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# Will implementation of high-quality bicycle parking facilities make cycling more attractive in city central areas

A study about the relationship between high-quality bicycle parking facilities and bicycle share in Trondheim

Master's thesis in Physical Planning

Supervisor: Yngve Karl Frøyen

June 2021



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Faculty of Architecture and Design  
Department of Architecture and Planning





## **Topic of the thesis**

Will implementation of high-quality bicycle parking facilities make cycling more attractive in city central areas.



## **Masteroppgavens tema**

Vil tilretteleggingen av høy-kvalitets sykkelparkeringer gjøre sykling mer attraktivt i sentrumsnære områder.







## Preface

The master thesis is my final work of my Master of Science in Physical Planning at the Norwegian University of Science and Technology (NTNU), in Trondheim. The thesis is the documentation of my research during my last months of acquiring my degree, which constitutes 30 study points. The research was conducted and performed over the spring semester of 2021.

The thesis is written as an academic paper and is followed by several appendixes which is not part of the thesis – but support the findings and results of the thesis. The results are based on a digital survey created with Nettskjema, and the results are analysed with **Excel, SPSS, and ArcGIS Pro**. The task description was described and formed in cooperation with and supervised by Professor Yngve Karl Frøyen at the Norwegian University of Science and Technology, institute for architecture and planning. With co-supervisor/Experts in the field Eva Heinen (Professor at NTNU) and Ole Vebjørn Bakken from Miljøpakken.

Being born and raised in Trondheim has been a significant factor for my interest and passion for the city development in Trondheim. At least for the past years as a grown-up experiencing real life situations in perspective myself, and especially ever since I started my higher education in planning. As my knowledge grew broader and learned the value for universal design, whilst also having in mind the seventeen sustainable development goals by the United Nations. I dream now to participate in the development for a green and blue future in urban spaces and think of solutions for both societal and environmental reasons. Therefore, in this thesis I have put my heart and soul into the people's opinion and see if I can provide improvement to my hometown, Trondheim.

The experience in writing this project has been very educational, an eye-opener when it comes to exploring the existing solutions from other countries and reading numerous research papers. Seeing how cities in other countries have achieved goals that we are aiming for, while Trondheim has not – is also very inspirational and sort of making me feel envious, though it makes me feel that we can also implement those actions to our city and make change for a better future.

This semester has without doubt been hard for me, both on the physical and mental side, and I do not doubt that it is a common situation for others during this pandemic. The pandemic has made it hard for most of us to keep having our heads up and be motivated for work for

continuity. However, with great people around me – it has kept me going forward. Being a voluntary in the student organisation VSAiT has also been helpful on the social front, as through our arrangement we have invited members and friends to social events – reminding me of the importance of having not only being with friends, but also to meet new people.

The first group of people that I would like to thank, is none other than my entire family. I come from a poor family who started from scratch with nothing in adult age; my parents are one of the “Boat people” – whom are war refugees from Vietnam. I feel immeasurably lucky to have been born in Norway, wearing the pride of calling myself a Norwegian.

To make my family proud, I have always strived to become the best version of myself – continuously seeking for knowledge and never giving up, no matter how long it takes or how hard it is. Today I sit 29 years old, and close to finalizing my master’s degree, moving onto a new chapter in life. I have my family to thank for all the strength I have had up until now, and of course my friends, who I wish to express my gratitude to as well.

Next, I would like to thank my classmate, Jørgen Strøm Iversen. Whom I have been in class with since the first year of our bachelor’s degree in Geography in 2015, and fortunately – we ended up in the same master as well in 2019. I would also like to thank my international friend from Urban Ecological Planning, Robin Ang Surya. He has been a huge factor for my motivation, as we are always on the same boat and pushing each other to keep on getting progress. He is a reminder for me that we are all human, we make mistakes, we learn from it, and we move forward – happily and stronger.

For everyone else who have been there for me this semester, I cannot thank you enough for the social and mental support. I am unable to name everyone, but I am sure everyone knows their places in my heart.

There is a major group that I would like to thank. I know the names of none of them, but they have contributed to my thesis in a way no existing research paper can. This group is the people who spent their time to participate in my digital survey. Thank you for all your comments and enthusiasm for the topic regarding bicycle parking in Trondheim. Your contribution has been invaluable, and I thank you for that.



Lastly, I would once again give a specific thank you to my supervisor, Professor Yngve Karl Frøyen. He has been understanding all the way and given support whenever needed. I went through some tough situations in life during this thesis, but he was patient and always offered time to talk if needed. Thank you for all the patience, feedbacks, and your presence despite being super busy as a supervisor for multiple students. I feel lucky to have had you as one of my professors for three years, one year longer than my classmates.

Trondheim, June 2021



Phong Vuoc Tran



## Summary

The Norwegian National Transport Plan 2022-2033 has a long-term goal for bicycle share to reach 20% in central city areas, and 8% nationwide. Reaching these goals requires complex cooperation between all businesses, municipalities etc., to create a culture focused on facilitation and policy development for cycling.

To motivate people living in central city areas to cycle as a transportation mode, all types of facilitation for cycling must be considered. One of the facilitations are good bicycle parking and will be investigated in this thesis to understand its capability to increase bicycle share in central city areas.

The study combined national research with international research papers with «state-of-the-art» to find deeper understanding of the topic, which were used in preparation for a quantitative study in the form of an online survey. The design of the survey was logically built up to collect information about high-quality bicycle parking and its potential to increase bicycle share in central city areas.

Based on results from the survey, respondents seem to believe that bicycles will get a more secure parking, and the respondents would feel more comfortable leaving the bicycle without fearing it would get stolen. As bicycle theft is a widely known to be a problem in most major cities, it was likely to be in Trondheim as well. Most respondents resonated that high-quality bicycle parking facilities is a good implementation for increasing the secureness of current bicycle parking situation in Trondheim. Today, the capacity for high-quality bicycle parking is low and has a high demand. As cyclists are worried about their bicycle's safety, and non-cyclists are reluctant to purchase a bicycle to use as primary transportation mode in city central areas due to low bicycle safety.

Furthermore, the study shows that bicycle theft is not the only factor for a reluctant bicycle share. Other factors such as facilitation attributes are just as important, for instance by having a roof or wall for sheltering against weather conditions. Those attributes are important for winter cycling and work/study travels because it requires parking over longer time.

Although bicycle road infrastructure is important, seeing from results and literature reviews, the importance of high-quality bicycle parking is just as important for increasing bicycle shares in central city areas.



## Sammendrag

Den Norske Transport Planen 2022-2033, har et langsiktig mål mot en økning av sykkelandelen med 20% i byene, og 8% på landsbasis. For å oppnå disse målene, kreves det et kompleks samarbeid med alle selskaper, kommuner osv., for å skape en kultur fokusert på fasilitering og en politisk utvikling rettet mot sykling.

For å motivere mennesker som bor i sentrumsnære områder til å bruke sykkelen som transportmiddel, krever det at alle typer sykkelfasiliteter skal bli vurdert. Et av fasilitetene er god sykkelsykkelparkering, som vil være undersøkt i denne oppgaven for å forstå dens kapasitet til å øke sykkelandelen i sentrumsnære områder.

Studiet kombinerte nasjonal forskning med internasjonal forskning ved hjelp av «state-of-the-art» for å skape en dypere forståelse av temaet, noe som ble videre brukt i forberedelsen til et kvantitativt studie i form av en digital spørreundersøkelse. Utformingen av undersøkelsen var bygd opp logisk sett for å samle inn informasjon om høy-kvalitets sykkelparkering og dets potensiale til å øke sykkelandelen i sentrumsnære områder.

Basert på resultatene fra undersøkelsen, så ser det ut til at deltakerne mener sykkelparkeringer vil være mer sikre, og at deltakerne vil kunne føle seg mer tilfreds med å forlate sykkelen uten å være bekymret for at den skal bli stjålet. Sykkelparkering er et allerede veldig kjent problem i de fleste storbyer, så det var antatt å ha lignende forhold i Trondheim. De fleste deltakerne uttrykte at høy-kvalitets sykkelparkering fasiliteter ville utgjøre god tilrettelegging for syklister, og øke sikkerheten for den nåværende sykkel parkeringssituasjonen i Trondheim. I dag er kapasiteten for høy-kvalitets sykkelparkering lav, men med høy etterspørsel. Syklister er bekymret for sykkeltryggheten, og ikke-syklister er nølende med anskaffelse av sykkel som primær transport i sentrumsnære områder grunnet frykt for sykkeltyveri.

Videre viste det seg at sykkeltyveri ikke er den eneste faktoren til hvorfor en nølende sykkelandel finnes. Andre faktorer som fasilitetenes egenskaper er minst like viktige for økt sykkelandel. Deriblant, tak eller vegger rundt parkeringen for å beskytte sykkelen mot ulike værforhold, som for eksempel – regn og snøvær. Det spiller en viktig rolle for vintersyklister eller syklister til jobb/studier, siden det krever parkering over lengre tid.

Selv om sykkelinfrastruktur er viktig, sett fra resultater og tilgjengelige forskningspapirer, så er viktigheten av høy-kvalitets sykkelparkering minst like viktig for å øke sykkelandelen i sentrumsnære områder.



## Abstract

**Keywords:** Bicycle parking, travel behaviour, public transport, bicycle infrastructure, high-quality parking, electrical bikes, bicycle theft, winter cycling.

Cycling is a means of transportation that has gained a lot of attention in many cities in recent years. Despite the bicycle being parked for most of the time, it is an important and sustainable source of transportation for both the rich and poor. The purpose of this thesis is to understand the correlation of increased security and safety for bicycle facilities, cycling policy development and cycling itself as a transportation mode. Several studies from Netherlands, Germany and Denmark have already proven that implementation of high-quality bicycle parking facilities make cycling attractive – but can also be done affordable. Norwegian cities are a little behind other countries regarding bicycle infrastructure, bicycle parking solutions and policy development for bicycles. The reasons behind this are mostly due to the elder generation of urban planning and policy decisions. Such as prioritizing motorised vehicles and seeing that as “the future mode of transportation”. In more present times, motorised vehicles have set concerning issues regarding greenhouse gas emissions – leading to not global warming, but into a situation that has already developed to what we are calling a *climate change*. It is a global challenge that we all must participate, a reason to follow the *Sustainable Development Goal 17: Partnership for the goals*. We need to create a better and more sustainable future. Therefore, the aim of this study is to research and understand if implementing high-quality bicycle facilities can lead to positive changes in the environment and for the overall public health by making cycling more attractive.





## **Abbreviations**

BL – Bicycle locker

BH – Bicycle hotel

CBD – Central Business District

GIS – Geographical Information Systems

SHT – Stichting Historie der Techniek

SOTA – State of the art

SPSS – Statistical Package for the Social Sciences

RVU – Reisevaneundersøkelse / Norwegian National Travel Survey



## **Structure of the master thesis**

This master thesis consists of different sections; introduction, context, research method, results, discussion and conclusion, followed by list of references and extended appendices.



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# 1 Introduction

As the population is currently exponentially increasing, various challenges regarding built environment, infrastructure and climate will occur. Not surprisingly, but for a few decades this has already been predicted. All due to planning of the past around mid-1900s, when urban planners and politicians did not put sustainable transport and humans as a priority – but rather the motorised vehicles, which was a new and unquestionable revolutionary technology development. Which caused high attention and priority for development to be able to use the luxury of motorised vehicles such as a car.

With all of this in mind and in the centre of attention, it would lead to building broader roads with multiple lanes, massive pumping for fuel and gas – as several companies seemed to achieve great economic benefits for this. Unfortunately, the following consequences decades later are now not only air pollution, but also water pollution. Causing loss of carbon dioxide storages such as coral reefs and deforestation of rainforests and other vegetation. Global warming was a subject, which now has become a climate change as consequence. Then roads and cities were built to match the needs of the motorised vehicle user. Thus, universal design was not in mind and hardships were made for people who wanted to ride the bicycle, walk the streets, or rely on public transits. Moreover, it created far distances to important services such as health care centres, shopping malls and other service facilities to maintain a healthy as satisfaction for everyday needs.

Along with the rapid population growth worldwide, common challenges such as effective use of space for good livelihood, a good road infrastructure for non-motorised and motorised transportation modes and how to implement solutions to avoid traffic congestion to make a shift for a more attractive, sustainable and climate friendly transportation modes – such as cycling.

In the light of modern planning, accessibility and universal design has become more important – as scientists have concluded by obvious reasons that it results in societal and health benefits for the people. Especially for the younger, elder and the disabled/physically challenged. As an attempt to make a shift for the better future – modern planners, architects and engineers are now working hard and strategically to re-create cities to be more *exciting, healthy, safe, reducing air pollution, unnecessary use of space, reduction of greenhouse gas emissions and creating an efficient road infrastructure for transportation*. All of this to ensure that both traffic

and public health are positively developing. Considering that urban immobility has increased simultaneously as greenhouse gas emissions the last decades. The lack of urban planning from the past and not adopting to sustainable mobility alternatives is leading to an unfortunate collapse in city development (Guerreiro et al., 2018).

The Norwegian National Transport Plan (2016) has reported a plan towards the goal of zero-increase for private vehicles, by directing future planning towards other transportation modes such as public transits, bicycle and walking. With the limited capacity with land area in Norwegian cities, it is a challenge. Considering the amount of space required to build parking facilities for motorised vehicles, contra how many people it fits per square meter – it is not efficient use of space. When comparing facilities for cars against bicycles, it is surely a significant difference in area used per user. A creative and efficient solution in Dublin (see figure 1) proves that a parking lot for a car, can instead fit ten bicycles. This solution grants efficient use of the urban space.



Figure 1. Bicycle racks in Dublin Credit: Dublin Cycling Campaign

In Norway, there has been done limited research on the subject about bicycle parking facilities and road infrastructure for bicycles. Which is also one of the reasons why the country's policy and road infrastructure development is so far behind that of some other countries, such as the Netherlands, German and Danish. Norway also has other challenges that may slow down the process of realising the ideal policy and road infrastructure for bicycles. These challenges are factors like *topography, climate, localisation of important destinations, public transit quality and implementations for bicycle traffic* (Lodden, 2002).

The Norwegians are currently striving to improve the bicycle network structure in most cities, as seen from the national travel survey from 2019, the number of both traditional and electrical bicycle share is slowly increasing in the largest cities in Norway (Urbanet analyse, 2019).

When we consider improvement and increase for cycling in general, we need to pay more attention to facilitate parking for cyclists. Existing research for cycling and parking facilities are significantly less than for motorised vehicles. As we can see from existing research for car parking, it is documented that higher demand will result with increased parking capacity, and increase the number of car users (Christiansen et al., 2017). Hypothetically, an increase for parking facilities for bicycles should also increase the number of cyclists. Which is something this thesis will try to find an answer to.

Understanding the people's need for access to high-quality bicycle parking facilities and optimal road infrastructure for bicycles are essential for increasing bicycle ridership. Literature from state-of-the-art research show that the duration of the parking, frequency, trip characteristics and location are important factors that shape desired facilitations for bicycle parking (Vorhaug, 2021).

Existing research that covers the important factors for maintaining a high number of cyclist throughout winter, mentions that access to a good bicycle parking facility is of great importance for their mode choice (Bergström & Magnusson, 2003). Thus, making bicycles as a primary mode makes sustainable transport more relevant throughout the year. More importantly, the research supports the statement from Pucher and Buehler (2008) that history, culture, topography and climates are indeed important factors for the fate of cycling, but not necessarily the sole reason. So, we need to understand this in a holistic way.

### **Will implementation of high-quality bicycle parking facilities make cycling more attractive in areas close to the city central areas.**

The objective of this thesis is to understand and look for answers to if high-quality bicycle parking facilities such as bicycle hotels and lockers – will make cycling more attractive in central areas in cities. In this case, I have chosen Trondheim as a study area. However, due to lack of local and national existing research, data from other countries that have found success in bicycle policy development, facilities and infrastructures will be used in addition. During the spring of 2021, I conducted a digital survey in Trondheim. The target groups were set to be

both bikers and non-bikers to minimise the effect (or error, or skewness) of biased opinions as much as possible. The survey's objective is to examine and understand the need and use of high-quality bicycle parking facilities at their respective work/study places and for different trip purposes (such as visiting people, shopping, trips etc.). The survey is also to better understand if these implementations can make cycling more attractive regardless of being a cyclist or not. The objective in this thesis is addressed in the following questions:

### **1.1 Research questions**

1. *How does high-quality bicycle parking facilities affect the mode choice to and from central areas?*
2. *Will high-quality parking bicycle facilities be decisive for the people's transportation mode choice?*
3. *To what extent does high-quality bicycle parking facilities matter for the cyclist's safety in terms of theft and maintenance?*







## **1.2 Background and motivation**

### **1.2.1 Bicycle commuting**

Cycling is an option for many commuters, especially those who must travel short distances. Commuting is a travel behaviour that is important for the society, as it contributes to economic prosperity (Heinen et al., 2010). Commuting allows individuals to work somewhere further away from home, and allows the individual to avoid being spatially restricted to distances to work (Attar, 2015).

### **1.2.2 Benefits of cycling**

It is without a doubt that cycling in urban settings gives satisfaction to both societal and individual needs. As mentioned in the Norwegian Transport Plan (2014), the city of Trondheim is going through rapid population growth and urbanization. Thus leading to congestion in traffic for private as a result, and therefore it is necessary to develop the city towards better infrastructure for cyclists, pedestrians, and users of public transits (Miljøpakken, 2014).

Behind these ideal thoughts about implementing physical solutions, lies good benefits for public health and spatial aesthetics of the city. There are many good reasons why we should prioritize improving road infrastructure and facilities for bicycle, and to our best ability make biking more attractive and accessible.

Theoretically, cycling is a form for physical activity that effectively works the cardiorespiratory and metabolic functions of the entire body and is naturally an activity that results to many potential health benefits. For that reason, cycling is being recognised as an important potential means of transport to both promote public health and sustainability (Oja et al., 2011). Studies have proven that active commuting with bicycles are reducing the risk of type-2 diabetes, hypertension, cardiovascular events and improves fitness (Oja et al., 2011).

For societal and individual needs, cycling has several interesting advantages over other modes of transport. In urban areas, cycling is proven to be faster than other transportation modes due to its ability to avoid most traffic jams (Heinen et al., 2010). For societal needs, a bicycle will cause no noise or air pollution and consumes significantly less non-renewable resources than any motorized vehicle (Pucher & Buehler, 2008). Although there is a current shift toward a new bicycle type, introducing the electric bicycle which may not be as requiring physically. However,

it is still a good choice, and will participate in reducing the number of drivers on the roads. Besides, it runs on electricity and not fossil fuels. On the individual level, cycling is as mentioned a healthy transportation mode, but also cheap form of transport.

### *Disadvantages of cycling*

However, despite a lot of advantages, like everything else – there are some disadvantages. Some to mention is that cycling requires a greater physical effort unless you have an electric bicycle. The difficulties of carrying loads and being exposed to weather conditions such as rain and snow is challenging a cyclist (Heinen et al., 2010). Some other disadvantages are the speed limit, that are lower than motorised transport. Then again cyclists are soft in traffic, being more prone to damages and life-threatening accidents if unfortunate.



*Figure 2. Sustainable development goals, United Nations.*

### **1.2.3 Cycling and the Sustainable development goals**

In 2015, the goals for sustainable development were released and ratified by the United Nations in Agenda 2030. The goal is to improve the global sustainability by 2030, and aimed to cover all aspect of sustainability and sectors of society (Fleming et al., 2017). Development strategies consider mobility as an essential element to achieve the Sustainable Development Goals – so, meeting the needs of people who wish to cycle more is critical for helping cities decrease greenhouse gas emissions, improve air quality and to provide road safety.

According to the United Nations, cycling is at least relevant for 11 sustainable development goals (United Nations, 2021) – as listed below, but the thesis will only mention 7 of them.

❖ **Sustainable development goal 3: Good health and well-being**

*By cycling, we generate a healthier and a lifestyle that avoids air pollution. Physical activity through biking plays part in reducing heart diseases and other negative impacts on your health (United Nations, 2021).*

❖ **Sustainable development goal 8: Decent work and economic growth**

*Bicycles can transport both people and goods, while also provide sustainable tourism and healthy leisure activities. Through cycling, jobs are created – significantly more than air and spacecraft industry, and even more than the car industry (United Nations, 2021).*

❖ **Sustainable development goal 9: Industry, innovation, and infrastructure**

*With access to affordable, flexible and sustainable transportation, the governments can easier build resilient infrastructure and more sustainable transport systems for better general well-being. Giving people the ability to switch from motorised transport to active mobility with combination with public transport (United Nations, 2021).*

❖ **Sustainable development goal 11: Sustainable cities and communities**

*Having more bicycles in the cities creates a reassuring emotion for the population, since it is a safe and affordable option that is non-polluting, healthy and promotes sustainable economy. Increased cycling in cities is highly resilient as it is very independent from advanced technology and therefore is usable by the majority. Then bicycles also goes hand-in-hand with technology, as electric bikes are developing fast and is integrating cycling into “Intelligent Transportation Systems of Cities”. This goal is concluded by, the higher share of walking, cycling and public transport – the more sustainable transport system there is.*

❖ **Sustainable development goal 12: Responsible consumption and production**

*Transportation of people and goods can through bicycles be offered to move around in all categories – either as a commuter, tourist, consumer or even for production, consumption, and deliveries in sustainable ways. Most urban cities can have over 50% of goods delivered by bicycles (United Nations, 2021).*

❖ **Sustainable development goals 13: Climate action**

*Bicycles have always been a symbol for sustainable and green transport. It decarbonizes transport and societies and offers an immediate climate action. Governments can all take action for integrating cycling into their policies for climate action, strategies and education to raise awareness (United Nations, 2021).*

❖ **Sustainable development goal 17: Partnerships for the goals**

*Goal number 17 is the most important one for all goals, therefore is a very important matter to have in mind when implementing policies and strategies for increased bicycle ridership. Various organisations, experts, governments on worldwide level, should support each-other to reach goals for a greener footprint on the already struggling planet. Together, it is possible to seek for new knowledge and achieve successful environmentally friendly technology and development of cycling policies in developing countries across every continent.*



## 2 Context

### 2.1 High-Quality Bicycle Parking Facilities

In an article by the city of Toronto (2006), the quality of bicycle parking is decided by the different criteria they fulfil. Bicycle parking is defined by two categories according to a research paper by the City of Toronto: *Short-term bicycle parking (1) and long-term bicycle parking (2)*.

There should be a large supply of good bicycle parking throughout the city, preferably with improved lighting and good security levels in the facilities, featuring video-surveillance and guards (Pucher & Buehler, 2008).

