FINAL REPORT: Urban Cycling Project (CityStudio)

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Executive Summary

The goal of this project was to assess the state of 3 seawall bike paths (Seawall by Denman, Seawall by Harbour Green Park, Seawall by Coal Harbour) in Stanley Park and Vancouver. This Project specifically assessed the bike routes based on the cyclists' perceptions of safety, interaction comfort with other forms of traffic on the path (human traffic), and bike path width safety (does the bike path width promote dangerous activities such as tailgating and/or overtaking that make the cyclists feel uneasy). Our data was gathered by surveying cyclists on the bike paths that were being assessed. Cyclists were asked 3 questions. Each question was then given a score from 1-5, with 1 being defined as "I very much dislike it" and 5 being "I wouldn't change a thing". This study found that overall, cyclists felt safe on the paths with a combined average safety perception score of 4.24 out of 5 when combining the results of all 3 bike paths. Interaction comfort had similar results with a combined average score of 4.1 out of 5. Width safety scored lowest when compared to the other measurements of safety with a combined average score of 3.69 out of 5. The Seawall by Harbour Green Park route, along with the Seawall by Coal Harbour route had a low width safety perception (scores of 3.33). This was noteworthy because both these routes had participant width safety rating scores of 2, which was not seen for any other category across all 3 routes. Despite this, the overall implications of the findings are that the bike paths we assessed are perceived by cyclists as being safe. Although the bike paths overall are perceived as safe, this does not mean that there are no improvements that can be made. Based on the findings of this study, we recommend that the Seawall by Denman route installs signs warning path users of the surface changes that occur in certain sections of the route. For the Seawall by Coal Harbor route, we have two recommendations; firstly, we recommend that the city install signs warning users of a change in elevation and secondly, we recommend more aggressive signage or physical barriers. Fences or medians may be needed on this route to prevent pedestrian obstruction. For the Seawall by Harbour Green Park route, we recommend the installation of a fence with crosswalk breaks rather than the current open design which allows pedestrians to walk freely on the bike route. We would also recommend a widening of the path at problem narrow areas, although this may be an unfeasible recommendation due to cost considerations and the path being in close proximity to the sidewalk and road.

Introduction

There are several benefits associated with increased bicycling rates in a city, both to the individual and to the environment. These include improved mental health, reduced risk of cardiovascular disease and obesity, as well as reduced noise, air, and greenhouse gas pollutants (Reynolds, Harris, Teschke, Cripton, & Winters, 2009). Despite the positive outcomes that can be sustained on a public health level, cycling does carry a heightened risk of injury compared to driving motorized vehicles (Reynolds et al., 2009).

Literature Review

Key features of the built environment, including the capacity for volume of traffic, availability of biking infrastructure, and multi-use routes can affect overall biking usage, safety, and perception (Krenn, Oja, & Titze, 2014; Reynolds et al., 2009). In a survey conducted in Vancouver, one of the primary reasons adults did not ride their bike in general included the amount of cars, trucks and bus traffic in an area (Reynolds et al., 2009). Thus, analyzing different traffic volumes and patterns in the three bike routes may help inform comfort-promoting principles in bike route development. For example, *The Transportation Design Guidelines* developed by the City of Vancouver (2017), suggest that adding traffic calming strategies might benefit route rideability in areas that have high traffic. It will be determined whether such features may be applicable to the routes we intend to analyze for our report.

Biking infrastructure, as used in this report, refers to features designed to improve safety and accessibility for bikers, and can include bike paths, bike routes, and bike parking. Pucher, Dill, and Handy (2010) suggest that the cities with the highest rates of cycling and safety are likely to have extensive infrastructure in addition to bicycling-promoting policies. Thus, the additional accessibility and safety-promoting features we encounter on the three bike routes we aim to collect data from will constitute a vital part of this project. In addition, prior methods of selecting bike routes for development have not always considered both urban conditions and rider safety (Allen-Munley, Daniel, & Dhar, 2004). For these reasons, it is important to consider the construction of the environment on our selected routes from both a safety and a comfort perspective.

A final pertinent consideration in bike route development and planning is the multi-use path feature. A multi-use path, as used in this report, refers to pathways that are shared by cyclists, joggers, skaters, pets, and other pedestrians. While multi-use routes may provide great flexibility for all users, Reynolds and colleagues (2009) suggest that these routes, along with sidewalks, pose the highest risk of injury for cyclists. Furthermore, the Greater Victoria Cycling Coalition (2004) suggests that, while cyclists are safe from motor vehicle collisions on these paths, skaters, joggers, and other pedestrians may act in an unpredictable fashion and force bikers to slow down quickly or swerve onto roadways. For these reasons, it is vital to consider the frequency of interactions between cyclists and other pedestrians in multi-use routes. This report aims (1) to identify the current state of specific comfort and safety features through user ratings of cyclists associated with three bike routes in the Stanley Park area of Vancouver and (2) develop recommendations to inform future bike route development considerations.

Methods

Research Design

This study used a Post-Positivism paradigm using a Likert scale survey consisting of three unique questions (appendix B) to examine overall safety of the Denman, Harbour Green Park, and Coal Harbour sections of the Seawall. This approach uses a modified objectivist epistemology where the researchers are aware of possible influence on the study. Therefore, as the authors of this proposal, we must declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this proposal. As researchers, we adopted a neutral approach with the aim of not influencing the participants' answers. We utilized a non-experimental design to gather data about safety on the designated routes. This study was conducted using a quantitative method of research by examining the numeric data produced by a survey that consisted of 3 questions (Appendix B). The study was conducted on Saturday March.3/2018 during the hours of 11:00 am to 2:30 pm. We hoped that conducting the surveys on a Sunny weekend day would increase the amount of traffic for each section of the seawall bike lane, which would aid us in increasing the chances of obtaining participants for the survey. The quantitative survey captured the current thoughts of active participants on the path.

