Photo Mapping Winter Cyclists' Experiences to Improve Winnipeg's Bikeable Infrastructure

Max Neustaedter
Department of City Planning
University of Manitoba
2025

Photo Mapping Winter Cyclists’ Experiences to Improve Winnipeg’s Bikeable Infrastructure

Max Neustaedter
Master of City Planning Capstone
Department of City Planning
Faculty of Architecture
University of Manitoba
2025

Acknowledgements

I would like to thank Dr. Rae Bridgman, who has supported this study as my capstone instructor and advisor. I greatly appreciate the care and intentionality she has shown me through many inspiring conversations. I would like to thank Dr. Orly Linovski, whose guidance as my internal advisor has been fundamental to this research. Dr. Linovski's research expertise and thoughtful advice grounded this study and motivated me to be meticulous and concise. Also, I would like to thank Anders Swanson, as my external advisor, who has provided valuable cycling knowledge to shape this research. To the winter cyclists who participated in this study, thank you for your time and our conversations. Your commitment to winter cycling was central to this study and I could not have done it without you.

Photo Mapping Winter Cyclists' Experiences to Improve Winnipeg's Bikeable Infrastructure is supported in part by funding from the Social Sciences and Humanities Research Council. I would like to express my deep gratitude to the Council. Their funding was essential to this study and completing my degree.

I express my gratitude to my wife Kayla, who has never ceased to stay by my side. I also thank my family and friends, who have encouraged me through all my years of school. Your support and prayers never ceased.

"People don't notice whether it's winter or summer when they're happy."

\- Anton Chekhov

Executive Summary

Cycling is an active mode of transportation that supports the development of healthy and sustainable communities. Many people use cycling as a primary mode of transportation year-round. However, those who do face challenges specific to cold-weather months, which is certainly the case in Winnipeg, Manitoba.

Winter cyclists often experience situations that put them at risk. Unstable surfaces, prolonged hours of darkness, and conflicts with traffic are a few examples of challenges that arise. Compared to motorists, winter cyclists are at a disadvantage on the road, being more vulnerable and exposed. Seeking to improve the experiences of local winter cyclists, I used participatory photo mapping to engage eight participants by asking each of them to capture photographs of high- and low-quality aspects of a winter bike ride. Through interviews, I used photo elicitation to learn about their perspectives on the existing infrastructure and gain understanding about the challenges they face in Winnipeg.

Through inductive coding, I organized the experiences into five categories: context for participants' experiences, high-quality aspects, low-quality aspects, suggested solutions, and priority locations. Within low-quality aspects, I describe three main challenges that the participants face, which are conflicts with motorists, lack of snow clearing, and gaps in the cycling network amplified by winter conditions.

Analyzing these challenges allowed me to provide three long-term strategies that could be used to improve the experiences of all winter cyclists in Winnipeg. These three strategies are: increasing user equity on roads by reducing conflicts, improving the communications related to snow clearing by the City, and increasing access to the cycling network.

I then identified four short-term recommendations based on the assessment of participants' experiences and best practices found in the literature review. I recommend that drivers' education be adapted to include an enhanced module related to sharing the road with cyclists generally, and more particularly, winter cyclists. I also recommend the City of Winnipeg implement bike boxes downtown, update road signage in areas where the cycling network requires cyclists to use the road, and develop an online, live snow clearing map. These solutions are limited by cost and weather conditions yet may help mitigate challenges and improve the experiences of winter cyclists who use the cycling infrastructure. As Winnipeg moves towards becoming a winter cycling city, these short-term recommendations can raise awareness of the need for change.

Previous Winnipeg-based cycling studies have included interviewing decision makers. This study identifies how Winnipeg's cycling infrastructure can be improved, without seeking the input of decision makers by providing local winter cyclists a chance to share their lived experiences.

Table of Contents

List of Figures

List of Tables

1.0 INTRODUCTION

Through this research, I sought to understand the perspectives of winter cyclists in Winnipeg by engaging participants in photography, to capture their positive and negative perceptions of what it is like to cycle during winter in Winnipeg.

Based on eight winter cyclists' experiences, I have identified strategies and recommendations to mitigate challenges that winter cyclists experience in Winnipeg. Challenges faced by winter cyclists include conflicts with motorists, issues around snow clearing priority, and challenges related to gaps in the cycling network. Strategies to improve these challenges are to reduce conflicts, improve snow clearing, and increase access to the cycling network. I developed short-term recommendations based on the participants' experiences and best practices. Recommendations include increasing education for motorists, implementing bike boxes, updating road signage, and improving the communication of snow clearing.

This study is based on participatory photo mapping as a method of engagement and dissemination. Photographs from participants are used in this document to support my findings and to visual their experiences. Figure 1 provides a map of the locations of where the photographs were captured in Winnipeg.

1.1 Significance of the Research

There have been two previous master's theses out the Department of City Planning at the University of Manitoba that have focused on winter cycling. These two theses are *Mainstreaming bicycling in winter cities: the case of Oulu, Finland* by Pratte (2011) and *Pedal power: designing effective cycling infrastructure in Winnipeg with lessons from Minneapolis* by Harris (2013). Both of these studies included discussions with decision makers, and both included autoethnography as a research method. In 2014, the consulting firm Urban Systems released the Winnipeg Pedestrian and Cycling Strategies report, which was prepared for the City of Winnipeg, which also included discussions with decision makers.

This study attempts to shift the focus onto people who have committed to using Winnipeg's cycling infrastructure year-round. To my knowledge, this is the first study that has focused solely on members of the public to inform winter cycling in Winnipeg.

This research has the potential to inform policy makers and decision makers by sharing the experiences of winter cyclists. By using a bottom-up approach to inform policy, my intent is that this study continues to keep the wheels rolling on the importance of planning for types of transportation besides cars, and to encourage Winnipeggers to live an active lifestyle year-round. This research also identifies recommendations that can be implemented in Winnipeg in order to increase safety and ease of use within the cycling network for new and experienced winter cyclists.

1.2 Research Questions

The following questions were used to guide this research:

1. How can the experiences of winter cyclists in Winnipeg contribute to the improvement of cycling infrastructure for winter use?
2. To what extent do winter cyclists’ suggestions for improving Winnipeg’s winter cycling infrastructure align with previously published recommendations?
3. Where could the participants’ suggestions be implemented in Winnipeg?

2.0 RESEARCH METHODS

2.1 Participatory Photo Mapping

Participatory photo mapping combines native photography (photos taken by participants) and photo elicitation (presenting photos captured to participants for discussion) with the specific intention to raise political awareness for a social issue (Dennis, et al., 2009; Gaulocher, et al., 2010; Blinn & Harrist, 1991; Moletsane, et al., 2017). This methodology helps to introduce researchers to the experiences of participants at a level that goes deeper than a typical survey or interview (Harper, 2002). Participatory photo mapping identifies a collective narrative based on insights from the interviews. The images and experiences are then spatially mapped, allowing policymakers and the community to reflect on the issues and lived experiences in a manner that calls for policy change (Blinn & Harrist, 1991; Dennis, et al., 2009; Gaulocher, et al., 2010; Moletsane, et al., 2017). Over the past fifty years, the fields of anthropology and sociology have used photographic data as a means to research what experiences are like as photographs are both geographically based and narrative in nature (Blinn & Harrist, 1991; Dennis, et al., 2009).

I used this methodology as an overarching guide to how this research was structured. It began with recruiting participants and providing them with a prompt to take images. The prompt provided was "Pause to take photographs during a winter bike ride: take photos of high-quality and low-quality aspects of the places that you bike during winter." Participants were provided with directions to structure their ride (Appendix A). They were asked to take between ten and twenty photographs with their phone camera during a bike ride in January 2025. It was suggested that the bike ride was between 20 and 60 minutes and that it would be on a route that they are familiar with. Rides were asked to be done within the City of Winnipeg limits. The rides were allowed to be recreational or as part of a commute.

Once completing the ride, participants emailed the images to myself. After I received the images, I set up a time for individual, semi-structured interviews with each of them to discuss their experience. These interviews are described further below. During the interviews I used photo elicitation to spark discussion with the participants, learning what challenges they experience and what positive aspects there are for winter cyclists in Winnipeg.

2.2 Recruitment Methods

Participants were recruited through local cycling stores' social media and one hard copy poster (see Appendix B). I intended to recruit 8 participants based on what was feasible for the time constraints of the study. As people responded, many of them mentioned the number of years that they have been a winter cyclist for. Due to the time constraints of this study, I made the decision to reach out to the people who stated the number of years that they cycled in their inquiry email. This was 14 people. I made this decision because these individuals (all who indicated they had 2 or more years of winter cycling experience) already met one of the inclusion criteria: "Participants must consider themselves to be an experienced winter cyclist with at least one year of experience cycling during winter months." Due to time constraints on the study, this decision reduced the possibility that individuals did not meet all of the inclusion criteria. The entire list of the inclusion criteria for participants included:

1. Participants must be the age of eighteen (18) or older, a resident of Canada, and live in the City of Winnipeg.
2. Participants must consider themselves to be an experienced winter cyclist with at least one year of experience cycling during winter months.
3. Participants must testify that they understand local laws related to cycling.
4. Participants have a camera to take their own photographs.
5. Participants must not be a professional planner in or in a position to directly impact cycling policy in Winnipeg.

Additionally, I reached out to one potential participant who stated in their inquiry email that they often winter cycle with their child. Of the 15 people I reached out to, ten people signed the Participant Informed Consent Form (see Appendix C), and I received photographs from eight of the participants. Due to the amount of time that I gave participants to conduct their bike ride, I did not reach out to more participants once I realized that some who had engaged in becoming participants had stopped responding.

2.3 Participants

I had a total of eight participants. All participants met the inclusion criteria. Table 1 lists demographic information provided to me during the semi-structured interviews (interview questions can be found in Appendix D) and from responses to a questionnaire (see Appendix E). Three female cyclists and five male cyclists participated. Cyclists had a variety of years of experience, ranging from two to twenty years. Cyclists ride between two and a half to six times per week in the winter months. Seven of eight cyclists are commuters and only one does recreational riding. Three cyclists are outside what would be considered ‘middle-aged’. All of the eight cyclists have European origins. Over half of the cyclists have an annual household income of over one hundred thousand. None of the cyclists live by themselves. Six are employed full time, one is employed part time, and one is retired.

The areas of the city participants documented as part of this study reflected a variety of places in Winnipeg. The general routes of participants are shown in Figure 1, the Participant Photo Map. Figure 1 also identifies the location of each photograph by indicating the figure number used in this report on the map. The Participant Photo Map created shows the spatial distribution of where images used in the report were captured. Each line represents the general route described by each cyclist. The map reveals the variety of challenges faced across a large section of the city. The routes were all different, but a few of their routes crossed paths with each other. For example, four participants biked through downtown, two participants went along part of the rapid transit multi-use path, two along Wellington Crescent, and three near the intersection of Assiniboine Avenue and Main Street.

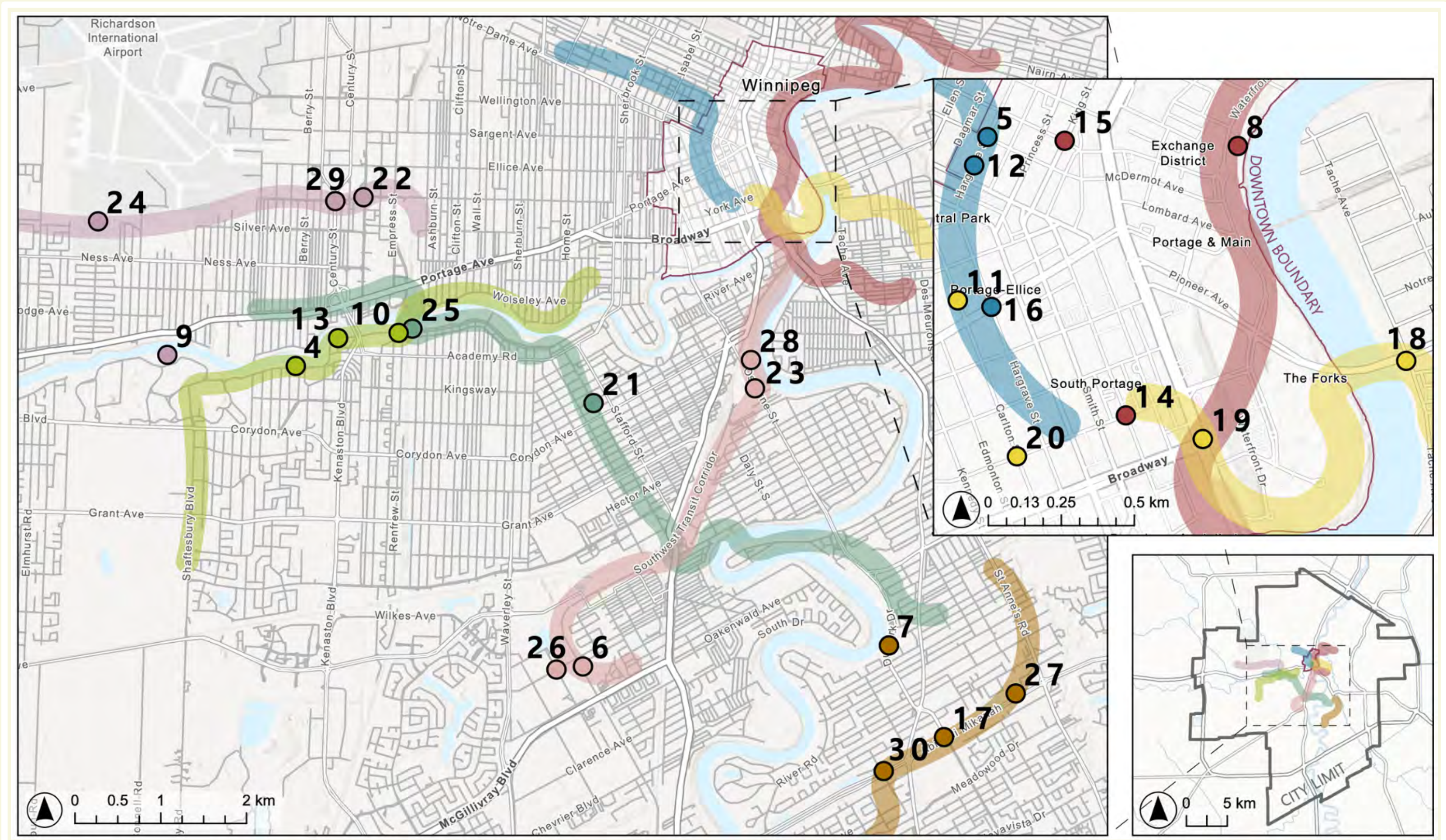
Table 1:
Participant Demographics

Participant	Experience winter cycling (years)	Frequency per week in winter (days)	Primary reason for cycling in winter	Gender	Age	Ethnic origins	Annual household income	Number of people in household	Profession
Cyclist 1	5	3.5	Commuting	Male	18-34	European origins	100,000 or higher	2	Employed (full time)
Cyclist 2	3	5	Commuting	Male	35-49	European origins	100,000 or higher	5 or more	Employed (full time)
Cyclist 3	2	2.5	Errands	Female	65 or older	European origins	25,000-50,000	2	Retired
Cyclist 4	6	6	Commuting	Female	50-64	European origins	Prefer not to say	4	Employed (full time)
Cyclist 5	6	6	Commuting /Recreation	Male	35-49	European origins	25,000-50,000	5 or more	Employed (full time)
Cyclist 6	20	3	Commuting	Female	50-64	European origins	100,000 or higher	2	Employed (part time)
Cyclist 7	5	4	Commuting	Male	50-64	European origins	100,000 or higher	5 or more	Employed (full time)
Cyclist 8	3	3.5	Commuting	Male	18-34	European origins	100,000 or higher	2	Employed (full time)

Note. Demographics collected from interview questions (Appendix D) and questionnaire (Appendix E).