#### 2.1.1 Types of High-quality bicycle parking facilities

High-quality bicycle parking facilities can be differentiated by two types. The types are called *Bicycle Lockers (BL)* and *Bicycle Hotels (BH)*.

##### Bicycle lockers

This is a rectangular metal box for bicycles that can room up to two bicycles on each side. They are modular, so several boxes can be attached to each other to increase the capacity. Dependent on the producer of the boxes, regarding technology used – they could be installed anywhere without access to electricity (SafeBikely, 2021). The bicycle lockers can be opened through an application on the phone, remotely, if used by multiple users. Others are accessible by key, swipe card (fob) or with an electronic keypad on the lockers door (City of Toronto, 2006).

The bicycle lockers are considered high-quality due to its level of high security, ability to shelter from bike theft, vandalism, and protection from weather – keeping it completely dry throughout the period of use. The bike will be fully hidden from the public since people cannot look inside the bicycle lockers. It is also the only option that gives total protection against bicycle theft, since it is only the owner who has access to that room (Pablo Celis & Bølling-Ladegaard, 2008).



*Figure 3. Example of a Bicycle Locker (BL) from SafeBikely*

Bicycle lockers require a flat surface to install, and enough clearance for the doors to open. Dense surfaces such as concrete is recommended, although it can vary from which model is used. Most bicycle lockers are installed near workspaces, school/studies, city centres or student housings (City of Toronto, 2006). The lockers are best places away from areas with high pedestrian traffic or sidewalks.



## Bicycle hotels and cages

Characteristics of bicycle hotels, or cages is that they restrict access by limiting it to only those who have a valid access card, using an electronic key pad or similar systems (City of Toronto, 2006). Inside of the bicycle hotels or cages, there are installed high quality racks which the bicycles can lock onto. Since there are often several users coming into the bicycle hotels and cages, the facilities are monitored through surveillance cameras and/or having a security guard available to enforce security of the facility (City of Toronto, 2006). In addition, the bicycle hotels should have good lightning and good locking options regardless of bicycle type (Cargo bike, electrical bike etc..). The bicycle parking should also have access to power outlets for charging electrical bicycles and maintenance services such as cleaning and workshop (Norconsult, 2019). It is in addition recommended for bicycle hotels to have high architectonic quality so it feels socially safe (Urheim et al., 2017).



Figure 4. Bicycle hotel in Asker. Credits: Velopa

## Other facilities

There are some facilities that accommodate high quality bicycle parking facilities, such as indoor bicycle parking in a garage or a dedicated bike room. The two are usually on the first floor and is easy to access and exit (Norconsult, 2019). Parking garages can be qualified for long-term parking if controllable access were to be implemented or if it provided a type of cage or locked. With more than one level of security, it will further improve the quality of the bicycle parking (City of Toronto, 2006). Other than garages, there could be dedicated rooms within existing buildings to fit in good quality bicycle racks that are securely fixed on the ground (City of Toronto, 2006).



*Figure 5. Indoor bicycle parking. Credits: Norconsult (2019)*

Additional features of these facilities could be to reserve a small area for self-service bicycle maintenance, repair and air pumps. Providing tools for maintenance will lift the quality of the facility significantly (City of Toronto, 2006; Skjerve-Gordley et al., 2019).

### 2.1.2 Categories of bicycle parking

Information about bicycle parking's duration can be used to manage demand (Moskovitz & Wheeler, 2011), and how to satisfy the needs for bicycle parking facilities on all occasions.

#### Short-term bicycle parking

Those are the kind of bicycle parking racks that has easy accessibility and located in public spaces. It is often not sheltered, but some are sheltered. Short-term bicycle parking is available for everyone. However, the bicycle safety on for this kind is of the lowest degree – as bicycles are vulnerable to theft, vandalism and even bad weather (City of Toronto, 2006).

Most short term bicycle parking are defined by the duration less than 2 hours according to Moskovitz and Wheeler (2011). Although mid-term bicycle parking is not mentioned by the City of Toronto, Moskovitz and Wheeler (2011) consider durations between 2 to 4 hours as the defined category.



*Figure 6. Bicycle racks at Gløshaugen for short-term bicycle parking.*



## Long-term bicycle parking

This kind of parking is normally in an enclosed and secure facility with controlled access. The parking will secure the bicycle significantly more than ordinary racks in public spaces, as it is sheltered (City of Toronto, 2006). Examples of long-term bicycle parking facilities can be in a locker or in bicycle hotels. Long-term bicycle parking is defined by Moskovitz and Wheeler (2011) to have durations longer than 4 hours.



Figure 7. Bicycle racks in a bicycle hotel. Credits: SteadyRacks

## 2.2 Bicycle theft

Bicycle theft is a frequent issue in cities all over the world. Bicycle theft is not only when the bicycle gets stolen, but also parts (wheels, pedals etc ...) and accessories of the bicycle (Johnson et al., 2008). According to research by Chen et al. (2018), bicycles are more likely to be stolen (4.7%) than cars (1.2%) and motorcycles (1.9%). Bicycle theft often goes unnoticed, as it will often be categorised as “lost property” and then become an insurance case (Van Lierop et al., 2015). Chen et al. (2018) mean that bicycles are attractive objects as they are easy to steal, resell, difficult to track and widely available. According to Chen et al. (2018) the likeliness to be arrested for stealing a bicycle is significantly lower than for other crimes.

### 2.3 Current situation of bicycle parking facilities in Trondheim

In Trondheim there are currently an approximate of 11 bicycle lockers, with the capacity for 92 bicycles and an additional 4 bicycle hotels that are located outside of the city centre with capacity for approximately 100 bicycles.

The bicycle hotels are currently managed by the municipality and the bicycle lockers are managed by a high-quality bicycle parking company named "SafeBikely". The municipality and SafeBikely are collaborating on the central bicycle lockers, which are only currently located two places in town. The bicycle hotels are placed strategically next to busy public transits such as bus stations or train stations for easier access to those who are commuting to work by bike. The bicycle hotels are not free of use, but the current pricing is 10 NOK for 24 hours and 600 NOK for 365 days (one year). The bicycle hotels are open all year round and any time of the day. To access the bicycle hotel, an application must be downloaded and remotely opened through the application. Bicycle lockers are placed in high-frequency areas where people have offices, or areas where they go for recreational purposes. Most of the bicycle lockers in Trondheim are free of use for a certain amount of time (at most 4 hours free), then it cost 10 - 15 NOK per hour after.

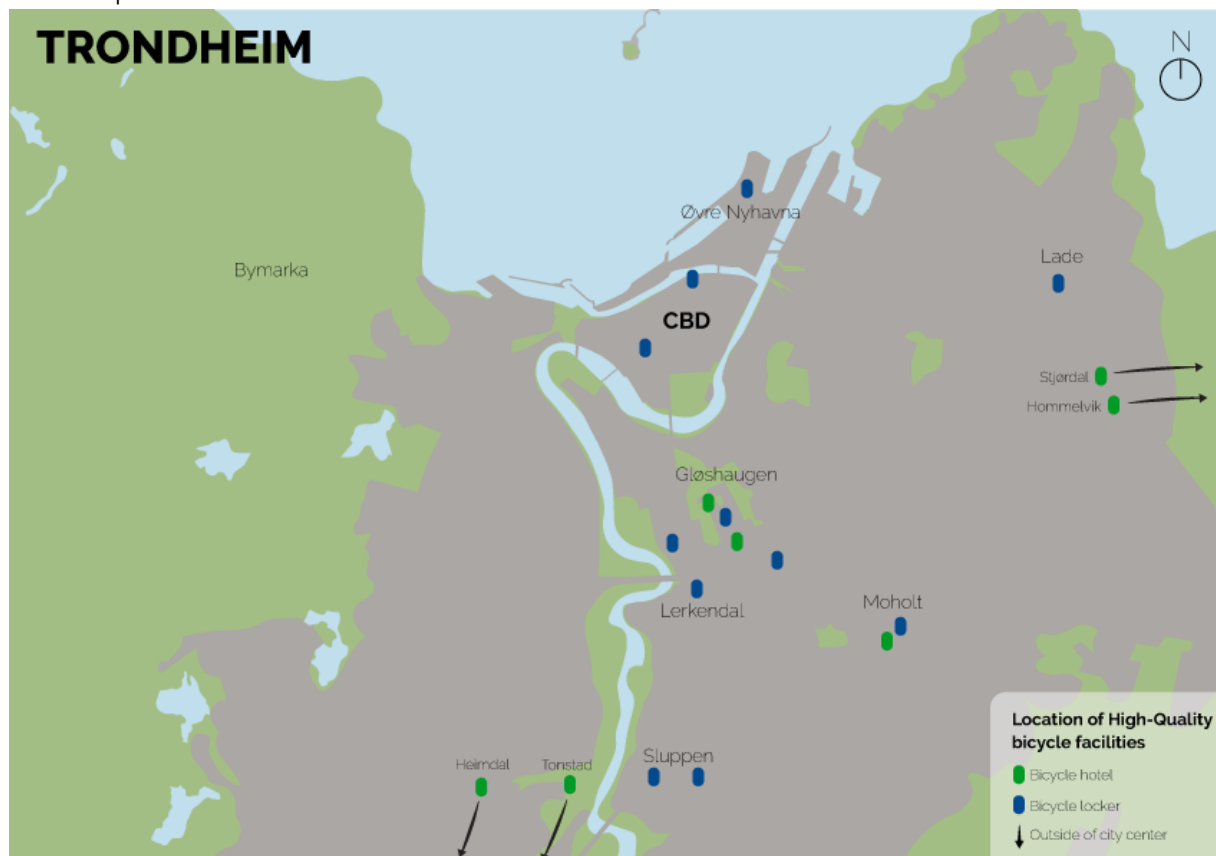


Figure 8. Illustration of existing Bicycle hotels and lockers in Trondheim.

In Trondheim, a report by Miljøpakken that discuss bicycle development strategy for the period from 2014 to 2025. The main goal is to make Trondheim the best cycling city in Norway, with three primary objectives: (1) *Increase bicycle ridership, aiming for 15% bicycle share within 2025*, (2) *Create safer environments for cycling* and (3) *to make it easier to cycle* (Miljøpakken, 2014).

In the past few years, not only in Trondheim has bicycles gotten more attention – but also the other municipalities such as Oslo. Trondheim is the city that has come the furthest in terms of high-quality parking facilities, since Miljøpakken which is located in Trondheim have allocated funds for bicycle lockers by the company “SafeBikely” on several locations around town (Miljøpakken, 2020). While also building several bicycle hotels around the city, which is currently only on the outskirts of town, see figure 8 (Heimdal, Tonstad, Stjørdal and Hommelvik).

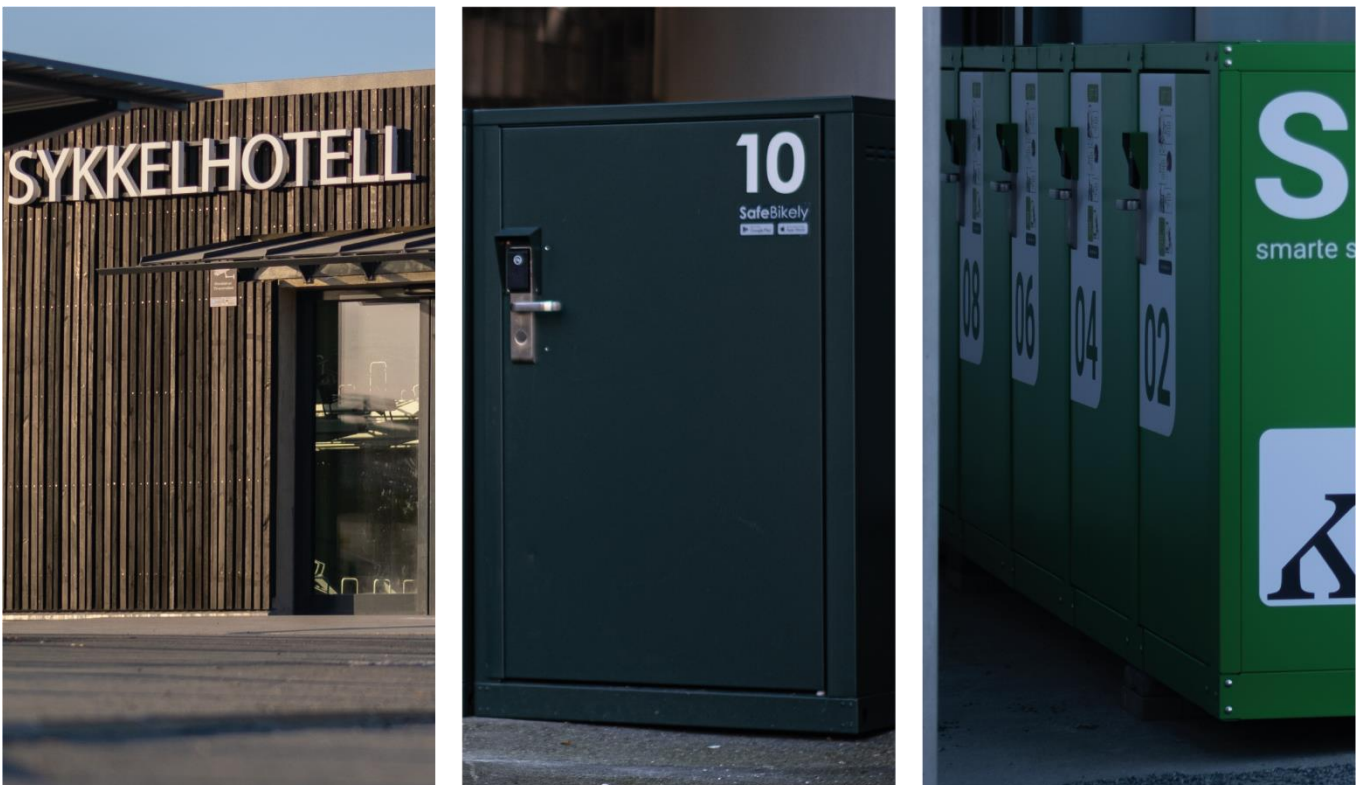


Figure 9. Photos of bicycle hotels and lockers in Trondheim.







### **3 Literature review about bicycle policy development and bicycle parking facilities**

This section will use existing scientific literature to identify different factors that may influence bicycle use in various countries across the world. Most of the literature is based on international reports from mainly European countries and some from North America and South-East Asia. The existing research surrounding bicycle parking facilities is based on various cases and factors, that implicit that there are many factors that are decisive for whether cycling is attractive in their country. The findings are showing that location of the facilities is especially important for a positive result on attractiveness. The following chapter will introduce the current knowledge and findings on bicycle parking from different geographical locations world-wide. As well as the existing Norwegian literature.

#### **3.1 Determinants of bicycle commuting**

##### **3.1.1 Development of policy and cycling infrastructure.**

Cycling have not always been given a priority and not handed the policies needed for further development in many countries. Thus, not all countries have gotten equally far in terms of developing policies for bikes. Of those whom have gotten the best development in both infrastructure and policies are the Dutch, German and Danish (Pucher & Buehler, 2008). The three countries have cyclists riding on inexpensive and simple bikes, which is an important factor for making it cheap, accessible, and attractive to choose cycling. It is also assumed safe to ride a bike without wearing bicycle outfits and less people feel the need to wear safety helmets. Cycling is supposed to and should be for everyone and for all daily purposes. It should not be viewed as a transport mode which requires extensive training or a high level of fitness. Cycling should be seen as a comfortable way to travel, without having to argue about the spatial needs against bigger motorized vehicles, such as cars and other public transits (Pucher & Buehler, 2008).

While it seems like these countries have had a successful bicycle culture for a long time, it is not the entire truth. According to the Ligtermoet (2006) the bicycle share in nine European countries have had higher percentages before the second world war (see figure 10) and steadily decreased as the war ended and technology for motorised vehicle development found

progress. If we look at figure 10, there was a high level of bicycle share before 1950, which then began to decrease from around 1950 to 1975. The share of bicycles then stabilized and found renewed development of bicycle use (Ligtermoet, 2006).

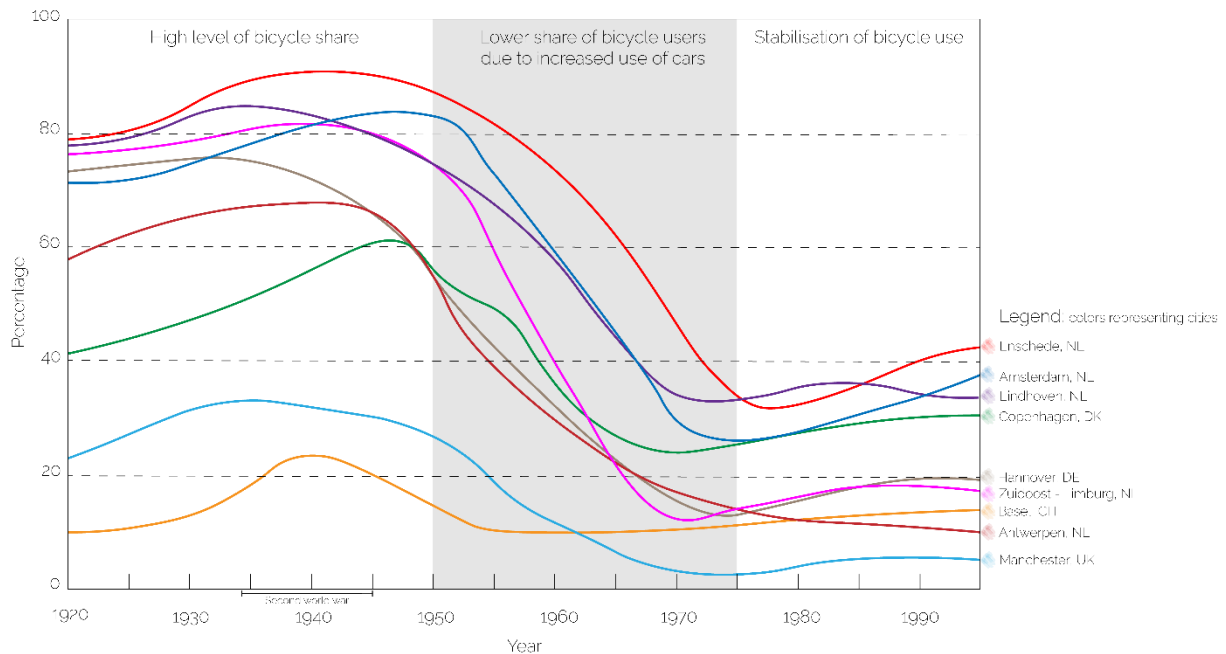


Figure 10. Trend lines of bicycle shares in the total number of car, bicycle, moped and public transport journeys (in %).

Despite an increase in policy and academic interest in cycling, there have been given little attention to cycling when we compare it to other transportation modes (Heinen et al., 2010). In order to develop policies that can encourage cycling, it is important to understand what determines bicycle use (Heinen et al., 2010).

### **Bicycle infrastructure**

Bicycle lanes, paths and normal streets that have markings or even without markings are all part of a bicycle infrastructure. It is often assumed that it is safer to separate cyclists away from the rest of the traffic. Existing research confirms that certain types of bicycle infrastructure do matter (Heinen et al., 2010). Preferences for the type of bicycle facilities vary across experienced and non-experienced cyclists. Most inexperienced cyclists, younger and women tend to prefer proper bicycle facilities (Stinson & Bhat, 2005). While experienced users are desiring nothing more than a *wide curb lane*, which is a roadway wide enough to be considered safe side-by-side a bicycle and motorised vehicle (Heinen et al., 2010).



Figure 11. Bicycle path, credits: PeoplePoweredMovement

Heinen (2010) argues that the question of bicycle infrastructure is highly correlating to safety, and can be identified as two types; *objective* and *subjective* safety. Objective safety is the “real” safety for cyclists, in terms of absolute numbers in bicycle related incidents per million inhabitants (Heinen et al., 2010). Subjective on the other hand is referring to an individual’s own perception of safety and is often measured in terms of safety experience of themselves or other users (Heinen et al., 2010). According to Klobucar and Fricker (2007), the effect of subjective safety levels are higher with dedicated bicycle facilities available.

### 3.1.2 Key policies and innovative measures

To make cycling safe and convenient for many people in a population, a list of seven categories with measures that has been widely used in the Danish, German and Dutch cities is to be presented. The success in making cycling appealing with the help of these measures comes from the implementation of seven measures, but two most relevant for bicycle parking facilities are (1) Bicycle parking and (2) Extensive systems of separate cycling facilities (Pucher & Buehler, 2008).

*Table 1. Key policies and innovative measures used in Dutch, Danish and German cities to promote safe and convenient cycling (Pucher & Buehler, 2008).*

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<b>1. Extensive systems of separate cycling facilities</b>	<ul style="list-style-type: none"><li>▪ Well-maintained, fully integrated paths, lanes and special bicycle streets in cities and surrounding regions.</li><li>▪ Fully coordinated system of colour code directional signs for bicyclists.</li><li>▪ Off-street shortcuts, such as mid-block connections and passages through dead-ends for cars.</li></ul>
<b>2. Bicycle parking</b>	<ul style="list-style-type: none"><li>▪ Large supply of good bicycle parking throughout the city.</li><li>▪ Improved lightning and security of bicycle parking facilities often featuring guards, video surveillance and priority parking for women.</li></ul>

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### 3.1.3 End of trip facilities

With focus on potential increase of cyclists in city central areas, it is a must to consider if the individual's decision to cycle to their end of trips is affected by facilities at their destination or not. Several reports discuss the matter including Vorhaug (2021), Martens (2007), Pucher (1998; 2008), Heinen and Buehler (2019) and several other authors are finding results that clearly shows that cyclists consider safe and secure bicycle facilities as a necessity and contributes significantly for increased bicycle ridership to destinations such as work, studies and other daily needs. Vorhaug (2021) and Heinen (2019) reports that the strongest preferences are bicycle lockers and hotels, followed by bicycle racks. Although not all cyclists are having the same perception in what is valuable to parking facilities, as some prefer just simple racks instead of high-quality bicycle parking facilities (Attar, 2015). In addition, Attar

(2015) discovered that there are mostly men, younger people and others with expensive bicycles that prefers to have a high-quality bicycle parking facility, and Heinen (2019) also argues that travel time is an important factor for the use of these facilities.

According to Attar (2015), having high-quality parking facilities were even more important to electric bicycle owners, because of their vulnerability to coldness – as batteries discharge faster in cold weather.

