Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
Department of Civil and Environmental Engineering

Mahgol Afshari

Identifying methods and tools toward more active mobility

Case Elgeseter gate

Master's thesis in Project Management
Supervisor: Alenka Temeljotov Salaj
Co-supervisor: Agnar Johansen, Jardar Lohne
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Abstract

As the world's population expands at a rapid rate, cities are dealing with difficulties such as traffic congestion, air pollution, road accidents, and urban sprawl. Cycling and walking are non-motorized modalities that require less infrastructure and do not utilize fossil fuels. They are also less expensive to deploy and maintain for both users and governments than motorized modes of transportation. As a result, this master's thesis aims to find strategies and instruments for greater active mobility. A scoping literature review, document study, a digital survey, and interviews were used to identify measures that might be utilized as incentives to promote walkability and bikeability in the Elgeseter neighborhood of Trondheim. The analysis is carried out according to the following research question: What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking? The findings identified motivators, barriers, and recommendations for increasing active mobility in the Elgeseter district. Even while practically every city in the world is keen to solve these concerns, they will require comprehensive planning methods that cover everything from land use to municipal infrastructure design. Such strategies are required to persuade individuals to adopt green, sustainable means of transportation as a lifestyle option rather than a legal need. The study adds to our understanding of the factors that influence commuters' willingness to engage in active mobility in the Elgeseter district.

Sammendrag

Ettersom verdens befolkning ekspanderer i rask hastighet, møter byer problemer som trafikkorker, luftforurensning, trafikkulykker og byspredning. Sykling og gange er ikke-motoriserte modaliteter som krever mindre infrastruktur og ikke bruker fossilt brensel. De er også rimeligere å distribuere og vedlikeholde for både brukere og myndigheter enn motoriserte transportformer. Som et resultat av dette er målet med denne masteroppgaven å finne strategier og virkemidler for større aktiv mobilitet. En omfattende litteraturgjennomgang, dokumentundersøkelser, 15 intervjuer og en digital undersøkelse ble brukt for å identifisere tiltak som kan brukes som insentiver for å fremme gang- eller sykkelvennlighet i Elgeseter-området i Trondheim. Analysen er utført i henhold til følgende forskningsspørsmål: Hva kan motivere innbyggere som pendler til eller reiser innenfor Elgeseter-distriktet til å endre adferd mot mer gange eller sykling. Funnene er identifiserte motivatorer, barrierer og anbefalinger for å øke aktiv mobilitet i Elgeseter-distriktet. Selv om praktisk talt alle byer i verden er opptatt av å løse disse bekymringene, vil de kreve omfattende planleggingsmetoder som dekker alt fra arealbruk til utforming av kommunal infrastruktur. Slike strategier er nødvendige for å overtale enkeltpersoner til å ta i bruk grønne, bærekraftige transportmidler som et livsstilsalternativ snarere enn et juridisk behov. Studien bidrar til vår forståelse av faktorene som påvirker pendleres vilje til å engasjere seg i aktiv mobilitet i bydelen Elgeseter.

Preface

The master's thesis was written at the Norwegian University of Science and Technology (Norges Teknisk Naturvitenskapelige Universitetet) in Trondheim in the spring of 2022. The author's interest in identifying methods and tools for more active mobility and determinants that are important for encouraging commuters towards active mobility has been the background for the master's thesis. These are fields that have received attention for a long time. The work with the master's thesis has been incredibly instructive.

Many should be thanked for their contribution to the thesis. I would like to thank my main supervisor at the faculty, Alenka Temeljotov-Salaj, and my co-supervisors, Agnar Johansen and Jardar Lohne. Their guidance, commitment, and good advice have been so beneficial. I appreciate the time they took to read and have regular meetings with me. I would also like to thank everyone who has accepted my request to have the interview and everyone who has participated in my digital survey. Their contribution with important perspectives has been essential to answer the master's thesis research question. Finally, I would like to thank all people that helped me through this thesis at NTNU, Trondheim kommune, Fylkeskommune, Statens vegvesen, Elgeseter gate residents, and the people who were involved in Elgeseter gate projects for their guidance through the initial stages of my work.

I am incredibly lucky to have had the opportunity to be around supportive people and finish my master's project. This master's thesis marks the end of two fantastic years in Trondheim and now, at this stage of my life, I am excited for what lies ahead!

Trondheim, 02. June. 2022

Mahgol Afshari

PART 1: Master's Thesis

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List of Abbreviations (or Symbols)

NTNU	The Norwegian University of Science and Technology
ZEN	Zero Emissions Neighborhood
ZEB	Zero Emissions Building
GHG	Greenhouse Gas
SDGs	Sustainable Development Goals
MDGs	Millennium Development Goals
WoS	Web of Science
SD	Science Direct

1 Introduction

1.1 Background

People are increasingly relocating to cities across the world, and many European nations are focusing on the creation of smart cities (Collins et al., 2021). The location, design, and operation of a residential or commercial complex influence how frequently people walk, bike, take public transportation, or drive, as well as whether their commute is pleasant or unpleasant. Many other elements, such as geographical qualities, cultural backgrounds, and understanding of the impact of travel on climate change, can also influence people's travel behavior. Walking and cycling, for example, may result in economic savings, reduced CO2 emissions, less noise and air pollution, and less traffic congestion (Rabl et al., 2012).

According to Trondheim's pledge to minimize Greenhouse Gas (GHG) emissions (Trondheim kommune. 2017), the city is striving to combat the consequences of urbanization, city development, and motorways as impediments to efficient collaboration in the Elgeseter region. The largest university and hospital in Norway, as well as several technologies and other businesses, are located in the region. The Elgeseter initiative has several purposes, and it is working toward the Sustainable Development Goals. Some of the project's goals include reaching zero-emission, consolidating sustainable lifestyles, promoting mental and societal health, advancing toward innovation and development in an urban setting, and accomplishing systemic transformation toward a sustainable society.

1.2 Case study description

Elgeseter gate is an urban road located directly south of Trondheim's city center, connecting Professor Brochs gate to Klostergata in the north. The road is a continuation of the major route that runs from the city center to the south. The term Elgeseter district will be used in this study to refer to the region surrounding Elgeseter gate. Figure 1.1 displays the case study area, which includes the Elgeseter gate, the surrounding region, and the - connecting roadways.

Figure 1.1: The focus area of the case study

1.3 Scope and purpose of the study

The master's thesis was written for the Department of Civil and Environmental Engineering at the Norwegian University of Science and Technology (NTNU) in Trondheim. The thesis was completed in the spring of 2022 under the subject code *TBA4910 Project Management, Master's Thesis* and its main focus is on identifying methods and tools that increase people-centric and active mobility that is relevant for the Elgeseter district. More specifically, the analysis ambitions to recognize incentives for increasing walkability and bikeability in the Elgeseter district. Based on this, the research presented in this study addresses the following main research question

"What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking?"

1.4 Structure

The IMRaD model for the structuring of the thesis, as shown in table 1.1 (NTNU Senter for faglig kommunikasjon (u.å)), was chosen as a starting point.

Table 1.1: Structure of the master's thesis

Introduction	Providing background for the chosen topic and research question, as well as describing the case study of the report.
Theory	Explaining the concepts and theories that are important to the phenomenon being investigated.
Methodology	Describing the background for the investigation and the methods used, including data collection, data processing, and strengths and weaknesses of the methodologies.
Result	Presentation of findings on walkability and bikeability motivators from the literature study in Chapter 4, Document study in Chapter 5, Digital survey in Chapter 6 and interviews in Chapter 7.
Discussion	The findings are discussed concerning the study topic and the research question.
Conclusion	Summarizing the thesis's main results and providing answers to the thesis's research question and some hints for further work.

2 Theory

In 122 nations around the world, more than 30% of adults were found to be physically inactive (Hallal et al., 2012). A considerable proportion of people in countries all over the world have adopted sedentary and physically inactive lifestyles (Van Dyck et al., 2013). This chapter provides a theoretical background on the relevance of physical activities in people's daily life, as well as how active mobility might meet this requirement. Furthermore, walking and cycling as two major types of active transportation are discussed, with bikeability being the more popular way of transportation among the public and also as a result of urban and transportation design and policy in cities, participatory planning and citizen cooperation are discussed. Finally, a summary of active mobility as part of the development of a new town area is presented.

Physical activity has been shown to increase emotion, sense of recognition, overall life quality, anxiety neurosis (Ohmatsu et al., 2014), as well as lower depression (Dunn, Trivedi, & O'Neal, 2001). Physical activity has been shown to benefit people's health by lowering their risk of being overweight or obese, as well as in the primary and secondary prevention of a variety of chronic illnesses and their risk factors, thereby improving global public health (Warburton et al., 2006). Physical activity can benefit people physiologically by having a favorable impact on their mental health, in addition to enhancing their physical health. Therefore, active mobility, which is linked to health, physical activity, and the prevention of chronic diseases, is increasingly being included in transportation and urban planning studies looking for alternatives to motorized transportation (Arbab et al., 2020).

Urban and transportation design and policies in cities have frequently proved detrimental to health. However, there is another feasible reality in which urban and transportation design and policy become advocates and drivers of excellent public health, resulting in healthier and more sustainable communities. However, how can we create cities that encourage health? This may begin with an awareness and acceptance of the evident relationship between land use, behavior, exposure, sickness, and death (Nieuwenhuijsen & Khreis, 2018). Figure 2.1 depicts a conceptual framework of linkages between urban and transportation design, environmental exposures, physical activity, and health (Nieuwenhuyse, 2016).

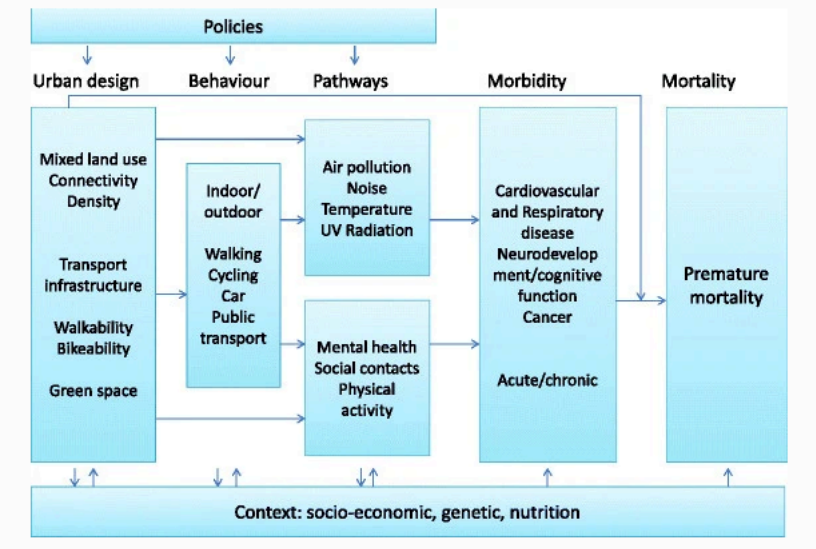

Figure 2.1: Conceptual framework for the relation between urban and transport planning, environmental exposures and health

According to the International Guidelines on Urban and Territorial Planning (UN HABITAT, 2015, p.20), 'Urban and territorial planning contributes to increased human security by strengthening environmental and socioeconomic resilience, enhancing mitigation and adaptation to climate change, and improving the management of natural and environmental hazards and risks.' Greater population and development density, for example, may result in shorter distances as destinations get closer to sources. Shorter trips are easier and more convenient to walk or bike. Diversity is a measure of an area's land use mix, which includes residences, stores, schools, and workplaces. When there are more stores close to home, individuals may drive less distance and utilize means of transportation other than the vehicle to go to the store. The design reflects the total infrastructure, and effective design promotes public and active transportation while discouraging the use of automobiles (Nieuwenhuijsen & Khreis, 2018).

Active transportation (i.e., walking/cycling to get from one place to another) can be done regularly, is a low-cost and easily accessible form of physical activity, and is simple to incorporate into adults' daily lives, it may be an important contributor to meeting the daily physical activity guidelines for health (Mertenes et al., 2016). Active mobility (also known as non-motorized mobility) is critical to the development of efficient and equitable transportation networks as well as the transition to more sustainable communities (Victoria Transport Policy Institute, 2016).

Non-motorized modes are environmentally friendly because they require less infrastructure (such as roads and parking spaces) and have low costs for users, governments, and the environment. They can also be easily integrated into public transportation networks, offering diverse mobility access for everyone, including kids, seniors, individuals with impairments or special needs, and the economically disadvantaged who might otherwise struggle to move independently (Victoria Transport Policy Institute, 2016). Beyond efficiency and equality, these modes provide a joyful and healthy way to move around the city, assisting in the creation of more livable communities and promoting efficient development (Victoria Transport Policy Institute, 2016).

Unlike passive mobility, active mobility, which includes physical locomotion activities such as walking and biking, has environmental benefits such as reduced carbon emissions and

traffic congestion (Helbich, 2017). Walking and cycling for transportation (referred to as "active mobility") are frequently considered to reduce CO2 emissions by substituting at least some motorized transit (de Nazelle et al., 2010). Furthermore, Non-motorized modes, such as cycling and walking, use no fossil fuel energy and require less infrastructure, have lower implementation and maintenance costs for users and governments, may be integrated into public transportation systems, and are a feasible option for the economically disadvantaged (Hermida et al., 2019).

Walking and cycling activities, among other sorts of physical activities, have recently gotten more attention from both civic and academic sectors as a way to increase people's physical activity levels. Their popularity was aided by a variety of factors. First, walking and cycling are suitable for people of all ages because they do not necessitate any special skills or equipment. Second, even though cycling is better for longer excursions, walking and cycling allow people to choose their preferred movement intensity. Finally, walking and cycling can assist people, particularly those from low-income groups, in breaking free from sedentary and inactive lifestyles (Brownson et al., 2000).

Cycling has several health benefits, including a lower incidence of obesity, greater cardiovascular fitness, and a lower risk of heart disease, diabetes, high blood pressure, and a variety of cancer side effects (Oja et al., 2011). In recent years, there has been an increasing interest in the bicycle as a healthy and environmentally friendly mode of transportation (Fishman and Cherry, 2015, de Kruijf et al., 2018). Bicycle excursions, for example, are predicted to save roughly 11 million tons of CO2 in the European Union (Neun and Haubold, 2016). Furthermore, encouraging more people to ride their bikes can help towns become more sustainable and livable (CIVITAS, 2017). As a result, in various places throughout the world, policies and initiatives targeted at boosting the use, accessibility, and safety of cycling have increased during the previous decade (Pucher and Buehler, 2017). Many communities throughout the world are interested in bicycling for transportation because of the accompanying public health and environmental benefits (Desjardins et al., 2021).

Participatory planning is a valuable tool for increasing the legitimacy of policy and decision-making by instilling a feeling of local ownership and ensuring the rights of residents and property owners are respected (Hassan et al., 2011). It is claimed that participatory planning is a superior management model to "traditional" management models relying mostly on expert advice. Among the explanations stated are:

- *A tool for designing the city's rules and relationships*. It offers a planning process with information and judgments on the vitality and adaptability of local systems, which aids in providing a clear image of the entire city complex system. The participant here can contribute to the decision-making system's learning capabilities by helping to refocus system-wide objectives and norms. This leads to a greater knowledge of the underlying causes of challenges, as well as the capacity to analyze the ramifications of any planned development activities (Hassan et al., 2011).
- *A tool for dispute resolution*. It deals with the growth of local conflicts as well as a shift in traditional notions of the connection between the ruling power and the capital community. People's acceptance of measures improves when they feel they have an opportunity to contribute. This allows the cleanup to be completed without interruption, which is beneficial if there are any issues or adversities. The more stakeholders participate in remediation, the more included they are, the more they are involved in the repair (by being accountable and formative), and the less they

would oppose (Shapiro et al., 1992). This leads to greater integration of power and authority, resulting in a more democratic society.

- *A method for identifying and prioritizing needs in the city*. Information is acquired from the people concerned to build solutions based on their expertise. This process results in a progressive rise in the engagement of ordinary residents in making decisions that touch their lives, at community levels of the organization, and in the responsiveness of local government. It is envisaged that a new degree of citizenship will arise (Hassan et al., 2011).
- *A tool for identifying and improving socially acceptable solutions*. People are utilized for information provision, which is referred to as consultation. Participation in this may be characterized as an interdisciplinary process of integrating, analyzing, and disseminating knowledge pieces from many disciplines to provide insights to decision-makers (Hassan et al., 2011).
- *A tool for instilling a new feeling of responsibility in both issues and solutions*, resulting in more successful and long-term development program/action execution (Hassan et al., 2011).
- *A tool for analysis and assessment planning*. Simply said, participation gives a larger and perhaps more thorough context for study and assessment. Members of the community can easily detect certain types of repercussions that are inherent in the acceptance of various alternatives. More importantly, community members may contribute to the production of relevant alternatives, saving the planning process energy that would otherwise be spent on the preparation and removal of irrelevant alternatives (Bremner, 1998).

The SDGs concept has fast acquired traction because of the rising necessity for sustainable development for the entire planet. Despite differences in definition, sustainable development encompasses the so-called triple bottom line approach to human well-being. Almost all cultures admit that they seek a balance of economic progress, environmental sustainability, and social inclusiveness, although the precise goals vary internationally, between countries, and within civilizations (Sachs, 2021). Nations gathered in New York in September 2015 to agree on the Sustainable Development Goals (SDGs)—17 global goals with 169 targets—to be achieved by 2030 (UN, 2015). Figure 2.2 depicts the Sustainable Development Goals (SDGs), also known as the Global Goals, which were established by the United Nations in 2015 as a global call to action to eradicate poverty, safeguard the environment, and ensure that by 2030, all people enjoy peace and prosperity.

https://www.letlaoslearn.org/volunteer-in-laos.html?gclid=CjwKCAjwve2TBhByEiwAaktM1JdS2y6Do0MhNc_Dit5vB4rnUg8DJnetkPSBkfm3cW2-3J4CNyKxgxoCi6QQAvD_BwE

Figure 2.2: Sustainable Development Goals

The SDGs, as a framework, expand the previous Millennium Development Goals (MDGs) in many areas, most notably by attempting to deeply integrate the social, economic, and environmental components of goals. This, in turn, involves connecting across time—ensuring that the short-term success of greater human well-being does not come at the expense of compromising long-term well-being by destroying the underpinning social and environmental capital on which our global life support system is based (Stafford-Smith et al., 2017). The SDGs are a set of 17 goals that include all areas of sustainability and are an ambitious move toward concrete targets for sustainable development in all sectors of society (Fleming et al., 2017).

This study is contributing to achieve four of the Sustainable Development Goals which are Good Health and Well-being (Number 3), Sustainable Cities and Communities (Number 11), Climate Action (Number 13) and Life on Land (Number 15). Figure 2.3, given by Fleming et al., (2017) depicts the 17 SDGs in greater detail than Figure 2.2.

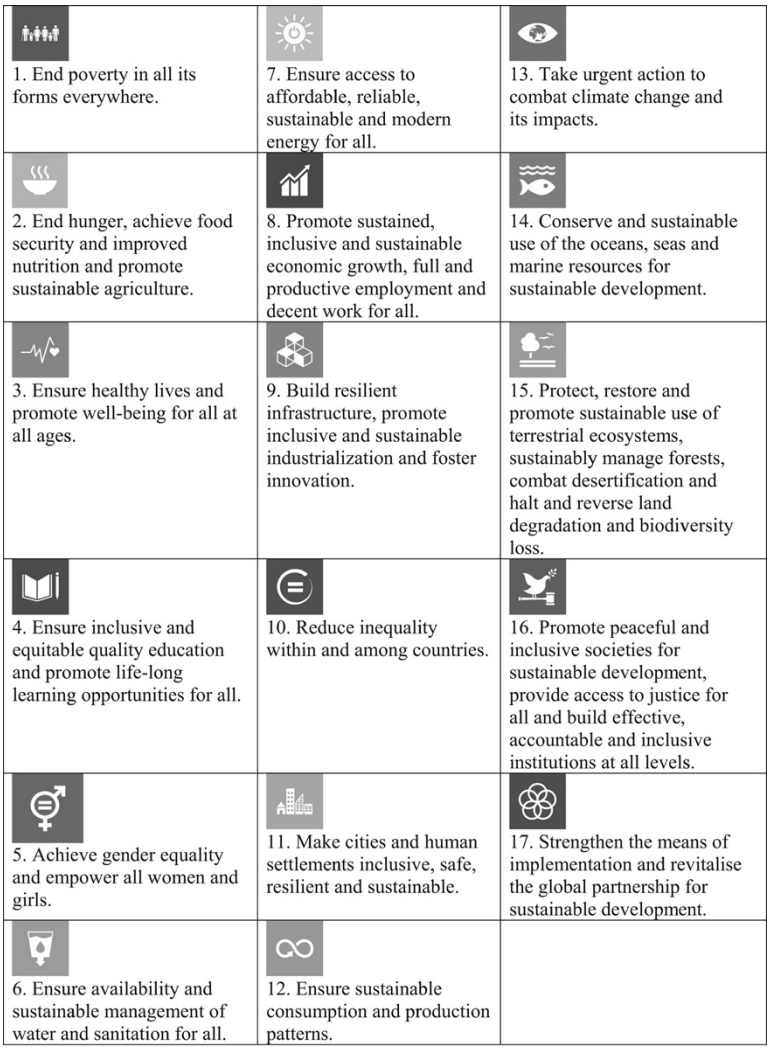

Figure 2.3: The 17 SDGs

Overall, the natural and manmade environments, as well as individual and household characteristics, all have an impact on the decision to travel by bicycle (Heinen et al. 2009). Reduced physical activity/active mobility can be caused by poor sidewalk conditions, limited access to recreational facilities, and a lack of viable nearby destinations. Bicycling infrastructure can help reduce greenhouse gas emissions (Zahabi et al., 2016), while other measures that promote human-powered modes can help improve air and noise pollution. These advantages motivate towns to encourage greater riding but doing so necessitates legislative changes that bring bicycling on par with other modes of transportation. Where people live and work has a significant impact on the transportation options they have, the destinations and amenities they can visit, and the routes they can take to go from point A to point B. As a result, bicycle research pays close attention to the built environment since elements that promote bicycling can be addressed by urban and transportation planners to potentially shift a substantial number of currently driving journeys (Desjardins et al., 2021).

By giving this background and by reviewing the works of literature, some *knowledge gaps* in terms of walkability and bikeability motivators and barriers have been found. In other words, there was no paper that only focused on the methods for motivating people towards more active mobility. Therefore, the current paper tries to identify the methods and tools for increasing active mobility and analyze the factors which can affect citizens' commuting

behavior, especially the factors that can motivate and encourage them towards more walking or biking.

The above section (Section 2) is slightly modified and augmented from my work on the Specialization project in the autumn of 2021.

3 Methodology

This chapter presents the scientific theory of methods in research projects and explains the methodological choices made in the thesis. This thesis has used four types of methods, consisting of scoping literature review, document study, digital survey, and interview. The procedure for these methods will be presented in the following.

3.1 Choice of method

There are several methods for gathering data to solve an issue. The technique chosen must be justified considering the situation (Dalland, 2017, p.225). In research, two methodologies are frequently distinguished: qualitative and quantitative.

The analysis of qualitative data, such as text data from interview transcripts, is known as qualitative analysis. Unlike quantitative analysis, which is driven by statistics and is essentially independent of the researcher, qualitative analysis is primarily reliant on the researcher's analytic and integrative abilities, as well as personal understanding of the social environment in which the data is obtained. Rather than forecasting or explaining, the emphasis in qualitative analysis is on "sense-making" or comprehending a phenomenon. For qualitative analysis, a creative and exploratory mentality is required, as well as a morally enlightened and participant-in-context attitude and a set of analytic tools (Bhattacherjee, 2012, Chapter 13). The data often has high nuance richness and can appear complex. In addition, the data can often be based on a few respondents, and in that way, it can be challenging to draw generalizable conclusions. There is also a danger of having a "research effect" with qualitative methods, which means that the actual study affects the findings from the phenomenon studied and hence also the results (Jacobsen, 2005, p. 130).

