Facilitating winter cycling in Trondheim


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Reaching national goals for cycling mode share will also require more cycling during winter months. While some cyclists continue to cycle at a high frequency during winter, many account for the increased difficulty in conditions by shifting to cars or public transport. Across all groups of cyclists, a more reliable winter maintenance and better cycling infrastructure are pointed to as the main elements to make winter cycling more attractive.

SUMMARY

The research covered differences between current winter and non-winter cyclists and their perspectives towards what could make winter cycling more attractive. Current winter cyclists differ from other groups of cyclists by putting more emphasis on the transport function of cycling, typically having shorter distances and being more persistent in staying on the bike. Less frequent winter cyclists are quicker to perceive conditions as too poor for cycling and to use motorized modes instead.

Across all groups of cyclists studied: frequent, in-frequent and non-winter cyclists, the winter conditions and the state of winter maintenance is mentioned as the key issue or key enabler of further winter cycling. Enhanced and reliable/predictable winter maintenance seems necessary to enable infrequent as well as non-winter cyclists to cycle more. Another important issue raised is the quality of the cycling infrastructure, which should be further developed to get more people cycling in the winter.

The study identified different levels of willingness and comfort/risk perceptions among the non-winter cyclists that would also need to be addressed to facilitate more cycling during winter months.

INTRODUCTION

As a contribution to environmental, livability and public health objectives, many cities and countries worldwide aim to increase the cycling mode share. Trondheim has adapted national policy for increasing cycling mode share with municipal goal of increasing the cycling mode share by twofold from 2009 to 2025 (Trondheim kommune et al., n.d.). This goal also relates to the zero-growth agreement between the Norwegian state and the municipalities in the Trondheim region. Following this agreement all future increases in traffic should be acquired by other modes than the private car – thus by walking, cycling or public transport (Norwegian Ministry of Transport, 2024, Meld. St. 14, (2023-2024)).

The travel survey conducted in 2022 indicate that Trondheim has a long way to go if it still aims to double cycling by 2025. In 2022, the cycling mode share has stagnated at 9 pct, which while representing a slight growth from 7 pct in 2009/ 2010, remains significantly below the target for 2025 (14 pct) and even further away from the nationally stated target for urban areas which is 20 pct. Promoting cycling towards these ambitious objectives will likely require many and diverse efforts – including looking more into how to make cycling more attractive across all seasons of the year.

Seasonal and weather-related factors have significant effects on mode choice and the decision to cycle, especially in areas that experience significant variation in weather conditions throughout the year (Sears et al., 2012). Unsurprisingly, there has been observed a relationship between precipitation as well as temperature and cycling ridership. Very high temperatures in the summertime and cold temperatures in the wintertime reduce cycling, with precipitation having an additional reducing effect (Brandenburg et al., 2007, Miranda-Moreno and Nosal, 2011, Sears et al., 2012). Brandenburg et al. (2007) argue that this effect is stronger for recreational cycling, whereas commuting trips are less impacted. Sears et al. (2012) studied how weather conditions impacted the likelihood of bicycle commuting in Vermont, USA. The results of their study indicate that in addition to temperature and precipitation, wind speed and snow cover also had a significant impact on the probability of choosing bicycle for the respondents' commute. Interestingly, daylight did not have a noteworthy effect, despite Vermont's northern location in the US (Sears et al., 2012). In the Nordic context, it can be speculated whether daylight might have a bigger impact, due to days being significantly shorter compared to Vermont.