### **3.1.4 Commitment in High-Quality bicycle parking facilities**

The level of commitment in each country is different regarding the quality and amount of bicycle parking facilities. The countries who already have an extensive bicycle parking of all sorts are Netherland, Denmark, and Germany. In these countries there have already been established a large number of bicycle rack all around the cities, but more importantly what they have in common is the provision of bicycle parking facilities near train stations (Pucher & Buehler, 2008). Meanwhile, Norway still stands rather far behind regarding this subject – The city Trondheim for instance in 2021, only have two high-quality bicycle parking facilities (Bicycle hotels) near public transit with the capacity of approximately 100 bicycles in total, according to Miljøpakken. While cities like Amsterdam, Groningen, Copenhagen, Odense etc. offers dozens of secure, indoor bicycle parking, with Utrecht Station in the Netherlands having the capacity for over 22 000 bicycles by itself (Zasiadko, 2019). Most of these bicycle parking facilities have access to maintenance services and direct transfer to train platforms (Pucher & Buehler, 2008).

While in Odense, car parking facilities were exchanged for 800 bicycle stands in 2006. While the rest of the city also increased the quantity to over 800 bicycle parking stands in the city centre and at train stations. Comparing to the Netherlands the numbers may not be considered high, but the quality for bicycle parking is higher in Denmark (Ligtermoet, 2006). Ligtermoet (2006) also argue that quality is easier attained when quantity is low.

In table 2 by Martens (Martens, 2007), we can see the early development and commitment from 1985 to 1999 in the Netherlands to both high-quality bicycle parking and normal bicycle parking facilities. More updated numbers on bicycle parking place in the Netherlands from 2017 – 2021 consists of a total approximate 490 000 of all types (Boztas, 2019), with an increase to 401 train stations in 2021 (Wikipedia, 2021).

Table 2. Number of bicycle parking places at Dutch Train Stations (Martens, 2007).

Type of bicycle parking facility	1985	1992	1999
Guarded	115 000	100 000	120 000
Bicycle lockers	3000	6000	16 000
Not guarded	65 000	90 000	143 000
<b>Total</b>	<b>183 000</b>	<b>198 500</b>	<b>279 000</b>
Number of train stations	348	358	370

Meanwhile the numbers of bicycle parking in Norway could not be found available online, however meeting up with Ole Vebjørn Bakken from Miljøpakken, it was known that Trondheim has a few pilot projects with bicycle lockers located around central areas of the city to test and understand the necessity of bicycle security. Comparing to other cycling countries, Norway is beginning to shift their bicycle policy to similar focus. With similar goals to improve security for bicycles to reduce bicycle theft by providing better roads and bicycle parking facilities near work, public transits, universities, and different services, hopefully to increase bicycle share in City central areas as well.

### 3.2 Differences in bicycle shares

Ligtermoet (2006) found out in the 90s that the bicycle shares in cities varied from each other, despite being in the same country. While some cities had success with high bicycle share, some would have a rather low percentage despite being in the same country. Ligtermoet (2006) divides the level of bicycle shares from High (<30%) to Low (>10%) which can be seen below.

#### High level of bicycle share, <30%

Famous cities of cycling such as Amsterdam, Eindhoven, Enschede and Copenhagen had in the 90s a high number of bicycle shares at 30% in their SHT report (Ligtermoet, 2006). Which is the Dutch study of bicycle history, use and policy in nine Western European cities. Madsen (2018) can confirm that Copenhagen have had over 30% bicycle share since for work and school/studies trips. Madsen's report shows and can confirm that Copenhagen have maintained a minimum of 35% bicycle share since 2009, peaking with a 49% in 2018 and set their goals for 50% to 2025 (Madsen, 2018). In addition, figure 12 below shows that not all cities have been able to maintain an increase in bicycle shares, as Enschede have dropped below 30% during the period from 2010 to 2016 in urban areas (Harms & Kansen, 2016).

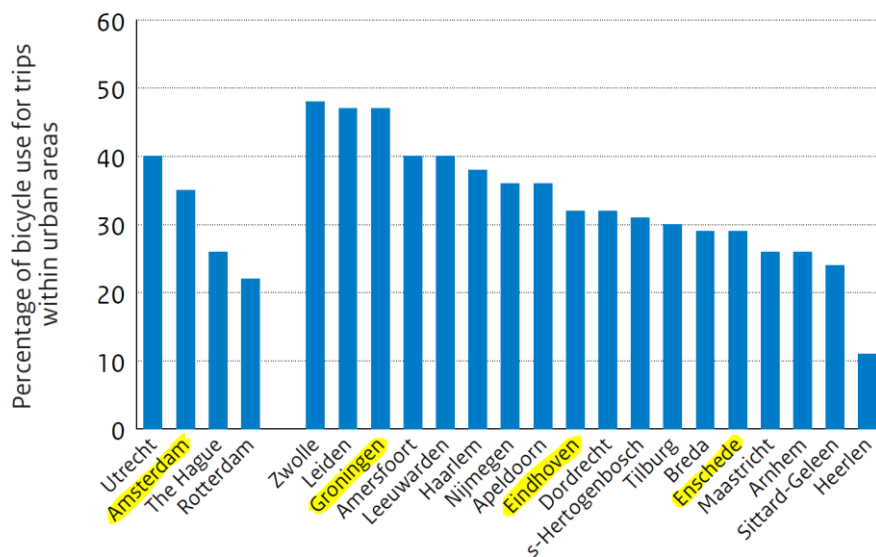


Figure 12. Proportion of bicycle use in trips within urban areas, 2010/2016 by Harms & Kansen, 2016

Bicycle commuting has since the 50s been accepted as a regular traffic participant and given equal rights on the road. According to Ligtermoet (2006) the crucial factor in this particular success lies in the mindset of the government and those responsible for infrastructural

development and policies. They realised that a motor car infrastructure is not at the expense of the cyclist, meaning they could go hand in hand together in road infrastructure conflict-less (Ligtermoet, 2006).

### Average level of bicycle share, 20%

Other cities fairly known for cycling had about 20% bicycle share, which was average in the 90s. The cities under this category are South-East Limburg and Hannover. In the two cities, motorised vehicles experienced a rise, and the policies were pro-car. With a spatial structure more towards the motor car rather than non-motorised transportation modes (Ligtermoet, 2006). Results from travel surveys in Trondheim, Norway shows that the bicycle share is at 2,6 – 12,1% dependent on whether it is during winter or summer. With the highest share during warm periods (Hoem, 2018). So, it varies from an average level of bicycle share, to very low.

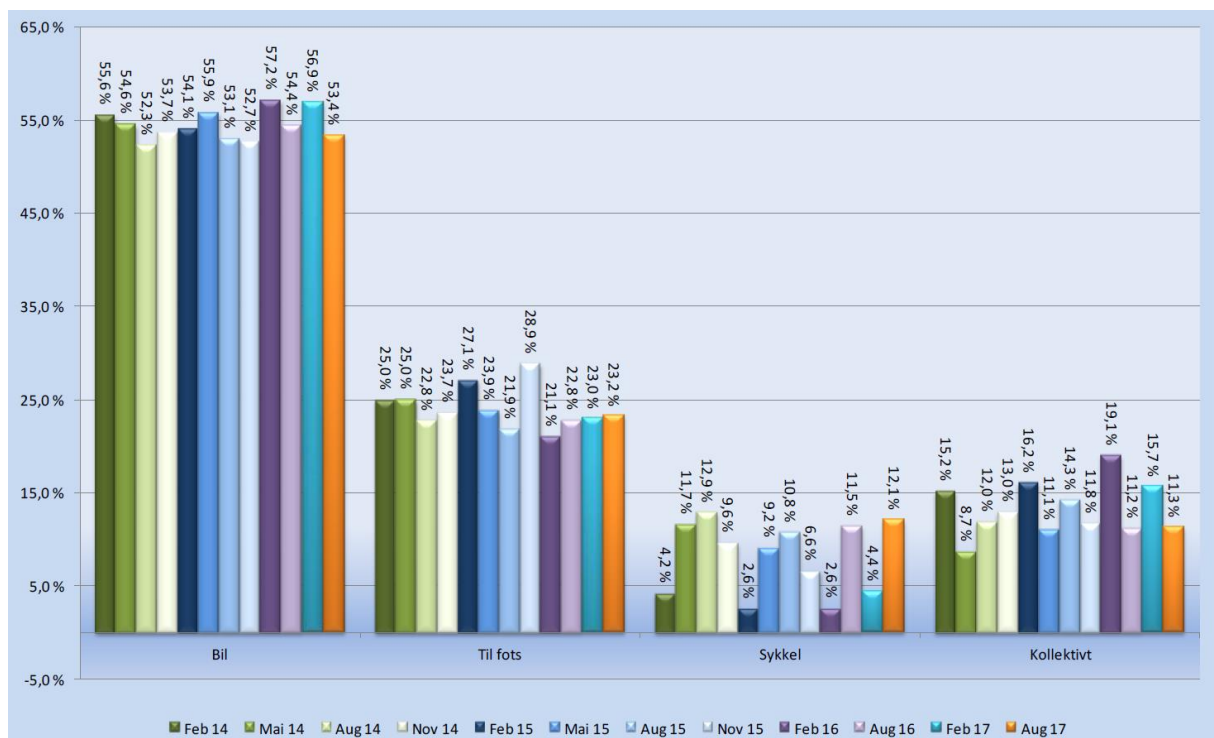


Figure 13. Travel mode choice distribution based on 10 mini surveys from 2014 - 2017. Credits: Hoem (2018)



### **Low level of bicycle share, >10%**

While some cities set their focus on a well-built cycling policy or a combination of both motorised/non-motorised policy and infrastructure – some will let the arrival and development of motor car go uninterrupted and exponentially growing by the day. The cities that go under this category are Antwerp, Manchester and Basel. The car-oriented traffic policy has influenced the development of a properly functioning public transport system in one of the three cities, Manchester (Ligtermoet, 2006).

#### **3.2.1 Gender difference in perceptions of safety by cycling**

Studies aimed at perceptions of cycling safety, writes that there is a difference between male and female cyclists regarding perceptions of safety and other trip needs - regardless of their experience level (Emond et al., 2009). According to Emond (2006), women are more discouraged to cycle due to what they think of safety on roads. For instance, women think that sharing roads with motorised vehicles are more negative than what men do. Although, what men and women have in common is that both sexes prefer to have separated bicycle paths and lanes (Emond et al., 2009).



## **4 Research Method**

### **4.1 Empirical data collection**

A combination of quantitative research method in the shape of an online survey was chosen for this topic to help understand how high-quality parking facilities could help increase bicycle ridership in central areas. The study area for this thesis is situated in Trondheim, the fourth largest city in Norway – located in Mid-Norway.

To design a logical survey, and to retrieve both useful and valuable data, several people were contacted to get feedback on the survey's build and wording. The people who were contacted has expertise in dissemination of similar surveys, and co-students in the same field who voluntarily provided some input on the survey. Eva Heinen from NTNU and Ole Vebjørn Bakken from Miljøpakken with background in spatial planning, mobility and bicycle facilities were also contacted and offered voluntarily supervision to the thesis. Additionally, once the drafting of the survey was completed – it was presented to selected students from different faculties other than Architecture and Design to participate as early-respondents to give constructive feedback on the survey's build.

### **4.2 State of the art (SOTA)**

As high-quality bicycle parking facilities are not widely known in Norway, "State-of-the-art" research had to be used to understand it from other perspectives around the world from researchers working on the topic. The literature review was conducted using results from NTNU Oria and Google Scholar search tools.

### **4.3 Details of the survey for data collection**

The main objective of this online questionnaire was to collect data for us to understand the respondent's opinion in this topic, and further understand if the implementation of high-quality bicycle facilities would play a role in making people cycle more, or cycle at all. The self-completion survey was conducted through "Nettskjema", which is a digital platform for survey design – provided by the University of Oslo.

The final edition of the digital survey consisted of 35 questions, divided into three sections – which will be described further in this paper. The survey used "routing" and was logically built by allowing certain parts of the questions only to be visible based on your previous answer. For instance, if you selected that you owned a bike OR did not own one, you would get follow-up questions appropriate to the selected answer. This method allowed the respondent to not get irrelevant questions and provided the researcher deeper insight to the respondent's perspectives.

In the survey, most questions are multiple-choices – but some questions the participant could opt for the written answers. The written answers and comments will be listed at the end of this paper in Appendix D, along with a list of the online groups and places distributed and the final questionnaire can be found in Appendix D.

#### **Part 1: Introduction; About the respondent.**

As an introduction, the survey asks for their age, current career status, gender, bicycle ownership and lastly their residency – which was an optional question as people may feel uncomfortable revealing their private location. The questions about their current situation such as working or being a student, gives an implication of their current economic situation. By knowing their current situation, it gives an overall better understand of the respondent.

This survey was conducted 15 months after the coronavirus was discovered for the first time in Norway. As restrictions and guidelines are still on high alert, the pandemic still have a long way to go until it can be considered defeated. The respondents were asked to state if the pandemic has been a reason for using the bicycle more, at all or not at all.



Figure 14. Bicycle lockers by SafeBikely at Teknobyen, Trondheim in collaboration with KLP Eiendom.

## Part 2: Facilities for bicycles; Parking facilities in central areas

Further on, they were asked about their opinions on today's solutions for bicycle parking in central areas, especially near to their study place, employment, grocery stores, shopping malls and other services such as health care centres. They were also asked about what their bicycles were used for, which the alternatives consisted of the following: *Work, Studies, Shopping etc...*

The second part of the survey was also looking to understand the respondent more in depth by asking if they have ever heard about "high-quality bicycle parking facilities" before. The survey would in addition provide a short introduction about high-quality bicycle parking facilities and a question that would map down the respondent's knowledge about existing high-quality bicycle parking facilities in Trondheim.

Lastly, the respondents were asked if implementations of high-quality bicycle parking facilities would either make them (1) *bike more – if the respondent already own a bike OR (2) bike at all – if the respondent do not own a bike*. The second (2) alternative would ask the respondent without a bicycle to specify what kind of bicycle they would buy, if they were to buy one; the alternatives consisted of *traditional bicycle, an electric bicycle or none*.



*Figure 15. Bicycle Hotel at Tonstad Public Bus Station.*

### **Part 3: The bicycle's safety use and preferences.**

The third and last part of the survey ask the respondents about what they think about various kinds of bicycle parking facilities, such as; How important it is for them to have access to bicycle parking facility with roof. Then they are also asked to specify what kind of bicycle parking facilities are available close to their home, workplace, school/studies etc.

Later they are asked how many hours a day the bicycle is being used per day, if the bicycle would have been used more if there were easier and better access to high-quality bicycle parking facilities near daily grocery stores, if the bicycle would have been used more if there was an option to park in high-quality bicycle parking facilities etc.

Then they are asked they have personally experienced theft or vandalism, if they have not – it was asked if they did know of someone who had. Then they were asked to specify if it was the whole bike, parts of it, the accessories or if it was pure vandalism.

Lastly, they were asked to describe their subjective opinion on what the ideal bicycle parking facility was.

#### **4.4 Distribution**

The online survey was distributed in May 2021 and remained open over the course of four weeks. The secretaries of various companies were contacted by through e-mail to ask if they were interested to participate on a quick survey. Most of the secretaries would relay the information to their offices, but warned that most employees had home-office, so it there was no guarantee that they would do the survey. At school/studies, posters were hung up on walls in several buildings at most NTNU campuses across Trondheim. However, it would be taken down every Monday. For online gathering for mass collection, several facebook groups for cyclists and other public groups not related to cycling were contacted for distribution of the survey and poster. Lastly, the survey poster was also hung out in public spaces, as well contacting their administration by e-mail for internal distribution. To reduce the amount of biased opinions as much as possible, the survey poster was also sent out to other companies that had not invested in high-quality parking facilities for bicycles yet. Additionally, a limited number of the flyer was put in mailboxes at three selected student housings in Trondheim. The flyer can be found in Appendix C. Approximately 60 flyers were distributed and hung up on higher school/studies, and about 200 for the mailboxes. The rest were distributed digitally online. The chosen student housings were Berg Studentby, Moholt Studentby and Lerkendal Studentby. All locations including student housings, school/studies (NTNU Campuses) and shopping malls were within 5 km of the Central Business District (CBD/City center).

To get as many respondents as possible, the respondents was notified that they had a chance to win a gift card. The how-to-win was to leave behind their e-mail address at the final page before finishing up the survey. Five respondents would then be selected through a “random number generator”, as each of the respondents would be given their own numbers dependent when they took the survey. For instance, the first participant would have the number 1. A total of 1000 NOK, split into five 200 NOK cards were distributed at the end of May 2021.

## 4.5 Analysis tools

When the data collection was completed, several tools were utilised for analysis. The first tool was the online survey platform, Nettskjema – for designing the survey and to export data in a format that could be read by Excel and SPSS. ArcGIS Pro was used for geographical visualisation and Adobe Illustrator was used as a complementary tool to improve the quality of the result from ArcGIS Pro.

SPSS was used as descriptive statistics to analyse relationship between different variables. To get a better overview of the results, two functions especially were in use. Those were Descriptive Statistics: *Frequencies* and *Crosstabs*.

Frequencies simply gave an overview of the results, showing the absolute number and percentage of the result. Crosstabs show the same in numbers (in absolute and percentage) but using two variables together to compare and calculate for deeper analysis to understand correlation.







## 5 Results

This section will be divided into three sub-chapters. First chapter is about the selection of the survey, with simple descriptive statistics of distribution of gender, bicycle ownership, bicycle theft experience and more. The second sub-chapter going more in depth on their opinions about various questions from the online survey regarding bicycle parking. Last sub-chapter will present what the respondents believe is the ideal parking.

### List of questions in the survey

Table 3. List of questions in the survey

LIST OF QUESTIONS IN THE SURVEY	
Q1	Have you considered buying a bicycle?
Q2	Has the pandemic (Covid-19) contributed to increased use of the bicycle?
Q3	Do you know the location of one or more bicycle lockers and/or hotels in Trondheim?
Q4	What do you think of today's level of safety/security for parked bicycled in city central areas?
Q5	Have you heard about high-quality bicycle facilities before?
Q6	What is the highest amount you would pay for such an offer?
Q7	Would the implementation of bicycle lockers- and hotel make it more attractive for you to cycle?
Q8	Would the implementation of bicycle lockers- and hotel make it more likely for you to buy a bicycle?
Q9	Do you think that bicycle lockers and hotels can contribute to make it feel more safe and secure to park the bicycle?
Q10	How important is it for you to have a bicycle parking with roof/cover?
Q11	How many hours a day is the bicycle used in terms of travels?
Q12	Would you have used the bicycle more often, if there were better bicycle parking close to grocery stores and similar?
Q13	Would winter cycling have been more attractive if you had the possibility to park inside of a bicycle locker or bicycle hotel?
Q14	What do you think about the facilitation for cyclists in Trondheim?

## 5.1 Describing respondents and understanding relations of variables

The chapter will describe the respondents from the online questionnaire in more detail, such as their gender, the different age groups, bicycle ownership, time spent on bicycles a day, if bicycle theft has been experienced and their knowledge of existing high-quality bicycle parking facilities in Trondheim.

### 5.1.1 Gender distribution

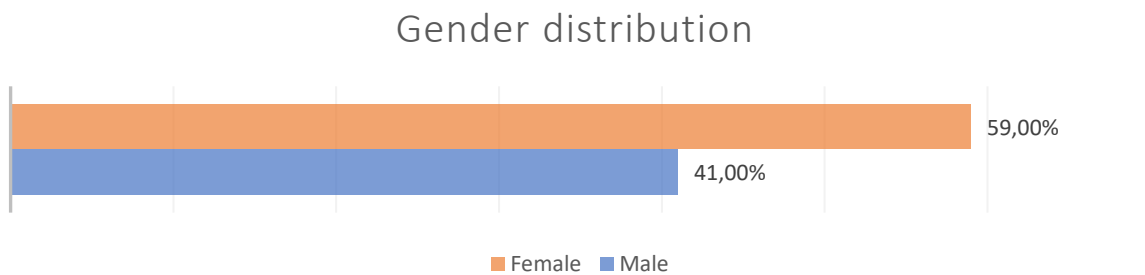


Figure 16. Frequency of gender distribution.

A total of 213 people responded to the online survey, 41% male and 59% females. 77% (N=164) responded that they own at least one bicycle, and 23% (N=49) responded that they did not own a bicycle, which can be seen in table 4. Most respondents had ownership of a traditional bicycle (N=111) over an electric bicycle (N=19) although group of respondents own both traditional and electric bicycles (N=29), while a small group has ownership of a kick scooter (N=2), as seen in figure 17.

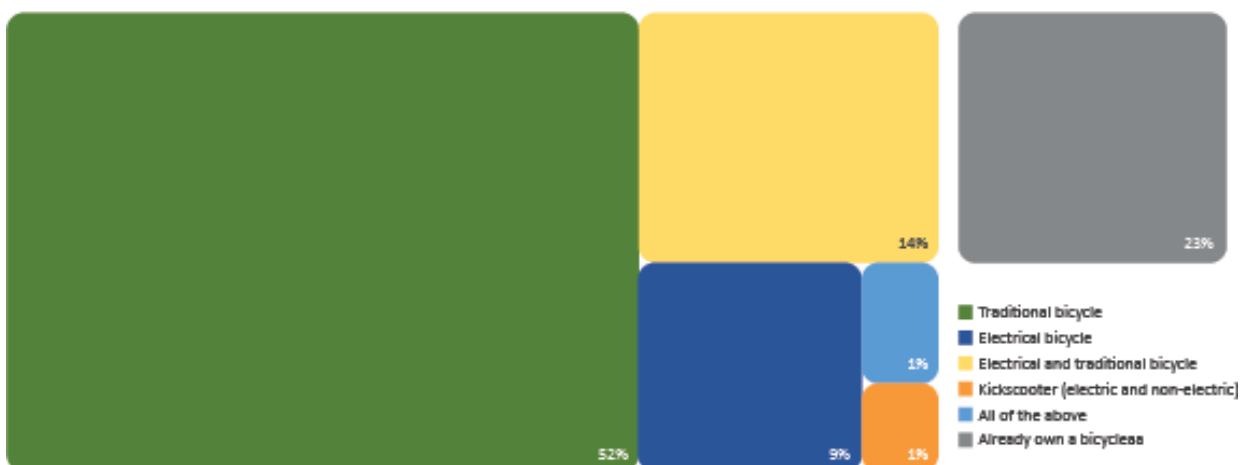


Figure 17. Distribution of bicycle types on respondents.

### 5.1.2 Share of bicycle users.

Table 4. Share of bicycle users and respondents considering ownership.