In the second method, numerical data obtained in a research endeavor may be quantitatively examined using statistical techniques. The statistical description, aggregation, and presentation of constructs of interest or relationships between these constructs are referred to as descriptive analysis. The statistical testing of hypotheses is referred to as inferential analysis (Bhattacherjee, 2012, Chapter 14). Quantitative approaches offer a significant benefit in that they may standardize and arrange information, making it easier to comprehend. Often, the procedure is also less labor-intensive, allowing more respondents to participate in the survey and increasing the likelihood of generalizing results. They are stricter and allow for less flexibility than qualitative methods (Jacobsen, 2005, p.132 and 133).

This thesis has chosen to be based on both qualitative and quantitative methods. The qualitative method provides the opportunity to perform thorough analyzes in a field. Its flexibility has allowed the task to be changed and clarified along the way. This has been extremely useful since important considerations have become uncovered during data collection. On the other hand, a quantitative survey allows for much more research to be conducted, including more participants. Naturally, I was able to generalize my findings more correctly over a larger sample of people.

3.2 Research design

Scientific research operates at two levels: a theoretical level and an empirical level. The theoretical level is concerned with developing abstract concepts about a natural or social phenomenon and relationships between those concepts (i.e., building "theories"), while the empirical level is concerned with testing the theoretical concepts and relationships to see how well they reflect our observations of reality, intending to ultimately build better theories. Over time, a theory becomes increasingly refined (i.e., fits the observed reality better), and science gains maturity. Scientific research involves continually moving back and forth between theory and observations. Both theory and observations are essential components of scientific research (Bhattacherjee, 2012, Chapter 1).

A research design is a detailed plan for collecting data in an empirical research effort. It is a "blueprint" for empirical research that aims to answer particular research questions or test specific hypotheses, and it starts with deciding which methods to use for data collection and analysis (Bhattacherjee, 2012, Chapter 5).

All materials in this thesis are original except the ones which have an explanation at the end of the section that comes from the "Specialization project" done in autumn 2021 or the conference paper which was written for Creon 2022.

3.3 Method triangulation

In the literature on social science research methodologies, there is a separate tradition that encourages the use of numerous approaches. This type of research technique is commonly referred to as convergent methodology, multimethod/multitrait (Campbell and Fiske, 1959), convergent validation, or "triangulation" (Webb et al., 1966). Denzin (1978: 291) defines triangulation generally as "the integration of techniques in the investigation of the same phenomena." Given fundamental geometric concepts, different views allow for increased precision. Similarly, organizational researchers might increase the accuracy of their assessments by gathering many types of evidence on the same phenomena. Triangulation reduces the risk of bias that can occur if only one method is used. This protects the author from being accused of using only one method, or the author's bias (Bowen, 2009). Moreover, the triangulation metaphor derives from navigation and military tactics, which employ several reference points to determine an object's precise location (Smith, 1975: 273).

Figure 3.1 depicts the master's methodology triangulation, which demonstrates how this thesis use multiple methodologies or data sources in research to generate a thorough knowledge of phenomena and to boost the reliability and validity of research findings.

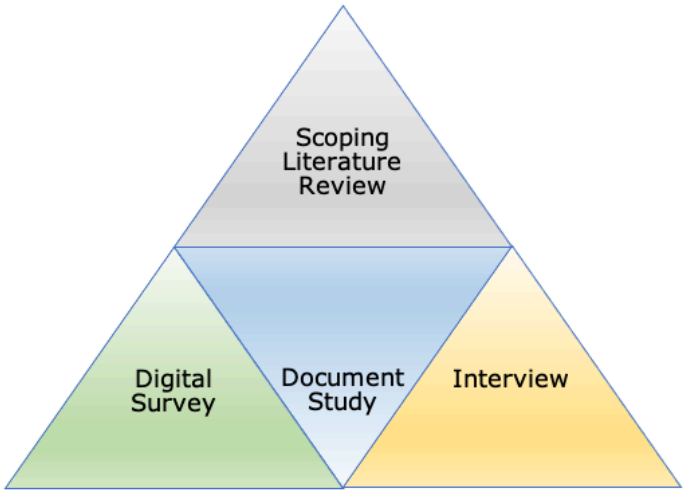

Figure 3.1: Master's method triangulation

3.4 Objectivity, Reliability and Validity

If research is to be credible, it must assure objectivity, reliability, and validity. *Objectivity* refers to evidence's neutrality, intending to reduce personal biases, emotions, or simply restrictions provided by the setting in which human feature annotation is accomplished (Frambach et al., 2013).

The consistency of evidence is what *reliability* is concerned about (Frambach et al., 2013). In other words, it indicates whether the job is reliable and trustworthy. Reliability may be accomplished by clarifying how data is gathered or alluding to potential causes of mistakes. *Validity* is concerned with the truth value of the evidence, or if we actually measured what we wanted to measure. Furthermore, validity implies reliability, but not the other way around (Frambach et al., 2013).

3.5 Scoping literature review

Scoping literature reviews is beneficial when the research seeks to identify possible research gaps by reviewing an existing body of literature on a certain topic (Munn et al., 2018). The structure of the scoping review was inspired by the framework developed by Arksey and O'Malley (Arksey et al., 2005). Scoping reviews are also appropriate strategies when the research questions are wide and comprehensive, with no goal of validating or refuting existing practices in the chosen sector (Arksey et al., 2005; Colquhoun et al., 2014; Munn et al., 2018).

3.5.1 Systemic search

Four databases were chosen for the scoping literature review: Google Scholar, Science Direct, Web of Science, and Scopus. The study was limited to articles, books, and theses that have been published in the last 10 years. My initial search string was "motivation AND commute AND walkability." Searching for this term yielded 9380 results in Google Scholar, 1748 results in ScienceDirect, 1 result in WoS, and no results in Scopus. Because 9380 and 1748 were unmanageable, I tweaked my search term. When I searched for "motivation AND commute AND bikeability," I received 709 results in GS, 1243 results in SD, 1 result in WoS, and no results in Scopus. Still, the increased figures were unmanageable, especially given the research question I needed to answer concerning both walkability and bikeability. As a result, I created a new search string.

By defining *"motivation AND commute AND walkability AND bikeability"* as the main search string, 447 results appeared in GS, 694 results appeared in SD and no results in WoS and Scopus. Based on the Research Question, the titles of the findings were read to select the most relevant literature for the topic. I removed 257 useless papers from Google Scholar by merely reading the titles, and I transferred 190 papers with relevant titles to Mendeley. After discovering 694 results in ScienceDirect, I narrowed them down to just subscribing journals. So, after receiving 565 results from SD, I began reviewing the titles and deleting extraneous items. I removed 409 uninteresting publications from ScienceDirect by merely reading the titles and transferred 156 papers with relevant themes to Mendeley.

I read the titles of my findings based on my Research Question to determine which ones are relevant and which are not. What I mean by irrelevant titles is that they included items in the title that had nothing to do with my project topic at all; just a few of the terms in my research string were in those papers, but the major emphasis of those papers and their study topic was so distant from what I was seeking for. As a result, I eliminated them and only transferred the ones that I believed would be related to my theme.

After transferring all 346 relevant articles based on their titles to Mendeley, 5 sets of duplicates have been found. So, for the next step, I started to read the abstracts of the 341 remaining documents and transfer the relevant ones to the comparison table. By reading abstracts, 53 final documents were chosen as the most relevant to the research topic. The framework for the scoping review performed in this paper is visualized in Figure 3.2.

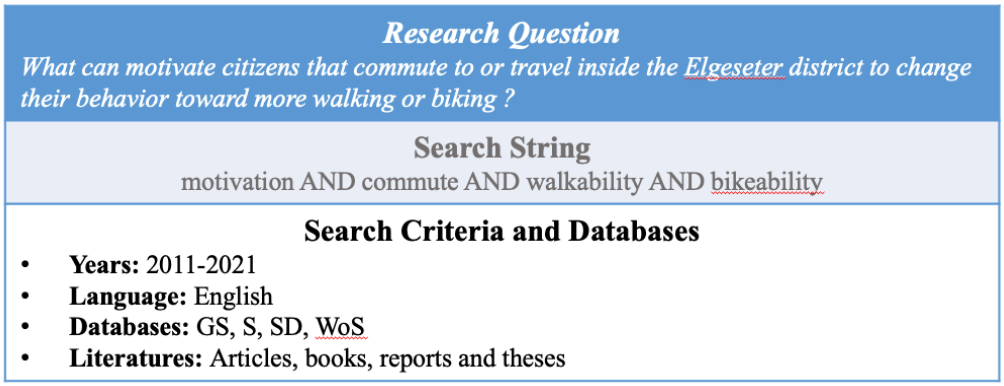

Figure 3.2: Framework scoping study

3.5.2 Searh procedure

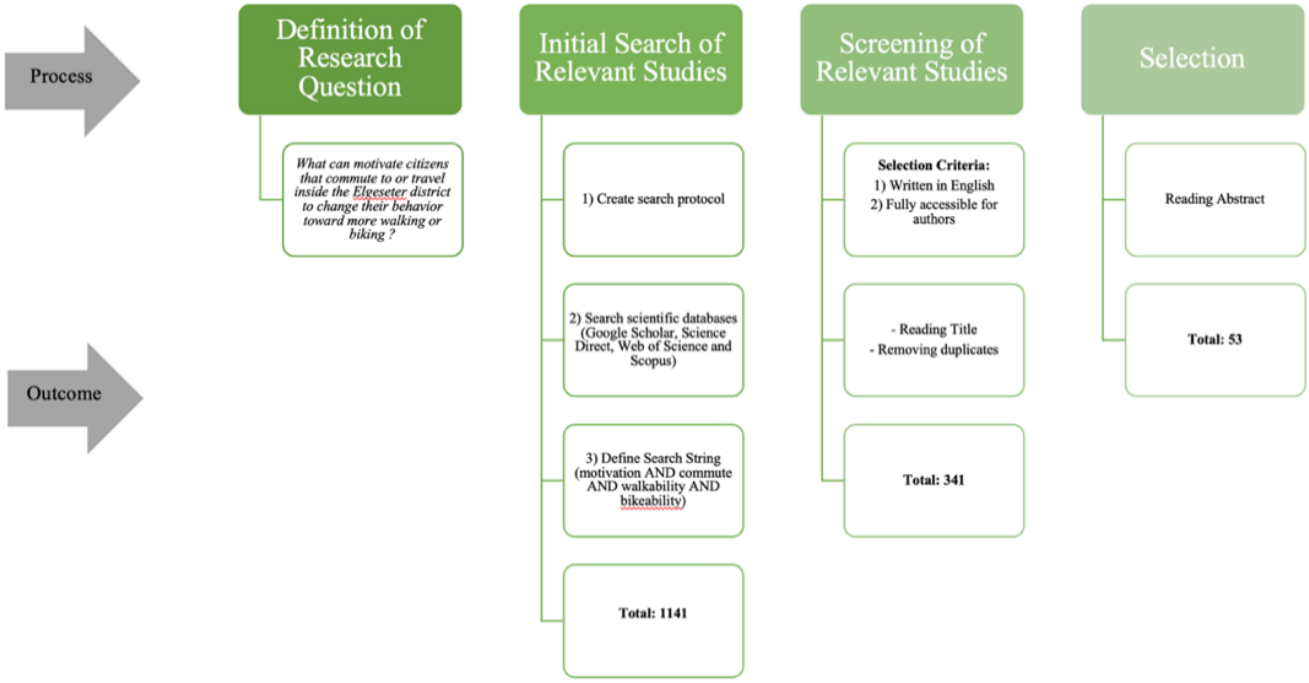

Figure 3.3: Scoping review process as followed in the research presented in this thesis

Following the protocol of the scoping review (Arksey et al., 2005), the steps are explained as follows (Figure 3.3):

1. One research question is defined.
2. After several trials and errors, an initial search of relevant studies was conducted using available scientific databases with the following search string: "motivation AND commute AND walkability AND bikeability"
3. The selected databases were Google Scholar (GS), Scopus (S), Science Direct (SD), and Web of Science (WoS).
4. The language is limited to English, and the year of publication was set from 2011 to 2021.

3.5.3 Filing of articles and data analysis

Once the preliminary conditions were met, the searches in the specified databases were carried out using the techniques shown in Table 3.1.

Table 3.1: Search strings and sampling

Search term	Google Scholar	Science Direct	Web of Science	Scopus	Access date
motivation AND commute AND walkability	9380	1748	1	0	11.Nov.2021
motivation AND commute AND bikeability	709	1243	1	0	11.Nov.2021
motivation AND commute AND walkability AND bikeability	447	694	0	0	11.Nov.2021
By only reading the titles	190	156	0	0	15.Nov.2021
5 sets of duplicates have been found	186	155	0	0	18.Nov.2021
By only reading Abstracts	53		0		24.Nov.2021

Table 3.1 displays the number of examined publications that were chosen for further investigation. As a comparison table, these documents were inserted into an excel file. This table contains nine columns that describe each paper. The characteristics used to describe the investigated documents in the comparison table were Title/Year, Author,

Institution/Country, Publisher, Abstract (which is divided into four categories: Purpose, Method, Result, and Implication), Relevance to the issue, Type of publication, Keywords, and Link. The more practical studies are indicated in green in this table. The comparison table is included in Appendix 1.

3.5.4 Limitations to the analysis

It should also be emphasized that the research methodology used in this study has some limitations. The snowballing process, for example, has only been applied to a subset of the articles, not all of them. The bulk of the documents was scanned, which requires quickly reading texts to find a specific piece of information. By removing these limits, there is a higher chance of generating more valuable results.

3.5.5 Objectivity, Reliability, and Validity

The focus of the publications has been on numerous criteria that make the information credible, such as using subscription journals and assessing the impact factor. Furthermore, it was critical to use content that was not obsolete, therefore none of the articles are more than ten years old. This is how an attempt to shed light on present attitudes and practices has been made.

To guarantee objectivity in the literature research, attempts were taken to search multiple databases and apply permutations of search keywords and refinements to ensure that the literature selected was the most relevant. It is likewise concerned with getting literature in a verified manner.

The validity and reliability of the reports utilized in the thesis are assessed. Some of the reports are supplied by supervisors who have the expertise, experience, and background in the thesis area. Furthermore, the reports are written by well-known organizations. Because the reports are mostly authored by or on behalf of organizations, detailed assessments of the report's objectivity were undertaken during the study. Most of the reports are also traceable because they are published on the internet.

The articles are thought to be valid because they fill in or embellish terminology, methodologies, or trends that are necessary background material for considering walkability and bikeability motivators potential. To guarantee that the selected literature was related to the thesis and reputable, it was analyzed in addition to keywords and content in which the research paper was substantially cited further. As a result, these publications have been examined with this in mind, and conclusions that are no longer valid have been eliminated.

The above section (Section 3.5) is slightly modified and augmented from my work on the Specialization project in the autumn of 2021.

3.6 Document study

Document study is a methodical process for studying or assessing documents, both printed and electronic (computer-based and Internet-transmitted). Document analysis, like other analytic procedures in qualitative research, necessitates the examination and interpretation of data to elicit meaning, acquire insight, and build empirical knowledge (Corbin & Strauss, 2008; see also Rapley, 2007). Documents contain text (words) and images that were recorded without the intervention of a researcher. Document study is frequently used in conjunction with other qualitative research methods as a form of

triangulation—"the combining of approaches in the study of the same issue" (Denzin, 1970, p. 291).

Non-technical literature, like reports and internal communications, can provide empirical data for case studies (Mills, Bonner, & Francis, 2006). Furthermore, documents of all kinds can assist the researcher find meaning, improving knowledge, and discovering insights pertinent to the study subject (Merriam, 1988, p. 118). This master's thesis uses qualitative document study to investigate and comprehend the contents of multiple documents.

3.6.1 Selection of documents

The document analysis in this master's thesis is based on six main documents, one from a collaboration between Milijøpakken, Trøndelag Fylkeskommune, Jernbane-direktoratet, Trondheim kommune, and Statens vegvesen, three of which came from Trondheim kommune, one from Trøndelag Fylkeskommune, and one from COWI's pedestrian and bicycle registration figures.

All of Trondheim kommune's papers, as well as those on which Milijøpakken, Trøndelag Fylkeskommune, Jernbane-direktoratet, Trondheim kommune, and Statens vegvesen collaborated, are open to the public and may be easily accessed by searching their titles. My co-supervisor gave me one from Trøndelag fylkeskommune, and one from COWI came from one of the interviewees who works as a bicycle planner in Trondheim kommune. In addition to these six key sources, snowballing happened, which implies that the author of this thesis examined some of the important reports referenced in these six documents in greater depth.

3.6.2 Analysis of documents

The analysis of the documents began with a focus on the dates on which they were published. So, first, the document, which was co-authored by Milijøpakken, Trøndelag Fylkeskommune, Jernbane-direktoratet, Trondheim kommune, and Statens vegvesen and published in 2018, was read. The records from Trondheim kommune were then reviewed to discover how Trondheim kommune devised the process of designing the Elgeseter gate and the surrounding region. Two of the documents from 2019 were examined first, and then the document from 2020, which focuses on walkability and measures to encourage people to walk more in the neighborhood, was read. The ideas provided by Trøndelag fylkeskommune in 2021 were checked later, and finally, the registration figures for walking and biking generated by COWI were analyzed to realize the number of people who walk or bike in the area, which revealed that the number of pedestrians and bikers is significantly reduced in the entrance of Elgeseter gate.

Various parts of the thesis's topic have been conducted in each document, such as;

- Identifying current challenges in the Elgeseter district
- Decisions that are taken by the municipality and associated entities
- Evaluation of present pedestrian, cycling, and automobile links, as well as meeting spots and green spaces, and identification of opportunities to improve them
- Outlining some general planning principles
- Methods for increasing mobility and transportation
- The significance of accessibility, safety, and comfort in drawing individuals to active mobility
- Presenting some remedies and suggestions for existing traffic problems

- Also included are statistics on the number of active pedestrians and bikers in the region.

3.6.3 Objectivity, Reliability, and Validity

One of the primary benefits of a document study is that it allows researchers to research issues to which they do not have simple physical access. It is also devoid of reactivity, which is especially important when the content is prepared for another purpose.

Based on Bowen (2009), it is an efficient, cost-effective, and stable approach that allows for the analysis of a wide range of materials. But there are also several disadvantages to this method. For example, as the data being studied in a single document analysis is not meant to be utilized for research, it seldom contains extensive information that may be used to answer research questions. Furthermore, it might be difficult to locate the papers that have been studied, making the process untrustworthy. There is also a risk that the papers being evaluated include bias, as they frequently represent the beliefs and attitudes of organizations seeking to portray themselves favorably. Overall, the document analysis is regarded as valid and reliable.

In the process of document analysis in this master thesis, all materials were released during the previous four years and are deemed up to date. This increases the document's validity. Furthermore, the bulk of the materials has been created by actors and people with professional competency in what they say, which increases their reliability. Throughout the project, efforts were made to ensure the material's traceability and to examine any potential bias in the papers. This improves objectivity.

3.7 Digital survey

Digital surveys are presently one of the most popular data collection tools. The explanation for this is partly due to its low cost and capacity to capture enormous amounts of data in a short period of time. Digital surveys can be distributed to a substantial number of people in a variety of geographic areas and places, and they can be done and processed fast (Digital Survey Research, Retrieved 2022).

3.7.1 Survey procedure

The digital survey for this research was prepared in Nettskjema and in both Norwegian and English, and it began with a brief overview of the case study and the goal of my master's thesis. There were 14 questions in all, three of which were optional. Seven of them were questions with radio buttons, three were questions with checkboxes, two were matrix questions with radio buttons, and two were open questions. The survey form has been attached in Appendix 2.

I opened the survey form on April 1st and shared the link with the ones I know who reside or commute in Elgeseter gate. On the same day, the link was also posted in Facebook groups for Trondheim students and residents, as well as on the LinkedIn platform. By the end of April 4th, 89 replies had been received. On April 5th, the link was circulated in several Innsida channels, and 18 additional answers were added.

After that, I prepared a paper with a brief description of my study goal and the QR code and distributed it to some students in Gløshaugen, some pedestrians in Elgeseter gate, one hair salon in Elgeseter gate, and I also placed it in the post boxes of some of the houses in Elgeseter gate. By the end of April 18th, 116 additional answers had been received. The papers were then placed on several bikes parked in Gløshaugen, and I

handed them to the students and Elgeseter gate pedestrians one more time. So, by the end of April, a total of 283 answers had been received. On the 13th of May, I closed the survey form.

3.7.2 Survey analyzing

The survey's analysis began by exporting all the data to an excel file. The data cleansing procedure was then initiated. Each question (both the Norwegian and English versions) was exported into a single excel sheet, and all Norwegian terms in the replies were converted into English so that all responses were in one language. The questions were then grouped, and graphs were created based on their substance and connection to the other questions. The charts were created in the 2-D column, 3-D pie, and Doughnut formats to best display the results.

This study's digital survey was not only quantitative, but also qualitative, because many of the respondents wrote several comments in open questions about the motivators for increasing walkability and bikeability in the area, the barriers in the Elgeseter district, and their experiences with the topic. As a result, the data have been added to and evaluated alongside the survey findings.

Furthermore, I attempted to communicate with Elgeseter gate commuters by setting up a booth in the area and showing the commuters eight photographs and asking them to select two of the photographs that they loved the most. The images depicted several activities that may be implemented in the region to encourage inhabitants to walk and bike more. Section 6 mentions the outcomes of this part.

3.7.3 Objectivity, Reliability, and Validity

The occurrence of bias might explain the objectivity of the digital survey used in this investigation. This survey was considered objective since it was anonymized and there was less risk of bias in it. It is considered reliable since 283 individuals responded to the survey, which is a large quantity for this research. It is also regarded as valid because all of the rules and procedures were followed precisely during the development of questions, distribution of them to the appropriate persons, and analysis of them.

There is one possibility that can always occur during data collection in a survey, which is the difficulty in understanding whether the responses read the questions and answered them with a high concentration or not, which, based on a large number of comments that the respondents wrote in this survey, has a low chance of occurring.

3.8 Interview

Interviews are a qualitative research approach that entails "doing thorough individual interviews with a limited number of respondents to investigate their perspectives on a certain topic, program, or issue" (Boyce & Neale, 2006). Qualitative interviews have been mostly classified into three categories: unstructured, semi-structured, and structured.

3.8.1 Interview form and interview guide

Interviews can be conducted in a variety of ways. In this thesis, a semi-structured interview was conducted, which will be detailed below.

Whereas unstructured interviews are undertaken in combination with the gathering of observational data, semi-structured interviews are frequently the main data source for a qualitative research project and are generally organized in advance at a certain time and

location outside of ordinary happenings (Adams et al., 2002). They are often structured around a series of predefined open-ended questions, with additional questions arising from the interviewer-interviewee exchange. Semi-structured in-depth interviews are the most utilized interviewing method for research, and they can take place with individuals or in groups. They are typically performed only once for an individual or group and might take anything from 30 minutes to several hours to complete (DiCicco-Bloom & Crabtree, 2006).

In this master's thesis, 15 interviews were conducted, 12 of which were individual interviews and two of which had two interviewees and one which had three interviewees. In all, 19 participants were interviewed in a semi-structured format. The interviewees had varying levels of expertise regarding the phenomenon. There was a good chance that there would be items in the interview that were not covered in advance in the interview guide. So, at the end of the interview, the interviewees were also asked if they had any other comments. This is how the interviewee was given the opportunity to convey crucial themes that they felt were not covered in the interview.