Figure 1:

Participant Photo Map with Photograph Locations by Figure Number.



Source: Basemap data from Esri Canada, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, USDA, NRCan, Parks Canada.

2.4 Semi-Structured Interviews

Semi-structured interviews were chosen as they allow for researchers to develop a better understanding from a participant's perspective, while allowing for flexibility in a conversation-style discussion (Adeoye-Olatunde & Olenik, 2021; Harrell, et al., 2009). This approach is commonly used in policy-related research (Harrell, et al., 2009; Kallio, 2016). The flexibility of conversation allows researchers to engage in meaningful discussion about topics that participants bring up that may not have been expected in the research, and it allows interviewees to better express their experiences and attitudes towards the topics (Adeoye-Olatunde & Olenik, 2021; Harrell, et al., 2009). I conducted all of my interviews over Zoom. These were recorded and transcribed by Zoom. Transcripts were read thoroughly to ensure accuracy.

By using photo elicitation, where I showed each participant the photographs they took, the positive and negative aspects of winter cycling were described to me by each cyclist. The purpose of collecting photographic data was to guide the conversation during the interview, allowing cyclists to visualize high-quality and low-quality aspects of the cycling infrastructure they use. The images were then used in the findings, discussion, and analysis to visualize the challenges and positive aspects that the participants experience.

2.5 Inductive Coding

The first step that I did for inductive coding was to collect all of the transcripts from the interviews and read through all of them (Elo & Kyngäs, 2008). I then reviewed them again, highlighting overlapping ideas across the transcripts (Elo & Kyngäs, 2008). I made in-depth notes connecting the common concepts in the data that emerged. The third step that I took was then to identify themes that emerged from the dataset (Elo & Kyngäs, 2008). I read through the transcripts again and organized the highlighted quotes into 24 sub-categories. As I gained deeper understanding of the data, I ended up excluding some of the quotes that I had originally highlighted and included some quotes that I had not originally highlighted. I was able to identify five overarching themes and three subthemes (Attride-Stirling, 2001). Finally, the last step of the coding process was to develop my thesis statement based on what emerged from the data (Elo & Kyngäs, 2008; Weber, 1990).

Inductive coding can be conducted in a variety of ways based on the information presented, as there is "no simple right way to do content analysis" (Weber, 1990, p.12). This ambiguity has the potential to reduce the reliability of the analysis, based on the researcher's ability to accurately analyze qualitative data (Elo & Kyngäs, 2008). To reduce this limitation, I followed a step-by-step guide (Drew, 2023) for developing themes, based on work by Elo and Kyngäs (2008) and Attride-Stirling (2001). Additionally, working with any type of qualitative data, interpretation depends on the ability of the researcher (Elo & Kyngäs, 2008). While this is a disadvantage, qualitative data gathering offered a fruitful way to engage with participants and solicit their insights (Elo & Kyngäs, 2008).

2.6 Limitations

During the interviews, some of the photographs were pixelated because receiving them by email reduced the size. Thankfully, participants had taken the images themselves and could identify them. However, some of the photographs used in this report are pixelated. It would have been beneficial to establish a better method of receiving images so every photograph can be viewed easily. Participants were asked not to take photographs that included people's faces. Three of the participating cyclists mentioned this limited their ability to capture images in some locations. There are likely aspects of participants' experiences that could have been more clearly articulated but may not have been mentioned in the interviews due to this.

Due to the time restraints of this study, it seemed that increasing the number of interviews I was expecting to do would not have been feasible. I received approximately 50 emails expressing interest in participating. This study is based on the experiences of eight participants, yet there are many more cyclists in the city whose input was not included. This research does not perfectly reflect challenges faced by *all* winter cyclists in Winnipeg, nor are the proposed strategies and recommendations certain to improve experiences for the entire cycling community. Additionally, there are likely active transportation users who have valuable lived-experiences to benefit this research who may have felt excluded if they do not consider themselves a "winter cyclist" or if they face other barriers to volunteer their time.

3.0 LITERATURE REVIEW

This literature review outlines previous academic research to identify gaps in the knowledge of winter cycling as a topic (Scarano, 2023). First, I discuss demographics of winter cyclists, followed by describing common barriers that winter cyclists face. Each common barrier also identifies suggestions found in the literature to mitigate each barrier. Lastly, I review literature that demonstrates how winter cycling policies have been implemented.

3.1 Demographics of Winter Cyclists

A study conducted by Sadeghpour, et al. in 2015 surveyed cyclists in Calgary. They found that the rate of cycling trips dropped by nearly half during cold weather, and the number of cyclists who cycle during cold weather dropped by a third (Sadeghpour, et al., 2015). Of the cyclists surveyed in Calgary who do cycle in cold weather, the number of male cyclists was 5.5 times greater than female cyclists (Sadeghpour, et al., 2015). This aligns with more recent research which also looks at race and income. According to Gervais, et al. (2023) and Nahal & Mitra (2018), winter cyclists are most likely to be middle-aged males who are Caucasian and have a high annual income.

3.2 Benefits of Winter Cycling

People who choose to be a winter cyclist reap the benefits of exercise and connecting with their local environment. For example, Turunen (2023) writes:

> Everyday winter cycling is not only a matter of moving from one place to another. In contrast to commuting by car and public transport, cycling has the potential of providing a more holistic experience of the environment. This experience brings together observations of weather and topography and is accompanied by the cyclist's own physical exercise. While cars are largely protected against the wind and the rain and the snow and the frost, cyclists are exposed to changing weather conditions and have only the restricted protection of clothing and bicycle tires. (p. 168)

Year-round cycling results in multiple benefits for cyclists and society (Chapman & Larson, 2021; Turunen, 2023). Benefits include improved physical health and wellness as a result of physical activity (Turunen, 2023;

Chapman & Larson, 2021). As cyclists interact with the environment at a pedestrian scale, interaction with nature can improve mental health (Turunen, 2023; Chapman & Larson, 2021). Additionally, cycling year-round reduces CO^2 emission rates, which helps to mitigate anthropogenic climate change (Turunen, 2023).

3.3 Barriers Winter Cyclists Experience

In winter cycling literature, there are four major barriers that prevent people from committing to cycling year-round. These are (1) safety concerns (Chapman & Larson, 2021; Brömmelstroet, 2024; Komorowski & Manaugh, 2022; Sadeghpour, et al., 2015; Turunen, 2023), (2) trip management (Chapman & Larson, 2021), (3) weather conditions (Chapman & Larson, 2021; Turunen, 2023), and (4) adequate cycling infrastructure and its connectedness within the city (Turunen, 2023; Chapman & Larson, 2021).

3.3.1 Safety Concerns

Safety concerns are most prominent in the literature, as there are many perceived dangers to winter cyclists. Experiencing an accident, either small or severe, is a deterrent to year-round cycling. This is because snowy, slushy, or icy weather conditions make people wary of their ability to ride on affected surfaces (Sadeghpour, et al., 2015; Turunen, 2023), and people who are on the road are more vulnerable to vehicle-related accidents (Brömmelstroet, 2024). Brömmelstroet (2024, p. 9) argues that society puts more pressure on pedestrians and cyclists to *stay* safe compared to how much pressure there is for motorists to *be* safe. It is not only the responsibility of the cyclist to have a safe experience. Developing a safe cycling environment requires motorists, planners, engineers, and politicians to advocate and plan for it.

3.3.2 Navigating Trip Management

Trip management refers to the considerations of cyclists for the beginning and end of a ride (Chapman & Larson, 2021). Cyclists in Winnipeg and beyond face difficulty determining what to wear for riding in the winter, as well as concern about where to store their bike at the end of their ride or where there are bike servicing stations available for them (Chapman & Larson, 2021; Urban Systems, 2014). End of the ride details may also include factoring in the need for a place to change clothes or shower after engaging in physical activity, amenities that are likely increased as cities increase in bikeability (Chapman & Larson, 2021; Turunen, 2023). Trip management can be deconstructed to fit under weather conditions (for determining how to dress appropriately for the conditions) and the need for cycling infrastructure (the presence of amenities such as bike parking and changerooms).

3.3.3 Weather Conditions

Weather condition considers the temperature during the ride and the potential for snow build up and precipitation (Chapman & Larson, 2021). Concerns are also raised at the ability to cycle through snow when there is uncertainty in the frequency of maintenance or low expectations of snow removal (Harris, 2013). Additionally, the anticipated changes from anthropogenic climate change do not necessarily mean less snow as Turunen (2023) points out. Rather, increased rain could result in greater frequency of freeze-thaw patterns, causing even greater uncertainty in road conditions (Turunen, 2023).

Research in Germany by Hudde (2023) identified that the cultural intuition of what the cycling season has been in the country has had a large impact on people's willingness to cycle. Hudde (2023) implies that there is a socially constructed season to not bike (winter months) as a result of the cycling industry's effort to get people to bike during 'good' weather. Social conditions are likely to have underlying impacts to winter cycling culture (Hudde, 2023; Chapman & Larson, 2021).

3.3.4 Lack of Infrastructure and Network Connections

The need for the presence of cycling infrastructure and its connectedness is essential to accommodating cyclists, yet is often lacking in urban areas (Turunen, 2023; Chapman & Larson, 2021; Nahal & Mitra, 2018). Infrastructure is intrinsically linked to politics and planning policy (Cox, 2020). The presence and adaptation of infrastructure to accommodate winter cycling is a primary way for policy to lead to improvement. There are three main aspects that form good cycling infrastructure in the winter cycling literature, which are high-quality cycling infrastructure, a well-connected cycling network, and efficient snow clearing.

A city can have high-quality cycling segments, but if they are fragmented, ridership will not be sustained year-round as the segments are not properly connected (Turunen, 2023). Similarly, a city may be home to well-connected cycling infrastructure, but if it consists of primarily low-quality conditions, ridership will not be sustained year-round either (Nahal & Mitra, 2018; Turunen, 2023; Pratte, 2011). Cyclists tend to stick to available bike friendly infrastructure to increase comfortability, even if it means increased time, indicating the importance of having a connected network (Nahal & Mitra, 2018). Cycling infrastructure should focus on developing a network that is designed for year-round use (Komorowski & Manaugh, 2022; Nahal & Mitra, 2018). Design elements should include features like cycling paths separated from vehicular traffic, adequate lighting for darker winter months, and infrastructure designed to maximize snow clearing efficiency (Komorowski & Manaugh, 2022; Post, 2024a; Post, 2024b).

Infrastructure serves winter cyclists best when it is planned for efficient snow measures, factoring in designed elements and consideration of where snow sits after being plowed (Pratte, 2011). All of these efforts should be accompanied with snow removal specific to the infrastructure type (Urban Systems, 2014; Komorowski & Manaugh, 2022). Snow removal policies can support cycling specific infrastructure by prioritizing maintenance as these pathways do not experience the same type of surface heating as roads do from the friction of car tires (Komorowski & Manaugh, 2022).

3.4 Policy Implementation of Winter Cycling

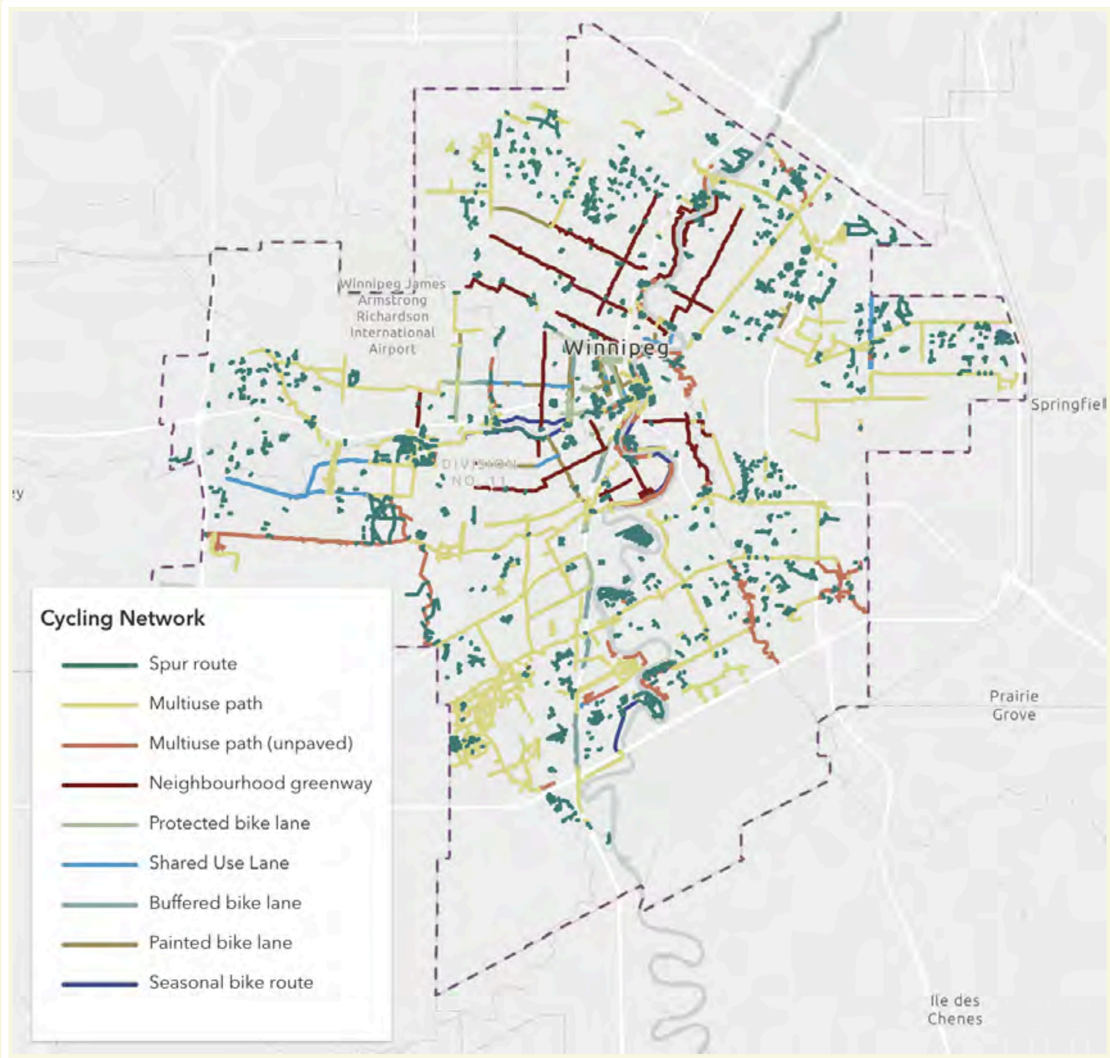
The more that winter cycling increases in a given area, the more likely that there will be an increase of targeted policies (Hudde, 2023). Policies should focus on providing year-round access to cycling infrastructure (Gervais, et al., 2023; Hudde, 2023). Developing and implementing policies for winter cycling is not viable if winter cycling cannot be maintained all year (Hudde, 2023). Therefore, policies that prioritize the development of cycling specific infrastructure that can be used in all four seasons is monumental for the development of winter cycling policies and winter cycling culture in general (Hudde, 2023).