	<i>Have you considered buying a bicycle?</i>		
	N	Yes	No
<b>Do you own a bicycle?</b>			
<b>Yes</b>	77% (N=164)	-	-
<b>No</b>	23% (N=49)	15% (N=32)	8% (N=17)

As seen in table 4, the share of bicycle owners is quite high (77%) comparing to the total. There could be many factors that could explain the high share of bicycle users. For instance, the usage of forums for the online distribution for the survey, that were already focused on cyclists that did their daily trips or commuting in/to Trondheim on daily basis. Thus, making it unavoidable to have respondents who are likely to already own a bicycle. Since most  $\frac{3}{4}$  of the respondents already owns a bicycle, and only about  $\frac{1}{4}$  does not, there is a probability of biased opinions. Despite most of the respondents already having bicycle ownership, their opinions are also valuable because they have experience in the current bicycle infrastructure in Trondheim. They are the most invested respondents in positive development for bicycle policy and bicycle safety, and it is presumed they will participate with honest opinions and good ideas. The remaining  $\frac{1}{4}$  who does not have bicycle ownership, will be able to provide answers about what measures could increase bicycle ridership among non-cyclists.

### 5.1.3 Time spent on a bicycle per day

Cyclists were asked to choose the time spent per day for bicycle use. Results show that most people (73%) use the bicycle for maximum 1 hour a day for travelling. While the remaining 27% respondents would cycle more than 1 hour a day.

Table 5. Crosstabulation of current career situation and hours spent on day-to-day cycling.

	<i>Hours spent on day-to-day cycling</i>		
	> 1 hour	< 1 hour	Total
<i>Full-time</i>	24 %	12 %	<b>36 %</b>
<i>Part-time</i>	15 %	6 %	<b>21 %</b>
<i>Student</i>	34 %	9 %	<b>43 %</b>
<b>Total</b>	<b>73 %</b>	<b>27 %</b>	<b>100 %</b>

**5.1.4 High-quality bicycle parking facilities' effect on respondents**

From the survey, information collected from non-cyclists (23%) are very important to understand bicycle ownership and how to increase bicycle share. If we look at table 6, almost all respondents, including non-cyclists and cyclist mean that high-quality parking facilities will provide better safety<sup>1</sup> and increase security<sup>2</sup> for bicycles.

*Table 6. Effect of high-quality parking facilities on bicycle security and safety.*

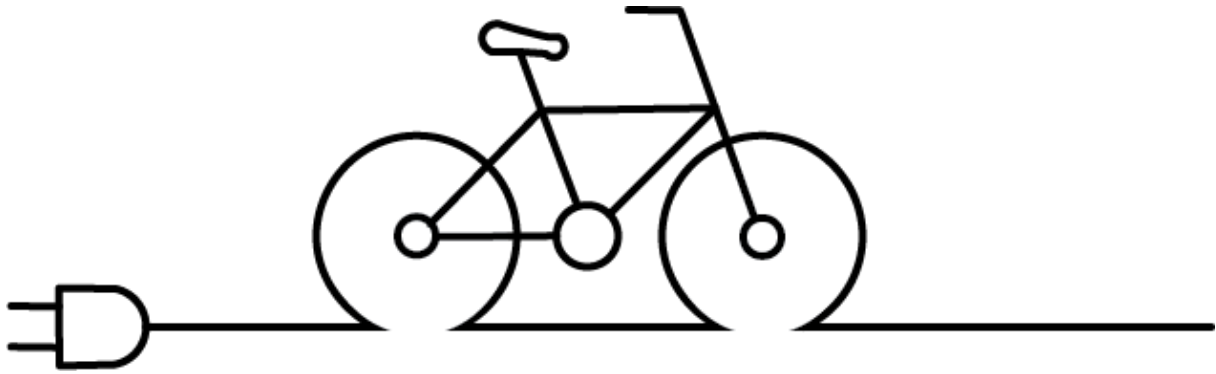
<b>Will high-quality parking facilities increase bicycle safety and security?</b>			
	<b>Yes</b>	<b>No</b>	<b>Total</b>
<b>Non-cyclist</b>	23%	2%	25%
<b>Cyclist</b>	75%	0%	75%
<b>Total</b>	98%	2%	100%

As high-quality bicycle facilities prove to be decisive for the respondent’s sense of safety and secureness for bicycles, we can look back to table 4 from chapter 5.1.2 – which shows how many non-cyclists have considered to buy a bicycle. The table shows that 15% out of 23% (non-cyclists) are considering buying a bicycle. Thus, researching more in depth about non-cyclists demands and requirements may provide ways to understand how to increase bicycle share and make cycling more attractive for non-cyclists. Before that, we will look at the results for age distribution and the respondents bicycle ownership.

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<sup>1</sup> Safety: The perception of bicycle safety. Example, if you feel the bicycle could easily get stolen or vandalised, it then feels unsafe – and opposite.

<sup>2</sup> Security: The physical security of the bicycle. Such as surveillance system, a guarded facility, walls, roof, controlled access etc



### 5.1.5 Age distribution and type of bicycle ownership

To understand the relation of bicycle types of ownership (or no bicycle at all) a crosstabulation with age distribution was performed in SPSS. From results in table 7, there are indications that age is related to bicycle type owned. Most younger cyclists seem to own cheaper bicycles while older and more experienced cyclists have a higher share of more expensive bicycle types, such as electrical bicycles or both types (+ traditional).

Table 7. Crosstabulation of age distribution and bicycle ownership type.

		<b>Bicycle type, ownership</b>						
		Traditional bicycle	Electrical bicycle	Electrical and traditional	Kick scooter (electric/traditional)	All of the above	None	<b>Total</b>
<b>Age group</b>	Below 30	75	5	8	1	0	46	<b>135</b>
	Above 30	36	14	21	1	3	3	<b>78</b>

### 5.1.6 Bicycle theft and common experiences

There is a reason to believe that people that took the survey may have a personal interest in the topic, as bicycle theft and vandalism seem to occasionally happen in Trondheim, as seen in figure 18. The green colours on the figures represents a positive experience as the respondents have not experienced bicycle theft.

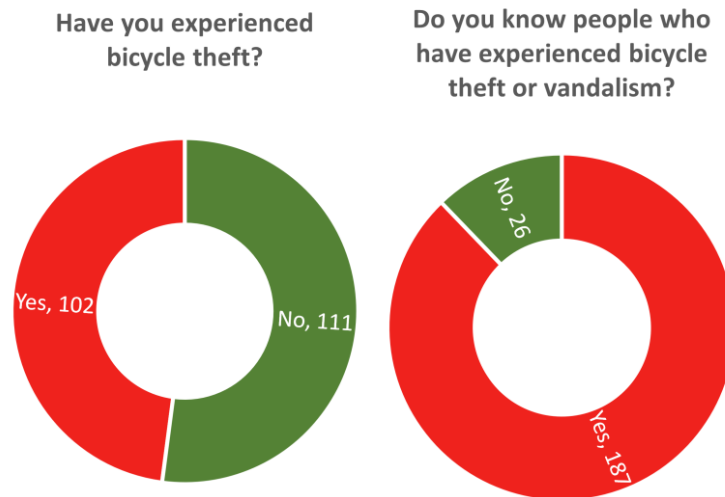


Figure 18. Distribution of personal and known cases of bicycle theft experience.

About half (N=102) of the respondents already owning a bicycle, have self-experienced bicycle theft in Trondheim, and another significant 88% (N=187) know people or have seen others have their bicycles stolen or vandalized.

Comparing the two charts on figure 18, almost half of the respondents have experienced (left) bicycle theft in Trondheim themselves. It also clearly shows that even if there has been no personal experience of theft, the respondents would know another individual who have experienced it (right). From a respondent with bicycle ownership, bicycle theft is expressed as a realistic problem in Trondheim that seem to be a factor that cuts down bicycle share:



*“I would have felt surer that the bicycle was still there when I was finished shopping at the store. For instance, the reason why I did not bike to friend was because the solutions were not good enough for safe bicycle parking. To lock the bicycle outside on a rack in a neighbourhood do not feel safe anymore.”*

*Female student with part-time job, 27*

Bicycle theft is becoming a clearer issue among respondents, as a non-cyclist respondent adds her experiences in his neighbourhood.

*“I have not bothered buying one. In addition, in my neighbourhood - bicycle theft is a common problem.”*

*Female student with part-time job, 21*

### 5.1.7 Chance of converting a non-cyclist to cyclist.

In table 8, it can be seen that when non-cyclists were asked if implementation would make it more likely for them to buy a bicycle, surprisingly 13% out of 23% selected that they would consider buying an electric (8%) or traditional bicycle (5%), meanwhile 10% would not be affected by these solutions.

*Table 8. Crosstabulation of bicycle ownership and if implementation of bicycle hotels and lockers would increase likeliness for bicycle purchase.*

		<i>Will implementation of bicycle hotel and lockers make it more likely for you to buy a bicycle?</i>		
		Yes, electric bicycle	Yes, traditional bicycle	No
Do you own a bicycle?	Yes	0 %	0 %	0 %
	No	8 %	5 %	10 %
			<b>Total</b>	23 %
	Already owns bicycle			77 %
	<b>Total</b>			100 %

Despite seeing 13% out of 24% having an increase in likeliness for bicycle purchase. The facilities do not seem to be the decisive factor for making cycling more attractive. As only 2% out of 23% non-cyclists believe it would increase their likeliness to feel more attracted to cycling, in table 9.

Table 9. Crosstabulation of bicycle ownership and high-quality bicycle facilities would make it more attractive to cycle.

		<i>Will implementation of high-quality bicycle parking facilities make it more attractive for you to cycle?</i>		
		<b>Yes</b>	<b>No</b>	<b>Total</b>
<i>Do you own a bicycle?</i>	<b>Yes</b>	1 %	0 %	1 %
	<b>No</b>	2 %	6 %	8 %
<b>Total</b>		3 %	6 %	9 %

*“I think bicycle roads are more important than the parking for it. It feels safe most places in Trondheim.”*

*Male student, 24*

One of the 24% non-cyclist commented that he thinks bicycle roads are more important than bicycle parking facilities, as he feel they are safe enough as it is.

### 5.1.8 Crosstabulation of cyclists/non-cyclists and their knowledge about high-quality bicycle parking

As high-quality bicycle parking is becoming more widely known across the world – curiosity about the respondents’ knowledge of these facilities as well. The survey asked specifically if the respondents knew of knowledge of high-quality facilities for bicycle parking in Trondheim, and 22% (N=47) answered NO, as seen in table 10. Which is quite high, considering that most of the survey was distributed in online groups and specific locations such as offices and campuses that have these facilities available, and that already have access or could get access.

Table 10. Crosstabulation of Cyclists/Non-cyclist and their knowledge about high-quality bicycle facilities in Trondheim.

		Do you know about high-quality bicycle parking facilities in Trondheim?		
		Yes	No	Total
Do you own a bicycle?	Yes	63% (N=135)	14% (N=29)	77% (N=164)
	No	15% (N=31)	8% (N=18)	23% (N=49)
Total		78% (N=166)	22% (N=47)	100% (N=213)

### 5.1.9 Relationship between bicycle parking near shopping with bicycle share and other variables.

Respondents were asked if they would have used the bicycle more often, if there were better bicycle parking close to grocery stores and similar. Security from theft seem to have divided in opinions then regarding grocery shopping and similar activities. One of the many reasons behind why most respondents replied NO (59%) in figure 20 about the importance of high-quality bicycle parking outside of grocery shopping etc., has been explained by a few of the respondents as quoted below.

*“There are already bicycle parking there, and we spend so little time in the store that a roof and high security is not necessary.”*

*Male student, 23.*

Male student (23) thinks that the time spent there is too short for the bicycle to be stolen, and which is a comment that has repeated a few times among other respondents. As we can see in this comment below:

*“Grocery shopping is not taking that much time, vandalism on the bike is unlikely.”*

*Male student with part-time job, 27.*

Male student (27) agrees that it does not take much time, and it is unlikely for the bicycle to get stolen or vandalised within the time they are inside of the store.

*“I am already using a bicycle without having to worry about bicycle theft. If I had a very expensive bicycle, I would likely have thought differently.”*



*Female full-time employee, 29.*

However, interestingly female employee (29) does not worry about bicycle theft at all. Likely because she is using a cheap bicycle, as she tells she would have thought differently dependent on the bicycles' value.

*“For me, the most important is to cycle to studies and work, not for shopping.”*



*Female student, 21*

... and lastly, a female student (21) thinks the priority for bicycle facilities should be put at schools or offices, as she believes that is more important.



Figure 19. Bicycles parked in Amsterdam, credits: Wallpaperflare.com

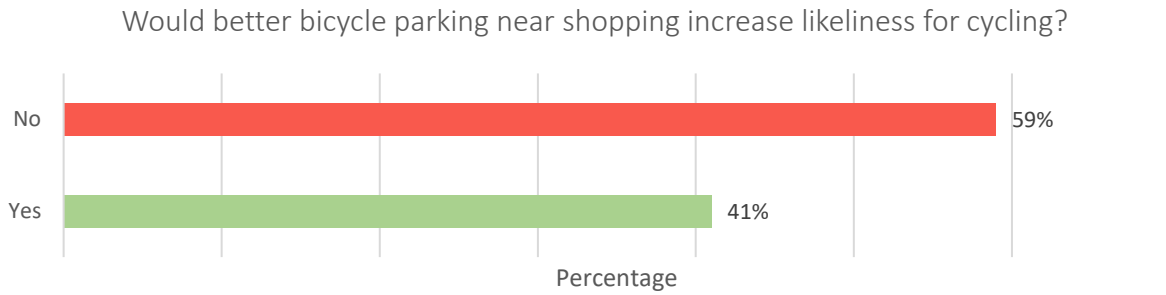


Figure 20. Distribution of respondent's opinion on whether implementations would increase cycling to shopping or not.

An explanation for why over half of the total does not believe that improved and increased amount of high-quality bicycle parking facilities near shopping services could be many. As seen from the comment section, most respondents do live in the city centre – or just on the outskirts, next to a grocery store. It seems like most of the respondents do not have an electric bicycle, and their purposes and time spent for shopping or especially daily grocery shopping, are very limited. The argument is that they do not think the bicycle will be stolen within this amount of time. Which can be exemplified by a few comments made in the free text section below:

*“By the daily grocery store, the bicycle is not standing for long. So, there is no need for it.”*

*“The daily grocery stores I am using are close, so it is just as easy to walk.”*

*“I am living outside of the city's core, and nearby stores feel like a safe place to park (the bicycle).”*



As seen above, distance to the services is also a factor for not being affected by an improvement or increase in high-quality bicycle parking facilities. As well if one has ownership of an electric bicycle or an expensive tradition bicycle.

## 5.2 Trip purposes and attitudes

When asked what purpose the bicycle is for the respondents who use the bicycle, it has been identified 6 distinct categories based on the respondents' bicycle parking locations: *at work* (N=91), *school/studies* (N=52), *shopping* (N=93), *recreational purposes* (N=116), *Health care* (N=70) and *other purposes* (N=51).

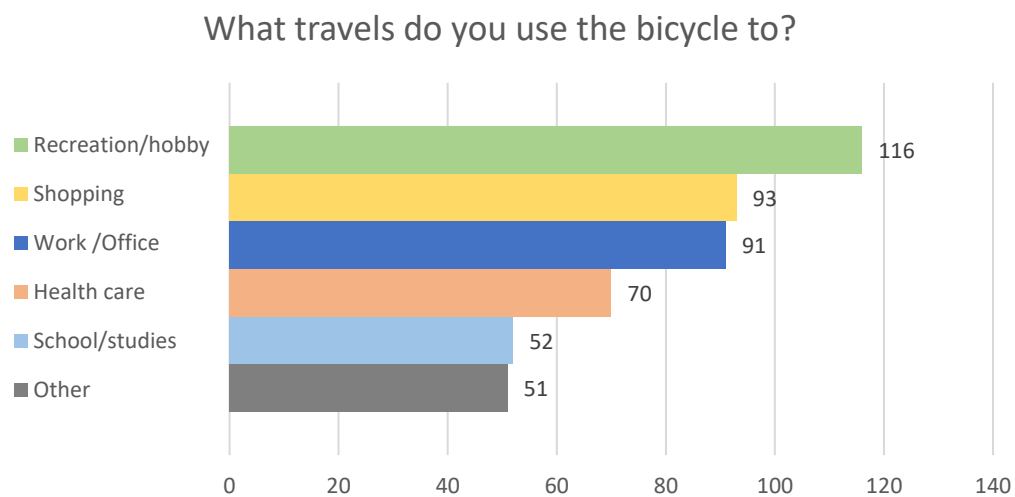


Figure 21. Means of trip purpose with bicycle.

The variation of means for trip purposes can be seen in figure 21. The amount of people using their bicycles to *recreational and hobby purposes* are the largest group in this survey and stands out with the longest pillar, with a frequency of 116. While shopping and work/office is also put high up on the ladder, with 91 (work/office) and 93 (shopping) respondents selecting the trip purpose.

The total amount of people using their bicycle for work and studies (N=143) is greater than all other trip purposes when put together. The category shopping is less consistent, as seen from the respondents replies in Appendix D, as the choice of transport is revealed to be dependent on the accessibility on bicycle parking, the quantity of things to shop and the distance are decisive factors.

## Distribution of transportation purposes

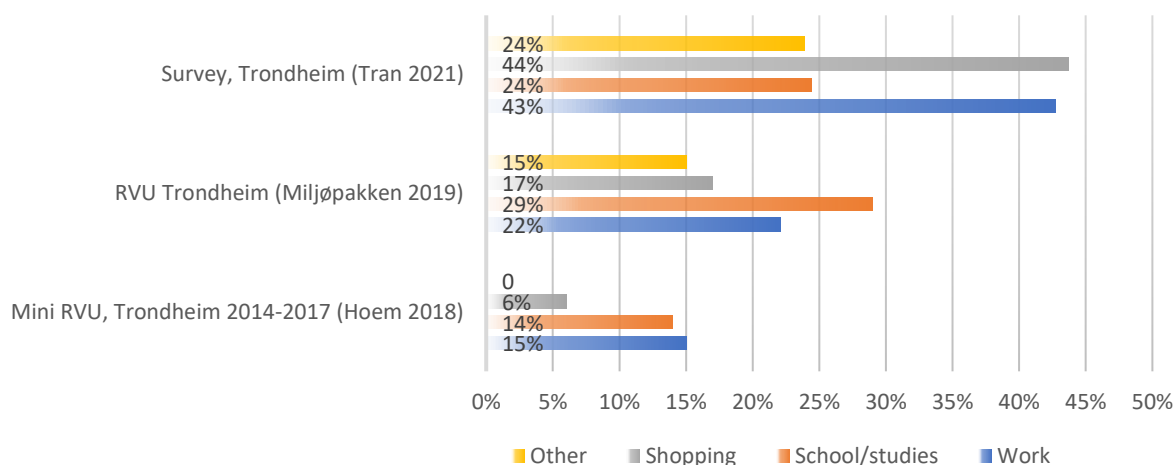


Figure 22. Result for distribution of transportation purposes in other surveys compared to the thesis's survey.

When regarding the collected data, it may be insightful to compare them to other existing surveys on travel behaviour. In the chart above (see figure 22, it can be observed that the share of cyclists with purpose to get to work or school/studies are the dominating variables in all three surveys. While the majority of the thesis's survey are using the bicycle for shopping, it differs from Hoem's (2018) significantly where only 6% in his survey would use the bicycle as transportation mode for shopping. Meanwhile, Miljøpakken's (2019) survey resulted with 17% bicycle users for shopping in 2019.

These numbers however cannot be compared entirely, as the survey for the thesis were more specifically asked about bicycle parking and the surrounded questions whether it would make the respondent cycle more or not. Meanwhile the RVU's are wording questions differently and has significantly more respondents than the thesis. RVU from 2019 has about 6100 respondents and Mini-RVU from 2018 is a collection of 12 surveys about RVU from 2014 to 2017, resulting in 12 000 respondents.

### 5.2.1 Perception on bicycle facilities and sense of safety

In table 11 about the respondent's perception on bicycle facilities in Trondheim and the other about their subjective sense of safety for bicycles. The results came out interestingly as the respondents clarify that the bicycle facilities (bicycle lanes/paths/parking) in Trondheim are considered good by the majority. Very few think it is bad, and none think it is very bad. The remaining are neutral or think it is very good. If we look at table 11 for the perception analysis of bicycle safety and facilities in Trondheim, 56% of the respondents think that the bicycle facilitation is good and only 5% think it is bad. If we compare it to their perception of *Bicycle safety*, then we can see the results are on the other end. Most respondents think it feels unsafe (43%) or very unsafe (17%) for their bicycles in Trondheim.

Table 11. Showing the respondents perception of bicycle safety and current bicycle facilitation in Trondheim.

<b>Perception analysis of...</b>					
<i>Bicycle Facility (Very Good to Very bad)</i> <sup>3</sup>	10%	<b>56%</b>	28%	5%	0,0%
<i>Bicycle Safety (Very Safe to Very unsafe)</i> <sup>4</sup>	2%	12%	26%	<b>43%</b>	17%

From these results, it is understood that people are afraid of their bicycles safety despite having good access to bicycle facilitation such as road and parking. See these comments below for examples.

*"I do not dare to let the bike stand out on the streets, even with a relatively expensive bicycle lock."*

*"I would have used the bicycle more often to the daily grocery shopping if there was a safe place to park nearby."*

*"Avoiding cycling to the city centre and shopping malls because of fear for bicycle theft."*



<sup>3</sup> What do you think of today's level of safety/security for parked bicycled in city central areas?

<sup>4</sup> What do you think about the facilitation for cyclists in Trondheim?



The survey asked if the respondents would get an increased sense of safety<sup>5</sup> and security<sup>6</sup> for the bicycles if they could use high-quality bicycle parking facilities. Nearly all respondents (98%) agree that high-quality bicycle facility surely will increase the sense of safety and security on bicycles while parked. As seen in figure 23, only 2% of the total claim that this implementation would not increase their sense of safety for the bicycles. The 2% that have replied **NO** on figure 23 has in addition provided some detailed explanation to why they chose this answer.