The interview guidelines were created depending on each interviewee's background, position, and the target group to which she/he belonged to. Certain questions were comparable in all interview guides, while others were unique dependent on the interviewee's expertise. All interviews begin with a discussion of my subject and thesis goals, followed by queries about the interviewee's background (warm-up questions), and finally with professional inquiry. It was conceivable that more questions would be asked as a consequence of the conversation, or that some of the planned questions would be amended as a result of the discussion. Interview guides have been shown in Appendix 3.

3.8.2 Selection of interviewees

The interviewees are classified into three categories: public, private, and people. Fylkeskommune, Trondheim kommune, and Statens vegvesen were the target groups for the public sector. Elgeseter gate residents (building owners/rentals) are put in the private sector, and in the people sector, those participating in Elgeseter area initiatives, ZEN (Zero Emissions Neighborhood) researchers, Elgeseter area daily commuters, an active biker, and an active pedestrian are placed. They were chosen deliberately. That is, one selects persons who have the necessary expertise or abilities to solve the problem in a methodical manner (Thagaard, 2018, s.54). Table 3.2 shows the target groups, interviewee positions, and the date of the interview.

Table 3.2: List of interviews

	Target groups	Interviewees' positions	Duration of the interviews	Interview date
Public	Fylkeskommune	- Project manager, Road section - Senior engineer, Department of Roads, Section of Road Sciences	56 minutes	19.Apr.2022
	Trondheim Kommune	Project manager in the mobility and transport unit	57 minutes	28.Mar.2022
		Bicycle planner	35 minutes	11.Apr.2022
		- Municipal director - Senior consultant - Advisor on businesses at the municipality director's office	49 minutes	02.May.2022
	Statens vegvesen	Working in the Transport and Society section	58 minutes	30.Mar.2022
		Working in the Traffic safety department	52 minutes	06.Apr.2022
Private	Elgeseter gate residents	Housewife	32 minutes	24.Mar.2022
		PhD student	28 minutes	22.Mar.2022
People	Involved in Elgeseter area projects	Chief Development Officer	50 minutes	22.Mar.2022
		Civil architect, MNAL, Planner	1 hour	25.Mar.2022
	ZEN	Research Scientist	38 minutes	25.Mar.2022
		Researcher and Urban Planning Expert	29 minutes	27.Apr.2022
	Daily commuters	Real Estate Broker at Heimdal Eiendom	Written interview	22.Mar.2022
		Researcher at department of marine technology	45 minutes	21.Mar.2022
	Active biker in Trondheim (International culture representatives)	Master student	33 minutes	25.Mar.2022
	Active pedestrian in Trondheim (International culture representatives)			

3.8.3 Conducting an interview

The interviews took place between the 21st of March and the 2nd of May. The somewhat long interview period is owing to the large number of interviewees, the slow response time to arrange an appointment interview time, and the Easter vacation break. The interviews lasted between 29 and 60 minutes, depending on how much time the candidates had available and how long it took to finish the conversation.

As some of the interviewees couldn't have the interview physically, three of the interviews were performed digitally in Microsoft Teams, one interviewee answered the questions by email, and the remaining interviews were conducted physically.

3.8.4 Analysis of the interviews

You must observe the NSD privacy requirements when writing a thesis for NTNU. Therefore, all interviewees have been provided with a consent form, which explains all the terms and conditions of the interviews and must be granted for the interviews to be utilized as findings to solve the problem. The consent form is attached in Appendix 4.

All digital interviews were video recorded, while all physical interviews were voice recorded. The author transcribed the video and audio recordings directly, rather than using transcription software.

The interviews should be analyzed in two stages: description and conceptualization. The term "description" refers to offering a narrative of the instance or cases under consideration, whereas "conceptualization" refers to systematizing and classifying the facts and determining how they aid to explain the phenomena under research (Hoyos et al., 2012). In this study, the raw data was described by transcribing all of the interviews and looking over the notes collected during the interviews. This is followed by data classification. Categorization is a method of simplifying complex and extensive data. It is accomplished by categorizing utterances and phrases based on predefined criteria. These categories must be problem-relevant and theoretically sound (Jacobsen, 2005). The interview findings were then organized according to thematic issues addressed by the various respondents and sources.

3.8.5 Objectivity, Reliability, and Validity

It comments on numerous areas of data gathering that are critical for transparently presenting interview findings. Objectivity was sought by asking open-ended questions that were unaffected by one's own opinions. It needs to be mentioned that two of the interviews had two interviewees. A potential flaw with several interviewees in the same interview is that one interviewee is not permitted to speak or is hesitant to make claims. To avoid this, questions were asked of all interviewees, and enough time was set aside for the interview.

In general, it is acceptable to assume that the reliability of the interviews is assured by drafting one interview guide in advance, as well as preparation for the important themes before having the interview according to the several target groups. This guarantees that you ask the same questions for all the interviews and can provide insight into which findings are consistent and which are not. This increases the validity of the data and makes it easier to form conclusions. The sample used for the interview is considered reliable since it includes a variety of people in diverse positions. In other words, the author attempted to look at the issue and problem in Elgeseter gate from several viewpoints, such as interviewing experts in the public and private sectors, as well as residents and daily commuters in the neighborhood.

4 Literature study

In this chapter, the results are presented in two different categories. In the first section, the focus is on descriptive analysis, and in the second section, an overview of the overall findings from the literature is presented.

4.1 Descriptive analysis

In this section, the descriptive findings from the literature review are analyzed from two different aspects. In the first part, the number of publications of the examined papers during the last 10 years is provided and in the second part, the top journals are identified.

4.1.1 Number of publications

In general, there was a notable increase in the number of publications connected to active mobility in 2020 and 2021, with 9 and 10 publications, respectively. Between 2011 and 2019, the number of papers published ranged from three to six, except for 2013, when no relevant papers were found. Figure 4.1 depicts the number of publication trends from 2011 to 2021.

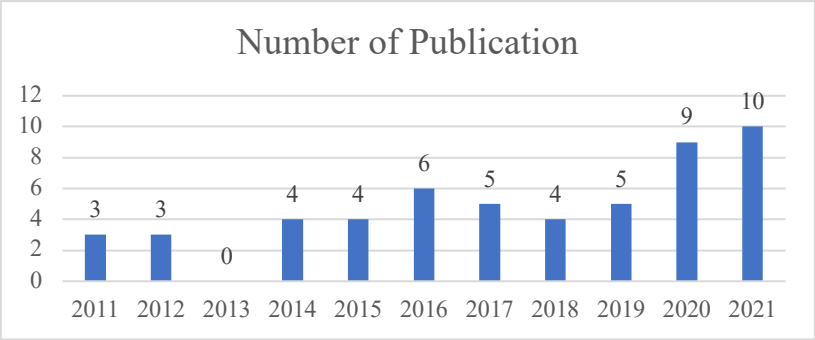

Figure 4.1: The number of publication trends between 2011-2021

4.1.2 Top journals of the examined papers

"Transportation Research Part A: Policy and Practice" and "Environmental research and public health," each with four papers, were the top journals in the field of study of this report, according to the analysis. In addition to them, three other journals, each with two papers, were active in this instance. The remaining papers originate from grey papers, other journals, conference proceedings, and publishers, with each having less than two papers. The number of papers in the most prestigious journals for the 53 examined papers is depicted in Figure 4.2.

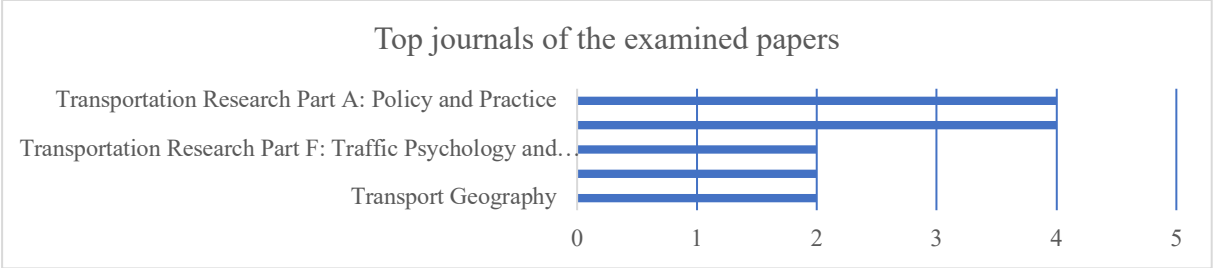

Figure 4.2: Top journals of the examined paper

By presenting the descriptive analysis in this section, the main focus of the next part will be on four different sets of findings from the literature.

4.2 Findings from the literature

In order to identify approaches to increase active mobility, the main findings from the scoping literature review are categorized into four groups. First, the benefits of active mobility are presented. Then, bikeability and walkability motivators are discussed respectively, and finally, the barriers to active mobility are mentioned.

4.2.1 Active mobility advantages

Active transportation modalities are a low-cost means of commuting with a low environmental impact. Based on Walks (2014), among adult commuters, there is a strong link between general psychological well-being and active transportation. Because of their low cost, flexibility, beneficial physical and psychological health impacts, and zero emissions, active modes (such as walking and bicycling) are deemed green, economic, equitable, and convenient (Gan et al., 2018). Walking or cycling as an alternative to motorized transportation for everyday journeys are examples of active mobility modes. Based on previous studies, each of these alternatives is beneficial for the communities and they have many advantages for the people, societies, and environment.

Cycling as one of the active mobility modes has been shown to reduce the incidence of obesity, increase cardiovascular fitness, and reduce the risk of heart disease, diabetes, high blood pressure, and a variety of cancer-related side effects (Oja et al., 2011). Cycling may also provide financial benefits, as well as reduced CO2 emissions, noise and air pollution, and traffic congestion (Rabl et al., 2012). Mueller et al., (2015) believe that cycling for transportation has physical health benefits, such as lower all-cause mortality, diabetes, weight gain, and cardiovascular disease. In addition to Mueller, Menai et al., (2015) also mention that cycling for transportation has the potential to raise physical activity levels in adults because it is a simple and inexpensive form of exercise that can be adopted into daily life at any age.

Moreover, bicycling infrastructure expansion can reduce greenhouse gas emissions (Zahabi et al., 2016). Kim et al., (2016) believe that bicycling is critical for creating a city with sustainable development by lowering pollution from motorized vehicle emissions, improving inhabitants' health and physical fitness, and, most critically, minimizing road traffic accidents. Cyclists also tend to feel more motivated when they arrive at work or school, and cycling is the mode of transportation that has the least detrimental impact on punctuality (Loong et al., 2017). As a result, promoting bikeability and walkability as a mode of transportation can help communities become more sustainable and livable.

In addition to the above benefits, some other advantages of active mobility have been found in the literature which is mentioned in table 4.1.

Table 4.1: Active mobility advantages

Orellana et al., 2016	Active mobility (also known as non-motorized mobility) plays a key role in both developing efficient and equitable transportation systems and in moving towards more sustainable cities.
Merten, 2016	Since active transport (i.e., walking/cycling to go from place to place) can be done regularly, is an inexpensive and very accessible form of physical activity and is easy to schedule in the daily lives of adults, it might be an important contributor to reach the daily physical activity guidelines for health.
	Cycling to work might decrease stress, increase vitality, health-related quality of life, improve cognitive function and mental well-being (i.e., person's psychological health, mood, and self-perception). At the same time, cycling for transport also has many other advantages besides its positive health effects. First, cycling implies economic advantages for cyclists such as the reduction of their gasoline purchases. Next, environmental benefits like the reduction of CO2 emission or the reduced noise are also clearly demonstrated. Finally, increasing the proportion of cyclists instead of car drivers could reduce traffic congestion and increase traffic management benefits.
Washington et al., 2017	There are good reasons for the encouragement of cycling as a mode of transportation: it is healthy, sustainable and it may promote increased mobility and access.
	Daily recommended activity can be achieved by active transportation.
	Cycling is also better for the environment than other modes of transportation by nature because of its use of human-propelled energy.
	Cycling can "reduce air pollution… traffic congestion, advance energy conservation and promote environmental quality,"
	Cycling responds to public health, environmental and mobility issues in cities.
	The bicycle can increase mobility and access to jobs and other destinations by providing a cheap form of transportation that allows users to cover longer distances than would be possible on foot.

4.2.2 Bikeability motivators

Changes in travel behavior have been demonstrated to be one of the most effective ways to reduce greenhouse gas (GHG) emissions in transportation. Based on this fact, cycling is becoming increasingly popular as a non-automobile means of transportation. Therefore, the focus of this section is on introducing some incentives which can lead to an increase in the rate of biking among people.

According to prior research, there are a variety of bikeability motivators that can encourage people to choose riding as a mode of transportation. Winters et al., (2010) present that in Vancouver, Canada, different sorts of bicyclists, both existing and potential, rated "routes with magnificent scenery" as a top motivator, slightly higher than routes with divided bicycle tracks or a flat slope. In another research, Heesch et al., (2012), compared biking incentives between men and women and mentioned that women were significantly more

motivated by fun and enjoyment, getting fresh air, incorporating physical activity into a busy lifestyle, confidence in their cycling abilities, seeing other people cycle, encouragement from others, convenient or inexpensive mode of transportation, and environmental concerns than men.

According to Dill et al., (2013), protected bike lanes, known as "gold standard," bike lanes, are perceived to be safer than their non-protected counterparts because they use a barrier to separate cyclists from motorists. This sense of security, or comfort, could be critical in drawing more bicycles onto the roads. Furthermore, active lifestyles can be encouraged by environments that allow individuals to securely walk and cycle for transportation (Trowbridge et al., 2013)

In another study, Habib et al., (2014) indicated that people who have a greater perception of a city's bikeability and a low level of safety awareness are more likely to pedal for utilitarian reasons. Furthermore, the perceived connection and quality of bicycle infrastructure are major factors in visitors' decision to use bicycling as their primary mode of transportation (Puello et al., 2015). Cole-Hunter et al., (2015) mentioned public bicycle sharing in their paper, and based on his research, nearby public bicycle sharing stations were a significant favorable indicator of bicycle commuting. It is also important to consider the quality of the urban environment. In other words, areas with trees and green space are also associated with more cycling.

While many research studies are discussing bikeability motivators without focusing on specific areas, some other researchers present their findings based on different case studies in different geographical locations. For example, based on research in Brisbane, Australia, shorter distances to destinations, such as a commercial district with jobs and a river with bicycle routes, enhanced the likelihood of riding (Heesch et al., 2015). According to another study, bicyclists in Seattle, Washington choose short, flat routes with well-connected amenities on highways with low traffic speeds. Their research discovered higher variation in preferences for views along routes with mixed land use, street trees, illumination, and city elements (Chen et al., 2017).

According to focus on environmental aspects, Marquart et al., (2020) believe that bicyclists value aesthetics and nature along the route as significant and entertaining features. In other words, people like to walk and cycle in regions that are surrounded by natural scenery, such as along the shore or in the hills (Peggy et al., 2021). Table 4.2 lists some more bikeability incentives.

Table 4.2: Bikeability motivators

Merten, 2016	The most preferred cycle path is a cycle path that is well separated from the motorized traffic of which a hedge as separation is preferred above a curb as separation, and a curb is preferred above a cycle path marked with white lines.
Malmo-Laycock et al., 2017	Protected facilities, complementary infrastructure and programs, and intentional network design that takes land uses and destinations into account are all important considerations for the encouragement of urban cycling.
Yeshitla, 2020	It is better to design bicycle lanes on flat ground with low slopes unless the cycle is used for adventure rides. It is better to design bicycle lanes on flat ground with low slopes unless the cycle is used for adventure rides.

Desjardins et al., 2021	Bicyclists highly value infrastructure and seek routes that minimize interactions with cars, while avoiding many arterial roads that prioritize motorists. Routes that appear to be more human-oriented or that have nature are also attractive. Routes that are more human-oriented or that have nature are also attractive.
	Higher levels of bicycling are typically observed in neighborhoods with good street connectivity, supportive infrastructure, and a variety of amenities that can be reached in a short distance.
	The availability of jobs and different land uses and destinations at the end of the trip were positive attractors of bicycle trips.
Gan et al., 2021	The influence of the presence of good bicycling facilities is strongest, followed by safe and enough parking space, and an enjoyable bicycling environment. It indicates that bicyclists are most concerned about bicycling infrastructure.

4.2.3 Walkability motivators

A neighborhood's walkability is a measure of how walkable it is. The availability or absence of footpaths, sidewalks, or other pedestrian rights-of-way, traffic and road conditions, land use patterns, building accessibility, and safety are all factors that can influence people's decision to walk as their primary means of transportation. According to Hess et al., (1999), in more walkable communities, that have a higher density, and a diversified land use mix, there is a higher use of active modes and transit.

Elahi (2019), has mentioned some tips for boosting walkability which is: adding shaded components to pedestrian spaces and covering the roof to allow for strolling in a variety of weather situations, adding additional trees and greenery to pedestrian pathways, infrastructure installation in areas with lack of furniture and facilities, improving the state of the sidewalks, improving neighborhood safety and finally, designing the neighborhood area with a diversity of land uses in mind to meet the requirements of the entire community. Zhang et al., (2020) also mention that if it is busy, dark, or hazardous, people will avoid walking. While strolling, pedestrians often consider additional facilities such as a water fountain, a restroom, and shade.

Alfonzo et al., (2008) believe that sidewalks width and quality, benches, and crosswalks all had a beneficial impact on the number of pedestrians and/or the amount of time they spent walking. In other words, well-designed green street facilities contributed to more attractive walking environments (Adkins et al., 2012). Moreover, the likelihood of preferring to walk for both access and egress trips was positively and significantly linked with enough perceived walking amenities and comfortable walking space (Wu et al., 2018). The perceived walkability of pedestrians (in terms of pavement condition, sidewalk continuity, and the existence of pedestrian services) can also influence their decision to walk (Arellana et al., 2020).

A walkable city has safe, accessible, and comfortable walkways, trails, and street crossings for people of all abilities. In rural areas where physical activity and active mobility options are severely limited, planners should prioritize building paths to connect residences with services and investing in more recreational facilities within walking distances (Pavlick et al., 2020). More walkability motivators are demonstrated in Table 4.3.

Table 4.3: Walkability motivators

Wang et al., 2016	Opportunities include availability and suitability of facilities and shortening the distance, Safe accessibility such as improving personal security and improving transport safety, and Physical setting in terms of increasing comfort level and provision of supporting facilities.
Merten, 2016	High walkable neighborhoods (i.e., neighborhoods with high street connectivity, mixed land use, and high residential density).
Hynes et al., 2018	Walkability is a measure of how friendly, safe, accessible, and pleasant an area is for walking and in many ways is the cornerstone to an urban area's efficient ground transportation system. To promote this active mobility form, we must strive for agreeable and easy walking distances that meet every day needs such as access to public spaces, education, shops, places to eat, health services, parks, and recreational facilities, and good additional transportation options that allow people access employment opportunities, places to socialize, and further lifestyle choices and opportunities.

4.2.4 Active mobility barriers

Identifying the constraints that prevent individuals from walking or cycling to their destinations is the first step toward promoting active mobility. Greater distance, increased household income, and increased car ownership are consistently related to lower rates of active mobility among the factors that cannot be controlled for. According to Pucher et al., (2006), bicycle journeys are less common in low-density areas, as there are fewer places that can be visited in a short amount of time.

Ma et al., (2014) investigated active mobility barriers from an age standpoint. He believes that younger individuals are more likely to bicycle. Older adults are less likely to ride a bike, which could be explained by the fact that as people get older, they become more concerned about safety and fear of being injured in an accident. However, Habib et al., (2014) explored cycling barriers from the perspective of gender. Based on his findings, women are more concerned about traffic and safety conditions, which is why they are less likely to cycle.

Based on Rojas et al., (2017), the most commonly reported walking difficulties in Singapore were distance limitations, sluggish transport speeds, and hot, wet weather. The need to carry stuff (particularly for students) was also emphasized. Users, primarily younger users, stated that they must commute a significant distance to work or education. As a result, walking trips were frequently overlooked. Some people said they have to carry a lot of stuff to go to work (notebooks, lunch, paperwork, etc.), which makes walking more than a few blocks difficult. Parents also mentioned that their children have a lot of items to carry to school, so walking is not enticing to them. Furthermore, according to Rojas' research, the number of users on routes and/or cars, i.e., under crowding and/or congestion, was observed to enhance safety issues. The walkway was viewed as being too small since it was used by pedestrians, cyclists, and users of personal mobility devices (PMDs, such as kick scooters, hoverboards, and other assistive devices that promote individual transportation). The majority of participants agreed that if larger channels were accessible, sharing would not be a risk, and so safety concerns would be alleviated.

Opportunity barriers, distance barriers, access obstacles, and safety barriers were all identified as hurdles to physical activity by Lee et al., (2016). Some more active mobility barriers based on the literature review are presented in table 4.4.

Table 4.4: Active mobility barriers

Wang et al., 2016	Lack of residential density could produce negative effects on walking or cycling activities.
	Opportunity barriers such as limited foot and cycling paths and lack of land for recreation, Accessibility barriers including travel distance, poor access to the facilities, and no interesting destinations, Safety barriers in terms of unsafe foot or cycling paths, traffic safety, and security of exercise place, and Physical setting barriers such as lack of pleasant routes, discomfort, and no supporting facilities.
Malmo-Laycock et al., 2017	Chief among economic arguments against bike infrastructure are those that have to do with the allocation of public funds, the disappearance of road space and parking, and the purported links between bike lanes and property values. First, investments in cycling infrastructure are a waste of taxpayer money. Second, the reduction of road space and parking threatens motorists, residents, and businesses. And finally, as a middle-class amenity, bike lanes may increase property values and cause gentrification in low-income neighborhoods or may drive property values down in affluent neighborhoods.
Arbab et al., 2020	Poor quality of sidewalks, limited access to recreational facilities, and lack of available nearby destinations are possible causes of inactivity by decreasing physical activity/active mobility.
Gan et al., 2021	Shared bicycle users are frequently concerned about the availability of shared bicycles when they are required or the scarcity of parking spots while returning the bike, whereas private bicycle users are typically concerned about the safety of the parking spaces.
	The higher the industrial/manufacturing ratio, the shorter the distance that people walk. The noise and heavy air pollution from industrial zones, and poor walking conditions (many trucks and lack of sidewalks) may reduce the possibility of walking.
	Pedestrians with long access/egress trips are more likely to report a negative assessment of current walking facilities and the walking environment.
Desjardins et al., 2021	Commercial locations and other destinations at the zone of origin, as well as topography, had a negative influence on the number of expected bicycle trips.
Piras et al., 2021	In terms of hilliness, we discovered that the average slope of uphill portions had a negative influence on the likelihood of biking to work.

The above section (Section 4) is slightly modified and augmented from my work on the Specialization project in the autumn of 2021.

5 Document study

This chapter presents the results of the document analysis. The document analysis's purpose is to provide an overview of the region's existing plans and functions, as well as an assessment of the primary bikeability and walkability motivators and attractions that can boost citizens' willingness to bike and walk. In total, six main documents were examined: one from the collaboration of Milijøpakken, Trøndelag Fylkeskommune, Jernbane-direktoratet, Trondheim kommune, and Statens vegvesen (5.1), three from Trondheim kommune (5.2, 5.3, and 5.4), one from Trøndelag Fylkeskommune (5.5), and one from COWI's pedestrian and bicycle registration figures (5.6).

5.1 Plan program for Elgeseter gate and surrounding streets

Elgeseter gate has been an important entry point to the city center since the former railway line became a street in 1882. Elgeseter gate is an urban and historically significant residential street that passes through one of Norway's most productive and inventive campus regions. Today, the roadway is old, loud, and dusty, and because of the volume of traffic, the street is viewed as a barrier for the area's soft road users (Side 2 Planprogram for Elgeseter gate, 2018).

