sample: 1) completed the Neighbourhood Profile Survey; 2) completed a trip in both Phase 1 and 2; and 3) trip origins and destinations started and ended in a location within Metro Vancouver.
- In total, this produced a final study sample of ***N*=524 unique residents** that participated in both Phase 1 and 2 of the study, were validated to be the same participants, and met the inclusion criteria.

3.1.2 TREATMENT AND CONTROL GROUP

- **Treatment Group A:** n_A=136 residents living within one-block of the Greenway (26.0% of the total sample).
- **Treatment Group B:** n_B=316 residents living within 500 metres of the Greenway, but not within a block of the Greenway (60.3% of the total sample).
- **Treatment Group A and B combined:** n_{A+B}=452 residents living within 500 metres of the Greenway (86.2% of the total sample).
- **Control Group:** n_C=72 residents living further than 500 metres of the Greenway—outside the Greenway's range of influence (13.7% of the total sample).

Figure 3-1 illustrates the geographic distribution of the study participants' primary place of residence by Treatment and Control Groups.

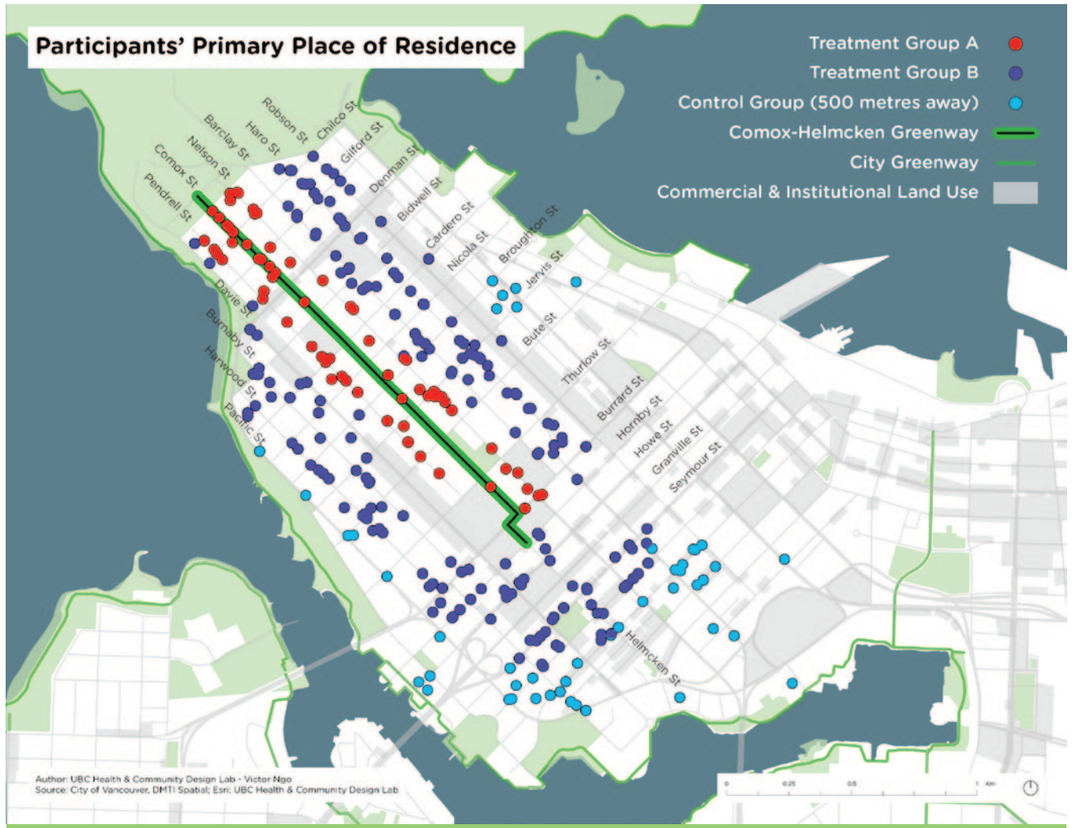

Figure 3-1. Study context: Geographic distribution of participants' primary place of residence.

3.2 DEMOGRAPHICS

This section provides an overview of the demographics for the Treatment Group A study sub-sample. The sample is compared to 2011 Census data for the West End neighbourhood and the Vancouver Census Sub-division (CSD), the census geographic unit for the City of Vancouver.

3.2.1 AGE

Overall, the study sample ranged in age from 22 to 88 years old in Phase 1, and 24 to 90 years old in Phase 2 (see Figure 3-2).[9] The median age was 47 years old in Phase 1, and 49 years old in Phase 2. This means that the study participants are generally older than the typical West End resident (median age of 38 years) and the typical Vancouver CSD resident (median age of 40 years; see Figure 3).

When comparing the age cohorts of the study sample to the West End and the Vancouver CSD, there was an:

- **Overrepresentation of 60 to 69 years old**—27.2% in the sample compared to 10.4% in the West End and 11.6% in the Vancouver CSD.
- **Underrepresentation of 20 to 29 years old**—7.4% in the sample compared to 26.2% in the West End and 20.6% in the Vancouver CSD.

In Phase 2, the largest age cohort were participants 60 to 69 years old (27.2%), followed by 30 to 39 years old (24.3%), 40 to 49 years old (19.1%), and lastly 50 to 59 years old (14.7%). The 20 to 29 year old cohort saw the largest decrease from 14.8% in Phase 1 to 8.0% in Phase 2—many of the participants were in their late-20s and transitioned into their early 30s by Phase 2.[10]

Examining the geographic distribution for all of the target study participants (Treatment Group A and B), younger participants primarily live around the center and eastern portion of the Comox-Helmcken Greenway (see Figure 3-3). In contrast, older adults are predominantly located in the western portion of the Greenway (see Figure 3-4).

[9] Some participants misreported their age. However, in general, participants aged two to three years from Phase 1 to 2, corresponding with the time period between the two phases.
[10] Due to the distribution of ages among the study sample, not all the increases or decreased observed for a specific age cohort will necessarily correspond to the age transition from the previous age cohort. For example, the 4% absolute decrease in the 20-29 age cohort will not necessarily result in a 4% increase in the 30-39 age cohort.

3.0 | RESULTS

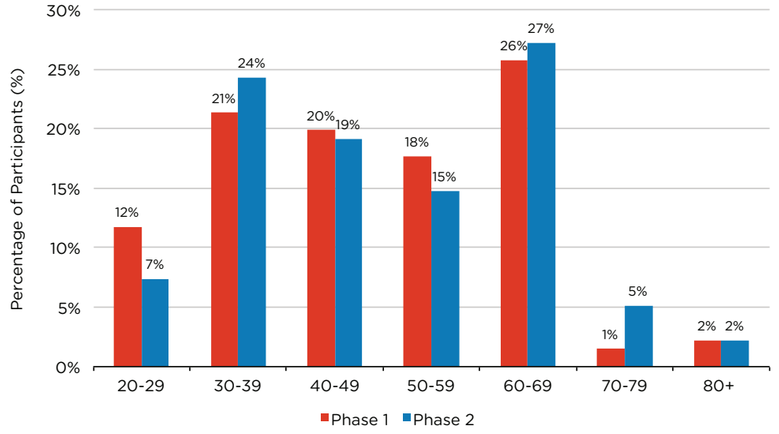

Figure 3-2a. Demographics: Age distribution - Treatment Group A, Phase 1 & 2 (*n*=136).
Q5.1: What is your age?

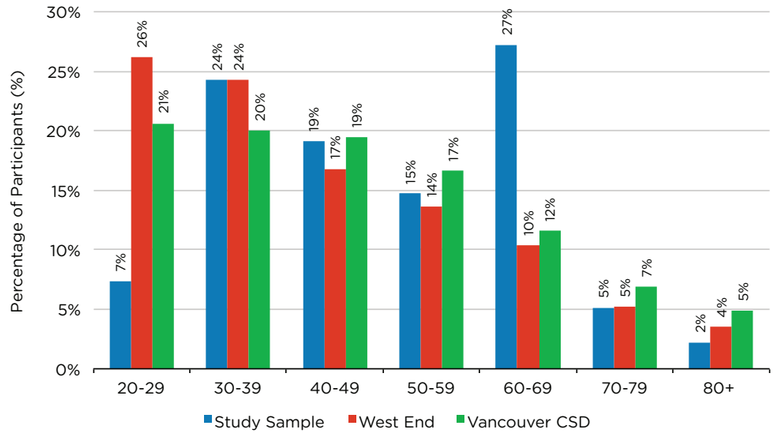

Figure 3-2b. Demographics: Age distribution - Treatment Group A, Phase 1 & 2 (*n*=136).
Q5.1: What is your age?

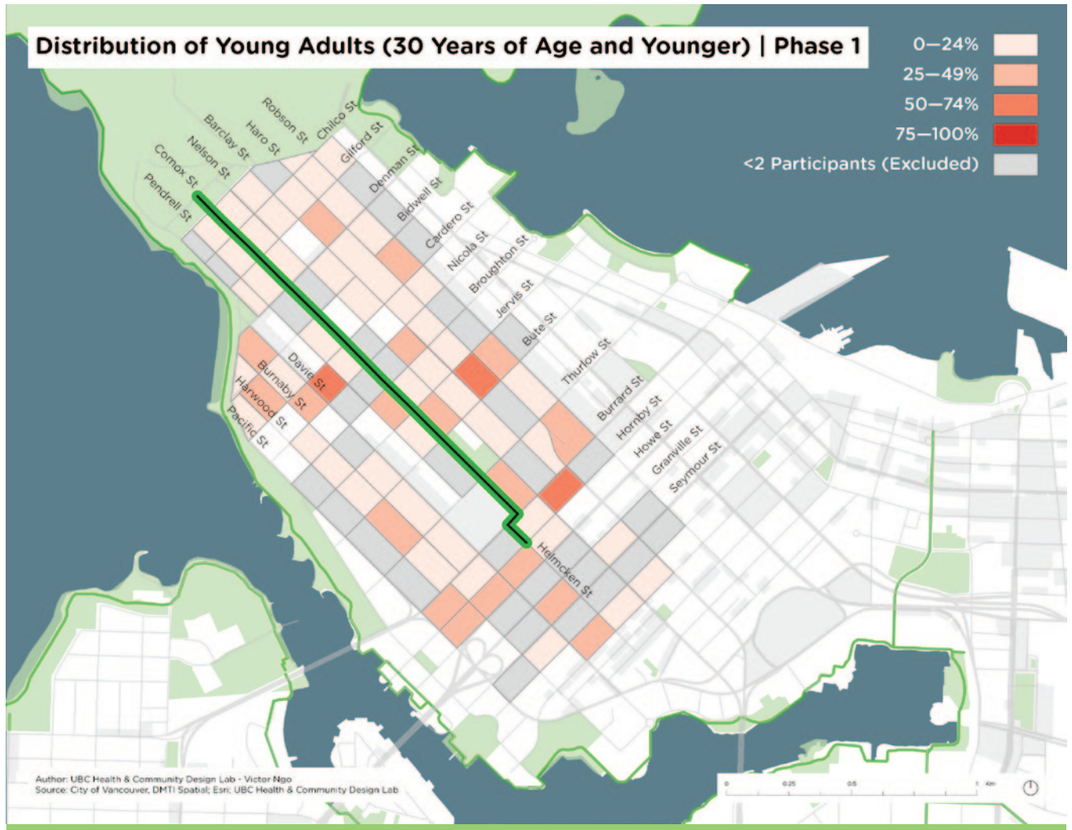

Figure 3-3a. Demographics: Geographic distribution of young adults (30 years of age and younger) - Treatment Group A & B, Phase 1 (*n*=101).

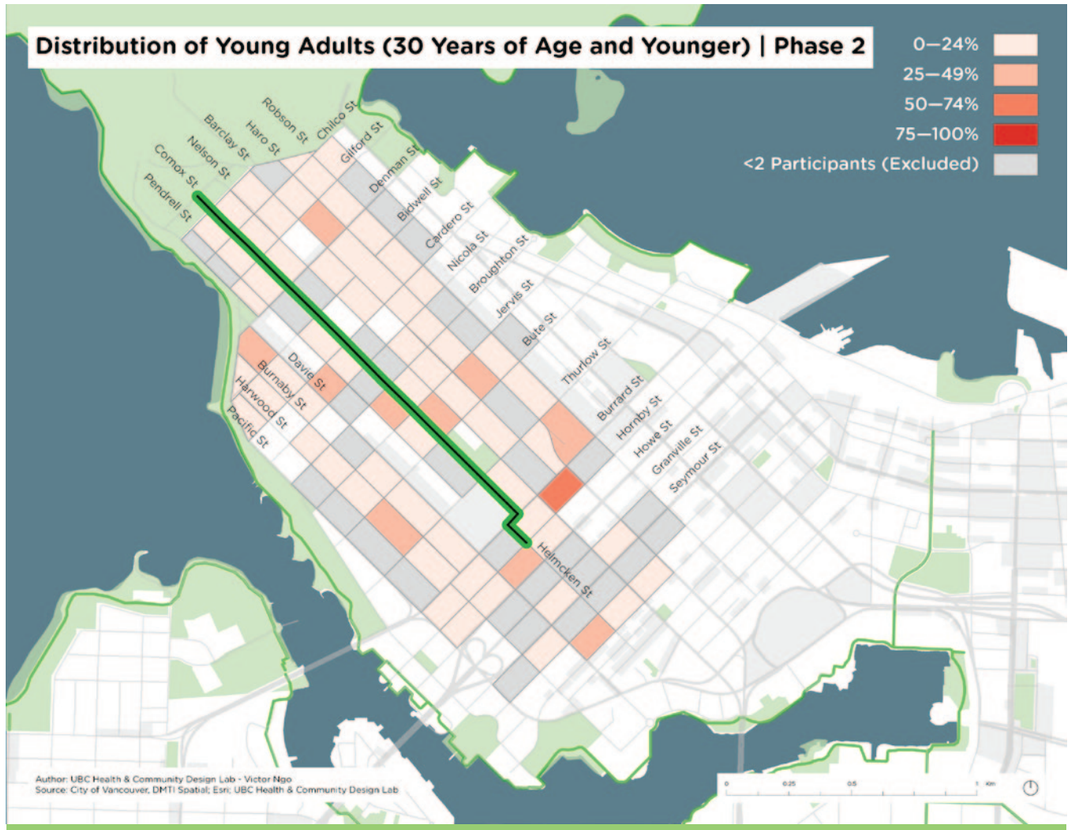

Figure 3-3b. Demographics: Geographic distribution of young adults (30 years of age and younger) - Treatment Group A & B, Phase 2 (*n*=101).

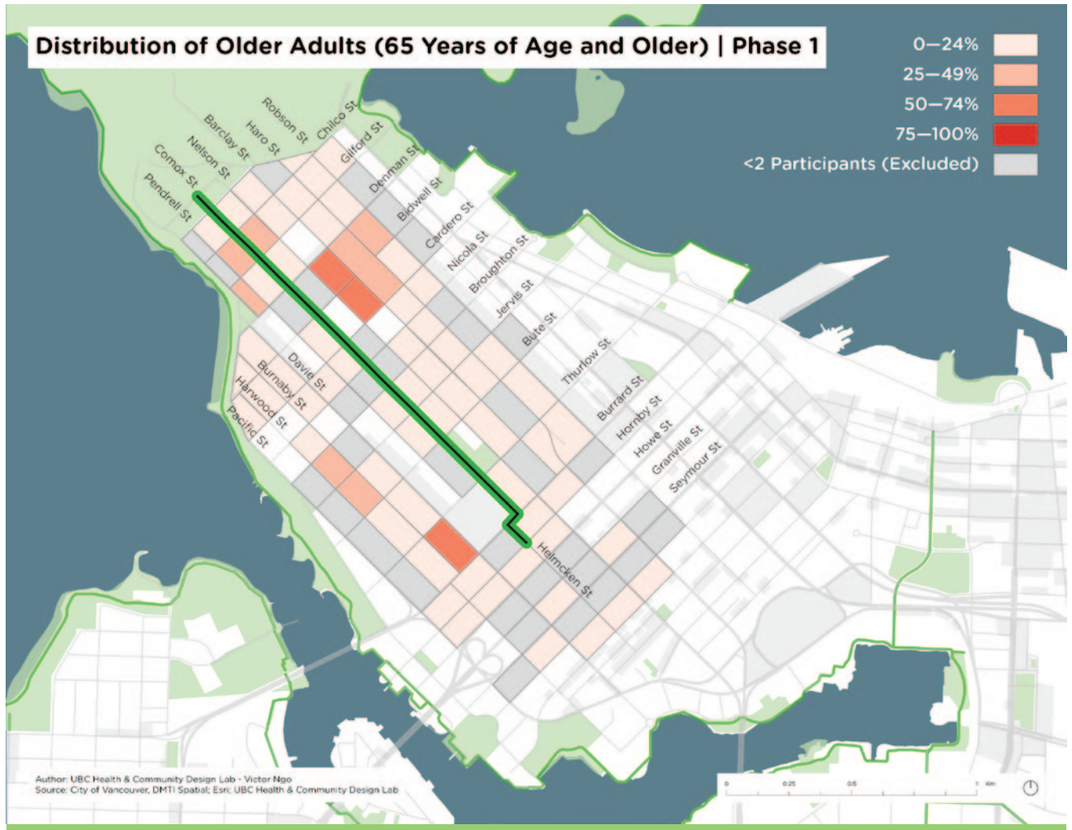

Figure 3-4a. Demographics: Geographic distribution of older adults (65 years of age and older) - Treatment Group A & B, Phase 1 (*n*=58).

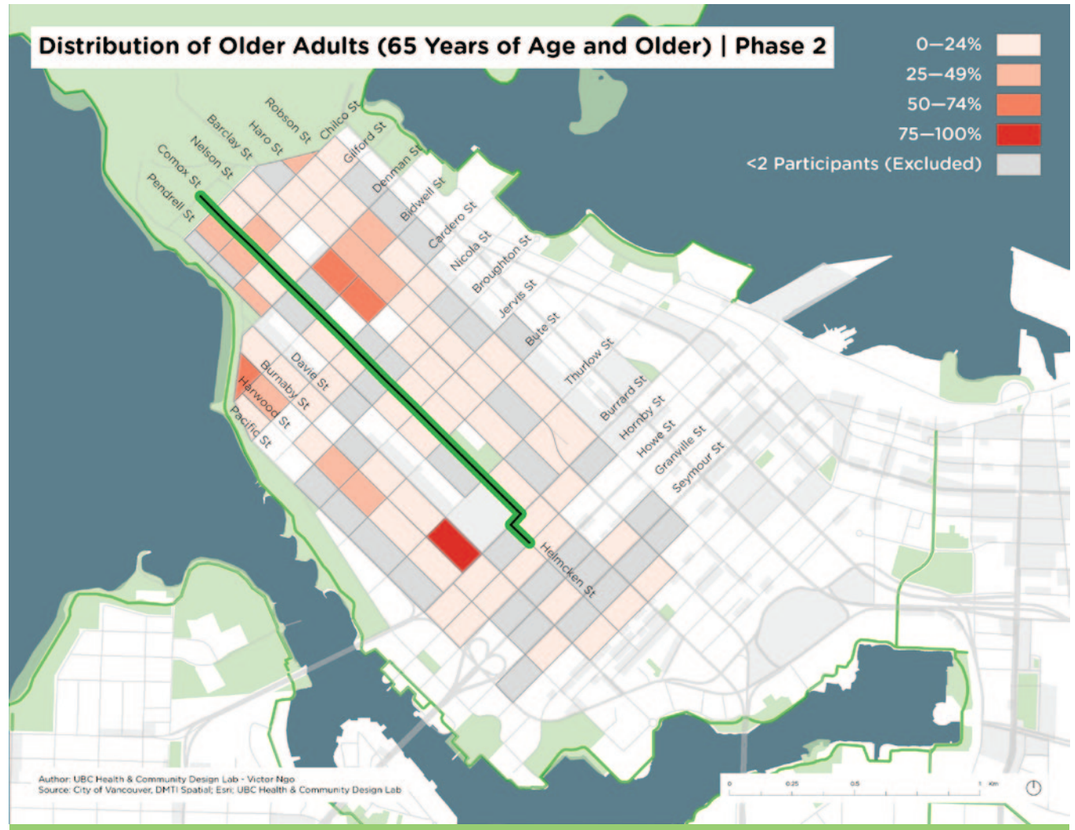

Figure 3-4b. Demographics: Geographic distribution of older adults (65 years of age and older) - Treatment Group A & B, Phase 2 (*n*=76).

3.2.2 GENDER

Overall, the study sample skewed slightly towards individuals identifying as female when compared to both the West End and the Vancouver CSD (see Figure 3-5). 53.0% of participants identified as female, and 47.1% of participants identified as male. This breakdown remained the same from Phase 1 to Phase 2.

Males are the dominant gender group in the West End, forming 52.4% of all residents, with 47.6% of West End residents identifying as female. This is reversed for the Vancouver CSD as a whole, with 48.9% of residents identifying as male, and 51.1% identifying as female. For this reason, the study sample is more similar to the Vancouver CSD breakdown than compared to the West End.

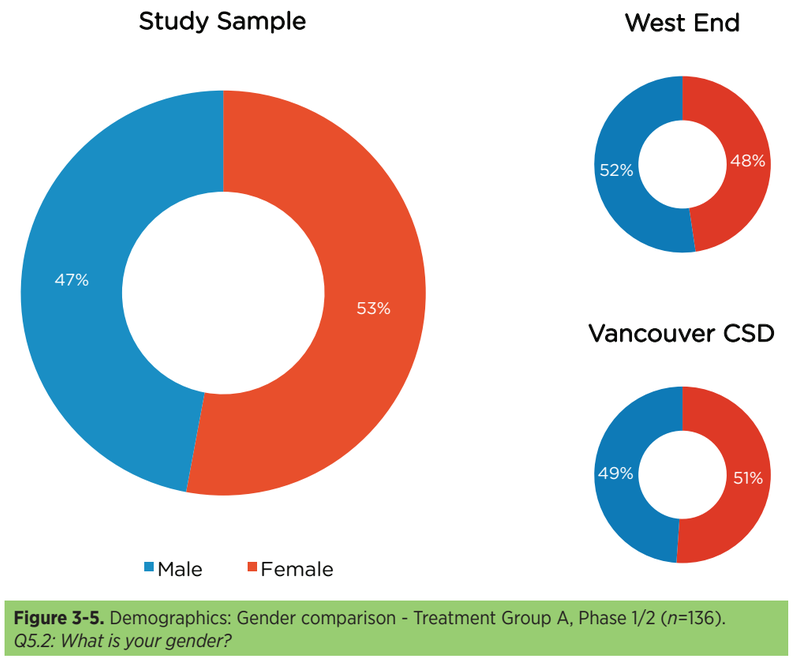

Figure 3-5. Demographics: Gender comparison - Treatment Group A, Phase 1/2 (*n*=136).
Q5.2: What is your gender?

3.2.3 HOUSEHOLD INCOME

Overall, the study sample reported a relatively high median household income bracket of $60,000 to $79,000 in both Phase 1 and 2 (see Figure 3-6). In Phase 2, when broken down by income brackets, the greatest share of participants reported a household income bracket of $100,000 and over (26.1%), followed by $40,000 to $59,999 (21.0%).

The study sample has a substantially higher household income than the typical West End resident (median income bracket of $30,000 to $39,999) and the typical Vancouver CSD resident (median income bracket of $40,000 to $49,999; see Figure 11).[11] The sample had an underrepresentation of the following:

- **Under $10,000 income bracket**—0.8% in the study sample compared to 13.1% in the West End and 9.0% in the Vancouver CSD.
- **$10,000 to $19,999 income bracket**—5.9% in the study sample compared to 13.6% in the West End and 12.2% in the Vancouver CSD.
- **$20,000 to $29,999 income bracket**—6.7% in the study sample compared to 12.0% in the West End and 10.5% in the Vancouver CSD.

The sample had an overrepresentation of the following:

- **$80,000 to $99,999 income bracket**—15.1% in the study sample compared to 6.3% in the West End and 8.3% in the Vancouver CSD.
- **$100,000+ income bracket**—26.1% in the study sample compared to 8.9% in the West End and 17.9% in the Vancouver CSD.

As a result, the study has an overrepresentation of higher income households and an underrepresentation of lower income households.

[11] Median household income in the West End: $38,581; median household income in Vancouver CSD: $47,299.

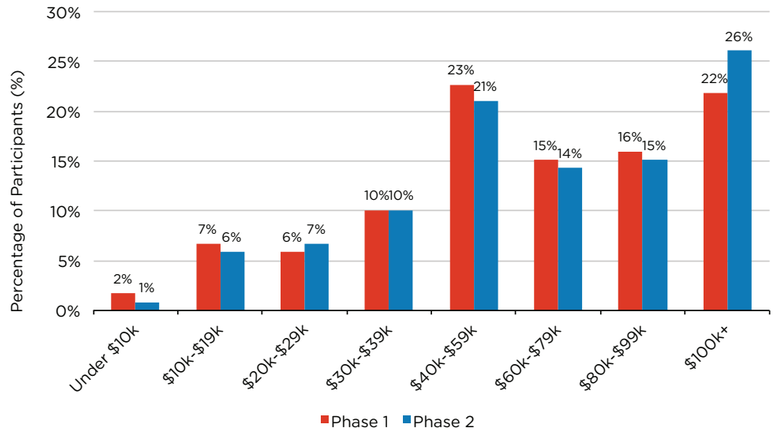

Figure 3-6a. Demographics: Household income - Treatment Group A, Phase 1 & 2 (*n*=119). *Q5.16/5.17: Which category does your total annual household income fall before taxes?*

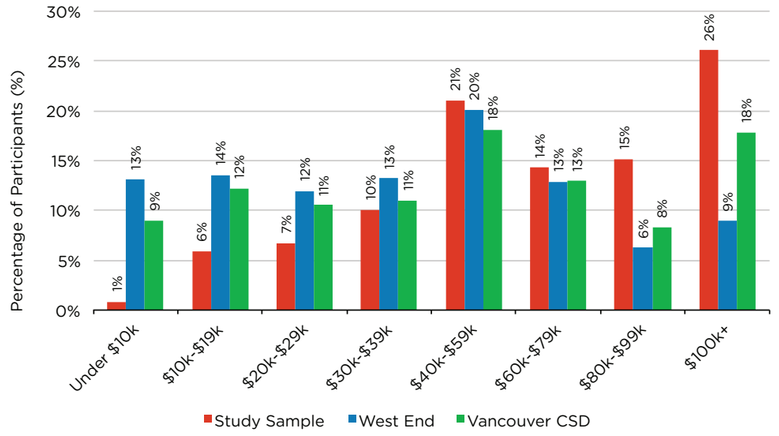

Figure 3-6b. Demographics: Household income comparison - Treatment Group A, Phase 2 (*n*=119). *Q5.16/5.17: Which category does your total annual household income fall before taxes?*

3.2.4 HOUSING TENURE

The majority of the study sample is composed of renters. In both Phase 1 and 2, 69.1% of participants reported renting (see Figure 3-7). The remaining participants were homeowners at 30.9%.

This distribution suggests that there are a higher proportion of renters in the study sample than the city-wide average, with 52% of households as renters and 48% as owners. However, when compared to the West End, the number of renters in the sample (69.1%) is lower, with 81% of West End residents reporting renting, and 19% reporting owning.

The fewer number of renters in the study sample corresponds to the overall higher reported household income by the study participants, typically associated with higher levels of homeownership.

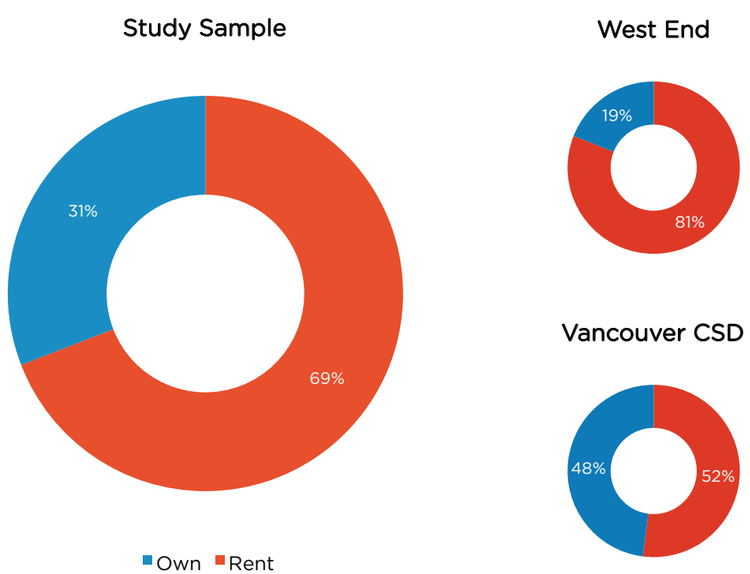

Figure 3-7. Demographics: Housing tenure comparison - Treatment Group A, Phase 2 (*n*=136).
Q5.9: Do you own or rent your home?

3.2.5 HOUSING STRUCTURE

Participants generally reported living in high-rise apartments, reflecting the urban form of the West End (see Figure 3-8). In Phase 1:

- 79.4% of participants reported living in a high-rise apartment (5 or more storeys);
- 19.1% reported living in a low-rise apartment (less than 5 storeys); and
- 1.5% reported living in a mixed-use apartment.

By Phase 2, this breakdown changed with slightly fewer people living in a low-rise, and slightly more people living in a high-rise apartment:

- 81.6% of participants reported living in a high-rise apartment (5 or more storeys);
- 16.2% reported living in a low-rise apartment (less than 5 storeys);
- 1.5% reported living in a mixed-use apartment; and
- 0.7% reported living in a single-family attached house (e.g, duplex, townhouse, rowhouse).