Oulu, Finland, has an extensive cycling network accompanied by political understanding of the community's commitment to year-round cycling, and is home to a strong winter cycling culture (Pratte, 2011; Turunen, 2023). Over the last fifty years, Oulu has integrated cycling infrastructure and pushed political awareness of the importance of cycling as an all-season mode of transportation (Turunen, 2023; Pratte, 2011). Montreal boasts 901 km of cycling network, with 80 percent of it being accessible during every season (Post, 2024b). Even with this amount of winter cycling infrastructure available, there is often still political resistance to allocate funds towards improving cycling (Komorowski & Manaugh, 2022).

4.0 CONTEXT

In 2014, cycling was the "fastest growing mode of transportation in Winnipeg" (Urban Systems, 2014, p. 52). While Winnipeg has seen an increase of people willing to cycle, most prairie cities have seen a decline (Urban Systems, 2014). Winter cycling is an even less frequent activity for Winnipeg cyclists. Winnipeg's cycling network is relatively extensive across the city. Figure 2 shows the variety of route types across in Winnipeg. For example, neighbourhood greenways are "on-street routes designated to comfortably and safely move both cyclists and pedestrians *and* motor vehicles" (City of Winnipeg, 2024).

Figure 2:
Winnipeg's Cycling Network.



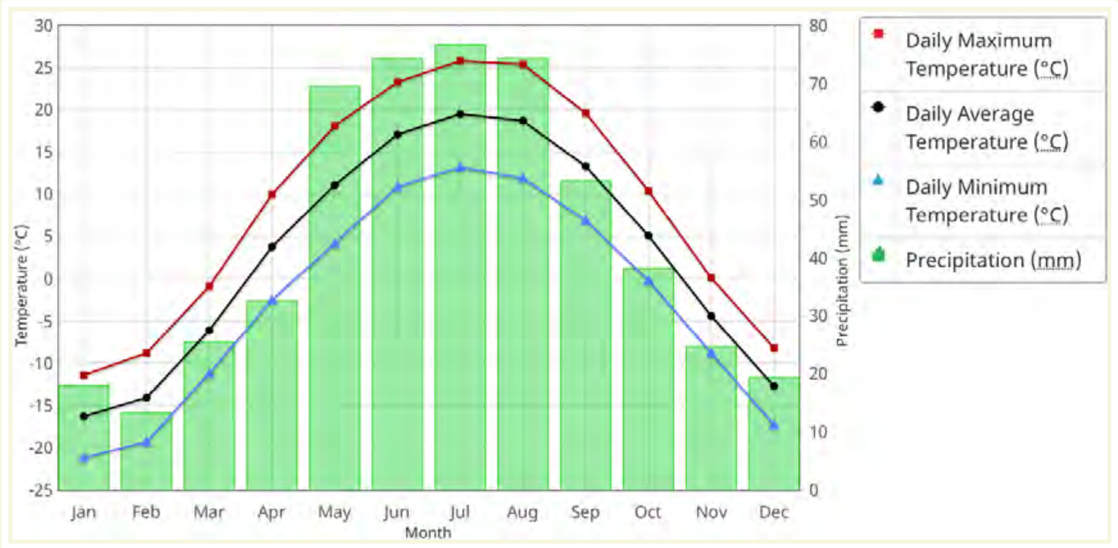
Source: (City of Winnipeg, 2023). Basemap data from Esri Canada, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, USDA, NRCan, Parks Canada.

4.1 Impacts of Winnipeg's Climate on Winter Cycling

Figure 3 shows Winnipeg's climate normals from 1991 to 2020, including daily maximum temperature, daily average temperature, daily minimum temperature, and precipitation.

Figure 3:

Winnipeg's Climate Normals from 1991 to 2020.



Source: (Government of Canada, 2024).

Winnipeg faces considerable restrictions to year-round cycling due to the climate. The Government of Canada's report for Winnipeg's climate from 1991 to 2020 reports that the month of January experiences a daily average temperature of minus 16.3 °C and a daily minimum temperature of minus 21.1 °C, making it Winnipeg's coldest month (Government of Canada, 2024). From November to March, Winnipeg's climate maintains a daily average temperature and a daily maximum temperature below 0 °C, with the exception of a daily maximum temperature of 0.1 °C in November (Government of Canada, 2024).

4.2 Recent Development of Winter Cycling

Winter cycling has become more common in cities like Oulu, Finland (Pratte, 2011), Minneapolis, United States (Harris, 2013), Copenhagen, Denmark (Hudde, 2023), and Montreal, Canada (Komorowski & Manaugh, 2022). The improvements to winter cycling infrastructure in these cities have occurred from a combination of political action, urban planning, policy work, and research. Additionally, advancements of cycling gear suitable for winter has played a role in aiding more people to feel comfortable riding in winter conditions (Komorowski & Manaugh, 2022).

5.0 FINDINGS

The participants provided well-rounded insights as they described their experiences winter cycling in Winnipeg. Through the inductive coding process, I identified five main themes that have structured this section. These are context for participants' experiences, high-quality aspects, low-quality aspects, suggested solutions, and priority locations. There are three subthemes for low-quality aspects: conflicts with motorists, lack of snow clearing, and network issues amplified by winter.

5.1 Context for Participants' Experiences

5.1.1 Participant Ride Descriptions

Table 2 provides a summary of how participants described their self-led ride.

Table 2:

How Participants Described Their Ride.

Participant	Descriptive terms used to describe ride
Cyclist 1	Felt safe
Cyclist 2	"Typical"
Cyclist 3	"Typical"
Cyclist 4	"Typical," good conditions
Cyclist 5	"Average"
Cyclist 6	"Typical"
Cyclist 7	"Typical," lower encounters with others than usual
Cyclist 8	A bit more snowy than usual

Note. This table lists descriptive words participants responded with during the semi-structured interviews after being asked "Tell me about your bike ride for this study, what was your experience like?"

5.1.2 Why Participants Cycle in Winter

Four participants mentioned that it encourages them to be active. Cyclist 5 expressed their desire to be active as they said, "I know when I get home, I've worked all day. I'm probably just gonna sit on the couch and do nothing. So, I might as well get a little bit of exercise in." Another reason to bike year-round for one cyclist is that it is better for the environment. Cyclist 3 emphasized this, saying "We have strong values around cutting down on our carbon footprint. So, when we can get our errands done, or transportation done with cycling, even in the winter, it feels like a huge win for us."

Participants who are employed described there are benefits to cycling to work, which has led them to prefer cycling as their method of commuting. Three participants expressed that cycling year-round is a better option for them than owning an additional car for their family. Cyclist 7 expressed that cycling is a better option to access their workplace. Cyclist 5 expressed that the amount of time that it takes them to get to their workplace by bike is essentially the same as when they drive, because when they drive, they end up waiting at red lights.

Cycling immerses the cyclist in the environment around them, and in Winnipeg, the environment often includes a nearby river. Three participants shared that a reason that they enjoy cycling is because they get to enjoy the natural features around them in the urban environment. Cyclist 7 told me, "this is the most enjoyable part of my ride" as they described Figure 4, a snowy, naturalized area along Wellington Crescent.

Figure 4:
Naturalized Area on Wellington Crescent.

5.1.3 How Winter Cycling is Different from Summer Cycling

Cycling in winter is more challenging than summer as expressed by the participants. For example, due to snow and ice, cyclists are slower and have a harder time accelerating and slowing down. It takes more time to get places, and cyclists have to be extra cautious manoeuvring through traffic as they avoid vehicles and anticipate sudden surface changes. Another big difference is the limited hours of daylight that occur during winter. Cyclists who commute during the summer are likely to have full sun on the way to and from work, whereas during winter, the sun rises later and sets earlier. The chances that cyclists are in the dark during winter is much higher. One example of a quote that speaks to this is from Cyclist 4 discussing the quality of their photos, "You notice the pictures are in the dark. As a winter cyclist you spend a lot of time cycling in the dark." This increases potential danger and is one of the reasons that participants wear reflective vests and ensure that they have adequate lighting on their bike.

Some of the challenges that participants face initially appeared to be reflective of general cycling and not specific enough to winter cycling to be included in this analysis for the purpose of this study. However, through the iterative process of coding, I was able to identify that these are general cycling issues that are amplified by the conditions of winter, certainly making them challenges to include in my analysis.

Figure 5:
McDermot Avenue and Hargrave Street Advance Light for Cyclists.

Examples of how winter amplifies conditions include unstable surfaces that make it harder to accelerate and stop and cyclists moving at reduced speeds. Winter conditions also result in an increase in the number of gaps in Winnipeg's cycling network. An example of this was expressed by Cyclist 8, who brought up their concern about advanced green lights for cyclists in downtown. Because of the unstable conditions of the snowy bike lane, accelerating at the right moment is challenging to avoid conflict with motorists. Cyclist 8 said this as they described Figure 5:

> *I find, with Winnipeg's bike infrastructure, is [that] the bike lane gets its own bicycle traffic light, but it's not timed any differently from the car lights. So, there's kind of no advantage to it. If they gave me like even a second or two, it'd be way safer.* (Cyclist 8)

5.1.4 Participants' Perceptions of Their Own Photographs

Each participant was asked if they felt that the photographs they took accurately documented the challenges they face winter cycling. Table 3 provides a summary of their responses.

Table 3:
How Photographs Represented Challenges of Participants.

Participant	Degree to which photographs represent challenges faced
Cyclist 1	Certainly, but slightly more positive outlook
Cyclist 2	Lack of snow clearing was not represented well enough
Cyclist 3	Yes, participant appreciates infrastructure, hard to access services
Cyclist 4	Fairly captures the challenges, except some years there is more snow
Cyclist 5	Doesn't show snow cover or that priority clearing is not always done
Cyclist 6	Doesn't show challenges during morning rush hour
Cyclist 7	A bit easier ride because it wasn't as cold
Cyclist 8	In general, yes, but it doesn't fully show that cycling is harder in winter

Note. This table lists summaries of how participants responded in the semi-structured interviews after being asked "Are the images representative of any challenges you face while winter cycling?"

5.2 High-Quality Aspects

During the interviews, each participant mentioned at least one positive aspect of their experiences winter cycling in Winnipeg. Cyclist 1 and Cyclist 4 spoke positively about the rapid transit multi-use path. Cyclist 1 described the reliability of snow clearing on the rapid transit multi-use path to be “really pleasant in general” saying, “they do come through relatively often on this portion compared to other portions.” Cyclist 4 spoke highly of the rapid transit multi-use path as they said this describing Figure 6:

> *I will consider this world class cycling infrastructure. It's away from all traffic. It's wide. It's clear. There’s good sight lines, there's lighting. There's some landscaping. So, it makes for a very pleasant ride. The other thing to notice is that the surface is in good condition, so it's well cleaned. That's something I have to give the City of Winnipeg full marks for. They do a very good job of keeping the Blue line transportation path plowed in the wintertime.* (Cyclist 4)

Figure 6:
Rapid Transit Multi-Use Path Near Seal Station.

Cyclist 3 spoke about a multi-use path that they use in the neighbourhood of St. Vital, pictured in Figure 7. Cyclist 3 expressed appreciation for separated cycling infrastructure as they told me:

> *This is a really good spot here. This is kind of gold standard infrastructure. Can you see the sign that shows that pedestrians go to the right, cyclists go to the left? We don't even have to share space there. And it's underneath the snow. Fresh, new infrastructure. It's awesome.* (Cyclist 3)

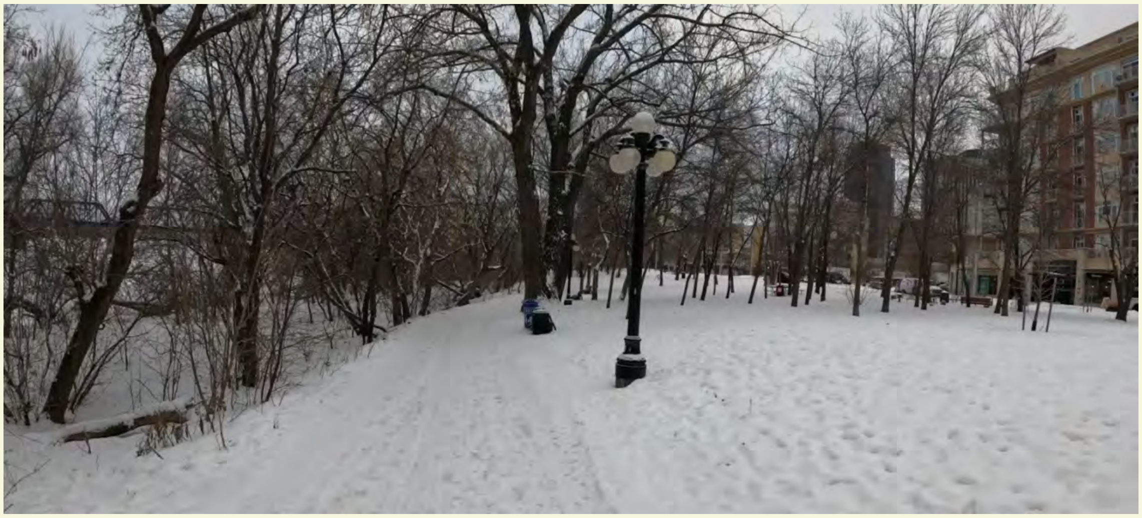
Figure 7:
Separated Infrastructure on Dunkirk Drive.

Some of the positive aspects mentioned related to being outside and experiencing Winnipeg's nature. Cyclist 2 and Cyclist 5 discussed their enjoyment of cycling near local rivers as they described Figure 8 and Figure 9, respectively.

> *An example of where we have a beautiful multi-use path. It's through a very quiet area next to Waterfront. It's beautiful. You're going next to the river. It's quiet. There's no interaction with cars*. (Cyclist 2)

Figure 8:

Pathway Along the Red River.