The quantitative survey utilized convenience sampling, ensuring we had easy access to the participants who were cycling along the Seawall, and any rider on one of the three paths was able to meet inclusion criteria for the survey. Random selection and exclusion criteria were not used to avoid the division of the population of seawall cyclists into a subset sample based on specific characteristics. Safety is a main concern for many cyclists so no inclusion/exclusion criteria was used. However, we did make note of whether a participant was male/female, tourist/non-tourist, and whether they used a bicycle or alternative mode of transportation such as rollerblades. This was to examine if there were any trends among participants to answer in a certain fashion due to these common factors. For the Denman bike route we were only able to collect data from 5 participants in total due to a low volume of cyclers on this given route. For the Harbour Green Park bike route we were able to collect data from 9 participants which we found to be a sufficient sample size. For the Coal Harbour bike route we were able to collect data from 8 participants that exclusively consisted of cyclists. The data was collected using a cross-sectional design consisting of a one-shot study that allowed us to collect data and conclude the study on March.3/2018.

Measures and Instruments

This study was conducted with using quantitative research by examining the numeric data produced by a survey that consisted of the 3 questions found in Appendix B. The questions were answered on a Likert scale of 1-5 in order to produce numeric data used to analyze the safety of cycling on the seawall. A 5-point Likert scale (1-5) was used because it provides a unipolar scale and meaningful differentiation between responses that allows for better distribution of responses (Appendix B). This was important for our research design because it optimized our chances at creating a standard distribution of responses that had normality, variance, and modality that would give our data validity. The data was converted into a graph that shows the distribution of responses and mean scores for each individual question for the given cycling

routes. The mean scores were analyzed and discussed in the results section using an inductive approach to develop suggestions on how to improve the safety of the Denman, Harbour Green Park, and Coal Harbour Seawall bike lanes.

Strengths and Limitations

The Likert scale survey was excellent for collecting data, however it also presented a slew of challenges. The scale provided a good sense of validity and ability to directly examine the source of retrieved data and receive an accurate measure. However, we recognize this could possibly be affected by the fixed questions that are present in the survey and the associated lack of flexibility which could potentially force a participant to answer in a specific context which would lower validity. The reliability of the survey is high because it can be repeated efficiently and easily. However, questions may be misinterpreted resulting in poor reliability if each participant is perceiving the questions in a different context compared to others. The usage of self reporting exposes the research and data to potential dishonesty in the responses provided by the participants. The introspective ability to provide an accurate response will differ based on a participant's ability to accurately assess themselves. The rating scale used in the questionnaire also exposes the results to potential skewing, due to the possibility that participants interpret the meaning of the scale differently. We also found that a limited sample size may affect the mean scores for each rating on the 3 questions because the number of participants acts as the denominator when calculating the mean.

Rationale for Research Questions

For each route we have selected three factors to examine using the Likert scale survey. The research was primarily focused on the safety of the Seawall bike lanes in the 3 routes stated above. We recognized the Seawall's unique characteristic of being a large, multi-traffic pathway that has an established infrastructure such as bike paths. This is important because in Damant-Sirois, Grimsrud, and El-Geneidys' (2014) study they found that 76% of their sample size were path-using cyclists, leisure cyclists, or fair-weather cyclists who preferred to use bike paths compared to dedicated cyclists. This suggests the importance of leisure bike paths and their potential as a gateway to increased bicycle usage and a healthier, more active community. Multiple articles have indicated that establishing high-quality bike paths and networks leads to an increase in the number of active cyclers using the paths (Birk & Geller, 2006; Rietvield & Daniel, 2004). Maintaining and improving the overall experience of the Seawall is vital to encourage increased bike usage of the path which may then transfer to bike usage throughout the city. We are specifically focusing on safety because this directly impacts the overall experience and quality of the bike path infrastructure and safety concerns often prevent many people from cycling (Damant-Sirois et al., 2014). Due to these factors, our first question asked was "How safe is this bike path in this area on a scale of 1-5?" While we predicted that the overall safety of the Seawall would be rated quite high due to a lack of non-motorized vehicles, the high usage and symbolic nature of the Seawall as the world's longest uninterrupted waterfront path make it a primary component of Vancouver's identity as a city and continually enhancing the quality and standards of this path in every aspect remains a top priority (City of Vancouver, 2018a).

Our second question was “How comfortable do you feel with pedestrian/other traffic on this bike route on a scale of 1-5?” Chong, Poulos, Olivier, Watson, and Grzebieta (2010) suggest that, while motor vehicle-cyclists accidents are generally more severe, cyclist-pedestrian accidents also cause significant injury and, due to the increasing promotion and usage of pedestrian-cyclist multi-use paths, these accidents are occurring in higher frequencies. Germany, who is one of the leading countries in bike promotion and usage, has implemented policies in its most cycling friendly city to have integrated bike paths separated from both auto and pedestrian traffic (Pucher, 1997). Kiyota, Vandebona, Katafuchi, and Inoue (2000) also note that when densities begin to rise on shared pedestrian-cyclist pathways, cyclists are forced to travel at low speeds and pedestrians must take extra caution to avoid collisions which may be physically detrimental to elderly or younger individuals. These authors also indicated that elderly and primary school children are most apprehensive to high-density multi use pathways. While much of the Seawall around Stanley Park is separated into distinct pathways for pedestrians and cyclists, there is approximately 2.2 km of pathway in the Coal Harbour area that is not as clearly distinguished, parts of which we focused on (City of Vancouver, 2018b). We expected the perceived safety in these areas of the Seawall to be lower compared to the areas with more distinguished pedestrian and cyclist traffic lanes. Landis, Petritisch, Huang, and Do (2004) also note that forms of transportation such as scooters, strollers, hand cycles, wheelchairs, rollerblades, and others have become increasingly present on roads and shared use trails. Due to differences in locomotion patterns in regard to speed, stopping ability, signal ability, or space usage/lateral operating movement, new designs considerations and features must be continuously recognized and implemented into prominent shared usage paths. Vancouver’s identity as a city focused on diversity and accessibility combined with the Seawall being one of the city’s top recreational spots for citizens and tourists alike make safety a top concern. Therefore, we felt this may be one of the potential areas for improvement amongst the areas of the Seawall we investigated.