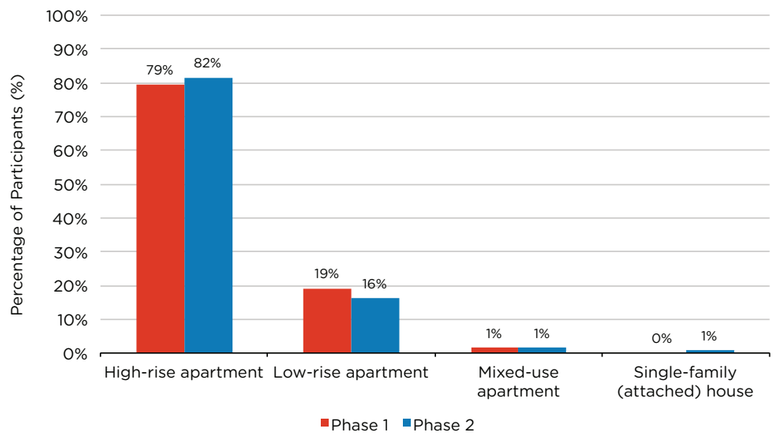

Figure 3-8. Demographics: Housing structure - Treatment Group A, Phase 1 & 2 (*n*=136).
Q5.8: What type of residence do you live in?

3.2.6 TRANSPORTATION OWNERSHIP AND MEMBERSHIP

The majority of the study sample reported varying levels of transportation ownership and membership. The majority of participants reported owning a bicycle, with slightly less than half reported owning a motor vehicle, and about a quarter of the sample reported having membership to a car sharing network.

Ownership/membership increased across the board from Phase 1 to 2 (see Figure 3-9). The largest increase observed was for membership in a car sharing network. In Phase 1, 27.2% of participants in the Treatment Group reported membership. In Phase 2, this figure increased to 33.8%, a statistically significant increase of +24.3%. An increase was observed in both the Treatment Group and Control Group, with no statistically significant difference when comparing the Treatment to the Control.

Bicycle ownership saw the second largest increase, from 58.8% in Phase 1 for the Treatment Group to 67.6% in Phase 2, a statistically significant increase of +15.0%. An increase was observed in both the Treatment Group and Control Group. When compared to the other study groups (Treatment Group B and Control Group), residents living within one-block of the Greenway had the greatest increase in bicycle ownership. This effect was statistically significant.

Motor vehicle ownership increased slightly from 44.1% in Phase 1 for the Treatment Group to 46.3%, an increase of +5.0%. However, this was not statistically significant. Interestingly, residents in the Control Group saw a decrease in motor vehicle ownership, while residents living within 500 metres of the Greenway (Treatment Group A and B) saw an increase. However, these changes were very modest, and the trend was not statistically significant.

As the study period coincides with a period of substantial increase in car share penetration in the Vancouver market, this may have impacted travel patterns among the study participants. For example, the Metro Vancouver Car Share Study found that about one-half of households with no vehicles prior to joining car share reported driving more.[12] However, one-third of households that owned vehicles prior to joining car share reported an overall reduction in driving. These effects may have been more pronounced in the West End, as the neighbourhood has a very high concentration of car sharing users relative to other cities. Research regarding the impact of car sharing on vehicle kilometres travelled is currently inconclusive. For this reason, car sharing in the West End may skew auto trips in this study in either direction.

[12] Metro Vancouver. (2014). The Metro Vancouver Car Share Study: Technical Report. Burnaby, BC: Metro Vancouver. Retrieved from: http://www.metrovancouver.org/services/regional-planning/PlanningPublications/MetroVancouverCarShareStudyTechnicalReport.pdf

3.0 | RESULTS

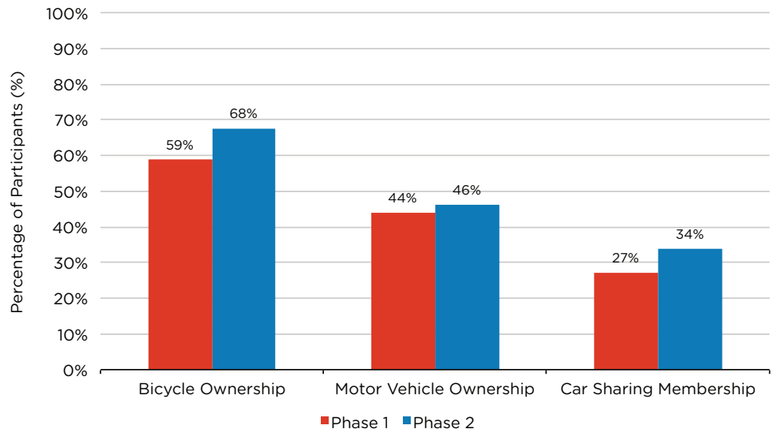

Figure 3-9. Demographics: Vehicle ownership and membership - Treatment Group A, Phase 1 & 2 (*n*=136). *Q5.10: Do you own a motorized vehicle (car, van, truck, motorcycle, street scooter)?; Q5.11: Are you part of a car sharing cooperative (such as Modo, ZipCar, etc.)?; Q5.12: Do you own a bicycle?*

3.0 | RESULTS

3.2.7 TREATMENT AND CONTROL GROUP COMPARISON

In an ideal experimental setting, the demographics of the control group should be similar to the treatment group to ensure any changes are a direct result of the intervention, and not due to the characteristics of the control group itself. Four statistically significant differences were detected between Treatment Group A and the Control Group. In Phase 2, the Control Group had:

- **Younger participants** (median age of 43 years old) compared to Treatment A (median age of 49 years old);
- **Higher motor vehicle ownership** (69% mean ownership) compared to Treatment A (46% mean ownership);
- **Fewer renters** (mean of 42% renters) compared to Treatment A (mean of 69% renters); and
- **Fewer people living in low-rise apartments** (1.3%) and **more people living in mixed-use apartments** (16.7%) compared to Treatment A (16.2% and 1.5% respectively).

4.0 RESULTS: BUILT ENVIRONMENT

This section provides an overview of the changes to the built environment during the study period.

4.1 WALKABILITY INDEX

The West End neighbourhood ranks high on traditional measures of walkability. For example, the UBC Health & Community Design Lab's Walkability Index is a tool that measures the characteristics of the physical environment that contribute to walkable neighbourhood design.[13]

The Walkability Index was calculated for a 500-metre area around the Comox-Helmcken Greenway. Table 4-1 shows the results for the Greenway area and other areas of Metro Vancouver for comparison purposes. The Comox-Helmcken Greenway area has a significantly higher walkability measure compared to Downtown New West, Metrotown, and Ambleside, in part due to the neighbourhood's high residential density.

[13] Frank, L.D., Devlin, A., Johnstone, S., van Loon, J. (2010). *Neighbourhood Design, Travel, and Health in Metro Vancouver: Using a Walkability Index*. Vancouver, BC: Health & Community Design Lab, The University of British Columbia. Retrieved from: http://atl.sites.olt.ubc.ca/files/2011/06/WalkReport_ExecSum_Oct2010_HighRes.pdf

4.0 | RESULTS: BUILT ENVIRONMENT

Table 4-1. Built Environment: Walkability Index measurements.

Area	Net Residential Density (dwelling units/ acre)	Commercial Density (retail floor area ratio)	Intersection Density (per square kilometre)	Land Use Mix (0 to 1)	Walkability Index
Comox-Helmcken Greenway - City of Vancouver (500 m buffer)	164.6	1.4	68.4	0.6	9.8
Downtown New West - City of New Westminster (Columbia St & 6th St)	48.7	1.8	103.4	0.6	5.9
Metrotown - City of Burnaby (Kingsway & Sussex Ave)	33.1	2.0	63.3	0.7	3.8
Ambleside - District of West Vancouver (Marine Dr & 19th Ave)	18.0	0.9	68.8	0.6	1.6

Note: **Residential density** is the number of residential units per acre designated for residential use within a neighbourhood buffer. Higher densities indicate more people live in the area. **Commercial density** (or Retail Floor Area Ratio) is the amount of area designated for commercial use within a neighbourhood buffer, using a ratio of commercial floor area to commercial land area. Higher ratio numbers indicate higher commercial density. **Street connectivity** is measured by the number of street intersections in a neighbourhood buffer. More intersections suggest a greater degree of network connectivity enabling more direct travel between two points using existing streets and pathways. **Land use mix** is the evenness of square footage distribution across residential, commercial (including retail and services), entertainment, and office development within a neighbourhood buffer. A higher value in this measure indicates a more even distribution of land between the land use types.

4.2 BUILT ENVIRONMENT AUDIT

The Microscale Audit of Pedestrian Streetscapes (MAPS) tool is an objective and standardized environmental audit tool that measures microscale features of the built environment. For the purposes of this study, analysis is conducted using three sections of the MAPS tool:

- **Route** features—measures characteristics for a whole route using variables that are general throughout an entire route (e.g., speed limit, aesthetics) or are infrequent (e.g., transit stops);
- **Segment** features—measures characteristics that are specific to a segment of a route, defined as the area between crossings; and
- **Street crossing** features—measures characteristics present only at every intersection or crossing of a route.

Table 4-2 lists all the microscale features included within the scope of each section of the MAPS tool. Table 4-3 shows the results (mean, standard deviation, and absolute and percentage change) of the audit before and after the Greenway's construction.

Table 4-2. Built Environment: Microscale Audit of Pedestrian Streetscapes: Scope of microscale features measured.

Route	Segment	Street Crossing
• Land use and destination • Transit stops • Street amenities • Traffic calming • Hard- and software aesthetics • Social environment	• Sidewalks • Street buffers • Sidewalk slope • Bicycle facilities • Shortcuts • Trees • Visibility from buildings ("eyes on the street") • Building aesthetics • Building setbacks • Building height	• Crosswalks • Slopes • Width of crossings • Crossing signals • Pedestrian protection (e.g., curb extension, protected refuge islands)

Table 4-3a. Built Environment: Microscale Audit of Pedestrian Streetscapes: Before and after changes for the Comox-Helmcken Greenway - Route section.

Microscale Feature	Phase 1		Phase 2		Change	
	Mean	SD	Mean	SD	Absolute	Percentage
Part 1: Route						
A. Destination and Land Use						
Overall	5.3	1.6	5.0	1.2	-0.3	-5.8%
Positive Subscale	5.8	2.0	5.5	1.6	-0.3	-5.3%
Negative Subscale	0.5	0.9	0.5	0.9	0.0	0.0%
B. Streetscape						
Overall	1.8	2.0	5.8	1.5	4.0	226.1%
Positive Subscale	2.8	1.8	6.9	1.6	4.1	147.2%
Negative Subscale	1.0	0.4	1.1	0.3	0.1	7.7%
C. Aesthetics and Social						
Overall	0.3	1.0	1.9	1.3	1.6	525.0%
Positive Subscale	1.2	0.4	2.2	0.8	1.0	81.3%
Negative Subscale	0.9	0.8	0.3	0.6	-0.6	-66.7%
D. Route Overall						
Overall	7.4	2.9	12.7	2.4	5.3	71.9%

Table 4-3b. Built Environment: Microscale Audit of Pedestrian Streetscapes: Before and after changes for the Comox-Helmcken Greenway - Street Segment section.

Microscale Feature	Phase 1		Phase 2		Change	
	Mean	SD	Mean	SD	Absolute	Percentage
Part 2: Street Segment						
A. Positive Subscale						
Building Height and Setbacks	3.4	1.3	3.4	1.3	-0.1	-2.3%
Sidewalk	2.2	0.4	2.2	0.4	0.0	0.0%
Buffer	1.7	0.7	1.7	0.7	0.0	2.3%
Bicycle Infrastructure	0.1	0.4	2.1	1.0	2.0	2600.0%
Building Aesthetics and Design	5.0	0.9	5.0	0.9	0.0	-0.8%
Trees	3.3	1.3	3.5	1.4	0.2	5.8%
B. Negative Subscale						
Building Height to Road Width Ratio	2.0	0.9	2.1	0.9	0.1	5.9%
Sidewalk	0.2	0.4	0.2	0.4	0.0	25.0%
Sidewalk Slope						
Child/Adult	0.2	0.4	0.2	0.4	0.0	0.0%
Senior	0.9	0.9	1.0	0.8	0.1	8.7%
C. Segments Overall						
Overall						
Overall - Child/Adult	14.8	6.6	19.5	1.5	4.8	32.3%
Overall - Senior	14.0	6.4	18.7	1.5	4.7	33.4%
Positive Subscale	17.7	1.7	19.9	1.4	2.2	12.6%
Negative Subscale						
Negative - Child/Adult Subscale	0.3	0.5	0.4	0.6	0.0	12.5%
Negative - Senior Subscale	1.0	0.9	1.2	1.0	0.1	11.1%

Table 4-3c. Built Environment: Microscale Audit of Pedestrian Streetscapes: Before and after changes for the Comox-Helmcken Greenway - Street Crossings section.

Microscale Feature	Phase 1		Phase 2		Change	
	Mean	SD	Mean	SD	Absolute	Percentage
Part 3: Street Crossings						
A. Positive Subscale						
Crosswalk Amenities	0.8	0.8	1.7	1.1	0.9	118.8%
Curb Quality & Presence	1.3	0.9	1.9	0.4	0.6	44.5%
Intersection Control & Signage	1.4	0.9	2.0	1.6	0.6	43.2%
B. Negative Subscale						
Road Width	0.4	0.7	0.3	0.6	-0.1	-24.3%
Crossing Impediments	0.3	0.7	0.1	0.5	-0.2	-55.1%
C. Crossings Overall						
Overall	2.7	2.3	5.1	2.5	2.4	86.8%
Positive Subscale	3.5	1.9	5.6	2.4	2.1	60.6%
Negative Subscale	0.7	1.0	0.5	0.7	-0.3	-37.8%

- **Route:** Overall, the Route section score had a statistically significant increase from a mean of 7.4 (Phase 1) to a mean of 12.7 (Phase 2), an increase of +71.9%. Improvements to the aesthetic/social environment (+525.0% increase) and streetscape (+226.1% increase) contributed to the score's positive increase. These improvements included the addition of new street amenities along the Greenway, such as benches and bicycle racks.

- **Street Segments:** Overall, the Segments section score had a statistically significant increase from a mean of 14.8 (Phase 1) to a mean of 19.5 (Phase 2) for children/adults (+32.3% increase), and from a mean of 14.0 (Phase 1) to a mean of 18.7 (Phase 2) for seniors (+33.4% increase). Substantial improvements to bicycle infrastructure (+2600.0% increase) and the sidewalks (+25.0% increase), and the addition of trees along the Greenway (+5.81% increase) contributed to the score's positive increase.

- **Street Crossings:** Overall, the Street Crossings section score had a statistically significant increase from a mean of 2.7 (Phase 1) to a mean of 5.1 (Phase 2), an increase of +86.8%. Improvements through the addition of new intersection controls (e.g., stop signs, traffic signals) and pedestrian protection (e.g., mid-block and corner bulges) along the Greenway contributed to the score's positive increase.

4.0 | RESULTS: BUILT ENVIRONMENT

In summary, despite the already strong performance of the neighbourhood's walkability as measured using the Walkability Index, the improvements made to the Comox-Helmcken Greenway translated to statistically significant increases across standardized urban design microscale measures. These positive results suggest improved neighbourhood walkability, bikeability, and livability outcomes for residents living near the Greenway and for the West End in general.

4.3 WALKABILITY AND BIKEABILITY

Generally, the physical improvements made to the Comox-Helmcken Greenway as measured by the MAPS tool corresponded to related self-reported responses in the Neighbourhood Profile Survey. Study participants are generally very satisfied with the perceived walkability and bikeability of their neighbourhood (see Figure 4-1 and 4-2). In Phase 1, 93.2% of participants in Treatment Group A were satisfied with neighbourhood walkability.[14] This increased by 4.1% to 97.0% of participants in Phase 2. However, this increase was not statistically significant.

Perceived neighbourhood bikeability improved among participants. In Phase 1, 82.3% of participants were satisfied with neighbourhood bikeability. This remained the same in Phase 2. However, the proportion of participants who responded with "5=Very satisfied" increased by 24.0% from 47.9% in Phase 1 to 59.4% in Phase 2. This increase in perceived neighbourhood bikeability was statistically significant. However, an increase in perceived bikeability was observed across all study groups (Treatment A, B, and Control Group). This corresponds to general improvements to bicycle infrastructure across Vancouver during the same period. Notwithstanding this trend, residents living within one-block of the Greenway reported the highest satisfaction levels compared to those living further away.

Study participants also reported an increase in the perceived access to bicycle routes. In Phase 1, 89.7% of participants agreed that bicycle routes in their neighbourhood were easy to access. In Phase 2, the share of participants expressing agreement increased by 4.1% to 93.4% (see Figure 4-3). This increase was statistically significant when compared to the Control Group. Participants within one-block of the Greenway reported the greatest positive increase, whereas participants in the Control reported an overall decrease.

In general, this suggests that the Greenway improvements, along with bicycle improvements elsewhere in the city, contributed to a positive increase in perceived neighbourhood bikeability. However, the Greenway did not result in a notable difference in residents' satisfaction with neighbourhood walkability.

[14] "Satisfied" includes participants who responded with "4" and "5" on questions with a 1 to 5 scale, where 1=Not at all satisfied and 5=Very satisfied.

4.0 | RESULTS: BUILT ENVIRONMENT

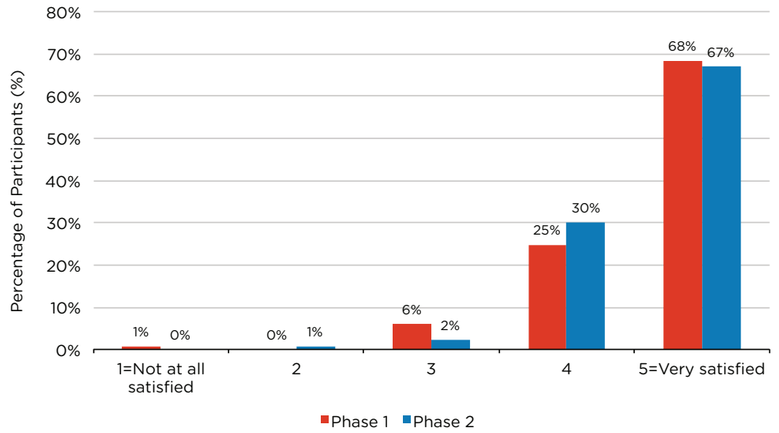

Figure 4-1. Built Environment: Perceived neighbourhood walkability - Treatment Group A, Phase 1 & 2 (*n*=133).
Q1.7.7: How satisfied are you with how easy and pleasant it is to walk in your neighbourhood?

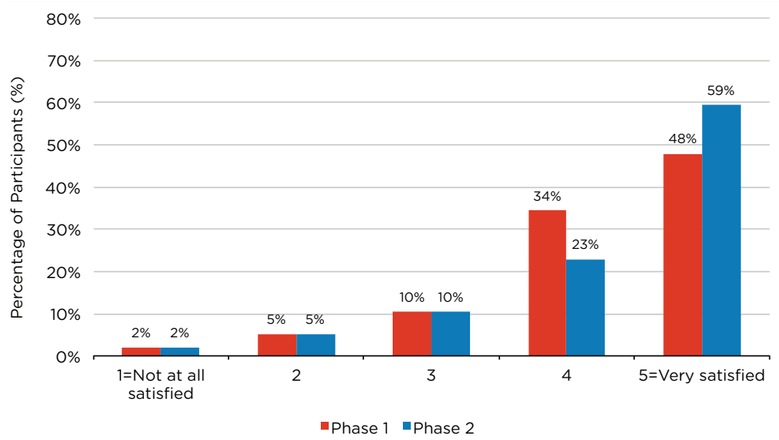

Figure 4-2. Built Environment: Perceived neighbourhood bikeability - Treatment Group A, Phase 1 & 2 (*n*=96).
Q1.7.8: How satisfied are you with how easy and pleasant it is to bicycle in your neighbourhood?

4.3 WALKABILITY AND BIKEABILITY (CONT'D)

4.0 | RESULTS: BUILT ENVIRONMENT

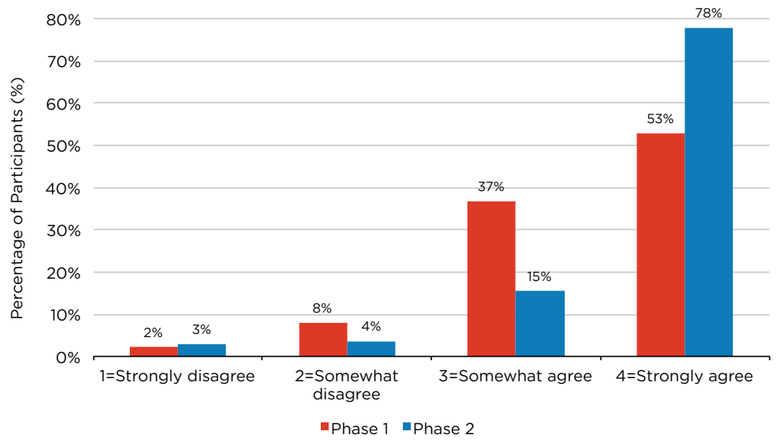

Figure 4-3. Built Environment: Perceived access to neighbourhood bicycle routes - Treatment Group A, Phase 1 & 2 (*n*=96).
Q1.3.3: There are bicycle routes in or near my neighbourhood that are easy to get to.

4.4 AMOUNT AND SPEED OF TRAFFIC

In contrast to neighbourhood walkability and bikeability, only half of participants are satisfied with the traffic levels in their neighbourhood. In Phase 1, 54.4% of participants living within one-block of the Greenway reported being satisfied with the amount and speed of neighbourhood traffic. Satisfaction decreased by 1.3% to 53.7% in Phase 2 (see Figure 4-4), but this change was not statistically significant.

Despite this, overall mean satisfaction did see a marginal improvement; in Phase 1, 16.2% of participants reported they were not satisfied with the amount and speed of traffic in their neighbourhood. This decreased by 18.5% to 13.2% in Phase 2. When taken collectively, this translated to an overall mean of 3.50 (on a 1 to 5 scale) in Phase 1, increasing marginally to 3.55 in Phase 2.

In contrast, overall satisfaction with the amount and speed of traffic saw a decrease from Phase 1 to 2 for residents living further away from the Greenway (Treatment Group B and the Control Group; see Figure 19). These changes were not statistically significant. This difference between the study groups may suggest that background traffic levels worsened in the West End and Downtown Vancouver during the study period. However, the Greenway improvements, including vehicle calming, may have provided a "protective" buffer and benefit for residents living within the one-block area of the Greenway. In other words, had the Greenway not been constructed, satisfaction levels for residents living within one-block would have followed the same overall decline as their counterparts living further away.

Additional evidence, while again not statistically significant, lends further support to this hypothesis. Residents living within one-block of the Greenway reported that their overall perception of slow neighbourhood traffic increased during the study period. In Phase 1, 87.5% of participants agreed that traffic on nearby streets is usually slow (50 km/h or less). In Phase 2, this increased by 4.2% to 91.2% of participants expressing agreement (see Figure 4-5).

In contrast, participants in the Control Group saw a decrease in their perception of slow traffic. In Phase 1, 65.3% of participants agreed that traffic on nearby streets is usually slow. In Phase 2, this decreased by 12.9% to 56.9% of participants.

In terms of geographic variation regarding residents' satisfaction with traffic for all target study participants (Treatment Group A and B), results were generally positive (see Figure 4-6). Overall, satisfaction increased in the western portion of the Greenway, including the section of Comox between Jervis and Bute, and the section of Comox between Thurlow and Burrard.

4.0 | RESULTS: BUILT ENVIRONMENT

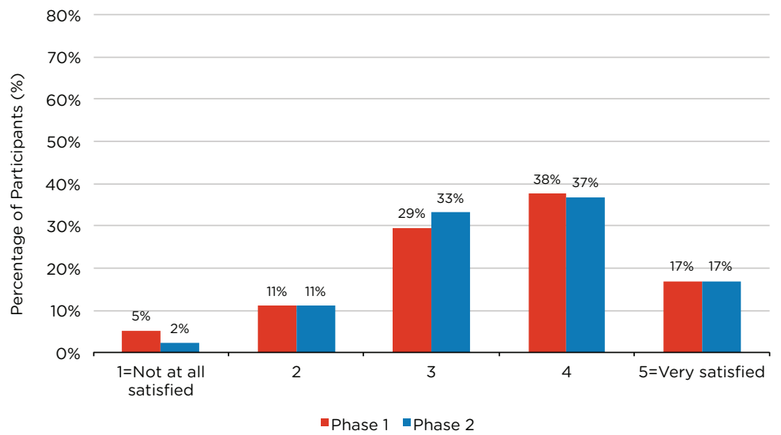

Figure 4-4a. Built Environment: Perceived neighbourhood traffic - Treatment Group A, Phase 1 & 2 (*n*=136).
Q1.7.12: How satisfied are you with the amount and speed of traffic in your neighbourhood?

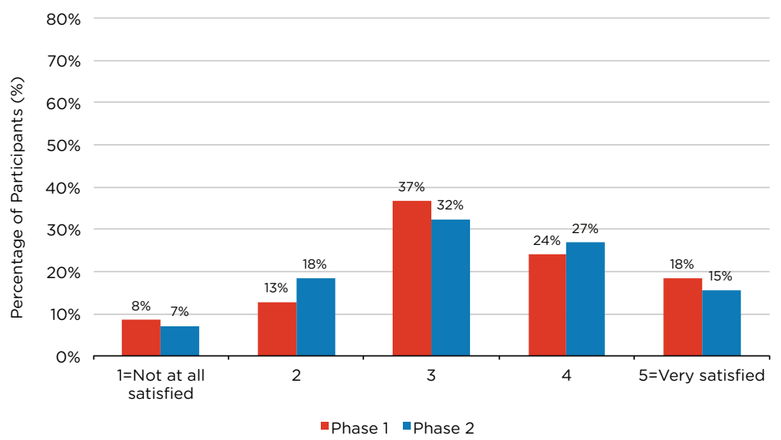

Figure 4-4b. Built Environment: Perceived neighbourhood traffic - Control Group, Phase 1 & 2 (*n*=71).
Q1.7.12: How satisfied are you with the amount and speed of traffic in your neighbourhood?

4.4 AMOUNT AND SPEED OF TRAFFIC (CONT'D)

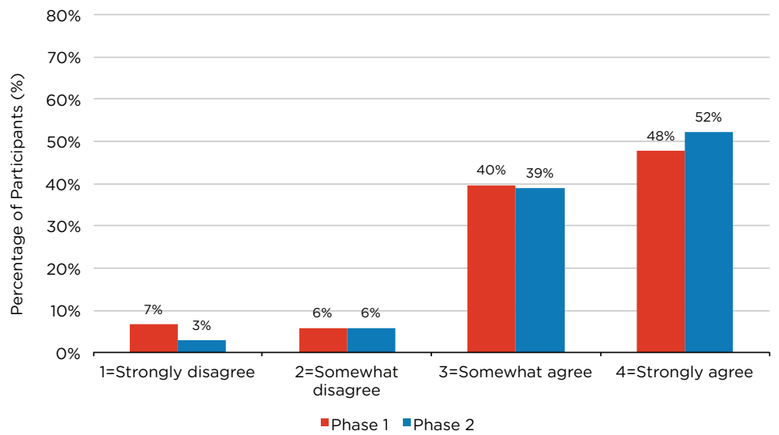

Figure 4-5a. Built Environment: Perceived slow speed of traffic - Treatment Group A, Phase 1 & 2 (*n*=136).
Q1.5.4: The speed of traffic on most nearby streets is usually slow (50 km/h or less).

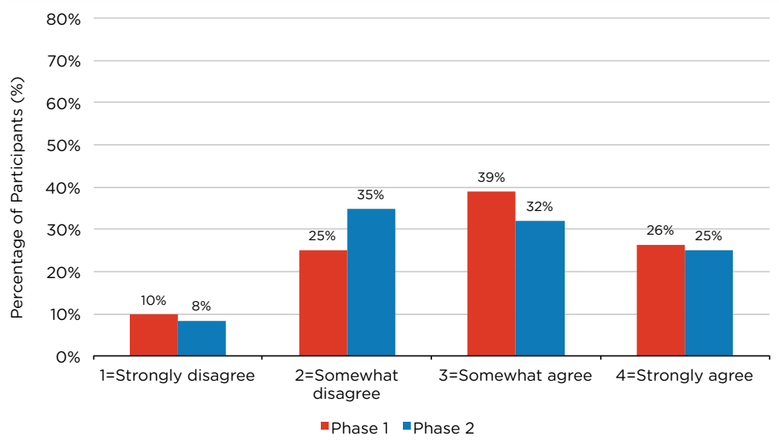

Figure 4-5b. Built Environment: Perceived slow speed of traffic - Control Group, Phase 1 & 2 (*n*=72).
Q1.5.4: The speed of traffic on most nearby streets is usually slow (50 km/h or less).