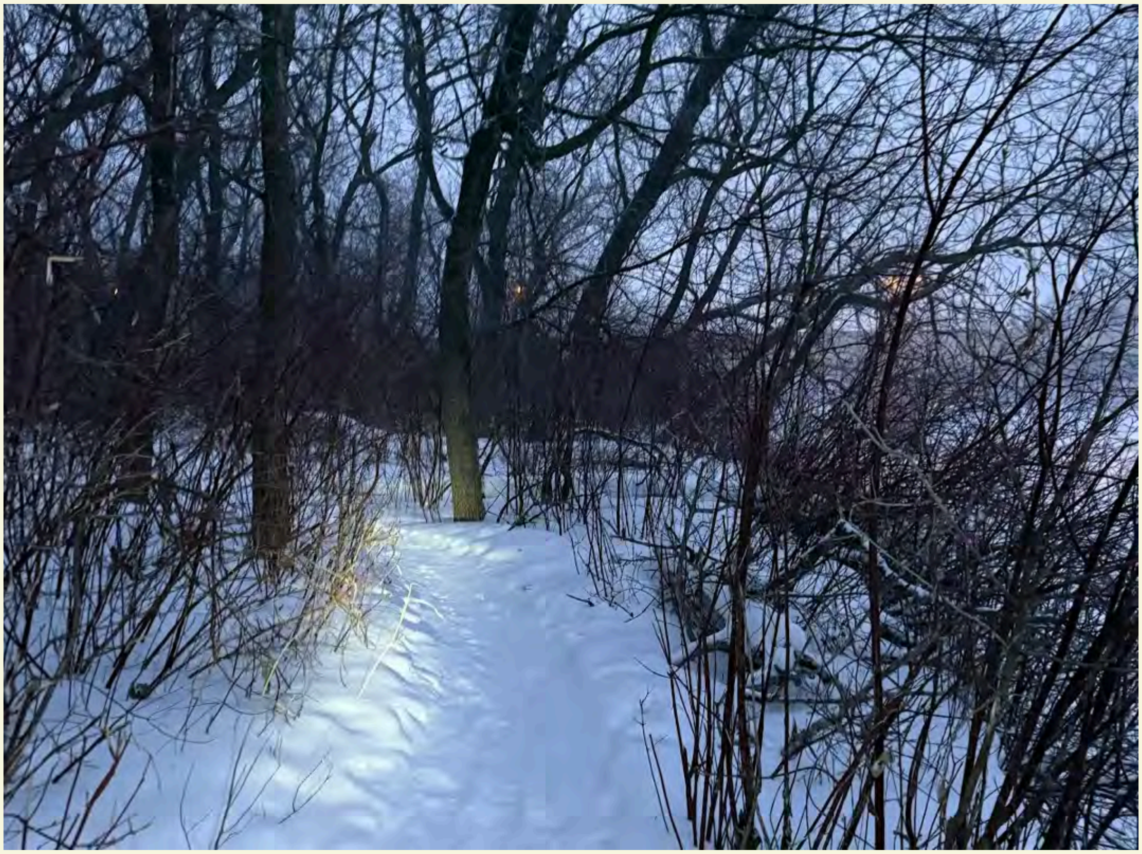


Cyclist 5, the only participant who does recreational rides in addition to commuting, described their enjoyment of trails along the Assiniboine River, saying this as they described Figure 9:

> *I just kind of thought it was a beautiful shot. And it's called the monkey trails, but it's a path that goes through Assiniboine Park in the forest section …A combination of cyclists and walkers or runners pack it down and see, you can ride right through the forest there. It's beautiful [and] sheltered*. (Cyclist 5)

Figure 9:

Trail in Assiniboine Park Along the Assiniboine River.



Some of the participants simply appreciated Winnipeg's bike infrastructure altogether. Overall, Winnipeg's existing bike infrastructure present mostly meets their needs for commuting. For example, Cyclist 7 said to me, "I have the crème de la crème bike commute of all cyclists." Cyclist 8 described their experience cycling downtown as said, "I happen to be lucky with pretty good bike infrastructure between where I live and where I work."

Overall, there are many valuable assets to Winnipeg's cycling infrastructure that exist. However, the majority of interview discussion focused on negative aspects that the participants experience.

5.3 Low-Quality Aspects

During the interviews, each participant mentioned low-quality aspects of their experiences winter cycling in Winnipeg. Low-quality experiences include conflicts with motorists, the lack of snow clearing, and network issues being amplified by winter.

5.3.1 Conflicts With Motorists

All eight cyclists spoke about the challenge of conflict with motorists. When cyclists and motorists interact, the possibility for conflict increases. These types of conflicts typically arise when cyclists and motorists share the same space or have intersecting paths. In terms of safety, cyclists are at a disadvantage. Cyclists are exposed on their bike while motorists have a sense of protection in their vehicle. Cyclist 1 discussed this directly, explaining that winter cyclists are in "more danger" compared to drivers. Cyclist 1 also expressed their desire for change, saying "it's more about sharing the roads and having a more positive community relationship between motorists and cyclists, especially in the wintertime." This potential change of motorists' perception about what it means to *truly* share the road would likely reduce conflicts for winter cyclists.

5.3.1.1 Shared Space

All eight cyclists included at least one image that shows them riding on a road. To reach the final destination, winter cyclists are often forced to travel directly in the traffic lane. Cyclist 2 articulated this well, saying "If you're gonna go places, if it's your mode of transportation, you have to be okay with cycling on the road." Sometimes, there are signs indicating that the lane should be shared between cars and bikes. Cyclist 1 and Cyclist 2 commented on their experiences of how cyclists and motorists understand the idea of sharing differently. Cyclist 2 expressed their concern saying:

> *It means two very different things to drivers and to cyclists. To cyclists, 'share the road' means 'I have the legal right to be here and to use the lane,' and for drivers 'share the road' means 'get out of my way so I can pass you without slowing down.'* (Cyclist 2)

When cyclists are traveling on the road there are multiple challenges. However, there is one benefit, as the lane tends to have two strips of clean pavement that are a result of tires melting the snow. An example of this is shown in Figure 10, taken by Cyclist 7. In describing this image, Cyclist 7 spoke about the ease of cycling in the tire track saying, "This is me just taking a picture of why I enjoy driving on the road, because it's nice and smooth."

Figure 10:
Clear Tire Track along Wellington Crescent.

However, when cyclists are riding on the road in the tire track, potential danger is greatly increased. Motorists may not be watching for cyclists or may not be expecting that there are cyclists during wintertime. When motorists pass cyclists on the road, vehicles aren't always manoeuvred far enough away for a cyclist to feel safe. Five participants expressed that motorists do not give them enough space when they are passed. Cyclist 1 described this, saying:

But the thing is, when the bike lane is not cleared, and I just have to go in their tire track, then they're forced to move. So sometimes they just don't move all that far, and sometimes I'm like 'Well, you could probably go a little farther.' (Cyclist 1)

Cyclist 6 described Figure 11 to me, a photograph they took to show that they would rather wait for all of the traffic to pass the construction zone so they could feel comfortable going where there is only one lane.

Figure 11:
Construction on Carlton Street in Downtown.

Cyclists appreciate separated bike lanes because they greatly reduce conflict with vehicles. For instance, if a cyclist falls from slipping on a patch of ice in a separated bike lane, they don't need to fear that a vehicle may hit them from behind. Cyclist 8 described a separated bike lane in downtown while discussing Figure 12.

So, at this point the protected lane resumes again. It's buried under snow, but there is a curb here. It's full of unplowed snow, but it wasn't as bad as before. So, in winter or summer, I really like this segment because it is protected. (Cyclist 8)

Figure 12:

Separated Bike Lane on Hargrave Street, Downtown.

Three cyclists shared with me that the speed of traffic is a challenge they experience in shared spaces. Cyclist 7 stated, “One of the biggest problems that I experience and feel when I bike is the speed difference between others on the road.” Both Cyclist 1 and Cyclist 7 discussed their concern about speed while referencing Wellington Crescent. Cyclist 7 said “Is it 50 on Wellington, or is it 30? I think it's problematic that it changes.” Cyclist 1 made a similar comment as they said “So, a street like Wellington, for example. One thing that would be really nice on that particular street would be keeping it 30 all year instead of just in the summertime, where there's more bike and foot traffic.” Cyclists face the issue of drivers being confused on Wellington Crescent because the speed limit changes and vehicular access changes between summer and winter. This causes increased conflict which could be mitigated if the speed limit was consistent year-round.

> *If they were able to keep that infrastructure all year, I'd feel a lot safer, because again, there's no need for cars to go on there unless you live in that area other than trying to avoid traffic on major motorist routes. So, having that stuff to stay all year round would really be nice, even keeping it 30 might just deter drivers from driving on there, because it's not 50.* (Cyclist 1.)

Cyclist 7 described Figure 13 that shows turns in the road along Wellington Crescent. A slight hill at the turn means that neither cyclists, nor motorists, have a clear view of what is ahead. Though there is reduced visibility for everyone, motorists will still pass. This can be uncomfortable for a cyclist if they are in the middle of the road while navigating around parked cars.

Figure 13:
Reduced Visibility on Wellington Crescent.

Cyclist 7 also depicted their experience cycling on roads with speed limits over 50 kilometers per hour as they shared this with me:

> *I didn't get out my measuring stick, but I can tell you as a cyclist, when someone's passing you at 50 to 70 kilometers and they give you a meter, it's not enough.* (Cyclist 7)

Cyclist 3 was the only participant to bring up that there was a maximum speed of road that they are willing to travel on, stating:

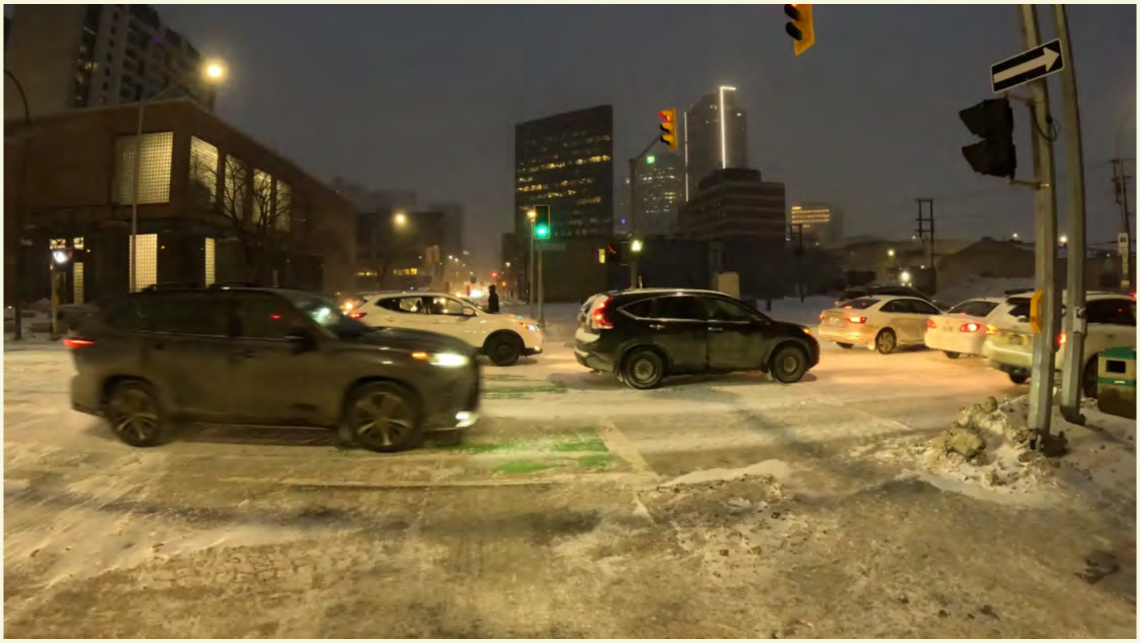
> *I will not ride on 60 kilometer an hour roads. So, St. Mary's, St. Anne's, Dunkirk, those are scary because they're skinny. There's no place for a bike to escape to, and the cars are just way too fast. They're not watching out for cyclists there. So, it has to be 50 kilometers or less before I'll be on a road*. (Cyclist 3)

5.3.1.2 Intersecting Paths

Six of the eight participants expressed how navigating intersections is particularly challenging during winter. There are three main concerns about intersections that were brought up. The first is that vehicles do not follow stop lines and sometimes stop partly into the intersection if they are entering or exiting. This often blocks cyclists' right-of-way and can result in the cyclist missing an advance green light. Cyclist 2 described Figure 14 as they said:

> *I find in the winter, the lines tend to get obscured by snow, and it gets much, much worse. And then in the spring the lines are basically [gone], the paint is washed off, and so vehicles are more [likely to be] stopping at the start of the bike lane, so that pedestrian space is very often filled with drivers.* (Cyclist 2)

Figure 14:
Traffic Blocking Cyclist Right-of-Way at Advance Green Light Downtown.



Once a cyclist has missed an advance green light, there is increased danger for them going through the intersection. The second concern is around entering the intersection, for two reasons. The first aspect is that cyclists are not always seen by motorists when approaching intersections. For example, Cyclist 6 described this as they said:

> *But we've got a 'T' stop and cars going left and right, and a lot of times, because it's so wide, their cars accelerate hard to get around me. And then stop dead, and then they're turning right, and I'm trying to go left. And so sometimes I just get off and walk because it's safer, just to run [with] my bike, because I can accelerate faster.* (Cyclist 6)

Motorists do not always obey traffic laws, such as illegally turning right at a red light. Two cyclists shared that it seems like motorists will simply follow along when a motorist in front of them disobeys the law. This can lead to motorists sideswiping a cyclist. These cyclists expressed this concern to be occurring downtown, experiencing it nearly every time they ride. Cyclist 2 captured this in Figure 15.

Figure 15:
Cut-Off at King Street and Bannatyne Avenue Advance Green Light.

The second aspect is around entering the intersection and how the timing of lights favours vehicles, often leaving cyclists to frequently get stuck at red lights. Sometimes the beg button cannot be reached due to snow build up. If there is a specific traffic light that is supposed to be an advanced green light for cyclists, it often does not provide any advanced entry to the intersection. This means that cyclists do not have a head start to move through the intersection, and with the conditions of winter, cyclists are often accelerating slower than in summer conditions.

The third concern about intersections is related to moving through them. The way that snow is plowed in the intersection can sometimes cover cyclists' right of way, forcing a cyclist to move into the vehicle lane, which increases danger. The way that infrastructure is designed can limit cyclists' ability to safely manoeuvre through the intersection. Cyclist 8 discussed this challenge as they described Figure 16.

You can see a little bit of a divot in the snow closer to the lights on the right-hand side. That's where the curb actually ends. But all the way to the left there's a ridge of snow that I wouldn't be able to punch through with my bike. So, I have to go out into traffic and then hook back to the right to get into the protected lane. So, this is something that is just a thing all winter long, every winter. I can see why it forms, because the city is just plowing, and it's leaving a ridge. But it is an annoyance as a cyclist. (Cyclist 8)

Figure 16:
Snow in Cyclist Right-of-Way at Portage Avenue and Hargrave Street.

Multiple intersections that participants talked about have slip lanes. Cars often turn through slip lanes faster than a cyclist expects. Three cyclists expressed that this is a danger that they experience year-round. However, crossing a slip lane, or moving though it as part of a turn, is challenging when there are unstable surfaces below cyclists. At intersections, cyclists often manoeuvre through both the shared space with vehicles and into shared space with pedestrians. Cyclist 3 described Figure 17, saying:

> *You kind of have to weave around the bus, stop on the island, and again you're doing right hand turns. It's tricky. Lots of people around there with pedestrians and bus stop users, and the plow couldn't do this part. It was too big, so the quality of the surface was pretty rough in here, hard going, and in fact, I was slipping a little bit in there, trying to get some grip. I have studded tires too, on both of them, and I was still slipping in this part here.* (Cyclist 3)

Figure 17:
Crossing a Slip Lane at Abinojii Mikanah and Dakota Street.

Cyclist 2 talked about not being able to see at an intersection where a road designated as a neighbourhood greenway has a stop sign, but traffic running perpendicular to the neighbourhood greenway does not. The participant would need to go out far enough on their bike onto the road to see if they can safely cross. Cyclist 2 did share that there are some roundabouts on Eugenie Street where there are limits for where cars can park to protect sight lines. They also said that the roundabout on Eugenie Street is a much safer way to manoeuvre through the intersection regarding conflicts with cars. Cyclist 6 described how they face this challenge in St. Boniface after crossing the Red River from downtown. As Cyclist 6 was shown Figure 18, they said to me, “People accelerate off the bridge and that is one of the most dangerous places of my ride.”