All the data in sections 5.1.1 and 5.1.2 are gathered from *Side 2 Planprogram for Elgeseter gate* (2018).

5.1.1 Elgeseter gate problems

Elgeseter gate, Prinsens gate, and Holtermanns veg all have sidewalks on both sides. It is the high volume of traffic, long crossing wait times, and significant distances between modified crossing stations in some areas of the roadway.

Elgeseter gate is currently not bicycle-friendly. Parallel roadways to Elgeseter gate, Klaebuvegen, and Udbyesgate house the primary bicycle network. In Klostergata, south of Elgeseter bridge and past the Studentsamfundet on the east side of Elgeseter gate, bicycle parking is scarce.

Within the planned area, there have been several accidents involving soft road users. The majority of the injuries are mild (source: vegkart.no).

Many bikers congregate at the Studentsamfundet, walking and waiting for buses.

5.1.2 Decisions

According to the concerns described above, various decisions were made to address such issues, including as

- Having a middle-class public transportation lane and a parallel bus lane to the west. The City Council highlighted in its decision that both solutions must promote walking and cycling, street life, trading activities such as the delivery of products and that historical assets in the cityscape be preserved.
- Elgeseter gate and Holtermanns veg have central public transportation lanes. The roadways are enabled with essential speed restriction measures and measures that promote the dispersal of automobile traffic so that buses have enough access. The system transition from center to the side is accomplished in a traffic-safe manner. This is proposed for Ilevollen in the west, Sluppen in the south, and south of Prinsenkrysset in the middle.

- Elgeseter gate will serve as a major public transportation hub in Trondheim.
- St. Olav's hospital must be easily accessible, and emergency vehicles must have safe passage.
- During the building period, a safe and appealing school road for children must be provided.
- Elgeseter gate should be a pedestrian-friendly street with good crossings and cross-connections to significant goal locations.
- The system modification should be planned in a decent and urban style, with good and safe solutions for all road user groups.
- Improve street accessibility and attractiveness for pedestrians, cyclists, and public transportation to achieve the zero-growth target.
- Prioritize walking, cycling, and public transportation over access for car traffic
- Ensure good accessibility for public transportation, goods delivery, and emergency vehicles
- Reduce the street barrier effect for soft road users across the street
- Facilitate more street life and a better living and urban environment along the street
- Improve traffic safety and security for all user groups
- Ensure the possibility of efficient goods delivery and urban logistics
- Ensure that historical values can be preserved to the greatest extent possible, and used as a resource for the streets and the cityscape
- Seek adaptability to promote alternate, sustainable transportation alternatives.
- Improved street environmental conditions (noise, dust, surface water, local temperature)
- Preventing a growth in car-based traffic on streets and neighboring residential streets

5.2 Indicative plan for public spaces and connections in the city campus

For many years, the NTNU collection surrounding Gløshaugen has been one of Trondheim's greatest urban development initiatives. Trondheim will have an open, appealing, and thriving city campus by 2030. This will help the city become a more sustainable and globally known city of technology and knowledge, as well as the finest study city in the Nordic area. Bycampus Elgeseter will be further developed as a knowledge and creativity powerhouse and will serve as a critical basis for the development of future workplaces and communities on a local, regional, and national scale (bycampus.no).

Ragna Fagerli, city planning manager of Trondheim municipality mentioned that 10,000 students and 2,000 more employees than today will travel to Gløshaugen instead of to Dragvoll. This is a potential for city life but will lead to increased pressure on public transport and a significant increase in the number of pedestrians and cyclists. It is a premise that no one else should drive a car. As a result, stronger, safer, and more secure walking and cycling links must be built throughout the planned area. The urban environment is an essential venue for people to meet. High-quality urban areas provide appealing and uniting centers that inspire visitors to remain and participate in multidisciplinary gatherings. It adds to NTNU's high visibility and promotes the city campus' identity (bycampus.no).

By providing this context, the findings of analyzing this document are divided into six sections, which are shown below. All the data in sections 5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5 and 5.2.6 are gathered from *bycampus.no - Veiledende plan for offentlige rom og forbindelser i bycampus.*

5.2.1 Pedestrian connections

- Safe, attractive pedestrian connections with a quick and clear approach to essential destination sites must be developed in dense, integrated networks.
- The walking network in developing zones should be clearly connected to the city's other pathways.
- Pedestrians should not primarily be mixed with vehicles. Joint usage is acceptable if future traffic with automobiles and bicycles is minimal, and the speed is moderate (less than 30 km/h). This should be avoided on school routes and connections with a traffic volume of more than 100 kjt / hour during peak hours.
- The effective width of municipal sidewalks must be at least 2.5 meters.
- The pedestrian space must be dimensioned according to the quantity of pedestrian traffic in critical pedestrian linkages. In addition, there is a furnishing zone, a necessary place for snow storage, a wall zone, and a foundation.
- Sidewalk spaces must be seen as safe and appealing to encourage people to walk.
- The pedestrian connections must be designed with clear sightlines.
- Important connections must have year-round operation. Pedestrian connections must be illuminated. They should provide plants and chairs where it is practical.
- Along pedestrian connections with heavy use, there should be seating for every 50 meters. For other connections, there should be seating every 100 meters.
- The ground level of new buildings facing public connections should have active facades with outward-looking services and a facade design that encourages pedestrians to walk or bike there.

Figure 5.1 shows the pedestrian connections. Blue lines show the pedestrian routes, red lines show upgrading routes, dotted red lines show the new routes and stars show the bus stops.

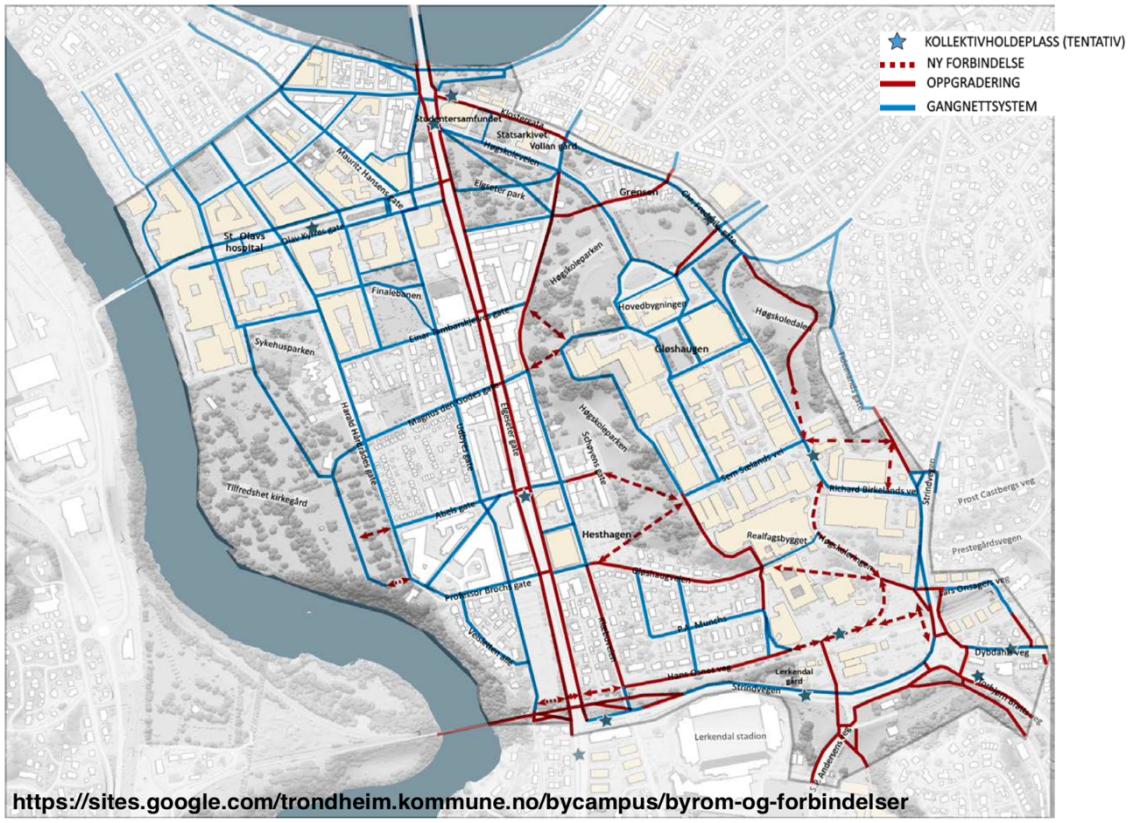

Figure 5.1: Pedestrian connections

5.2.2 Bicycle connections

- Cycling connections must be planned to give a clear path to major destinations, and they must be compatible with the rest of the city's bicycle network.
- Connections with through bicycle traffic shall be designed either as a cycle path with pavement or with a bicycle lane in the street. If the speed is low (lower than 30km/h) and the future carload will not exceed 200 kjt / hour during the peak hour, bicycle lanes in streets with car traffic can be substituted with red bicycle box markings.
- For bicycle connections that cross pedestrian connections, where pedestrian traffic is greater than 300 times per hour, pedestrian traffic shall be given priority. The intersections must have good traffic safety.
- Bicycle lanes should be a minimum of 1.7 meters wide at 30 km / h, and Bicycle paths with pavements should be designed with a minimum width of 3 + 2.5 meters. The width can be increased where there is a large number of cyclists and pedestrians.
- Bicycle connections must be illuminated.
- External guests to visitor-intensive activities should be able to park their bicycles near the main entrance. Bicycle parking should also be available in areas near key access routes. Employee and student bicycle parking should be undercover, as far as feasible incorporated into buildings or below ground level, and close to cloakroom facilities. Where there is a demand for big capacity bicycle parking regularly, a share of bicycle parking solutions can be integrated into urban furniture that can otherwise give living values. It is necessary to prepare for good land usage.

Figure 5.2 shows the bicycle connections. Green lines show the bicycle routes, red lines show the upgrading routes and red dotted lines show the new routes.

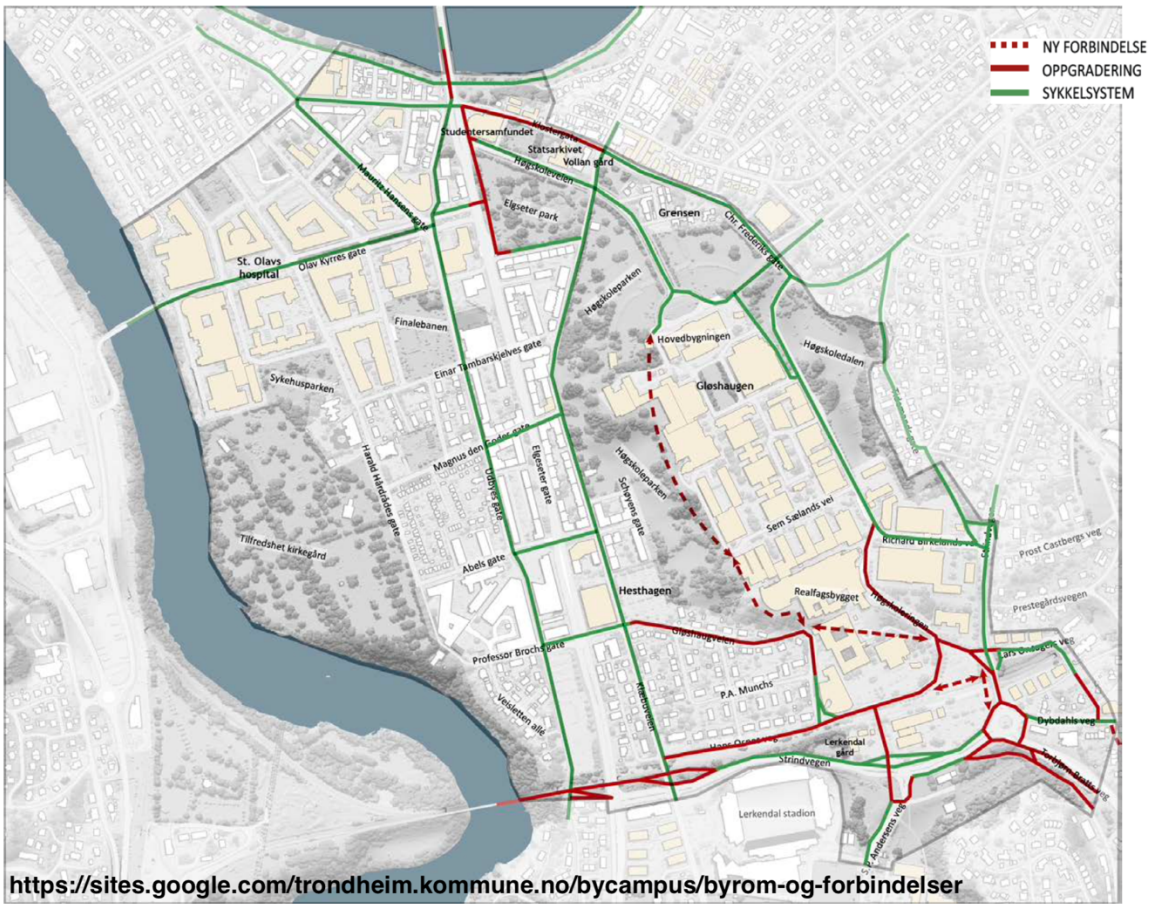

Figure 5.2: Bicycle connections

5.2.3 Driving connections

- Elgeseter gate is the main thoroughfare for public transport. Klæbuveien and Udbyes gate function as a local street without traffic for cars.
- Road networks for commercial traffic should be planned to provide good accessibility and a short distance to important destination points without creating conflicts with walking and cycling.
- Parking spots for individuals with limited mobility must be available at the main entrance of buildings that meet universal design criteria.
- All main entrances must have driven access. There must be good accessibility for emergency services.

Figure 5.3 shows driving connections. Red crosses show the parts which proposed to be closed, thin lines with arrows show the secondary roads and thick lines with arrows show the primary roads.

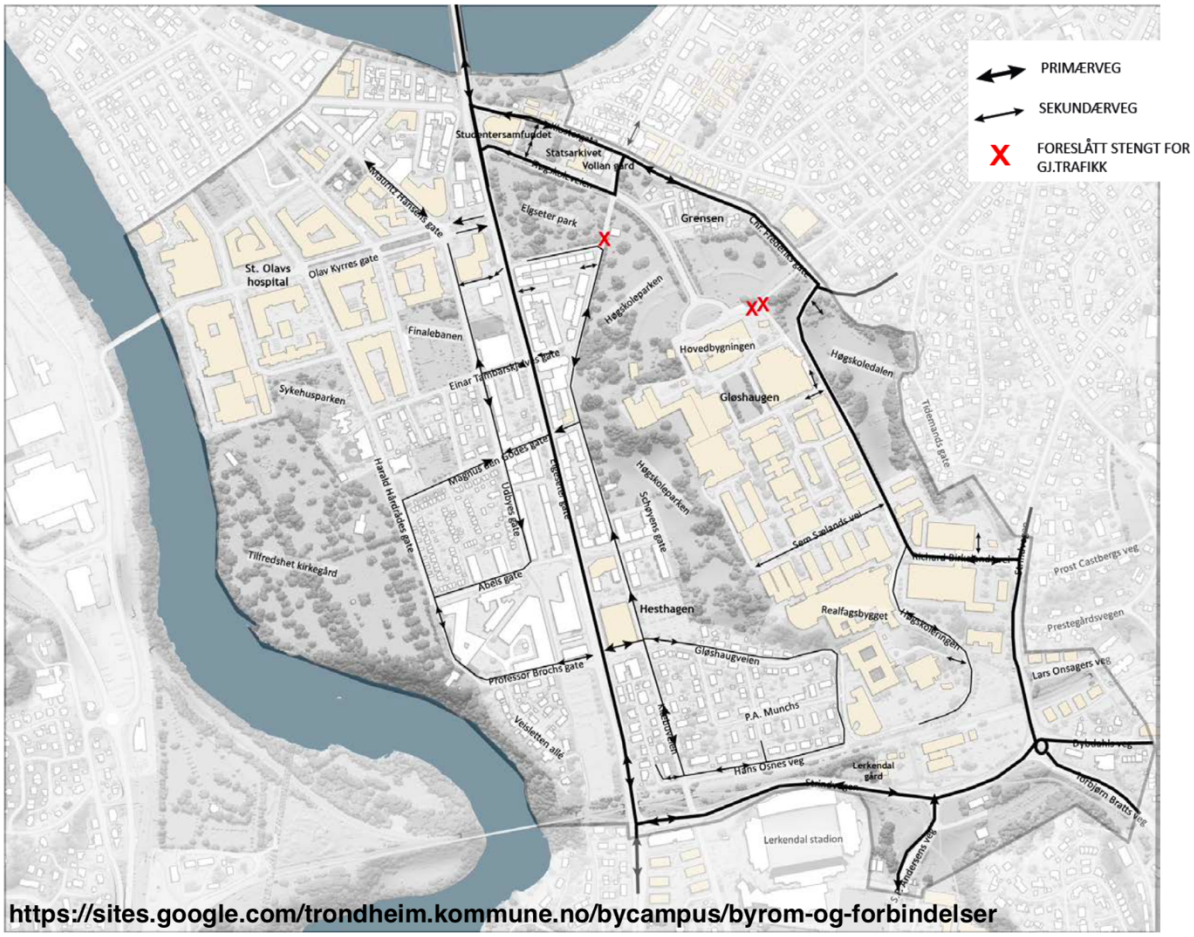

Figure 5.3: Driving connections

5.2.4 Urban space for stays, meetings, and recreations

- New buildings must be provided with active and living facades at street level towards the urban space.
- Entrance area and service functions must be oriented towards urban spaces and important connections.
- There should be windows facing streets and squares that show the activity inside in such a way that the building's activities are shown to the public. Between significant entrances and sidewalks/streets that also match the standards for safe exit, a forecourt should be constructed.
- Benches and greenery should be placed on the forecourt.
- The boundaries of urban areas must be clearly defined.
- Every venue should have suitable living circumstances that allow for both formal and informal meetings. This should be reflected in the architecture of urban areas and nearby buildings. Planting shall be used to ensure good local climatic living zones.
- Places should, as far as possible, have artistic decoration.
- Places and parks shall, as far as possible, be arranged for children and young people. At the same time as universal design and safety criteria must be addressed, the traffic area should be built as an essential element of the space.

- The separation and delimitation of streets and squares must be constructed with the clearest feasible alignment in mind.
- Public spaces and adjacent areas should have the most holistic sense possible, with space set aside for plants, seats, and other street furniture. For larger projects, a separate design guide should be created.

Figure 5.4 shows an overview of the urban spaces in the area and their potential.

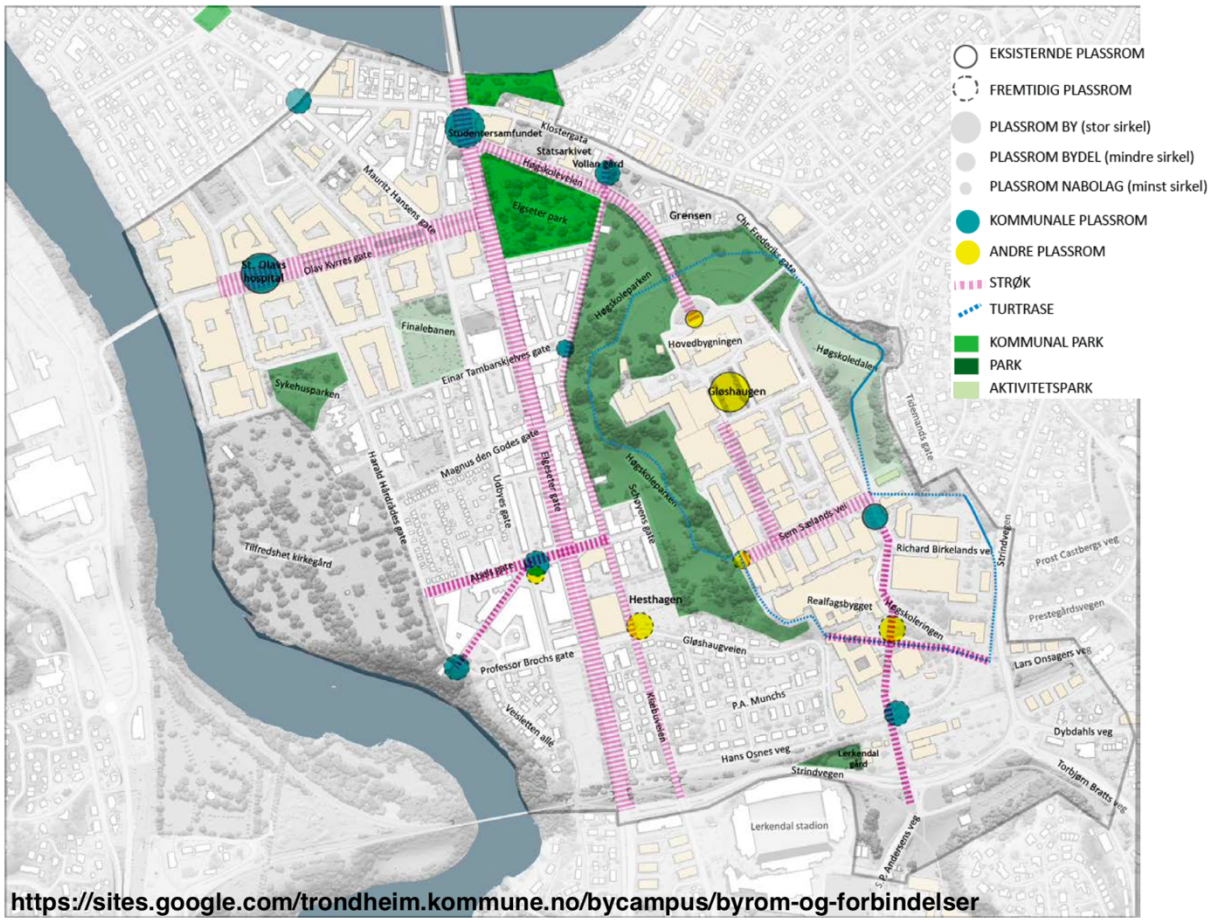

Figure 5.4: Urban spaces for stays, meetings, and recreations

5.2.5 Green connections

- To enhance biological variety and give experiential characteristics, green links must be conserved and strengthened. They must have a diverse and adequate flora that may provide ideal dwelling zones for birds and animals, as well as protected and sheltered local climatic zones for individuals who remain and travel outdoors. Green links will assist in the protection of natural corridors.
- Large trees should in principle be preserved.
- Alleys should be replaced if they are eliminated.
- Cross connections must visually lead to the surrounding landscape's green areas. This aims to provide optimal direction and readability, as well as to follow known urban design practices in Trondheim.

Figure 5.5 shows green areas and the connections that should be strengthened.