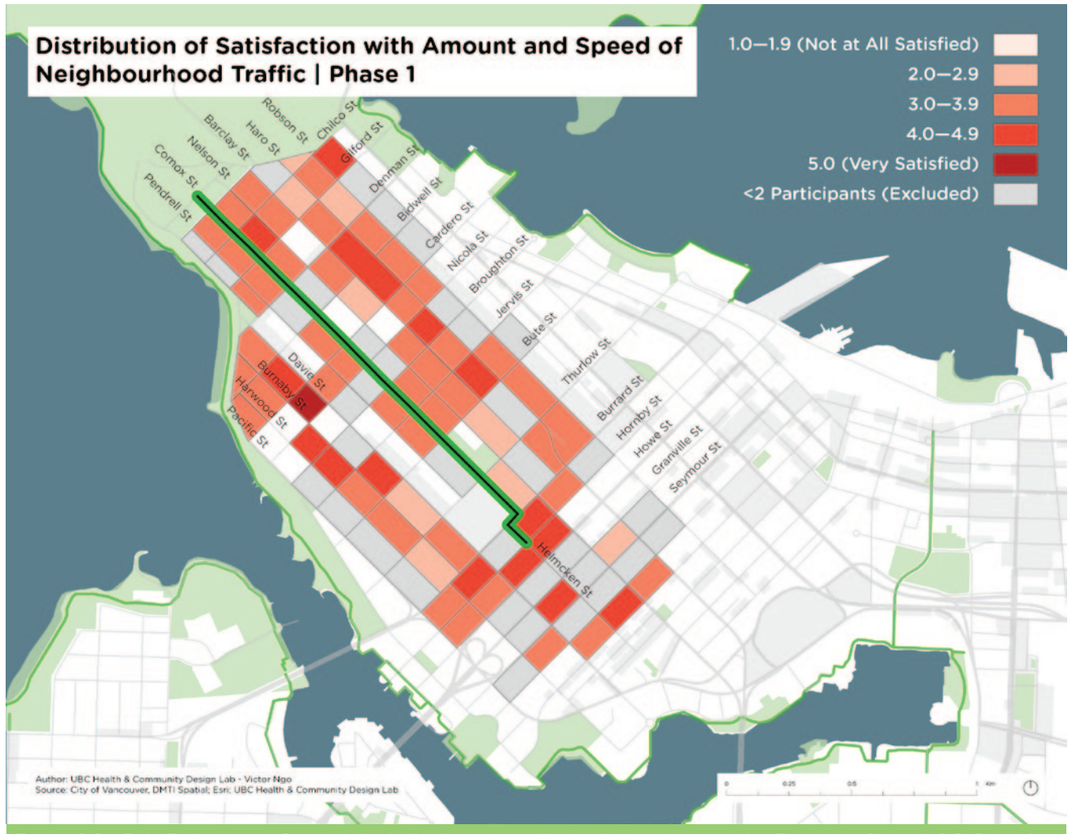

Figure 4-6a. Built Environment: Geographic distribution of perceived neighbourhood traffic - Treatment Group A & B, Phase 1 (*n*=136).
Q1.7.12: How satisfied are you with the amount and speed of traffic in your neighbourhood?

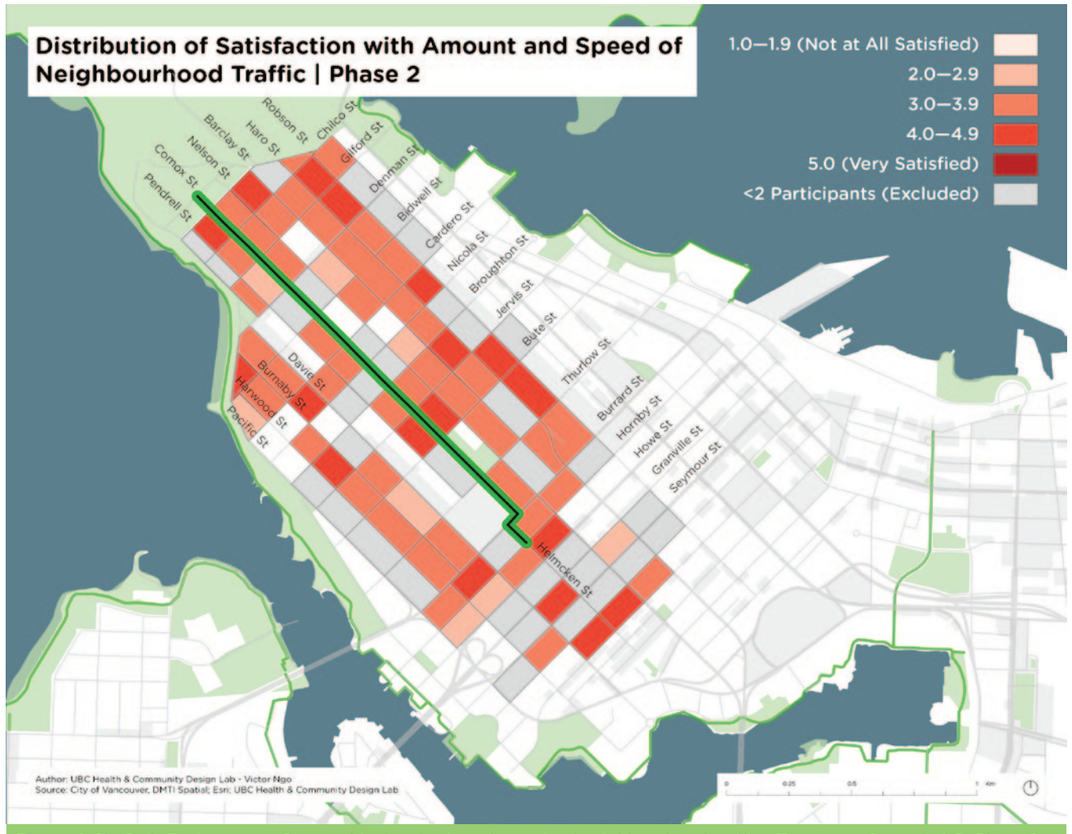

Figure 4-6b. Built Environment: Geographic distribution of perceived neighbourhood traffic - Treatment Group A & B, Phase 2 (*n*=136).
Q1.7.12: How satisfied are you with the amount and speed of traffic in your neighbourhood?

5.0 RESULTS: TRAVEL PATTERNS

This section provides an overview of the changes to travel patterns during the study period.

Two types of trips are defined for the purposes of analysis (see Section 2.2.2: Trip Diary Survey for more information).

- **One-way trip:** a trip with a unique trip purpose from origin to destination.
- **Partial trip:** a trip defined by the travel mode used in completing the one-way trip.

Table 5-1 shows the distribution of trips recorded during the two days of the Trip Diary Survey for residents living within one-block of the Greenway, and for those in the Control living further than 500 metres away from the Greenway.

5.1 MODE SHARE

Mode share is defined as the proportion of total person trips by travel mode. For residents living within one-block of the Greenway, a total of 1,042 completed trips were recorded in Phase 1, and a total of 922 completed trips were recorded in Phase 2. In Phase 1, 89.2% of all trips either began or

5.0 | RESULTS: TRAVEL PATTERNS

Table 5-1. Distribution of days recorded in the Trip Diary Survey - Treatment Group A & Control Group, Phase 1/2 (n_{P1}=136; n_{P2}=72).

Group	Day	Mon	Tues	Wed	Thu	Fri	Sat	Sun	Total
Treatment Group A	Day 1	30	22	20	14	15	16	19	136
	Day 2	19	30	22	20	14	15	16	136
	Total	49	52	42	34	29	31	35	272
	% of Total	18.0%	19.1%	15.4%	12.5%	10.7%	11.4%	12.9%	100.0%
Control Group	Day 1	12	11	10	7	12	11	9	72
	Day 2	9	12	11	10	7	12	11	72
	Total	21	23	21	17	19	23	20	144
	% of Total	14.6%	16.0%	14.6%	11.8%	13.2%	16.0%	13.9%	100.0%

Table 5-2. Mode share (one-way trips) - Treatment Group A (n_{P1}=1,042; n_{P2}=922) & Control Group (n_{P1}=519; n_{P2}=491), Phase 1 & 2.

Mode	Phase 1		Phase 2		Absolute Difference		Percentage Difference	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Walk	59.2%	59.0%	58.1%	57.0%	-1.1%	-1.9%	-1.8%	-3.3%
Auto	22.8%	25.6%	19.8%	29.9%	-3.0%	+4.3%	-13.1%	+16.8%
Transit	15.0%	11.9%	17.6%	10.6%	+2.6%	-1.4%	+17.4%	-11.3%
Bicycle	3.0%	3.5%	4.4%	2.4%	+1.5%	-1.0%	+49.5%	-29.5%

Table 5-3. Mode share (partial trips) - Treatment Group A (n_{P1}=1,405; n_{P2}=1,311) & Control Group (n_{P1}=648; n_{P2}=651), Phase 1 & 2.

Mode	Phase 1		Phase 2		Absolute Difference		Percentage Difference	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Walk	64.3%	61.9%	65.2%	62.5%	+0.9%	+0.6%	+1.5%	+1.0%
Auto	17.2%	21.1%	14.4%	23.2%	-2.8%	+2.1%	-16.3%	+9.7%
Transit	16.2%	14.2%	17.2%	12.3%	+1.1%	-1.9%	+6.7%	-13.4%
Bicycle	2.3%	2.8%	3.1%	2.0%	+0.8%	-0.8%	+33.2%	-28.1%

Table 5-4. Mode share (one-way trips) for journey to work - West End Neighbourhood, 2006 Census.

Mode	Phase 1
Walk	40.8%
Auto	31.6%
Transit	24.5%
Bicycle	3.1%

ended in the downtown peninsula (west of Main Street), and in Phase 2, this increased to 91.1% of all trips.

Table 5-2 and 5-3 provides an overview of the mode share for Phase 1 and 2 for one-way and partial trips using all trip purposes. For context, Table 5-4 provides the mode share for West End journeys to work using 2006 Census data. Statistics and discussion will generally focus on the analysis of one-way trips unless otherwise stated.[15]

In general, the majority of trips taken for all trip purposes are dominated by walking, followed by auto, transit, and lastly bicycle. This mode share corresponds with the Census data for the journey to work in the West End. Walk mode share declined for both residents living within the one-block area and those in the Control Group. In contrast, bicycle and transit mode share increased for participants within the one-block area, and decreased for those in the Control. Auto mode share decreased for those in the one-block area, and increased for those in the Control. Only the change for bicycle mode share was statistically significant at the 90% confidence level (see Figure 5-1).

- **Walk Trips:** Walk trips form the greatest share of trips among the study participants. Walk trips had a modest decline in mode share. In Phase 1, 59.2% of trips were by foot, and in Phase 2, 58.1% of trips were by foot—a non-statistically significant decrease of -1.8%. However, there was a decline in walking trips for both residents living within one-block of the Greenway (Treatment Group A) and those living further than 500 metres (Control Group). For the Control Group, walk mode share was 59.0% in Phase 1, decreasing by -3.3% to 57.0% walk mode share in Phase 2. This decrease was not statistically significant.

  These results suggest that there was an overall decline in walking trips for the entire study area during the study period. However, the decline in walking was the lowest for residents living within one-block of the Greenway, which may suggest that residents living within the one-block area would have otherwise made fewer walk trips if the Greenway was not present.

  When comparing one-way trips and partial trips, walk trips are the only mode of travel that differed in the direction of change. For one-way trips, walk trips declined by -1.8%. In contrast, for partial trips, walk trips increased by +1.5%. This may suggest that while there was a decline in the number of trips where walking was the primary mode, participants were creating more complex trips that involved travel by foot in order to link to other transportation modes for both study groups.

- **Auto Trips:** Auto trips form the second greatest share of trips among the study participants. From Phase 1 to 2, there was a non-statistically significant decrease in auto mode share. In Phase 1, 22.8% of trips were by auto, decreasing by -13.1% to 19.8% auto mode share in Phase 2. Auto trips in the Control Group followed the opposite trend, with a +16.8% non-statistically significant increase in auto mode share from 25.6% auto mode share in Phase 1 to 29.9% in Phase 2.

[15] Only a standard test of proportion is used to compare mode share from Phase 1 to 2 within the Treatment Group, and not compared to the Control Group.

5.0 | RESULTS: TRAVEL PATTERNS

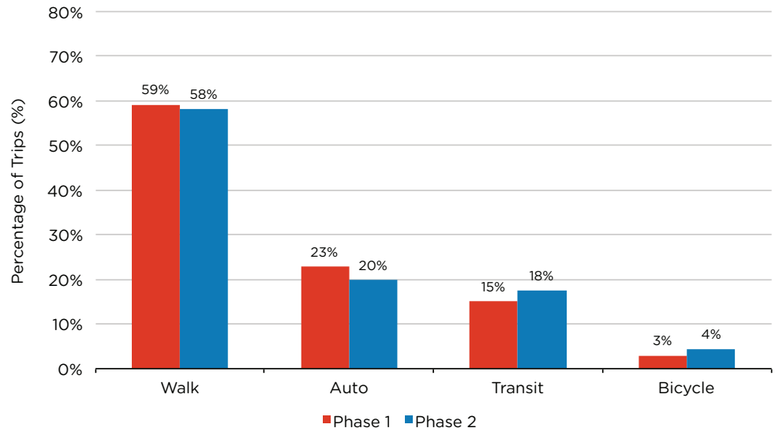

Figure 5-1a. Travel Patterns: Mode share - Treatment Group A, Phase 1 & 2 (n_{P1}=1,042; n_{P2}=922).

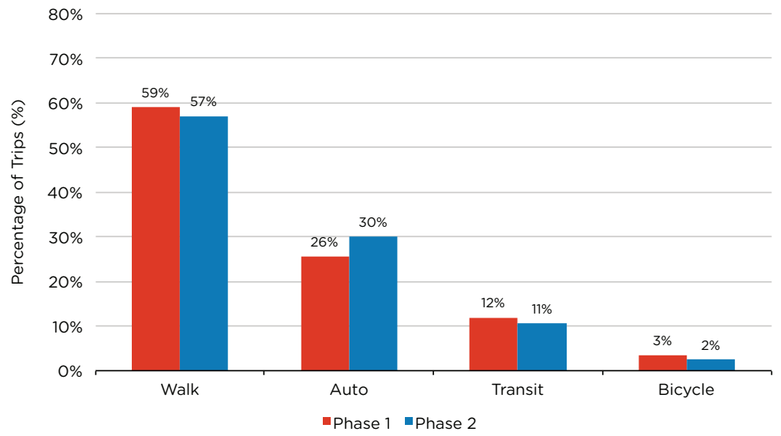

Figure 5-1b. Travel Patterns: Mode share - Control Group, Phase 1 & 2 (n_{P1}=519; n_{P2}=491).

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- **Transit Trips:** Transit trips form the third greatest share of trips among the study participants. From Phase 1 to 2, there was a non-statistically significant increase in transit mode share. In Phase 1, 15.0% of trips were by transit, increasing by +17.4% to 17.6% transit mode share in Phase 2. Transit trips in the Control Group followed the opposite direction, with an -11.3% decrease from 11.9% transit mode share in Phase 1 to 10.6% in Phase 2.

- **Bicycle Trips:** Bicycle trips form the lowest mode share among the study participants. However, bicycle mode share experienced the largest growth during the study period. In Phase 1, 3.0% of trips were by bicycle, increasing by +49.5% to 4.4% of trips in Phase 2. This change was statistically significant (90% confidence level). Bicycle trips in the Control Group followed the opposite direction, with a -29.5% decrease from 3.5% bicycle mode share in Phase 1 to 2.4% in Phase 2. This change was not statistically significant.

5.1.1 Mode Share: Seasonal and Climatic Influence

There are a number of studies that have investigated the relationship between travel behaviour and the influence of seasonal change and climate, including precipitation, temperature, and wind.[16] As active modes of transportation are more likely to be affected by climatic conditions, temperature and precipitation data were obtained for Vancouver from Environment Canada to track the changes from Phase 1 to 2 (see Table 5-5).

The Travel Diary Survey was conducted during late autumn and winter from October to December 2012 for Phase 1, and from October 2014 to March 2015 for Phase 2. As a result, the collection period for Phase 2 was longer than Phase 1, with the collection period extending into the beginning of the spring season.

This report does not formally investigate the impact of seasonal and climatic influence on travel patterns. From Phase 1 to 2, there was an increase in temperature extremes, with statistically significant changes in minimum and maximum temperature. Overall, this produced a statistically significant lower mean temperature change of -0.4 °C in Phase 2. This potentially may have contributed to lower walking and bicycle trips in Phase 2. These seasonal and climatic influences should be taken into consideration when interpreting the findings of the study.

[16] Böcker, L., Dijst, M., & Prillwitz, J. (2013). "Impact of Everyday Weather on Individual Daily Travel Behaviours in Perspectives: A Literature Review." *Transport Reviews, 33*(1): 71-91.

Table 5-5. Temperature and precipitation during the study period, Phase 1 & 2 (*n*=272).

Weather Variable	Phase 1	Phase 2	Difference	Statistically Significant?
Mean Temp (°C)	6.3	5.9	-0.4	Yes
Min Temp (°C)	3.8	2.5	-1.3	Yes
Max Temp (°C)	8.8	9.3	+0.5	Yes
Precipitation (mm)	5.4	5.2	-0.2	No

5.2 TRIP RATE

Trip rate is defined as the number of person trips on a daily basis. For residents living within one-block of the Greenway, the mean daily trips per person was 3.8 trips/person in Phase 1. This decreased in Phase 2 by -10.5% to 3.4 trips/person (see Figure 5-2). Similarly, for the Control Group, the mean daily trips per person was 3.5 trips/person in Phase 1, decreasing by -3.8% to 3.3 trips/person in Phase 2. This decrease was statistically significant (90% confidence level) and observed across all the study groups. These numbers are within the general range, albeit lower, of the city-wide trip rate of 3.8 trips/person according to the City of Vancouver's 2014 Transportation Panel Survey.[17]

Changes in trip rate by mode generally corresponded with the direction of mode share change.

- **Walk Trip Rate:** Walk trip rates rank the highest among the study participants. In Phase 1, the mean daily walk trips per person was 2.2 walk trips/person. This decreased by -11.3% to 2.0 walk trips/person in Phase 2. This change was not statistically significant when compared to the Control Group. For the Control, mean daily walk trips per person was 2.0 walk trips/person in Phase 1, decreasing by -6.5% to 1.9 walk trips/person in Phase 2.

- **Auto Trip Rate:** Auto trip rates rank the second highest among the study participants. In Phase 1, the mean daily auto trips per person was 0.9 auto trips/person. This decreased by -22.9% to 0.7 auto trips/person in Phase 2. This change was statistically significant (90% confidence level) when compared to the Control Group. In contrast to residents living within the one-block area, the Control Group saw an increase in their auto trip rates, corresponding to the directional change in their auto mode share. For the Control Group, the mean daily auto trips per person was 0.9 auto trips/person in Phase 1, increasing by +11.6% to 1.0 auto trips/person in Phase 2.

- **Transit Trip Rate:** Transit trip rates rank the third highest among the study participants. In Phase 1, the mean daily transit trips per person were 0.6 transit trips/person. Transit trip rate increased modestly by +2.6% in Phase 2, remaining at 0.6 transit trips/person. This change was not statistically significant. In contrast to residents living within the one-block area, the Control Group saw a decrease in their transit trip rate, corresponding to the directional change in transit mode share. For the Control Group, the mean daily transit trips per person was 0.4 transit trips/person. This decreased by -16.1%, remaining at 0.4 transit trips/person in Phase 2.

- **Bicycle Trip Rate:** Bicycle trip rates rank the lowest among the study participants. In Phase 1, the mean daily bicycle trip per person was 0.1 bicycle trips/person. This increased by +32.3% to 0.2 bicycle trips/person in Phase 2—the largest percentage change. In contrast to residents living within the one-block area, the Control Group saw a decrease in their bicycle trip rate, corresponding to the directional change in bicycle mode share. For the Control Group, the mean daily bicycle trip per person was 0.1 bicycle trips/person in Phase 1. This decreased by 29.4%, remaining at 0.1 bicycle trips/person in Phase 2.

[17] City of Vancouver. (2015). *2014 Transportation Panel Survey*. Vancouver, BC: City of Vancouver

5.0 | RESULTS: TRAVEL PATTERNS

The changes in bicycle trip rates were not statistically significant in part due to the low sample size, with a small number of participants cycling. Despite this, when taking into account the mode share change, the bicycle trip rates are nonetheless a promising result despite non-significance.

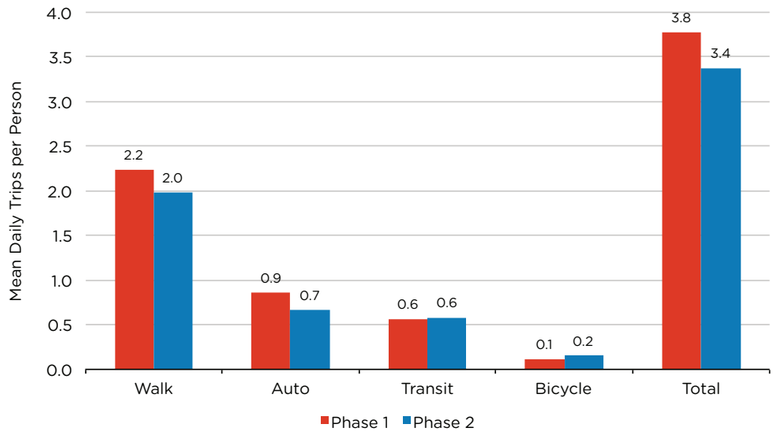

Figure 5-2a. Travel Patterns: Trip rate by mode - Treatment Group A, Phase 1 & 2 (*n*=135).

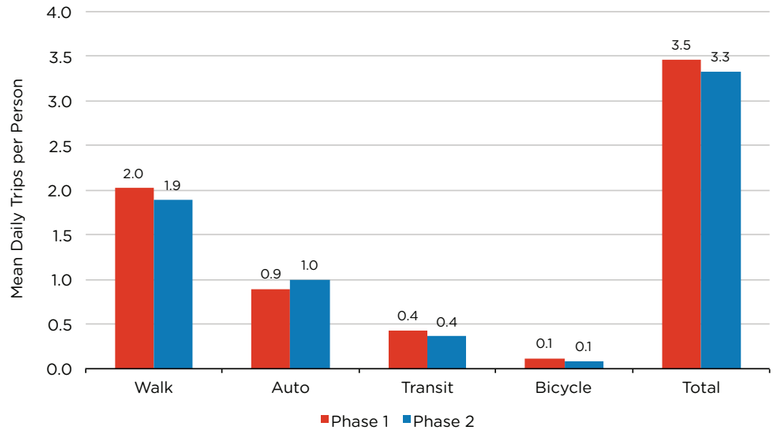

Figure 5-2b. Travel Patterns: Trip rate by mode - Control Group, Phase 1 & 2 (*n*=72).

5.2.1 Trip Rate: Age Cohort

Differences emerged when examining trip rates by age cohort. Tables 5-6 and 5-7 provide a breakdown of trip rates by mode by age cohort for residents living within 500 metres of the Greenway (Treatment Group A & B) and the Control Group.

The following provides a descriptive breakdown of differences by age cohort for Phase 2:

- **20-29 years old:** The 20-29 age cohort was most likely to walk (1.7 walk trips/person), followed by auto (1.0 auto trips/person), transit (0.8 transit trips/person), and lastly bicycle (0.1 bicycle trips/person). This age cohort had the highest total trip rate (3.6 trips/person).

- **30-44 years old:** The 30-44 age cohort followed the same pattern as the 20-29 age cohort. They were most likely to walk (1.8 walk trips/person), followed by auto (0.7 auto trips/person), transit (0.6 transit trips/person), and lastly bicycle (0.2 bicycle trips/person). This age cohort had the third highest trip rate (3.3 trips/person).

- **45-64 years old:** The 45-64 age cohort followed the same trend as the 20-29 and 30-44 age cohort. They were most likely to walk (2.1 walk trips/person), followed by auto (0.6 auto trips/person), transit (0.56 transit trips/person), and lastly bicycle (0.2 bicycle trips/person). This age cohort had the second highest trip rate (3.4 trips/person).

- **65+ years old:** The 65+ age cohort were most likely to walk (1.9 walk trips/person), followed by transit (0.6 auto trips/person), auto (0.6 transit trips/person), and lastly bicycle (0.04 bicycle trips/person). This age cohort had the lowest trip rate (3.1 trips/person).

There were notable differences when comparing trip rates by mode by age cohort (see Figure 5-3). However, statistically significant differences were not detected when comparing trip rates between age cohorts within the Treatment Group, and the Treatment Group to the Control Group due to low statistical power, i.e., the sample sizes are insufficient for proper comparisons due to heavy sampling stratification.

- **Total Trip Rate:** In Phase 1, the 45-64 age cohort had the highest trip rate at 3.6 trips/person. This was followed by 65+ age cohort (3.5 trips/person), 20-29 (3.5 trips/person), and lastly 30-44 (3.4 trips/person). By Phase 2, the 20-29 age cohort had the highest trip rate at 3.6 trips/person. This was followed by 45-64 (3.4 trips/person), 30-44 (3.3 trips/person), and lastly 65+ (3.1 trips/person).

  The directional change to trip rates by age cohort corresponded with the changes observed in the Control Group.

- **Walk Trip Rate:** In Phase 1, the 45-64 age cohort had the highest walk trip rate (2.2 walk trips/person), followed by 30-44 (2.1 walk trips/person), 65+ (2.0 walk trips/person), and lastly 20-29 (1.8 walk trips/person). By Phase 2, the 45-64 age cohort remained at the top (2.1 walk trips/person), followed by a decrease for the remaining age cohorts—65+ (1.9 walk trips/person), 30-44 (1.8 walk trips/person), and lastly 20-29 (1.7 walk trips/person).

5.0 | RESULTS: TRAVEL PATTERNS

  When compared to the Control Group, the 20-29 and 45-64 age cohorts differed in their trip rate directional change. For the 20-29 and 45-64 age cohorts, there was a decrease in walk trip rates in the Treatment, and an increase in the Control.

- **Auto Trip Rate:** In Phase 1, the 65+ age cohort had the highest auto trip rate (0.8 auto trips/person) followed by all the other cohorts (0.7 auto trip rates). In Phase 2, the 20-29 age cohort rose to the top (1.0 auto trips/person). This was followed by the 30-44 age cohort which saw an increase (0.8 auto trips/person). In contrast, the 45-64 and 65+ age cohort saw a decrease in their trip rate (0.6 auto trips/person).

  When compared to the Control Group, the 45-64 and 65+ age cohort differed in their trip rate change. For the 45-64 and 65+ age cohort, there was a decrease in auto trip rates in the Treatment, and an increase in the Control.

- **Transit Trip Rate:** In Phase 1, the 20-29 age cohort had the highest transit trip rate (0.8 transit trips/person), followed by 65+ (0.6 transit trips/person), and lastly 30-44 and 45-64 (0.5 transit trips/person). In Phase 2, the only change observed was among the 30-44 and 45-64 age cohort, which saw an increase in their transit trip rate (0.6 transit trips/person). The 65+ age cohort had a modest decrease in their transit trip rate.

  When compared to the Control Group, the 20-29, 45-64, and 65+ age cohorts differed in their trip rate change. For the 20-29 and 45-64 age cohort, there was an increase in transit trip rates in the Treatment, and a decrease in the Control. For the 65+ age cohort, there was a decrease in the Treatment, and an increase in the Control.

- **Bicycle Trip Rate:** In Phase 1, the 20-29, 30-44, and 45-65 age cohort shared the same trip rate (0.1 bicycle trips/person). The 65+ age cohort had a zero bicycle trip rate. In Phase 2, the 30-44 and 45-65 age cohort had an increase in their trip rate (0.2 bicycle trips/person). The 65+ age cohort also saw a very modest increase (0.04 bicycle trips/person) from a previous zero trip rate.

  When compared to the Control Group, the 30-44 and 45-65 age cohort in the Treatment saw a decrease in their bicycle trip rates. The 20-29 and 65+ age cohort had no change. These changes in bicycle trip rates suggest there may have been a positive generational equity benefit from the Greenway improvements, as indicated by the increase in bicycle trip rates among older adult participants.

Table 5-6a. Travel Patterns: Trip rate by mode by age cohort - Treatment Group A & B, Phase 1 & 2.

Mode	Phase 1				Phase 2			
	20-29	30-44	45-64	65+	20-29	30-44	45-64	65+
Walk	1.8	2.1	2.2	2.0	1.7	1.8	2.1	1.9
Auto	0.7	0.7	0.7	0.8	1.0	0.7	0.6	0.6
Transit	0.8	0.5	0.5	0.6	0.8	0.6	0.6	0.6
Bicycle	0.1	0.1	0.1	0.00	0.1	0.2	0.2	0.04
Total	3.5	3.4	3.6	3.5	3.6	3.3	3.4	3.1

Table 5-6b. Travel Patterns: Trip rate by mode by age cohort (Difference scores) - Treatment Group A & B, Phase 1 & 2.

Mode	Phase 1				Phase 2			
	20-29	30-44	45-64	65+	20-29	30-44	45-64	65+
Walk	-0.2	-0.2	-0.2	-0.1	-9.3%	-10.1%	-6.9%	-4.8%
Auto	+0.2	-0.0	-0.1	-0.2	+34.5%	-2.2%	-9.7%	-29.0%
Transit	+0.0	+0.0	+0.0	-0.1	+5.8%	+4.0%	+7.0%	-8.7%
Bicycle	-0.0	+0.1	+0.0	0.04	-6.0%	+66.9%	+31.1%	No Change
Total	+0.1	-0.1	-0.1	-0.4	+3.4%	-3.8%	-3.9%	-10.0%

Table 5-7a. Travel Patterns: Trip rate by mode by age cohort - Control Group, Phase 1 & 2.