Figure 18:
Slip Lane at Provencher Boulevard and Tache Avenue.

5.3.2 Lack of Snow Clearing

All eight cyclists described challenges that they face related to snow and six cyclists directly expressed concern over snow clearing on their routes. Winter cyclists find snow on pathways to be a challenge because it makes it hard to bike when there are unstable conditions. It also makes it harder to plan their route when they do not know if a path that they are planning to travel on has been cleared.

Six cyclists talked about “snirt.” Snirt is a mixture of snow and dirt and is sometimes referred to as “brown sugar.” Snirt is typically a result of the snow clearing process as layers of snow and road salt are scraped to the side of the road. The far-right side of the road is where cyclists normally ride. When snirt covers a surface that winter cyclists interact with, it can negatively impact cyclists' ability to stay stable while riding. Interaction with snirt puts cyclists at risk of danger. Its presence is often one of the reasons that a cyclist will end up in the tire track on the road or illegally on a sidewalk, as cyclists may prefer these options that provide a safer riding experience.

Cyclist 6 described this as they said, "It was just a pile of you know – brown sugary crap. So, the walking side was actually nicer. So, I waited for the pedestrian to go, and I rode around that way." Figure 19 shows the preferred route of Cyclist 6. Figure 20 is a photograph of snirt on a road downtown that Cyclist 6 disliked, stating, "I couldn't ride in that. There's ice under there, and it was just brutal."

Figure 19:
Cleared Pedestrian Right-Of-Way at Assiniboine Avenue and Main Street.

Figure 20:

Snirt Covering Right Side of the Road on Carlton Street.

When it is not winter, cyclists typically stay to the side of the road allowing cars to pass more comfortably. Four cyclists specifically mentioned that snirt on non-separated bike lanes is a challenge for them. When snirt accumulates on the side of the road, non-separated bike lanes essentially disappear. If it is soft enough to ride through on a bike, it is likely still too unstable to feel safe. Cyclists have limited alternatives to where they can be. Cyclist 7 described it this way:

> *Particularly cyclists who are commuters that are averaging 20 to 30 k plus are really in between a rock and a hard place, because they're hated on the road, and they're hated on the active transit lane or the active walking lanes.* (Cyclist 7)

Figure 21 shows an example of this along Harrow Street in River Heights.

Figure 21:
Invisible Bike Lane on Harrow Street.

Cyclist 5 captured Figure 22 at the intersection of St. James Street and St. Matthews Avenue. Cyclist 5 described feeling unsafe as they commented on the photograph, saying:

> *So, there's about a foot of this grungy snow that is preventing me from getting closer or safer to the curb, forcing me closer to where the vehicles are, and so that driver is pretty close to the bike line there. But I basically have the width of the handlebars, and that's it. So, there's no room for error. If I, for whatever reason, lose control, I could be sliding into that vehicle.* (Cyclist 5)

Figure 22:

Invisible Bike Lane at St. James Street and St. Matthews Avenue.

Figure 23:

Separated Path Adjacent to Osborne Street.

Cyclist 4 mentioned that a separated path they ride on along Osborne Street still gets covered in snow, despite the presence of a barricade. Cyclist 4 described Figure 23 as they stated, "They don't do a great job of keeping it clear, and you get a lot of pedestrian traffic. So, you end up with very rough snow."

Four cyclists expressed that a challenge they face is when large snow drifts block their path. Weather conditions can often result in excess snow, and it can become impassable for cyclists. Cyclists must get off their bike to push it through or lift it over, and in some cases must turn around. When describing the snow drifts on the multi-use path shown in Figure 24, Cyclist 5 said "It's kind of begun to be covered up. It could have started completely bare, and in fifteen minutes it would look like that, and then in another fifteen it would be knee deep." Cyclist 5 shared how they've seen snow drifts on this path reach waist height, emphasizing this issue saying, "I've seen city plows stuck there, and then they've had to call the big front-end loaders to tow them out."

Figure 24:
Large Snow Drifts Adjacent to the Richardson International Airport.

Overall, all eight of the participants desire that snow clearing is done more effectively by the City. An example of this is how Cyclist 3 expressed a desire for better snow clearing as they described the City's snow clearing priorities:

> *Streets are deemed priority one, two, and three. Three is only plowed when they call for full residential curb to curb cleaning. So, this does not see a lot of plowing during the course of the winter. This is a huge gap in the infrastructure, and just leaves us hanging here.* (Cyclist 3)

There are numerous sections of the cycling network in winter that do not get plowed in a reliable manner, which causes frustration for cyclists. Cyclist 1 described Figure 25 which shows a short connecting path.

Figure 25:

Uncleared Connecting Path Near Wellington Crescent.

Cyclist 1 explained their frustration over this as they said "It's really difficult to push through it. I think it's just such a small piece of a path that they kind of forget about it, or don't really manage it all that." This path connects to Wellington Crescent and is often used by both cyclists and pedestrians, which has the potential to lead to conflicts.

Cyclist 1 and Cyclist 4 indicated that there are sections of Winnipeg's network that do get cleared consistently. Each of them indicated that the clearing of the rapid transit multi-use path along the Blue Line was typically reliable. However, the lack of snow clearing across the city typically brings uncertainty to the condition of routes.

5.3.3 Network Issues Amplified by Winter

Six of the participants commented on how the lack of a complete cycling network in the city is a challenge. There were two main concerns brought up by these participants, which were dead ends in the cycling network, and gaps in the cycling network. However, from their experiences, the network has an increased number of gaps during winter since there are segments that do not get cleared, specifically smaller, connecting segments. One cyclist expressed great concern over the fact that some of the unplowed gaps are connections that are supposed to go to services and amenities. Because these areas are not cleared, cyclists are likely to end up on the road in entry/exit points to services and are put at greater risk of getting into conflict with vehicles.

Four cyclists shared how there are sections along the cycling network that end abruptly and do not have any signage that indicate the section is ending. Some areas of the city also lack adequate signage for cyclists to connect to other bike-specific infrastructure. Cyclist 4 emphasized this challenges as they described Figure 26, saying:

> *Because it's in the dark, it's hard to tell, but there is no sidewalk, there is no path, it just ends. And that's a big negative. Because now where do you go? And unfortunately, this is one instance, but Winnipeg has several instances where the bike paths just end.* (Cyclist 4)

Figure 26:

Dead End in Cycling Network at Seel Avenue and Fennel Street.

Figure 27:

Informal Pathway Formed to Access Services Near Abinojii Mikanah.

Cyclist 3 provided an example of a network gap that they have been impacted by while discussing Figure 27. The image shows an informal path that has been made by pedestrians in order to access services by foot. While running errands, Cyclist 3 often bikes on this path to avoid using a slip lane to access the services there. A snow hill has been piled at the end of the path, which blocks pedestrians and cyclists from reaching the businesses in a safe manner. Cyclist 3 stated that "it's the only safe way into that parking lot." Because of gaps in the network like this one, cyclists are forced onto the road, which increases their risk of danger.

Cyclist 3 and Cyclist 4 each mentioned a section of the trail they would normally take which gets dark. Both cyclists expressed that they themselves or others they know may avoid these areas because they feel unsafe when there is not adequate lighting, and when they cannot see if there is someone ahead of them. Essentially, if there are areas that are dark and someone does not feel safe, this acts as a gap in the cycling network. An example of this was captured by Cyclist 4 in Figure 28. Furthermore, these gaps are amplified by winter due to longer hours of darkness.

Figure 28:
Winter Conditions Darken a Multi-Use Path Along the Red River.

5.3.4 *Participants' Suggestions for Improvements*

When asked what types of solutions the participants believe would help solve the challenges that they face winter cycling, there was a variety of answers. The responses are summarized in Table 4. The participants' responses generally align with recommendations that were found in the literature review, such as focusing on education (Brömmelstroet, 2024), streamlining snow clearing processes (Komorowski & Manaugh, 2022) and improving the cycling network (Turunen, 2023; Chapman & Larson, 2021; Nahal & Mitra, 2018).

Table 4:

Participants' Solutions Summarized

Summarized Solution	Participants' Suggestions
Adapt cycling network to reduce conflicts with motorists (5/8 cyclists).	Improve intersections. Reduce road speeds.
Improve snow clearing (5/8 cyclists).	Invest in broom plows. Target short connecting segments.
Improve and continue to develop the cycling network (4/8 cyclists).	Increase bike lanes. Increase access to services.
Help cyclists be heard, and help motorists understand traffic laws (2/8 cyclists).	Increase voices of cyclists. Adapt education. Enable discussion between road users.

Note. This table lists summaries of how participants responded in the semi-structured interviews after being asked "What do you believe are solutions that could be implemented in Winnipeg to improve issues winter cyclists face?" Summaries also integrate solutions participants mentioned throughout their interviews.

6.0 ANALYSIS & DISCUSSION

Drawing upon the interview data, I have identified three long-term strategies that could reduce challenges in order to improve the experiences of winter cyclists. This section describes each of the strategies. First, conflicts between motorists and cyclists must be reduced. Second, snow clearing processes must be improved. Third, providing proper access to main cycling routes must be addressed.

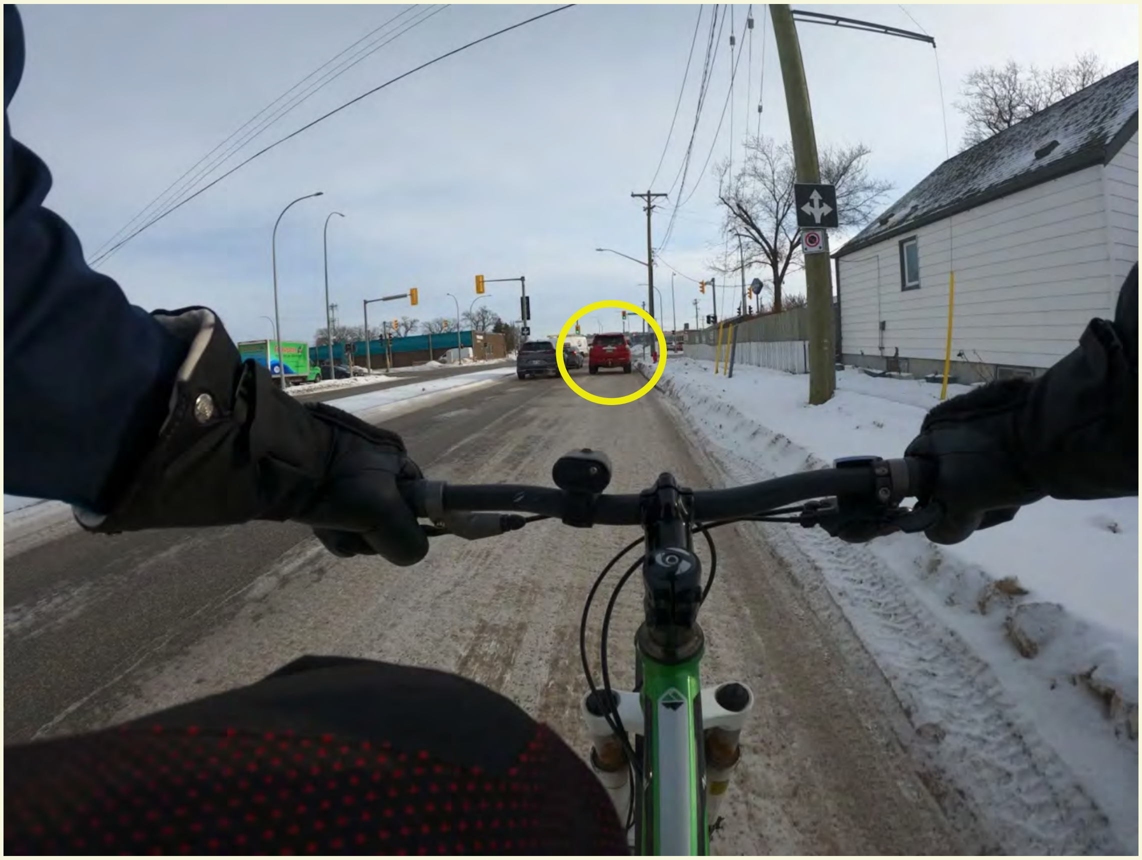
6.1 Reduce Conflicts by Adapting Infrastructure

All eight cyclists identified challenges they face related to conflicts with motorists. To improve winter cyclists' experiences, conflicts with motorists must be reduced. Brömmelstroet's (2024, p. 9) argument on the perception of safety for motorists and cyclists supports this finding. It is not only cyclists who are responsible for their safety on the road, motorists must understand their role in ensuring that cyclists can be safe (Brömmelstroet, 2024). Motorists should be compelled to increase their awareness while driving and to expect the presence of winter cyclists. As Hudde (2023) identifies, the typical social perception of cycling is that winter is not a season for cyclists. There must be a cultural shift towards winter cycling that is a result of a change in motorists' perceptions, political advocacy, and in policy. Political awareness can lead to changes in the perception of winter cycling, as seen in Oulu, Finland (Turunen, 2023; Pratte, 2011).

Road signage and educational material should encourage motorists to change their perception and to follow traffic regulations. For example, Figure 29 shows a motorist using a bike lane as a turning lane, despite signage directing vehicles to turn right from the left lane. Motorists are told that giving cyclists a one-meter distance is safe (Manitoba Public Insurance, 2017), but this must be reconsidered in respect to winter conditions. As bike lanes disappear and road surfaces become unstable during winter, motorists need to understand that a one-metre distance does not feel safe for winter cyclists.

Figure 29:

Motorist Turning Illegally at St. Matthews Avenue and Century Street.



Note. Annotation of image identifies motorist illegally driving in the bike lane.

Additionally, measures must be taken to help winter cyclists feel confident. Traffic laws and road signage should support safety for winter cyclists. Infrastructure should be designed in a manner that serves all users and considers how winter impacts the cycling network (Komorowski & Manaugh, 2022). When intersections are being developed or redesigned, there should be a greater level of consultation with pedestrians and cyclists about their perceptions of safety in regard to the potential designs. Public consultation should ensure that those who are exposed on the road are rightfully involved, as they are the ones who are most vulnerable to accidents (Brömmelstroet, 2024).

Winter cyclists desire to be treated as equal users of the road. However, negative interactions with motorists lead to minimized equity for winter cyclists. Existing infrastructure in Winnipeg limits feelings of confidence for winter cyclists as many aspects of it do not promote safety or equitable interactions. There must be a combination of education, policy changes, infrastructure design changes, and political advocacy to reduce conflicts and to increase equity for all road users.

6.2 Improving Snow Clearing

To improve winter cyclists' experiences, Winnipeg's snow clearing processes must be improved. Each of the eight cyclists were negatively impacted by snow on their routes, and each expressed desire for the City to clear snow more effectively. Many of the paths are not cleared in a reliable manner, despite the City's snow clearing priority policies. Measures should be taken to reduce uncertainty in the frequency of snow removal (Harris, 2013). With increased frequencies of freeze-thaw patterns anticipated from anthropogenic climate change (Turunen, 2023), the importance of communicating road conditions to winter cyclists will likely increase with time.

