FINAL REPORT: City of Vancouver Bike Route Feedback

Group 8
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KIN 464 - Health Promotion and Physical Activity

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Executive Summary: City of Vancouver Bike Route Feedback

This study was conducted in order to assess the safety and comfortability of three bike routes: Ontario between 49th and 50th, the portion of the Seawall by George Wainborn Park, and the portion of the Seawall between Burrard and Hornby street. With support for City Studio members, KIN 464: Health Promotion and Physical Activity resources, review of literature, and a survey of the routes, our team determined three aspects that were significant in determining both the safety, accessibility, and comfortability of each route. The three features were the width of bike lanes, visibility of the bike lanes, and surface of the bike lanes. These three features were then used to create a survey that was presented to cyclists utilizing these bike routes, giving them the opportunity to rate each feature in terms of satisfaction. The purpose of collected data was to provide the City of Vancouver, city planners, transportation councils, and engineers with the proper insight to not only improve the current cyclist experience but to aid in the development of future bike lanes and promote greater participation in cycling from the city's diverse population.

In total, we collected data from 25 participants: 15 from the bike route on Ontario between 49th and 50th and 5 from both Seawall locations. Results implied that riders were generally satisfied with the width and surface of all three locations. Questions involving comfortability travelling with high speeds, passing cyclists, being passed by cyclists, and travelling through intersections were met with general satisfaction as more than 60% of all participants responded positively. However, a key issue at both Seawall routes was the lack of visibility; most notably the lack of adequate lighting. Only 40% of participants felt the route at Wainborn Park had proper lighting while 20% felt comfortable with the level of lighting at the portion of the seawall between Burrard and Hornby Street.

Based on this data, it appears most participants felt that they were a safe distance away from vehicles on the road, but not a safe distance from other cyclists while they were passing or being passed. To mitigate this, we propose to create additional lanes within current bike lanes, allowing for passing without concern. This may also allow cyclists to ride at higher speeds without having to worry about other cyclists. Additionally, more information is needed on how cement barriers affect the perception of safety among cyclists. There was not a big difference between routes with barriers (Ontario street) and without barriers (Seawall at George Wainborn park and between Hornby Street and Burrard Street) among participants on how comfortable they feel cycling at higher speeds. Further research should be conducted in this area to evaluate how useful this barrier is and how safe it makes cyclists feel. Lastly, more effective lighting is necessary along the bike routes along the Seawall. Most participants did not feel there was adequate lighting which discourages user ship and overall cycling participation from citizens.

Introduction

The city of Vancouver, has consistently been regarded as one of the greenest cities in the world, notably through its increased focus on the development of cycling route infrastructure within the last decade (Luvelo, 2016). By encouraging cycling as a key mode of transportation among citizens, Vancouver accomplishes its sustainability goals through reduced gas emissions and promotes overall health through increased levels of physical activity among residents (Heath et al., 2006). With approximately 10% of residents relying solely on cycling for commuting and exponential growth of recreational cyclists, the safety, accessibility, and comfortability of bike routes are imperative in ensuring that the city's biking culture continues to flourish (Luvelo, 2016).

We, a group of University of British Columbia (UBC) students in the KIN 464: Health Promotion and Physical Activity course in collaboration with the City Studio members conducted this project in order to assess the current and proposed bike lanes of three bike routes: Ontario between 49th and 50th, the portion of the Seawall by George Wainborn Park, and the portion of the Seawall between Burrard and Hornby street. Through our review of literature and survey of the routes, we identified three features that were significant to the safety and comfortability of each route. Features included the width of bike lanes, visibility of the bike lanes, and surface of the bike lanes. These three characteristics were then used to create a survey that was presented to cyclists utilizing these bike routes, giving them the opportunity to rate each feature in terms of satisfaction.

The findings of this project were shared with the Active Transportation Unit of the City of Vancouver and used to design a 'user' rating system for select bike routes in the city. Additionally, findings were utilized to highlight aspects of bike routes that can be improved or modified in order to provide a safe and comfortable riding experience for the diverse population.