Mode	Phase 1				Phase 2			
	20-29	30-44	45-64	65+	20-29	30-44	45-64	65+
Walk	2.3	2.0	1.7	3.0	2.3	1.6	1.8	2.4
Auto	0.6	1.0	1.1	0.7	0.7	1.1	1.1	0.7
Transit	0.4	0.4	0.5	0.3	0.4	0.4	0.2	0.6
Bicycle	0.0	0.2	0.2	0.00	0.0	0.1	0.2	0.00
Total	3.3	3.5	3.5	4.0	3.3	3.3	3.3	3.7

Table 5-7b. Travel Patterns: Trip rate by mode by age cohort (Difference scores) - Control Group, Phase 1 & 2.

Mode	Phase 1				Phase 2			
	20-29	30-44	45-64	65+	20-29	30-44	45-64	65+
Walk	-0.0	-0.3	+0.1	-0.6	+1.6%	-16.8%	+7.5%	-19.0%
Auto	+0.1	+0.2	+0.0	+0.0	+11.0%	+17.3%	+1.9%	+7.1%
Transit	-0.1	+0.1	-0.3	+0.2	-14.3%	+18.5%	-60.0%	+71.4%
Bicycle	No Change	-0.1	-0.0	No Change	No Change	-55.6%	-11.1%	No Change
Total	-0.0	-0.2	-0.2	-0.3	+1.3%	-5.3%	-5.4%	-7.1%

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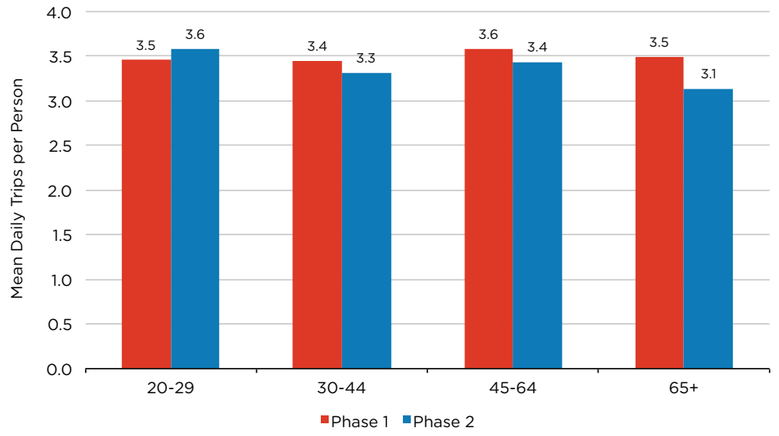

Figure 5-3a. Travel Patterns: Trip rate (total) by age cohort - Treatment Group A, Phase 1 & 2.

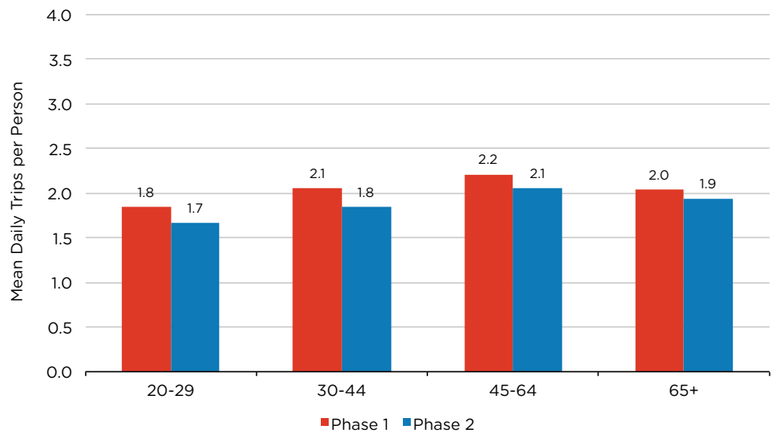

Figure 5-3b. Travel Patterns: Trip rate (walk) by age cohort - Treatment Group A, Phase 1 & 2.

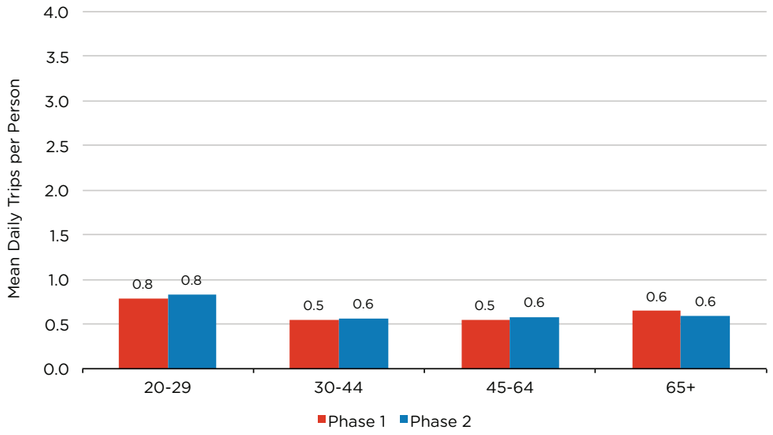

Figure 5-3d. Travel Patterns: Trip rate (transit) by age cohort - Treatment Group A, Phase 1 & 2.

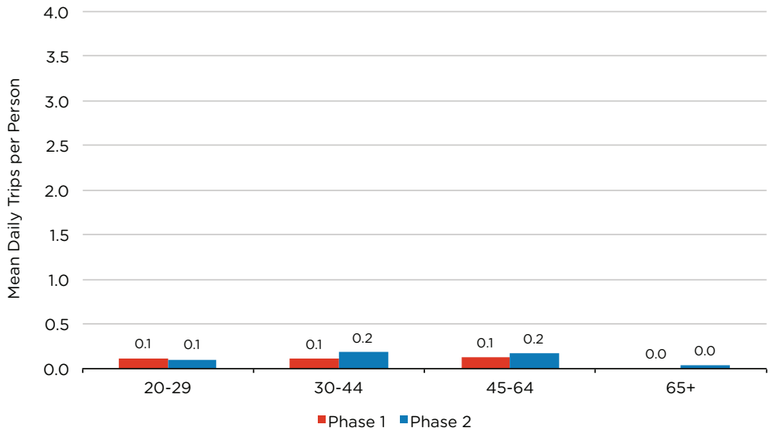

Figure 5-3e. Travel Patterns: Trip rate (bicycle) by age cohort - Treatment Group A, Phase 1 & 2.

5.2.2 Trip Rate: Walkbility and Bikeability

Trip rate changes also differed by perceived neighbourhood walkability and bikeability. Figure 5-4 provides trip rates by mode for residents living within 500 metres of the Greenway (Treatment Group A & B).

Caution should be exercised when interpreting the findings in this section, as there are very small sample sizes for values of "low" walkability and bikeability. For this reason, comparisons within the Treatment Group and to the Control Group are not conducted. Only values for "high" walkability and bikeability are compared across Phase 1 and 2 as comparisons between "low" and "high" would be statistically unreliable. Notwithstanding this, values generally matched expected patterns. For example, there are higher walk trip rates for participants who rated walkability in their neighbourhood "high" than those who rated it "low."

In general, trip rates did not differ between "high" perceived neighbourhood walkability compared to "high" bikeability with no statistically significant changes.

For "high" perceived neighbourhood bikeability from Phase 1 to 2:

- **Total Trip Rate:** There was a statistically significant (90% confidence level) decrease in the total trip rate from 3.6 trips/person in Phase 1 to 3.4 trips/person in Phase 2, corresponding to the decrease in the overall number of trips.
- **Walk Trip Rate:** In Phase 1, the walk trip rate was 2.1 walk trips/person, decreasing to 1.9 walk trips/person in Phase 2.
- **Auto Trip Rate:** In Phase 1, the auto trip rate was 0.7 auto trips/person, decreasing to 0.6 auto trips/person in Phase 2.
- **Transit Trip Rate:** In Phase 1, the transit trip rate was 0.6 transit trips/person, remaining the same in Phase 2.
- **Bicycle Trip Rate:** In Phase 1, the bicycle trip rate was 0.1 bicycle trips/person, increasing to 0.2 bicycle trips/person in Phase 2.

For "high" perceived neighbourhood bikeability from Phase 1 to 2:

- **Total Trip Rate:** In Phase 1, the total trip rate was 3.6 trips/person, decreasing to 3.3 trips/person in Phase 2.
- **Walk Trip Rate:** In Phase 1, the walk trip rate was 2.0 walk trips/person, decreasing to 1.8 walk trips/person in Phase 2.
- **Auto Trip Rate:** In Phase 1, the auto trip rate was 1.0 auto trips/person, increasing to 1.1 auto trips/person in Phase 2.
- **Transit Trip Rate:** In Phase 1, the total trip rate was 0.4 transit trips/person, remaining the same in Phase 2.
- **Bicycle Trip Rate:** In Phase 1, the total trip rate was 0.1 bicycle trips/person, remaining the same in Phase 2.

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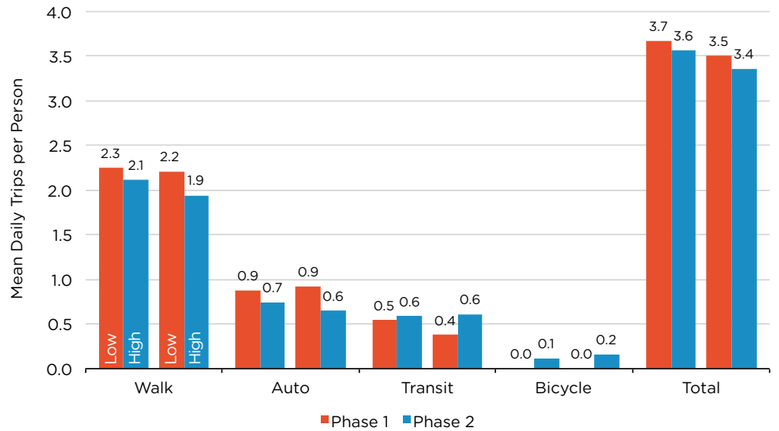

Figure 5-4a. Travel Patterns: Trip rate by perceived neighbourhood walkability - Treatment Group A, Phase 1 & 2 (Low: *n*=12; High: *n*=409).

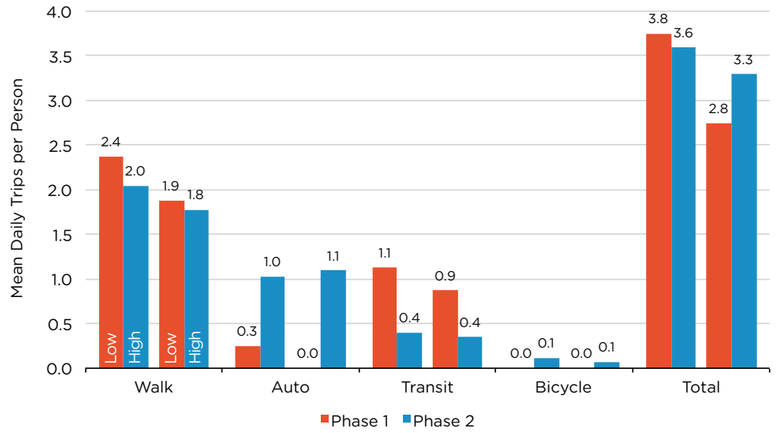

Figure 5-4b. Travel Patterns: Trip rate by perceived neighbourhood bikeability - Treatment Group A, Phase 1 & 2 (Low: *n*=4; High: *n*=54).

5.3 TRIP PURPOSE

In general, trip purposes remained the same from Phase 1 to 2 (see Figure 5-4).[18] In Phase 2 for residents living within one-block of the Greenway, the largest share of trips are shopping-related (24.8%), followed by work (23.6%), and recreational (19.9%). The largest change observed was for recreational trips. In Phase 1, 18.0% of all trips were recreational/social/entertainment-related, increasing +11.4% in Phase 2 to 19.9% of all trips.

Trip purposes were grouped into recreational, utilitarian, and shopping trips for further analysis (see Table 5-8 and Figure 5-5).[19]

Recreational Trips:
- There was no statistically significant difference.
- In Phase 1, 39.8% of trips were recreational, increasing by +3.0% to 41.0% of trips in Phase 2.
- Recreational trips in the Control Group followed the same direction.

Utilitarian Trips:
- There was no statistically significant difference.
- In Phase 1, 33.4% of trips were utilitarian, increasing by +2.4% to 34.2% of trips in Phase 2.
- Utilitarian trips in the Control Group followed the opposite direction, with a -10.2% decline in utilitarian trips from Phase 1 to 2.

Shopping Trips:
- There was no statistically significant difference.
- In Phase 1, 26.8% of trips were shopping, decreasing by -7.4% to 24.8% of trips in Phase 2.
- Shopping trips in the Control Group followed the opposite direction, with a +0.1% increase in shopping trips from Phase 1 to 2.

Trip purposes were also broken down by mode (see Table 5-9 and Figure 5-6). In general, mode share followed the same previous patterns with walking as the dominant mode, followed by auto, transit, and lastly bicycle. However, there are distinct differences in mode share change depending on the type of trip purpose.

Recreational Trips:
- Walking is the dominant mode choice, with 72.8% of trips by foot in Phase 1, decreasing by -5.5% to 68.9% walk mode share in Phase 2.
- Auto was the second largest mode share, with a 15.5% auto mode share in Phase 1, increasing +24.5% to 19.3% auto mode share in Phase 2.
- This was followed by transit, with a 9.8% transit mode share in Phase 1, decreasing by -8.1% to 9.0% transit mode share in Phase 2.
- Lastly, bicycle mode share was 1.9% in Phase 1, increasing 52.0% to 2.9% bicycle mode share in Phase 2.

[18] Only a standard test of proportion is used to compare mode share from Phase 1 to 2 within the Treatment Group, and not compared to the Control Group.
[19] **Recreational trips** include "Dining," "Recreational/social/entertainment," and "Walk/Exercise." **Utilitarian trips** include "Personal Business," "School," and "Work." **Shopping trips** include "Shopping."

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Utilitarian Trips:
- Walking is the dominant mode choice, with 44.1% of trips by foot in Phase 1, increasing by +4.4% to 46.1% walk mode share in Phase 2.
- Auto mode share was the second highest in Phase 1 at 26.6%. However, it became the third highest in Phase 2, decreasing -28.8% to 19.1% auto mode share. This decrease was statistically significant (90% confidence level).
- Transit mode share was the third highest in Phase 1 at 25.2%. However, it became the second highest in Phase 2, increasing by +16.6% to 29.4% transit mode share.
- Lastly, bicycle mode share was 4.1% in Phase 1, increasing +33.0% to 5.4% bicycle mode share in Phase 2.

Shopping Trips:
- Walking is the dominant mode choice, with 64.0% of trips by foot in Phase 1, increasing by +3.4% to 66.2% walk mode share in Phase 2.
- Auto was the second largest mode share, with a 24.2% auto mode share in Phase 1, decreasing by -32.9% to 16.2% auto mode share in Phase 2. This decrease was statistically significant (90% confidence level).
- This was followed by transit, with a 10.1% transit mode share in Phase 1, increasing by +33.6% to 13.5% transit mode share in Phase 2.
- Lastly, bicycle mode share was 1.7% in Phase 1, increasing 140.5% to 4.1% bicycle mode share in Phase 2.

There were also mode share differences depending on the trip purpose. The following provides a breakdown for Phase 2.

- **Walk Mode Share:** Walk mode share is highest for recreational trips (68.9%), followed by shopping (66.2%), and lastly utilitarian (46.1%). Utilitarian trips had the largest increase in walk mode share from Phase 1 to 2 (+4.4%), followed by shopping (+3.4%), and a decrease for recreational (-5.5%).

- **Auto Mode Share:** Auto mode share is highest for recreational trips (19.3%), followed by utilitarian (19.1%), and lastly shopping (16.2%). Recreational trips had the largest increase in auto mode share from Phase 1 to 2 (+24.5%), with a decrease for utilitarian (-28.1%) and shopping (-32.9%).

- **Transit Mode Share:** Transit mode share is highest for utilitarian trips (29.4%), followed by shopping (13.5%), and lastly recreational (9.0%). Shopping trips had the largest increase in transit mode share from Phase 1 to 2 (+33.6%), followed by utilitarian (+16.6%), and a decrease for recreational (-8.1%).

- **Bicycle Mode Share:** Bicycle mode share is highest for utilitarian trips (5.4%), followed by shopping (4.1%), and lastly recreational (2.9%). Shopping trips had the largest increase in bicycle mode share from Phase 1 to 2 (+140.5%), followed by recreational (+52.0%), and lastly utilitarian (+33.0%).

Table 5-8. Travel Patterns: Trip purpose - Treatment Group A (n_{p1}=665; n_{p2}=597) & Control Group (n_{p1}=332; n_{p2}=300), Phase 1 & 2.

Trip Purpose	Phase 1		Phase 2		Absolute Difference		Percentage Difference	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Recreational	39.8%	41.3%	41.0%	45.0%	+1.2%	+3.7%	+3.0%	+9.1%
Utilitarian	33.4%	36.7%	34.2%	33.0%	+0.8%	-3.7%	+2.4%	-10.2%
Shopping	26.8%	22.0%	24.8%	22.0%	-2.0%	-0.0%	-7.4%	+0.1%

Table 5-9. Travel Patterns: Trip purpose by mode - Treatment Group A & Control Group, Phase 1 & 2.

Trip Purpose	Phase 1		Phase 2		Absolute Difference		Percentage Difference	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Recreational								
Walk	72.8%	74.3%	68.9%	53.8%	-4.0%	-20.5%	-5.5%	-27.6%
Auto	15.5%	19.9%	19.3%	17.5%	+3.8%	-2.3%	+24.5%	-11.6%
Transit	9.8%	4.4%	9.0%	27.5%	-0.8%	+23.1%	-8.1%	+523.0%
Bicycle	1.9%	1.5%	2.9%	1.2%	+1.0%	-0.3%	+52.0%	-20.5%
Utilitarian								
Walk	44.1%	53.3%	46.1%	48.5%	+1.9%	-4.8%	+4.4%	-9.0%
Auto	26.6%	20.5%	19.1%	29.3%	-7.5%	+8.8%	-28.1%	+42.9%
Transit	25.2%	21.3%	29.4%	17.2%	+4.2%	-4.1%	+16.6%	-19.4%
Bicycle	4.1%	4.9%	5.4%	5.1%	+1.3%	+0.1%	+33.0%	+2.7%
Shopping								
Walk	64.0%	65.8%	66.2%	63.6%	+2.2%	-2.1%	+3.4%	-3.2%
Auto	24.2%	23.3%	16.2%	30.3%	-7.9%	+7.0%	-32.9%	+30.1%
Transit	10.1%	6.8%	13.5%	4.5%	+3.4%	-2.3%	+33.6%	-33.6%
Bicycle	1.7%	4.1%	4.1%	1.5%	+2.4%	-2.6%	+140.5%	-63.1%

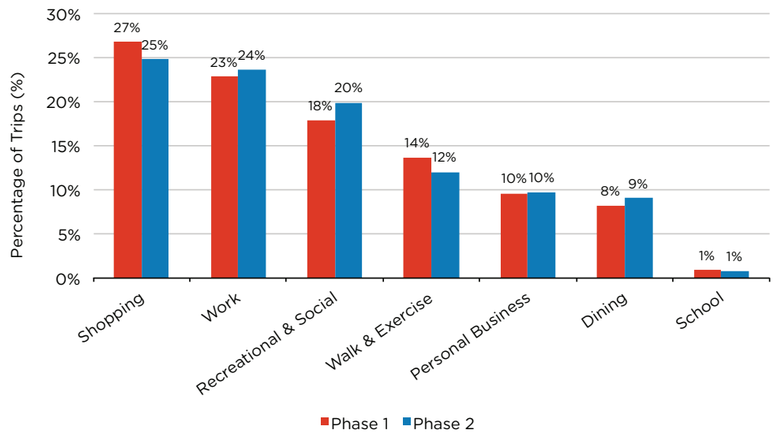

Figure 5-4. Travel Patterns: Trip purpose (all purposes) - Treatment Group A, Phase 1 & 2 (n_{p1}=665; n_{p2}=597).

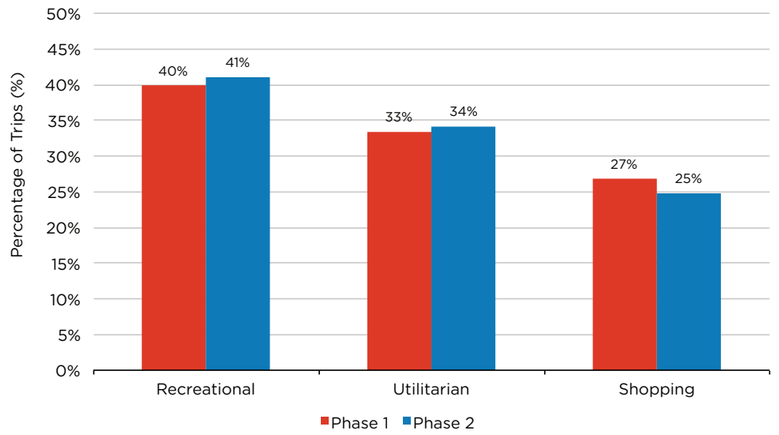

Figure 5-5. Travel Patterns: Trip purpose (recreational, utilitarian, and shopping) - Treatment Group A, Phase 1 & 2 (n_{p1}=665; n_{p2}=597).

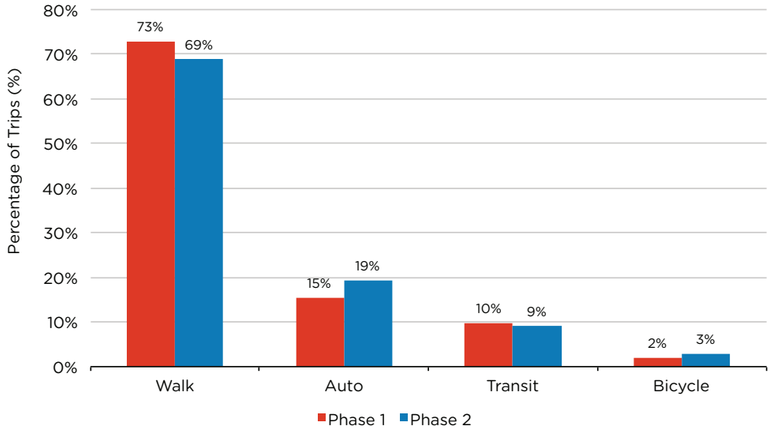

Figure 5-6a. Travel Patterns: Trip purpose by mode (recreational) - Treatment Group A, Phase 1 & 2 (n_{P1}=265; n_{P2}=244).

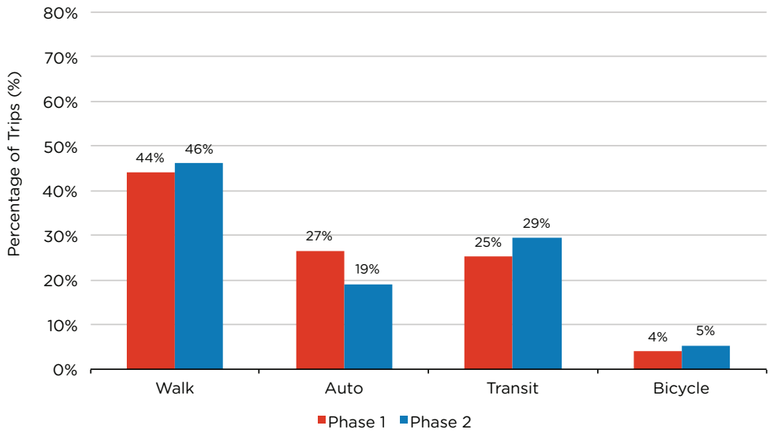

Figure 5-6b. Travel Patterns: Trip purpose by mode (utilitarian) - Treatment Group A, Phase 1 & 2 (n_{P1}=222; n_{P2}=204).

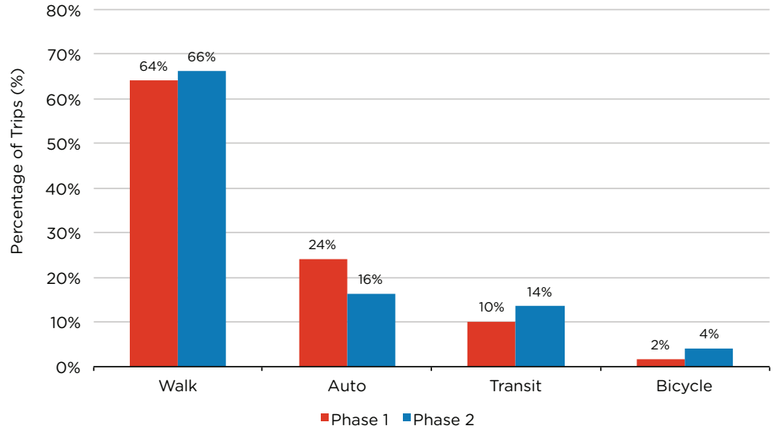

Figure 5-6c. Travel Patterns: Trip purpose by mode (shopping) - Treatment Group A, Phase 1 & 2 (n_{P1}=178; n_{P2}=148).

5.4 TRAVEL DISTANCE

5.4.1 Travel Distance: Total Distance

Mean total daily distance travelled refers to the total distance travelled averaged over the two diary days. Travel distance is estimated using the shortest path route. Results are calculated for all participants, regardless if they made a trip or not.

Overall, there was a decrease in mean total daily distance travelled from Phase 1 to 2 for participants living within one-block of the Greenway (see Figure 5-7). In Phase 1, the mean total daily distance travelled was 12.4 kilometres. In Phase 2, there was a decrease of -16.6% to 10.4 kilometres travelled. This decrease was statistically significant when compared to the Control Group, which saw an overall increase in total daily distance travelled.

Breaking down total daily distance by mode shows distinct differences.

Walk Distance:

- Walk distance travelled was the third highest out of the four modes.
- In Phase 1, total daily distance travelled was 2.0 kilometres. This decreased by -10.1% to 1.8 kilometres in Phase 2.
- Walk distance travelled followed the opposite direction in the Control Group, with a +28.2% increase for the Control from 1.4 kilometres in Phase 1 to 1.8- kilometres in Phase 2.

Auto Distance:

- Auto distance travelled was the highest out of the four modes.
- In Phase 1, total daily distance travelled was 6.3 kilometres. This decreased by -35.1% to 4.1 kilometres in Phase 2. There was a statistically significant difference when compared to the Control.
- Auto distance travelled followed the opposite direction in the Control Group, with a +33.4% increase for the Control from 5.3 kilometres in Phase 1 to 7.0 kilometres in Phase 2.

Transit Distance:

- Transit distance travelled was the second highest out of the four modes.
- In Phase 1, total daily distance travelled was 3.8 kilometres. This increased by +8.0% to 4.1 kilometres in Phase 2.
- Transit distance travelled followed the opposite direction in the Control Group, with a -23.3% decrease for the Control from 2.6 kilometres in Phase 1 to 2.0 kilometres in Phase 2.

Bicycle Distance:

- Bicycle distance travelled was the lowest out of the four modes.
- In Phase 1, total daily distance travelled was 0.3 kilometres. This increased by +15.2% to 0.4 kilometres in Phase 2.
- Bicycle distance travelled followed the same direction in the Control Group, with a +56.3% increase for the Control from 0.3 kilometres in Phase 1 to 0.4 kilometres in Phase 2.

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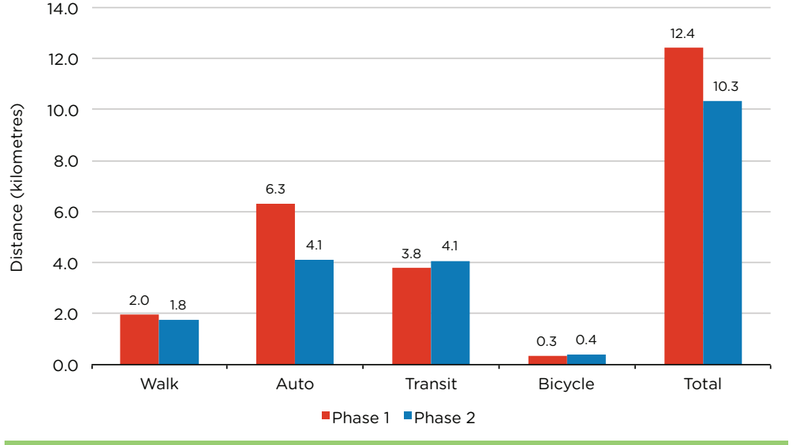

Figure 5-7a. Travel Patterns: Mean total daily distance travelled - Treatment Group A, Phase 1 & 2 (*n*=133).

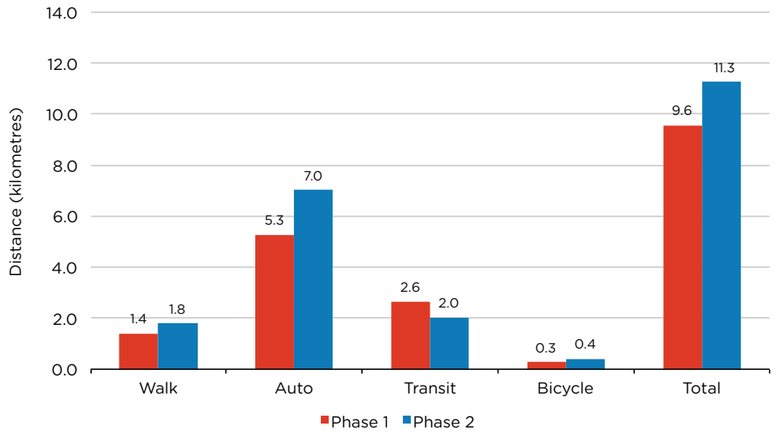

Figure 5-7b. Travel Patterns: Mean total daily distance travelled - Control Group, Phase 1 & 2 (*n*=69).