Our third question for cyclists who are utilizing the seawall bike lanes was “Does the narrowness of the bike path promote dangerous evasive maneuvers or uneasiness from actions such as overtaking and tailgating on a scale of 1-5”. We believed this was a important concern because the seawall is divided into two clear sections, one for walkers/joggers (closest to water) and one for cyclists/skaters (inside path), however on sunny days or weekends the multi-use pathway tends to become subject to a significantly increased volume of individuals utilizing the path (City of Vancouver, 2018a). We understand that studies indicate, via analysis of bike lanes, that the function of narrow pathways is too contain the flow of traffic moving on it (Dondi, Simone, Lantieri, & Vignali, 2011). However, for the city of Vancouver, this presents a problem because an increased density of people on shared pedestrian-cyclist pathways causes cyclists to travel at low speeds (Kiyota et al., 2000). This is concerning because a study indicated that a corresponding result of high traffic in narrow bike lanes showed that 16% of all accidents occurred due to the imprudence of individuals showing a lack of restraint when being stuck behind other cyclists (Dondi et al., 2011). Another study indicated that 14.5% of all collisions or falls occurred when cyclists took avoidance manoeuvres while cycling on densely populated bike lanes (Teschke et al., 2014). Therefore, it is advisable when modeling the infrastructure of multi-use pathways (i.e seawall) that the design should create lanes that are straight, wide and obstacle-free passage for cyclists (Teschke et al., 2014). Thus, we believed this question would produce important data on the basis that accidents may occur on any route due to a variety of circumstances (i.e imprudence/avoidance manouevers) and that understanding these differences

will help planners design cycling routes in a way that maximizes safety (Teschke et al., 2014). The city of Vancouver has already taken notice of the difficulties created by the one-way bike lanes along the seawall and the need for increased space for bike movements along the narrow pathways (City of Vancouver, 2018a).

Results

We chose the "Seawall by Harbour Green Park", "Seawall by Coal Harbour Community Centre", and "Seawall by Denman" routes for this project. All data was collected on March 3, 2018, on a sunny day. The survey rating scale used for all questions went from 1 to 5, with 1 being "I very much dislike it", 2 being "It needs a lot of work", 3 being "It's ok but needs some work", 4 being "It's good" and 5 being "Wouldn't change a thing." While striving to maintain anonymity of participants in the survey, we recorded the resident/non-resident status of the cyclists, along with their sex. We felt that this would allow us to further understand our audience. Participants were assigned a number to maintain anonymity. All participants verbally consented to the use of their data in our project. In addition, we also recorded any relevant statements made by participants.

The Seawall by Denman route had the least number of participants (5) and the lowest average overall safety rating (4) amongst all routes. The Seawall by Coal Harbour route had the most participants (9) and had a low average width safety rating (3.33) along with the Seawall by Harbour Green Park. The Seawall by Harbour Green Park route had 8 participants and also had the lowest average interaction comfort rating (3.77).

The following table summarizes the number of participants and the average overall ratings for the 3 categories in all routes.

		Rating			
Route	Participants Surveyed	Overall Safety	Interaction Comfort	Width Safety	Overall
Seawall by Denman	Female Residents: 2 Male Residents: 2 Male Non-residents: 1	**4**	4.2	4.4	4.2
Seawall by Coal Harbour	Male Residents: 3 Male Non-residents: 2 Female Non-residents: 4	4.33	4.33	**3.33**	3.99
Seawall by Harbour Green Park	Female Residents: 2 Male Residents: 2 Male Non-residents: 1 Female Non-residents: 3	4.38	**3.77**	**3.33**	**3.82**

Bold = lowest average category rating amongst all routes

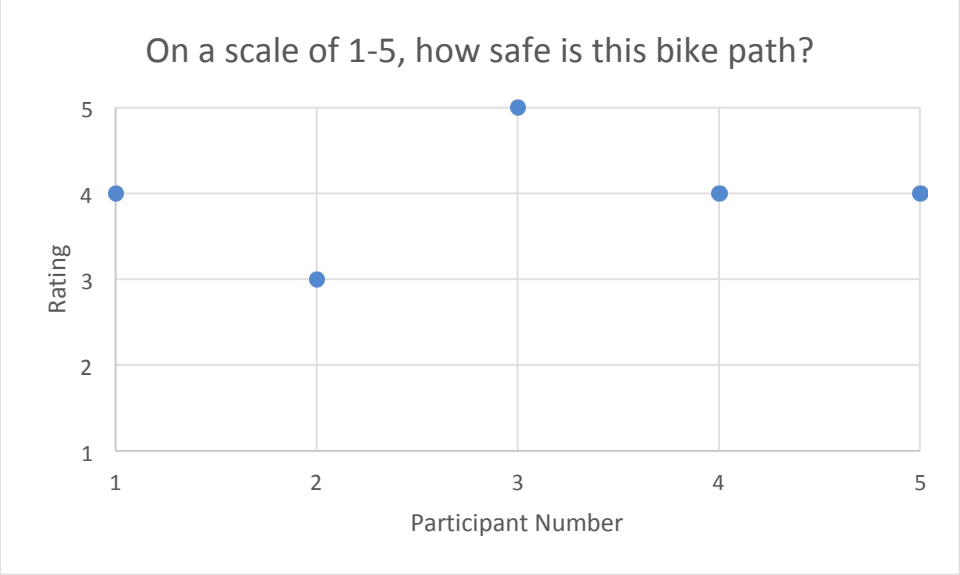
Seawall by Denman

For the Denman route, we received a total of fifteen responses from five participants. Despite optimal weather conditions present for cycling, we could not get many responses on this route, and thus also included a rollerblader participant in the survey.