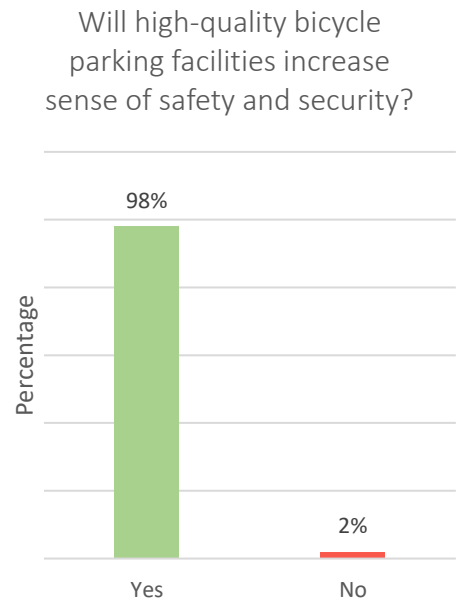


Figure 23. Sense of safety and security for bicycles.

One of the respondents think the probability of having the bicycle stolen is close to zero, because he owns a cheap bicycle. Even if it were to be stolen, it would not matter much as the cost of it is low enough to not worry. The more important factor would instead be to shelter the bicycle against weather conditions, as that has been the decisive factor for whether he would cycle or not. While another is just simply satisfied with the current solutions, which are simple bicycle racks – but says that a few sheltered ones would not be a bad idea. One also speculated that if high-quality would become the standard, then the respondent would likely in return feel very unsafe when that level of security is not available.

However, most respondents (98%) believes that an implementation of high-quality bicycle facility would increase their sense of safety and security. What is common for most of them, is that it correlated with their reply on the question about bicycle theft (see figure 18 or 24). Nearly all the respondents have either experienced personal bicycle theft and/or experienced others who have experienced either vandalism and/or bicycle theft.

Something in common from both respondents selecting YES or NO, is that they prefer sheltered bicycle parking facilities, if possible. See Appendix D for more comments.

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<sup>5</sup>Safety: The perception of bicycle safety. Example, if you feel the bicycle could easily get stolen or vandalised, it then feels unsafe – and opposite.

<sup>6</sup>Security: The physical security of the bicycle. Such as surveillance system, a guarded facility, walls, roof, controlled access etc.



Figure 24. Bicycle theft experience.

Looking at the respondents' desires, it seems to be bicycle parking facilities that have both controlled access and sheltering towards weathering conditions and perhaps even visual insight, in a way that others cannot see or access the bicycles. Many respondents also desired to have some sort of surveillance, for instance with a camera for insurance purposes if anything should happen. The pattern of the results and abovementioned comments, seem to correlate with the respondents' perceptions of bicycle safety in city central areas in Trondheim.

### Crosstabulations on high-quality bicycle parking facilities and experienced bicycle theft

Respondents were asked if they had experienced bicycle theft, which 48% did and another 52% had not yet experienced bicycle theft (see table 12). In any case, they were asked if they thought bicycle hotels and lockers would increase bicycle safety and security in central city areas. The answer was pretty clear regardless of self-experience or not as a whole 98% of all respondents think that it do matter, and will increase bicycle safety and security.

Table 12. Crosstabulation of self-experienced bicycle theft x bicycle safety and security.

		Do you think bicycle hotels/lockers can increase sense of bicycle safety and security?		
		Yes	No	Total
Self-experienced bicycle theft?	Yes	47 %	1 %	48 %
	No	51 %	1 %	52 %
	Total	98 %	2 %	100 %

Further on, next in line were respondents who have not yet experienced bicycle theft yet – but know of people who have experienced it. First of all, 86% of the respondents knew of someone who had experienced bicycle theft, and a 12% had never experienced or know about anyone who have gotten their bicycles stolen.

Then, respondents who have not experienced bicycle theft yet were asked the same question as respondents who have experienced it. *“Do you think bicycle hotels/lockers can increase the level of bicycle safety and security?”*.

Like table 12, most respondents think it would. 98% of the respondents selected that it would increase the level of bicycle safety and security, with 86% who knew of someone with bicycle theft experience, and 12% had never experienced it, but still believed it would matter for increased perception of bicycle safety and security.

Table 13. Crosstabulation of known cases of experienced bicycle theft x bicycle safety and security.

*Do you think bicycle hotels/lockers can increase sense of bicycle safety and security?*

	Yes	No	Total
Know others who have experienced bicycle theft?	86 %	2 %	88 %
	12 %	0 %	12 %
Total	98 %	2 %	100 %

**5.2.2 Sheltering/roof on bicycle parking facility**

Respondents were asked to what degree does it matter with sheltered or roofed bicycle parking facility options. The results are clarifying that most respondents wish to have a bicycle parking facility with a roof or being sheltered. If we look at figure 25 below, 19% think it is very important, and another 36% think it is important. Meanwhile, 10% think it does not matter or not at all.

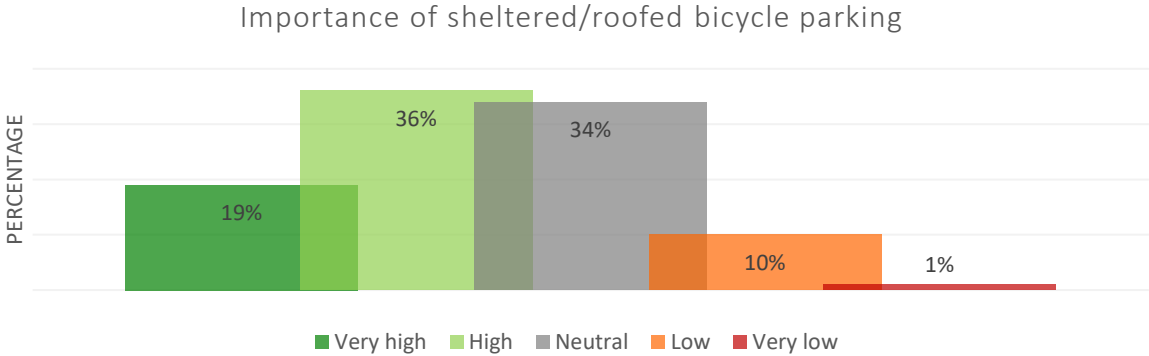


Figure 25. Respondents’ opinion for the importance of bicycle parking facility shelters or roofed option.

The respondents generally spoke positively about bicycle parking that had roofs or were sheltered. As well discussing the importance of time spent for parking their bicycle. For example, this respondent spoke about his preference for bicycle parking.

*“Bicycle parking with roof. I am not very afraid of bicycle theft for my bicycle, so I do not really need a bicycle locker or hotel. In addition, it would probably take a bit longer time to park the bicycle with these kinds of solutions. Roof is nice though, so I can avoid sitting on a wet bicycle seat.”*

This respondent is expressing the wish for more roofed options and explains his needs does not reach higher quality. However, another respondent expresses otherwise and think that the most secure bicycle parking would be high-quality bicycle parking facilities.

*“The most secure is a bicycle locker, but they are so ugly those containers. So, visually, a bicycle hotel would have fit the environment better.”*

If we look at table 14, we can see that nearly no one think it is very unimportant, although 21 respondents out of 213 selected the second last alternative “Unimportant”, which could indicate that it is a subjective perspective that makes it unimportant for them. Factors that could play a role would be the type of bicycle. As seen from the table below, 12 out of 21 respondents selecting “unimportant” owns a traditional bicycle, which could very well be a cheap bicycle that the respondent prefer to park in public spaces with bicycle racks.

Table 14. Distribution of importance for bicycle parking roof related to type of bicycle owned, or non-cyclist.

		<i>Importance of roof for bicycle parking</i>					
		Very important	Important	Neutral	Unimportant	Very unimportant	Total
Type of bicycle	Traditional	15	42	41	12	1	111
	Electric	7	7	2	3	0	19
	Both	9	12	7	1	0	29
	Kick scooter	0	1	1	0	0	2
	All of	0	2	1	0	0	3
	None	10	12	21	5	1	49
	Total	41	76	73	21	2	213

Most of the respondents are however thinking that roofs for bicycle parking ranges from important to very important. With 76 respondents selecting important and 41 respondents selecting very important. Most respondents in those two groups are not surprisingly owning traditional bicycles, as that is the most affordable bicycle for many of us, but what is interesting is that these two groups also have the highest share of electric bicycle shares, as well a group owning both bicycle types and even a few that has all the above-mentioned types.

Another interesting result to see in this table is that non-cyclists have expressed their thoughts about the importance of bicycle parking roofs too. According to table 14, 22 non-cyclists thinks that it is important/very important, and 21 naturally would be neutral – which makes sense, since they do not have a bicycle.

### 5.2.3 Bicycle ridership increase potential.

Looking at the chart (figure 26) for potential bicycle ridership, some respondents (N=26) seem to be willing to make a shift towards greener transportation and buy either a traditional bicycle (5%) or an electrical bicycle (8%). Meanwhile, another group (11%) would not change consider buying a bicycle, as implementation of high-quality bicycle parking facilities would not make a difference for them.

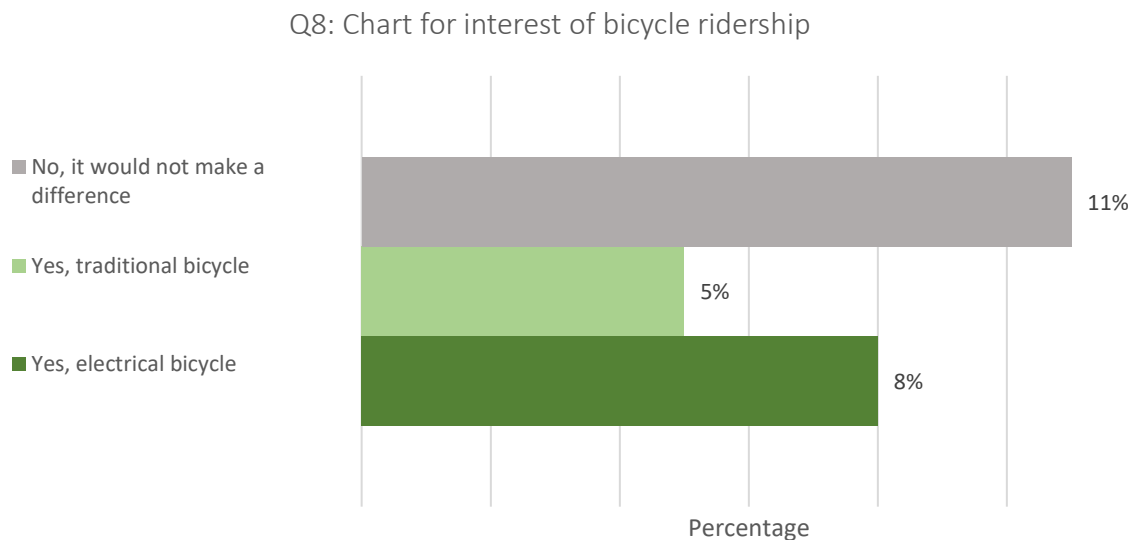


Figure 26. Chart showing the distribution of respondents considering buying a bicycle based on the potential implementation of high-quality bicycle facilities in city central areas.

The survey is attempting to understand perspectives of various age groups. Comparing age and their willingness to paid services (high-quality bicycle parking facility), with five options ranging from Free to 20 kr/hr. In table 15, it shows that most of the younger cyclists from age 18 to 30 would prefer a free service, or around 5 to 10 kr/hr. Meanwhile, older and more experienced cyclists with fulltime jobs would not mind paying for it, although a slight number would prefer a free service. One of the older respondents commented that if he were to pay for the parking every day at work, it would cost more than the car parking at his workplace.

Table 15. Overview of willingness to pay (in price) for high-quality bicycle facilities \* age.

Age	Price					Total
	Free	5 kr/hr	10 kr/hr	15 kr/hr	20 kr/hr	
18	0	0	1	0	0	1
19	1	1	0	0	0	2
20	3	3	7	1	0	14
21	7	6	2	0	0	15
22	11	4	3	0	0	18
23	4	6	5	4	1	20
24	6	5	3	0	1	15
25	5	4	6	0	1	16
26	3	1	2	1	0	7
27	0	4	5	0	0	9
28	2	3	2	1	0	8
29	4	4	2	0	0	10
30	3	0	0	0	0	3
31	0	2	1	1	0	4
32	0	4	0	0	1	5
33	3	0	0	0	0	3
34	1	0	2	0	0	3
35	0	1	0	0	0	1
36	1	1	0	0	1	3
37	0	0	3	0	0	3
38	0	0	1	1	0	2
39	0	1	1	0	1	3
40	2	0	3	1	0	6
41	2	3	0	0	1	6
42	0	0	1	1	0	2
43	4	2	0	0	0	6
44	0	1	0	1	0	2
45	2	0	0	0	1	3
46	0	0	3	0	0	3
47	0	0	0	0	0	0
48	0	0	1	1	0	2
49	2	1	1	0	0	4
50	0	1	0	0	0	1
51	0	0	0	0	0	0
52	1	3	1	0	0	5
53	0	0	0	0	1	1
54	1	0	0	0	0	1
55	0	0	2	0	0	2
56	0	0	0	0	0	0
57	0	0	0	0	1	1
59	0	0	0	0	0	0
59	0	0	0	0	0	0
60	0	0	0	0	0	0
61	0	1	1	0	0	2
62	0	0	1	0	0	1
<b>Total</b>	<b>67</b>	<b>62</b>	<b>60</b>	<b>13</b>	<b>10</b>	<b>213</b>

Three tables below (16-18) have been generated to analyse (1) the correlation between age group and price for paid service, (2) same as previous, but data is presented with horizontal percentage, and (3) the average price willing to pay per age group.

### Highest willingness

In table 16 and 17, the data is presented to see the distribution for which age groups are willing to pay for which prices, ranging from Free to 20 kr/hr<sup>7</sup>. As seen in both tables, the willingness to pay increase with the lower price, as the dominating variables are ranging from “Free”, “5 kr/hr” and “10 kr/hr”. A total of 190 respondents selected the three variables, with most age groups wishing for a free service, except for 50+ y respondents who are willing to slightly more. The highest number comes from respondents under 25 with N=32 respondents, which is 38% of the total age group.

A common detail on these tables is that all age groups uniformly agree to the same prices willing to pay for bicycle parking facilities. All variables from “Free”, “5 kr/hr” and “10 kr/hr” stay above 25% of all respondents per age group, except for 50+ y that has 14% willing on “Free” and 36% on both “5 kr/hr” and “10 kr/hr”.

Table 16. Distribution of age and price willing to pay per hour for high quality bicycle parking in absolute numbers.

<i>Age group</i>	<i>Free</i>	<i>5 kr/hr</i>	<i>10 kr/hr</i>	<i>15 kr/hr</i>	<i>20 kr/hr</i>	<i>Total</i>
<i>Under 25</i>	<u>32</u>	<u>25</u>	<u>21</u>	<u>5</u>	<u>2</u>	<u>85</u>
<i>25-30 y</i>	<u>17</u>	<u>16</u>	<u>17</u>	<u>2</u>	<u>1</u>	<u>53</u>
<i>31-49 y</i>	<u>17</u>	<u>16</u>	<u>17</u>	<u>6</u>	<u>5</u>	<u>61</u>
<i>50+ y</i>	<u>2</u>	<u>5</u>	<u>5</u>	<u>0</u>	<u>2</u>	<u>14</u>
<i>SUM</i>	<u>68</u>	<u>62</u>	<u>60</u>	<u>13</u>	<u>10</u>	<u>213</u>

Table 17. Distribution of age and price willing to pay in a horizontal percentage.

<i>Age group</i>	<i>Free</i>	<i>5 kr/hr</i>	<i>10 kr/hr</i>	<i>15 kr/hr</i>	<i>20 kr/hr</i>	<i>Total</i>
<i>Under 25</i>	<u>38 %</u>	<u>29 %</u>	<u>25 %</u>	<u>6 %</u>	<u>2 %</u>	<u>100 %</u>
<i>25-30 y</i>	<u>32 %</u>	<u>30 %</u>	<u>32 %</u>	<u>4 %</u>	<u>2 %</u>	<u>100 %</u>
<i>31-49 y</i>	<u>28 %</u>	<u>26 %</u>	<u>28 %</u>	<u>10 %</u>	<u>8 %</u>	<u>100 %</u>
<i>50+ y</i>	<u>14 %</u>	<u>36 %</u>	<u>36 %</u>	<u>0 %</u>	<u>14 %</u>	<u>100 %</u>
<i>SUM</i>	<u>32 %</u>	<u>29 %</u>	<u>28 %</u>	<u>6 %</u>	<u>5 %</u>	<u>100 %</u>

<sup>7</sup> Valuta 30.06.21: 1 USD = 8,56 kr



### Lowest willingness

Meanwhile on the end with higher price from “15 kr/hr” to “20 kr/hr”, willingness to pay decreases significantly with a lowest average percentage at 5% (20 kr/hr) and 6% (15 kr/hr).

### Average price willing to pay per age group

The table below consist of the age groups and the average price willing to pay per group. With age, it seems to increase the willingness as “50+ y” are willing to pay up to 8,21 kr per hour. While the younger end (“Under 25”) of the table has the lowest price willing to pay 5,29 kr/hr. With “25-30 y” barely higher at 5,66 kr/hr.

*Table 18. Average price willing to pay per age group.*

<i>Age</i>	<i>Price</i>
<b>Under 25</b>	<b>5,29 kr</b>
<b>25-30 y</b>	5,66 kr
<b>31-49 y</b>	7,21 kr
<b>50+ y</b>	8,21 kr
<b>SUM</b>	6,13 kr

### 5.3 Ideal bicycle parking

In this section, the respondents were asked to describe what they personally think is a solution that would satisfy their individual needs to both improve objective and subjective safety for their bicycles. Most of the respondents were of the same opinions, which was to have a bicycle parking that was sheltered with roof and walls, and preferably with access control. For some, even access to a maintenance workshop and self-cleaning service was wanted.

Several questions were utilised that could identify their perception on bicycle parking in Trondheim, and what they think of the current solution for bicycle parking. Furthermore, the survey would ask the respondents what the ideal parking is from their opinion, which leaves behind important knowledge and impression about what different individuals classify as a good to decent bicycle parking that satisfies their needs. In addition, the respondents were asked about how much bicycle parking meant to them in terms of increasing bicycle ridership or not at all. The respondents were also asked if a potential improvement and implementation of such facilities, would make the bicycle a more attractive means of transport in city central areas.

Some respondents wished for simple services such as an increase of tall enough bicycle racks that would lock both the wheel and frame of the bicycle.

*"Increase good bicycle racks in several places in the city centre. By good, I mean they should be tall enough to be able to lock the bicycle frame too and not only the wheel."*



*Female full-time employee, 36*

Another respondent expresses the commuting situation using multiple transportation modes such as bicycle and bus.

*"Free option for bicycle storage. Bicycle hotels is a really good option, and I will then travel with the bus after. It should be easy to just leave the bicycle at the "parking area", and not spend several minutes just to register etc. to use it. Eventually, pay for the bicycle after having been to the parking area, just to save some time."*



*Female student with part-time job, 20*

From the responses that have been written by respondents that can be seen in Appendix D for “Ideal Parking”, it is highly preferred with bicycle hotels and lockers over bicycle racks without shelter/roofing. Respondents are clearly expressing their preference for weather sheltering to avoid wet seats and winter cycling. Which can amplify their whole cycling experience throughout the whole trip.

Although most respondents agree with each other - some results vary with trip locations/purposes such as work/school, in the city centre or for grocery shopping. For work, which are often over longer period – respondents feel the need to have the bicycle locked behind doors with a roof, or ideally in a heated room. If it was in the city centre, having the bicycle locked into any kind of frame, preferably with a roof and close to their destination. For grocery shopping, it seems like simple bicycle racks will do the job as the respondents use very short amount of time there. In addition, the bicycle’s cost and type and setting were also an important matter. See the comment below:

*“... If I had a newer, more modern or an electric bicycle. I would have preferred a more secure place. Bicycle hotels are probably ideal, then the bicycle can avoid weathering and wind”.*



*Female full-time employee, 36*

Similarly, another respondent express preference for higher quality bicycle parking, for more reasons than only leaving behind the bicycle.



*“Bicycle locker is perfect. Closed and locked, nobody can see if there is a bicycle in there or how expensive it is. Also, nice to leave behind helmet and backpacks.”*

*Male full-time employee, 42*

This respondent also related the ideal parking to more than just safety and security, but as well relating to the distance, accessibility, aesthetics, and long-term potential in urban planning/architecture.

*“Personally, I think a bicycle hotel are the best ones, and is the easiest definition of what I mean is an ideal solution. If I should list everything in keywords, then there is bicycle parking behind walls/fences where nobody can get to, except those who have parked their bicycles there. Important with overhang/roof so that my bicycle can be protected from various weather conditions. But it is a pity that there are very few of these bicycle hotels. I think they are aesthetically finer and have a higher potential than bicycle lockers - which can look very ugly and square.”*



*Male student with part-time job, 29*

**5.4 Attractiveness of winter cycling with bicycle hotels or lockers.**

Cyclists were asked if high-quality bicycles would make it more attractive to cycle to central city areas. In table 19, we can see that 38% cyclists who own a bicycle – would indeed think cycling would become more attractive if bicycle hotels or lockers were more available. In addition, what is interesting is that 8% of the cyclists who do not own a bicycle also think that it would contribute to the attractiveness of winter cycling. However, a whole 39% of cyclists think that it would not be a factor that makes winter cycling more attractive. Lastly a 15% of non-cyclists also do not think it will make winter cycling more attractive.

*Table 19. Attractiveness of winter cycling for respondents.*

*Would winter cycling be more attractive with a bicycle hotel/locker?*

		<b>Yes</b>	<b>No</b>	<b>Total</b>
<b>Bicycle ownership</b>	<b>Yes</b>	38 %	39 %	77 %
	<b>No</b>	8 %	15 %	23 %
	<b>Total</b>	46 %	54 %	100 %

Further on in table 20, it was investigated whether the price of high-quality bicycle parking facilities would matter. As seen in the table, most respondents (N=114) think that it would not make it attractive regardless of price. Still, the number of respondents thinking that it will make it more attractive is quite high (N=99), with most of them wishing for the cheaper end of the price tag (“Free”, “5 kr/hr”, “10 kr/hr”).

Table 20. Crosstabulation of winter cycling attractiveness with bicycle hotel/lockers and the price willing to pay for such services.

		Would winter cycling be more attractive with a bicycle hotel/locker?		
		Yes	No	Total
Willingness to pay	Free	27	41	68
	5 kr/hr	29	33	62
	10 kr/hr	32	28	60
	15 kr/hr	3	10	13
	20 kr/hr	8	2	10
	Total	99	114	213

### 5.5 Bicycle use during the pandemic

Raising questions about the pandemic has increased the use of cycling among the respondents were of interest, as there were recommendations by the government to cycle, walk or even use private vehicles to get around. In the survey, a direct question asking whether the pandemic have had an effect of the transportation mode is resulted below in figure 27.