A study conducted by Bergström and Magnusson (2003) examined the variations in the modal split of two Swedish cities from summer to winter, and the potential of increasing the number of cycling trips and simultaneously reducing car trips in the winter. The results indicate that the number of trips made by bicycle were almost cut in half during winter, while car use saw a relative increase of 27 pct. This indicates that many cyclists who stop cycling in the winter choose to drive their cars instead, with the remaining people choosing either to walk, travel by public transport or ride a car as passenger (Bergström and Magnusson, 2003). Interestingly, among those who decided to cycle in the winter, travel distances were shorter compared to the summer. This would indicate that the attractiveness of winter cycling is reduced particularly on longer distance trips, strengthening the statement made by Clark et al. (2016) and Dill (2009) of cycling being an attractive mode of transportation on short distances of less than five kilometers or so. A similar study to that of Bergström and Magnusson (2003) was conducted in Trondheim by Zhupanova and Tørset (2017). In the study, employees working in the Sluppen neighborhood were asked to participate in a travel survey both in the winter and summer. The results showed a very similar trend compared to Bergström and Magnusson's (2003) study, with the cycling mode share getting halved from summer to winter. There was a 14 pct relative increase in car use, as well as a modest increase for other transportation modes (Zhupanova and Tørset, 2017). The results also showed a large potential of transferring car trips to bicycle, both in the summer and in the winter, with 38 and 31 pct of respondents mentioning bicycle as their second-best alternative after the car, respectively. The respondents named safer infrastructure, better maintenance of cycling facilities and subsidies for purchasing ebikes as the best measures for making cycling more attractive for them (Zhupanova and Tørset, 2017).

Estimates of seasonal variations in cycling in Trondheim vary somewhat, depending on source. Between 30 and 50 pct of the population who cycle in the summer respond that they also cycle in the winter (Miljøpakken, 2023, Trondheim kommune et al., n.d.). Travel survey data indicates that December/January has the lowest cycling mode shares, while the height of summer in June/August has the highest. Available bike counts also reflect this, but differences are less pronounced (Figure 1). The differences in cycling between the 'worst' months in midwinter and the 'best' months (June/August) is between a factor of four and six.

With its large student population, population growth and ongoing containment and densification efforts – Trondheim could be in a good position to develop the position of cycling in its transport system. Including higher levels of cycling outside the summer season.

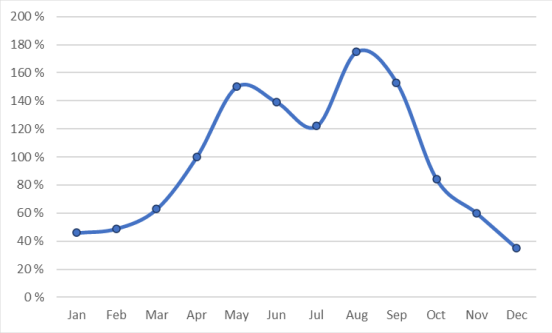

Figure 1: Cycling by month as pct of mean monthly traffic (MDT). Average based on bike counts from three locations in Trondheim (Pirbrua, Stavne, Elgeseter bru).

Due to its proximity to the Norwegian Sea, Trondheim receives abundant precipitation throughout the year, but also has comparatively mild winters. Snow cover varies greatly between and within the winter seasons, as cold and mild periods alternate. The terrain variations within the urban area, from sea-level to almost 200 meters over sea level, adds to the varied climate with colder weather and more snow/ice in the heights. As the temperature often shifts around the freezing point this increases the risk of slippery ice-surfaces forming. With respect to winter maintenance of infrastructures, the municipality of Trondheim follows the national guidelines, but has also assigned an increasing proportion of the bike-network to the higher winter maintenance standards. In the winter 2023/2024, 150 km of bike paths were assigned to the winter maintenance standards of either GsA or GsB where the aim is a snow- and ice-free surface based on salting (GsA) or a hard layer of snow/ice with a maximum of 1 cm loose snow based on mechanical snow removal (GsB). Thus, improving the conditions for winter cycling is a stated priority, but the perceptions of cyclists and the general preconditions of winter cycling is also an area in which limited knowledge is available.

The main purpose of this paper has therefore been to study the preconditions for cycling in winter and non-winter conditions and address measures and factors that could contribute to a larger number of cyclists during the winter.

METHOD

For this study, an online survey was conducted in collaboration with Trondheim municipality. The survey was distributed through social media and targeted incentives and deterrents to winter cycling in Trondheim.

The survey was open for replies from 8 March to 8 April 2024 and available in both Norwegian and English. The distribution channels were a Facebook group for cyclists in Trondheim (In Norwegian: På sykkel i Trondheim), Miljøpakken's Facebook page, as well as the Facebook page of Trondheim municipality. By April 8th, a total of 1,124 respondents had submitted their response to the survey.

The survey contained 30 questions in total; some of which were only asked if the respondent reported that they cycle during the winter. The main questionnaire items are summarized below.