If snow clearing for cycling network is not maintained, Winnipeg will likely not see an increase in winter riders (Nahal & Mitra, 2018; Turunen, 2023). Cycling infrastructure should be designed with snow clearing in mind so that it can be used year-round (Komorowski & Manaugh, 2022). Increasing year-round cycling infrastructure also requires political advocacy and policy changes (Komorowski & Manaugh, 2022; Hudde, 2023). Figure 30, taken by Cyclist 3 shows an example of inefficient infrastructure design, showing the importance of designing for winter.

Critical to improving the experiences of winter cycling in Winnipeg will be designing infrastructure to accommodate proper clearing. Measures should also be taken to increase winter cyclists' certainty in the snow clearing process.

Figure 30:

Inefficient Infrastructure Design for Tunnel Under Abinojii Mikanah.

6.3 Increasing Access to the Cycling Network

Measures must be taken to improve access to main routes. Encountering gaps or dead ends in Winnipeg's cycling network was addressed by six of the cyclists. This is important to address as winter weather conditions can amplify these gaps. Ensuring that the cycling network is well connected is fundamental to encourage winter cycling in urban areas like Winnipeg (Turunen, 2023; Chapman & Larson, 2021; Nahal & Mitra, 2018). Network gaps force cyclists to take alternative routes, and the number of gaps can increase during winter (Komorowski & Manaugh, 2022; Nahal & Mitra, 2018). In some instances, this can put pedestrians at risk of conflict, or it can put cyclists in places that they do not feel safe, such as on a busy road amidst traffic. Cyclists tend to take the route that is most comfortable, with a preference of bike-friendly infrastructure (Nahal & Mitra, 2018). Cycling infrastructure should be planned and designed in a manner that provides winter cyclists with access to their destinations. Increased access can be encouraged through policies that prioritize year-round access to cycling infrastructure (Gervais, et al., 2023; Hudde, 2023).

To improve the experiences of winter cyclists in Winnipeg, political advocacy and policies should promote completing Winnipeg's cycling network, ensuring that a high percentage of the network is usable year-round (Komorowski & Manaugh, 2022).

7.0 RECOMMENDATIONS

This section provides short-term recommendations that could be used to implement the strategies identified in the analysis and discussion. Recommendations are based on best practices found in the literature and concepts that arose through the analysis of the findings. I have provided four recommendation areas, which are adapting education, using bike boxes, updating road signage, and improving communication on snow clearing. Lastly, I have identified areas for future research. Recommendations were developed by comparing the qualitative data from the interviews with best practices and previous research outlined in the literature review. These recommendations and their locations demonstrate how the solutions desired by the participants align strongly with previous recommendations and best practices.

Short-term recommendations give an opportunity to spark change and awareness of winter cycling. Each of these four recommendations on their own will not resolve issues that winter cyclists face. Furthermore, even if all four of the recommendations were implemented, challenges will still exist. However, making small-scale efforts in the short-term can help to build up to greater changes in the long run. The participating cyclists desire an integrated and cleared cycling network – which could exist in Winnipeg if funding and policies support these changes in the future. The recommendations listed here identify how small-scale changes can be implemented to get the wheels rolling on making Winnipeg not just a winter city, but a winter *cycling* city.

7.1 Adapting Education

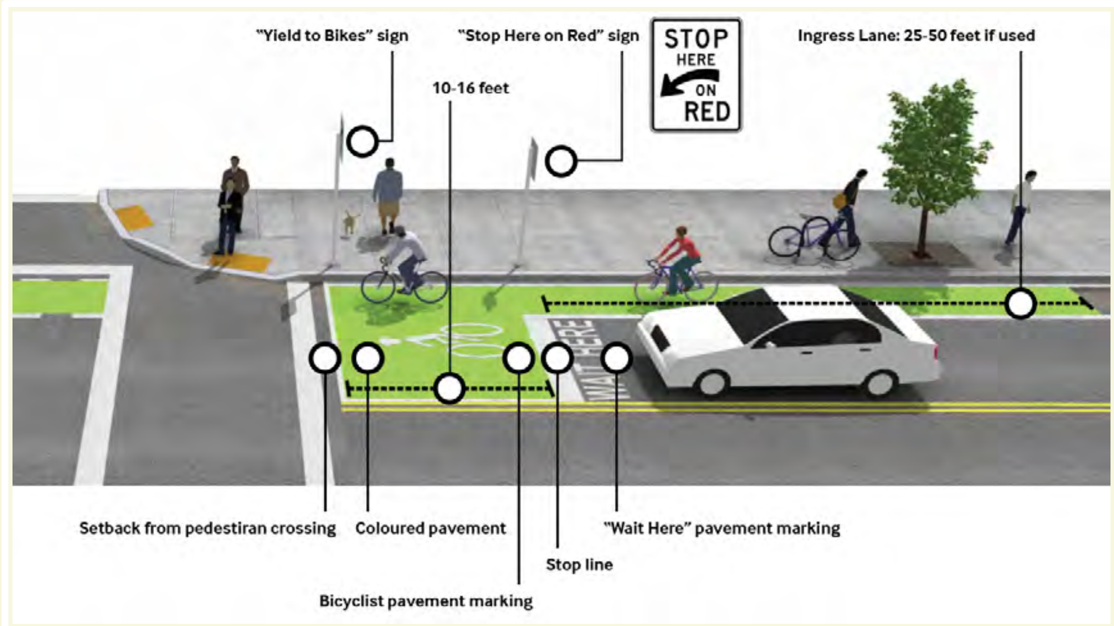
To reduce conflicts between motorists and cyclists, driving education across the province should include content that encourages motorists to drive in a manner that supports the safety of cyclists year-round (Turunen, 2023; Brömmelstroet, 2024). Cycling-related education should use facts supported by statistics, rather than common sense (Winters, et al. 2013). Using statistics could reduce the motorists' perceptions to be safe, and cyclists' perceptions to stay safe (Winters, et al. 2013; Brömmelstroet, 2024).

Educating motorists can be done by promoting safe interactions with winter cyclists on billboards and other promotional signage (Dill, et al., 2012). Instead of encouraging motorists to give cyclists a one-meter distance when passing, promotional signage can encourage motorists to respect the spaces on the road that are designed for cyclists. For example, billboards downtown can remind motorists not to block cyclists' right-of-way at intersections. This was found to be a problem by participants in downtown, as shown in Figure 14. This could also help to reduce conflict by mitigating negative interactions such as sideswiping at intersections, as shown in Figure 15. Promoting messages like these to motorists could be done by Manitoba Public Insurance or by the City of Winnipeg.

7.2 Implementing Bike Boxes

To improve winter cyclists' experiences at intersections in Winnipeg's downtown, the City could implement bike boxes. Bike boxes, as shown in Figure 31, have been considered to increase safety in intersections for cyclists from the perception of both cyclists and motorists (Dill, et al., 2012). A bike box is a space given to cyclists "at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase" (NACTO, 2014, p. 49). They are designed to "reduce conflicts between motor vehicles and cyclists and help motorists identify areas of potential conflict" while "enhancing the perception of safety and priority at an intersection" (Dill, et al., 2012, p. 126). Downtown is a suitable place for bike boxes as they are typically applied to signalized intersections in areas with higher frequency of traffic (NACTO, 2014).

Figure 31:
Example of a Bike Box at an Intersection.



Source: (NACTO, 2014). Annotated for clarity.

While bike boxes do not perfectly address the challenges that winter cyclists experience at intersections, the benefits they provide greatly outweigh negative impacts (Dill, et al., 2012). Bike boxes increase the visibility of cyclists on the road, locating them in front of motorists, preventing potential conflict (Dill, et al., 2012; NACTO, 2014). Bike boxes also have great potential to reduce vehicles from stalling in the cyclists' right-of-way (Dill, et al., 2012).

Providing an advance green light for cyclists at intersections with bike boxes greatly reduces right-hook conflicts between vehicles and cyclists (Russo, et al., 2023), especially as cyclists may take longer to accelerate in winter. Cyclists also end up being grouped together at the entrance to the intersection, allowing them to move through as a group, reducing delay for drivers (NATCO, 2014).

A limitation to bike boxes is that encroachment into the cyclists' right-of-way by vehicles making a right turn has been found to increase, but this is likely a result of the geometry of the bike boxes studied (Dill, et al, 2012). However, using an advance green light can mitigate this issue (NACTO, 2014). Additionally, If drivers are not educated on how bike boxes work, cyclists' safety may not increase (Christofa, et al., 2024). Another limitation is that bike boxes heavily rely on being seen by drivers, and since they are marked by paint on the road, they are likely to be covered with snow and will rely on snow clearance and additional signage.

7.3 Updating Road Signage

Updating road signage could improve winter cyclists' experiences by reducing conflict, increasing cyclists' confidence on main routes, and reduce reliance on snow clearing. Including signage in areas that permit cyclists to take up the full lane could help to reduce conflict by communicating to motorists that cyclists can use the tire track in winter (Federal Highway Administration, 2024). With signs being present, cyclists don't need to feel bad as they are permitted to occupy the entire lane (Hess & Peterson, 2015). Thus, drivers are made aware that cyclists are allowed to take up the full lane.

"Bicycles May Use Full Lane" signs have been found to be more effective to communicate to drivers on how to share the road with cyclists compared to shared lane markings (Hess & Peterson, 2015). In Winnipeg, the City could instal these signs during winter so that cyclists are permitted to take up the full lane during winter months. An example of this sign is shown in Figure 32.

Figure 32

"Bicycles May Use Full Lane" Sign.

Source: (Coalition of Arizona Bicyclists, 2015).

In addition to posted signs, motorists could be informed by road surface markings that state "Bike May Use Full Lane" as shown in Figure 33. This road surface marking could be used on segments where cyclists are required to be on the road. Strategically placing this marking where the snow melts in the tire track will allow this to be more visible to motorists, in addition to posted signage. This type of road signage can be introduced on streets where separated cycling infrastructure does not exist, helping to both reduce conflicts and reduce gaps in the cycling network.

Figure 33

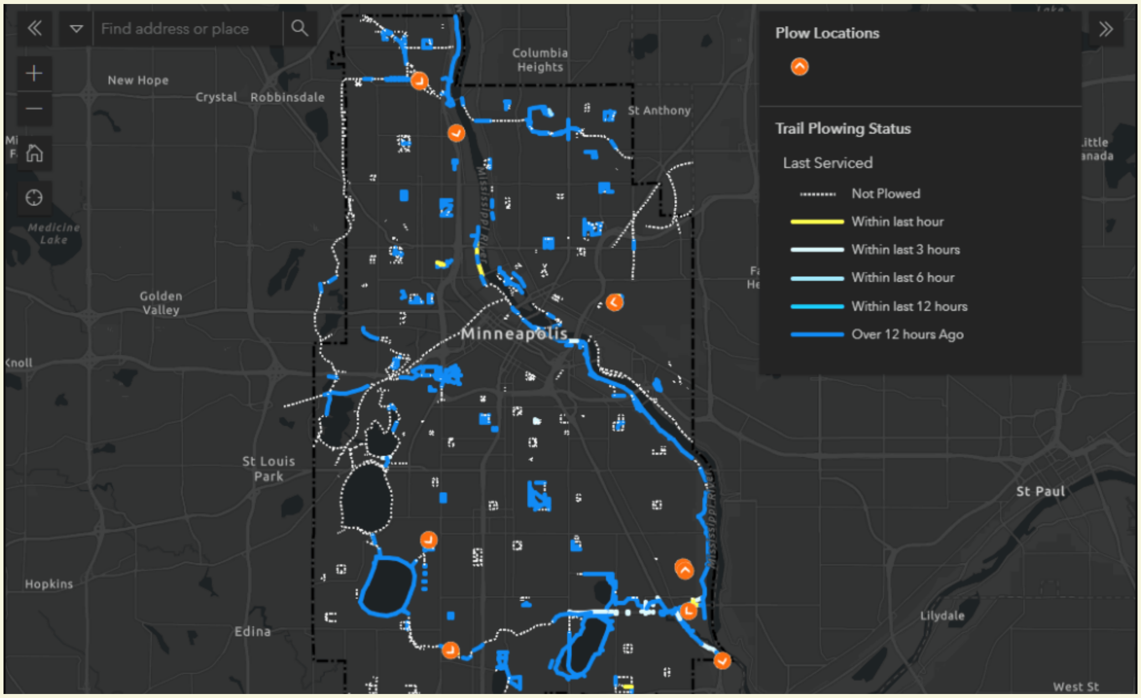
Winter Design Alternative for "Bicycle May Use Full Lane."

7.4 Improving Communication of Snow Clearing

Communicating the conditions of the cycling network to winter cyclists could help cyclists plan their route to ride on cleared paths. This online transparency would reduce challenges that winter cyclists face related to snow clearing. All eight cyclists expressed concerns related to snow being a challenge and six cyclists expressed their uncertainty in the City's snow clearing abilities. Therefore, I recommend that the City would invest in developing a website and/or app to communicate live updates on snow clearing of the cycling network. This was recently done by the Minneapolis Park & Recreation Board (MPRB). In 2024, MPRB released the Trail Plowing Status Map which provides live updates on snow clearance across 240 kilometers of trails in Minneapolis (Lowthian, 2024). Figure 34 shows the Trail Plowing Status Map.

Figure 34:

Trail Plowing Status Map.



Source: (Minneapolis Park and Recreation Board, 2025).

A system like MPRB's live snow clearing map can reduce winter cyclists' challenges navigating the cycling network and it could greatly improve how reliable cyclists consider the City's snow clearing to be. Besides snow clearing, there currently are not better methods that have been developed to get rid of snow on the road (Lißner, et al., 2023), but this is something that could be explored in the future as technology advances.

Currently, the City of Winnipeg does have a Snow Clearing Status map. However, updates are only published twice a day (approximately 7:00 am and 7:00 pm) and updates only occur shortly after major snow clearing events (City of Winnipeg, 2025). Switching to a map that is updated every three minutes (Minneapolis Park and Recreation Board, 2025) would benefit winter cyclists who leave for their commute prior to 7:00 am and go home prior to 7:00 pm. Additionally, cyclists who work part time or have other professions would benefit from live updates as well.

7.5 Areas for Future Research

As the real-life experiences of cyclists continue to be researched in the future, sharing the outcomes with the participants' community provides an opportunity for decision makers to gain knowledge, possibly shaping their decisions on policy (Blinn & Harrist, 1991; Dennis, et al., 2009; Gaulocher, et al., 2010; Moletsane, et al., 2017).

1. Site Specific Recommendations: Future research could be conducted to identify specific sites for implementing the above recommendations. This could include an analysis of where winter cyclists ride by conducting a survey. The local winter cycling community is strong, and I anticipate that many would respond to a survey.
2. Assessing Changes to Education: Adapting education to improve winter cycling is a topic that could be researched to a much greater extent. This study does not have the capacity to go deeper on this topic. As reducing conflicts between motorists and cyclists is a primary way to improve the experiences of using Winnipeg's bikeable infrastructure, assessing education for motorists could lead to in-depth recommendations that address this challenge directly.
3. Assessing Feasibility of Live Snow Clearing Map: Future research could assess the feasibility of developing a live snow-clearing website or app for the City. Researching lessons learned from other cities who have implemented this could benefit the City if a live map is implemented.

8.0 CONCLUSION

In this section, I will discuss key findings and final thoughts on this study. The goal of this study was to understand how the experiences of winter cyclists in Winnipeg could impact infrastructure design through an analysis of their perceptions of the local cycling infrastructure. Overall, it is clear that those who winter cycle in Winnipeg face many challenges related to the cycling infrastructure.