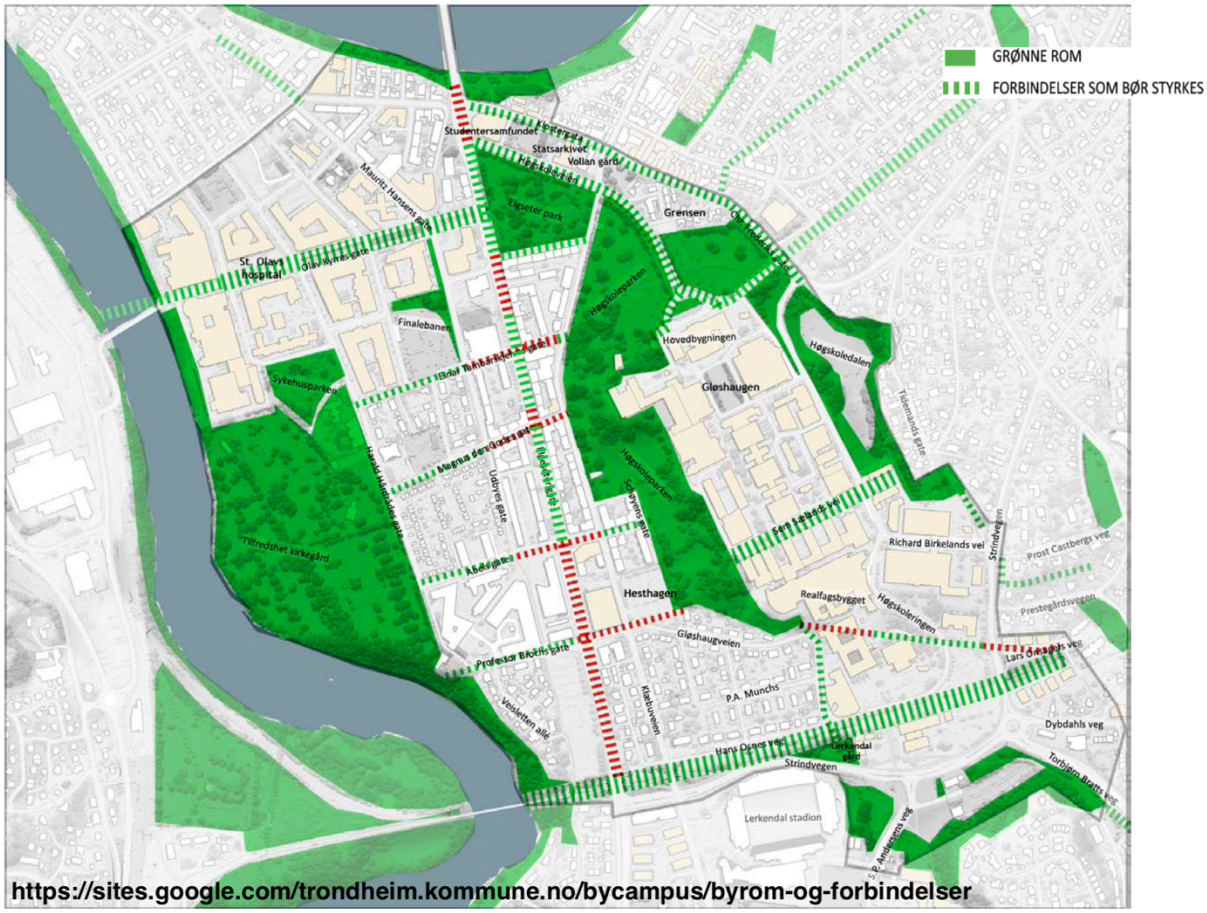

Figure 5.5: Green connections

5.2.6 General Planning Guidlines

Trondheim municipality is concentrating on several planning criteria, including:

- Establishing a range of urban settings and linking connections to interconnected networks to improve prospects for urban living.
- Preserving cultural monuments and the cultural environment as a resource and attractiveness and highlighting them in the urban space as identity markers and storytellers. Historic buildings and structures must have the necessary sight space around them.
- Ensuring safety and security for the population with special emphasis on children's interests, pedestrians, and cyclists. Promote health by facilitating recreation.
- Ensuring good accessibility for everybody, particularly for pedestrians and cyclists.
- In the event of a lack of space, the need for walking and cycling must be given priority.
- Spaces, parks, and green areas shall be worked up with quality and the standard required as a result of expected use and importance in the urban space network.

5.3 Urban development strategy for Trondheim

The plan for an urban development strategy suggests ways for more people in the city to walk, cycle, or take the bus in their daily lives. Working methodically with this adds to the city's more appealing and climate-friendly growth. The strategy is a continuation of the municipal sub-plan for energy and climate, the municipal component of the municipal plan, and the agreement on the urban environment and urban growth. Building the city close

and with a fine-grained network of services, meeting places, and connections will lead to more and more people having local destinations that can be readily accessed without a car, greater mobility for both residents and companies, and a more inclusive and diversified city (Byutviklingsstrategi for Trondheim).

Given this context, the findings of this document's analysis are more focused on mobility and transportation, as stated in further detail in the sections below. All data in section 5.3.1 are gathered from *Byutviklingsstrategi for Trondheim - strategi for areal- og transportutvikling fram mot 2050 - Trondheim kommune*.

5.3.1 Mobility and transport

Every day, there will be more travel as the population grows. While the usage of private automobiles should be minimized, the mobility offer should be maintained, if not increased. Part of this is developing infrastructure that makes it easier to choose walking, cycling, or public transportation as a mode of transportation for daily travel. This contributes to the zero-growth aim, making it simpler to live in an ecologically responsible manner, and can free up capacity on the road network, improving commercial transportation mobility. Greater pedestrian and cycling traffic have a variety of good consequences on public health, including increased physical activity, social engagement, and reduced pollution.

Proximity to diverse offerings is a necessity for increased walking, cycling, and short public transportation, which is especially crucial for children and the elderly, who have a larger need to feel safe and secure than other demographic groups. Building the city close and with a fine-grained network of services, meeting places, and connections will lead to more and more people having local destinations that can be readily accessed without a car, greater mobility for both residents and companies, and a more inclusive and diversified city.

On the issue of what should be within walking distance of the home in the New Year 2019, this was brought in by a guest: "... For it to be nice to walk, we think there must be green spaces or trees along portions of the road, and walkways must be in order and plowed in the winter." "The most essential thing is to have a grocery store nearby, so you can easily buy supplies for home after work." The easier it is, the more people will ride the bus to and from work; this eliminates the need to drive a car, mostly to avoid the long trip from the store with heavy shopping bags. The bus station is also conveniently located within walking distance of the house so that it does not become a "measure" to go around the city...

Soft road users are more prevalent in downtown locations, smaller downtowns, and hubs. As a result, these places must be adapted for everyone, regardless of age or degree of function, and contribute to everyone's ability to travel safely and securely. Mobility will be improved by building mobility points, among other things. Accessibility and development of the places must prioritize individuals who walk and cycle, take public transportation, and use essential transportation above those who drive a private automobile. Pedestrians, bikers, and individuals with disabilities will be accommodated at the stations. The center will focus on public transportation. The prioritization pyramid depicts the ideas for prioritizing the major road user groups in the development of Trondheim city center and local city centers until 2050.

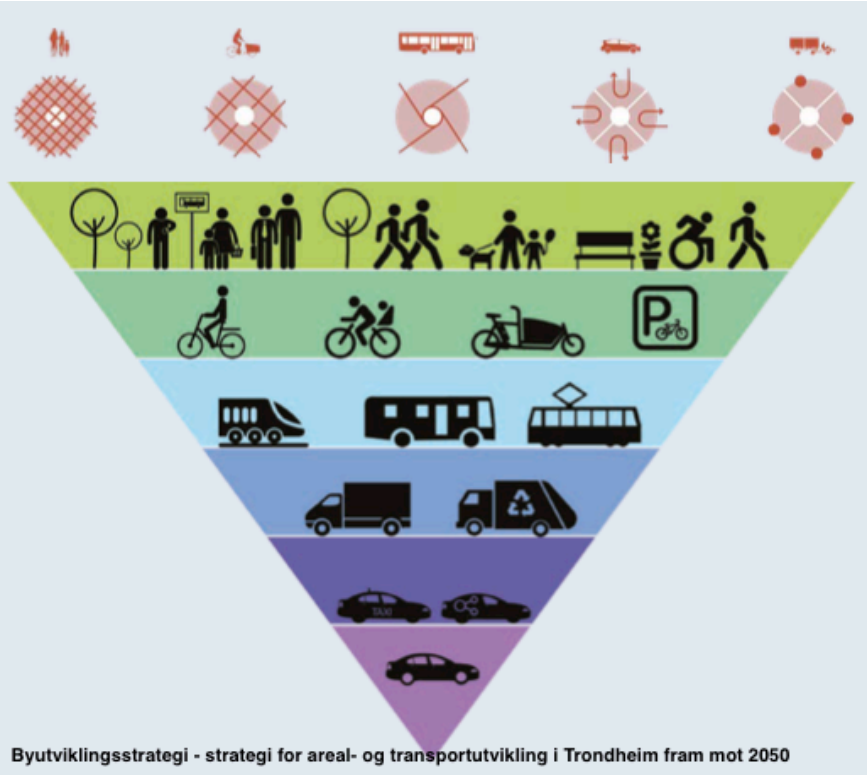

Figure 5.6: Prioritization pyramid

As figure 5.7 shows, different road user groups have different needs. The goal should be to strengthen mobility so that it becomes easier for even more people to get around the city. Photo: Solveig Dale, Carl Erik Eriksson, Øystein Ask

Figure 5.7: Different road users

5.4 Gait-promoting planning

Walking is beneficial to the environment, your health, and your social life. As more people walk, the urban environment improves, becoming more beautiful, vibrant, and safe (Nasjonal gåstrategi del 2,kap 1). Identifying strategies and technologies that encourage individuals to walk more is therefore critical. As a result, attractiveness and security are highlighted as equally important motivators for increased walking (Gangfremmende planlegging, 2020).

Planning pedestrian connections includes ensuring the excellent location of new connections, enhancing those that currently exist, and providing good pedestrian-friendly surroundings. All major pedestrian connections should be accessible and passable, as well as safe, pleasant, and appealing (Gangfremmende planlegging, 2020). The placement and design of junctions have an impact on walkability. As a result, crossing locations must be designed as part of the extension of natural paths, in the appropriate location and of the appropriate type and design. Pedestrians must have priority over other traffic on major pedestrian routes.

All data in sections 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.4.5 and 5.4.6 are gathered from Gangfremmende planlegging.pdf (2020).

5.4.1 Accessibility

Accessibility determines whether the walkway provides a connection (Gåing til/fra holdeplasser, 2018). It can be seen as both physical accessibility (distance between destinations and climbing conditions) and mental accessibility (ability to orient oneself and read the structure).

Good accessibility implies that pedestrians may reach their destination in a timely and efficient manner at all times of the year, absent of physical obstructions or other constraints that result in increased time consumption (Nasjonal gåstrategi, kap 5.8) or other perceived disadvantages.

Good accessibility is provided by a dense, logical, and well-designed pedestrian network with short distances between goal sites, where the pedestrian may swiftly and easily find his route regardless of functioning. A generically constructed pathway, with, for example, suitable slope conditions, provides adequate accessibility for as many persons as feasible. The walkway area must be wide enough to accommodate anticipated foot traffic in the link, and all functions occurring on the site must be considered. This can be used for snow storage, gathering areas, and entrances with the requisite forecourt area. If walking should be available all year, the walkway area must be assured breadth and winter operation preparation.

The inclusion of a side area with rest and accommodation alternatives enhances accessibility for those with varying degrees of mobility difficulty, such as children and the elderly. Furthermore, appropriate illumination promotes accessibility during the night.

5.4.2 Safety

Security encompasses both safety from other road users and protection from crime and violence. These are complicated criteria that do not always have clear solutions. Separation of road users can improve traffic safety without reducing social control (Gåing til/fra holdeplasser, 2018). Experienced safety in pedestrian connections can be significant in

determining whether walking is seen as a viable mode of transportation. This is particularly critical for children, the elderly, and the disabled.

Most pedestrians consider environments with a large number of people around and a good view of the destination places to be safe. It is also critical to have adequate lighting (Plan for friluftsliv og grønne områder - Vedlegg 3) and a dense network with access to multiple alternative routes. Visibility also allows for more time to react to threats.

The speed and volume of vehicle traffic have an impact on pedestrians' perceptions of safety on roadways and when crossing them. It can also be dangerous if it is not large enough to function in the winter, resulting in the risk of slipping and falling (Helen et al., 2019). Lighting is crucial for walking ease (Helen et al., 2019). and helps to create a safe and secure environment. All regulated paths must have lighting and crossing points must have lighting.

5.4.3 Comfort

Most pedestrians consider a stroll to be comfortable if it is shielded from the elements, such as wind and rain, as well as pollution and noise. It is also crucial that the promenade gives engaging experiences, offers many possibilities for rest breaks, and goes straight to the destination.

The pedestrian space must also be sufficiently large and sloped to allow for uninterrupted walking. Only if the pedestrian link is both accessible and safe can it be considered pleasant (Gåing til/fra holdeplasser, 2018).

5.4.4 Attractiveness

Pedestrian connections that connect various meeting places such as squares, and cafes are attractive. The same applies to parks and greenside areas, benches, and the like. Active and open first floors with audience-oriented activities, mixed functions with housing, human scale, and variety in facade expression provide an attractive walking environment. Visual contact with landmarks in the city provides good orientation. Walkways should ideally be positioned in well-lit, populated locations. Ideally, via residential and retail districts, but not through dense woodland or clean office areas. Underpasses and footbridges can frequently create many and lengthy diversions, limiting pedestrian accessibility and flexibility. Solid visibility to crucial orientation points and a good overview of the surroundings are essential.

5.4.5 Regulating new walking routes in existing surrounding

In general, new walkways should have the least amount of inclination feasible. People with limited mobility, as well as the movement of prams, must be given extra care at bus stops and other essential destinations. An ideal slope of no more than 5% fulfills universal design criteria and should be reached for connections between public and educational buildings and the nearest bus stop. Shortcuts can be planned with stairs. Sufficient flattening must be planned towards intersections where road traffic (car and bicycle) meets pedestrians and where the road is sloping.

In the planning of new pedestrian connections, all values must be weighted, and the planner must usually prioritize between the values. It can often be demanding to weigh the consideration of the different values against each other. In traditional road planning, traffic safety and accessibility are given very high priority, but the impact of an attractive environment can be just as important to get people going. We believe that the instrument

is best illustrated through an example. The walking environment at Bakklandet appears very attractive but will on some times of the day do not have good accessibility for pedestrians due to very narrow sidewalks used for sales activities and occasionally heavy bicycle traffic with relatively high speeds. Traffic safety is not optimal, but the route is still very popular and stimulates many to walk, both walking and transport.

A suitable side area should be provided for snow storage, local surface water management, and any delays based on local circumstances for a walk-friendly operation. The requirement for snow storage must be determined in each case depending on the amount of additional useable space available. A 3-meter pathway is usually required. The pedestrian crossing is elevated, at a speed of more than 30 km/h. Walking and cycling are segregated, including at crossing places, and the crossing distance is kept to a minimum.

Walking-friendly planning entails the addition of:

- Waiting areas at bus stops and metro bus stations outside of the traffic area.
- A side section is designated for benches and other furnishings.
- Based on local conditions, enough space is made aside for managing snow and surface water.

5.4.6 sufficient space for flower gardens and trees

Natural factors such as trees and other plants have a good impact on walkability. It can also establish a physical barrier between the traffic and improve security. Green discounts must be at least 1.5 meters wide to function as a green area, according to a walking-friendly design. The width of the discount with street trees must be at least 2 meters.

5.5 Sustainable mobility for the Innovation District

Trøndelag fylkeskommune offered several solutions for reducing traffic difficulties in Elgeseter gate during a workshop on May 11, 2021, which are depicted in Figures 5.8 to 5.15:

Figure 5.8: Metrobus route

Figure 5.9: Shortcuts above ground

Figure 5.10: Skywalks

Figure 5.11: Sky trans

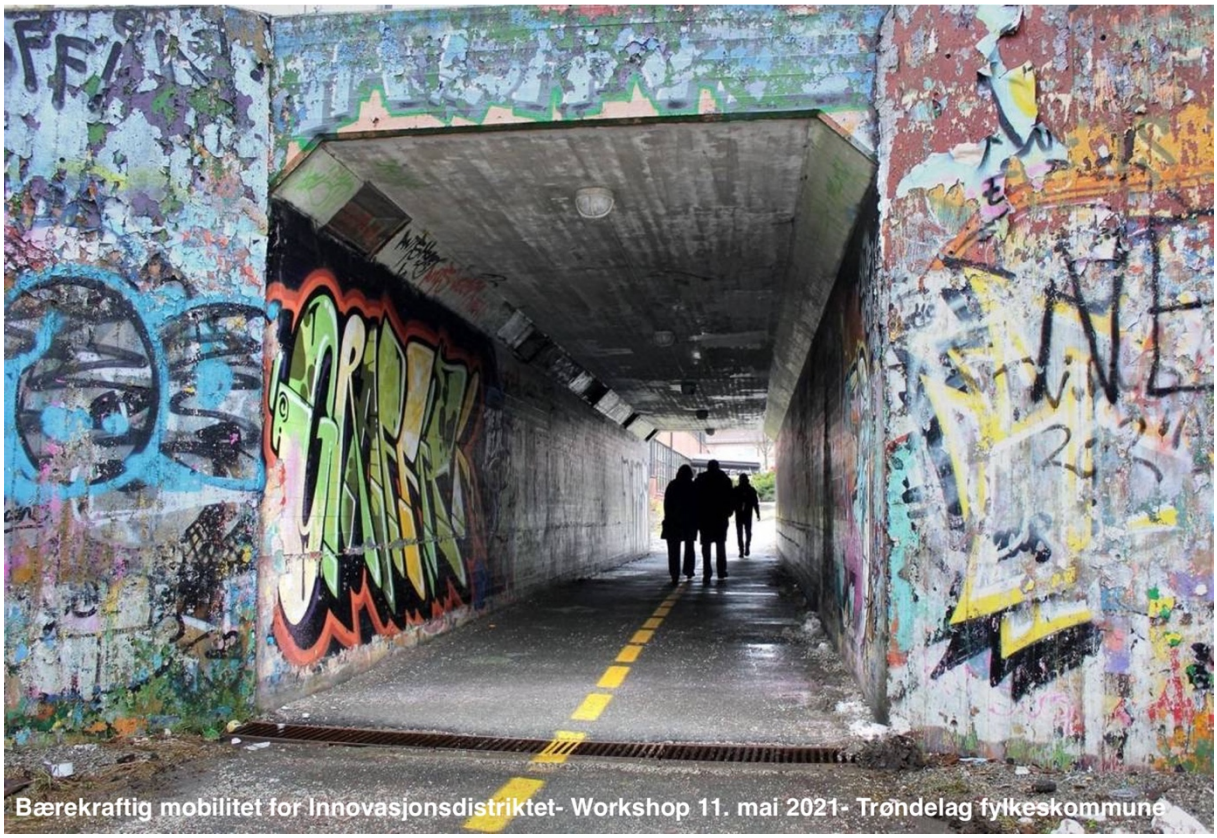

Figure 5.12: Underground shortcuts

Figure 5.13: Underground shortcuts with lights and colors

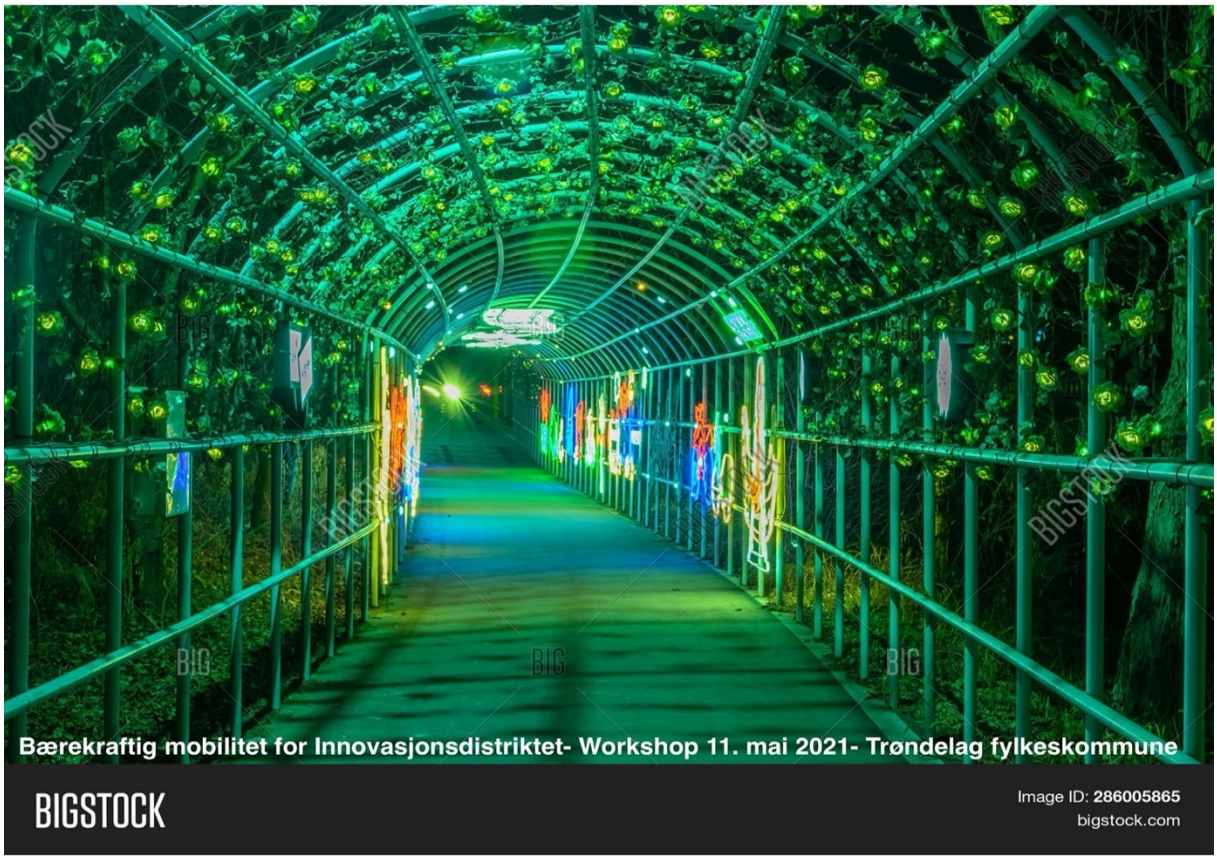

Figure 5.14: Underground shortcuts with nature

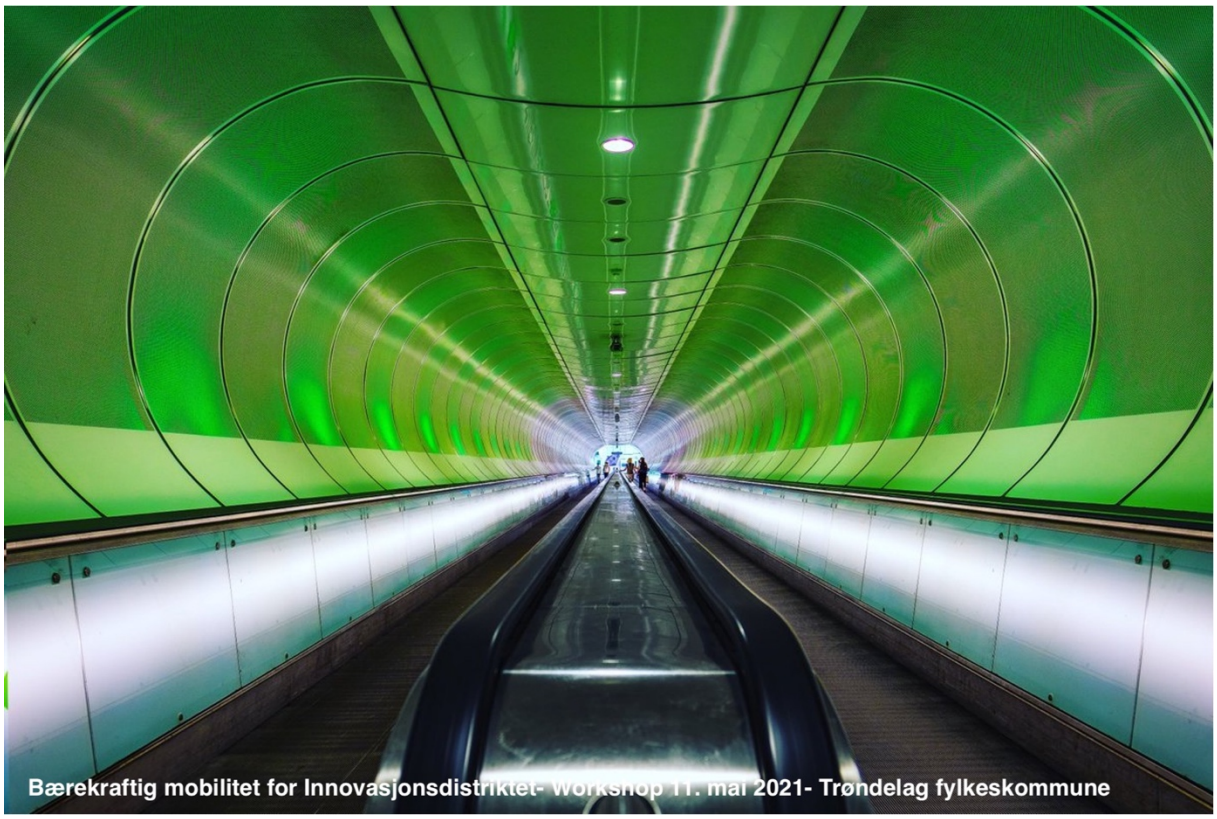

Figure 5.15: Underground shortcuts with the opportunity to save time

5.6 Pedestrian and bicycle registrations

The data from the pedestrian and bicycle registrations made at Samfundet in conjunction with the work on the zoning plan for Elgeseter gate supplied by COWI are shown below (Heatmap for gående og syklende ved Elgeseter).