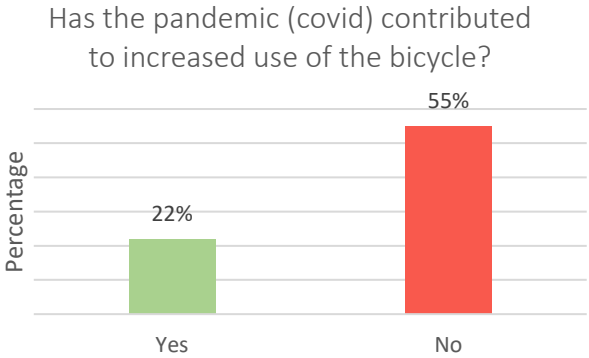


Figure 27. Question regarding bicycle use during the 2019 pandemic (Covid-19).

As seen in figure 27, 22% did choose to cycle more during the pandemic, meanwhile 55% were not affected and remained the same routines.



## 6 Discussion

This thesis aims to understand (1) *how high-quality bicycle parking facilities can affect the mode choice to and from central areas*, (2) *will high-quality parking facilities can be decisive for the people's transportation mode choice*, (3) *to what extent high-quality bicycle parking facilities matter for the cyclist's safety in terms of theft and maintenance*. In the thesis, several patterns emerged from the analysis regarding bicycle parking at various locations.

Firstly, high-quality bicycle parking facilities has proven by multiple research paper to affect people's mode choice for transport. The thesis found similar results and can be confirmed as a similar case in Trondheim, Norway that high-quality bicycle facilities do affect cyclist's mode choice to and from central areas. Respondents for this thesis in Trondheim tend to park their bicycles in available bicycle parking that is of high-quality, if that is available. However, it is also highly dependent on the time they plan to use on their trip purpose, the amount of load they carry or the value of their bicycles. Bicycle parking of lower quality is often used by respondent who own a traditional bicycle that they are not worried about losing, and therefore bicycle racks without shelter, roof or access control is fine. They argue that those are the most convenient, but a roof over bicycle racks would not have been a problem, matter of fact it is preferred by many of the respondents. If paid service for bicycle parking were compared to free bicycle parking, many cyclists would lock their bicycles to street-furniture that are not intended for bicycle parking, and overall reduces the likelihood of using a bicycle facility, as well reduces bicycle ridership (Heinen & Buehler, 2019). This indicates a disbalance in supply and demand, as it seems from the results are correct, as most respondents believed that cost and increase of high-quality bicycle parking facilities would increase the likelihood of them cycling.

Secondly, the correlation between high-quality bicycle parking facility and increased bicycle ridership was questioned in this thesis. From results, it is clear the respondents would cycle more if they had secure and better sheltered options available to park their bicycles. From many of the questions, it seemed like most of the respondents have had bad experience with finding central locations with high-quality bicycle parking, making the respondents to either leave the bicycle at home, drive the car, take the bus, or simply walk to their destinations. Then considering the results, it seems like awareness of high-quality bicycle facilities will increase bicycle ridership, if the service is either free or affordable. However, respondents are also willing to pay for better bicycle parking facilities, see chapter 0. As well convenience such as

easy access and short distances to the bicycle facilities are important factors for potential increased bicycle ridership. From other aspect, the respondents also believe it would benefit in personal health, environmentally and saving time compared to other transportation modes.

*“Because it is good for health and also sustainable. Sometimes, it is a quicker transport mode than the bus and car.”*



Third, it appears that interest of cycling is high in Trondheim, but at the same time the perception of bicycle safety in terms of theft is very low. Leaving the impression that it is not safe to leave bicycles around in town, even if it is locked into a bicycle rack. Most respondent seem to have experienced bicycle theft themselves, or at least have experienced others prone to bicycle theft and vandalism. Respondents have selected that they do think that high-quality bicycle parking facilities do play an important role in the challenge for reduced bicycle theft and vandalism, as they also write in the comment sections how important and what it means to have access to high-quality bicycle parking facilities.



*“... in my neighbourhood - bicycle theft is a common problem.”*

Respondent NN is expressing theft as a common problem. Another respondent adds that there is fear for bicycle theft while living in the city centre.

*“Fear of the bicycle theft/live in the city, and has Dragvoll as campus.”*



The perception of safety is going to the extent that respondents do what they can to avoid worrying about theft. Like going for a bicycle subscription with city bikes.



*“I think the city bike subscription is covering most of my needs better. I get the flexibility and do not need to bring the bicycle wherever I go. I do not have to think about bicycle theft.”*



## 6.1 How are high-quality bicycle parking facilities in city central areas related to an increase of bicycle share

According to results, it seems that high-quality bicycle parking is attractive among respondents and has a high potential for increasing bicycle ridership in city central areas in Trondheim. Not only cyclists are saying that they would feel more safe and secure with their bicycles with these solutions, but also non-cyclists would consider cycling if it were “guaranteed” that their bicycle would not be prone to theft or vandalism. As one respondent wrote for as his ideal parking:

*“I have had problems with bicycle theft, so something that avoids this (which bicycle hotels/lockers do) ...”*



While another respondent also wishes for the same but added that it would be good for police and insurance cases in terms of reporting bicycle theft.



*“Bicycle hotel with some guarding, eventually good camera surveillance that makes it easy to report vandalism/theft.”*

Since there is a high risk of bicycle theft in Trondheim (check chapter 5.2.1), the importance and demand for high-quality bicycle parking is increasing. Ensuring safe and secure parking for the cyclists would bring positive changes and attitudes towards cycling in city central areas. Johnson et al. (2008) claim that there are many factors that are closely related to bicycle theft, such as the lock type and the kind of facilities used to park.

Today there are very few high-quality parking facilities, and most bicycle hotels only exist on the outskirts of town, and bicycle lockers are very low in quantity per se. Paid services for high-quality facilities seem to be unpopular, as most respondents would prefer to have a free service or keep the price at least lower than for car parking.

Potentials of High-Quality bicycle parking facilities can reach longer than only increasing bicycle share in Trondheim, but also being part of the bigger picture towards the shift to greener transportation, reduction of greenhouse gas emission and dust particles in the cities. In long term, public health will increase and the number of sick of leave will likely decrease, as physical activity will increase if more people cycle for commuting, services, hobby, or recreational purposes.

## 6.2 Parking facilities wanted by respondents

If we further discuss chapter 5.2.2 and 5.3 about Ideal bicycle parking and Sheltering/roof on bicycle parking facility, many of the respondents have expressed the need of good parking facilities. The respondents believe that it is very important to increase the number of high-quality facilities as they truly believe it will help prevent bicycle theft and vandalism, but also sheltering against weathering conditions. The need for type of facility do vary with the type of bicycle owner, as seen in chapter 5.2.2. Roofed, sheltered or high-quality bicycle parking are especially important for owners of electrical bicycles, or people who cycle on a very expensive/high value bicycle. Value can be subjective, which can be described by this respondent.

*“... I have an electric bicycle that I built myself, which itself make it unique. For that reason, I think it has high value, and I would wish for any way possible not to have it stolen or vandalised.”*

The respondent clearly wishes for the highest quality parking for the bicycle, which is pointing to a bicycle locker or hotel as those are the options with very low probability of bicycle theft and vandalism.

Another respondent has lower requirements, and preferably wants a solid but standard bicycle rack that is a bit taller than the ordinary. A roof is preferred too.

*“... Solid stand that can lock the bicycle frame, without those bars that will damage the disc brakes. Preferably with a roof.”*

Roofs on bicycle parking are clearly a winner if we look at the free text comments in Appendix D. Several respondents are preferring a roof, indoor parking or any kind of good bicycle parking that is safe, secure and sheltered from bad weathering conditions.

*“... Bicycle parking with roof. I am not very afraid of bicycle theft for my bicycle, so I do not really need a bicycle locker or hotel... Roof is nice though, so I can avoid sitting on a wet bicycle seat.”*

## 6.3 Important factors for increasing bicycle share

### 6.3.1 Distance, Travel time and End of trip facility

The distance and travel time to the destination is one of the most important factors for choosing cycling, says the respondents. Their willingness seems to increase if there are safe and secure alternatives for parking their bicycles when approaching the end of trip. This graph in figure 28 by Pablo Celis and Bølling-Ladegaard (2008) demonstrates how two variables = time and distance from destination would correlate with demands. The longer you must travel, the higher quality parking is demanded.

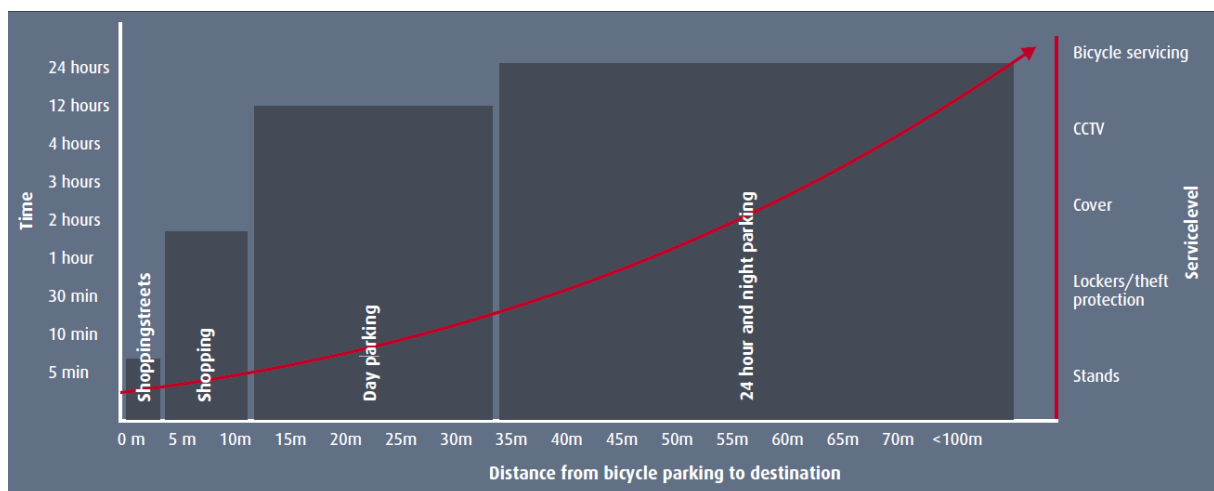


Figure 28. Principle for locating bicycle parking - Acceptable distances depending on function, time and service levels. Source: Pablo Celis and Bølling-Ladegaard (2008)

### 6.3.2 Safety and security

These two factors, I can confidently say do matter when it comes to increasing the willingness to cycle. As a common problem (bicycle theft) worldwide, safe and secure alternatives for parking bicycles have high demand, but not implemented in quantities yet near city central areas in Trondheim. From the results it can be proven that safe and secure alternatives are highly sought after.

### 6.3.3 Cost for paid service

The willingness to use bicycle parking services correlate with the usage price. Most respondents do not wish to pay for the service, but if they had to – they would prefer it very affordable. As they argue that if it exceeds a certain price (approximately 10kr/hr) it would be cheaper to use the car for commuting to work or similar. In that way, it makes sense to keep it free or very cheap. Since the goal of cycling development is to increase bicycle ridership, and for the

municipality, it would be an investment to promote sustainable and healthy transportation mode.

#### **6.3.4 Topography**

Trondheim is a city that have challenging topography, with a lot of steep hills. Which can be one of the reasons why some respondents are considering buying electric bicycles, to conquer all those hills without breaking a sweat. Again, that leaves the respondent no other option than having an expensive bicycle – then it would increase the demand for high-quality bicycle parking facilities.

### **6.4 Possible future development for high-quality bicycle facilities**

Many cities nowadays are trying to adapt to technological systems in the form of *Integrated information and communication technology*, also known as ICT (Thornbush & Golubchikov, 2019). This is an implementation to make use of systems digitally, without having to generate physical objects such as papers for services such as parking and those similar. The newer systems are more intelligent and can be connected with devices in real-time, using computer programming to sense capability and automation. Because of the implementation of this technology, the companies are also able to easier collect and generate Big Data in the urban setting (Thornbush & Golubchikov, 2019). This system can be implemented in facilities such as the Bicycle Hotels and Bicycle Lockers.

Future development of these facilities could use environmentally friendly building material, and to use its own source of energy to power the entire building and for providing electricity to bicycles. This can be done by installing solar panels on the roofs. This will make it become more attractive for the users and perhaps keep the maintenance cost lower for long-term use of the facilities. Technology development is important to keep striving for improved security, and it is also possible to combine existing technology to implement into these systems. Such as subscription card or a mobile application account that can give access the bicycle facilities.

## **6.5 Practical implications**

This research provided valuable insights for high-quality bicycle facilities in central city areas for potential increase in bicycle share.

First, I found the positive impact of increased safety and secureness perception for parked bicycles. The research resulted in an uneven balance between bicycle parking facilities and road infrastructure, where road infrastructure was more well developed. Therefore, it is important for the public and private entities to prioritise good bicycle parking, and make sure that public participatory is included in the process of doing so. For example, the entities can send out surveys or do more in-depth interviews for successful implementations.

Secondly, bicycle parking functionality is more important than you think. All cyclists have different needs, but the research must be done in a way that covers the group of cyclists that have demands for continuous cycling throughout the year. Such as, increase the number of roofed bicycle parking and bicycle hotels. Bicycle lockers can be built differently, in an aesthetic way or place the lockers in appropriate places, instead of random locations where the lockers have a contrast to the built environment.

Thirdly, economically speaking. Bicycle parking facilities should be free. Although the entities are spending money on these facilities and may cost millions – it is an investment to the people's health and to the natural environment. In the long run, overall public health can be improved if bicycle share increases. That will likely lead to less money spent on health care services and as well lower maintenance of roads for motor vehicles.

Given that high-quality bicycle facilities are free, it is important to continue encourage, promote cycling and make sure cycling is affordable. Bicycles have an important role as a sustainable and efficient transportation mode, so we need to prioritise policy and facility development for cycling.



## 7 Conclusion

This thesis was motivated by the lack of high-quality bicycle parking facilities in Trondheim. The thesis explored the potential benefits and changes these solutions could bring in terms of increased bicycle ridership in city central areas. Challenging bicycle theft and vandalism in Trondheim, to understand if bringing higher security and safety to the table for bicycles would correlate with increased bicycle share in city central areas or not. The thesis focus on high-quality bicycle parking facility types: Bicycle hotel and lockers and have additional research on standard bicycle racks with/without cover.

To answer the research questions, increased installations of high-quality bicycle parking facilities will contribute to increasing the people's sense of safety and security for the bicycles and may be a decisive factor for increasing bicycle ridership in Trondheim. Mostly due to the high level of bicycle theft in city central areas in Trondheim despite having a very good bicycle road infrastructure.

*"I considered buying an electrical bicycle, to be used for shopping instead of using a car, especially when having some heavy loads. But it is expensive, and even the cheaper electrical bicycles are attractive and vulnerable for theft due to the lack of good bicycle parking options. That is also applied to weather and wind. The same goes for cycling to work. It is a little bit too far to cycle on a traditional bicycle, but I would have cycled if an electrical bicycle could safely park."*

This comment from a respondent is very thoroughly explained and is cohering with many other respondents. Bicycle theft is an issue widely spread throughout central city areas, and the respondent also talks about weathering conditions, which can affect the likeliness of choosing cycling as a transportation mode. Which looks to help with a good bicycle facility at the end of trip. Cycling to work are for a few respondents, just a little bit too far on a traditional bicycle. Which have been told by other respondents as well that the topography in Trondheim is simply challenging with a lot of uphill, therefore it is more likely to buy an expensive electrical bicycle for convenience. In return, the bicycle is also more prone to theft.

Bicycle parking facilities do matter for most respondents. Many of non-cyclists, do not cycle because they have the attitude that it is not safe to own a bicycle in Trondheim, in fear of theft. Both cyclists and non-cyclists are agreeing (98%) that high-quality bicycle parking facilities do matter when it comes to increasing their likeliness for cycling in central city areas, and most of all the service should be free, or minimum at a low-cost approximating from 5 kr/hr to 10 kr/hr.

Another important conclusion for the project is that the demand for bicycle parking is high, and most respondents think that roof on bicycle parking or sheltering is of great importance. Especially for weathering conditions to avoid exposure to rain and snow.

Bicycle theft relating to the willingness to pay for high-quality bicycle services AND sense of safety/security for bicycles seem to relate to each other very much. As most respondents who have or even have not experienced bicycle theft, do believe that these facilities will have a significant role in increasing safety and security for bicycles in central city areas.

### **7.1 Study limitations and suggestions for future research**

The focus of this thesis was to research the effect high-quality bicycle parking facilities had on respondents in terms of safety and secureness perception. However, many of the respondents already owned bicycles. For future research, this thesis seems to consist of a higher bicycle share than the population according to the National Transportation Plan (2020), the goal is to reach 20% bicycle share in central city areas and 8% overall in Norway. While in the thesis, it has resulted in 77% bicycle owners, which can be understood as bicycle share as well. Thus, concluding that the result could be biased due to a lacking number of non-cyclists. It can be recommended to investigate a selection that does not consist of cyclists at all to make it more precise to cover the main questions to this thesis, which was to investigate if bicycle parking facilities is a factor for non-cyclists to consider cycling if the options for parking were better. Furthermore, reaching out to the older end of the age group seemed to be a challenge, as most respondents in this thesis were below 30 years old. My thoughts are that it could be technological conflicts, with possible struggles such as connecting to (1) QR code, (2) internet, (3) Web browser etc. Therefore, it can be recommended to do qualitative research to get more in-depth information by cyclists passing by in central city areas.

More research on this would add more understanding to the topic, it could also be done by doing a comparative study with other cities in Norway.





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## **Appendices**

### **A Dissemination of the survey**

This appendix will summarize the process and work done surrounding design and dissemination of the survey for data collection. The appendix consists of an explanation of designing progress, shaping, applications and distribution.

#### **Preparation and design of the survey**

In the process of preparing and designing the survey, researching the field of interest, similar work and existing research papers were investigated. In addition to consultation with the supervisor and co-supervisors about what to include, exclude and change in the survey. In addition to the abovementioned, other people such as students and respondents were asked to comment if they had any suggestions to improve the survey.

The survey was designed and collected with a web-based software called 'Nettskjema', provided by University of Oslo. To use the platform, the researcher had to fulfil requirements to satisfy GDPR guidelines accordingly to the needed data to collect. In this matter, anonymous identity was used, leaving no name and only gathering age, gender and e-mail were acquired as "identifiable" data. When the survey was complete, it was sent to NSD (Norsk Senter for Forskningsdata) for approval. Which was acquired quickly.

The process of forming and designing was done from February to April and was then distributed throughout the whole month of May. The main target was to acquire data about respondent's opinion and perception of high-quality bicycle facilities in Trondheim and if they could be a solution to increase bicycle ridership in Trondheim. As well increase sense of safety from bicycle theft and vandalism.

The flyer was colour printed and included both the university logo and information that this study was done by a master's student from the university. The flyer can be found in Appendix B.

The questionnaire can be found in Appendix C as a Flow-chart divided in three parts (One part per page).

## Distribution of flyer

Based on the number of respondents distributed on various age groups, it seems like the distribution of survey flyer has been effective. Table 21 is showing where the flyer was distributed online, and physically.

Table 21. List of social media groups, offices, and campuses where the flyer was distributed online and physically.

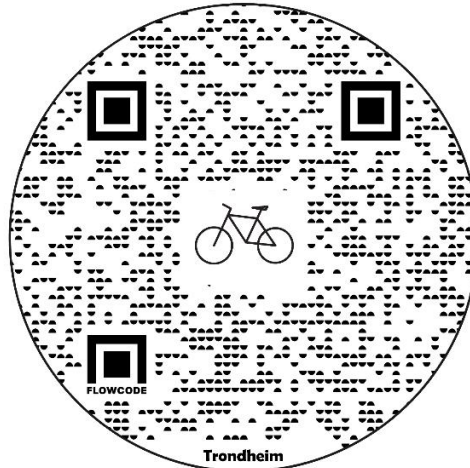
Physically	Online
<ul style="list-style-type: none"> <li>▪ NTNU Kalvskinnet</li> <li>▪ NTNU Dragvoll</li> </ul>	<ul style="list-style-type: none"> <li>▪ På sykkel i Trondheim (Facebook)</li> <li>▪ Trondheim Sykkel Funnet/Stjålet (Facebook)</li> </ul>
<ul style="list-style-type: none"> <li>▪ NTNU Gløshaugen</li> <li>▪ NTNU Handelshøyskolen</li> </ul>	<ul style="list-style-type: none"> <li>▪ NTNU Vakt og Sikring (Facebook)</li> <li>▪ Trenger du noe? Studenter som kan hjelpe i Trondheim! (Facebook)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Berg studentby mailboxes</li> <li>▪ Moholt studentby mailboxes</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tapt og funnet Trondheim (Facebook)</li> <li>▪ Vietnamese Student Association in Trondheim (Facebook)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Bærekraftssenteret, Trondheim</li> </ul>	<ul style="list-style-type: none"> <li>▪ Miljøpakken (E-mail)</li> <li>▪ Hippodamus Linjeforening (E-mail)</li> <li>▪ COWI Areal og Samferdsel (E-mail)</li> <li>▪ Sirkus shopping (E-mail)</li> <li>▪ Lager 11 (E-mail)</li> </ul>



## B Flyer

# Digital undersøkelse: Scan QR kode!

VINN GAVEKORT FRA WOLT



[nettskjema.no/a/hoykvalitetparkering](https://nettskjema.no/a/hoykvalitetparkering)

## HØY-KVALITETS PARKERINGSFASILITETER FOR SYKLER I SENTRUMSNÆRE OMRÅDER, TRONDHEIM

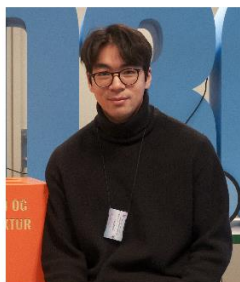
### Beskrivelse av undersøkelse

Temaet handler om høy-kvalitets sykkelparkeringer (sykkelskap eller sykkelhotell) kan bidra til at nemlig **deg** som respondent - vil sykle mer, sykle i det hele tatt og/eller om disse høy-kvalitets parkeringsfasiliteter for sykler vil gi deg og sykkelen økt trygghet ved bruk.

Undersøkelsen vil ta omtrent 5 til 8 minutter å fullføre, og du får muligheten til å vinne et gavekort fra Wolt på 200 NOK. Fem vinnere blir kontaktet på e-post i løpet av 31. Mai 2021.