Analyzing the experiences of winter cyclists in Winnipeg allowed me to identify what the common challenges are that winter cyclists face. I found that participants frequently have negative interactions with motorists, often become frustrated with the City's snow clearing process, and continually experience challenges navigating the cycling network.

The identification of these main challenges can contribute to the improvement of Winnipeg's cycling infrastructure as these challenges led to the identification of three long-term strategies. Improving winter cycling in Winnipeg can be accomplished by reducing conflict between motorists and cyclists, improving snow clearing, and increasing access to the cycling network. Barriers to winter cycling that were found in the literature included safety concerns (Chapman & Larson, 2021; Brömmelstroet, 2024; Komorowski & Manaugh, 2022; Sadeghpour, et al., 2015; Turunen, 2023), trip management (Chapman & Larson, 2021), weather conditions (Chapman & Larson, 2021; Turunen, 2023), and adequate cycling infrastructure and its connectedness within the city (Turunen, 2023; Chapman & Larson, 2021). As participants described challenges related to safety, snow, infrastructure, and the cycling network, these barriers were found to be true.

The participants' suggested solutions, which were shown in Table 4, strongly align with previously published recommendations for winter cycling. Through the analysis of the challenges and in light of the participants' suggestions, four short-term recommendations were developed that are strongly supported by the literature.

The four recommendations demonstrate how these changes could take place and where they could happen in Winnipeg. Across the city, education can be adapted to change the perception of motorists towards winter cyclists. This can be done using billboards and promotional signage, as well as adapting the content in education for motorists across the province. Bike boxes can be introduced downtown to increase safety for cyclists by reducing conflict with traffic. Road signage can be updated in areas where cyclists must travel on the road. Permitting use of the full lane solidifies cyclists' right to ride in the cleared tire track left by vehicles. Updating signage also helps to show that cyclists are an equal user of the road. Improving the communication of snow clearing was recommended to encourage the City to provide cyclists with an online, live map of the cycling network. This could decrease the uncertainty that winter cyclists have in the City's snow clearing capabilities.

Overall, participants face many challenges related to the cycling infrastructure. The strategies and recommendations demonstrate how winter cycling infrastructure in Winnipeg could be improved. To see positive change in society's perception towards cycling as a year-round mode of transportation (Hudde, 2023), the experiences of winter cyclists must be shared with decision makers and the public. Winnipeg would need to experience a societal shift that is rooted in education and political advocacy while being supported by infrastructure design changes across the city.

Bibliography

Adeoye-Olatunde, O. A., & Olenik, N. L. (2021). Research and scholarly methods: Semi-structured interviews. *JAACP : Journal of the American College of Clinical Pharmacy, 4*(10), 1358–1367. https://doi.org/10.1002/jac5.1441

Attride-Stirling, J. (2001). Thematic networks: an analytic tool for qualitative research. *Qualitative Research : QR, 1*(3), 385–405. https://doi.org/10.1177/146879410100100307

Blinn, L., & Harrist, A. (1991). Combining Native Instant Photography and Photo-Elicitation. *Visual Anthropology, 4*, 175-192. Harwood Academic Publishers. DOI:10.1080/08949468.1991.9966559

Brömmelstroet, M. (2024). Increase road safety or reduce road danger: challenging the mainstream road safety discourse. *Traffic Safety Research, 6*. https://doi.org/10.55329/qukq2875 https://tsr.international/TSR/article/view/26039/23172

Chapman, D., & Larsson, A. (2021). Practical urban planning for winter cycling; lessons from a Swedish pilot study. *Journal of Transport & Health, 21*, 101060-.https://doi.org/10.1016/j.jth.2021.101060

Christofa, E., Ai, C., Deliali, A., Tainter, F., Cesic, L., Hannon, T., & Kostopoulou, E. (2024). Bicyclist and Motorist Behavior at Bike Boxes. *Transportation Research Record, 2678*(3), 235-251. https://doi-org.uml.idm.oclc.org/10.1177/03611981231179473

City of Winnipeg. (2023). *Cycling Network* [Open Data]. Winnipeg. From https://data.winnipeg.ca/Transportation-Planning-Traffic-Management/Cycling-Network/kjd9-dvf5/about_data

City of Winnipeg. (2024). *Neighbourhood greenways*. Winnipeg. Accessed March 19, 2025, from https://legacy.winnipeg.ca/publicworks/pedestriansCycling/neighbourhood-greenways.stm

City of Winnipeg. (2025). *Snow*. Winnipeg. Accessed March 16, 2025, from https://legacy.winnipeg.ca/publicworks/snow/default.stm

Coalition of Arizona Bicyclists. (2015). *Overtaking Bicycles and Arizona's Three Foot Law. Coalition of Arizona Bicyclists.* Accessed February 24, 20205, from https://www.cazbike.org/overtaking-bicycles-and-arizonas-three-foot-law/

Cox, P. (2020). Theorising infrastructure: a politics of spaces and edges. In *The Politics of Cycling Infrastructure* (pp. 15–34). Policy Press. https://doi.org/10.51952/9781447345169.ch001

Dennis, S., Gaulocher, S., Carpiano, R., Brown, D. (2009). Participatory photo mapping (PPM): Exploring an integrated method for health and place research with young people. *Health & Place, 15*(2), 466-473. https://doi.org/10.1016/j.healthplace.2008.08.004

Dill, J., Monsere, C. M., & McNeil, N. (2012). Evaluation of bike boxes at signalized intersections. *Accident Analysis and Prevention, 44*(1), 126–134. https://doi.org/10.1016/j.aap.2010.10.030

Drew, C. (2023). *Inductive Coding: A Step-By-Step Guide for Researchers*. Helpful Professor. Accessed February 18, 2025, from https://helpfulprofessor.com/inductive-coding/

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Gaulocher, S., Dennis, S., & Brown, D. (2010, July 23). *Intro to Participatory Photo Mapping (PPM) and Using Participatory Photo Mapping (PPM) to Engage Communities*. The Communication Initiative Network. https://www.comminit.com/global/content/intro-participatory-photo-mapping-ppm-and-using-participatory-photo-mapping-ppm-engage-c

Federal Highway Administration. (2024). *Manual on Uniform Traffic Control Devices*. United States Department of Transportation. https://mutcd.fhwa.dot.gov/htm/2009/mutcd2009cl_9.htm

Gervais, J., Kingsbury, C., Lapointe, J., Lanza, K., Boiché, J. & Bernard, P., (2023) It's snowing? Keep on rolling! Individual determinants of winter cycling in Québec, *Active Travel Studies 3*(2). https://doi.org/10.16997/ats.1384

Government of Canada. (2024). *Canadian Climate Normals 1991-2020 Data*. https://climate.weather.gc.ca/climate_normals/results_1991_2020_e.html?searchType=stnName_1991&txtStationName_1991=Winnipeg&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=242000000&dispBack=1

Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies (Abingdon, England), 17(*1), 13–26. https://doi.org/10.1080/14725860220137345

Harrell, M. C., Bradley, M., National Defense Research Institute . Intelligence Policy Center., & Rand Corporation. (2009). *Data collection methods : semi-structured interviews and focus groups*. RAND. https://www-rand-org.uml.idm.oclc.org/pubs/technical_reports/TR718.html

Harris, D. (2013). *Pedal power: designing effective cycling infrastructure in Winnipeg with lessons from Minneapolis*. [Unpublished doctoral dissertation/master's thesis]. University of Manitoba. http://hdl.handle.net/1993/22202

Hess, G., & Peterson, M. N. (2015). "Bicycles May use Full Lane" signage communicates U.S. Roadway rules and increases perception of safety. *PloS One, 10*(8), e0136973–e0136973. https://doi.org/10.1371/journal.pone.0136973

Hudde, A. (2023). It's the mobility culture, stupid! Winter conditions strongly reduce bicycle usage in German cities, but not in Dutch ones. *Journal of Transport Geography, 106,* 103503-.https://doi.org/10.1016/j.jtrangeo.2022.103503

Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing, 72*(12), 2954–2965. https://doi.org/10.1111/jan.13031

Komorowski, B. & Manaugh, K. (2022) Winter Cycling. In Norcliffe, G., Brogan, U., Cox, P., Gao, B., Hadland, T., Hanlon, S., Jones, T., Oddy, N., & Vivanco, L. *Routledge Companion to Cycling* (1st ed., Vol. 1) (pp.385-387). Routledge. https://doi.org/10.4324/9781003142041

Lißner, S., von Harten, M., Francke, A., Ruf, S., & Hagemeister, C. (2023). Safe cycling in winter: Results of a case study on the role of de-icing in the city of Hamburg, Germany. *Journal of Safety Research, 87*, 244–256. https://doi.org/10.1016/j.jsr.2023.09.020

Lowthian, R. (2024). *The Minneapolis app tells you trails plowed after it snows*. HaveFunBiking.com. Accessed February 26, 2025, from https://havefunbiking.com/minneapolis-trail-plowing-status-map-app/

Manitoba Public Insurance. (2017). *Motorists encouraged to leave one-metre distance when passing a cyclist*. *Manitoba Public Insurance*. Accessed March 16, 2025, from https://www.mpi.mb.ca/motorists-encouraged-to-leave-one-metre-distance-when-passing-a-cyclist/

Minneapolis Park and Recreation Board. (2025). *Winter Maintenance*. Minneapolis Park and Recreation Board. Accessed March 16, 2025, from https://www.minneapolisparks.org/park-care-improvements/maintenance/winter_maintenance/

Moletsane, R., Mitchell, C., & De Lange, N. (2017). Project Design: Beginning With the End in Mind. In *Participatory Visual Methodologies* (pp. 19–45). SAGE Publications, Limited. https://doi.org/10.4135/9781526416117.n2

Nahal, T., & Mitra, R. (2018). Facilitators and barriers to winter cycling: Case study of a downtown university in Toronto, Canada. *Journal of Transport & Health, 10*, 262–271. https://doi.org/10.1016/j.jth.2018.05.012

National Association of City Transportation Officials (2014). *Urban Bikeway Design Guide* (1st ed. 2014.). Island Press/Center for Resource Economics. https://doi.org/10.5822/978-1-61091-582-3

Post, E. (2024a) *When the Snow Flies: A Guide for Winter Cycling Success – Part 1*. Mobycon. https://mobycon.com/updates/when-the-snow-flies-a-guide-for-winter-cycling-success-part-1/

Post, E. (2024b) *When the Snow Flies: A Guide for Winter Cycling Success – Part 2*. Mobycon. https://mobycon.com/updates/when-the-snow-flies-a-guide-for-winter-cycling-success-part-2/

Pratte, J. (2011). *Mainstreaming bicycling in winter cities: the case of Oulu, Finland*. [Unpublished doctoral dissertation/master's thesis]. University of

Manitoba. https://mspace.lib.umanitoba.ca/server/api/core/bitstreams/73dfec70-158a-4d5e-b047-801705a6bc8b/content

Russo, B., Kothuri, S., Smaglik, E., & Hurwitz, D. (2023). Analyzing the Impacts of Intersection Treatments and Traffic Characteristics on Bicyclist Safety: Development of Data-Driven Guidance on the Application of Bike Boxes, Mixing Zones, and Bicycle Signals. *Transportation Research Record, 2677*(12), 187–200. https://doi.org/10.1177/03611981231167414

Sadeghpour, F., Isaac, S., and Amiri, M. (2015). Winter cycling in very cold climate - a case study in T. *Journal of Construction Project Management and Innovation, 5*(2), 1238-1265. https://hdl.handle.net/10520/EJC183322

Scarano, A., Aria, M., Mauriello, F., Riccardi, M. R., & Montella, A. (2023). Systematic literature review of 10 years of cyclist safety research. *Accident Analysis and Prevention*, *184*, 106996–106996. https://doi.org/10.1016/j.aap.2023.106996

Turunen, M. T. (2023). Winter Cycling Developments in Two Cities of Northern Finland. In *Living and Working With Snow, Ice and Seasons in the Modern Arctic* (pp. 167–189). Springer International Publishing. https://doi.org/10.1007/978-3-031-36445-7_9

Urban Systems (2014). *Winnipeg Pedestrian and Cycling Strategies*. City of Winnipeg. https://legacy.winnipeg.ca/publicworks/pedestriansCycling/strategiesActionPlan/pdf/strategy.pdf

Weber, R. P. (1990). *Basic Content Analysis* (2nd ed., Vol. 49). SAGE Publications Inc. https://doi.org/10.4135/9781412983488

Winters, M., Weddell, A., & Teschke, K. (2013). Is Evidence in Practice?: Review of Driver and Cyclist Education Materials with Respect to Cycling Safety Evidence. *Transportation Research Record, 2387*(1), 35–45. https://doi.org/10.3141/2387-05

Appendix A

Guideline for Bike Rides

How to Structure Your Bike Ride:

Please take 10-20 photos with your phone camera during one bike ride before January 25, 2025. When you are done, please email the photos to neustae1@myumanitoba.ca. Choose a route that you are familiar with to cycle. For this study, please allow 20 to 60 minutes for your ride. However, you can choose to cycle shorter or longer if you prefer. Ensure that you are within the boundaries of the City of Winnipeg. This can be a recreational ride or done during your commute.

What to Photograph:

Use this prompt to inspire your photographs:
"Pause to take photographs during a winter bike ride: take photos of high- quality and low-quality aspects of the places that you bike during winter."

Photography Ethics:

It is important to ensure that images you take do not include aspects that would reveal a person's identity, such as their face or identifiable information. For this study, please ensure that there are no people in any images that you take. The only exception to this would be if people are far away in the background. It is best to try to avoid capturing any in the images.

Safety:

When you find something that you want to photograph, do not take an image while operating your bike. This is important for your safety, and so that images are captured when the camera is still, reducing potential blur. Choose a route that you are familiar with to cycle. Please dress appropriately for the weather. Please review the associated risks as outlined in the Research Information Sheet.

Appendix B

Recruitment Poster

Appendix C
Participant Informed Consent Form

UM | University of Manitoba

Participant Informed Consent Form

Study Title: Photo Mapping Winter Cyclists' Experiences to Improve Winnipeg's Bikeable Infrastructure.

Student Principal Investigator: Max Neustaedter, Master's Student, Department of City Planning, University of Manitoba. Email: neustae1@myumanitoba.ca.

Student Advisor: Dr. Rae St. Clair Bridgman. Department of City Planning, University of Manitoba. Email: rae.bridgman@umanitoba.ca. Phone: 204-474-7179

Funder: This research is supported in part by funding from the Social Sciences and Humanities Research Council.

Conflicts of Interest and Undue Influence: Max Neustaedter does not have any conflicts of interest in this study/research.

You are being invited to participate in a research study. This consent form, a copy of which you can download or print, is only part of the process of informed consent. If you want more details about something mentioned here, or information not included here, feel free to ask any of the people named above. Please take the time to read this document and any accompanying information carefully. It is very important that you understand:

- what is being asked of you,
- what the risks and benefits of participation are, and

02/10/2024 Page 1 of 9

University of Manitoba

Participant Informed Consent Form

Study Title: Photo Mapping Winter Cyclists' Experiences to Improve Winnipeg's Bikeable Infrastructure.