- Cycling frequency during summer and winter season
- Reasons for not cycling during winter (txt)
- Winter cycling regardless of conditions
- Mode choice during winter or alternative to cycling when weather conditions are poor
- Preconditions for starting cycling or cycling more during winter (txt)
- Bicycles: type, e-bike, and the use of studded tires
- Length of experience with winter cycling
- Motivations for cycling during winter
- Respondents access to transport modes
- Distance between home and school/workplace
- Respondents' age, gender and municipality of residence

Most responses were given on nominal scales (modes, motives, bike types, municipality of residence), ordinal scales (frequency, distance, access to public transport) or as simple yes/no/don't know answers. Questions relating to

reasons for not cycling during winter as well as the preconditions to be in place for them to consider cycling or cycling more during winter were asked as open questions, giving the respondents the possibility to elaborate in text.

Of the 1,124 respondents, 54 pct were female, 45 pct male and 97 pct lived in the municipality of Trondheim. Compared to the population of Trondheim, respondents' age distributions points to a clear overrepresentation for ages between 30 and 59 – whereas older and younger groups are underrepresented. This is most likely a reflection of its distribution among Facebook users through the municipality pages – as well as the perceived non-relevance of the survey by non-cyclists. Respondents were almost exclusively existing cyclists and included a large group that cycled during winter. This means that the survey data is not representative of the general population, although the data presents large variations in the frequency and combinations of winter and summer cycling, which can reasonably support analysis of the motives and preconditions of winter cycling within the Facebook sample of Trondheim cyclists (over 30).

The analysis of the data was based on comparing three groups of cyclists defined based on their cycling frequency during winter (November 2023 – March 2024): 'frequent winter cyclists' that reported cycling 4-7 days a week during winter (N=585); 'infrequent winter cyclists' that reported cycling from once a month up to three times a week during winter (N=254) and finally 'non-winter cyclists' based on respondents that reported cycling less than once per month during winter (...fewer than five times in one winter) (N=231).

RESULT

The results from the survey allow a description of general differences between three groups of cyclists with respect to demographics and their transport conditions, their motives for winter cycling, their transport alternatives when not winter cycling – and finally statements with respect to which conditions that could make respondent cycle or cycle more during winter.

Differences in demographics and access to transport

The age distribution within the three groups of cyclists is relatively even, with frequent winter cyclists being slightly younger compared to the two other groups. However, the gender balance in the three groups is uneven, with a clear majority of non-winter cyclists being female – and a slight overrepresentation of men in the group of frequent winter cyclists.

In terms of access to transport, respondents in all groups seems to have good and even access to public transport from home and cars at the household level. Almost all non-winter cyclists also have access to a bicycle in the winter. However, when it comes to distance to workplace or school, the frequent winter cyclists live somewhat closer to their workplace or school, compared to the two other groups.

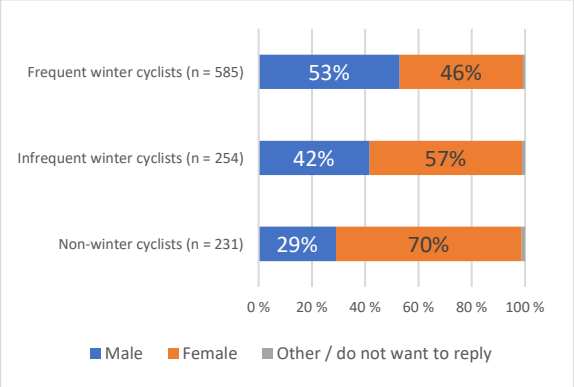

Figure 2: Gender distribution within the three groups of cyclists.

Motives for winter cycling

Amongst existing winter cyclists, the main motivations for cycling in the winter are health and speed, followed by practicality and flexibility. This is in line with what could be expected and generally apply across frequent and infrequent winter cyclists.

The differences in motives between the frequent and infrequent winter cyclists are especially apparent in the higher emphasis on speed amongst frequent winter cyclists (47 pct), alongside a higher emphasis on environment (30 pct), smaller emphasis on joy and fresh air – as

well as some emphasis on habit (12 pct), even though this is over all the least chosen motive.