5.4.2 Travel Distance: Distance Per Trip

Mean trip distance refers to the mean distance travelled per trip. Travel distance is estimated using the shortest path route. Results are calculated for only completed trips. Results are broken down by mode (see Figure 5-8).

Walk Distance:
- Mean walk trip distance was the lowest out of the four modes.
- In Phase 1, mean trip distance was 0.9 kilometres, remaining the same in Phase 2.
- Mean walk trip distance saw an increase in the Control Group, from 0.8 kilometres in Phase 1 to 1.1 kilometres in Phase 2.

Auto Distance:
- Mean auto trip distance was the highest out of the four modes in Phase 1, dropping to second highest in Phase 2.
- In Phase 1, mean trip distance was 7.4 kilometres, decreasing to 7.1 kilometres in Phase 2.
- Mean auto trip distance also saw a decrease in the Control Group, from 5.8 kilometres in Phase 1 to 5.6 kilometres in Phase 2.

Transit Distance:
- Mean transit trip distance was the second highest out of the four modes in Phase 1, increasing to the highest in Phase 2.
- In Phase 1, mean trip distance was 6.4 kilometres, increasing to 8.4 kilometres in Phase 2.
- In contrast, mean transit trip distance remained the same in the Control Group from Phase 1 to 2 at 6.6 kilometres.

Bicycle Distance:
- Mean bicycle trip distance was the third highest out of the four modes.
- In Phase 1, mean trip distance was 3.0 kilometres, remaining the same in Phase 2.
- Mean bicycle trip distance remained the same in the Control Group as well at 2.0 kilometres.

5.0 | RESULTS: TRAVEL PATTERNS

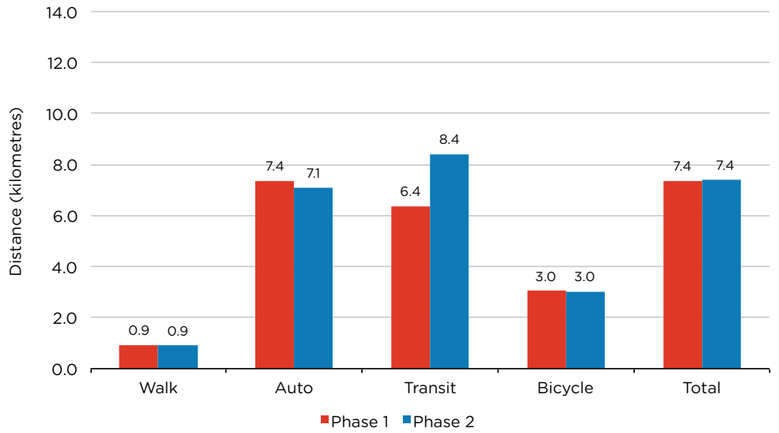

Figure 5-8a. Travel Patterns: Mean trip distance - Treatment Group A, Phase 1 & 2 (n_{Walk}=96; n_{Auto}=31; $n_{Transit}$=35; $n_{Bicycle}$=8).

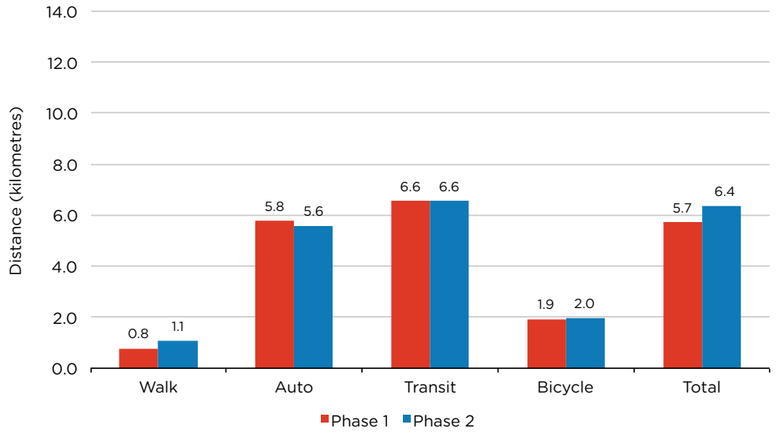

Figure 5-8b. Travel Patterns: Mean trip distance - Control Group, Phase 1 & 2 (n_{Walk}=50; n_{Auto}=26; $n_{Transit}$=7; $n_{Bicycle}$=3).

5.5 TRAVEL TIME

5.5.1 Travel Time: Total Time

Mean total travel time refers to the total travel time averaged over the two diary days. Travel time is estimated using the shortest path route based on average estimated speeds per mode. Results are calculated for all participants, regardless if they made a trip or not.

Overall, there was a decrease in mean total daily travel time from Phase 1 to 2 for participants living within one-block of the Greenway (see Figure 5-9). In Phase 1, the mean total daily travel time was 59 minutes. In Phase 2, this decreased by -12.3% to 51 minutes. This decrease was statistically significant when compared to the Control Group, which saw an overall increase in total daily distance travelled.

Breaking down total daily travel time by mode shows distinct differences.

Walk Travel Time:

- Walk travel time was the highest out of the four modes. In Phase 1, mean total daily travel time was 33 minutes. This decreased to 29 minutes in Phase 2.
- Walk travel time followed the opposite direction in the Control Group, with an increase for the Control from 23 minutes in Phase 1 to 30 minutes in Phase 2.

Auto Travel Time:

- Auto travel time was the second highest out of the four modes in Phase 1, but dropped to the third highest by Phase 2. In Phase 1, mean total daily travel time was 13 minutes. This decreased to 8 minutes in Phase 2. There was a statistically significant difference when compared to the Control.
- Auto travel time followed the opposite direction in the Control Group, with an increase for the Control from 11 minutes in Phase 1 to 14 minutes in Phase 2.

Transit Travel Time:

- Transit travel time was the third highest out of the four modes in Phase 1, but became the second highest by Phase 2. In Phase 1, mean total daily travel time was 12 minutes, remaining the same in Phase 2.
- In the Control Group, transit travel time had a decrease from 8 minutes in Phase 1 to 6 minutes in Phase 2.

Bicycle Travel Time:

- Bicycle travel time was the highest out of the four modes. In Phase 1, mean total daily travel time was 1 minute. This increased to 2 minutes in Phase 2.
- The same trend was observed in the Control Group.

5.0 | RESULTS: TRAVEL PATTERNS

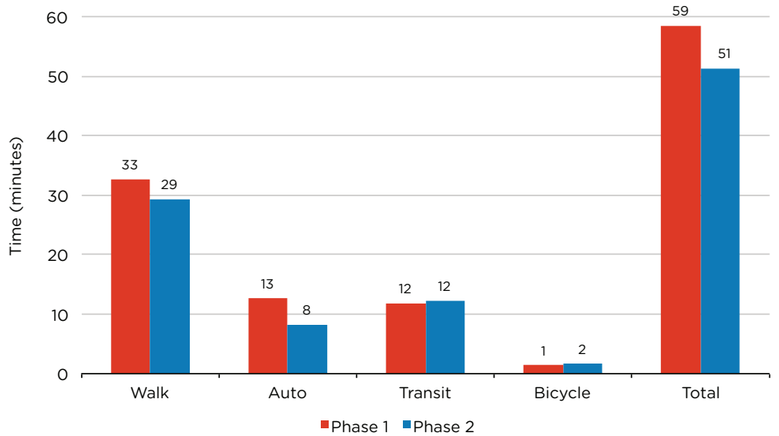

Figure 5-9a. Travel Patterns: Mean total daily travel time - Treatment Group A, Phase 1 & 2 (*n*=133).

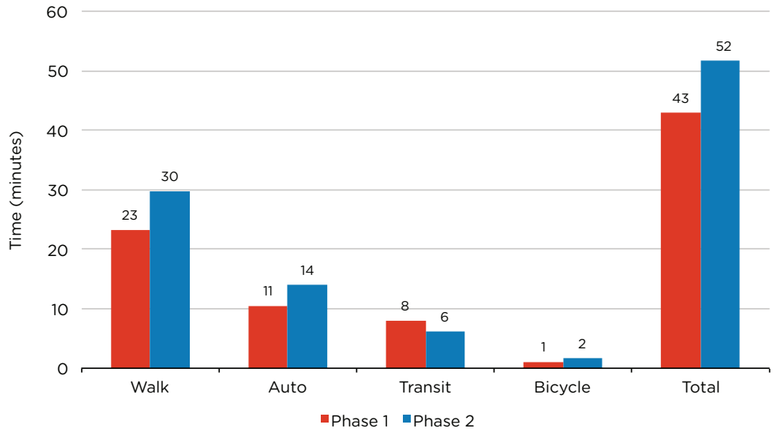

Figure 5-9b. Travel Patterns: Mean total daily travel time - Control Group, Phase 1 & 2 (*n*=69).

5.5.2 Travel Time: Time Per Trip

Mean trip travel time refers to the mean travel time per trip. Travel time is estimated using the shortest path route based on average estimated speeds per mode. Results are calculated for only completed trips. Results are broken down by mode (see Figure 5-10).

Walk Distance:
- Mean walk trip travel time was the second highest out of the four modes.
- In Phase 1, mean walk trip travel time was 16 minutes, decreasing to 15 minutes in Phase 2.
- Mean walk trip travel time followed the opposite trend in the Control Group, with an increase from 13 minutes in Phase 1 to 18 minutes in Phase 2.

Auto Distance:
- Mean auto trip travel time was the third highest out of the four modes.
- In Phase 1, mean auto trip travel time was 145minutes, decreasing to 14 minutes in Phase 2.
- Mean walk trip travel time followed the same trend in the Control Group, with a decrease from 12 minutes in Phase 1 to 11 minutes in Phase 2.

Transit Distance:
- Mean transit trip travel time was the highest out of the four modes.
- In Phase 1, mean transit trip travel time was 21 minutes, increasing to 24 minutes to Phase 2.
- Mean walk trip travel time followed the opposite trend in the Control Group, with a decrease from 23 minutes in Phase 1 to 20 minutes in Phase 2.

Bicycle Distance:
- Mean bicycle trip travel time was the lowest out of the four modes.
- In Phase 1, mean bicycle trip travel time was 12 minutes, remaining the same in Phase 2.
- Mean walk trip travel time followed the same trend in the Control Group, with a mean bicycle trip travel time of 8 minutes, remaining the same in Phase 2.

5.0 | RESULTS: TRAVEL PATTERNS

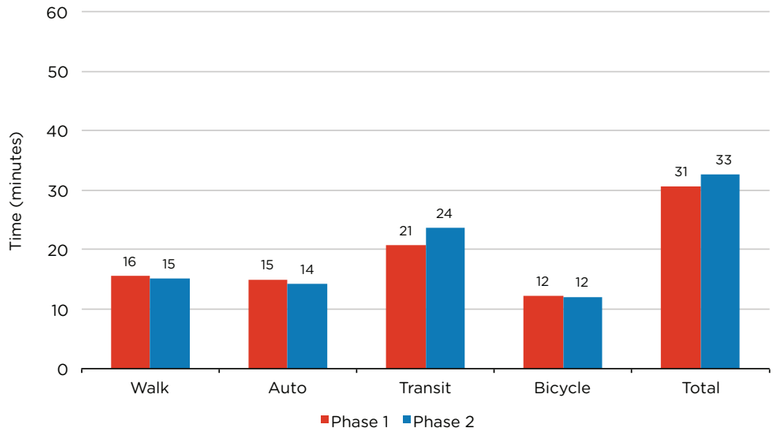

Figure 5-10a. Travel Patterns: Mean trip travel time - Treatment Group A, Phase 1 & 2 (n_{Walk}=95; n_{Auto}=30; $n_{Transit}$=35; $n_{Bicycle}$=8).

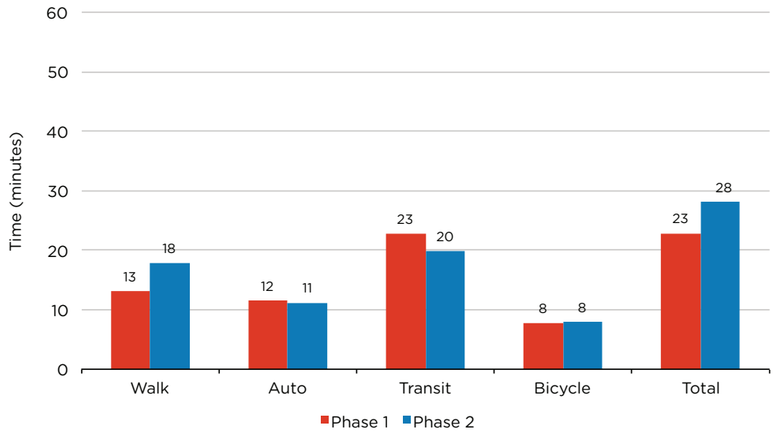

Figure 5-10b. Travel Patterns: Mean trip travel time - Control Group, Phase 1 & 2 (n_{Walk}=50; n_{Auto}=26; $n_{Transit}$=7; $n_{Bicycle}$=3).

5.6 STREET NETWORK USAGE

Estimated street network usage was generated using the shortest path route and creating an interpolated surface based on the number of trips per street segment. Analogous maps were not created for transit and cycling trips because these modes are more likely to be constrained to specific routes that are poorly reflected by a shortest-route based method (e.g., bus routes, bicycle lanes).

Walk Trips:
In Phase 1, there was generally a high concentration of trips along (see Figure 5-11):

- Denman Street;
- Davie Street;
- Sections of Comox Street;
- Sections of Barclay, Bute, and Haro Street in the northwestern area of downtown; and
- Sections of Granville Street.

In Phase 2, trips along Davie Street increased, particularly around the English Bay area (see Figure 47). On Comox Street itself, the section of Comox between Bute and Thurlow, Bidwell and Cardero, and Broughton and Jervis had notable increases in usage.

Auto Trips:
In contrast to walk trips, auto trips displayed a much more homogenous pattern, with only a small degree of clustering relative to walking trips. Comox Street saw decreased clustering for auto trips from Phase 1 to 2 (see Figure 5-12).

Comox Street:
Focusing on Comox Street, trips along the Greenway increased from Phase 1 to 2 (see Table 5-10).

- In Phase 1, there were a total of 3,678 completed trips. Of those trips, 3,271 (88.9%) of them had a trip origin or destination in downtown Vancouver. 264 (8.1%) of those downtown trips included a segment on Comox Street. These trips were made by 97 individuals, for an average of 1.36 trips per day on Comox Street.

- In Phase 2, there were a total of 3,514 completed trips. Of those trips, 3,154 (88.8%) of them were downtown trips. 261 (8.3%) of those downtown trips included a segment on Comox Street. These trips were made by 109 individuals, for an average of 1.20 trips per day on Comox Street.

For participants living on Comox Street, the number of downtown trips that included a segment on Comox Street increased 5.2%, from 57.4% (Phase 1) to 62.6% (Phase 2). All other areas saw an increase on the usage of Comox Street, except for those participants who lived 500 to 750 metres away from Comox Street.

Table 5-10. Travel Patterns: Usage of Comox Street, Phase 1 & 2.

Location of Participants	Phase 1			Phase 2		
	Number of Participants (Total)	Number of Downtown Trips	% of Downtown Trips Including a Segment on Comox Street	Number of Participants (Total)	Number of Downtown Trips	% of Downtown Trips Including a Segment on Comox Street
Facing Comox	32 (34)	223	57.4%	33 (34)	179	62.6%
1-Block from Comox	134 (136)	930	21.5%	132 (136)	842	22.1%
<250 m from Comox	214 (217)	1,430	15.6%	212 (217)	1,316	16.6%
250-500 m from Comox	230 (236)	1,419	2.8%	229 (236)	1,420	3.0%
500-750 m from Comox	59 (62)	352	0.3%	62 (62)	369	0.0%
>750 m from Comox	10 (10)	77	0.0%	10 (10)	60	1.7%

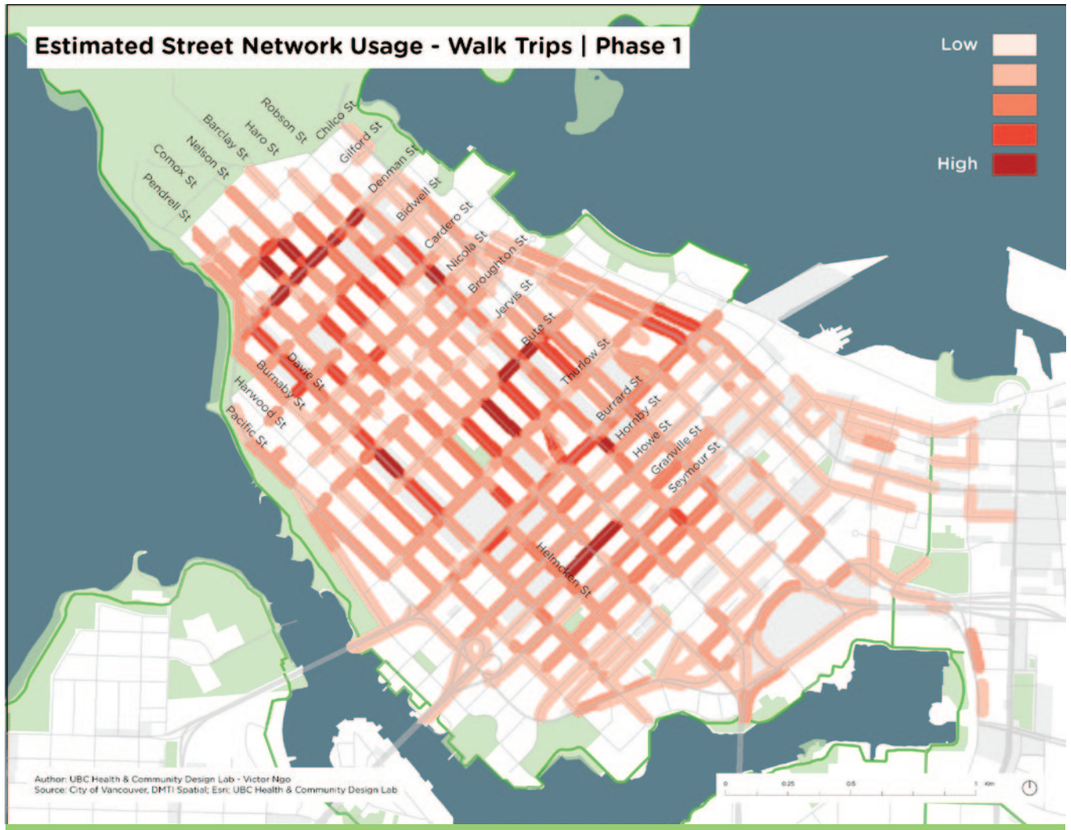

Figure 5-11a. Travel Patterns: Estimated street network usage (walk trips) - Treatment Group A, Phase 1.

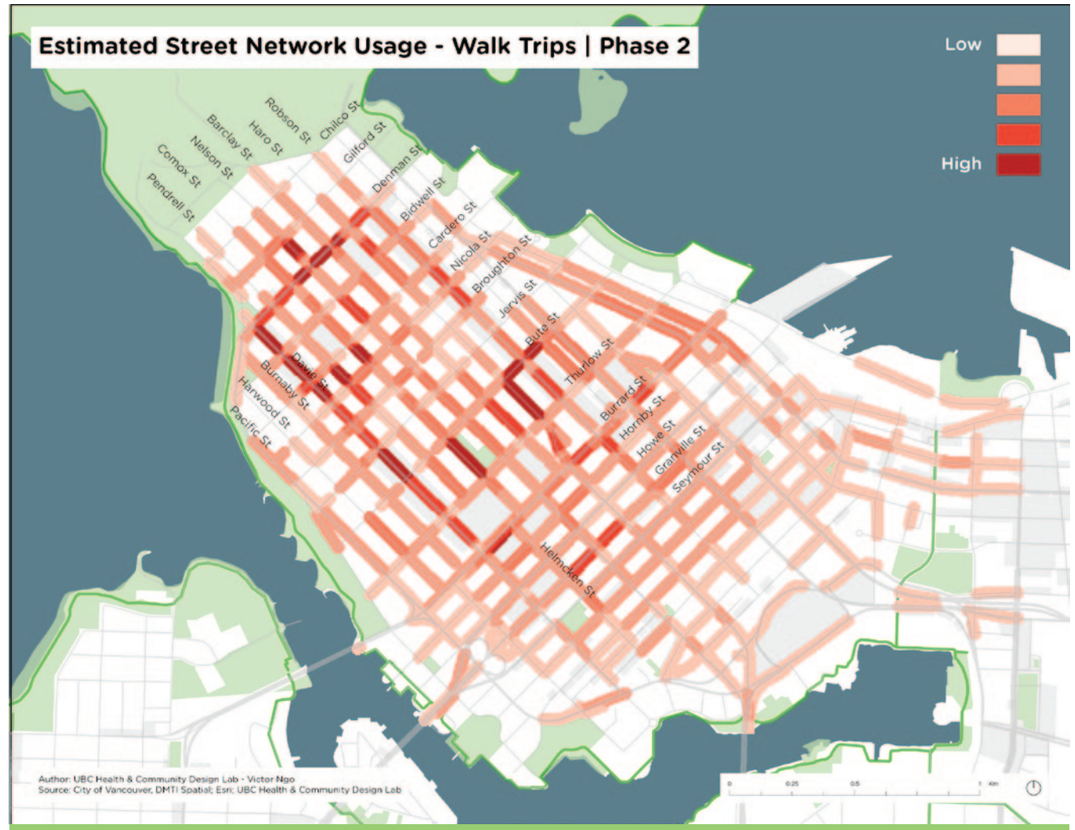

Figure 5-11b. Travel Patterns: Estimated street network usage (walk trips) - Treatment Group A, Phase 2.

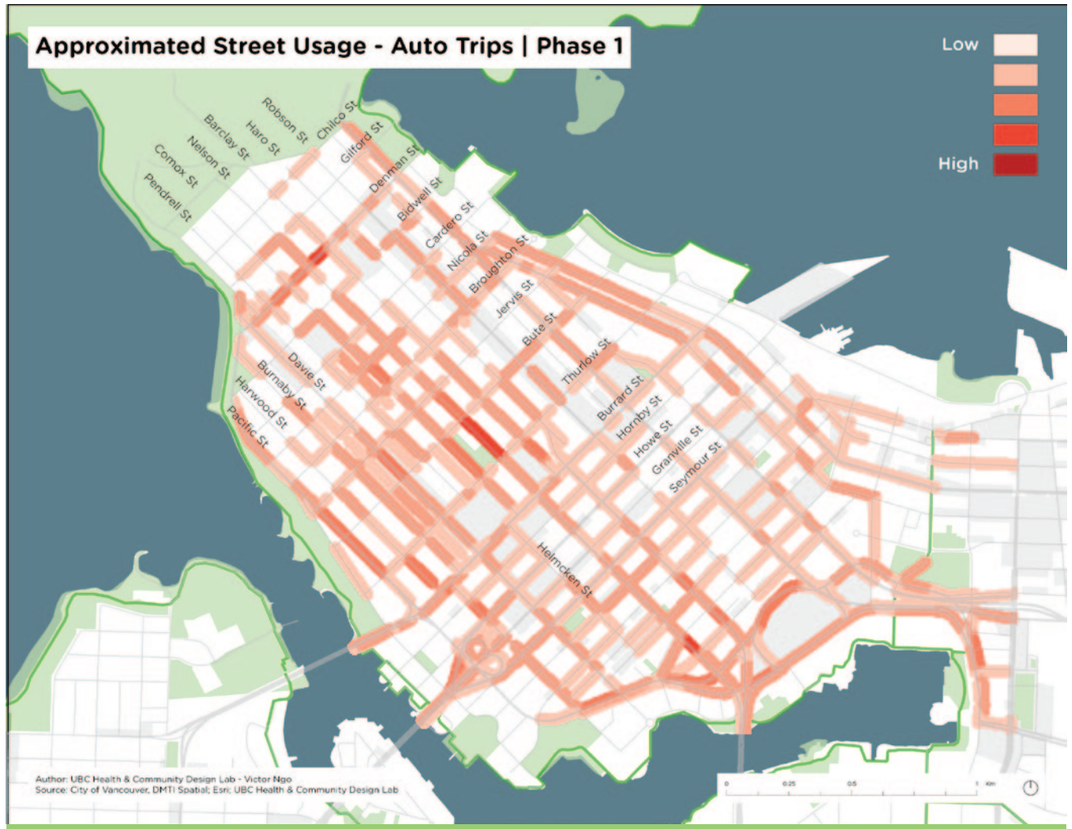

Figure 5-12a. Travel Patterns: Estimated street network usage (auto trips) - Treatment Group A, Phase 1.

5.0 | RESULTS: TRAVEL PATTERNS

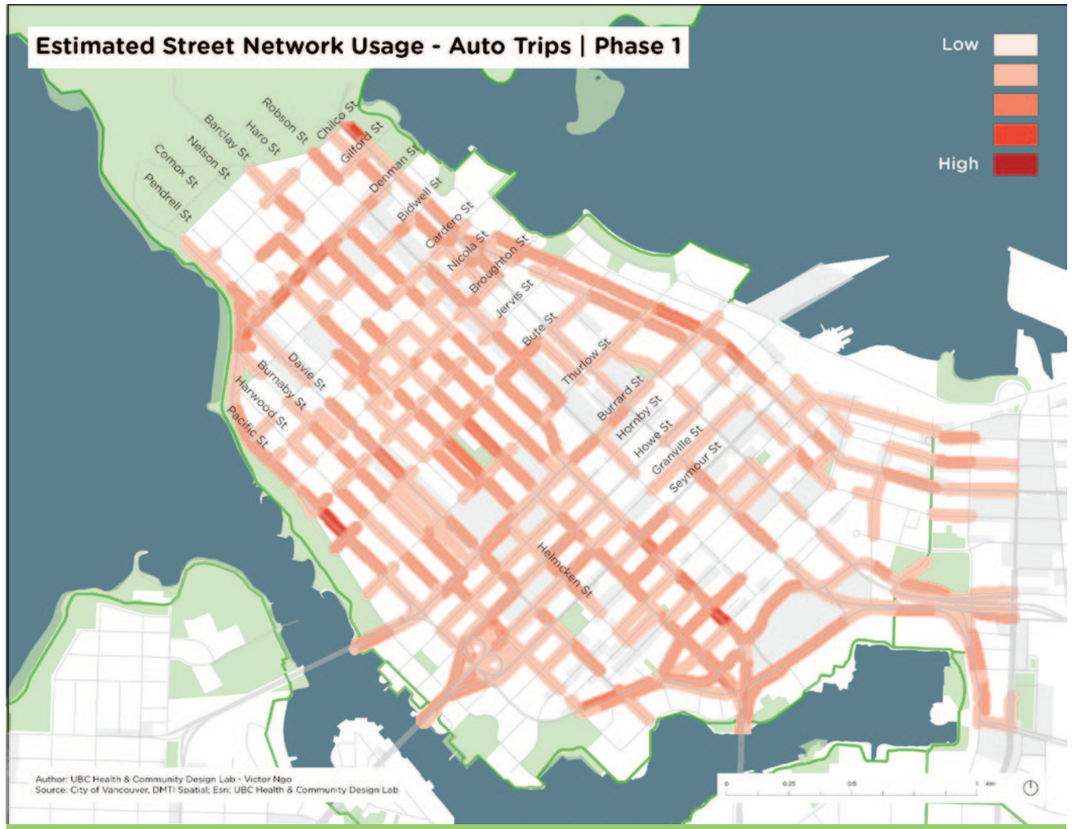

Figure 5-12b. Travel Patterns: Estimated street network usage (auto trips) - Treatment Group A, Phase 2.

6.0 POPULATION HEALTH

This section provides an overview of the changes to population health during the study period.

6.1 PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR

Two measures of physical activity saw improvement from Phase 1 to 2 (see Table 6-1:

- **Days of moderate physical**, defined as "activities that moderate physical effort and make you breathe somewhat harder than normal including carrying light loads." Examples included carrying light loads, bicycling at a regular pace, and double tennis.

- **Time spent sitting**, defined as "time spent at work, at home, while doing course work, and during leisure time." Examples included time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

The number of self-reported days of moderate physical activity increased by +16.1% from Phase 1 to 2, from 2.3 days a week to 2.7 days a week for the Treatment Group. This increase was statistically significant when compared to the Control Group (90% confidence level), which saw a -9.2% decrease in the number of self-reported days from 2.6 days a week to 2.3 days a week.

6.0 | RESULTS: POPULATION HEALTH

In addition, the time participants reported spent sitting in a week decreased by -8.0% from a mean of 7.9 hours during a week in Phase 1 to 7.2 hours during a week in Phase 2. This increase was statistically significant when compared to the Control Group, which saw a +18.5% increase in time spent sitting for participants in the control from 6.5 hours a week to 7.7 hours a week.

6.2 PHYSICAL AND MENTAL HEALTH

One measure of health saw improvement from Phase 1 to 2 (see Table 6-1):

- **Days of poor physical and mental health**, defined as days of "poor physical and mental health that kept you from doing your usual activities, such as self-care, work, or recreation."

The number of self-reported days of poor physical and mental health decreased by -9.8% from 2.3 days in the past month in Phase 1, to 2.0 days in the past month in Phase 2. This decrease was statistically significant when compared to the Control Group, which saw a +80.7% increase in the number of self-reported days of poor health from 1.9 days a month to 3.4 days a month.

Table 6-1. Population Health: Physical activity, sedentary behaviour, and physical and mental health, Phase 1 & 2 ($n_{Treatment}$=136; $n_{Control}$=72).