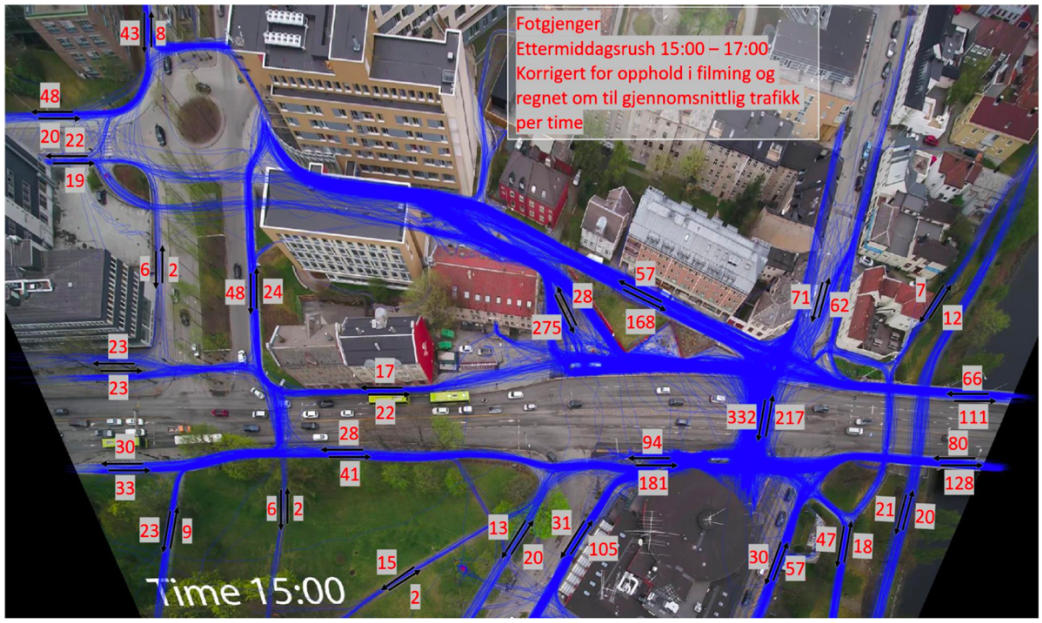

Figure 5.16: Pedestrian registrations

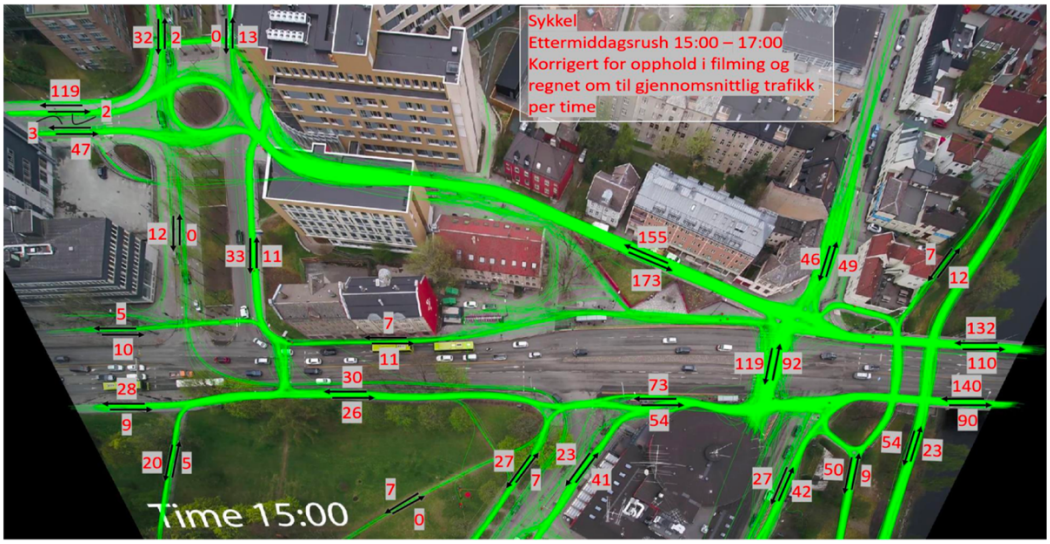

Figure 5.17: Bicycle registrations

Figures 5.16 and 5.17 show that fewer people walk or cycle on Elgeseter gate street compared to the surrounding region and Elgeseter bridge, indicating that the roadway is not conducive to walking and riding. In these figures, the traces are of people walking and cycling (respectively), between 3 pm and 5 pm (afternoon rush hour) and the numbers show a calculated average number of trips per hour in the direction indicated (Heatmap for gående og syklende ved Elgeseter).

6 Digital survey

The findings of the digital survey are presented in this section. As shown in Figure 6.1, a total of 283 replies were received, with 102 people responding in English and 181 in Norwegian.

Reply	Number	Percent
English	102	36%
Norsk (Norwegian)	181	64%

Figure 6.1: Number of responses

6.1 Quantitative results

One of the most crucial aspects was determining where the respondents resided and how near they were to the case study's target region. Figure 6.2 shows that 222 of the 283 respondents live within a 4-kilometer radius of the Elgeseter gate.

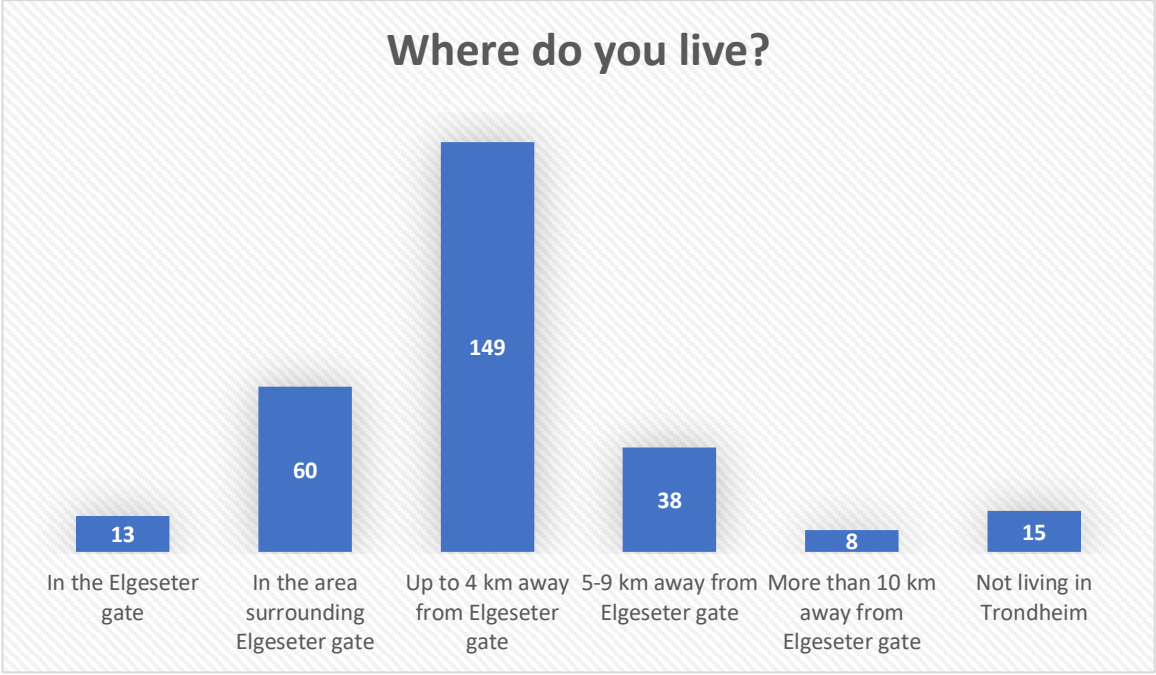

Figure 6.2: Living area

Another question asked of the participants was how often they commute to or go through Elgeseter gate, to determine how many of them are familiar with the area and how their experience there was, as well as the mode of transportation they use and why they use it. Figure 6.3 demonstrates that 179 of the 283 respondents commute in the neighborhood at least 1-3 times each week, with only 8 having never been there.

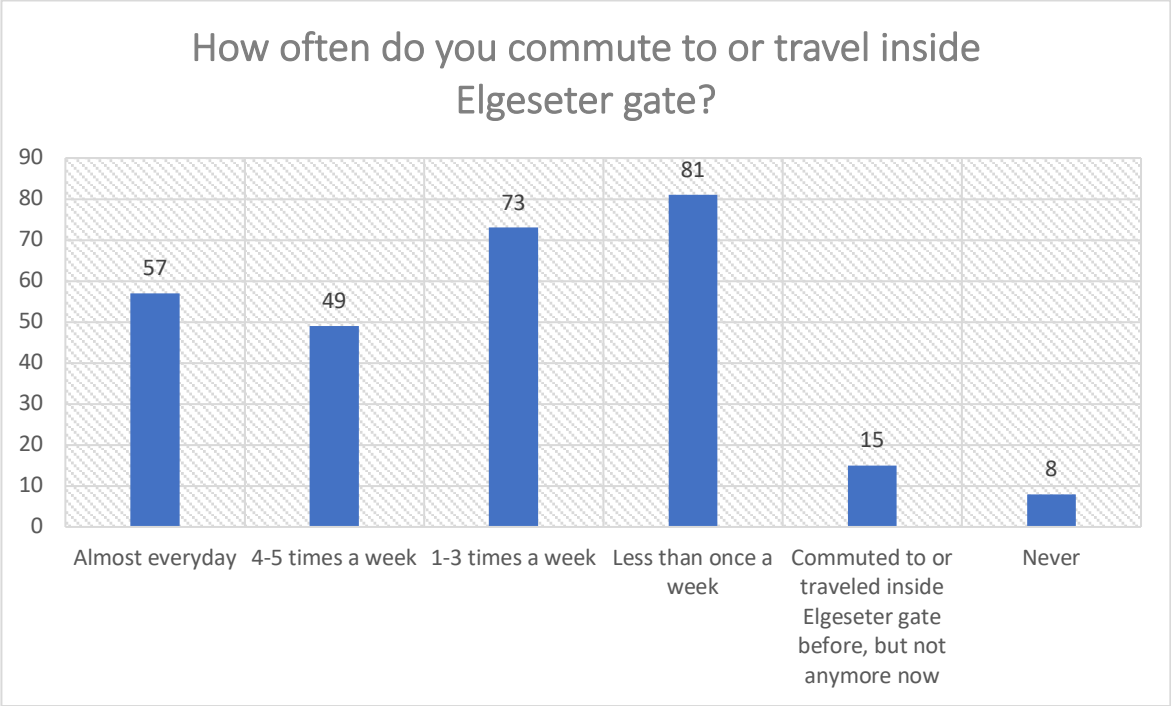

Figure 6.3: Frequency of commuting in Elgeseter district

Figure 6.4 depicts the percentage of respondents that pick walking as their major form of transportation, whereas Figure 6.5 depicts how their behavior changes when they choose to walk at Elgeseter gate. The interesting result of this section is that around 51% of participants often walk to their destinations, but this number drops to just 29% when asked about Elgeseter gate, and around 10% never prefer to walk in the area, implying that even people who can be considered active pedestrians are unwilling to walk in Elgeseter gate due to the barriers there.

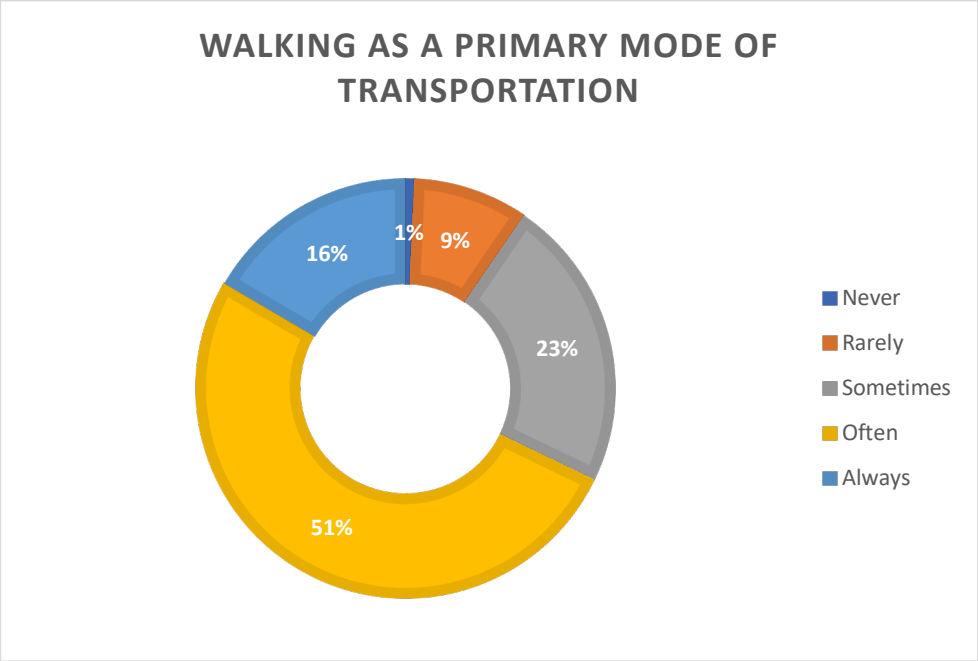

Figure 6.4: Walking as a primary mode of transportation

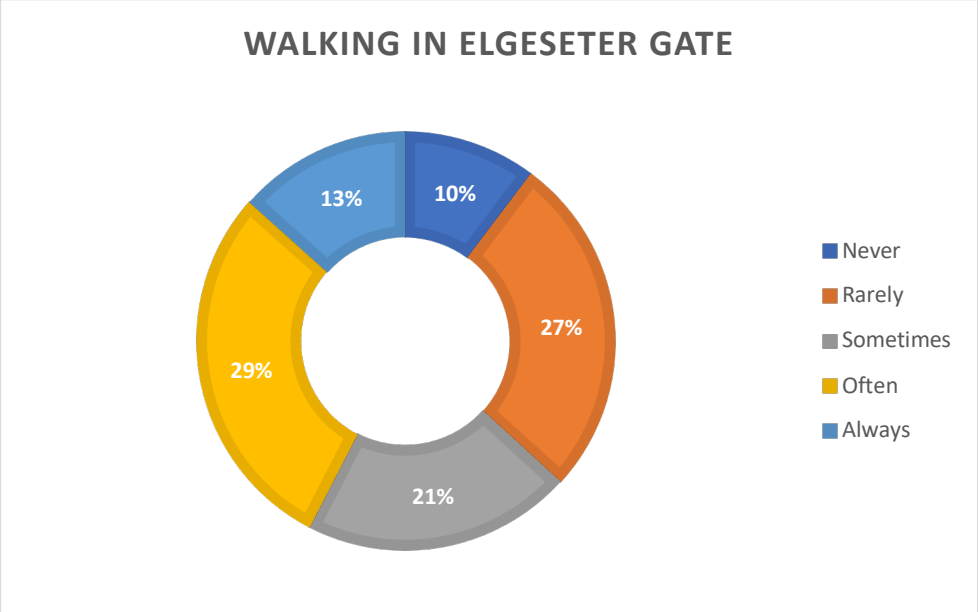

Figure 6.5: Walking in Elgeseter gate

In the same way that the preceding paragraph focused on walking, the biking situation in the Elgeseter district is also examined. Figure 6.6 shows the percentage of respondents that chose bicycling as their primary mode of transportation, whereas Figure 6.7 shows how their behavior changes when they choose to cycle at Elgeseter gate. The main result of this section is that approximately 24 percent of participants frequently bike to their destinations, but when asked about Elgeseter gate, this number drops to just 13 percent, and approximately 48 percent never prefer to bike in the area, which is nearly half of the respondents, indicating that the area is not pleasant enough for bikers.

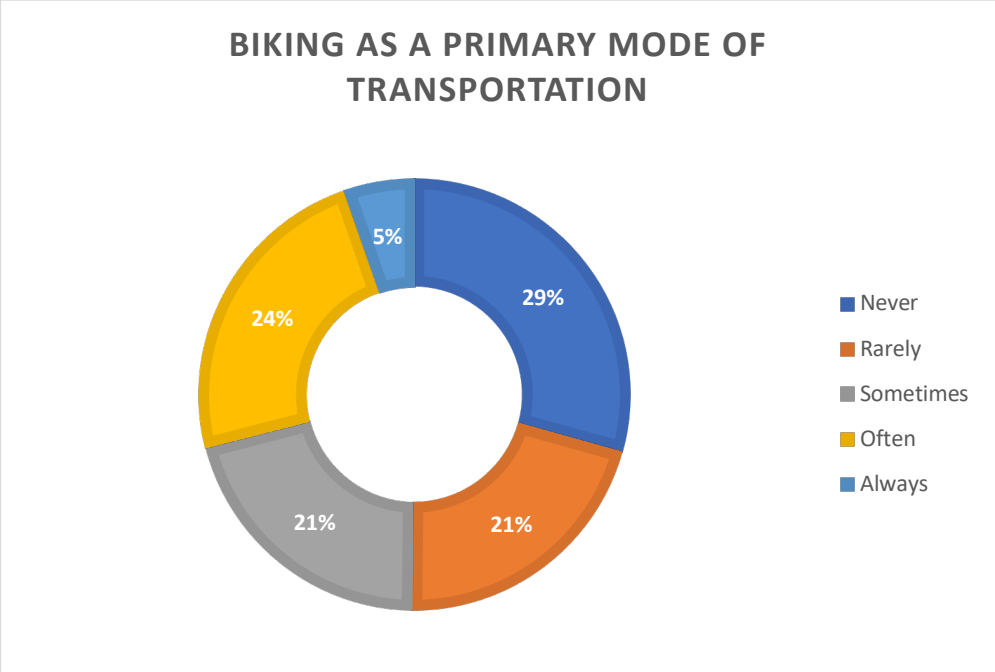

Figure 6.6: Biking as a primary mode of transportation

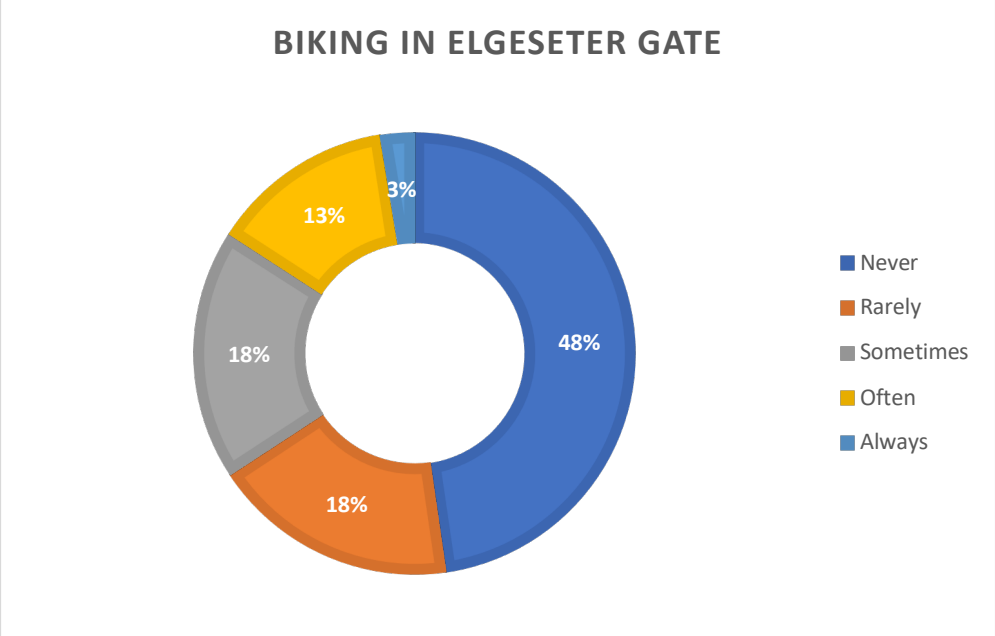

Figure 6.7: Biking in Elgeseter gate

6.2 Combination of quantitative and qualitative results

It was also interesting to see what reasons make the citizens commute in the area. It was fascinating to see that the majority of responders, about 19%, simply utilize Elgeseter gate as a shortcut to the other side of town. Also, 18 percent are students who use the roadway to get to university, and 17 percent go shopping in the vicinity. Residents in the region who utilize the roadway to go to their residences made up 16 percent of the respondents. Around 4% of respondents cite different reasons for traveling in the Elgeseter region, with the most prevalent being visits to St. Olav Hospital, going to the events in Studentsamfundet, visiting relatives, travelling to restaurants and cafés, and using the road to get to the bus stop. Figure 6.8 illustrates the causes in further detail.