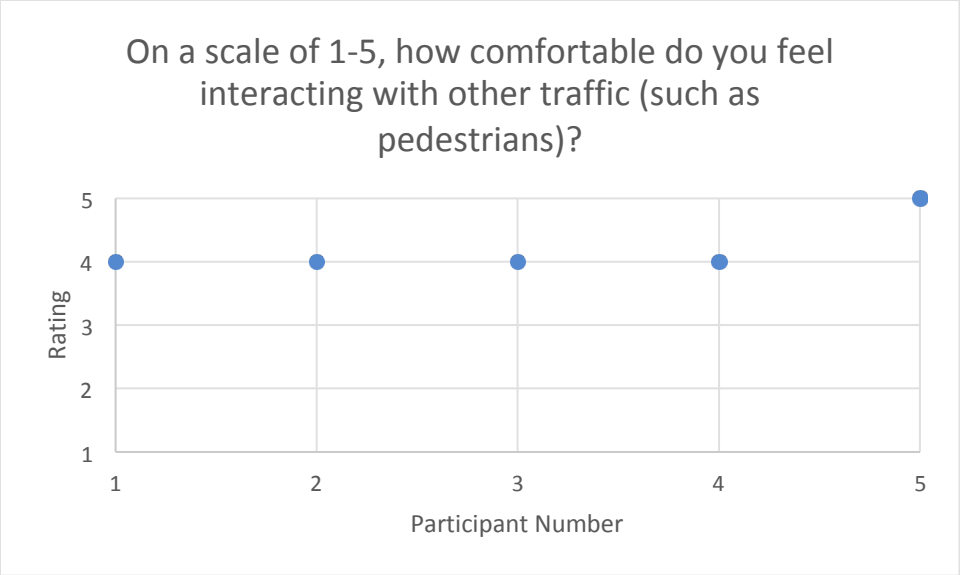
Compared to Harbour Green Park and Coal Harbour routes, the Denman route had the highest overall average rating (**4.2**).

Participant 1 was a female resident rollerblader, Participant 2 was a female resident cyclist, Participant 3 and 4 were male resident cyclists, and Participant 5 was a male non-resident cyclist.

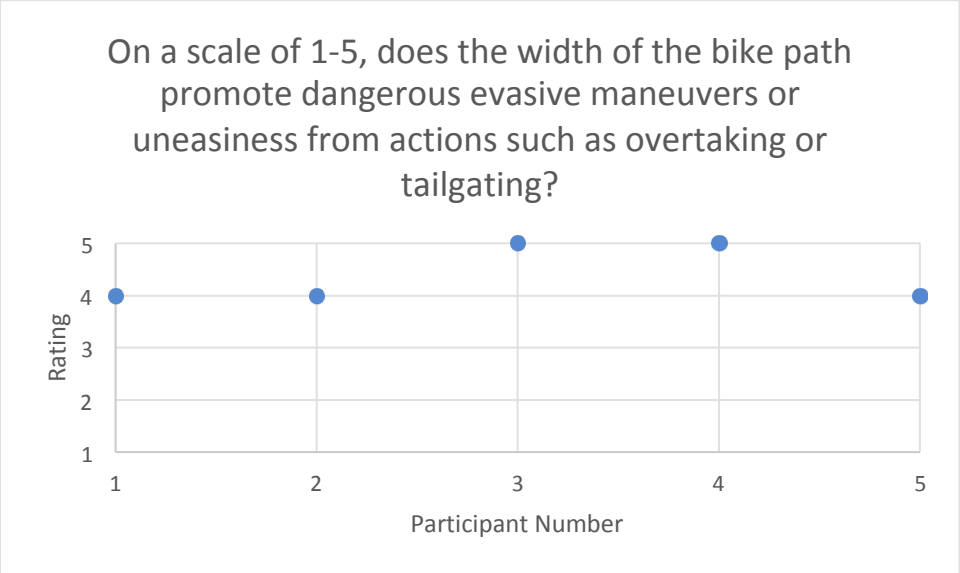
Participant 1 made a remark noting that surfaces on the bike path were not ideal for roller blading.



The average overall safety rating was this route was 4.



The average interaction comfort rating for this route was 4.2.



The average width safety rating for this route was 4.4.

Overall, ratings by females tended to be slightly lower than males, and no significant difference was noted between residents and the non-resident participant.

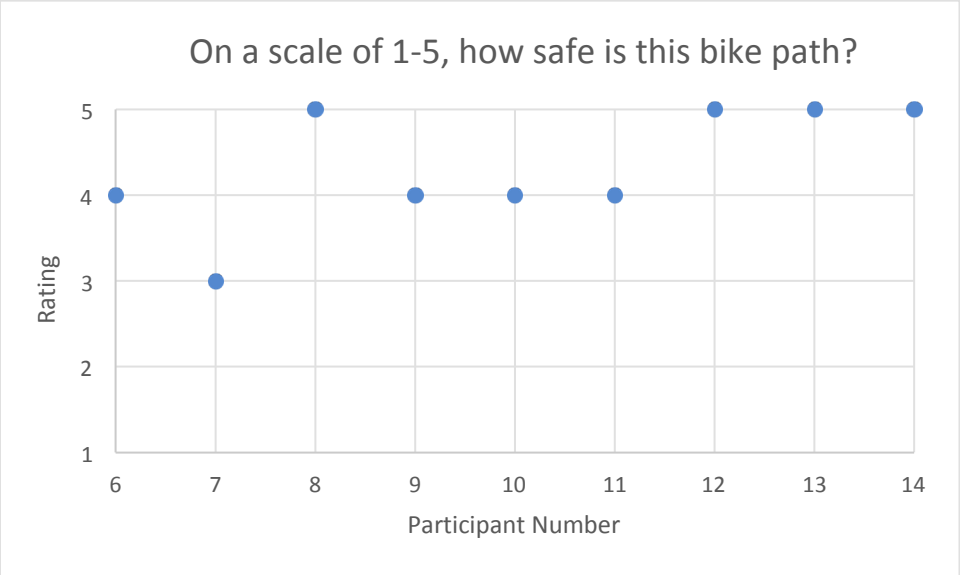
Seawall by Coal Harbour

For the Coal Harbour route, we received a total of twenty-seven responses from nine participants.