Health Measure	Phase 1		Phase 2		Absolute Difference		Percentage Difference	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Days of moderate physical activity (days)	2.3	2.6	2.6	2.3	+0.4	-0.2	+16.1%	-9.2%
Time spent sitting (hours)	7.9	6.5	7.2	7.7	-0.6	+1.2	-8.0%	+18.5%
Days of poor physical and mental health (days)	2.3	1.9	2.0	3.4	-0.2	+1.5	-9.8%	+80.7%

Note: **Days of moderate physical activity** = Q4.3 During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking; **Time spent sitting** = Q4.7 During the last 7 days, how much time did you spend sitting on a typical week day?; **Days of poor physical and mental health** = Q6.5 During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

7.0 SOCIAL INTERACTIONS

This section provides an overview of the changes to social interactions during the study period.

7.1 NUMBER OF PEOPLE IN TRIP PARTY

The majority of trips were made alone (see Figure 7-1). When broken down by mode in Phase 2, bicycle trips had the largest number of solo trips (87.5%), followed by transit (85.2%), walking (76.5%), and lastly auto (47.0%). Auto trips were most associated with communal travel, with the majority of trips (53.0%) in Phase 2. involving at least two people in the trip party.

The following provides a breakdown of trips that include at least two persons by mode.

Walk Trips:
- Trips with two persons form 17.5% of all walk trips in Phase 1, decreasing by -4.1% to 16.8% of trips in Phase 2.
- Trips with three to four persons form 3.9% of trips in Phase 1, increasing by +29.5% to 5.0% in Phase 2.

7.0 | RESULTS: SOCIAL INTERACTIONS

Auto Trips:
- Trips with two persons form 34.9% of all auto trips in Phase 1, increasing by +17.5% to 41.0% of trips in Phase 2.
- Trips with three to four persons form 5.9% of trips in Phase 1, increasing by +104.4%--the largest increase out of all modes—12.0% of trips in Phase 2.

Transit Trips:
- Trips with two persons form 7.7% of all transit trips in Phase 1, increasing by -84.6% to 14.2% of trips in Phase 2.
- No trips were recorded that had three to four persons in the trip party.

Bicycle Trips:
- Trips with two persons form 6.5% of all bicycle trips in Phase 1, increasing by +55.0% to 10.0% of trips in Phase 2.
- Trips with three to four persons form 3.2% of trips in Phase 1, decreasing by -22.5% to 2.5% of trips in Phase 2.

7.2 NUMBER OF PEOPLE SPOKEN WITH

The majority of trips were made without speaking with another person outside the trip party (see Figure 7-2). When broken down by mode in Phase 2, bicycle trips had the largest number of trips with social interactions (90.0%), followed by auto (80.9%), walking (67.4%), and lastly transit (48.1%). Transit trips were most associated with social interactions, with the majority of trips (51.9%) in Phase 2 involving an interaction with at least one other person outside the trip party.

The following provides a breakdown of trips that include social interaction with at least one persons by mode.

Walk Trips:
- Trips that involved interactions with one to four persons decreased from Phase 1 to 2.
- Trips that involved interactions with five or more persons saw an increase.

Auto Trips:
- Trips that involved interactions with one to four persons decreased from Phase 1 to 2.
- Trips that involved interactions with five or more persons saw an increase.

Transit Trips:
- Trips that involved interactions with two persons decreased from Phase 1 to 2.
- Trips that involved interactions with one person and three to four persons saw an increase.

Bicycle Trips:
- Trips that involved interactions with one persons decreased from Phase 1 to 2.
- Trips that involved interactions with two persons increased from Phase 1 to 2.

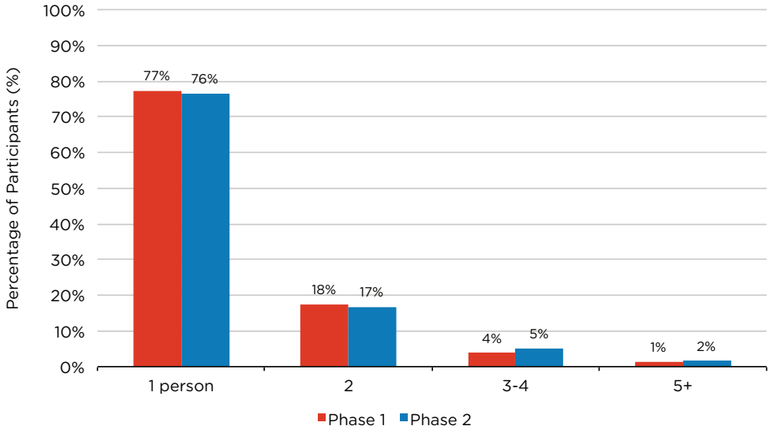

Figure 7-1a. Social Interactions: Number of people in trip party (walk) - Treatment Group A, Phase 1 & 2 (n_{P1}=617; n_{P2}=536).

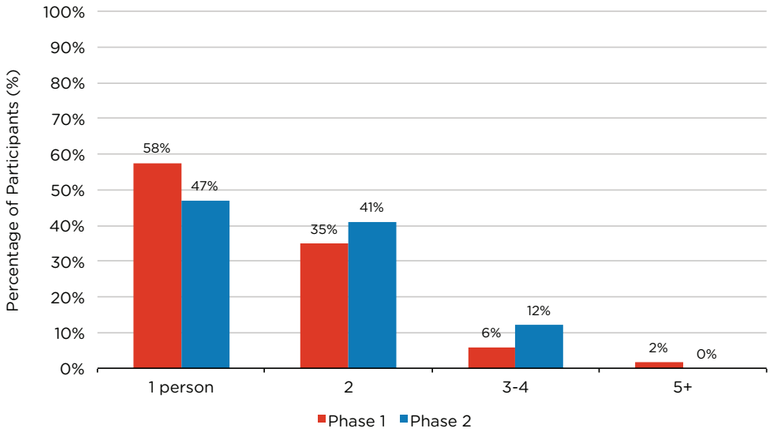

Figure 7-1b. Social Interactions: Number of people in trip party (auto) - Treatment Group A, Phase 1 & 2 (n_{P1}=238; n_{P2}=183).

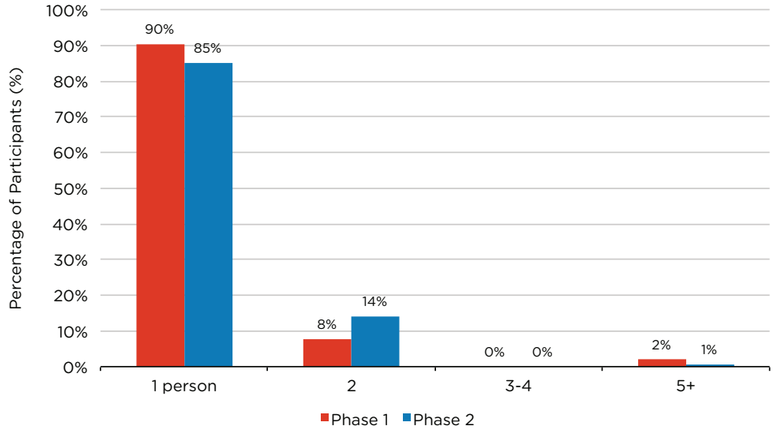

Figure 7-1c. Social Interactions: Number of people in trip party (transit) - Treatment Group A, Phase 1 & 2 (n_{P1}=156; n_{P2}=162).

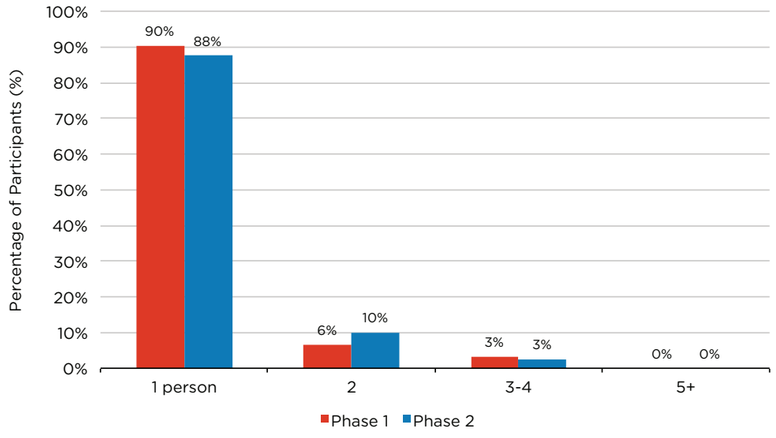

Figure 7-1d. Social Interactions: Number of people in trip party (bicycle) - Treatment Group A, Phase 1 & 2 (n_{P1}=31; n_{P2}=40).

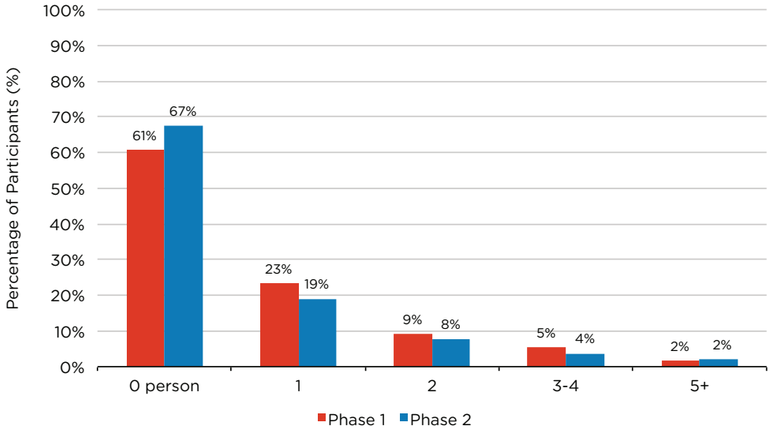

Figure 7-2a. Social Interactions: Number of people spoken with (walk) - Treatment Group A, Phase 1 & 2 (n_{P1}=617; n_{P2}=536).

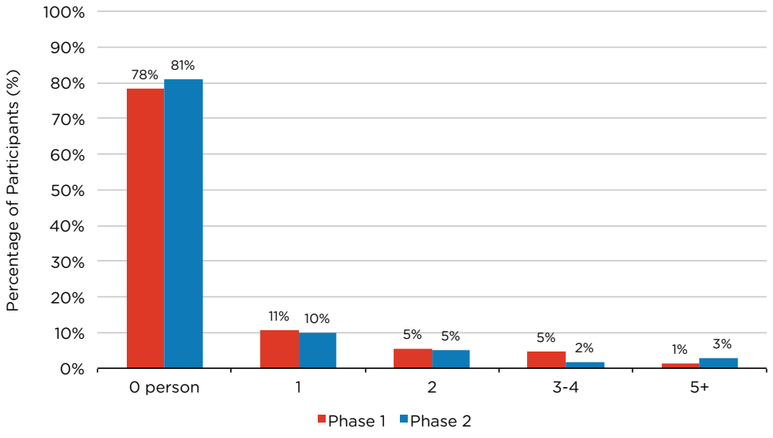

Figure 7-2b. Social Interactions: Number of people spoken with (auto) - Treatment Group A, Phase 1 & 2 (n_{P1}=238; n_{P2}=183).

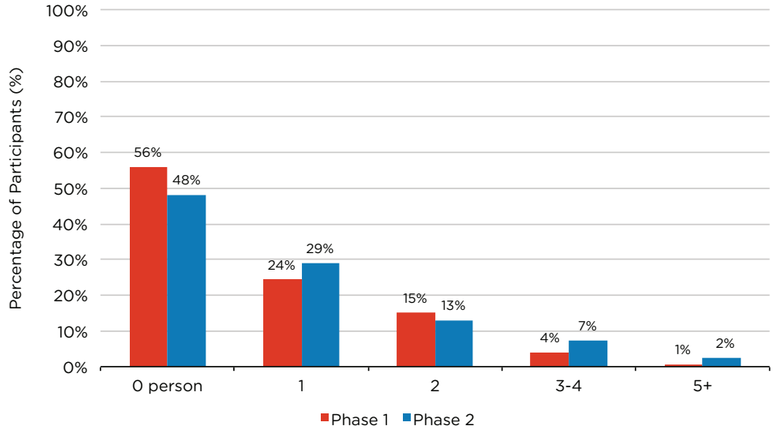

Figure 7-2c. Social Interactions: Number of people spoken with (transit) - Treatment Group A, Phase 1 & 2 (n_{P1}=152; n_{P2}=162).

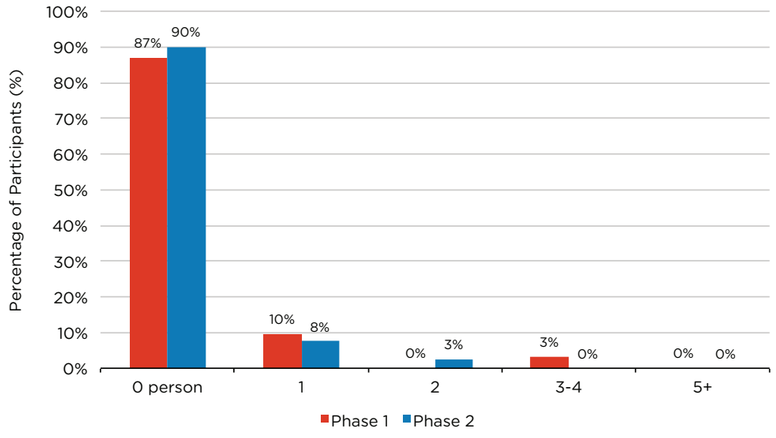

Figure 7-2d. Social Interactions: Number of people spoken with (bicycle) - Treatment Group A, Phase 1 & 2 (n_{P1}=31; n_{P2}=40).

7.3 INTERACTIONS WITH NEIGHBOURS AND STRANGERS

Socializing with neighbours: Participants for both residents living within the one-block area and those in the Control Group reported an increase in frequency in socializing with their neighbours. In Phase 1, 10.3% of participants in the one-block area reporting seeing their neighbour the day of or the day before they completed the survey. In Phase 2, this increased by +78.6% to 18.4% (see Figure 7-3).

Residents in the one-block area had a greater increase compared to the Control Group. While this increase was statistically significant (90% confidence level) from Phase 1 to 2 for both study groups, it was not significant for the Treatment Group when compared to the Control Group.

7.0 | RESULTS: SOCIAL INTERACTIONS

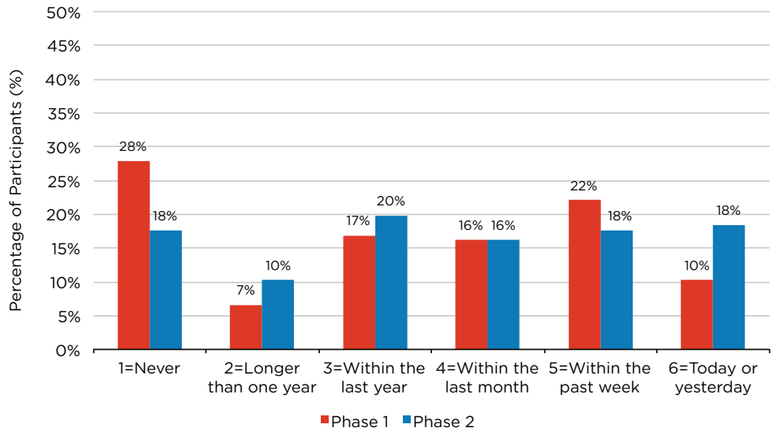

Figure 7-3a. Social Interactions: Socializing with neighbours - Treatment Group A, Phase 1 & 2 (*n*=136). *Q2.1.5: When is the last time you did the following? Socialized with your neighbour.*

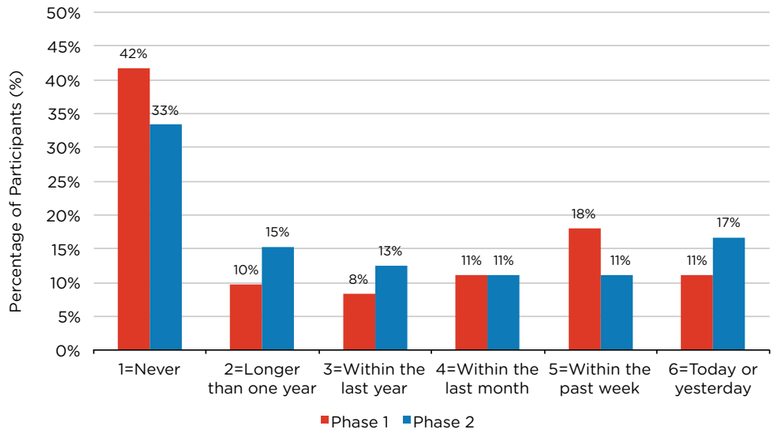

Figure 7-3b. Social Interactions: Socializing with neighbours - Control Group, Phase 1 & 2 (*n*=72). *Q2.1.5: When is the last time you did the following? Socialized with your neighbour.*

Conversations with strangers: Participants for both residents living within the one-block area and those in the Control Group reported an increase in frequency in spontaneous conversations with strangers on the street. In Phase 1, 9.6% of participants in the one-block area reporting engaging in a spontaneous conversation the day of or the day before they completed the survey. In Phase 2, this increased by +53.8% to 14.7% (see Figure 7-4).

Residents in the one-block area had a greater increase compared to the Control Group. While this increase was statistically significant (90% confidence level) from Phase 1 to 2 for both study groups, it was not significant for the Treatment Group when compared to the Control Group.

7.0 | RESULTS: SOCIAL INTERACTIONS

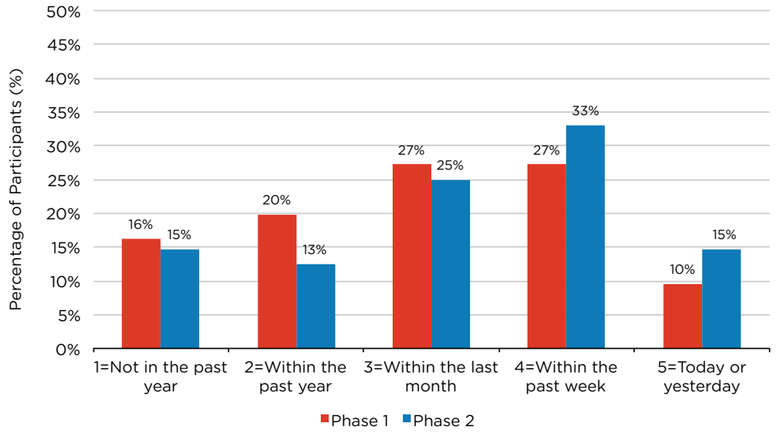

Figure 7-4a. Social Interactions: Conversations with strangers - Treatment Group A, Phase 1 & 2 (*n*=136). *Q2.4.5: How recently have you engaged in a spontaneous conversation on the street.*

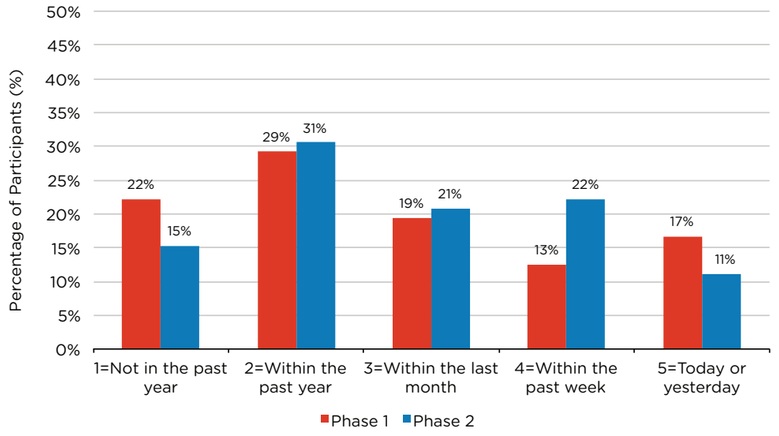

Figure 7-4b. Social Interactions: Conversations with strangers - Control Group, Phase 1 & 2 (*n*=72). *Q2.4.5: How recently have you engaged in a spontaneous conversation on the street.*

8.0 CONCLUSION

The results of the study found that the investments made to the Comox-Helmcken Greenway have generated many intended travel and health-related benefits. This is the first study of its kind in Canada to investigate the before and after impacts of an intervention such as the Comox-Helmcken improvements. The current study is also one of the first investigations to evaluate mental health and social interaction-related impacts of greenway investments in an urban setting. Findings from the study will help to inform future investments of this nature in terms of the types of features that were most effective in bringing about desired changes to travel behaviour and population health.

The study consisted of three primary methods: a Neighbourhood Profile Survey, and Trip Diary Survey, and a Built Environment Audit using the Microscale Audit of Pedestrian Spaces (MAPS) tool. In general, analysis of participants living within one-block of the Comox-Helmcken Greenway found the following when compared to participants living further than 500 metres in the Control Group:

- Increase in bicycle mode share, bicycle ownership, and perceived neighbourhood bikeability.
- Decrease in auto mode share, and decrease in mean total daily travel distance and mean total daily travel time by automobile;

- Decrease in mean total daily travel distance and mean total daily travel time;
- Increase in the usage of Comox Street across the study area, with the greatest increase observed for participants living directly on Comox Street;
- Increase in moderate physical activity, and decrease in time spent sitting (sedentary behaviour) and the number of days of poor physical and mental health; and
- No significant changes for social interaction, including the number of people spoken with on the street and socializing with strangers.

Taken collective, the Comox-Helmcken Greenway has had a positive impact on several aspects of travel and health. The results suggest that these observed changes in travel patterns, physical activity, and health-related outcomes will likely yield major benefits in terms of reductions in chronic disease including cardio-vascular disease and diabetes. All of these chronic diseases come with considerable societal costs and bring forth the prospect that the money spent on the corridor will be recovered through savings in health care expenditures. Despite this, significant work remains so that the transportation and health sectors can work more effectively together to realize saved sharings.

Future Research

- Additional work is needed to evaluate the impacts of specific microscale design features on physical activity and other health-related outcomes. For example, there is a growing awareness of the importance of seating and safe crossings for older adults. Sufficient evidence exists to begin to monetize the predicted healthcare cost savings from modest investments in streetscape amenities.
- The Travel Diary data collected holds many promising uses. For example, it is possible to develop a link-based, speed-sensitive, emissions modeling methodology that captures the instantaneous rate of emissions for both criteria air pollutants and greenhouse gas emissions.
- Further analysis using advanced statistical modeling procedures will be applied in future manuscripts where logistical regression and other structural modeling tools are helpful.

9.0 | REFERENCES

9.0 REFERENCES

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Welcome to our Survey about You and Your Neighbourhood

Why this information is important: The UBC research team and the City's planners need up-to- date information to design more optimal neighbourhoods. To do this, they need to better understand the characteristics of people in the neighbourhood, people's activity levels and how they feel about their neighbourhood in terms of access to services, amenities, safety, etc.. Thank you for contributing your candid answers to our questions. (All information is strictly confidential and will be reported only in aggregate form.)

1. Section 1: Your Neighborhood

We would like to know more information about the way that you perceive or think about your neighborhood.

1.1. Stores, facilities, and other places in your neighborhood

About how long would it take to get from your home to the nearest businesses or facilities listed below if you walked to them (or if in a wheelchair)? Please choose one answer for each business or facility type.

	1 1-5 min	2 6-10 min	3 11-20 min	4 21-30 min	5 31+ min	Don't know/ Not applicable
1. Your job (IF EMPLOYED)						
2. Your school (IF ATTENDING)						
3. Supermarket/ grocery store						
4. Fruit/vegetable market						
5. Hardware store						
6. Laundry/dry cleaners						
7. Clothing store						
8. Postal station/ post office						
9. Library						
10. Nearest school						
11. Book store						
12. Fast food restaurant/take-out						
13. Coffee place						
14. Sit down restaurant						
15. Pharmacy/drug store						
16. Salon/barber shop						
17. Transit stop (bus, train)						
18. Public park						
19. Neighbourhood community centre						
20. Gym or fitness facility						

1.2. Access to Services

Please select the answer that best applies to you and your neighborhood. Both local and within walking distance mean within a 10-15 minute walk from your home (or if in a wheelchair).

	1 Strongly disagree	2 Somewhat disagree	3 Somewhat agree	4 Strongly agree
1. I can do most of my shopping at local stores.				
2. Stores are within easy walking distance of my home.				
3. Parking is difficult in local shopping areas.				
4. There are many places to go within easy walking distance of my home.				
5. It is easy to walk to a transit stop (bus, train) from my home.				

1.3. Places for walking and cycling

Please select the answer that best applies to you and your neighborhood.

	1 Strongly disagree	2 Somewhat disagree	3 Somewhat agree	4 Strongly agree
1. There are walkways in my neighbourhood that connect streets where cars cannot go.				
2. The sidewalks in my neighborhood are well maintained (paved, even, and not a lot of cracks).				
3. There are bicycle routes in or near my neighborhood that are easy to get to.				
4. Sidewalks are separated from the road/traffic in my neighborhood by parked cars.				
5. There is a grass/dirt strip that separates the streets from the sidewalks in my neighborhood.				

1.4. Neighborhood surroundings

Please select the answer that best applies to you and your neighborhood.

	1 Strongly disagree	2 Somewhat disagree	3 Somewhat agree	4 Strongly agree
1. There are trees along the streets in my neighborhood.				
2. Trees give shade for the sidewalks in my neighborhood.				
3. There are many interesting things to look at while walking in my neighborhood.				
4. My neighborhood is generally free from litter.				
5. There are many attractive natural sights in my neighborhood (such as landscaping, views).				
6. There are attractive buildings/homes in my neighborhood.				

1.5 Safety from traffic

Please select the answer that best applies to you and your neighborhood.

	1 Strongly disagree	2 Somewhat disagree	3 Somewhat agree	4 Strongly agree
1. There is so much traffic along the street I live on that it makes it difficult or unpleasant to walk in my neighborhood.				
2. There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood.				
3. The speed of traffic on the street I live on is usually slow (50 kph or less).				
4. The speed of traffic on most nearby streets is usually slow (50 kph or less).				
5. Most drivers drive too fast while driving in my neighborhood.				
6. There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood.				
7. The crosswalks in my neighborhood help walkers feel safe crossing busy streets.				
8. When walking in my neighborhood, there are a lot of exhaust fumes (such as from cars, buses).				

1.6 Safety from crime

Please select the answer that best applies to you and your neighborhood.

	1 Strongly disagree	2 Somewhat disagree	3 Somewhat agree	4 Strongly agree
1. My neighborhood streets are well lit at night.				
2. Walkers and bikers on the streets in my neighborhood can be easily seen by people in their homes.				
3. I see and speak to other people when I am walking in my neighborhood.				
4. There is a high crime rate in my neighborhood.				
5. The crime rate in my neighborhood makes it unsafe to go on walks during the day.				
6. The crime rate in my neighborhood makes it unsafe to go on walks at night.				

APPENDIX A: NEIGHBOURHOOD PROFILE SURVEY

City of Vancouver/UBC — Downtown Residents Study
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Survey about You and Your Neighbourhood

1.7 Neighborhood satisfaction

Below are things about your neighborhood with which you may or may not be satisfied. Using the 1-5 scale below, indicate your satisfaction with each item by choosing a number on the scale. Please be open and honest in your responding.

How satisfied are you with…	1 Not at all satisfied	2	3	4	5 Very satisfied	Not Applicable
1. the number of pedestrian cross-walks in your neighborhood ?						
2. the access to public transportation in your neighborhood?						
3. your commuting time to work/school?						
4. the access to shopping in your neighborhood?						
5. how many friends you have in your neighborhood?						
6. the number of people you know in your neighborhood?						
7. how easy and pleasant it is to walk in your neighborhood?						
8. how easy and pleasant it is to bicycle in your neighborhood?						
9. the quality of schools in your neighborhood?						
10. access to entertainment in your neighborhood (restaurants, movies, clubs, etc.)?						
11. the safety from threat of crime in your neighborhood?						
12. the amount and speed of traffic in your neighborhood?						
13. the noise from traffic in your neighborhood?						
14. the number and quality of food stores in your neighborhood?						
15. the number and quality of restaurants in your neighborhood?						
16. your neighborhood as a good place to raise children?						
17. your neighborhood as a good place to live?						

1.8 Noise

Thinking about the last 12 months, what number from zero to ten best corresponds to how much you are bothered, disturbed or annoyed by the following types of noise in your neighbourhood? Please choose a number on the 0 to 10 point scale below to represent your feelings.

	Not at all bothered										Extremely bothered
1. Road traffic noise on the street	0	1	2	3	4	5	6	7	8	9	10
2. Noise from people on the street	0	1	2	3	4	5	6	7	8	9	10

Section 2: Community Interactions

We would like to learn more about the way that you interact with and view your community.

2.1 Interactions with Neighbors

When is the last time you did the following? *(Select one answer per statement.)*

When is the last time you:	**1 Never**	**2 Within the last year**	**3 Within the last month**	**4 Within the past week**	**5 Today or yesterday**
1. Acknowledged a neighbour (e.g. waved, smiled, nodded)					
2. Said hello to a neighbour					
3. Stopped and had a conversation with a neighbour					
4. Attended a neighbourhood social event (such as a block party, potluck dinner, etc.)					
5. Socialized with your neighbour					
6. Asked a neighbour for help or advice					
7. Borrowed something from or exchanged favours with a neighbour					

8. Do you know the first names of at least two of your immediate neighbours? Yes → SKIP TO SECTION 2.3 No → ASK SECTION 2.2

2.2 Reasons for Not Knowing Neighbours

IF NO TO Q8 ABOVE: Please choose the answer that best applies for each of the following:

I do not know some of my neighbors very well because…	**1 Strongly disagree**	**2 Somewhat disagree**	**3 Somewhat agree**	**4 Strongly agree**
1. I seldom see them.				
2. We have little interest in knowing each other.				
3. There is a language barrier.				
4. People move in and out too frequently.				