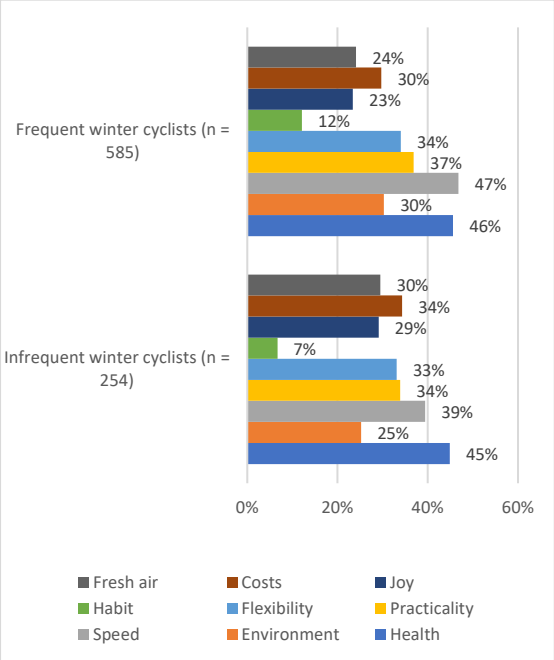

Figure 3: Motives for cycling in the winter selected by frequent and infrequent winter cyclists. Respondents could choose up to three motives.

Thus, the frequent winter cyclists deviate somewhat from the lower frequency winter cyclists in their perception of the transport value of cycling but are also more habitual and more focused on the environmental value of cycling.

The dependence of cycling on winter conditions and the alternatives when conditions prevent cycling

The two groups of winter cyclists respond very differently to the question of whether they cycle regardless of conditions. Among frequent winter cyclists a majority of 77 pct cycle regardless of conditions. Among infrequent winter cyclists this is reversed as only 24 pct cycle regardless of conditions and the majority (76 pct) does not.

When the conditions for cycling are too poor, cyclists are generally most likely to either drive a car or use public transport. However, there are also differences between the frequent and infrequent cyclists as the frequent winter cyclists are the ones that are most likely to stay home (8 pct) or use public transport (53 pct) – and the least likely to drive a car (23 pct). This behaviour may reflect that the frequent winter cyclists are a more urban population (living closer to work) but may also reflect that they do not have the same access to use a car for their daily travel as the infrequent cyclists and finally it aligns with the higher emphasis on environment in the group.

Compared to the frequent winter cyclists – the infrequent winter cyclists rely more on driving a car as the alternative to cycling (37 pct) and less on public transport (41 pct) – and they are less likely to stay home (2 pct).

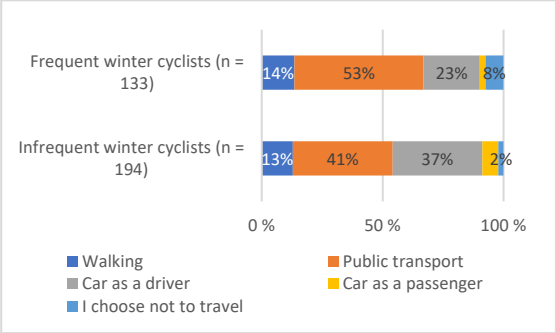

Figure 4: Alternative transport mode when the conditions are too poor for winter cycling.

Comparative analysis with other variables indicates the importance of access to driving, as respondents that have free parking available at their workplace or school are much more likely to drive if conditions for cycling are perceived as too poor, compared to respondents who do not have access to free parking. Results also indicate that E-bike users are more sensitive to poor conditions in their decision to cycle during winter. It is likely that e-bikes are predominately in use amongst cyclists which have differing perceptions and thresholds for comfort and risk than winter cyclists on conventional bikes. Further data collection and research would be required to elaborate on these differences.

What can make winter cycling more attractive?

The unstructured open text answers to the question of what would make respondents cycle more or cycle at all during winter provide some insight into the obstacles or measures that the different groups of cyclists perceived to be important. The responses are here summarized by their main themes for winter cyclists and non-winter cyclists.