Literature Review

Reynolds et al. (2009) conducted a systematic review investigating the risk of cyclist injury based on the infrastructure of the bike route, looking at the presence of a roundabouts, major roads, and shared bike lanes. The review showed that multi-lane roundabouts were associated with the greatest risk of cyclist collision and injury, that bike lanes along major roads had more risk than minor roads, and that specific bike facilities (marked bike lanes, routes, and off road bike paths) were associated with the least risk of collision and injury. Reynolds et al. (2009) also concluded that cycling facilities with street lighting, paved surfaces, and low grades of elevation were also associated with increased perceptions of safety among users. The government of British Columbia released a statement providing evidence-based safety findings for cyclists. It was found that separated bike lanes with barriers or markings were safer than bike lanes on shared roads. Bike lanes on minor streets were safer than bike lanes on major routes. This statement also showed that the greater horizontal distance between cyclist and vehicles

resulted in safer bike routes, as they "provide more passing distance for cars; reducing crash risk" (Government of British Columbia, 2018). This report also showed that the more light there is, the safer the bike route is. In addition, Teschke et al (2012) conducted a case crossover study that examined the relationship between bike infrastructure characteristics and associated injury risks in selected bike routes throughout Vancouver and Toronto. Consistent with the safety statement issued by the government of Canada, it was found that major roads with parked cars narrowed bike lanes resulting in greater risk of cyclist injuries (Teschke et al., 2012). Construction that inadvertently narrowed bike lanes resulted in higher rates of injury (Teschke et al., 2012). Furthermore, Design guidelines developed by the City of Vancouver, defines sufficient bike lanes as 2.5 to 3.0 meters in width that allows passing of oncoming cyclists as well as conversational cycling (City of Vancouver, 2018).

Holzel, Hochtl and Senner (2012) examined how different biking surfaces attributed to the comfort and discomfort of the users of the bike lane. Their results showed that asphalt and concrete slabs resulted in the most comfortable cycling experience. Conversely, cobblestones and self-binding gravel was determined to be the least comfortable (Holzel et al. 2012). These findings are consistent with bike route design guidelines provided by the City of Vancouver recently. A component of the guidelines suggests that rough surfaces make cycling more difficult for older cyclists and those who are new to the activity due to an increase of jarring, low levels of comfortability, and may to contribute to higher risks of falls (City of Vancouver, 2018). Asphalt and concrete materials were found to be the ideal surfaces for cycling (City of Vancouver, 2018). From these findings, we can see that the surface, width, and visibility of bike lanes are instrumental in not only determining the safety but also the comfortability of the riding experience. As a result, these features must be explored further and improved in order to promote cycling as a key mode of transportation and an accessible form of physical activity for citizens.

Methods & Rationale

This project examined several factors that influence the safety of cyclists on bike routes throughout the city of Vancouver. Three bike routes were examined in the current project. The route along Ontario street between 49th and 50th avenue in Vancouver is already an established route by a college campus. The two other bike routes analyzed were proposed routes along the Seawall in Vancouver. The insight gathered from current users of the proposed routes will be beneficial to the development of the future bike routes by city planners, transportation councils, and engineers.

The bike route features that were focused on were the width, surface, and visibility of routes. The width of the bike lane includes how much space is dedicated to only cyclists and how much of the lane is shared with other road users such as cars or pedestrians. Inquiring about the visibility of the route includes anything to do with obstacles and whether or not there is adequate lighting. Finally, the surface of the bike lane involves any potholes along the route, uneven surfaces, the smoothness of the riding surface, as well as the pavement material.

We investigated these features as the Government of British Columbia report (2018) determined them to promote safety along bike routes. This report (2018) found the safest bike routes were well lit, wider lanes for passing and distance from cars and with the smoothest surfaces. The systematic review by Holzel et al. (2012) supported these results with the smoothest surfaces resulting in the most comfort for the cycling user. We utilized the same three features for each route because they are quite similar in their infrastructure. This standard also

provided an opportunity to compare and contrast between the routes.The items on the questionnaires were based on literature (Government of British Columbia, 2018, Holzel et al. 2012, & Manaugh et al. 2017).