APPENDIX A: NEIGHBOURHOOD PROFILE SURVEY

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2.3 Community Engagement

Please choose the answer that best applies for each of the following:	**1 Strongly disagree**	**2 Somewhat disagree**	**3 Somewhat agree**	**4 Strongly agree**
1. I would be willing to work together with others on something to improve the living environment of my neighbourhood.				
2. Living in my neighbourhood gives me a sense of community.				
3. It is easy to make friends in my neighbourhood.				

2.4 Frequency of Community Activities

Thinking about <u>the past 12 months,</u> how recently have you:	**1 Never**	**2 Within the last year**	**3 Within the last month**	**4 Within the past week**	**5 Today or yesterday**
1. Visited your local library, community centre or recreation centre					
2. Participated in a neighbourhood or community project					
3. Attended a neighbourhood or community meeting					
4. Attended a city council or school board meeting					
5. Engaged in a spontaneous conversation on the street					

6. Where do you interact with people from your community (includes store staff as well as local residents)? *Choose all that apply.*
   - □ Community/recreation centre/library
   - □ Public parks and outdoor recreation space
   - □ Commercial sites
   - □ Private residence
   - □ Streets/sidewalks

3. Section 3: Your Travel Preferences & Usage

3.1 Please rank the following modes of transportation based on your preference.

	1 Least preferred	2	3	4 Most preferred
1. Walking				
2. Biking				
3. Driving or being driven (including taking a taxi)				
4. Taking public transportation (including HandyDart)				

3.1.1 Are there any other modes of transportation you prefer more? IF YES: Please list other preferred mode(s) you use here: **3.1.2** Is this your most preferred mode?				

3.2 Please rank the following modes of transportation based on how frequently you use them.

	1 Least frequent	2	3	4 Most frequent
1. Walking				
2. Biking				
3. Driving or being driven (including taking a taxi)				
4. Taking public transportation (including HandyDart)				

3.2.1 Are there any other mode(s) you use regularly? ?
IF YES: Please list other mode(s) you regularly use here:
3.2.2 Is this your most frequently used mode?

APPENDIX A: NEIGHBOURHOOD PROFILE SURVEY

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Section 4: Your Physical Activity

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities, if any, that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

4.1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling? Do not include walking.
_____days per week
□No vigorous physical activities →*Skip to question 4.3*

4.2. How much time did you usually spend doing vigorous physical activities on one of those days?
_____hours per day
_____minutes per day
□ Don't know/Not sure

Think about all the **moderate** activities, if any, that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

4.3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
_____days per week
□ No moderate physical activities →*Skip to question 4.5*

4.4. How much time did you usually spend doing moderate physical activities on one of those days?
_____hours per day
_____minutes per day
□ Don't know/Not sure

Think about the time you spent **walking**, if any, in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

4.5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
_____days per week
□ No walking → *Skip to question 4.7*

4.6. How much time did you usually spend walking on one of those days?
_____hours per day
_____minutes per day
□ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

4.7. During the last 7 days, how much time did you spend sitting on a typical week day?
_____hours per day
_____minutes per day
□ Don't know/Not sure

Section 5: About you

This section is crucial to the data analysis and will help better understand the needs of different types of residents. Be assured all information is strictly confidential.

5.1 What is your age? ____

5.2 What is your gender?
- □ Male
- □ Female
- □ Other

5.3 What is your race? (Mark all that apply.)
- □ White
- □ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
- □ Chinese
- □ Black
- □ Filipino
- □ Latin American
- □ Arab
- □ Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc.)
- □ West Asian (e.g., Iranian, Afghan, etc.)
- □ Korean
- □ Japanese
- □ Other (Please specify):

_____

5.4 How tall are you without shoes (in inches)? _____

5.5 How much do you weigh without shoes on (in pounds)? _____

5.6 What is the highest level of education that you have completed?
- □ Grade 8 or lower (Québec: Secondary II or lower)
- □ Some high school/secondary school
- □ Completed high school/secondary school
- □ Some college or vocational training
- □ Completed college or university (bachelor's degree)
- □ Completed graduate or professional degree (master's degree or doctorate)

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5.7 Are you currently: (Select all that apply)
- □ Employed for pay (full-time or part-time)
- □ Attending school
- □ Retired
- □ Homemaker
- □ Unemployed

5.8 What type of residence do you live in? (Select one.)
- □ Single-family (detached) house
- □ Single-family (attached) house – such as duplexes, townhouses, and row houses
- □ Laneway house (home built in the backyard of single-family houses, next to the back alley or lane)
- □ Low-rise apartment (less than 5 storeys)
- □ High-rise apartment (5 or more storeys)
- □ Mixed-use apartment (commercial shops on the bottom, and residential units on top)
- □ Other (please specify): _____

5.9 Do you own or rent your home?
- □ Own
- □ Rent
- □ Other (e.g., rent-free)

5.10 Do you own a motorized vehicle (car, van, truck, motorcycle, street scooter)?
- □ Yes
- □ No

5.11 Are you part of a car sharing cooperative (such as Modo, ZipCar, etc.)?
- □ Yes
- □ No

5.12 Do you own a bicycle?
- □ Yes
- □ No

5.13 How long have you lived at this address?
___ # years or ☐ Less than a year

5.14 How many people (including yourself) live in your household? _____

5.15 How many, if any, are children under 18? #___

City of Vancouver/UBC — Downtown Residents Study Mustel Research Group

Survey about You and Your Neighbourhood

Section 6: Your Health

We would like to learn more about the way you view your health, and will ask you about such things as physical activity, social relationships and health status. By health, we mean not only the absence of disease or injury but also physical, mental and social well-being.

6.1 In general, how would you rate your…

	1 Poor	2 Fair	3 Good	4 Very good	5 Excellent
1. physical health					
2. physical fitness					
3. mental health					

6.2 Using a scale of 0 to 10, where 0 means "very dissatisfied" and 10 means "very satisfied", how do you feel about your life as a whole right now?

Very Dissatisfied 0 1 2 3 4 5 6 7 8 9 10 Very Satisfied

This is important data to better understand the characteristics of residents in this neighbourhood. Be assured all information is strictly confidential.

6.3 Thinking about your physical health, for how many of the past 30 days was your physical health not good? _____days (0-30)

6.4 Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good? _____days (0-30)

6.5 During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation? _____days (0-30)

6.6 Do you have any of the following chronic health conditions? (A chronic health condition is a long-term condition which is expected to last or has already lasted 6 months or more and that has been diagnosed by a doctor or health professional.) *(Select all that apply.)*

- □ Asthma
- □ Chronic bronchitis, emphysema or chronic obstructive pulmonary disease or COPD
- □ High blood pressure
- □ Heart disease
- □ Diabetes
- □ Cancer
- □ Arthritis
- □ Fibromyalgia
- □ Back problems, excluding fibromyalgia and arthritis
- □ Depression, bipolar disorder, mania or dysthymia
- □ Migraine headaches
- □ Environmental allergies (not food or medicine-related)
- □ Other (please specify): _____ _____

Thank you very much for your input.

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Diary TAKE-ALONG SHEET — Day 1

Start at Midnight on: Assigned #1 Day of week: _____ (Month/Date) _____ PIN #: _____

INSTRUCTIONS: Think of **a trip** as **a recreational trip** with no destination (out for a walk, exercise, dog walk, etc.) **OR one-way travel to a destination** for a trip purpose. See Examples at bottom of page.

Note: **Transferring between modes** is part of same trip.

Where did you start on DAY 1? CHECK ONE: ☐ HOME ☐ WORK ☐ OTHER Metro Vancouver location ☐ OUT OF TOWN or STAYED HOME ALL DAY → Leave DAY 1 blank, Turn over for DAY 2

RECORD START: (2 nearby cross streets) _____ and _____ & Municipality _____

Where did you go first/next? DAY 1 **END location** Write in HOME **or** WORK **or** 2 nearby cross streets & Municipality	**TRIP 1** I went to:	**TRIP 2** I went to:	**TRIP 3** I went to:	**TRIP 4** I went to:	**TRIP 5** I went to:
Location type code **1.** House/apt. **4.** School/daycare **8.**Indoor rec/gym **2.** Office building **5.** Hospital **9.**Airport/BC ferries **3.** Outdoor rec (park, beach, golf, etc.) **6.** Store/mall **10.**Other (describe) **7.** Restaurant/theatre	Location code:	Location code:	Location code:	Location code:	Location code:
Main trip purpose *(choose one)* **7**. Shopping **8.** Dining **1.** To walk/exercise **4**. School **9**.Pick up/drop off someone **2**. Work **5.** Recreational/social/entertainment **3.** Going HOME **6.** Personal business (bank, dentist, etc.)	Purpose:	Purpose:	Purpose:	Purpose:	Purpose:
Modes of travel *(List all in order taken)* **1.** Walked **5.** SkyTrain **8.**False Creek Ferry/Aqua Bus **2.** Auto-driver **6.** SeaBus **9.** Bicycle **3.** Auto-passenger **7.** School bus **10.** Taxi **4.** Transit bus/Community shuttle **11.** Other (describe)	Travelled by:	Travelled by:	Travelled by:	Travelled by:	Travelled by:
Start time (RECORD TIME within 5 min.)	_____ AM _____PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM
Arrival time (RECORD TIME within 5 min.)	_____ AM _____PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM
No. of People: **# In your trip party** *including yourself*: **# Others you spoke to on the street** *(not in trip party)*: **Who you spoke with:** *(List all that apply)* **1.**No one **2.**My party **3.**Co-worker **4.**Neighbour **5.**Vendor **6.**Friend/acquaintance **7.**Driver personnel **8.**Stranger **9.**Other	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:
IF ORIGIN or DESTINATION is in Downtown Peninsula (west of Main Street), please record: **Downtown route you travelled along** *List Downtown streets, alleys, parks on your route in order taken.*	Route in order:	Route in order:	Route in order:	Route in order:	Route in order:
Did you make another trip today?	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Trip 6+ Print extra

Mustel Research Group: Email: DTRstudy@mustelgroup.com Tel: 604-677-1084 WHEN ALL TRIPS COMPLETED, **PLEASE ENTER ONLINE** www.downtownresidentstudy.com

Examples:		
TRIP #1: Home to school (dropping off child is one trip.)	TRIP #1: Home to coffee shop (stop on way to work is one trip)	TRIP #1: Home to home (walking for exercise only with no destination)
TRIP #2: School to shopping (shopping is another trip.)	TRIP #2: Coffee shop to work (continue to work is a separate trip)	**Transferring** between modes example: walk, bus, walk
	TRIP #3: Work to home (returning home is one trip.)	

Diary TAKE-ALONG SHEET — Day 2

Start at Midnight on: Assigned #2 Day of week: _____ (Month/Date) _____ PIN #: _____

INSTRUCTIONS: Think of **a trip** as **a recreational trip** with no destination (out for walk, exercise, dog walk, etc.) **OR one-way travel to a destination** for a trip purpose. See Examples at bottom of page.

Note: **Transferring between modes** is part of same trip.

Where did you start on DAY 2? CHECK ONE: ☐ HOME ☐ WORK ☐ OTHER Metro Vancouver location ☐ OUT OF TOWN or STAYED HOME ALL DAY → Leave DAY 2 blank

RECORD START: (2 nearby cross streets) _____ and _____ & Municipality _____

Where did you go first/next? DAY 2 **END location** Write in HOME **or** WORK **or** 2 nearby cross streets & Municipality	**TRIP 1** I went to:	**TRIP 2** I went to:	**TRIP 3** I went to:	**TRIP 4** I went to:	**TRIP 5** I went to:
Location type code **1.** House/apt. **4.** School/daycare **8.**Indoor rec/gym **2.** Office building **5.** Hospital **9.**Airport/BC ferries **3.** Outdoor rec (park, beach, golf, etc.) **6.** Store/mall **10.**Other (describe) **7.** Restaurant/theatre	Location code:	Location code:	Location code:	Location code:	Location code:
Main trip purpose *(choose one)* **7**. Shopping **8.** Dining **1.** To walk/exercise **4**. School **9**.Pick up/drop off someone **2**. Work **5.** Recreational/social/entertainment **3.** Going HOME **6.** Personal business (bank, dentist, etc.)	Purpose:	Purpose:	Purpose:	Purpose:	Purpose:
Modes of travel *(List all in order taken)* **1.** Walked **5.** SkyTrain **8.**False Creek Ferry/Aqua Bus **2.** Auto-driver **6.** SeaBus **9.** Bicycle **3.** Auto-passenger **7.** School bus **10.** Taxi **4.** Transit bus/Community shuttle **11.** Other (describe)	Travelled by:	Travelled by:	Travelled by:	Travelled by:	Travelled by:
Start time (RECORD TIME within 5 min.)	_____ AM _____PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM
Arrival time (RECORD TIME within 5 min.)	_____ AM _____PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM	_____ AM _____ PM
No. of People: **# In your trip party** *including yourself*: **# Others you spoke to on the street** *(not in trip party)*: **Who you spoke with:** *(List all that apply)* **1.**No one **2.**My party **3.**Co-worker **4.**Neighbour **5.**Vendor **6.**Friend/acquaintance **7.**Driver personnel **8.**Stranger **9.**Other	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to:____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:	# in party: ____ # others spoke to: ____ Who you spoke with:
IF ORIGIN or DESTINATION is in Downtown Peninsula (west of Main Street), please record: **Downtown route you travelled along** *List Downtown streets, alleys, parks on your route in order taken.*	Route in order:	Route in order:	Route in order:	Route in order:	Route in order:
Did you make another trip today?	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Go to next column	☐ NO Last trip of day ☐ YES Trip 6+ Print extra

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Examples:		
TRIP #1: Home to school (dropping off child is one trip.)	TRIP #1: Home to coffee shop (stop on way to work is one trip)	TRIP #1: Home to home (walking for exercise only with no destination)
TRIP #2: School to shopping (shopping is another trip.)	TRIP #2: Coffee shop to work (continue to work is a separate trip)	**Transferring** between modes example: walk, bus, walk
	TRIP #3: Work to home (returning home is one trip.)	

APPENDIX B: TRIP DIARY SURVEY

MAPS Survey

Entry 1: ID# _____ Date: _____

Entry 2: ID# _____ Date: _____

Date _____ Auditor ID# _____

Route # _____

Start Time: _____

End Time: _____

Route:

Section: Land use/destinations

Count both sides of the street

1. How is audit information collected?
   - ☐ Foot (walked route)
   - ☐ Auto (drove route)
   - ☐ Both (walked & drove route)

2. What parking facilities are present?
   Check all that apply
   - ☐ None
   - ☐ On-street, parallel or angled parking
   - ☐ Small lot or garage (< 30 spaces)
   - ☐ Medium to large lot or garage

3. What types of residential uses?
   Check all that apply
   - ☐ Single family houses
   - ☐ Multi-unit homes (duplex, 4-plex, row house)
   - ☐ Apartments or condominiums
   - ☐ Apartments above street retail
   - ☐ Retirement/senior living facility
   - ☐ Other (mobile home, dormitory)
   - ☐ None

4. How many of the non-residential buildings are adjacent to the pedestrian walkway or sidewalk and/or street?
   (Adjacent to sidewalk and street means that there is not a yard, parking lot or other space blocking entrances between the sidewalk and the building)
   - ☐ 0%
   - ☐ 1-33% ☐ 34-66%
   - ☐ 67-99% ☐ 100%
   - ☐ N/A (all residential buildings)
   - ☐ N/A (no pedestrian walkway/sidewalk)

5. How many of the non-residential buildings have parking lots or drives between the pedestrian walkway or sidewalk along the street and their entrances?
   - ☐ 0%
   - ☐ 1-33% ☐ 34-66%
   - ☐ 67-99% ☐ 100%
   - ☐ N/A (all residential buildings)
   - ☐ N/A (no pedestrian walkway/sidewalk)

6. How many of the following types of non-residential destinations are present? (Do not double count.)

Food-related land uses

a. Fast food restaurant *(national or local chain, primarily sells burgers, fried chicken, pizza, or "Americanized" Mexican, Chinese, etc.)*
☐ 0 ☐ 1 ☐ 2+

b. Sit-down restaurant
☐ 0 ☐ 1 ☐ 2+

c. Grocery/supermarket
☐ 0 ☐ 1 ☐ 2

d. Convenience store *(may also be a gas station)*
☐ 0 ☐ 1 ☐ 2+

e. Café or coffee shop
☐ 0 ☐ 1 ☐ 2+

f. Liquor/alcohol store *(primarily sells alcohol, wine bar, strip club)*
☐ 0 ☐ 1 ☐ 2+

g. Big box store *(e.g., Home Depot, Best Buy, Sears, Super Walmart, Target)*
☐ 0 ☐ 1 ☐ 2+

h. Specialty Food Store (*e.g., ice cream, candy, bakery)*
☐ 0 ☐ 1 ☐ 2+

Retail and service oriented land uses

i. Pharmacy or drug store
☐ 0 ☐ 1 ☐ 2+

j. Bank or credit union
☐ 0 ☐ 1 ☐ 2+

k. Health-related professional *(e.g., chiropractor, Dr. office)*
☐ 0 ☐ 1 ☐ 2+

l. Entertainment *(e.g., movie theatre, arcade)*
☐ 0 ☐ 1 ☐ 2+

m. Other service *(e.g., salon, lawyer, accountant, realtor, laundry/dry cleaner, commercial mailing service)*
☐ 0 ☐ 1 ☐ 2+

n. Other retail *(e.g., books, clothing, hardware, video rental)*
☐ 0 ☐ 1 ☐ 2+

Government or community land use

o. Health or social services *(e.g., hospital, health department, community action agency, police/fire stations, city hall, etc.)*
☐ 0 ☐ 1 ☐ 2+

p. Library/Museums
☐ 0 ☐ 1 ☐ 2+

q. Post office
☐ 0 ☐ 1 ☐ 2+

r. Senior center
☐ 0 ☐ 1 ☐ 2+

s. Place of worship *(e.g., church, synagogue, convent, mosque, etc.)*
☐ 0 ☐ 1 ☐ 2+

t. School
☐ 0 ☐ 1 ☐ 2+

Other land use

u. Warehouse/factory/industrial
☐ 0 ☐ 1 ☐ 2+

v. Abandoned building
☐ 0 ☐ 1 ☐ 2+

w. Unmaintained lot/field
☐ 0 ☐ 1 ☐ 2+

x. Casino
☐ 0 ☐ 1 ☐ 2+

Recreational land use

y. Community garden
☐ 0 ☐ 1 ☐ 2+

z. Private indoor *(e.g., commercial gyms, dance clubs)*
☐ 0 ☐ 1 ☐ 2+

aa. Public indoor *(community centers)*
☐ 0 ☐ 1 ☐ 2+

ab. Private outdoor *(e.g., private golf course, commercial outdoor recreation)*
☐ 0 ☐ 1 ☐ 2+

ac. Public outdoor pay *(e.g., pool)*
☐ 0 ☐ 1 ☐ 2+

ad. Public park
☐ 0 ☐ 1 ☐ 2+

7. Shopping Centers
Check all that apply
- ☐ Shopping Mall
- ☐ Strip Mall
- ☐ Shopping Arcade
- ☐ None of the above

May 2010 version

APPENDIX C: MICROSCALE AUDIT OF PEDESTRIAN STREETSCAPES SURVEY

MAPS Survey

Entry 1: ID# _____ Date: _____

Entry 2: ID# _____ Date: _____

Route

Section: Streetscape

Count both sides of the street

1. Number of public transit stops
If NO stops, skip to 3.
(a) Bus stops _____
(b) Senior transit/paratransit _____

2. What is available at each transit stop?
Only count benches that users could be easily identified by bus drivers as waiting to ride the bus.

Route # _____
☐ Bench ☐ Covered Shelter ☐ Timetable

Route # _____
☐ Bench ☐ Covered Shelter ☐ Timetable

Route # _____
☐ Bench ☐ Covered Shelter ☐ Timetable

Route # _____
☐ Bench ☐ Covered Shelter ☐ Timetable

3. Is there a posted speed limit along the route?
If multiple, select the highest
Regular
☐ Yes _____ mph ☐ No

Special zone *(school, construction)*
☐ Yes _____ mph ☐ No

4. What other street characteristics are present? (specify # of each type)
Check all that apply
- ☐ Traffic calming (signs, circles, speed tables, speed humps, curb extension) _____
- ☐ Roll-over curbs _____ (if whole segment = 1)
- ☐ Drainage ditches _____ (count one side of street)
- ☐ Instructional signs for pedestrian's _____
- ☐ Crosswalk signage or other pedestrian signage (for drivers) _____
- ☐ None of the Above

5. Are street lights installed?
- ☐ None
- ☐ Some *(e.g., overhead street lights on utility poles with wide spacing)*
- ☐ Ample *(e.g., regularly spaced pedestrian lampposts)*

6. How many driveways or alleys are there? Count only segment side of the street.
(Count only alleys that are wide enough to be used by cars or other vehicles that could impede pedestrian traffic.)
☐ None ☐ 1-2 ☐ 3-5 ☐ 6+

7. Presence of street amenities
Check all that apply
- ☐ Building overhangs that provide shelter from inclement weather in public space (i.e. sidewalks)
- ☐ Trash bins (public)
- ☐ Benches or other places to sit
- ☐ Bicycle racks
- ☐ Working drinking fountain
- ☐ Working public telephones
- ☐ Kiosks or information booths
- ☐ None of the Above

8. Presence of any mid-segment street crossing, where an individual could safely cross (marked by sign or crosswalk)?
☐ Yes ☐ No

Section: Aesthetics and Social

Count both sides of the street

1. Do you observe pleasant hardscape features, such as fountains, sculptures, or art (public or private)?
☐ Yes ☐ No

2. Do you observe softscape features such as gardens or landscaping *(e.g., Public: bodies of water, designated viewpoints; Private: retaining walls, bark, ponds)?*
☐ Yes ☐ No

3. Are there observable historic or cultural features along the route (*not further than one street segment away from route and can be seen from the route*)?
☐ Yes ☐ No

4. Are the buildings well maintained?
☐ 0% ☐ 1-49% ☐ 50-99% ☐ 100%

5. Is landscaping well maintained?
☐ 0% ☐ 1-49% ☐ 50-99% ☐ 100%

6. Which of the following physical disorders are present?
Check all that apply
- ☐ Graffiti/tagging (not murals)
- ☐ Abandoned cars
- ☐ Buildings with broken/boarded windows
- ☐ Drug paraphernalia
- ☐ Broken glass
- ☐ Beer/liquor bottles/cans
- ☐ Litter in yards
- ☐ Noticeable/excessive litter in street/sidewalk
- ☐ Neighborhood watch signs
- ☐ Signage for commercial destinations or parks
- ☐ None of these

7. Rate the extent of physical disorder *(question 6) (e.g., litter, graffiti, broken glass, abandoned cars)*
- ☐ None
- ☐ A little (physical/social disorder is present)
- ☐ Some (disorder is very noticeable)
- ☐ A lot (disorder is overwhelming)

8. Rate the extent of social disorder *(e.g., stray dogs, gangs, prostitution, hostile behaviors, drug dealing, panhandlers, etc.)*
- ☐ None
- ☐ A little (physical/social disorder is present)
- ☐ Some (disorder is very noticeable)
- ☐ A lot (disorder is overwhelming)

9. Other obstructions to walking
Check all that apply
- ☐ Railroad tracks (must obstruct walkway)
- ☐ Highway nearby (within one segment from walkway)
- ☐ Other: _____
- ☐ None

10. Presence of anyone walking?
☐ Yes ☐ No

May 2010 version

MAPS Survey

Entry 1: ID# _____ Date: _____

Entry 2: ID# _____ Date: _____

Segment: Walkway/Sidewalks

Segment ID# _____

Auditor ID # _____

Type: Residential / Commercial

Street _____Side N S E W

Starting Cross-street: _____

Ending Cross-street: _____

1. Is a sidewalk present?
☐ Yes ☐ No

2. What is the width of the majority of the sidewalk?
☐ < 3 ft. ☐ 3-5 ft. ☐ > 5 ft. ☐ No sidewalk

3. (a) Is there a buffer present?
☐ Yes ☐ No

(b) How wide is the majority of the buffer?
☐ < 3 ft. ☐ 3-5 ft. ☐ > 5 ft. ☐ N/A

4. Is the sidewalk *continuous* within the segment?
☐ Yes ☐ No ☐ No sidewalk

5. Are there poorly maintained sections of the sidewalk that constitute trip hazards? *(e.g., heaves, misalignment, cracks, overgrowth)*
a. Minor - moderate
☐ None ☐ One ☐ A few ☐ A lot ☐ No sidewalk
b. Major
☐ None ☐ One ☐ A few ☐ A lot ☐ No sidewalk

6. (a) How steep is the sidewalk at the steepest point in the segment? *(Excluding heaves)*
_____ degrees ☐ No sidewalk

(b) How much of the segment is at or near this level of steepness?
☐ Little (1-25%) ☐ Some (26-75%)
☐ Most or All (76-100%) ☐ No sidewalk

(c) If answer to 6(b) is "Little," provide a steepness measure that represents the majority of the segment
_____ degrees ☐ No sidewalk ☐ N/A

7. What is the steepest unavoidable cross-slope that affects walkers? _____ degrees ☐ No sidewalk

8. Are there permanent obstructions in the sidewalk? *(e.g., telephone poles, trees, café tables, shrubs, basketball hoops)*
☐ None ☐ Some ☐ Many ☐ No sidewalk

9. Are there temporary obstructions in the sidewalk? *(e.g., parked cars, sandwich boards, garbage cans)*
☐ None ☐ Some ☐ Many ☐ No sidewalk

10. How many traffic lanes are present (include all lanes that traffic can use; choose most predominant)?
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7+

11. Is the street predominantly one-way or two-way?
☐ 1-way ☐ 2-way

12. If no sidewalk, is there any other place to walk that is safe from traffic?
☐ Yes
☐ Unpaved pathway (goat path)
☐ Street shoulder
☐ Buffer
☐ No
☐ N/A Sidewalk present

13. If no sidewalk, what is the width of the place on which one could safely walk? *(Not in possible path of traffic)*
☐ None ☐ < 4 ft. 0 ☐ ≥ 4 ft. ☐ N/A

14. Is there a marked bicycle lane marked with a line or a raised curb?
☐ Yes ☐ No

15. Are there any signs indicating bicycle use (share the road, etc.)?
☐ Yes ☐ No

16. Are there any signs or structures discouraging skateboard usage?
☐ Yes ☐ No

17. Is there an informal path (shortcut), not on a cul-de-sac, which connects to something else?
☐ Yes ☐ No

18a. Is this a dead-end street?
☐ Yes ☐ No

18b. Is there a paved or informal path at the end of the cul-de-sac or dead end street that connects to something else?
☐ Yes ☐ No ☐ N/A

19. Estimate the proportion of street segment that has ground floor or street-level windows within 40 feet of sidewalk/walkway (or street if no sidewalk/walkway)
☐ 1-25% ☐ 26-50% ☐ No windows
☐ 51-75% ☐ 76-100%

20. How many different predominant building façade colors exist on the street segment? *(Count both sides of the street)*
☐ 1 ☐ 2-3 ☐ 4-6 ☐ >6 ☐ N/A

21. How many different building accent colors exist on the street segment? *(Count both sides of the street)*
☐ 1 ☐ 2-3 ☐ 4-6 ☐ >6 ☐ N/A

22. How many different predominant building materials (e.g., brick, concrete, steel, wood) exist along the street segment? *(Count both sides of the street)*
☐ 1 ☐ 2-3 ☐ 4-6 ☐ >6 ☐ N/A

23. How many trees exist within 5 feet of either side of the sidewalk/pathway (can be in buffer or setback; also count trees that are more than 5 feet away if they provide shade for the sidewalk/pathway)?
☐ 0 or 1 ☐ 2-5 ☐ 6-10 ☐ 11-20 ☐ 21+ ☐ N/A

24. How are the trees generally spaced?
☐ Evenly spaced ☐ Irregularly spaced ☐ N/A

25. What percentage of the length of the sidewalk/walkway is covered by trees, awnings or other overhead coverage?
☐ 1-25% ☐ 25-50% ☐ No coverage
☐ 51-75% ☐ 76-100% ☐ N/A

26. What is the smallest building setback from the sidewalk?
☐ No building ☐ <10 feet ☐ 10-20 feet
☐ 21-50 feet ☐ 51-100 feet ☐ >100 feet

27. What is the largest building setback from the sidewalk/walkway?
☐ No building ☐ <10 feet ☐ 10-20 feet
☐ 21-50 feet ☐ 51-100 feet ☐ >100 feet

28. What is the average height of buildings? *(Count both sides of the street)*
☐ No building ☐ 1-2 stories ☐ 3-5 stories
☐ 6-10 stories ☐ >10 stories

May 2010 version

APPENDIX C: MICROSCALE AUDIT OF PEDESTRIAN STREETSCAPES SURVEY

MAPS Survey

Entry 1: ID# _____ Date: _____

Entry 2: ID# _____ Date: _____

Crossings

Crossing ID# _____

Auditor ID# _____

Intersection of_____&

_____

Crossing from N S E W to N S E W

1. Intersection control
Check all that apply
☐ Yield signs
☐ Stop signs
☐ Traffic signal
☐ Traffic circle
☐ N/A – Unanticipated mid-segment crossing
☐ None of the Above

2. Number of legs at intersection
Check one
☐ T-intersection
☐ 4-way intersection
☐ > 4-ways
☐ N/A

3. Signalization
Check all that apply
☐ Green arrows for dedicated vehicle turn
☐ Pedestrian walk signals
☐ Push buttons
☐ Countdown signal
☐ Audible walk signal
☐ None of the Above

4. Crosswalk timing: _____ seconds
(Length includes white "walk" time + flashing red "don't walk" time)
☐ No crosswalk ☐ No signal

5. (a) Pre-crossing curb *(Even if there is no marked crosswalk, there is still a crossing)*
Check one
☐ Ramp lines up with crossing
☐ Ramp does not line up with crossing
☐ No ramp

(b) Post-crossing curb
Check one
☐ Ramp lines up with crossing
☐ Ramp does not line up with crossing
☐ No ramp

6. Gutters present in crossing
Within possible path of crossing pedestrians
☐ Yes ☐ No

7. Other characteristics of crossing
Check all that apply
☐ Steep slope or steep cross-slope at intersection
☐ Temporary obstructions
☐ Crossing aids (e.g., flags)
☐ None of the Above

8. Crosswalk treatment
Check all that apply
☐ Marked crosswalk
☐ High-visibility striping
☐ Stop lines on road or additional crosswalk warnings
☐ Raised crosswalk
☐ Different material than road
☐ None of the Above

9. Bike lane crosses the crossing?
☐ Yes ☐ No

10. Distance of crossing leg, including all potential parking and turn lanes
_____ lanes wide

11. Features
Check all that apply
☐ Specifically identified lanes **turning into crossing**
☐ Right turn ☐ Left turn
☐ Protected refuge islands
☐ One-way streets **through crossing**
☐ Curb extension
☐ None of the Above

12. Miscellaneous problems
Check all that apply
☐ Lack of lampposts or overhead street lamps
☐ Poor condition of crossing surface
☐ Poor visibility at corners
☐ Faded or worn crosswalk markings
☐ Unanticipated mid-segment crossing
Reason: _____
☐ Other: _____
☐ None of the Above

May 2010 version

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

School of Population and Public Health
2206 East Mall
Vancouver, BC Canada V6T 1Z3

Phone 604 822 2772
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info@spph.ubc.ca
www.spph.ubc.ca

Adult Consent Form

UBC Study of Neighbourhood Design and Travel, Health and Activity Patterns

Principal Investigator:
Dr. Lawrence Frank, J. Armand Bombardier Chair in Sustainable Transportation, School of Population & Public Health, UBC, 604-822-5387

Sponsor:
This research is made possible through funding from the City of Vancouver.