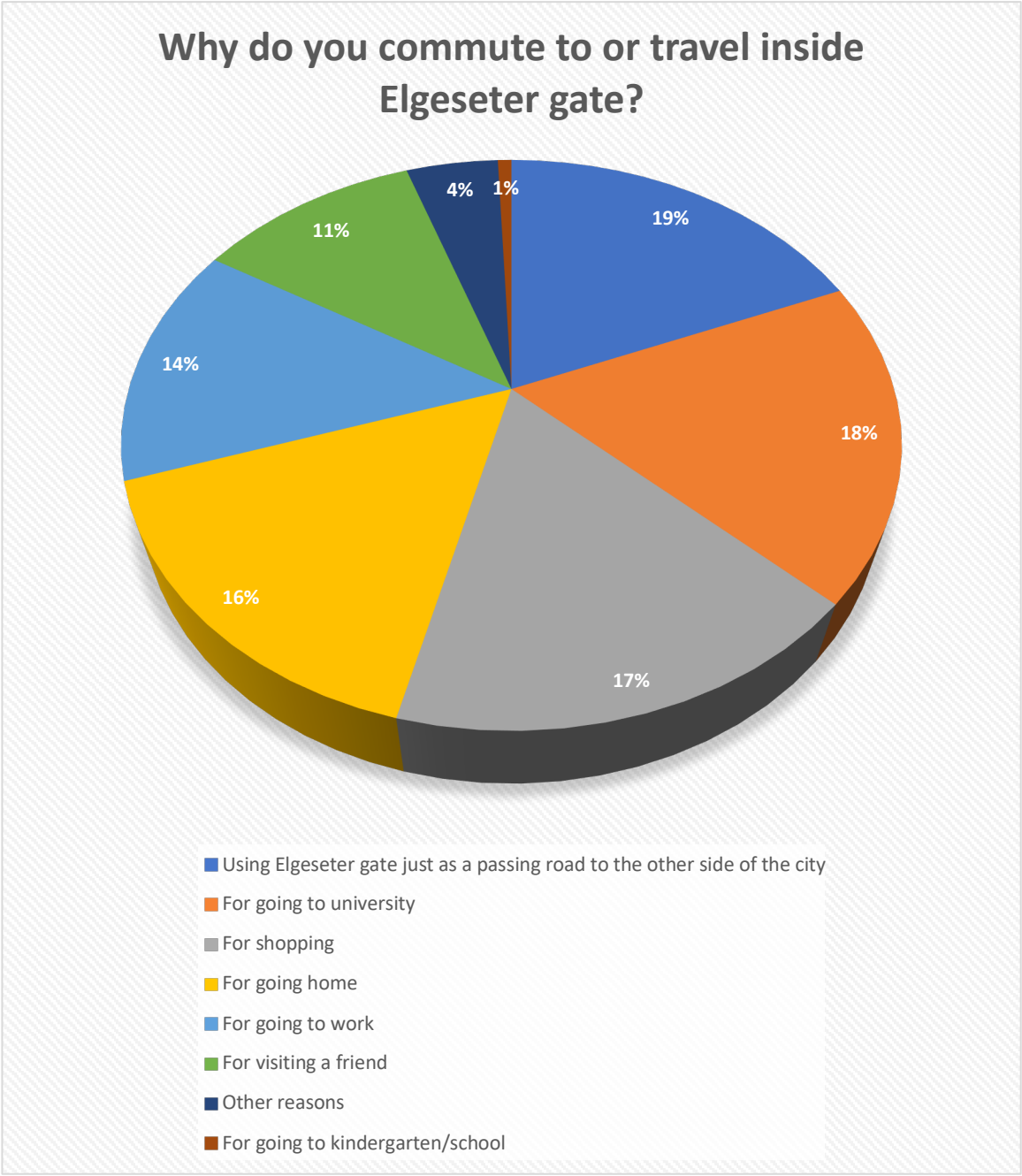

Figure 6.8: Reason for commuting to or travel inside Elgeseter gate

One of the most essential questions answered in this survey was about active mobility motivators, as the major goal of this thesis was to uncover strategies that might persuade individuals to walk and cycle more in the neighborhood. Figure 6.9 demonstrates that the presence of more trees and green places such as parks was the most appealing aspect to commuters, with 15% responding. Following that, with 12 percent and 11 percent, respectively, improving the quality of the sidewalks and the provision of decent bicycle facilities were two additional major motivators. Another major influence was the presence of routes with separate bike lanes and the development of certain pocket parks along the roadway, both of which received 10% replies.

Figure 6.9 shows all the factors in more detail and as you can see, 3% of the participants mentioned some other motivators which are implementing bicycle tunnels with heaters, wider sidewalks free of snow in winter, better facilitation at traffic lights, and pedestrian crossings, the shorter waiting time to cross the road, cycle path with pedestrian crossing, better bus connections to different parts of the city, having more restaurants and shops, using the parallel street for biking as the area is nicer and quieter and trying to get car traffic out of Elgeseter gate.

Furthermore, making a tunnel under Elgeseter gate for the cars, implementing more spaces for parking bikes, coloring the buildings, keeping the area clean, making the sidewalks quieter by adding trees or something between the street and sidewalk or by adding a sidewalk further from the road, adding nice cafés and more areas that are actually nice to be in, reducing traffic, noise, dust and the number of road users are some other factors mentioned by the commuters.

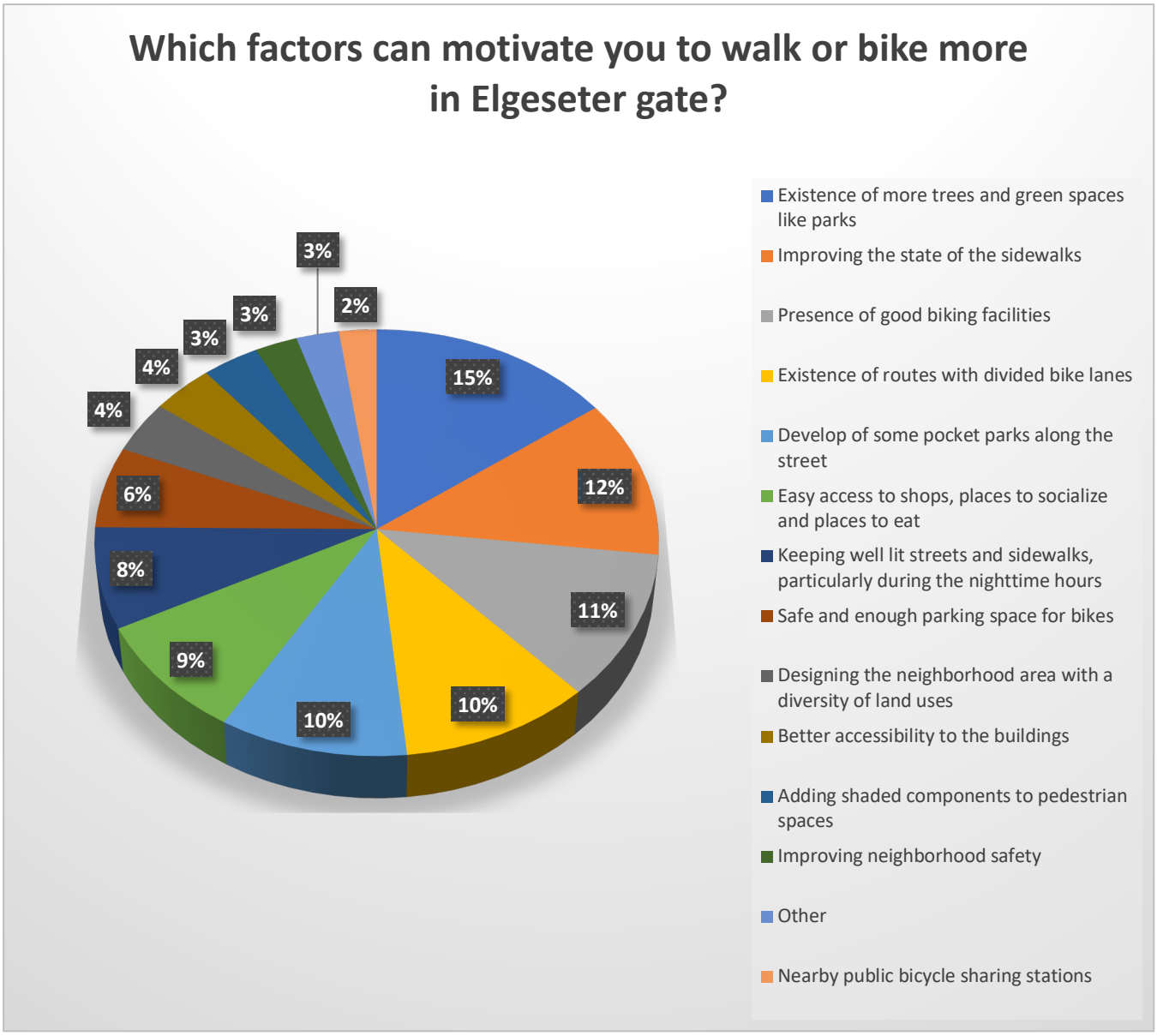

Figure 6.9: Active mobility motivators

Another essential aim of this thesis was to identify the characteristics that reduce commuters' motivation to walk and cycle in the Elgeseter district. As shown in Figure 6.10, the most important active mobility constraints for commuters were noise or air pollution (15%), weather conditions (14%), and sidewalk quality (12%). Following that, waiting times at pedestrian crossings, boring areas for walking or bicycling based on existing buildings, lack of a split cycle path and pedestrian route, and winter maintenance for pedestrians are all regarded as significant hurdles in the Elgeseter district.

Active mobility obstacles are depicted in further depth in Figure 6.10. Around 1% of respondents mention other factors that reduce their motivation for walking and biking, such as lack of biking safety, unpleasant environment due to all of the traffic, including noise and dust, lack of trees that can act as visual barriers, insufficient lighting for bikes during the winter, and dirty and slippery sidewalks during cold seasons.

Furthermore, on rainy days, buses and cars speed down Elgeseter street, and pedestrians might quickly get wet since the walkways are not wide enough in some parts. Overall, the primary problems are traffic and pollution (both air pollution and noise pollution), as well as lack of cafés and pleasant places to visit.

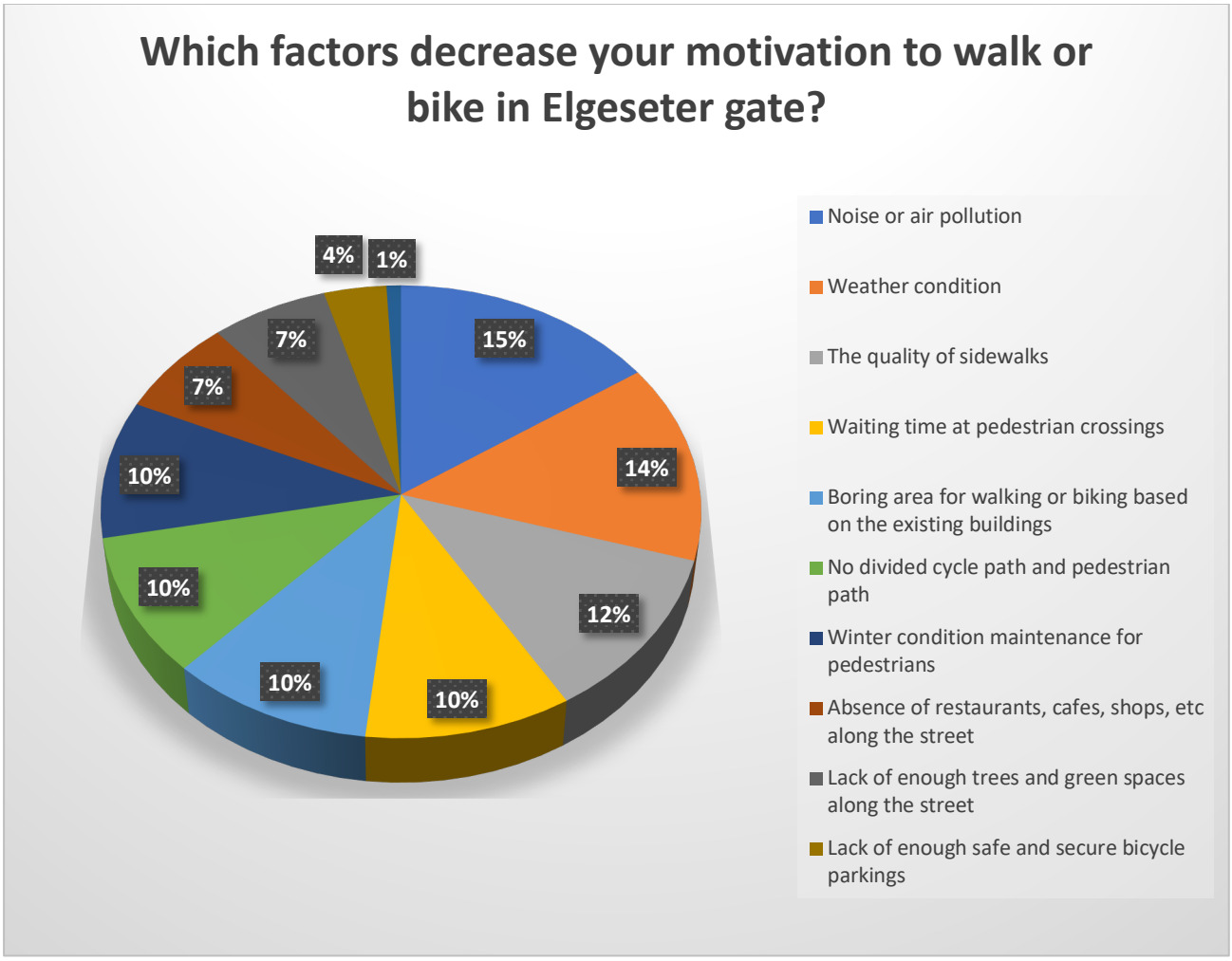

Figure 6.10: Active mobility barriers

6.3 Qualitative results

In addition to the previous parts, the participants were asked two open questions. The first asked if there was anything in particular that they thought would make them more willing to walk or bike in the Elgeseter district if it changed, and several comments were written by respondents, including

- The need for several restaurants, cafes, shops, greenery, parks, playgrounds, and benches;
- Making it easy to cross the street;
- Putting in tree-shaded pathways;
- A more accessible and well-maintained green space;
- More accessible and free bicycle sharing;
- Implementing safe bicycle parking along the road;
- Placing automobile traffic below ground level;
- Making sidewalks and bicycle lanes large and pleasant enough to minimize confrontation between walkers and cyclists, as well as being splashed down by the water when cars or buses pass through the water at full speed on rainy days,
- Reducing the number of cars on the road;
- Reduced wait times at pedestrian crossings;
- Improved building maintenance; the buildings do not look well at all;
- More cafés and stores, as well as parks, libraries, and study facilities. Then staying in this section of town will seem more common, especially for students;
- Hosting a lot of construction activities, which has made travelling there has been difficult in recent years;
- Tunnel for automobiles, free of pedestrians and bicycles;
- Prioritize pedestrians and cyclists above cars at traffic lights;
- It is quite slippery to walk in the winter, so if that could be corrected, it would be much better;
- Placing artwork or paintings on the walls of buildings;
- If the neighborhood grew more dynamic and convivial, inhabitants would begin to use it like Midtbyen and Solsiden, with lots of strolling and some bike/scooter riding;
- Creating a city design that offers adequate lighting and noise reduction;
- Fewer automobiles means more safety for bikers;
- A vibrant cityscape with a focus on smooth traffic boundaries and suitable circumstances for work, cultural, and leisure activities close to people's homes;
- Areas around the university must support students' everyday lives, particularly by providing a suitable blend of activities in everyday study as well as students' free time;
- Quieter areas with less traffic, as well as more trees and greenery. For example, the river promenade, the fjord promenade, the charging trail, and calm lanes around the city;
- Places where you can walk without fear of being hit by a car or a bike;
- Clear markings and a bike route that can be readily followed as far as feasible;
- Winter maintenance is critical.
- Improved pedestrian and cyclist facilities in comparison to automobiles. To put it another way, walking or cycling should be the most feasible alternative;
- Creating simpler transitions between buildings, such as skywalks;
- Low traffic speed, distinct cycling infrastructure, and nice walkways that are carefully maintained in the winter;
- Making use of historic structures with a new design;
- A cycling path along the river is pleasant in the summer but quite dangerous in the winter;
- Bike with decent road/path conditions so you don't have to be afraid of falling into a hole in the ground, and the pathways are cleared of snow/ice/gravel, so you don't slide. Deep snow, in particular, is a challenge.

The second open question was about what elements of the places they visited encouraged them to walk or bike, and various comments were submitted by respondents, including

- Good cycling lanes with a wonderful view and green space in Lade, Trondheim;
- The High Line—elevated NYC's park, as depicted in figure 6.11;

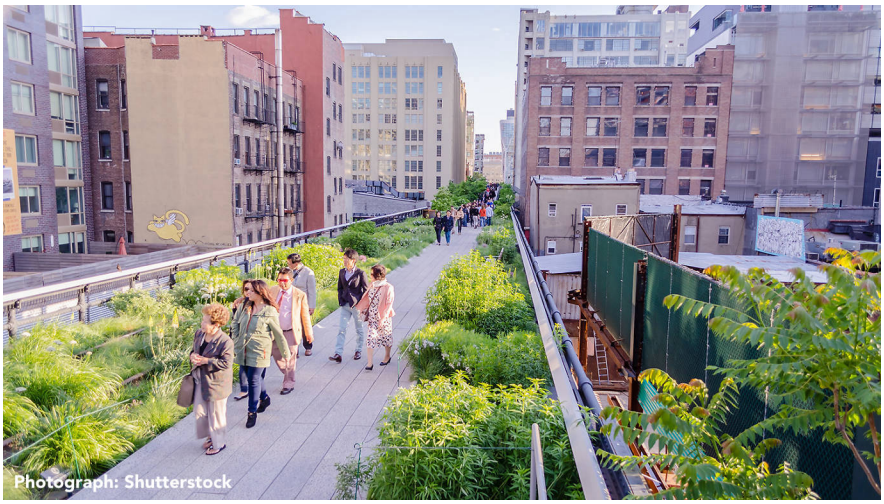

Figure 6.11: The High Line—NYC's elevated park

- Making certain underpasses under the ground, which is an excellent option for cold and long winters, as it is in Finland, Canada, and the Netherlands (Figures 6.12, 6.13, and 6.14);

Figure 6.12: Underpasses in Finland

Figure 6.13: Underpasses in Canada

Figure 6.14: Underpasses in Netherlands

- It is great in less frequented areas of the city, such as Bakklandet, where most people walk or cycle. Bakklandet has a living environment idea, with several cafés and a generally comfortable atmosphere (Figure 6.15). You may have a cup of coffee or sit on a bench;

Figure 6.15: Bakklandet in Trondheim

- Byåsveien around Havstad in the form of sidewalks/bicycle lanes, and the flower bridge;
- Bike lanes in Kristiansund with a good view of a lake and forest alongside the road;
- Helsinki, Finland: clean streets, safe bike lanes, and plenty of greenery (Figures 6.16 and 6.17).

Figure 6.16: Bike parking in Helsinki

Figure 6.17: Alepa Fillari bikes to rent in Helsinki Finland

6.4 Talk to the commuters in Elgeseter gate

In addition to the prior data from the digital survey, as shown in figures 6.18 and 6.19, I attempted to speak with commuters at Elgeseter gate, showing them eight different pictures and asking them to select two of them that they liked the most. The pictures are shown in figures 6.20 to 6.27.

Figure 6.18: Talk to the commuters in Elgeseter gate

Figure 6.19: Stand in Elgeseter gate

6.4.1 Findings from having stand in Elgeseter gate

As seen in figure 6.19, I placed eight photos on the table and labeled them with numbers 1-8. Then I started asking the commuters which of those photographs they liked the best. Pictures 1, 2, and 7 earned the most votes, indicating that commuters are eager to see buildings with active first floors with bakeries, cafés, restaurants, and small retailers along the road, as seen in picture 1. Furthermore, they were quite interested in having clean and divided walkways similar to picture 2 that was set back from the main road and had some greenery, as well as benches along the roadway for relaxing or sitting for a bit. And finally, implementing pocket parks with different kinds of benches and nice green surroundings far from the noise of the cars and buses as shown in picture 7, was the other picture that attracted the commuters the most.

Figure 6.20: Picture 1

Figure 6.21: Picture 2

Figure 6.22: Picture 3

Figure 6.23: Picture 4

Figure 6.24: Picture 5

Figure 6.25: Picture 6

Figure 6.26: Picture 7

Figure 6.27: Picture 8

7 Interview

The results of the interviews are provided in this chapter. Experts and non-experts are the two sorts of interviewees. The first category has five target groups: Fylkeskommune, Trondheim kommune, Statens vegvesen, ZEN, and people involved in Elgeseter area initiatives; the second has four: Elgeseter gate residents, daily commuters, active cyclists, and active pedestrians. The interview results are grouped into three categories: active mobility barriers in the Elgeseter district, active mobility motivators in the Elgeseter area, and recommended solutions.

7.1 Experts

7.1.1 List of interviewees

This section has 13 interviews from five different target groups:

Fylkeskommune:

- A project manager and a senior engineer began working on the road section on January 1, 2020.

Trondheim kommune:

- A project manager in the mobility and transport unit who began as a project leader for more construction and building in 2017 but is currently the project manager for early road section planning and works directly with the Elgeseter project. His workplace changed to Fylkeskommune after Easter 2022, but he still works on projects in Elgeseter.
- A Bicycle planner who started his position in November 2018.
- Municipal director of Trondheim kommune, a Senior Consultant, and an Advisor on businesses at the municipality director's office.

Statens vegvesen:

- One from the transport and society section who has been with the company since 2006.
- The other is from the traffic safety department who has worked in Statens vegvesen for around 40 years. Working mostly on safety, biking, and traffic planning.

ZEN:

- A research scientist who worked with the topic of ZEN since 2017 and more specifically in subjects of ZEB, energy power, special qualities, economy, innovation, and mobility.
- A Researcher and urban planning expert who currently works with a large research project in Stockholm called smart streets.

Involved in Elgeseter area projects:

- A Chief development officer who was involved in building Trondheim Business School ten years ago.
- A Civil architect, MNAL, and Planner who worked on several projects in Elgeseter for the road administration and Trondheim municipality.

7.1.2 Key findings from expert interviews

The key findings are grouped into three categories: Active mobility barriers in the Elgeseter district, Active mobility motivators in the Elgeseter area, and Recommended solutions.

7.1.2.1 Active mobility motivators

For having good mobility and for increasing walking and biking, the area should be *safe*, *comfortable,* and *attractive*. These are the three key factors that came up often during the interviews.

Safety refers to the ability to walk and bike around the area without feeling threatened by other people or vehicles. Everyone who walks or cycles should feel safe. It is critical to have a separate bike lane from the sidewalk to improve safety. Separate cyclists and pedestrians at junctions to ensure their safety and ensure that pedestrians have their own place to walk without cyclists in their path. People in this scenario are aware of where they belong to.

Certain requirements must be met to extend the distance between vehicle roadways and pedestrian paths. There should be adequate time for pedestrians to feel safe crossing the street, and they should not be in a hurry. In order to make the lanes safer, sidewalks should be renovated, and intersection laws should be altered. Slowing down automobile traffic, reducing the speed at crossing points, the existence of a decent side stroll, imposition of speed limits and, using helmets for the bikers might be extremely beneficial.

Copenhagen is Scandinavia's cycling capital. They have tight restrictions that cyclists devised specifically to make biking there safer. Biker traffic has its own lanes and traffic lights. Figure 7.1 depicts a separated bike lane from the pedestrian walkway and a vehicle road with a separate traffic light for cyclists in Copenhagen, Denmark. The bike lane was painted blue in various sections of Copenhagen city, as illustrated in figure 7.2, to make it more visible for commuters in the region. It's also worth mentioning that Denmark is flat, making biking simpler. In addition to Copenhagen, as seen in figures 7.3 and 7.4, Malmö, Sweden, has separated bike lanes on practically all major streets, with bikers having their own traffic lights.

Figure 7.1: Copenhagen, Denmark

Figure 7.2: Copenhagen, Denmark

Figure 7.3: Malmö, Sweden

Figure 7.4: Malmö, Sweden

Another crucial component in boosting active mobility is how *comfortable* the neighborhood is for walking and bicycling. We can build a more livable and comfortable location by removing as much traffic as feasible. With a nicer environment, students will want to descend down the hill and gather in the Elgeseter district, making it more habitable. Students enjoy urban spaces, but they must be made more user-friendly. There must be more convenient and pleasant ways to exit the walkway and gather. It should be able to locate locations off the pathway. First and foremost, get off the pathway and avoid sounds. In other words, it should be a calmer environment.

Along the Elgeseter route, there are several office buildings. We should endeavor to develop appealing spaces for bicycles when we design office buildings, such as inside parking spaces or places to wash or repair bicycles. It is critical to provide enough amenities and a safe and sufficient parking area for the bikes. As shown in Figure 7.5, most streets in Malmö, Sweden provide simple and convenient parking spots for bikes, notwithstanding the lack of such spaces along Elgeseter street. The bike is pricey if the person is an active cyclist, therefore he/she wants to take care of it as much as possible. Having the option to rent a bike in most areas makes riding as a primary form of transportation more convenient. Bikers seek to avoid bumpy roads. There should be one smooth, easy-to-maintain surface with no bumps. It's a good idea to make crossing easier. Furthermore, cars traveling at a slower speed produce less noise, making it more comfortable for bikers.