Of 247 responses to the question from winter cyclists, over 190 respondents (77 pct) point to winter maintenance in some way or form. Most respondents call for better winter maintenance, whereas others point out that winter maintenance is inconsistent throughout Trondheim, thus reducing predictability of surface conditions on their daily trips. The second most frequently mentioned measure (60 respondents, 24 pct) to make winter cycling more attractive was improvements in the cycling infrastructure. Better cycling infrastructure in this context includes provision of more designated cycleways, better general maintenance of existing cycleways in terms of fixing potholes and other damage on the road surface, as well as cycling facilities that are (perceived to be) safe for cyclists to use. The third most frequently mentioned, but perhaps most contentious factor (38 respondents, 15 pct), is the use of salt for winter maintenance. Generally, respondents wish to reduce the use of salt because of their bicycles being damaged through corrosion, and the associated maintenance requirements. This is of course in opposition to the request for ice-free surfaces which will generally require salting.

The remaining answers point to a variety of measures which would make cycling more attractive, ranging from economic support to buying a better bicycle.

Among the non-winter cyclists, measures very similar to those mentioned by winter-cyclists were proposed. Among the 184 responses from this group, approximately half mention winter maintenance. In addition, the desire for completely snow- and ice-free cycleways is emphasized to a higher degree compared to winter cyclists, possibly reflecting their inexperience with cycling in winter conditions. Another key aspect within winter maintenance mentioned by many respondents is having more predictable surface conditions. Seemingly, some respondents do not cycle in the winter, as they are uncertain of the conditions that they may be facing along their daily routes. As with winter cyclists, in over 40 responses (22 pct), the general requirement for better cycling infrastructure is mentioned. In addition, 21 respondents (11 pct) call for a reduction in salt use.

Interestingly, economic measures/incentives were mentioned to a larger extent by non-winter cyclists, with 19 respondents (10 pct) suggesting economic support for buying e-bikes, studded tires or getting their bicycles ready for winter. However, amongst non-winter cyclists, a considerable share (18 respondents, 10 pct) also report that they would not cycle, regardless of what is done to improve the experience.

CONCLUSION

This research develops further insight into the differences between current winter and non-winter cyclists and their perspectives towards what could make cycling a more viable year-round transport mode in cold urban climates.

The comparison of frequent and infrequent winter cyclists indicates differences in motives and behaviors, with speed and the transport function of cycling being more important to the frequent winter cyclists; frequent winter cyclists having shorter distances to cover; being much less likely to get off the bike in poor weather conditions - and when they do, they are more reliant on public transport than in-frequent winter cyclists. Thus, current high frequency winter cyclists seem to be in a condition where cycling 'makes a lot of sense' considering their lifestyles and daily transport norms, while alternatives to cycling are fewer/less attractive. Group compositions and responses also indicate differences in perceptions of conditions and risks between frequent and in-frequent winter cyclists. Lower frequency cyclists are more likely to perceive conditions as too poor for cycling and use motorized modes instead.

Across all groups of cyclists: frequent, infrequent, and non-winter cyclists that winter conditions and the state of winter maintenance is mentioned as the key issue or key enabler of further winter cycling. Generally enhanced but overall, more *reliable* winter maintenance seems necessary to get infrequent as well as non-winter cyclists to cycle more often in the winter. This would refer to both better/more frequent winter maintenance as well as a predictability of surface conditions, such that planned routes remain accessible. The predictability or timing of winter maintenance based on travel times/travel needs is something

that the current winter maintenance standards does not directly address.

Other types of enablers or incentives to make winter cycling more attractive are small in comparison to the key issues of winter maintenance and infrastructure. In relation to maintenance, there are important differences in emphasis between current winter and non-winter cyclists with non-winter cyclists putting a higher emphasis on completely snow and ice-free surface conditions as well as some non-winter cyclists underlining that there is no way they are going to cycle during winter. There are obviously different levels of willingness and comfort/risk perceptions within the current group of non-winter cyclists that would need to be addressed to facilitate more cycling during winter months.

Limitations and further research

The differences between frequent, in-frequent and non-winter cyclists provide insights based on the perceptions of cyclists. It also has limits in the sense that it does not address non-cyclists nor the change in cycling from summer to winter and vice versa. Weather and season will be part of the image of cycling held by non-cyclists and should therefore be addressed when considering how to promote cycling in general. The comparison of winter and summer is a simple juxtaposition which is helpful in a simplified survey context but does not allow e.g. the lenght of the cycling season to be addressed - even though this should also be considered important in the context of increasing cycling in Trondheim.

Acknowledgements/disclaimer

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