Purpose:
You have been invited to participate in this study because you live in the downtown study area. We are conducting research on the travel patterns, physical activity and social connections of individuals in your community. Your participation would help create knowledge about the effects of neighbourhood design on health and on communities--areas of research that have the potential to improve quality of life for many.

Study Procedures:
The study asks participants to describe travel, social interactions, and physical activities. No special activities are required. In fact, any changes to habits because of the survey will make the study less useful, because it will not accurately describe regular activities.

Participation in the study requires the completion of a self-administered survey and recording travel in a travel log for two days. Filling out the survey will take approximately 15-20 minutes, and the travel/activity log takes about 2 minutes per trip. More detailed information is available in the instructions document.

Potential Risks:
The research should not cause physical or emotional stress, as participants are only asked to describe activities they would normally do.

Potential Benefits:
Participants, by recording habits and activities, will learn about their own health. While the benefits for participants are relatively limited, the potential benefits for society are great. This research will generate knowledge about how neighbourhood design influences our behaviour, health, and the way we interact with our communities.

APPENDIX D: PARTICIPANT CONSENT FORM

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THE UNIVERSITY OF BRITISH COLUMBIA

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Phone 604 822 2772
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www.spph.ubc.ca

Research of this type will allow decision makers to create healthier communities for residents.

Confidentiality:
All documents will be identified only by code number and kept in a locked filing cabinet. Subjects will not be identified by name in any reports of the completed study. All electronic files will be kept on a password-protected hard drive. Only members of the research team will have access to documents. No published research resulting from this study will include information which would enable the identification of individuals.

Remuneration/Compensation: For completing the required study tasks you will receive an adult pass or gift certificate of your choice among selected City of Vancouver attractions and community centre use/programs and you will be entered into other prize draws.

Contact for information about the study:
If you have any questions about the study, or need explanation or assistance to complete the survey or travel diary, please contact us:
Email: spph.act-trans@ubc.ca
604-822-1898
Health & Community Design Lab - UBC
372 – 2206 East Mall
Vancouver, BC
V6T 1Z3

Contact for concerns about the rights of research subjects:
If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

Consent:
Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time.

Your acceptance below indicates that you have received a copy of this consent form for your own records. (You may save a copy or print this form for your records.)

Your acceptance below indicates that you consent to participate in this study.

☐ I agree
Participant Name:_____ Date: _____

Mustel Group
B398 City of Vancouver-UBC **Downtown Residents Study**

Registration Page Scripts

Downtown Residents Study on Neighbourhood Design and Travel, Health and Activity Patterns

Survey Registration

Welcome to our study!

Please enter your PIN number (as found on your notification letter) _____

1. **TBC:** First of all, do you plan to move away from your current area (i.e., within Downtown Vancouver) in the next 6 months?
   - ❍ YES →You are not eligible for this study, but you are eligible for another UBC study among people who are moving. Would you like to be contacted for the other study? May we pass your email information along to the UBC study team?
     - ❍ YES → Please enter your email address:
       Email confirmation:
     - ❍ NO, thank you.
   - ❍ NO → continue

Next, please enter the following information so we may verify your location and contact you for travel day reminders and other verification as needed.

2. Your home postal code: __ __ __ __ __ __
3. Your personal email address: _____

   CONFIRM (email match): _____

4. Your telephone number (best # to reach you):

Thank you.

APPENDIX E: SURVEY REGISTRATION FORM

Mustel Group
B398 City of Vancouver-UBC **Downtown Residents Study**

Registration Page Scripts

[SCREEN 2]

3 Steps to Participating: To participate in this important study among Downtown residents about neighbourhood design and travel, health and activity patterns, please complete the following.

1. **Your consent to participation:** Please click here to read the UBC consent agreement to participate. If you agree, you may continue. LINK TO CONSENT FORM

2. **Complete the Neighbourhood Survey:** This survey is about you and your opinions about your neighbourhood. Please click here to take this survey (it averages about 15 minutes to complete. You may come back to it if needed.) LINK TO NEIGHBOURHOOD SURVEY

3. **Record your travel the 2-day Diary:** So planners and designers better understand the travel patterns and choices of local residents. Your assigned travel days are 2 days in a row as follows:

DAY 1: [AUTO INSERT] and **DAY 2:** [AUTO INSERT]

Programming: Randomized Day Pair Assignments		
Version	**DAY 1**	**DAY 2**
V1	Monday	Tuesday
V2	Tuesday	Wednesday
V3	Wednesday	Thursday
V4	Thursday	Friday
V5	Friday	Saturday
V6	Saturday	Sunday
V7	Sunday	Monday

Please try to complete your travel diary in the next week. If not possible, then do the diary the week following. (Note: if one of your travel days falls on Sunday November 11th, please substitute the following week.) **Click here for Travel Diary & Info** **LINK TO TRAVEL DIARY**

Information Links

Study FAQs **Privacy** **Incentives/Prizes** **Contact Information**

[SCREEN 3] first page of the DAY1 Diary

Welcome to the Travel Diary

General Instructions:

- We are interested in all types of travel behaviour, so even if your travel day is unusual for you, please still record your activities.
- A Diary TAKE-ALONG sheet was included with the letter but if you need to print more copies, please click here for a PDF printable version. PRINTABLE 'TAKE-ALONG DIARY'

Reminders: Watch for the email reminders Mustel Group will send you on the day before your Day 1 and after your Day 2 (Subject line: ***Travel Reminder for Downtown Residents Study***).

To Start: If you are ready to start entering your trip information or you want to see what the diary looks like, please click here. You will be able to return by entering your PIN # if you do not finish the whole diary in one session: LINK TO TRAVEL DIARY **DAY 1**

LINK TO TRAVEL DIARY **DAY 2**

[SCREEN 4]

Study Closing Screen

1) <u>Your incentive:</u> As our thank you for completing the study tasks, please choose one of the following incentives:

- ❍ $10 Gift Certificate for use towards a program or class at one of these Downtown Community Centres: please select your choice:
  - o West End Community Centre or
  - o Round House Community Centre
- ❍ City of Vancouver Community Centre facility use (2 adult passes for any community centre in the City of Vancouver)
- ❍ VanDusen Gardens (1 adult pass)
- ❍ Bloedel Conservatory (2 adult passes)
- ❍ Stanley Park Ghost Train (1 adult pass)
- ❍ Stanley Park Bright Nights Train (1 adult pass)

This incentive will be mailed to you in the next 4-8 weeks.

2) <u>Prize draws</u>: You will also be entered into the following prize draws:

Prize draws	# of adult passes included	# of prizes to be awarded
VanDusen Botanical Garden 1-year Premium Membership (member + 1 guest for free)	1 membership	5
Bloedel Conservatory	4	10
Bloedel Conservatory Group rate (for use as a group)	10	2
Community Centre facility use 1-month adult pass city-wide or equivalent toward class/program at West End or Round House Community Centre	1	10
Community Centre facility 3-month adult pass city-wide or equivalent toward class/program at West End or Round House Community Centre	1	5
Golf package for 2	2	1

Note: Phase 1 Prize Draws awarded before Dec 2012 included 10 Bright Nights Train (4-passes) and 10 Festival of Lights (4-passes)

3) Finally, the City and UBC may do <u>a follow-up</u> of this study next year. Would you be willing to participate in a repeat of this study about a year from now?

- ❍ YES
- ❍ NO

Thank you again for helping your City, your community and making a difference. We truly appreciate your input.

To: Jami Koehl, Mustel Group
From: Eric Fox, Independent Contractor
Date: July 15, 2013
Project: UBC Comox-Helmcken Greenway Study
Re: Trip Diary Origin-Destination Trip Variables

Task: Calculate network-based, objectively measured travel distances (metres) and estimated travel times (minutes) based on mode for each trip in the trip diary. Travel distances are calculated using two street network datasets: 1) a walkable network for walking and cycling trips that contains only road segments where pedestrians are permitted (limited access highways, freeway ramps are removed), and 2) a automobile street network that contains all paved road segment feature. Travel time estimates are based on an mean travel time speed based on travel mode. As a result of the fact that the exact travel path is unknown, assumptions are made to determine an approximate trip speed that do not account for travel delays such as construction and traffic or wait times for transit. Multiple travel modes for trips are aggregated into a single travel mode for analysis. Trip speeds are based on an approximate average speed of various travel modes across a large age spectrum of respondents. Estimated trip times were compared with perceived travel times for reference, but may differ especially for longer trips. The datasets provided to the client allow for change in travel mode speeds to calculate other variations in estimated travel times if desired.

Software utilized: ESRI ArcGIS 10.1 SP1, SPSS 17.0, MS Excel 2007.

Step 1.) Review received trip diary dataset. Confirm unique identifiers and trip coordinates. Output dataset into SPSS file as well as dBASE in preparation for spatial referencing.

Total trips: 7425
Unique participants: 1113 of 7425
Unique trips (Case Number): 7425 of 7425
Trip origins without coordinates: 102 of 7425
Trip destinations without coordinates: 102 of 7425

Note that variables will not be able to be created for 103 trips defined in the data because no origin or destinations location information is available. Routes will be generated for 7322 trips that contain valid origin and destination coordinates.

Input file: ***Time-distance Trip DATAFILE.xlsx*** (n = 7425) Output files:
Mustel_Group_Vancouver_Trip_Diary_Data_A_EF_07072013.sav (n = 7425)
Mustel_Group_Vancouver_Trip_Diary_Data_A_EF_07072013.dbf (n = 7425)

Step 2.) Output origins and destinations into separate files.

Input files: ***Mustel_Group_Vancouver_Trip_Diary_Data_A_EF_07072013.dbf*** (n = 7425)
Output files:
Mustel_Group_Vancouver_Trip_Origins_EF_07072013.dbf (n = 7425)
Mustel_Group_Vancouver_Trip_Destinations_EF_07072013.dbf (n = 7425)

Step 3.) Plot previously created x/y coordinates for trip diary origins and destinations. Project data using a BC UTM coordinate system in preparation for analysis. Output spatial datasets.

Input files:
Mustel_Group_Vancouver_Trip_Origins_EF_07072013.dbf (n = 7425)
Mustel_Group_Vancouver_Trip_Destinations_EF_07072013.dbf (n = 7425)

Geographic Coordinate System: GCS_North_American_1983
Projected Coordinate System: NAD_1983_UTM_Zone_10N

Output files: ***Mustel_Group_Vancouver_Trip_Diary_Origins_Prj_EF_07072013.shp*** (n = 7425) ***Mustel_Group_Vancouver_Trip_Diary_Destinations_Prj_EF_07072013*** (n = 7425)

Step 3.) Review data. Create a route link ID.

Trip origins outside of Metro Vancouver: 12 of 7425
Trip destinations outside of Metro Vancouver: 17 of 7425

Input files: ***Mustel_Group_Vancouver_Trip_Diary_Origins_Prj_EF_07072013.shp*** (n = 7425)
Mustel_Group_Vancouver_Trip_Diary_Destinations_Prj_EF_07072013 (n = 7425)

Output fields:
[NO_COORD] = denotes (where [NO_COORD] =1) those trips that do not contain an origin or destination x/y coordinates
[OUT_M_VAN] = denotes (where [OUT_M_VAN = 1) those trip origins and destinations that are outside of Metro Vancouver

Step 4.) Develop vehicular and walkable road network for analysis. The road segment features indicated in Table 1 as non being walkable are removed from the vehicular network. The walkable road network will be utilized only for those walking trips ([TRIP_MODE] = 1). All other travel trips will utilize the vehicular network.

Input file: ***Mustel_Group_BC_Roads_Prj_EF_07072013.shp***[1]
Vehicular Network: ***Mustel_Group_BC_Roads_Prj_EF_07072013.shp***
Walkable Network: ***Mustel_Group_BC_Walkable_Roads_Prj_EF_07072013.shp***

[1] Generated from a 2010 North America ESRI street network dataset.

Table 1: FCC field codes used to define walkable road network.

FCC Code	*DESCRIPTION*	*# FEATURES*	*WALKABLE*
A11	Primary road with limited access or interstate hwy, unseparated	8	No
A15	Primary limited access or interstate highway, separated	2347	No
A16	Primary limited access or interstate highway, separated, in tunnel	29	No
A17	Primary limited access or interstate highway, separated, underpassing	0	No
A20	Primary Highways without limited access, major category	11609	Yes
A21	Primary US and State highways, unseparated	2256	Yes
A22	Primary Highways without limited access, unseparated in tunnel	6	Yes
A25	Primary US and State highways, separated[2]	4619	Yes
A27	Primary US and State highways, separated, underpassing	0	Yes
A30	Secondary State and County highways, major category	7051	Yes
A31	Secondary State and County highways, unseparated	13783	Yes
A33	Secondary State and County highways, unseparated, underpassing	0	Yes
A35	Secondary State and County highways, separated	9324	Yes
A37	Secondary State and County highways, separated, underpassing	0	Yes
A38	Secondary State and County highways, separated, with center rail line	0	Yes
A40	Local, neighborhood, rural road, city street, major category	90250	Yes
A41	Local, neighborhood, rural road, city street, unseparated	79952	Yes
A42	Local, neighborhood, rural road, city street, unseparated, in tunnel	2	Yes
A43	Local, neighborhood, rural road, city street, unseparated, underpassing	5	Yes
A44	Local, neighborhood, rural road, city street, unseparated, w/ rail line	0	Yes
A45	Local, neighborhood, rural road, city street, separated	2001	Yes
A50	Vehicular trail, road (4WD) vehicle, major category	0	Yes
A51	Vehicular trail, road (4WD) vehicle, unseparated	7	Yes
A60	Access ramp, not associated with a limited access highway	1902	Yes

[2] This category is comprised of non-limited access roads in which many of the features have sidewalks and pedestrian pathways and so they were included as walkable roads.

A61	Cul-de-sac, the closed end of a road that forms a loop or turn around	1775	Yes
A62	Traffic circle, the portion of a road that form a roundabout	457	Yes
A63	Access ramp, cloverleaf or limited access interchange	1450	No
A64	Service drive, provides access to businesses and rest areas	22	No
A65	Ferry Crossing, Passenger, Seasonal	34	Yes
A66	Ferry Crossing, Passenger, Year-Round	15	Yes
A68	Ferry Crossing, Vehicular, Seasonal	361	Yes
A69	Ferry Crossing, Vehicular, Year-Round	463	Yes
A70	Other thoroughfare, major category	33	Yes
A71	Walkway, nearly level road for pedestrians, usually unnamed	154	Yes
A72	Stairway, stepped road for pedestrians, usually unnamed	2	Yes
A73	Alley, road for service vehicles, located at the rear of buildings[3]	368	No
A74	Driveway	2446	Yes
A75	Road, Parking Area	274	Yes
	TOTAL	233011	

Output spatial selection expression: ***Mustel_Group_Vancouver_Non-Walkable_Roads_EF_07072013.exp***

Step 5.) Create new fields to denote transportation type. Determine the most prominent mode of travel chosen based on whether specific modes were used more than one during the trip. Table 2 provides a description of types of travel modes within the received trip diary dataset. As a result of the fact that some trips are traversed using between 2 and 6 modes of travel, assumptions were made in order to calculate an estimated time. A travel mode hierarchy is established based on travel type and speed to aggregate trips using multiple mode methods into a single mode (Table 3). If a trip only has one travel mode, that method is travel is utilized. The actual route traversed from origin to destination for each trip is unknown. It is not possible to distinguish to what extent a bus, skytrain, seabus, school bus, auto, walking, cyclying was used along which segments, therefore, to simplify the process, trips with multiple modes were aggregated down into a single mode. Because travel by water is unique and there are relatively few trips by ferry any trip that contains a ferry trip will be calculated using an average ferry travel time. For example, if a trip used both walking and taking the bus, bus would be the mode that was chosen to determine trip speed. If the first

[3] Roads and alleys may indeed be included in walkable road networks, however, they should be used to define walk neighborhoods with network buffers, however, alleys and lanes are excluded from walkable road networks that are used for routing because they often cause origin or destinations to snap to alleys or lanes behind the address rather than the actual street address.

travel method is "Other" (11) and it is not a ferry route, auto travel is used. If any of the travel modes is Skytrain (5), except if there is a ferry mode, the chosen mode is Skytrain. If there is bus and walking modes, the faster travel by bus is chosen. If there is cycling (9) and no Skytrain (5), cycling mode is chosen.

Input files:
Mustel_Group_Vancouver_Trip_Diary_Origins_Prj_EF_07072013.shp (n = 7425)
Mustel_Group_Vancouver_Trip_Diary_Destinations_Prj_EF_07072013 (n = 7425)

Output fields:
[TRIP_MODE] = collapsed travel mode type (numeric)
[TRIPMODE_T] = travel mode type (string)

Table 2: Description of types of travel modes.

Travel Mode	*Travel Mode Description*	*Collapsed Travel Mode*
1	Walking	Walking (1)
2	Auto – Driver	Auto (2)
3	Auto – Passenger	Auto (2)
4	Transit – Bus	Bus (3)
5	Transit – Skytrain	Skytrain (4)
6	Transit – Seabus	Ferry (5)
7	Transit – School Bus	Auto (2)
8	Transit – False Creek Ferry/Aqua Bus	Ferry (5)
9	Bicycle	Bicycle (6)
10	Taxi	Auto (2)
11	Other	Auto (2)

Table 3: Travel mode hierarchy based on type and trip speed.

Travel Type	*Hierarchy*
Ferry	Very High
Skytrain	High
Auto	Medium High
Bus	Medium Low

Cycling	Low
Walking	Very Low

Step 6.) Calculate network distance for each paired origin-destination. Use a 250 ft snapping distance. Calculate distance based on the following road network datasets:

1.) Walking – Walkable Network
2.) Auto – Driver, Auto – Passenger, Taxi, Other – Vehicular Network
3.) Bus – Vehicular Network
4.) Skytrain – Vehicular Network
5.) Ferry – Vehicular Network
6.) Cycling – Walkable Network

Input files:
Mustel_Group_Vancouver_Trip_Diary_Origins_Prj_EF_07072013.shp (n = 7425)
Mustel_Group_Vancouver_Trip_Diary_Destinations_Prj_EF_07072013 (n = 7425)
Mustel_Group_BC_Roads_Prj_EF_07072013.shp
Mustel_Group_BC_Walkable_Roads_Prj_EF_07072013.shp

Output files: ***Mustel_Group_Vancouver_Trip_Distances_Walkable_EF_07072013.shp*** (n = 4115) ***Mustel_Group_Vancouver_Trip_Distances_Walkable_Cycling_EF_07072013.shp*** (n = 264) ***Mustel_Group_Vancouver_Trip_Distances_Non-Walkable_EF_07072013.shp***[4] (n = 2943)

Output fields:
[PIN] = PIN (respondent ID)
[CASENUMBER] = Case Number
[RT_LINK_ID] = route link ID
[RD_SOURCE] = road network source
[LENGTH_M] = length of route in metres
[TRIP_MODE] = predominate mode of travel

Step 7.) Spatially merge all trips into one file.

Input files:
Mustel_Group_Vancouver_Trip_Distances_Walkable_EF_07072013.shp (n = 4115)
Mustel_Group_Vancouver_Trip_Distances_Walkable_Cycling_EF_07072013.shp (n = 264)
Mustel_Group_Vancouver_Trip_Distances_Non-Walkable_EF_07072013.shp (n = 2943)

Output file: ***Mustel_Group_Vancouver_Trip_Diary_Distances_EF_07072013.shp*** (n =7322)

[4] Calculated distances for all mode types except walking and cycling..

Step 8.) Review generated network distances for accuracy. Identify those routes that have the same origin and destination coordinates resulting in a zero metre trip distance.

Routes with the same origin and destination coordinates: 644 of 7322

No trips were missing mode information. There were also trips without any coordinates (n = 103). This is believed to refer to trips that began and ended at the same location.

Step 9.) Apply an estimated travel time based on an average constant speed of travel per modal type. Table 4 and Table 5 describes aggregated travel mode types used to calculate travel time estimates. Walk speeds are generated based on respondent age (Table 6).[5] Output selection expressions. Convert kilometres per hour measure to metres per hour. Estimated trip travel times in minutes are derived by dividing the trip distance in metres by the travel speed in metres and multiplying by 60.

Table 4: Description of aggregated trip modes and estimated assumed speeds.[6]

Aggregated Travel Mode Type	*Aggregated Travel Mode Type Description*	*Number of Trips*	*Speed (km/h)*
1	Walking	4115	3.6[7]
2	Auto	1619	30[8]
3	Bus	789	15[9]
4	Skytrain	480	25[10]
5	Ferry	56	Various (see Table 5)
6	Bicycle	264	15[11]

[5] Note that respondent ages range from 19 – 96. Age 19 was grouped with the age 20 – 40 cohort for trip estimate purposes.
[6] As a result of the limitations of this task, congested zone to zone travel times reflecting spatial and temporal (am/pm peak and off peak) variations in travel time could not be incorporated.
[7] Walking speeds vary by age with a mean walking speed of 3.6km/h. See Table 6 for more information.
[8] Mean average auto speed from 2010 ESRI road network dataset for Metro Vancouver road segments.
[9] Approximate average speed for diesel bus, trolley bus and community shuttle modes factoring in travel to and from stops. Comparable average bus speed for areas in North America using automated vehicle location (AVL) systems: 1) Chicago: http://www.transportchicago.org/uploads/5/7/2/0/5720074/bus_speed_tools_using_avl_data.pdf, 2) Washington D.C.: https://www.wmata.com/about_metro/bus_planning/bus_speeds.cfm
[10] Skytrain speed based on a reduced speed from average vehicle travel speeds allowing for travel to and from stations. Average speed gathered from Translink: http://www.translink.ca/~/media/Documents/plans_and_projects/rapid_transit_projects/UBC/technology_overviews/Rapid%20Transit%20Technology%20Brochure.ashx
[11] Parkin and Rotheram, 2010.

APPENDIX F: TRAVEL DISTANCE & TIME ESTIMATION METHOD

Table 5: Average ferry speeds by type

#	*Ferry Type*	*Average Speed (km/h)*
1	SeaBus	20[12]
2	BC Ferries	35[13]
3	False Creek Ferry/Aqua Bus	10[14]

Table 6: Objectively measured mean walking speed using GPS devices from the Neighborhood Quality of Life (NQLS) Study.[15]

#	*Age Cohort (years)*	*Mean Walking Speed (km/h)*	*Number of Trips*
1	20 – 40	3.7	1880
2	41-64	3.6	1726
3	≥ 65	3.3	509
	All ages (20-65+)	3.6	
	Total		4115

Input files:
Mustel_Group_Vancouver_Trip_Diary_Distances_EF_07072013.shp (n =7322)
Output fields:

[T_DIST_M] = trip distance in metres
[T_SPEED] = average approximate travel speed in kilometres per hour, where [T_SPEED] corresponds to the average overall speed in kilometres from Table 4.
[AGE_SPEED] = average age adjusted travel speed in kilometres per hour, where [AGE_SPEED] corresponds to the average speed by age cohort in kilometres from Table 6.[16]
[SPEED_MH] = average approximate travel speed in metres per hour, where [SPEED_MH] equals [T_SPEED] * 1000.
[A_SPEED_MH] = average age adjusted travel speed in kilometres per hour, where [A_SPEED_MH] equals [AGE_SPEED] * 1000.
[TIME_MIN1] = estimated overall mean travel time in minutes, where [TIME_MIN1] = ([T_DIST_M] / [SPEED_MH])*60

[12] Approximate average SeaBus crossing times from Translink: http://tripplanning.translink.ca/hiwire?.a=iScheduleLookupSearch&LineName=998&LineAbbr=998
[13] Approximate average BC Ferries vehicle speed based on time required to cross the Georgia Strait: http://www.bcferries.com/schedules/mainland/hbna-current.php
[14] Approximate average False Creek ferry speed: http://www.granvilleislandferries.bc.ca/schedule.htm
[15] Database of mean and median walking speeds based on the NQLS study was provided by Dr. Lawrence Frank at UBC.
[16] Age adjusted travel speeds and trip times are only calculated for walking trips.

[TIME_MIN2] = estimated age adjusted mean travel time in minutes, where [TIME_MIN1] = ([T_DIST_M] / [A_SPEED_MH])*60. Age adjusted trip time is only provided for walking trips.
[T_TIME_MIN] = estimated overall travel time in minutes (rounded, long) derived from [TIME_MIN1]. Note that all trips with a greater than zero travel distance, but less than 1 minute estimated trip time are rounded to 1 minute travel times.
[AGE_T_MIN] = age adjusted travel time in minutes (walking trips only) (rounded, long)
[P_TIME_MIN] = perceived travel time in minutes based on respondent start and end times.
[FERRY_T] = type of ferry where [FERRY_T] = 1 (SeaBus), 2 (BC Ferries), 3 (False Creek/Aqua Bus)
[T_DIFF] = time difference between objectively measured trip time estimate and perceived travel time where [T_DIFF] = [TIME_MIN1] – [P_TIME_MIN]
[TIME_MIN1R] = estimated overall travel times rounded to a minimum of 5 minutes (perceived travel times have a minimum of 5 minutes)
[T_DIFF2] = time difference between objectively measured trip time estimate (rounded to a minimum of 5 minutes) and perceived travel time where [T_DIFF2] = [TIME_MIN1R] – [P_TIME_MIN]

Output files:
Mustel_Group_Vancouver_Walk_Speed_1_EF_07072013.exp (age category 1)
Mustel_Group_Vancouver_Walk_Speed_2_EF_07072013.exp (age category 2)
Mustel_Group_Vancouver_Walk_Speed_3_EF_07072013.exp (age category 3)

Step 10.) Review estimated travel times and compare them to the perceived travel times. Create a new field that flags those trips that are believed to be inaccurate due to input origin and destination geographic coordinate values. Table 7 outlines the results between the comparison between the objective and perceived mean trip travel times for all valid trips.

Input file: ***Mustel_Group_Vancouver_Trip_Diary_Distances_EF_07072013.shp*** (n =7322)

Table 7: Comparison between overall objectively measured mean trip time and perceived trip time.

Objectively Measured Mean Travel Time	*Difference Between Objective and Perceived*	*Result*
Trip times < 5 minutes not rounded to 5 minutes	-4.99	Objective mean 5 minutes faster
Trip times < 5 minutes rounded to 5 minutes	-4.5	Objective mean 4 minutes 30 seconds faster

Output field:
[FLAG] = routes that have the same origin and destination locations resulting in a zero metre trip distance (n = 644).

Step 11.) Export final datasets for delivery: 1) all route variables and intermediate variables (***Mustel_Group_Vancouver_Trip_Diary_Distances_Time_submitted_EF_07152013.xlsx*** (n =

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7322)), 2) a finalized spreadsheet containing only the total trip distance, overall estimated travel time and age adjusted travel time for walk trips (***Mustel_Group_Vancouver_Trip_Diary_Distances_Time_Summary_submitted_EF_07152013.xlsx*** (n = 7425)). The datasets utilize the same field names as described previously.

Input file: ***Mustel_Group_Vancouver_Trip_Diary_Distances_EF_07072013.shp*** (n =7322)
Output files:
Mustel_Group_Vancouver_Trip_Diary_Distances_Time_submitted_EF_07152013.xlsx (n = 7322)
Mustel_Group_Vancouver_Trip_Diary_Distances_Time_Summary_submitted_EF_07152013.xlsx (n = 7425)

References:

Parkin, J and Rotheram, J. (2010). Design speeds and acceleration characteristics of bicycle traffic for use in planning, design and appraisal. *Transport Policy*, 17(1), 335-341.

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