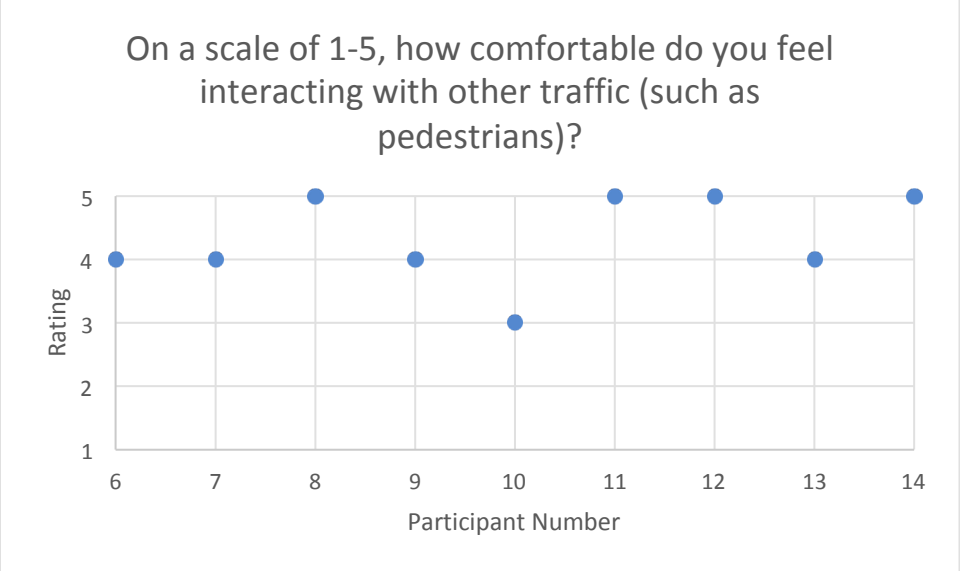
Compared to the Denman and Harbour Green Park routes, Coal Harbour had the 2nd highest overall average rating.

Participants 11, 12, and 14 were the only resident participants, and they were all male. Participants 6, 7, 9, 10 were female non-residents, while participants 8 and 13 were male non-residents.

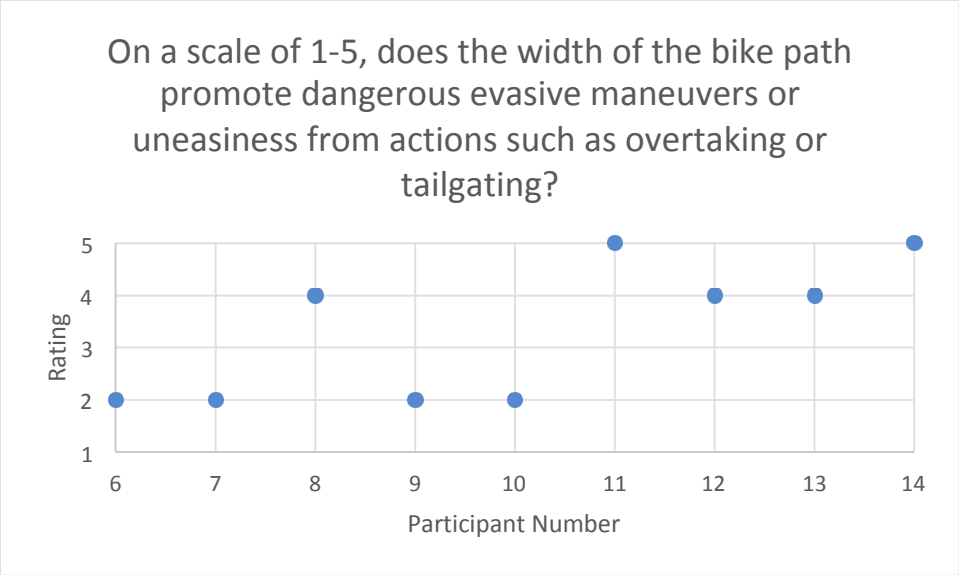
Participant 6 remarked that pedestrians were all over the bike path.



The average overall safety rating for this route was 4.33.



The average interaction comfort rating for this route was 4.33.



The average width safety rating for this route was 3.33.

Females (only non-residents were found) rated overall safety, interaction comfort, and width safety lower than male non-residents and male residents on average.

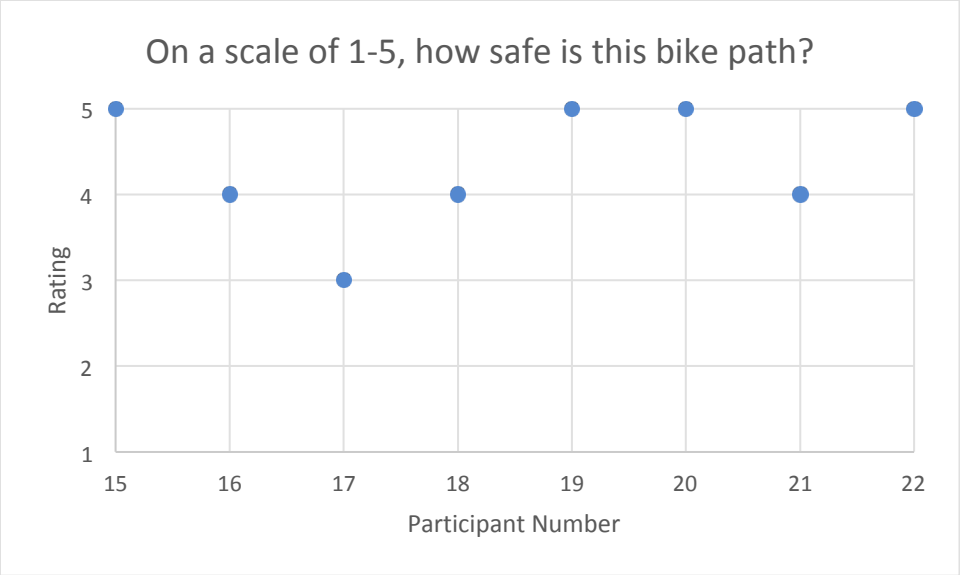
Seawall by Harbour Green Park

For the Harbour Green Park route, we received a total of 24 responses from eight participants.