Student Principal Investigator: Max Neustaedter, Master's Student, Department of City Planning, University of Manitoba. Email: neustae1@myumanitoba.ca.

Student Advisor: Dr. Rae St. Clair Bridgman. Department of City Planning, University of Manitoba. Email: rae.bridgman@umanitoba.ca. Phone: 204-474-7179

Funder: This research is supported in part by funding from the Social Sciences and Humanities Research Council.

Conflicts of Interest and Undue Influence: Max Neustaedter does not have any conflicts of interest in this study/research.

You are being invited to participate in a research study. This consent form, a copy of which you can download or print, is only part of the process of informed consent. If you want more details about something mentioned here, or information not included here, feel free to ask any of the people named above. Please take the time to read this document and any accompanying information carefully. It is very important that you understand:

- what is being asked of you,
- what the risks and benefits of participation are, and

- how the information you provide will be used and stored.

Purpose of the Study: You are invited to participate in this research study about winter cycling in Winnipeg, which aims to provide suggestions on how to improve the city's bikeable infrastructure from the winter cyclists' perspectives. I am hoping to learn what suggestions winter cyclists have for improvement in Winnipeg, how cyclists' experiences shape their suggestions, how these suggestions differ from previous findings that have sought suggestions decision makers, and to learn where winter cyclists want improvements in Winnipeg to occur. I am doing this research for my Capstone research project under the supervision of Dr. Rae St. Clair Bridgman.

Study Procedures: This research study is being conducted from the time period of September 2024 to May 2025. Participants are involved in the during January 2025, with an anticipated time commitment between 80 minutes (1 hour and 20 minutes) to 130 minutes (2 hours and 10 minutes), split up throughout the duration of the study. This is not including time to get to and from interviews, as this is dependent on where the participant lives within the city.

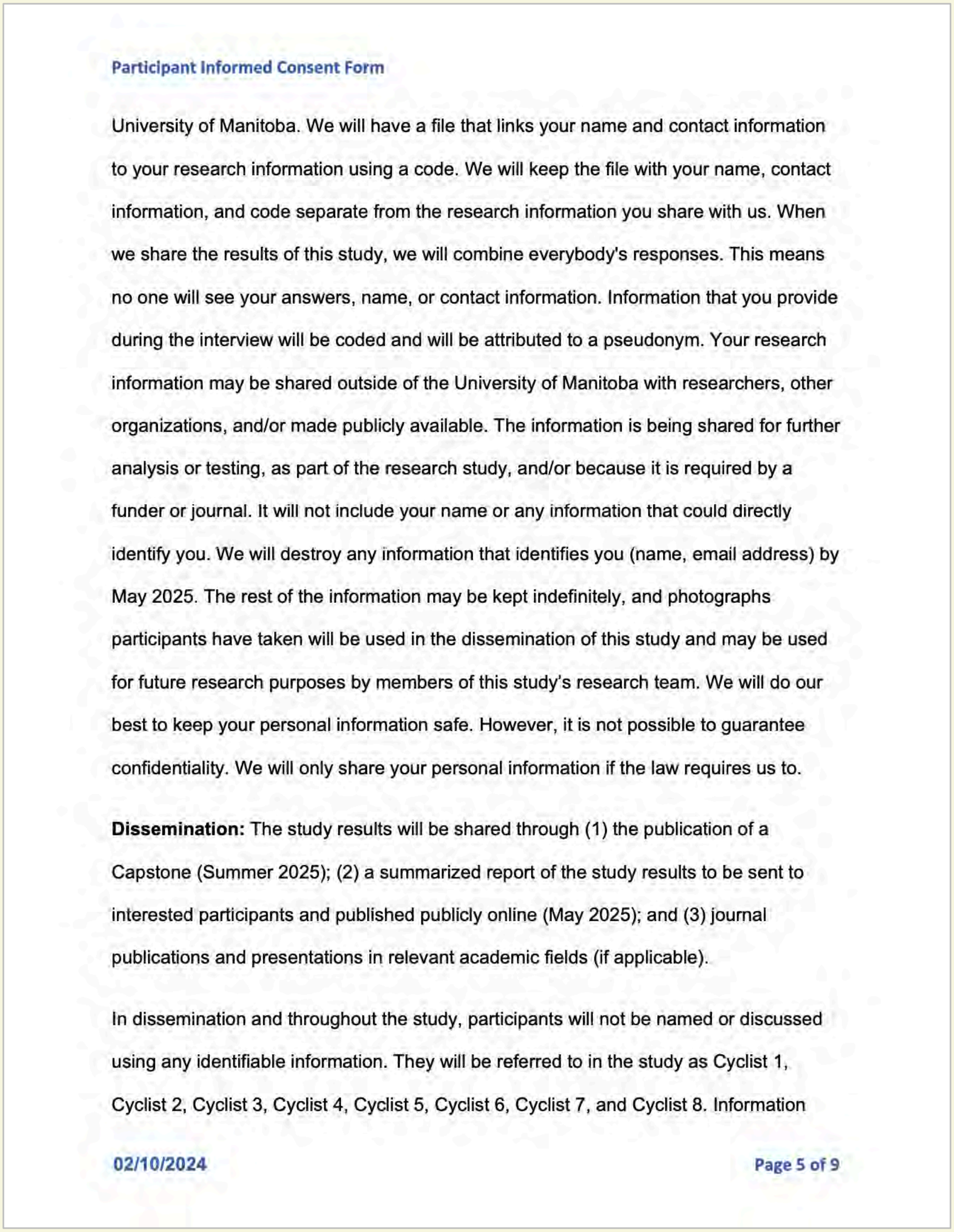
The breakdown is as follows for participant time commitment expectations: between January 5 and January 31, 2025, participants will be asked to spend up to 10 minutes to review an instruction sheet for taking photographs, an outline of bike ride requirements, and the ethic photographing protocol (i.e., no faces included in the image). This will be provided to participants in an email. Then, participants are given an estimated 20 to 60 minutes allotted for a winter bike ride in order to take photos. You will be provided with the prompt "Pause to take photographs during a winter bike ride: take photos of high-quality and low-quality aspects of the places that you bike during winter." Between January 27 and 31, 2025, participants will be asked to do a 30-to-40-minute, one-on-one recorded interview with the principal investigator. The nature of the interview is semi-structured, where the principal investigator will ask participants a few questions about their winter cycling habits, and then spend the bulk of the interview time asking participants to speak about the images they captured and why they stood out to them. Interviews will focus on how participants interpreted this prompt in the photographs that you took. With your consent, I will audio record our meeting.

Study Risks: Please be aware that participation in this research does involve an element of risk, including: (1) Cycling during the winter, which results in many safety concerns arising. By choosing to participate in this study and choosing to cycle, you acknowledge that the principal investigator, the University of Manitoba, or any other affiliated organization with this research cannot be held responsible for any accidents, injuries, falls, slips, or death of participants. It is your responsibility to understand your own limitations, how to bike, and to have appropriate knowledge of traffic laws and any other piece of legislation that may apply. (2) Some questions you may be asked could make you uncomfortable. Please be aware that you have the right to answer or not answer any question that is asked of you during this study. (3) Possible loss of confidentiality, where there is a chance that your data could be accessed by someone who does not have permission to access it. This study is taking considerable measures to limit any possibilities of this happening, by ensuring that all data is kept confidential, that it is stored on a password protected computer, and by keeping your contact information separate from the data you provide (images, information during interviews, review comments). Data that is no longer needed will be destroyed by the end of the study (May 2025). Data that will still be used are photographs. (4) Images that you take that conform to ethical practices are subject to be shared online in a public manner. There will be not attribution to you in order to maintain participants confidentiality. Images will be shared in order to illustrate actual sites in Winnipeg where suggestions for improvement could occur, in accordance with the aim of this study. Sharing publicly provides the best opportunity for the perspectives of participants to be heard by decision makers. However, there is a possible risk that images that you have captured that are posted online could be taken and used for other purposes beyond this study without your permission or the principal investigator.

Study Benefits: A direct benefit for participants is the opportunity for them to share perspectives on winter cycling in Winnipeg, giving their suggestions a greater opportunity to be read by decision makers. The suggestions formulated from the analytic induction will outline practical ways that outline how winter cycling infrastructure can improve in Winnipeg, Manitoba from a user perspective. Because this research is focusing on winter cycling, its outcome will likely be useful in other winter cities in Canada. The use of participant photo mapping as a precedent for future winter cycling research.

Compensation: There will be no compensation provided to participants in this study.

Storage and Use of Data: For confidential data: All the information you provide as part of this study is confidential. This means that only members of the research team will see your information. Your information will be stored on a secure platform approved by the



University of Manitoba. We will have a file that links your name and contact information to your research information using a code. We will keep the file with your name, contact information, and code separate from the research information you share with us. When we share the results of this study, we will combine everybody's responses. This means no one will see your answers, name, or contact information. Information that you provide during the interview will be coded and will be attributed to a pseudonym. Your research information may be shared outside of the University of Manitoba with researchers, other organizations, and/or made publicly available. The information is being shared for further analysis or testing, as part of the research study, and/or because it is required by a funder or journal. It will not include your name or any information that could directly identify you. We will destroy any information that identifies you (name, email address) by May 2025. The rest of the information may be kept indefinitely, and photographs participants have taken will be used in the dissemination of this study and may be used for future research purposes by members of this study's research team. We will do our best to keep your personal information safe. However, it is not possible to guarantee confidentiality. We will only share your personal information if the law requires us to.

Dissemination: The study results will be shared through (1) the publication of a Capstone (Summer 2025); (2) a summarized report of the study results to be sent to interested participants and published publicly online (May 2025); and (3) journal publications and presentations in relevant academic fields (if applicable).

In dissemination and throughout the study, participants will not be named or discussed using any identifiable information. They will be referred to in the study as Cyclist 1, Cyclist 2, Cyclist 3, Cyclist 4, Cyclist 5, Cyclist 6, Cyclist 7, and Cyclist 8. Information from participants will be presented with direct quotations from interviews, complimented with images taken during participant photo mapping. Additionally, summarizations of concepts expressed by multiple participants from separate interviews will be included.

Withdrawing: Your participation in this research study is voluntary. You can choose to do only the activities and/or answer only the questions that you are comfortable with. You may withdraw from the study for any reason. You do not have to explain why. You will not be penalized in any way. You may withdraw from the study until January 25, 2025. Should you withdraw, all gathered responses will be destroyed. After this date, we will start to analyze the information so it may not be possible to withdraw your information. To withdraw, please contact Max Neustaedter by email at neustae1@myumanitoba.ca indicating that you are withdrawing.

Questions or Concerns: Designated University of Manitoba personnel (and/or Funder) may check that this study is being done safely and properly. To do this, they may visit the study site or review the research records. We will tell you if someone outside the research team will be there while you are participating. If this makes you uncomfortable, please tell a member of the research team, who will ask the personnel to return at another time.

This study has been reviewed and approved by a Research Ethics Board at the University of Manitoba. However, this does not mean that participation is risk-free. If you have questions about your rights as a research participant, you may contact the Office of Human Research Ethics at humanethics@umanitoba.ca or (204) 474-7122.

If you have any questions, concerns, or complaints about this study, you may contact any members of the research team listed on the first page or the Office of Human Research Ethics.

Consent: By signing this document, I agree that:

- I have read the above information or had it read to me.
- I have had the opportunity to ask and have answered all of my questions.
- I understand what is being asked of me.
- I will be taking part in a research study.
- I may freely stop or leave the research study activities at any time.
- My information may be shared outside the University of Manitoba.
- I do not waive my legal rights by participating in the study.

I agree to participate in this study.	☐Yes

I agree to be audio-recorded in this study	☐Yes
I agree to have a general descriptor used instead of my name when results are shared for this study.	☐Yes

I agree that the information I provided for the research team can be used for future research purposes by members of this study's research team and/or their students.	☐Yes
I agree that the information I provided to the research team, which will be coded and anonymized, can be share with or used by other researchers, funders, research or community organizations, journals, or other third parties for any future research purposes.	☐Yes

If I choose to withdraw partway through the study, I agree that the research team may still include the responses I have completed in their analysis.	☐Yes
I agree that the research team can use photos I have produced for this study when they share the study results without directly attributing me.	☐Yes
I agree to follow ethic principles while taking photographs for this study, as outlined in the instructions that I will receive in an email.	☐Yes
By choosing to participate in this study and choosing to cycle, I acknowledge that the principal investigator, the University of Manitoba, or any other affiliated organization with this research cannot be held responsible for any accidents, injuries, falls, slips, or death of participants.	☐Yes

Name of Participant Participant's Signature Date

For Oral Consent: I read and explained to the participant all the information in this consent form before receiving the participant's consent. The participant verbally told me/nodded (explain how they acknowledged) to indicate their consent.

Name of Participant Researcher's Signature Date

Summary of Results: Please provide an email address below if you would like to be sent a summary of the study results and/or my individual results. A summary of the study will be available on the University of Manitoba's Faculty of Architecture's website when the study has finished (Summer 2025).

☐Yes ☐No

Notice Regarding Collection, Use, and Disclosure of Personal Information: Your personal information is being collected under the authority of *The University of Manitoba Act*. The University of Manitoba is committed to preserving your right to privacy. The information you provide will be used by the University to support our research. Your personal information will not be used or disclosed for other purposes, unless permitted by *The Freedom of Information and Protection of Privacy Act* or *The Personal Health Information Act*. If you have any questions about the collection of personal information: Ph: 204-474-9462 or Email: fippa@umanitoba.ca

This research has been approved by Research Ethics Board at the University of Manitoba, Fort Garry campus.

Appendix D

Semi-Structured Interview Questions

1. How long have you been a winter cyclist?
2. How often do you bike during winter?
3. What are your main purposes or reasons for biking in winter?
4. Tell me about your bike ride for this study. What was your experience like?
5. Tell me about the positive aspects of winter cycling that you captured in your images.
   Unstructured discussion about the aspects photographed.
6. Tell me about any negative aspects of winter cycling that you captured.
   Unstructured discussion about the aspects photographed.
7. Are the images representative of any challenges you face while winter cycling?
8. What do you believe are solutions that could be implemented in Winnipeg to improve issues winter cyclists face?
   Unstructured discussion about their ideas for solutions.
9. Where in Winnipeg do you believe these issues should prioritized?
   Unstructured discussion about their ideas for solutions.
10. What else would like to mention before we conclude?

Appendix E

Participant Questionnaire

What is your gender?

- o Please specify: ______
- o Prefer not to say

How old are you?

- o 18 – 34
- o 35 – 49
- o 50 – 64
- o 65 or older
- o Prefer not to say

Which ethnic origin best describes you? Select all that apply.

- o North American Indigenous origins
- o European origins
- o Caribbean origins
- o Latin, Central, or South American origins
- o African origins
- o Asian origins
- o Oceanic origins
- o Other (please specify): ______
- o Prefer not to say

What is the annual income of your household?

- o 0 – 25,000
- o 25,000 – 50,000
- o 50,000 – 75,000
- o 75,000 – 100,000
- o 100,000 or higher
- o Prefer not to say

Including yourself, how many people live in your household?

- o 1
- o 2
- o 3
- o 4
- o 5 or more
- o Prefer not to say

Please specify your current employment status.

- o Student
- o Employed (Part Time)
- o Employed (Full Time)
- o Unemployed
- o Retired
- o Other (please specify): ______
- o Prefer not to say