### Informasjon

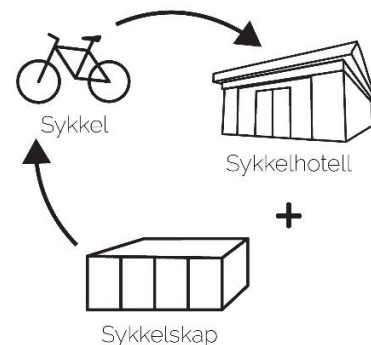
1. Undersøkelsen er gjort i forbindelse med en masteroppgave ved Fakultet for Arkitektur og Design NTNU.
2. Dette er fullstendig anonymisert, og all innsamlet informasjon vil bli slettet etter bruk.
3. Godkjent av NSD (Norsk senter for forskningsdata).



### Phong Vuoc Tran

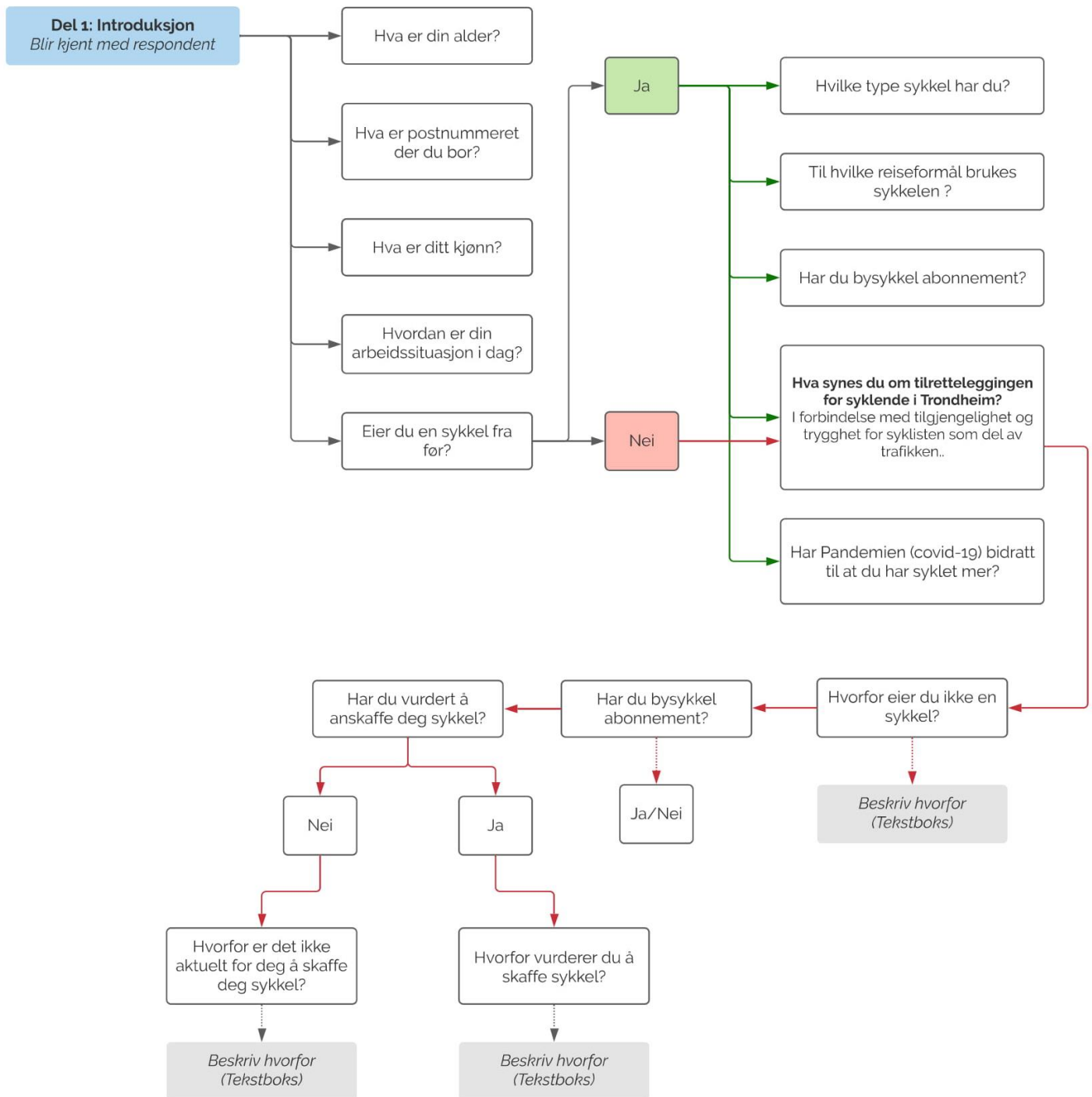
Master i Fysisk Planlegging  
Fakultet for Arkitektur og Design

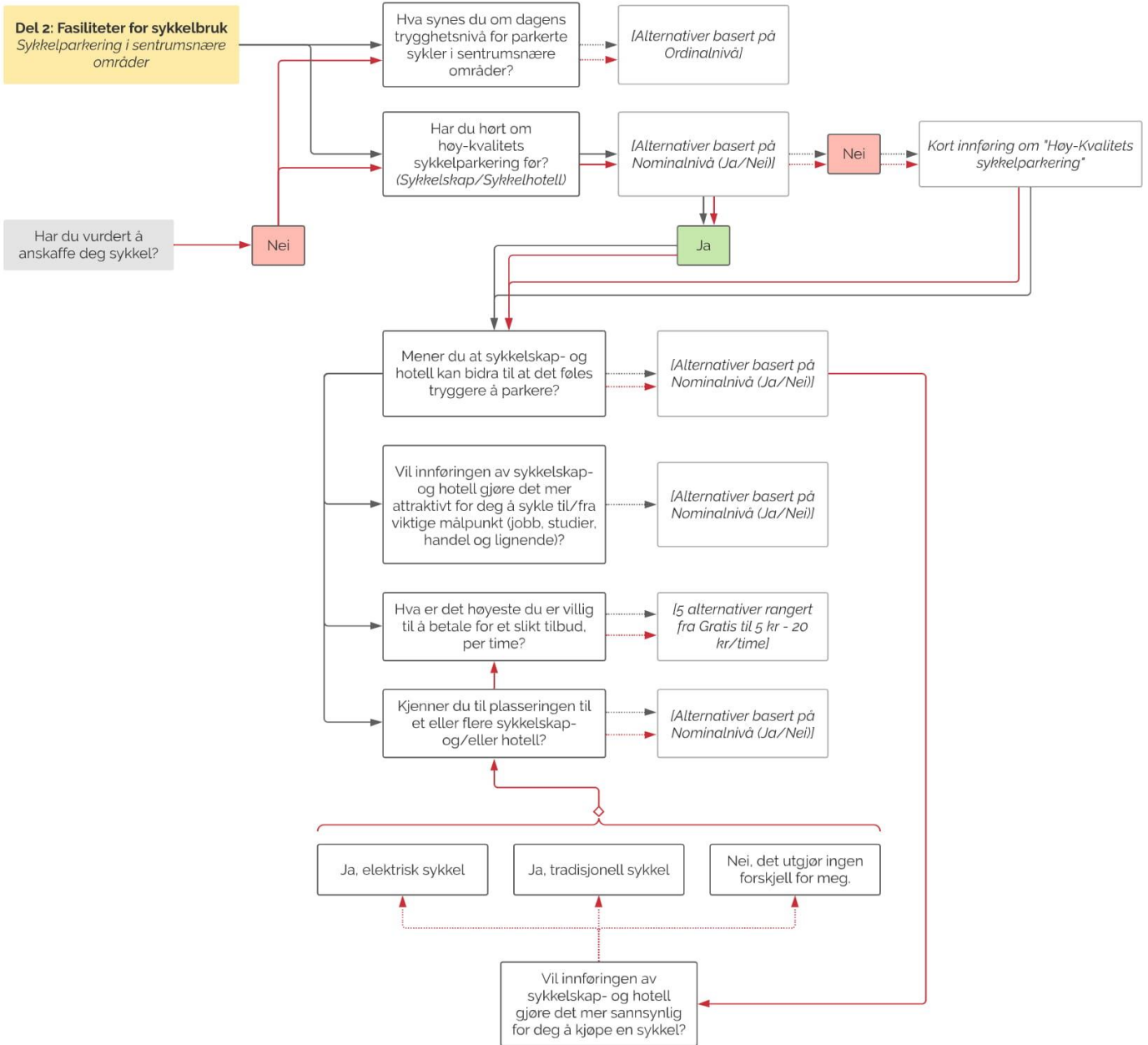
+47 482 20 814  
[Phongvt@stud.ntnu.no](mailto:Phongvt@stud.ntnu.no)



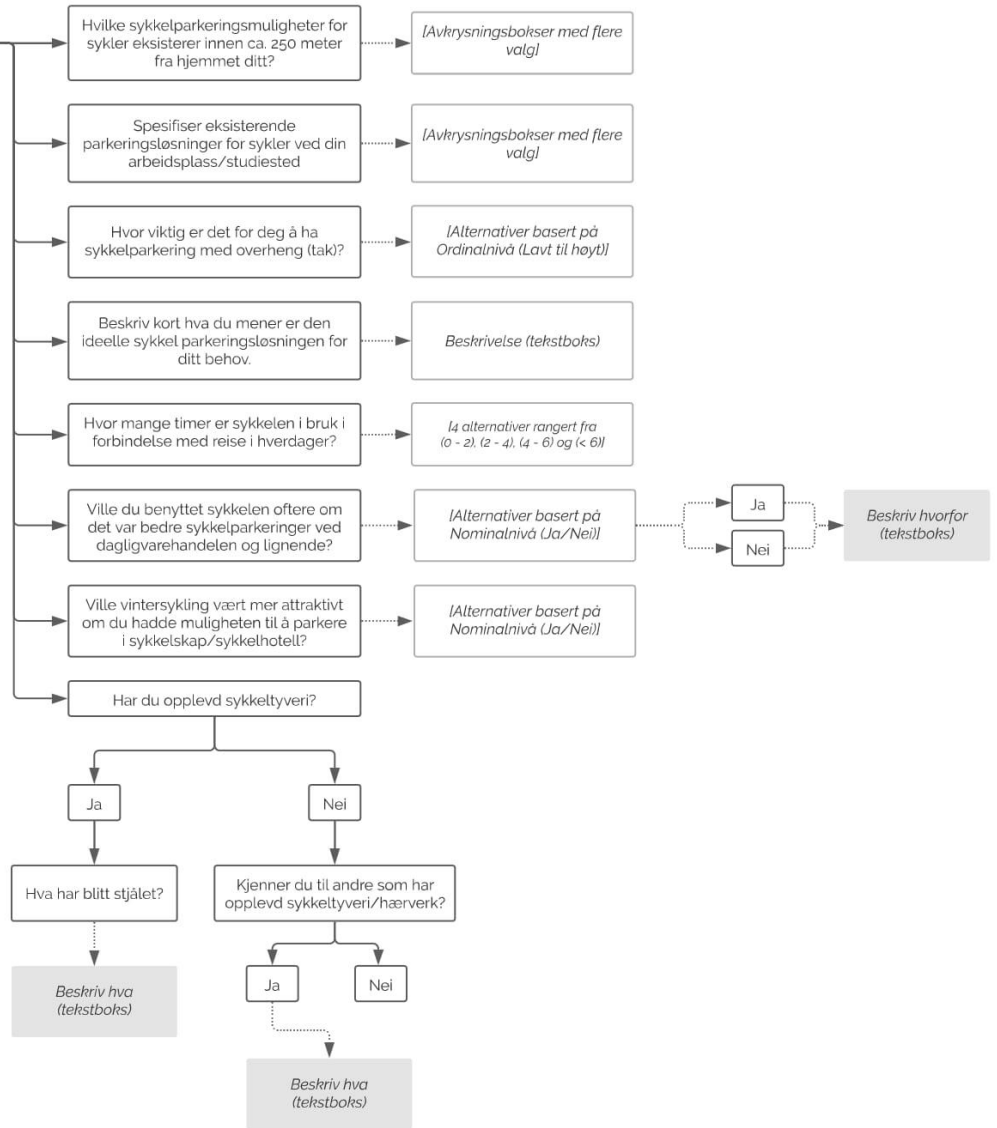


## C Survey flow-chart





**Del 3: Sykkelens bruk og trygghet**  
Omgivelse, ønsker og preferanser





## D Free text comments

All text has been translated to English. Most of the replies were originally in Norwegian.

### Why do you not own a bicycle?

English
As an international student we face a huge financial crisis which is the major reason behind not owning a bicycle.
Because I am staying here temporarily. In my home country, I don't bike too since there are no good public facilities for that.
Because of weather conditions.
I live in the city centre, but I work too far away for the bicycle to be preferred.
I am driving a car.
I am using a city bike.
I am using a city bike/Voi etc.
I am using a cycle subscription/daypass for city bikes. Risk of bicycle theft.
Bus is enough.
It got stolen.
It got stolen.
It got stolen this Autumn.
It is at home.
Do not feel the need, since the other mode of transport (the bus) is working super good for me.
I am poor and cannot afford.
It is too far to cycle to grocery stores etc.
I am walking during winter and riding electrical bikes when it is dry.
I have a car.
I have a kickscooter, and the city bike as neighbouring service so I do not see the necessity in owning a bicycle.
I do not need one.
I do not need one, considering the bus and the distance to the city centre.
I have not had much use for it, unlike I do for the bus.
I have not bought a new one yet, since my last one got broken.
I have not bothered buying one. In addition, in my neighbourhood - bicycle theft is a common problem.
I cannot afford.
Cannot afford and will not use it often, since the bus services are so good.
I cannot afford to buy an electrical bicycle.
I do have a bicycle, but not in Trondheim.
I have Trondheim City Bike.
I am an international student; bus is a better option for moving from place to place.
Not a priority.

Cannot afford, so I borrow one.
I do not like to cycle.
I sold my bicycle because I am not using it so much here in Trondheim. Mostly because of the uphill to and from the city centre.
I think it is scary to cycle in Trondheim.
I do not need it, since I work too far away from home, and I do not use a bicycle daily.
I can be just fine without a bicycle here in the city centre, but I am considering buying one to save some time.
It is easier with a city bike where I live.
I do not like to cycle
I do not like to cycle.
I do not like to cycle, it is uncomfortable.
A lot of uphill in Trondheim. Especially to/from Moholt and Dragvoll compared to the city centre.
My bicycle got broken last year's autumn, then I did not get a new one since I got the city bike subscription during spring.
Fearing the bicycle to be stolen.
Fear of the bicycle theft/live in the city and has Dragvoll as campus.
Rarely cycles, I would rather walk.
Mostly using the bus.
The weather and the hassle to bike upward when going home.
Was stolen recently.



## Why do you consider buying a bicycle?

English
It is always easy to get to places without having to watch time, and to run to the bus. In addition, the bus is unpredictable, and it takes a while to wait for the next bus during transitions.
Because its energy efficient and good for health too. Convenient for student like me than buses may be in financial term.
It is good for the environment, the body and mind.
It is practical and efficient to use to get around Trondheim.
Electrical bicycles seem very practical.
It is nice with a personal bicycle so one can travel more freely.
For exercise, the city bike is not very good.
Because it is good for health and also sustainable. Sometimes, it is a quicker transport mode than the bus and car.
I would have used it a lot.
Considered electrical bicycles. Because of recreation and to get to places where the buses are not going.
Mainly to save some time to places around the city centre.
It's easy to bike in Trondheim and cheaper than public transportation.
It's a good transport in Trondheim.
Maybe when I move from home to the city centre, closer to work.
It is convenient to have.
It is faster than having to walk.
Easy means of transport, the buses are often full so it would have been nice with a bicycle.
I like electrical bicycles. It is easier.
Because I can get to many places in Trondheim quick with a bicycle. It is very practical, and it is fun to cycle. Maybe it is also cheaper than the bus.
More freedom than a city bike.
Environmentally friendly.
Environmentally friendly, no need to pay for public transits or fuel, it is good motion.
Mobility around town.
A lot faster than walking and a lot cheaper than the bus.
Practical.
Saving money.
Stress to walk.
Summertime is approaching, might be nice to bike around in that time.
Think it could be nice to use a bicycle, and it is also good for the environment, I think.
Exercise and easy transport.

## Explain shortly, why is it not relevant for you to get a bicycle?

English
It is too far to cycle to stores, and I work at Stjørdal.
Dependent on quick means of transport to the city centre etc.
Beside my temporary stay, it is more to personal choice as I am not that into physical activities.
It is expensive and dangerous to cycle during winter.
Easier with a city bike, then you do not have to think about the bicycle wherever you are going :)
Because the bus services are very good.
Because I do not like to cycle, I think it is stressful.
Getting sore on the buttock muscles from bicycling. Prefers to drive a car, as it is also faster.
Have a car.
Have not had the necessity.
Not really into cycling in general, lot of slopes in Trondheim especially to where I live.
I am going to move in a year. I cannot be bothered with buying a bicycle now, then having to move it along with me among the other stuff.
As mentioned, a lot of slopes so it is faster with a bus.
I think the city bike subscription is covering most of my needs better. I get the flexibility and do not need to bring the bicycle wherever I go. I do not have to think about bicycle theft.
The contour where I need to go uphill plus weather and maintenance.
Trondheim's terrain is tough.

## Would you use your bicycle more if there were better bicycle parking facilities near daily grocery stores and similar? (1/2)

The replies are divided into two sections, where one would cycle more and the other would not. This table shows the respondents who replied to YES.

English
Right now, I am rarely using a bicycle in the city centre, in fear of it being stolen. So, yes, I would have used the bicycle more often if a service like this existed.
I am using a cheap bicycle for shopping. It would have been superb with more lockers near stores.
I am already using my bicycle quite often already, but I can see the value of usefulness if there was an even safer option. Currently, it is rather a calculated risk with a lot of money put into measures such as a good bicycle lock.
Stores rarely have bicycle parking, so I am dependent on finding a fence/hedge or something else to securely lock my bicycle on to. I am selectively not going to stores that do not have bicycle parking.
I would have felt surer that the bicycle was still there when I was finished shopping at the store. For instance, the reason why I did not bike to friend was because the solutions were not good enough for safe bicycle parking. To lock the bicycle outside on a rack in a neighbourhood do not feel safe anymore.
The racks that we can find are simple and randomly placed.
It is always nice to have (better bicycle parking). But it is not safe to leave a bike costing 10 000 NOK in Trondheim.
Where there are possibilities to park bicycles, there are more people using it. I am noticing it, I do not like to cycle to Rema 1000 Elgeseter, the bicycle parking there is bad compared to KIWI Nardo which has parking closer to the entrance and the racks there are better for locking the bikes onto. However, there are very few racks, often full, so it happens to be easier to just walk.
It is very poor options with bicycle parking facilities in the city centre (Midtbyen). For instance, by Rema 1000 Dronningensgate and Bunnpris Munkegata. This makes it hard to "safely" lock the bike.
I am not afraid to leave the bicycle.
I am afraid of the security (of the bicycle) so I choose not to use it, if it is possible to walk there.
Fear of theft.
It does not exist bicycle parking close to the daily grocery store.
For instance, to put groceries or things that I have bought in my bicycle bags while I am at another store or leaving behind clothes for exercise/work stuff etc. that I brought along. Must be an individual bicycle locker.
Because, then it would have been easier to leave the bicycle. Not being afraid of it being stolen.
Because I am afraid of it being stolen.
Because I have an electric bicycle that I built myself, which itself make it unique. For that reason, I think it has high value, and I would wish for any way possible not to have it stolen or vandalized. It is a pleasure to be able to use our bicycles everywhere, without fearing for bicycle theft. Even during short travels.
Less probability of bicycle theft.
Feels more secure.

Good enough solutions close to grocery stores or malls would help. But it would help “insurance” or warranty if it was a paid service.
Good racks that clearly shows that you are welcome as a cyclist.
Would have made it easier to cycle to and from a place.
Would have felt safer to park the bicycle.
Have previously experienced that the bicycle got stolen while it was locked. I want to feel sure that it will not be stolen before I can use the bike everywhere.
If it was safer to leave it.
Yes, I think so.
Yes, then it would not have been any danger for bicycle theft.
I live at Tiller, which is a hole with a lot of bicycle thieves.
I am already using the bicycle for all kind of shopping. There are usually racks to lock the bicycle close to the stores. However, I have the need to hang bicycle bags on the bicycle while being in the store. Currently, I am walking around with my bag, helmet and sometimes even the battery because one is afraid of this being stolen. A locker would therefore have been nice, or in separated sections in a “hotel”.
I am reluctant to cycle to places where there are no safe lockable stalls/lockers.
I am missing indoor parking with locking opportunities. That is the most important.
Less fear for theft and vandalism.
Now there is a high risk for the bicycle to be stolen. It is also unsafe to cycle on the roads in the area.
Now I am always cycling every day, so maybe it is wrong of me to write that I would have cycled more often. However, I miss bicycle racks that make me feel more welcome to do shopping when using the bicycle as a transportation mode.
If there were easier and faster ways to park, for example by providing built-in locks at bicycle parking’s.
People would find it more accessible and convenient if the grocery store had a spacious parking lot. As a result, more and more people are cycling because it has become a habit.
More secure and easier to park.
The way it is now, I am afraid the bicycle will be stolen while I am in the store doing shopping.
Avoids a wet seat or the risk of bicycle theft.
The place where I am shopping today, does not have a bicycle parking, which makes it hard to find a place to leave the bicycle.
The racks must be large enough to lock the bicycle onto the frame and they have to be permanently mounted.
Cycling is good motion and an active transportation mode. Better parking solutions would provide a bigger sense of safety for leaving the bicycle during the time I am for instance, in a grocery store.
Safer to leave the bicycle.
Safety.
I do not dare to let the bike stand out on the streets, even with a relatively expensive bicycle lock.
Avoiding cycling to the city centre and shopping malls because of fear for bicycle theft.