Verbal consent was collected from all participants. This type of consent was used as the nature of this study was extremely time sensitive, and it was more efficient for participants to complete consent verbally rather than signing a form (appendix 1). Questionnaires (appendix 2) were utilized to collect data from each participant after verbal consent was acquired to allow inclusion of their responses in the project results.

No personal or identifying characteristics were collected from the participants and there was no potential risk for physical or emotional harm posed to the participants during their voluntary participation. The questions were designed to be clear and concise as we needed participants to stop their commute in order to answer them. Each survey was simple in nature requiring an "agree" or "disagree" answer**.** Surveying posts were established at intersections and along regions of the route that naturally prompted a user to stop. This allowed for more time for individuals to respond to the questions presented by the researchers. Prior to data collection, we surveyed each route in order to determine which key characteristics of each route would be used in the creation of our questionnaire. We collected data from the bike route on Ontario Street between 49th Avenue and 50th Avenue from 4:30pm to 5:30pm on Wednesday March 23, 2018. At this location we were able to administer the questionnaire to a total of 15 participants. On Friday March 20, 2018, we collected data from bike routes at the Seawall by George Wainborn Park and the portion of the Seawall between Burrard and Hornby street. This data collection session lasted from 3pm to 6pm and we administered the survey to a total of 10 participants. Surveys were conducted on weekdays during evening peak hours (Monday to Friday, 4pm to 6pm), as the we felt most cyclists would be more likely to stop on their way home from work, rather than on their way to work in the morning. Photographs from the route with no users on them were taken also be included to provide context about particular positive or negative design features along the bike route.

Results

At each of the three bike routes, the same survey was administered to consenting cyclists regarding the width, visibility, and surface of the given bike route (Appendix 2).

Table 1 - Responses for cyclists stopped along Ontario Street route.

Participant	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8
1	3	agree	agree	disagree	agree	disagree	disagree	agree
2	5	agree	agree	agree	agree	agree	agree	disagree
3	7	agree	agree	agree	agree	disagree	agree	agree
4	5	agree	agree	agree	agree	agree	agree	agree
5	1	agree	disagree	agree	agree	agree	agree	disagree
6	1	agree	disagree	agree	agree	agree	agree	agree
7	1	agree	agree	agree	agree	agree	agree	agree
8	5	agree	agree	agree	disagree	agree	agree	disagree
9	5	agree	agree	agree	disagree	agree	disagree	agree
10	3	agree	disagree	agree	agree	agree	agree	agree

11	3	agree	agree	agree	disagree	agree	agree	agree
12	4	agree	agree	agree	agree	disagree	disagree	agree
13	5	agree	agree	disagree	agree	agree	agree	disagree
14	1	agree	disagree	agree	disagree	disagree	agree	disagree
15	3	agree	disagree	agree	agree	disagree	agree	agree

The bike route on Ontario Street between 49th Avenue and 50th Avenue had an average usership of 3.4 days per week among participants. In regards to the width of the route, 66% of participants felt a safe distance away from other vehicles and fellow cyclists. Meanwhile, 87% of participants felt that they could safely pass or be passed by other cyclists. In regards to their safety through intersections, 60% of participants felt safe passing through the intersections without worrying about cars and pedestrians. Overall, 66% of participants felt comfortable enough to cycle at high speeds on this route. Considering the lighting and visibility of the route, 73% of participants felt the route had adequate lighting and 66% of participants felt their view was un-obstructed by parked cars, trees, bushes or fences. The surface of this bike route was asphalt and 80% of participants felt the surface of the route was well maintained with no potholes/debris.