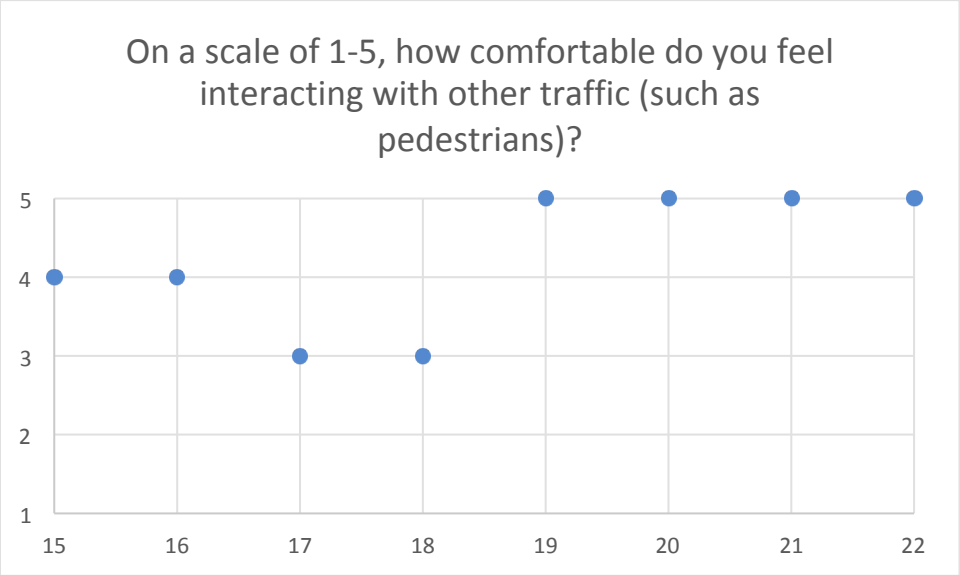
Compared to the Denman and Coal Harbour routes, Harbour Green Park had the lowest overall rating (**3.82**).

Participants 15 and 17 were resident females, while participants 16 and 18 were resident males. Participant 19 was a non-resident male, and 20, 21, and 22 were female non-residents.

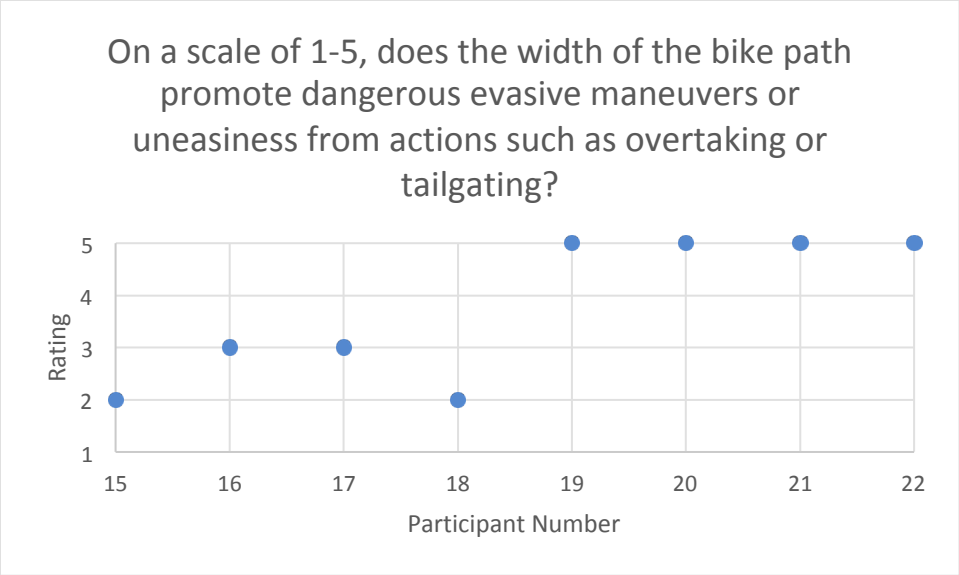
Participant 15 remarked that during busy times, she did not feel very safe on the route.



The average safety rating for this route was 4.38.



The average interaction comfort rating for this route was 3.77.



The average width safety rating for this route was 3.33.

While no significant differences were noted between males and females, non-residents tended to rate overall safety, interaction comfort, and width safety higher than resident participants.

Discussion

The overall goal of this project was to determine the overall safety of the Seawall for cyclists in the assigned target areas. While we expected the Seawall to get outstanding safety reviews relative to other bike routes, we justified our research into this topic with the fact that the Seawall is an icon of Vancouver and is heavily used by pedestrians, cyclists, residents, and non-residents alike (City of Vancouver, 2018a). Due to this, making all aspects of the Seawall as safe and welcoming as possible to all forms of traffic is a benefit to the city of Vancouver's resident well being and tourist infrastructure.

Our results suggest that the path by Denman had the lowest average overall safety rating with a score of 4, however, across all questions it ranked the highest with an overall score of 4.2. The bike path was wide relative to other areas of the Seawall and separated from other pathways significantly, ensuring no crossover which lead to high scores in overall safety, traffic interaction, and evasive maneuver ratings amongst cyclists interviewed. One participant on roller blades using the bike path was interviewed and noted that certain areas of the path used bumpier brick surfaces which were not ideal for roller blading and that significant attention had to be paid to the path at all times to ensure a safe transition from smooth to bumpy surfaces. While no cyclists complained about surface changes on the path, this may pose a problem to other wheeled traffic such as scooters, roller blades, and wheelchairs.