Outside of the closest stores, it is arranged that car parking is closest. While bicycle parking are the ones furthest away, but also blocked by parked cars. In addition, there is nothing to lock the bicycle on to.
I would have cycled more often if there were more secure, in terms of parking.
I considered buying an electrical bicycle, to be used for shopping instead of using a car, especially when having some heavy loads. But it is expensive, and even the cheaper electrical bicycles are attractive and vulnerable for theft due to good bicycle parking options. That is also applied to weather and wind. The same goes for cycling to work. It is a little bit too far to cycle on a traditional bicycle, but I would have cycled if an electrical bicycle could safely park.
Wish to have the option to lock the bike.
Maybe yes because we need to visit some places for our basic needs and on a regular basis. It's better to travel by bicycle than buses as they are energy efficient, less polluting and convenient healthy source
Lower risk of bicycle theft.
Yes. I would rather not leave the bike somewhere on the ground, and it would have been nice to have a place where everyone could park their bike. It would save us some time.
Yes, then we can feel more reassured about the fact that it will not be exploited for theft or vandalism.
Easier to leave the bicycle safely during shopping.
Faster to cycle.
I would have used the bicycle more often to the daily grocery shopping if there was a safe place to park nearby.
Daily grocery shopping is close enough for walking, but for other daily goals, better bicycle parking would have made me use the bicycle.
Would have been safer to park the bicycle, less risk of theft.
High rate of bicycle theft in Trondheim

## Would you use your bicycle more if there were better bicycle parking facilities near daily grocery stores and similar? (2/2)

The replies are divided into two sections, where one would cycle more and the other would not. This table shows the respondents who replied to NO.

English
Because I use it for recreational purposes.
I live so close that I would rather walk instead of cycling.
I live very close to stores and the gym, so I would rather walk (500 m). Other facilities are too far away, so I would rather not cycle.
I am living outside of the city's core, and nearby stores feel like a safe place to park (the bicycle).
I am already only using my bicycle. I am selectively choosing which store to visit, so I can park my bicycle the best way possible.
I am already using my bicycle every time.
I am already using my bicycle to everything possible with it, so it would not have changed anything. I would eventually feel more secure/safe.
I am not using much time inside of such places (stores), so it is not a deciding factor.
Using a bicycle independent of bicycle facilities.
The store is within short distance.
The daily grocery stores I am using are close, so it is just as easy to walk.
I am there in such a short period, so a bicycle hotel would not be necessary.
There is already good enough bicycle parking.
There is already good enough bicycle parking by the stores nearby.
There are already bicycle parking there, and we spend so little time in the store that a roof and high security is not necessary.
It is good enough as it is.
There are good bicycle racks near the stores that I am using. Otherwise, when I do my weekly shopping, I am using the car.
It is so close, so it is inconvenient to get the bicycle only for a 300 meters max trip.
The correct answer is maybe, or I don't know. I cannot say for sure that it will, therefore I chose "no". For me it is about that it is easier for me to simply walk to the grocery stores, which is also the only thing I do during "these times" (covid-19).
Those are not the exploited areas, in my opinion. Makes more sense close to offices and longer parking's.

Since I mostly use electrical kick scooters (can be folded and brought everywhere), or a city bike.. I do not have the need for a fancy bicycle parking. I would then instead consider replacing my kick scooter if a big enough service with bicycle lockers became available in the city centre.
I am satisfied with today's solutions.
For daily grocery shopping, only the volume of what I have planned to buy is decisive. If there is too much to carry on a bicycle with a backpack, then I would use my legs.
Too much to shop, cannot use bicycle for shopping. Even if I could, bicycle parking is not a problem.
The benefit with cycling is bigger than to not do so, even if the options for bicycle parking is bad.
Because there are already good solutions with bicycle racks wherever it is needed.
Because I feel my bicycle is standing safely as it is now, so if I do not cycle, then it would be because I would not have anyway.
Because I am walking to the store, and only use the bicycle when I need to shop odd things that are located at a place outside realistic walking distance.
Good enough to lock the bicycle outside of stores.
It is okay to park the bicycle at Heimdal.
I would rather walk than cycle, considering the distances the way they are today.
I would probably not have used a paid system just to go to the store. If there were bigger value for my bicycle, then my wish for that would have been bigger too.
I have walking distance to the closest store. If I were to use a bicycle for shopping in the city centre, then I would have bought an electric bicycle. I would then prefer a bicycle hotel/locker as the best options.
I do not have the need for a better bicycle parking, so it would not have changed my cycling habits.
I have a motorised vehicle, otherwise I am walking.
I have two children and do all daily grocery shopping by car.
I love bicycling so much I am already using it every day. But I would be happier with more facilities.
If I'm not planning to buy a lot of stuff, then I can use the bike but if I'm planning to buy a lot of stuff I think it's not easy if I use a bike.
Would not have used it more often, but it would have been safer.
Not a reason for me to cycle more.
Not very relevant, since it is not important for me whether or not there is a roof.
I am cycling anyway.
I am using the bicycle for daily grocery shopping today and am actually satisfied with the parking solutions. Of course, there is a variation in the offers. For me, it is more about what I am going to buy that hinders me cycling, above parking opportunities.
I am already using a bicycle without having to worry about bicycle theft. If I had a very expensive bicycle, I would likely have thought differently.

I am already using a bicycle very often, but I would have used the daily grocery stores more often if they had proper bicycle parking. The quality of the bicycle parking affects how attractive the store is in my opinion. If I have to park the bicycle further away for safety, then I would only use the grocery store if really necessary.
I am using the bicycle anyway.
I am using my bicycle for everything anyway.
I am always using my bicycle anyway.
I do not have the need for another parking, for me it is enough to lock the bicycle the way I am now. At night, I just park it at home.
I can walk to all those things.
I wish that the parking's were better, but I am cycling anyway.
I am always cycling to the daily grocery store.
Driving because of heavy grocery bags.
When I am inside the store for such a short time, it is not needed.
Missing the ability to carry/load on a bicycle.
Another alternative than cycling is not preferred. Then it would rather to be badly parked "off road" along a wall or something.
As a poor student I am cycling anyway, perhaps this is changing when I get access to a car or had a more expensive bicycle.
Mostly satisfied with how it is currently. Never experienced to never find an available bicycle parking.
Bicycle parking has never been a problem, if I can lock the bicycle onto something somewhere, then that works for me.
The cycling habits would stay unchanged. I trust that the bicycle will not be stolen if I lock it somewhere I think is safe.
Am already cycling often.
Cycling to the city centre/stores when it is appropriate, regardless of the parking solutions. At larger shopping trips, the car is mainly used, independently of parking solutions for bicycles.
Cycles anyway.
Cycles anyway.
Cycling anyway, so it would not have made any difference.
I think bicycle roads are more important than the parking for it. It feels safe most places in Trondheim.
As long as the bicycle only park in short periods, it will be fine.
I do not really care about that when I am using the bicycle to go to the store.
Need a bicycle parking when I am for instance, travelling away by train.
I do not think I would have cycled more, since I have a bus card.
Under the corona time, I began mass-shopping, and then it is more convenient with a car.
Very short distance to most things, so it almost always works out anyway.
Do not want to cycle anymore.



No, I would rather have more parking lots for cars.
It is almost faster to walk than to cycle to the store.
No, because the city bikes are already covering most of the areas I want to travel to.
I do not have any plan to use bicycle at any point right now.
I do not have a bicycle, and when I did have one, it did not matter.
Usure. I am rarely shopping. It is easier to walk with bags.
Do not have a bicycle.
Grocery shopping is not taking that much time, vandalism on the bike is unlikely.
Fast in and out of the store, so it is not so important with a full hotel for that.
No, because it is too far.
No, unpractical to shop and cycle with the bought stuff on the back for example.
I do not own a bicycle as of now.
For me the most important is to cycle to studies and work, not for shopping.
I live just next to stores, so I do not need to cycle there.
I do not really have many thoughts about that. Never experienced that the bicycle has been stolen from a bicycle rack. I think it matters the most if it stays there over a long time, or overnight. Maybe especially in the weekends.
Not really into cycling.
I live centrally.
No, because it is easier to just walk to drive.
I prefer more to walk.
I think the current parking is okay, it does not really matter. It would perhaps have matter more if I had a very expensive bicycle or an electric bicycle.
Yes, if I owned a bike, but it is still not relevant for me.
Does not feel good to ride the bicycle with groceries on.
It is so close that a bicycle would not be used anyway.
I do not have a bicycle.
By the daily grocery store, the bicycle is not standing for long. So, there is no need for it.
Does not matter much for me.
Because we only park it for a while, so if I can lock it then it is okay.

## What you think is the ideal bicycle parking facility solution.

English
A place not exploited for theft.
Available parking solutions at for workplaces or schools, would give a sense of safety when the bicycle is parked. Either it is an outdoor bicycle hotel or a bicycle garage at offices/campus. Especially bicycle parking facilities around student housings can be improved with their own bicycle basements or bicycle hotels since that is not the case in student housings today.
Garage/storage room that is easily accessible.
Bicycle locker or another type of secure storage.
Bicycle parking with roof and the possibility to lock the bicycle to the rack itself. Preferably in a locked backyard or a locked storage room.
Good space, under roof and sheltered from rain. Also, something to eventually lock the bicycle onto.
A room with limited access, a la bicycle hotel/locker/basement.
Close to the city centre so you do not have to walk far after you have parked, or when you are going to pick up the bicycle again.
I am not so afraid of theft, the most important is that it is easily accessible and sheltered from weather. Easy covered racks are nice.
A safe facility with large enough parking for cargo bikes.
If I were to lock outside of a locker, I would lock both the bicycle frame and rear wheel into something permanently placed. I have u-lock because it is the safest, but it does not give a lot of range. So, the rack cannot be too wide. I would like to safely lock my bicycle into a locker, especially so that no one else can have access, because I want to be able to walk away from my valuables that are inside of the bicycle bags. If someone could tell my employer (NTNU), that it is nice with tight walls on bicycle lockers to protect against weather and wind, that would be great ;) otherwise, I think the bicycle lockers are super for their use. What I really want? I would want underground bicycle parking facilities, like the ones they have in Tokyo!
It would probably be nice with a sheltered one, but it is far from necessary if I were to choose cycling.
Easily accessible, both at home and at work, but also in the city centre. Also, with warranty/insurances of the bicycle if we were to pay for this. At least if this was to cost over 5NOK/Hr, then I would even considered it. For example, if a bicycle locker/hotel at the price of 10NOK/hr close to work, it would have cost me 15 - 17 000NOK/yr. just for parking. At my current parking at work, I can get an electric car parking with charging at lower cost... To inform, if there is a bicycle theft or vandalism at work, it would likely be one of my colleagues, so it is unlikely that something would have happened.
Bicycle locker!
Dry and safe.
Bicycle hotel for a small cost. I have lost two of my bicycles in the city centre from traditional bicycle parking already, so... bicycle parking in the city centre is surely unsafe.
Locked into a personal shelter.

A bicycle parking facility that is covered (roof) and has enough slots/space for parking so that bicycles will not block each other in the process.
Bicycle parking with roof. I am not very afraid of bicycle theft for my bicycle, so I do not really need a bicycle locker or hotel. In addition, it would probably take a bit longer time to park the bicycle with these kinds of solutions. Roof is nice though, so I can avoid sitting on a wet bicycle seat.
Cage in a parking house or bicycle hotel with dedicated hoops for locking of the bicycle. With available washing station.
I think bicycle lockers works well. If a bicycle hotel is more sustainable, then I think that is the best, if we can guarantee the safety.
Own room with controlled access.
Either a room with camera surveillance, access controlled or individual bicycle lockers.
Bicycle locker.
A place where I can lock the bicycle and feel safe about it not being stolen. Preferably with camera surveillance.
Indoors, with limited access.
Racks that make it possible to lock the bicycle onto the frame, placed under roof and sheltered against wind and weather. Also, with air pump and washing options (for the salting during winter season).
Must be able to lock the bicycle onto something stationary somewhere. If there is a roof over the parking, then it is perfect.
A locked room with easy access. Hopefully with access to a lockable closet for equipment such as helmet and a change of clothes.
A place where the bicycle can stay dry, that gives a sense of safety.
The most secure is a bicycle locker, but they are so ugly those containers. So, visually, a bicycle hotel would have fit the environment better.
If I find a place nearby job, and able to lock it onto something stationary I am happy. At night, I use the garage.
Work: Bicycle parking below a roof, and preferably with the option to wash the bicycle. City centre: Not so important, during daytime it is safe to park in Trondheim. At night, it would be expensive anyway.
Bicycle racks in safe and bright conditions, preferably with camera surveillance. Should be many of those distributed around the city, also in outer parts of the city.
Dry area, without hardships to get to. Perhaps a bicycle hotel.
Bicycle parking with roof for city bikes. Bicycle hotel for road bicycles.
Bicycle locker but must be available in many places. Eventually, possibility to lock both wheels to the frame.
First of all, the option to easily lock the bicycle onto something stationary, a frame or something. The bicycle parking of my dreams would be to have a stationary frame that can be locked through the bicycle frame and locked with a personal lock.
Available, easy to use and completely free of use. Preferably with roof.
I do not cycle, but I think that I would have had the most use for a free of cost alternative where the bicycle can stay dry a secure.

End of trip facilities! I would love to have safe and covered parking for my bicycle. And a shower at my place of work where I could change clothes.
A bicycle rack that is not too tight and with a roof.
As a student - A cage with many slots that requires valid access for entry.
One that ensure that it is not possible to steal parts or the entire bicycle.
Bicycle locker.
Bicycle hotel seems nice, but will be limited to only park the bicycle in certain areas. It is a better way to secure the bicycle from theft.
Quantity in bicycle parking offers, short distance to the entrance where I want to be. This is just a speculation, but if it were to become normal with high-security, then I would feel more unsafe when that security was unavailable.
Easy to get around with the bicycle, good availability. Can leave the bicycle and lock it quickly.
Roof and secured against theft.
Free parking that is safe, close to campus or city centre.
Own lockers so we can leave bicycle bag, helmet, bicycle battery without having to bring those things along. One will fear that those things will be stolen otherwise.
In an open area, with possibility to lock both wheels onto something such as a stationary frame.
Bicycle shelter outside of Byggeteknisk at Gløshaugen would have been perfect! Has to use access card to get in, so nobody with bad intentions can get in, at the same time it is so easily accessible that it takes me the same time to lock the bicycle there - as it takes on a traditional bicycle rack. I like that I do not have to go through many buildings and doors to get to this.
Roof, and as few as possible people that have access to where the bicycle is.
Solid bicycle rack that supports the bicycle frame, not only the wheel, but also the possibility to firmly lock the bicycle to it. A roof to where I am going to park over longer time. In the city centre, closer distances to stores are more important than roofs for sheltering, so I can shop impulsively (do not apply to places outside of shopping malls).
Yes, it is pretty good with the boxes (bicycle lockers), if they are properly secured, since I have heard from people asking about "how easy it is to open them".
Parking with roof and possibility to lock the bicycle.
A way to hide the bicycle away from people generally.
Barricaded backyard/garage/bicycle room.
To have access to a bicycle parking place where we can leave the bicycle and know for sure that it will not be stolen or disassembled is the most important for me. It feels unsafe to park the bicycle in the city centre the way it is now. An individual box(locker)/closed with lock would have been perfect, and something I would have paid for.
More secure parking just outside of stores and stuff. Does not have to be paid or locked.
Secure and lockable bicycle lockers. Camera surveillance.

Indoors, locked inside and stationary lock with very limited people with access.
Bicycle locker or bicycle garage.
Expensive bicycle = Preferably bicycle locker. Genius when it can be reserved beforehand, so you know for sure that you have a place to leave the bicycle.
Sturdy and solid bicycle rack with a roof above.
Locked inside with roof above.
Bicycle rack.
With video camera and possibility to lock the bicycle onto something.
Bicycle locker feels the most secure and safe, since you have the locker by yourself.
To have the bicycle locked inside.
Closed shelter, preferably paid by the employer.
Easy accessible bicycle lockers.
At work: In a locked room
On a trip to grocery stores or next to recreational spaces: Good racks in public space (clearly visible) that is big enough to lock the frames on a cargo bicycle.
Its distance to workplace/home. Decent lighting. Protected from heavy rain and snow.
The current bicycle parking with cover is quite ideal, but sometimes people just put it so it's quite messy.
The bicycle parking must preferably secure and easily accessible (it must be quick to both lock the bicycle and retrieve it).
Close to workspace or university and weatherproof.
Bicycle parking with a roof or inside of a building (hotel).
Bicycle locker with friendly prices.
Solutions of today works ok for my needs (bicycle racks).
I have a "simple"/cheap bicycle that has low risk for being stolen, so the most important is protection against bad weather, since those are the factors that are decisive for where I leave the bicycle and how much I use it. Positive, if it (the bicycle facility) is helping the environment rather than just looking like a ugly bicycle locker, but everything that is easy accessible with roof has a tendency to get filled up.
Locked inside within walls in a rack.
Hotel.
Roof, camera etc.
For me, bicycle racks without roofs have worked pretty well so far. To lift the parking even more, it would be nice with more available bicycle parking with roofs. That way it will be more tempting to cycle on rainy days.
Bicycle locker, easy and avoids complicated parking.
Not too far away from where I am going. Should be easy and not too expensive.
Since the bicycle I have is not so expensive, then it would be ideal with a parking solution below roof. Perhaps a hotel, where it is possible to lock it in. If I had a more expensive bicycle, then I would wish for at least a hotel or a bicycle locker.

With a roof, and that it is placed.
Bicycle rack without roofing.
I have had problems with bicycle theft, so something that avoids this (which bicycle hotels/lockers do). Roofing is nice to protect the bicycle. Has to take short time to lock the bicycle, I have often short time.
In close relation to workplace/study place. Preferably in a locked room where only those who should have access, has.
I do not cycle, but if I did, bicycle hotel.
Increase good bicycle racks in several places in the city centre. By good, I mean they should be tall enough to be able to lock the bicycle frame too and not only the wheel.
A safe alternative in the city centre to make people choose the bicycle instead of driving.
Surveillance next to bicycle racks.
Indoors, heated room and with washing opportunities (for winter/salt).
Indoors (heated), so the bicycle is not standing outside exposed to the weather and wind (especially during winter). Good bicycle racks/stand that the bicycle can be locked into, but not the type that holds the wheels.
Secure parking solutions close to cinemas, theatres, concert hall, shopping malls and metrobus hubs.
Easy accessible and secure places to leave the bicycle without it being stolen.
Indoors and dry.
Home: Indoors, not heated. Work: Indoors, heated (>10 celsius degrees all year around, especially during winter). In the city, short stops (< 1 hr): Stand that supports the whole bicycle (Reversed U). In the city, longer stops (culture, meals, hobby etc): Locker or bicycle hotels by public transit hubs, long-time parking (several days ~ hurtigbåtterminal, togstasjon, flyplass): Locker.
Shelter or a locked bicycle box. Those have to be significantly safer than traditional bicycle locks.
I am often in a hurry and limited with time on my way to work, so then it has to be efficient and quick to park the bicycle. Roof/sheltered bicycle parking is an advantage, but preferably indoors with surveillance.
The way it is now is good, but a small roof here and there would be nice, for instance like in Gågaten at Norde Gate, Trondheim.
As a winter cyclist, I would like to have a roof over the bicycle when it snows.
Short distance to walk to end destination, easy to lock the bicycle to a bicycle stand.
Bicycle hotel or other solutions for the bicycle to be securely stored against vandalism and weather.
Enough facilities and preferably with roof.
A garage that can be easily rolled in to, with a locked door.
A little bit more secure bicycle parking, and improved sheltering from theft.
Solid stand that can lock the bicycle frame, without those bars that will damage the disc brakes. Preferably with a roof.
Bicycle racks.
It depends a bit on the settings. I have a pretty old bicycle, but a good one - that have been locked outdoor on a bicycle rack and been peacefully standing there. If I had a newer, more modern or an electric bicycle. I would

<p>have preferred a more secure place. Bicycle hotels are probably ideal, then the bicycle can avoid weathering and wind. But I would not have wanted to pay much for it with my current bicycle. With an electric bicycle, I would prefer a bicycle locker.</p>
<p>A solid bicycle stands in a place that has surveillance.</p>
<p>Free option for bicycle storage. Bicycle hotels is a really good option, and I will then travel with the bus after. It should be easy to just leave the bicycle at the "parking area", and not spend several minutes just to register etc. to use it. Eventually, pay for the bicycle after having been to the parking area, just to save some time.</p>
<p>Free bicycle hotels.</p>
<p>There are about twenty parking spaces available, each with a key attached and a cover if you plan on parking for an extended period or overnight.</p>
<p>Bicycle locker is perfect. Closed and locked, nobody can see if there is a bicycle in there or how expensive it is. Also, nice to leave behind helmet and backpacks.</p>
<p>Close to workspace or university and weather proof.</p>
<p>Current solutions work for my needs (bicycle racks).</p>
<p>It depends on the place and time. For many purposes it works with bicycle racks of good quality, with enough room to lock the bicycle frame onto. Many places in town, we do not even have that available. But, at the evening or night, I prefer to lock the bicycle indoors in a locker or in a bicycle hotel. It also applies for when I am going to leave for several days. For longer periods, it would be nice with a paid option that is cheaper than the ordinary bicycle hotel or lockers. It is important to be able to lock the bicycle onto a permanently mounted rack, also inside the bicycle hotel if more people have access.</p>
<p>A place where I can leave the bicycle, so it stays safe. Preferably a place that is under surveillance and filled with people.</p>
<p>Good distance between the bicycles to keep it neat, and a roof to prevent that the seat is getting wet.</p>
<p>Free and safe.</p>
<p>Free bicycle hotels.</p>
<p>Free bicycle lockers in many central places.</p>
<p>Preferably with a roof above, and the possibility to lock the bicycle.</p>
<p>Hotel.</p>
<p>Locked into something solid beneath a roof with surveillance. Eventually, a way that no one can access to it.</p>
<p>Might be the bicycle cabinets in regard to safety measures. Or parking under your building or room basement with lockers and some identification stickers or something noticeable.</p>
<p>Personally, I think a bicycle hotel are the best ones, and is the easiest definition of what I mean is an ideal solution. If I should list everything in keywords, then there is bicycle parking behind walls/fences where nobody can get to, except those who have actually parked their bicycles there. Important with overhang/roof so that my bicycle can be protected from various weather conditions. But it is a pity that there are very few of these bicycle hotels. I think they are aesthetically finer and have a higher potential than bicycle lockers - which can look very ugly and square.</p>

At work: Behind a locked port/door, with a roof. Ideally a heated room. In the city centre: Locked into something, preferably with a roof. Just next to your goal. Ideally, a bicycle locker, but I so far, I have only seen it placed far away from my goals.

Central placement, time efficient parking. Safe from theft.

Close to the city centre, so you do not have to go far after parking when you are picking it up again.

Bicycle hotel with some guarding, eventually good camera surveillance that makes it easy to report vandalism/theft.

Covered bicycle parking that is placed in a way with small risk of theft.

Bicycle locker.

A dry area without too much of a hassle to get to. Perhaps a bicycle hotel.

To be able to park it anywhere without it being stolen.