Table 2 - Responses for cyclists stopped at George Wainborn Park

Participant	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8
1	2	n/a	agree	disagree	agree	disagree	disagree	agree
2	3	n/a	agree	agree	agree	agree	agree	disagree
3	4	n/a	agree	agree	disagree	disagree	agree	agree
4	5	n/a	agree	disagree	disagree	agree	agree	agree
5	2	n/a	agree	agree	disagree	agree	agree	disagree

The bike route on the Seawall at George Wainborn Park had an average usership of 3.2 days per week among participants. In regards to the width of the route, 100% of users felt they can pass or be passed safely by other cyclists. While this route did not intersect with any cars, there was a shared section between cyclists and pedestrians, where 60% of participants felt safe riding through this area. Likewise, 60% of participants felt comfortable enough to cycle at higher speeds on this route. In regards to the lighting and visibility on this route, 40% of participants felt the route had adequate lighting, while 60% of participants felt their view was un-obstructed by trees, bushes or fences. The surface of this bike route was paved asphalt, and 80% of participants felt the route is adequately maintained with no potholes or debris.

Table 3 - Responses for cyclists stopped along seawall between Hornby and Burrard Street

Participant	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8
1	6	n/a	agree	disagree	disagree	disagree	agree	disagree
2	2	n/a	disagree	agree	agree	agree	disagree	disagree
3	1	n/a	agree	agree	disagree	disagree	disagree	agree

4	1	n/a	agree	disagree	disagree	agree	disagree	disagree
5	5	n/a	agree	agree	disagree	agree	disagree	disagree

The bike route along the Seawall between Hornby Street and Burrard Street had an average usership of 3 days per week among participants. In regards to the width of the bike lane, 80% of participants felt they can pass or be passed safely by other cyclist. While this route did not have intersect with any cars, there was a shared area between cyclists and pedestrians, and 60% of participants felt safe riding these areas. In regards to adequate lighting, 20% of participants felt the route had adequate lighting. Moreover, only 20% of participants felt their view was un-obstructed by trees, bushes or fences. This bike lane was made of cobblestone and 60% of participants felt the route was adequately maintained with no potholes or debris. However, only 20% of participants felt comfortable enough to cycle at higher speeds on this route.

Discussion

Overall, the surfaces of all 3 bike routes were well maintained and elicited a safe riding experience according to survey feedback. The two routes (Ontario street and George Wainborn park) that have an asphalt surface had 80% of participants respond "agree" when asked if they felt the route was adequately maintained without potholes or debris. Conversely, the route that had cobblestone (Seawall between Hornby and Burrard) only had 60% of participants respond with "agree" when asked if they felt the route was adequately maintained without potholes or debris. These findings are congruent with the study conducted by Holzel et al. (2012), which showed that the smoother the bike route, the more comfortable the cyclist perceives the route to be. In this circumstance, the routes paved with asphalt showed a higher satisfaction rating among participants, while the route with cobblestone - much less smooth than asphalt - reflected a lower satisfaction rating on the maintenance of the route.

The results of this study calls for a greater need of lighting sources along bike routes on the Seawall. As only 40% of participants felt there was adequate lighting along the bike route at George Wainborn park, it draws attention to the need for more light sources along this route. As the average usership average usership of 3.2 days per week, it is inferenced that many users will use this route as a route for transportation to and from work. During winter months in Vancouver, it gets dark very close to business hours, causing people to cycle in the dark. More adequate lighting could come from a variety of sources: brighter street lamps, more street lamps, or even the cyclist having lights on their bikes for their own visibility.

Furthermore, the results also show that a significant number of participants from all three routes felt uncomfortable travelling at higher speeds. At the bike route on Ontario Street between 49th Avenue and 50th Avenue, only 66% of participants felt comfortable travelling at high speeds, while only 60% and 20% of participants felt comfortable at the other two Seawall routes respectively. This is may be problematic as commuters who depend on bicycles as their main form of transportation view the ability to get to work on a timely manner a key determinant of utilizing this form of transportation (Heath et al., 2006). Commuters also expressed that bike routes that they felt comfortable cycling at high speeds on as well as those that elicit easy passing were preferred when compared to other routes (Heath et al., 2006). Therefore, it is important for

the City of Vancouver to improve these conditions in order to encourage an even greater level of cycling and physical activity among its citizens.