The Seawall by Harbour Green Park also received high safety ratings, however it was noted that pedestrians were often crowding the center bike lanes which caused frustration and a perceived lack of safety due to evasive maneuvers amongst the pedestrians. These qualitative findings were also supported by a score of 3.77 in interaction comfort which was the lowest in this category amongst all paths. We also observed many pedestrians walking in the bike lanes

despite numerous signage (see images in Apendix A). One male resident cyclist who was interviewed noted that on sunny weekend days in the spring and summer the pedestrian traffic in bike lanes gets much worse in the Harbour Green Park area of the Seawall. It appears that, despite adequate lane signage, the structure of the Seawall in this particular location does not adequately promote separate traffic lanes, which can lead to unsafe altercations between pedestrians and cyclists, especially on busier days in the summer. This infrastructure goes against the recommendations of Teshke et al., (2014) of straight and wide lanes permitting obstacle free passage. Another resident cyclist noted that certain portions of the Seawall, including parts by Harbour Green Park, have the cycling path more elevated than the pedestrian path which could potentially lead to dangerous accidents involving individuals with poorer eyesight or bike handling skills.

The Seawall by Coal Harbour was seen to have better separated cyclist and pedestrian pathways however, overall, the width of the cyclist path was narrower and lead to difficult situations when passing, with some resident participants noting that this was especially so during busier summer days when certain stretches of this path make passing nearly impossible. This path scored a 3.33 in width safety despite it not being peak Seawall biking season in Vancouver. One resident participant noted that, during busy times, narrow sections and corners of the Seawall can cause frustration, impatience, and sometimes dangerous passing maneuvers from faster, more aggressive cyclists. This participant noted also, on a more general note, that during bike races the Seawall routes have to be heavily supervised by police officers and other officials to ensure pedestrians do not cross to the bike lane. Blocking off the cyclists' lane from the pedestrian lane over the entire duration of the seawall may be a more cost-effective long-term solution in this regard.

Overall, the average ratings of safety for the Seawall routes were high, which we predicted, and despite the negatives we have outlined, the majority of residents and tourists, consisting of male and female adults, children, and older individuals, provided high ratings for all aspects of each targeted section of the Seawall. Overall the Denman route scored a 4.2 / 5 overall, the Coal Harbour route came in next with 3.99 / 5, and Harbour Green Park was not far behind with 3.82 / 5 overall. Although all routes scored highly, there were many challenges and limitations to our study. The majority of our participants were non-residents who had stopped to take pictures (11 non-residents vs 9 residents). The mindset of non-residents cycling the Seawall for the first time and residents that are familiar with the path may cause very different perspectives and responses on their critical assessment of the Seawall paths. As well as this, a small sample size of 18 total participants was also a major limitation. The vast majority of cyclers were not stopping, and we could not access all these individuals without being overly obtrusive. Despite our best efforts to collect data on a sunny weekend day, the traffic was not overly high, presumably due to cold weather and the winter season. Our questions were designed to be very quick and easy to answer to encourage individuals to participate and then continue on riding, however a continuous bike path where very few individuals stop made it quite difficult to access cyclists on the path. If more research was to be done on these specific bike paths we would recommend performing the research in a higher traffic season (Spring-Summer-Early Fall). We only encountered one participant who was a non-cyclist using the bicycle paths (1 rollerblader). It would be beneficial to perform research on the Seawall during busier times to attempt to access a more diverse population of users on the bike paths. Another recommendation for future research is the implementation of a less obtrusive approach to interviewing due to our challenges recruiting active participants on the Seawall. Perhaps interactive, anonymous survey

screens could be posted at Seawall maps in chosen areas or on columns outside of bike rental shops or food shops for a period of weeks. Stopped bikers could then initiate the survey on their own accord and data could then be collected after a few weeks. Although this would cost a lot more money than the unfunded research project approach we took for this class, the amount of willing participants and data would presumably be much higher. This strategy could access a larger diversity of cyclists on the seawall and would not restrict cyclists on the path in anyway.

Our research project was designed to focus on the safety of the Seawall for resident and non-resident users of the bike paths of all ages and abilities and, as such, the application of our findings applies specifically to the Seawall due to the unique design and nature of this bike path. There are few other multi-traffic recreational pathways like the Seawall, but our findings could be implemented in the design and application of other large scale multi-traffic pathways similar in design and structure. Many participants had qualitatively great things to say about the Seawall bike paths, but we feel our findings do suggest improvements can still be made to the pathways to improve the safety and overall experience of users. Continuously improving Vancouver's flagship recreational bike path is important for the recreational experiences of Vancouver citizens as well as tourists in the area. Not only this but providing great bike experiences on recreational pathways such as the Seawall can act as a gateway for individuals to cycle more consistently and seriously, perhaps promoting cycling as a form of transportation in other areas of the city leading to a healthier, active community and environment (Damant-Sirois et al., 2014).

Recommendations

Based on our results and observations, we developed route-specific recommendations to improve various aspects of bike route safety.

For the Seawall by Denman route, we recommend that the city install signs warning path users of the surface changes that occur in certain sections of the route. This recommendation is based on receiving a remark by a roller-blading participant that the surface changes from smooth to rough in particular sections of the bike route were not ideal for some users. As this route received the lowest overall safety rating, we believe that this approach will contribute to increased safety perception of this route.

For the Seawall by Coal Harbour route, we recommend two solutions. For a fast, low-cost implementation, we recommend that the city install signs warning users of a change in elevation. Although a more expensive solution, for greater effectiveness, could be to install ramps to allow gradual elevation increases and decreases. This recommendation is developed based on our observation that the bike path is significantly elevated compared to the pedestrian route. Despite the striking difference in elevation, a participant commented that "pedestrians were all over the path." As such, more aggressive signage or physical barriers such as fences may be needed on this route to prevent pedestrian obstruction. Interaction comfort was not a significant concern raised on this route, however, we recommend that passing zones be constructed for faster cycle traffic or rollerblading traffic based on observations of interactions on this route.