At the bike route along the Seawall between Hornby Street and Burrard Street, only 20% of participants felt their view was un-obstructed by trees, bushes or fences. This is significant as the seawall is a popular public site that facilitates high levels of physical activities during all seasons. It is also a way that Vancouverites can easily access nature as joggers, cyclists, children, dog walkers, and leisure walkers alike share this beautiful piece of infrastructure. Therefore it is crucial that all users of seawall feel that they are safe by having an unobstructed view. By lowering the risk of colliding with bikes, through improving the cyclist's view, more individuals of all ages will feel comfortable performing physical activity at the location. Especially for individuals over 65 years of age and younger children, the level of safety associated with a specific form of physical activity is a key determinant of participation (Macdonald, 2007).

Challenges

A major challenge faced in this study was getting participants to stop their bike ride to answer questions for us. The route on Ontario street between 49th avenue and 50th avenue had an intersection with a light, allowing for a natural stop in traffic. This allowed us to get a considerable number of cyclists to stop and participate in the study.

The bike routes on the seawall, both at George Wainborn park and between Hornby Street and Burrard Street, did not have a natural stop in traffic. Often people were not willing to interrupt their bike ride as there was no reason for them to stop other than answering the questions. Another major challenge faced in this project was inclement weather - while collecting data at George Wainborn park and between Hornby and Burrard - it was a rainy and windy day. This meant there were much fewer cyclists on the route, and less people willing to participate in our study as it was inconvenient.

Another key challenge we faced was that we were at times not visible to cyclists travelling at high speeds. Especially during rainy and windy conditions at the Seawall routes, cyclists were focused solely on their task at hand and only looking forward. Since data collectors were positioned on the side of the bike path, eliciting attention from potential participants was difficult.

Limitations

A limitation of this study was the sample sizes that we were able to collect.. While we had a larger sample with the bike route on Ontario Street, a sample size of fifteen is still rather small, and our sample sizes at George Wainborn park and on the Seawall between Hornby and Burrard were both five participants - far too small to be able to generalize to the greater population of the cyclists on either of these routes. Another limitation for us to collect data was how long it took to conduct our survey. We were able to ask all the questions within five minutes, and many people did not have that much time to spare. Perhaps a shorter survey would have resulted in a larger sample size collected.

A potential confounding variable that would affect the results is the overall skill level of the cyclist. How comfortable one feels cycling at different speeds, around cars and pedestrians, and overall familiarity to the route will influence their answers. The experience of a bike route is subjective to the user, and if a participant is less experienced, they may be less comfortable to ride at a high speed regardless of how safe the bike route is in itself. Furthermore, a cyclist's knowledge of road cycling guidelines as well as skill level may determine how comfortable they

are with passing or being passed by other riders. These factors also may affect their confidence in passing through intersections regardless of the three road factors we proposed.

A key limitation of the design of this study is the lack of analysis on the the type of bikes and tires that cyclists possessed. The response of participants to survey questions such as comfortability travelling at high speeds and passing other cyclists may be directly related to the type of bike they ride. For instance, a study found that individuals that utilized road bikes were much more comfortable riding at higher speeds due to its capability of reaching high speeds and smoothness when compared to those who rode mountain bikes (Arnberg & Tydén, 1974). Furthermore, road bikes also had built in brakes that made stopping more efficient (Arnberg & Tydén, 1974). The maneuverability and handling of road bikes were also superior giving riders greater confidence in passing and going at high speeds (Arnberg & Tydén, 1974). Another factor that could have potentially affected our data is the type of tires that riders used. While all winter tires have traction in rain and windy weather, everyday tires do not (Arnberg & Tydén, 1974). Especially since our data collection at the two Seawall locations happened on a day of rainy weather, this confounding variable could have been significant.

Our study design did not include data collection during night time when light availability becomes a major concern. Although bike lane usability significantly decreases during nighttime, the risk of cycling accidents increases (Hoque, 1990). As a result, it would be beneficial to administer this survey in order to access how users feel about the overall safety of the three bike routes during a high risk period.

To get more generalizable results, a greater sample size would be needed. In order to obtain a greater sample size, a group should choose to collect data on a day with sunny weather, as more people are likely to ride their bikes, rather than in the rain and wind. The researchers should also wear clothing with greater visibility, and make themselves more identifiable to potential participants. By wearing identifiable clothes, cyclists may be willing to stop for more information and participate in the study. Additionally, finding an intersection that is in close proximity to both the bike route on the Seawall at George Wainborn park and between Hornby Street and Burrard Street, allowing for a more natural stop in traffic. Many people were cycling at very high speeds and were not able to stop to participate in the study. Because of this, the sample size was very small and these results are not generalizable to a greater population. Although the time constraint is a barrier, we believe that collecting data regarding confounding variables such as an individual's bike type, tires, skill level, familiarity of the route, and overall knowledge of cycling rules provides the opportunity to account for these variables; resulting in data of greater objectivity and accuracy.

Recommendations

The results of this study showed that cyclists who used a bike route with cement barriers felt they were an adequate distance away from cars, as 66% of participants overall felt they were a safe distance from cars on the bike route. These results are aligned with the Government of British Columbia report (2018), and the City of Vancouver report (2018). However, 60% of participants cycling within this route did not feel they had enough space to pass or be passed by other cyclists safely. This is a cause for concern as cyclists may be forced to exit the safety of the barricaded lane in order to pass. An improvement that could be made to ensure the safety of cyclists while passing or being passed is to having marked lanes within the protected bike lane to allow for safe passing (Heath et al., 2006).The perception of safety with more than one user in a

lane is a key aspect in bike lane safety and should be considered when more lanes are being built (Heath et al., 2006).

Another interesting finding from our results is that the cement barriers that provide safety to the cyclists from cars does not seem to have any effect on increasing the riders level of comfort riding at high speeds. Along the section of Ontario Street between 49th and 50th Avenue, where 66% of the participants felt comfortable riding at high speeds where the route was protected from cars by cement barriers. This is only slightly higher than the 60% of participants who felt comfortable riding at high speeds along the bike route at George Wainborn park along the seawall, which is also separated from cars and pedestrians, but a few metres wider and bordered by bushes and the open park in comparison to the route along Ontario Street.

The lack of a significant difference in riders' comfort levels regarding cycling speed and comfort in passing or being passed by others may raise the question of how much of an effect the cement barriers have on the perceived safety of the cyclists using the protected bike lane. Based on these two points we believe that more research into the effectiveness of cement barriers protecting cyclists and increasing their level of perceived safety is necessary. It may be important to investigate the effectiveness of alternative methods of protection for cyclists such as pylons, curbs, or extra wide lanes, to see if they appear any less intimidating and confining to cyclists than cement barriers and help cyclists' comfort passing others and riding at higher speeds. If an alternative method of protecting bike lanes such as pylons was found to be more effective than cement barriers it could have several key influences on the development of new protected bike lanes. Pylons are likely to be cheaper than cement barriers, easier to install and maintain, take up less space on the road allowing for more room for cars and cyclists, and will be less obstructive to cyclists who are trying to pass others or ride fast in a confined space. If they can be implemented into current or future bike lanes and increase cyclists' comfort levels while maintaining effective protection for cyclists, it could produce a significant increase in rider satisfaction with the bike lanes in the city of Vancouver.

The final recommendation we can make for the development of future bike lanes and as an upgrade to existing bike lanes would be to provide more effective lighting along the bike routes. Many users felt dissatisfied with the amount of lighting along the bike routes, particularly along the seawall routes where the majority of users felt that the lighting was inadequate for riding at night time. Along the seawall at George Wainborn park, the lighting along the route was shared between the cyclist and pedestrian section of the seawall, but were placed in favour of the pedestrian pathway, with barely any of the light, which was also not very bright to begin with, to help illuminate the side of the bike path. Adequate lighting on a bike path is extremely important for cyclists to not only see where they can safely travel, but also allow cyclists to be seen easily by other cyclists and cars alike who might be sharing the road with them. With such low scores of agreeability regarding the adequacy of lighting on the bike paths we selected, we feel that this is an important concern that needs to be brought to attention and requires major steps towards improvement to be made in order to increase the safety and satisfaction of cyclists using our bike lanes.