For the Seawall by Harbour Green Park route, we recommend the installation of a fence or median with crosswalk breaks rather than the current open design which allows pedestrians to walk all over the bike route. This is of particular concern in the sections of this route in front of

restaurants, which attract a lot of tourist foot traffic. This recommendation was developed based on this route receiving the lowest interaction comfort rating amongst the three routes.

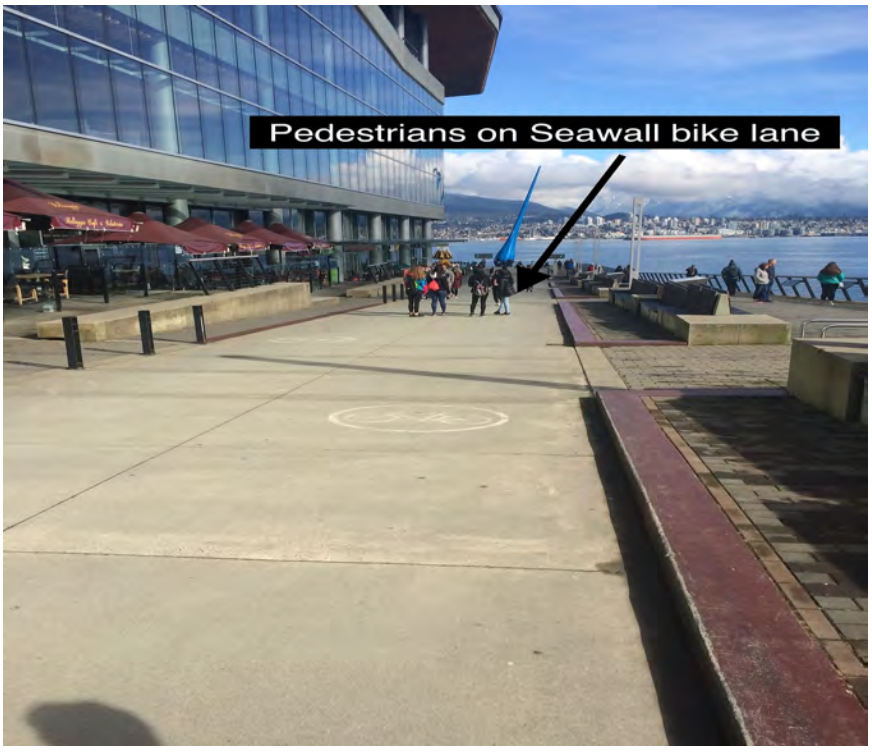
Both the Seawall by Harbour Green Park and Seawall by Coal Harbour routes had lower width safety ratings. The city of Vancouver has already taken notice of the difficulties created by the one-way bike lanes along the seawall and the need for increased space for bike movements along the narrow pathways (City of Vancouver, 2018a). Thus, if feasible, our recommendation would also be to increase the route space for cyclists along both sections of the Seawall.

Appendix A

Denman

Harbour Green Park & Coal Harbour


Elevation change from bike to pedestrian path


Pedestrians on Seawall bike lane

Appendix B

This is a copy of the survey questionnaire used to gather data from cyclists.

Interview Questions	1: I very much dislike it	2: It needs a lot of work	3: It's ok but needs some work	4: It's good	5: Wouldn't change a thing
How safe is this bike path in this area on a scale of 1-5?					
How comfortable do you feel interacting with other traffic (such as pedestrians) on this bike route on a scale of 1-5?					
Does the width of the bike path promote dangerous evasive maneuvers or uneasiness from actions such as overtaking and tailgating on a scale of 1-5					

Appendix D

Consent from all participants was collected verbally, and they were given an opportunity to read the form below and ask questions.

KIN 464: Health Promotion and Physical Activity

Participant Consent Form for Class-based Projects

Principal Investigator:
Dr. Andrea Bundon (Assistant Professor, School of Kinesiology, Faculty of Education)

Student Group: Group 17
Alex Bodman, Liam Haime, Jadin Sandhu, Soham Parelkar

The purpose of the class project:
To gather knowledge and expertise from community members on topics related to physical activity, recreation, health promotion and/or active transportation.

Study Procedures:
With your permission, we are asking you to participate in an answering 3 questions with numeric answers based on the 5-point scale provided. Students will take note of your responses. With the information gathered, students will critically examine how different individuals understand or engage in health promoting activities or initiatives.

Project outcomes:
The information gathered will be part of a written report for the class project. The written report will be shared with the community partners involved with the project. Summaries of findings may also be posted on the following website.

CityStudio Projects:
http://www.citystudiovancouver.com/projects/

No personal information/information that could identify participants will be included in these reports.

Potential benefits of class project:
There are no explicit benefits to you by taking part in this class project. However, participating will provide you with the opportunity to voice your opinion on your experiences with health promoting activities or initiatives in a broad sense and will provide the students with an opportunity to learn from your experiences.

Confidentiality:
Maintaining the confidentiality of the participants involved is paramount, and no names will be used in the reports.
At the completion of the course, all data (i.e. notes, interview transcripts) and signed consent forms will be kept in a locked filing cabinet in Dr. Andrea Bundon's research lab (1924 West Mall) at the University of British Columbia. All data and consent forms will be destroyed 1 year after completion of the course.

Risks:
The risks associated with participating in this research are minimal. There are no known physical,

economic, or social risks associated with participation in this study. Although there is a schedule of questions, participants are free to share what they would like, including refusing to answer specific questions. You should know that your participation is completely voluntary and you are free to withdraw from the interview and there will not be negative impacts related to your withdrawal. If you withdraw from the study, all of the information you have shared up until that point will be destroyed.

Contact for information about the study:
If you have any questions about this class project, you can contact Andrea Bundon by phone at 604-822-9168 or by email at andrea.bundon@ubc.ca

Research ethics complaints:
If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or e-mail RSIL@ors.ubc.ca. or call toll free 1-877-822-8598.

Consent:
Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time. Your signature below indicates that you have received a copy of this consent form for your own records. Your signature indicates that you consent to participate in this study.

Participant signature_____

Date: _____

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