Appendices

Appendix 1 - Proposed Consent

This form of oral consent will be used as it is a time sensitive manner for participants to participate in the study. As we will be interrupting their day asking questions, this method of consent would be best as it takes the least amount of time and would not require the participants to sign a form in the short amount of time they have to answer the questions.

Thank you for taking the time to stop and talk with us. We are a group of students from the University of British Columbia (UBC) working on our Kinesiology Undergraduate degrees. This project is a part of one of our courses at UBC regarding Health Promotion and Physical activity (KIN 464). The project we are working on is focused on evaluating certain aspects and safety features of bike paths in and around the City of Vancouver, and collecting feedback regarding the bike paths to create ideas on what safety features are important when planning and creating new bike paths in the city. The data collected from this project will be shared with our fellow classmates as well as members from CityStudio. "CityStudio is an innovation hub where City staff, students, and community co-create experimental projects to make Vancouver more sustainable, liveable and joyful." While we understand the need for individual privacy, we would like to assure you that all data collected will remain completely anonymous, and that no personal information will be recorded by us. By stopping to speak with us and taking part in our quick questionnaire, you hereby give your consent to have your answers recorded anonymously and used for evaluating current bike paths in the city of Vancouver and proposing new ideas on how to design future bike paths to be even safer and user friendly.

If you have any further questions regarding our project, or would like to be kept up to date with the results of our project, please feel free to contact us here.

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Appendix 2 - Survey questions

Question	Response
How many days per week do you ride along this route?	1 / 2 / 3 / 4 / 5 / 6 / 7
When riding along this route, do you feel like you are a safe distance away from cars sharing the road with you?	Agree / Disagree
When riding along this route, do you feel like there is adequate space to safely pass or be passed by other cyclists?	Agree / Disagree
When riding along this route, do you feel safe passing through intersections without having to worry about pedestrians or vehicles?	Agree / Disagree
When riding along this route, do you feel there is adequate lighting to easily see where you are going?	Agree / Disagree
When riding along this route, do you feel like you can clearly see around corners and through intersections without being obstructed by parked cars, trees, bushes, or fences?	Agree / Disagree
When riding along this route, do you feel that the road is adequately maintained in being kept free of debris and potholes?	Agree / Disagree
When riding along this route, do the road conditions make you feel comfortable riding along the path at higher speeds?	Agree / Disagree

Appendix 3 - Photographs of bicycle routes

Photo 1 - Seawall bicycle route between Hornby Street and Burrard Street. This photographs the large width of the bike lane contributing to the comfort of riders in regards to cycling around people and other cyclists as well as safely passing others. This photographs also depicts the brick surface of the bike route that was unique to this location, and how the road surface of the route is well maintained.

Photograph 2 - Seawall bicycle route passing George Wainborn Park shown to the left side of the photograph. This photograph depicts the division of the bicycle path from the pedestrian pathway by the trees and bushes running between them. This photograph also shows the poor lighting features of this bike route, as the light blue lamp posts in between the bicycle and pedestrian paths can be seen curving and placing the light source above the pedestrian pathway. This poor placement coupled with the low output of light from the old bulbs led to very low satisfaction of the lighting for this route by the cyclists surveyed.

Photograph 3 & 4 - Ontario Street between 49th Avenue and 50th Avenue. This photograph shows the cement barrier that is used to protect the bike lane. While the cement barrier was found to provide a sense of safety and protection from cars for the cyclists on this route, it also leads to low levels of comfort when cyclists had to pass or be pass by other cyclists using the bike lane.

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