Figure 7.5: Malmö, Sweden

The width of the sidewalk is crucial. When we mix multiple forms of traffic systems together, such as scooters, bikes, and other vehicles, we need enough room for people to walk side by side. The obstacles will be reduced when automobile traffic decreases. Winter maintenance and slippery conditions should be prioritized. It is beneficial to remove sand and dust and clean the road early in the spring. If you make Elgeseter more livable by adding more activities, creating new traffic routes, and reducing noise, the area will be more conducive to bicycling and walking.

People have different motivations to do active mobility but mainly it can be how easy it is to bike and walk and how *attractive* the area is. For people who walk not only feeling safe is important, but also having a pleasant surrounding area is also crucial. So active façade on the first floor of the buildings, more greenery, social areas free from so much noise, and less traffic can be some of the factors that attract people to walk and bike.

We need a beautiful atmosphere to have appealing office spaces or workplaces and to motivate people to walk or bike to work. We need to develop areas for this. In New York they make pocket parks, small spots where you can meet someone and find a place to stay, while it's so crowded. So it's a good idea to develop pocket parks and gathering spots along the road, as well as amenities like coffee shops and restaurants, so that residents may get out of the way of cyclists and walkers. Attractive streets should have shops and glasses and things to look at 1 – 2.5 meters in height from the ground. In other words, if anything interesting happens on the route, people will be more inclined to walk and cycle.

Creating distance is one approach to improve the quality of life for the residents and walking there will be less dusty and much more pleasant. We require roads with more room for trees and other carbon ecosystem services. In other words, greater vegetation and placing parking spaces between trees, as indicated in figure 7.6, or having some flexible zones along the road with bike parking zones. Accessibility is also important for people to walk. Making the surrounding roads more attractive will improve the situation in Elgeseter. Because people will be able to use other locations as well, reducing traffic congestion from the Elgeseter gate area.

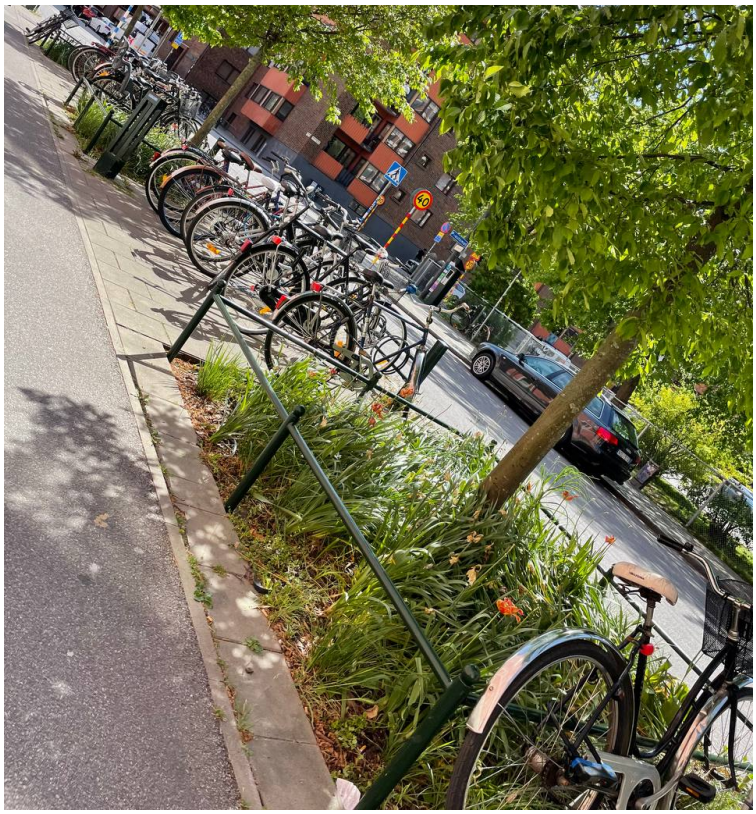

Figure 7.6: Malmö, Sweden

7.1.2.2 Active mobility barriers

In this section, several barriers in the Elgeseter district which reduce citizens' motivation to walk and bike there are mentioned according to interviews with the experts.

One of the barriers with Elgeseter gate is that there is too much traffic and not enough space. This is a problem that public transportation and cars travel the same route because we want to slow down cars while speeding up public transportation, which is difficult to achieve. The most difficult traffic location is in front of Studentsamfundet. In Studentsamfundet, there is a large swarm of people and bicycles sharing the same area. Furthermore, because there are few open areas nearby, those with disabilities struggle to cross promptly.

There is no space for people to stop and meet in Elgeseter gate. The pavement is sometimes narrow and sometimes wide, and it is not safe. They are also very near to the cars and buses. In Trondheim, the pavements are not adequately maintained throughout the winter. They clean the bike path, so you should occasionally simply walk on it because it is much cleaner and there is no ice or gravel. Because there isn't much greenery in this neighborhood, walking along the street in the summer will be quite hot and dusty due to the lack of shade. As you are so near to the walls and the street, you get wet from the cars and buses when it rains. Winter maintenance is not good, and the stones and sand make it difficult for bicycles to ride.

You are unable to go window shopping or have a cup of coffee in the area. You should just run down the street. That is the primary obstacle. There are no specific activities taking place along the route. The trek there is really tedious. It is not nice to reside on a busy,

dirty road that is noisy and difficult to navigate. The architecture is unappealing. It may also take at least 20 minutes to find parking because you must search the area for bike parking. Accessibility is also poor, and there is no purpose to establishing businesses because there is nowhere to stop.

The lack of bike lanes is a concern, and even where there are bike lanes, they are not properly connected since they stop so frequently and in so many areas. When you first start cycling, there are several disconnections along the bike paths. The bike lanes simply vanished from various directions. When there aren't these types of ties, it makes the area more unsafe for everyone.

7.1.2.3 Recommended solutions

One of the most common remedies suggested by experts is to learn how to use the street. A wide area for walking with some greenery and then the road for cars and buses would be a good idea. For example, a 3 to 4-meter pedestrian space, 2 to 3-meter greenery, and four bus and car lanes. Because it is impossible to place everything on the street, having bike lanes in parallel streets is one alternative. There is a side roadway that runs all the way along with Elgeseter gate that is quiet and has less traffic. As a result, an alternate method can be to activate adjacent roadways for riding because traffic on parallel streets is substantially lower.

Biking norms and traditions should be considerably more firmly established. It would be good if Elgeseter gate became a place where people would walk short distances and cycle along parallel streets for longer distances. We should instill a love of biking in the youngsters. Both children and adults must be encouraged to use their bikes and to know how to ride without falling. Children's travel habits are crucial since what they learn as children sticks with them. If you only drive children to school, there will be less chance for them to walk or bike in the future. Cycling education should be made mandatory for all children as they grow up. People should be educated to avoid driving towards the city center. People are more inclined to avoid driving if there is less parking. One thing to keep in mind is that, while it is important to educate and encourage people to walk or bike more if the barriers remain, it will not work. First, the impediments must be removed.

There are many buses at Elgeseter gate, and there is a demand for high-quality bus stops. Put a variety of buses in the region to make it easy for people to go to the hospital and be able to get there from practically anywhere. There may also be a tram route there in the future. Make a heavy-duty and capacity service, then have the buses out Sluppen and the tram line arrive before Sluppen. It will take up less space if we have one large bus station rather than two tiny bus stations. It is not necessary for all buses to depart from the center. Because there are many businesses around Sluppen, certain bus routes can begin in Larkendal and not continue to the center. As a result, inhabitants can take different buses, walk, or ride city bikes to Larkendal from Elgeseter gate. Various mobile applications that propose some commuting combinations can also be created. The application can give directions from the current location of the commuter. For example, start with an e-bike, then walk, and then take the bus with an estimated trip time.

That would be a good idea to have all of the traffic to the hospital come from the other side of the river. Elgeseter district should be used to gauge traffic demand. Reducing the speed at Elgeseter gate to 40 is also an excellent idea. The major goal is to minimize traffic congestion in the neighborhood so Singsaker road, which runs through Samfundet and up the hill towards Hogeskoleringen can be used as an alternative route for the cars. Furthermore, building safer crossings should be addressed, as this is one of the most

significant impediments, and repairing the street for pedestrians to a significantly higher quality should occur. Furthermore, making some space in the center of the street where the predestinarians can stay and wait a while before crossing the second part of the roadway can increase the safety of crossings.

Another idea suggested was to excavate down the roadway between some blocks. So, a tunnel in Elgeseter gate is a possibility. This tunnel should only be used by private cars, reducing traffic on the roadway greatly. As a result, the remaining ground area may be changed into a park, where various urban development strategies can be evaluated. It doesn't have to be extremely long; simply one block will suffice. The commuters will then be able to escape the noise and enjoy a more pleasant environment. A tunnel for people is not a good idea since it considers urban avoidance.

Increased environmental capacity is another recommended solution. To boost environmental capacity, either reduce traffic, which is difficult in Elgeseter gate or improve traffic handling capacity. It is critical to demonstrate to individuals the many modes of transportation available to them. We must demonstrate potential in a variety of ways. Not only is the form of transportation important, but so are the routes. Car sharing is one method for reducing traffic in the neighborhood and making the environment more pleasant for walking and biking. The economy and how inexpensive it may be to utilize car-sharing should be demonstrated to the public, as well as the prospect of learning how to use a combined mode of transportation. For example, people could walk from their location to the parking lot for city bikes, ride the bike till they reach the car-sharing, and then utilize the car share until they get to their destination. In this situation, some parking should be allowed in Elgeseter gate just for car-sharing and not for private vehicles.

Another option is to adopt the Dutch design for the region. It is not a car-free city, but if you drive into the city, you must return the same way you arrived. As a result, private cars cannot remain there. Not a car-free city, but one in which cars are guests. In this situation, we can make it much easier to walk, cycle, or take the bus, while making it more difficult to utilize the cars for short journeys. As a result, driving for short distances in the city will be impractical. Reducing the speed of the cars and placing several speed bumps might assist in making the region more uncomfortable for using private cars.

It is important to maintain the green spaces that we now have and to strive for more green spaces to improve the physical character of the neighborhood and make it more appealing to people. It may also stimulate additional stores, cafés, and other urban amenities. We want to bring vitality to the streets. So we may have bridges from one building to another on campus just for pedestrians and not cyclists and then use the remaining area for having more greenery.

When preparing such plans, it is critical to incorporate the surrounding community. It would be wonderful to have a space where people can come and share their thoughts. Temporary design solutions for decreasing speeds and testing and evaluating it can be a nice idea. For example, presenting a temporary street design with extremely basic and easy to implement transformations that can easily be reversed if it was a bad concept. Painting the crossing may be helpful as well, but the paint should be easily removed.

7.2 Non-experts

Six respondents from four target groups are placed in this section:

- Two interviews were conducted with Elgeseter gate residents, one of whom lives on Elgeseter street and the other in the surrounding area.

- Two of them were daily commuters of Elgeseter gate due to their employment locations.

- This section also includes one active biker and one active pedestrian who are both NTNU students.

7.2.1 Key findings from non-expert interviews

The key findings in this section, as in part 7.2.1, are divided into three categories: Active mobility barriers in the Elgeseter district, Active mobility motivators in the Elgeseter district, and Recommended solutions.

7.2.1.1 Active mobility motivators

Safety is critical in encouraging people to engage in active mobility. So, having enough light in the street when the weather is dark, having a separated sidewalk and bike lane, making safer pedestrian crossings, cleaning the sidewalk better in the winter, wearing a helmet while biking, and having traffic lights in bike lanes are some of the factors that can help increase safety and motivation for active mobility.

An attractive surrounding landscape, in addition to safety, is crucial for motivating residents to walk and bike. Renovating existing buildings, adding more trees, flowers, and nice green areas, painting some nice artwork on the walls of exciting buildings, and activating the first floors of buildings with cafes, shops, bakeries, restaurants, and other service facilities are all factors that can contribute to increased active mobility.

7.2.1.2 Active mobility barriers

Construction in the neighborhood makes it more difficult to walk and cycle there, especially because most projects take a long time, and it is difficult to utilize the same route as a pedestrian area. Construction equipment is also present and closing the road. They began construction on a new structure next to the gas station a year ago and the issue is that the route is closed on one side of the roadway, making it impossible to cross the street easily.

Another issue is that there is no separate bike and pedestrian route. Biking is especially challenging at traffic lights with a large number of people. Riding a bike on the Elgeseter bridge is especially inconvenient since the traffic is dangerously near to the sidewalk. Also, the wind on the bridge makes it difficult to maintain balance. It is not safe to ride a bike on the street while it is raining since you can quickly get drenched by cars and buses. In addition, the paths are quite slick in the winter, with numerous holes that make biking difficult. The existence of so much traffic also decreases commuters' motivation to bike and walk in the area

The street is so noisy and even smelly because of the gas from the cars, especially when the snow has melted. In the winter, there are also a lot of tiny stones everywhere, making biking extremely difficult. In addition, the air is occasionally dusty and filthy, making it difficult to breathe properly when pedaling. When it rains, it becomes more dangerous since it becomes more slippery and uncomfortable.

Another major issue is the presence of scooter riders. They park the scooters anywhere they want because there is no designated parking spot for them, making it difficult to cycle in the neighborhood. Furthermore, scooters are extremely fast, making riding and walking unsafe. They are mostly wearing headphones and are unable to detect the bikes or

pedestrians around them. Furthermore, pedestrians are concerned when the bike lane and sidewalk are not divided since they must continually glance behind them while walking to ensure that they are not mistakenly stepping in front of bikers.

The most significant disadvantage for cyclists in that area is the lack of bike parking along the route. Also, because there is no roof cover, current biker parking is insufficient for the Trondheim environment, which is typically snowy and wet. Furthermore, there is no safe place to park a bike. In addition, there is no commercial areas along the route. In such a location, there is also a lack of greenery, broad walkways, and certain services for disabled persons.

7.2.1.3 Recommended solutions

Some of the recommended solutions can be having more city bike stations along with Elgeseter gate with a selection of bikes of all sizes and types appropriate for persons of various ages and heights for rental bikes. In addition, making new bike lanes and painting them a distinctive color to make them stand out with their own traffic lights, which lead to calmer roadways in parallel streets.

Various pedestrians in some countries have winter heating. In Greece, for example, the paths are not open to the rain and are covered, thus pedestrians do not require an umbrella. For example, a structure with a ceiling that encompasses the space. In addition, it would be wonderful if the municipality swept and cleaned the sidewalks. if there is sufficient distance between the pedestrian area and the main road for automobiles, there may be enough room for several cafés with tables and chairs outdoors. Otherwise, sitting outside will be unpleasant.

8 Discussion

Elgeseter area, being one of Trondheim's most significant streets, is confronted with issues such as increased traffic, harmful pollutants, and noise pollution. Increased active mobility in the region can aid in the resolution of many of these issues. According to Temeljotov-Salaj and Lindkvist (2021), the contribution to health and well-being is important in a holistic approach to urban space regeneration, including both physical causes and symptoms of poor health, as well as the social, economic, and environmental components of individual-community-, and overall well-being. In other words, the main focus of this thesis is on finding incentives that will motivate residents to change their behavior and choose walkability and bikeability as a way to improve the quality of life in cities, particularly Trondheim in Norway, with the added benefits of enhancing public and private health and lowering harmful emissions, traffic congestion, and noise associated with excessive automobility to answer the research question, *What can motivate citizens who commute to or travel within the Elgeseter district to change their behavior toward increased walking and biking?*

Trondheim municipality wanted to establish Trondheim as a model and collaborative arena for the creation of green values and the development of a climate-friendly lifestyle. Furthermore, Trondheim kommune (2017) states that the municipality's objective is to cut greenhouse gas emissions by 80% by 2030, compared to 1991 levels. As a result, boosting active mobility in the Elgeseter area will address four sustainable development goals at the same time: Good health and wellbeing, Sustainable cities and communities, Climate Action, and Life on land.

The results from the method triangulation have provided several findings that should be discussed. These will be discussed in connection with the thesis' research questions. The discussion section is divided into three parts including Active mobility advantages, Active mobility motivators, and Active mobility barriers.

8.1 Active mobility advantages

According to the findings from the literature review in section 4.2.1, *Physical activities* have been demonstrated to improve people's health by decreasing their chance of becoming overweight or obese, as well as in the primary and secondary prevention of several chronic conditions (Warburton et al., 2006). Numerous studies in recent years have attempted to discover various techniques for promoting physical activity in the general public, with a particular emphasis on active mobility as one of the most important ways to improve an active lifestyle by utilizing walkability and bikeability as modes of commuting. In addition to that, results from the document study in section 5.4 show that walking is good for your health, the environment, and your social life. The urban environment improves as more people walk, becoming more attractive, dynamic, and safe.

Walking and cycling for transportation ('active mobility') are often assumed to reduce CO2 emissions by replacing at least some motorized transportation (de Nazelle et al., 2010). This is only one of the advantages of Elgeseter gate's dynamic mobility. Active mobility can assist accomplish social and environmental goals such as boosting social cohesion and cutting CO2 emissions by offsetting air pollution from motorized automobiles on such journeys. According to the results from scoping literature review in section 4.2.1, promoting biking and walking as modes of transportation can assist cities in being more sustainable and livable.

According to Washington et al., (2017) Active transportation can help you meet your daily exercise goals. It is healthful and sustainable, and it can help to minimize air pollution and traffic congestion while also advancing energy conservation and environmental quality. Therefore, based on the findings of the interview and conversations with daily commuters in the Elgeseter region, many individuals strive to undertake more active mobility to meet their body's requirement for daily physical exercise. In other words, if excellent quality active mobility is given to them, they are willing to walk and cycle instead of driving their private cars via Elgeseter gate.

8.2 Active mobility motivators

Natural characteristics such as trees and other plants, as indicated in section 5.4.6, increase active mobility. It may also be utilized to establish a physical barrier between vehicles and increase security. Areas with trees and green space are also related to greater biking, according to the findings of a scoping literature analysis reported in sections 4.2.2 and 4.2.3. According to figure 6.9, which depicts active mobility motivators as a consequence of evaluating the digital survey, the presence of more trees and green places such as parks received 15% of the replies and was the primary active mobility motivator for commuters. Finally, according to the findings of the interviews in sections 7.1.2.1 and 7.2.1.1, both experts and non-experts agreed that increasing the number of trees, flowers, and attractive green places is critical for promoting active mobility in the region.

According to the digital survey analysis illustrated in figure 6.9, the second most significant active mobility incentive was improving the *quality of the sidewalks*. The pedestrian zone must also be broad enough and sloping enough to allow for uninterrupted walking, according to the document studied in section 5.4.3 (Gåing til/fra holdeplasser, 2018). Furthermore, when talking to commuters at Elgeseter gate, the majority of individuals say that having a pleasant sidewalk can encourage them to walk more, and they picked figure 6.21 as their favorite style of the pedestrian walkway. The width of the sidewalk and winter upkeep was also often addressed in the interviews, as shown in part 7.1.2.1.

The presence of decent *bicycle infrastructure* is the third most important element in enticing individuals to active transportation according to a digital survey. Protected facilities, complementing infrastructure and programs, and planned network design that considers land uses and destinations are all essential aspects of encouraging urban cycling stated by Malmo-Laycock et al (2017). Having the opportunity to rent a bike in most regions makes riding as a major mode of transportation more convenient and offering adequate facilities as well as a safe and appropriate parking area for the bikes was emphasized several times in the interviews.

Having a *distinct bike lane from the pedestrian walkway* and a vehicle road with a separate traffic light for bicycles was one of the aspects suggested by the interviewees for improving active mobility, which is illustrated in section 7.1.2.1 with photographs from Malmö and Copenhagen as examples. Furthermore, according to figure 6.9 from the digital survey data, the presence of routes with separated bike lanes was the fourth significant criterion for luring people to greater active mobility.

Interviewees mentioned *safety, comfortability, and accessibility* as critical elements toward more active mobility in Elgeseter gate, and all major pedestrian connections should be accessible and passable, as well as safe, pleasant, and appealing, according to data collected from the document study (Gangfremmende planlegging, 2020). Because unsafe routes discourage walking and biking, pedestrian safety is crucial to developing active

transportation. According to commuters, one of the biggest problems discouraging inhabitants from walking in the Elgeseter region is the lack of pedestrian amenities in the area. The majority of sidewalks do not segregate bicycle routes and are either too wide or too narrow. Furthermore, According to Pavlick et al (2020), a walkable city has safe, accessible, and comfortable walkways, trails, and street crossings for people of all abilities.

8.3 Active mobility barriers

According to the digital survey, the biggest active mobility obstacle in Elgeseter gate was *noise or air pollution*, as shown in figure 6.10. The fact that the street is so noisy and even smelly due to gas from the cars, especially when the snow has melted, and that the air is occasionally dusty and filthy, making it difficult to breathe properly while pedaling was mentioned a lot in the interviews by people who are daily commuters of Elgeseter gate (Section 7.2.1.2). Furthermore, based on the findings of the scoping literature review, Gan et al (2021) said that noise and high air pollution may make walking difficult.

Inactivity and decreased physical activity/active transportation may be exacerbated by *poor sidewalk conditions*, restricted access to recreational facilities such as parks, and a lack of local attractions (Arbab et al., 2020). Poor sidewalk condition earned 12% of the votes as one of the key hurdles to promoting active mobility in Elgeseter gate, as shown in figure 6.10 of the digital survey findings. The pavements are not sufficiently maintained throughout the winter, according to the findings of the interview given in section 7.1.2.2, which acts as a barrier in the neighborhood and reduces people's enthusiasm to walk and cycle.

Furthermore, locations with trees and green space are connected with increased biking. There is currently insufficient open space in the Elgeseter neighborhood, and the region is largely surrounded by historic buildings, making it less appealing to bicyclists. Moreover, according to the results of a digital survey in section 6, lack of biking safety, an unpleasant environment due to all of the traffic, including noise and dust, lack of trees that can act as visual barriers, insufficient lighting for bikes during the winter, and dirty and slippery sidewalks during cold seasons are all barriers that reduce people's motivation to walk and bike in the area. In other words, more walkable and bikeable neighborhoods may influence residents' attitudes toward active transportation alternatives.

9 Conclusion

For significant health advantages, the World Health Organization advises 150 minutes of moderate physical exercise each week. Unfortunately, the majority of adults do not get enough exercise and spend the bulk of their waking hours inactive (MacKay et al., 2004). Walking and bicycling, as two means of active transportation, can help to get a daily dose of exercise. As a result, enticing individuals to engage in greater active mobility is a challenge because, while almost every city in the world is eager to address these issues, comprehensive planning strategies that span everything from land use to municipal infrastructure design will be required. The goal of this thesis is to look for the possibilities for individuals to live a healthy, economical, and happy life without the use of a personal car and improve walking and biking by identifying some motivational methods and tools. In addition, this master thesis sought to get a better understanding of the benefits of active mobility for people and society, as well as the impediments to the rise of walking and bicycling at Elgeseter gate in Trondheim and the surrounding region as a legitimate means of transportation in the area. The contribution of this thesis brings better comprehension on how beneficial active mobility is and what are concrete motivators and barriers for citizens, both from theoretical and practical perspectives. This goal was achieved by employing scoping literature review, document study, digital survey, and interview as research methods, putting the focus on citizen engagement.

The *walkability and bikeability* indices are used to assess how favorable an area is to walk and ride, and they generally include criteria such as comfort and perceived safety. Communities that are walkable and bikeable are regarded as ideal locations to live, work, and play because they offer recreational possibilities, more diversified and active transportation alternatives, and chances to be physically active, all of which contribute to our overall health and wellbeing. Data show that it is critical to understand that different users have different travel patterns and expectations. As a result, initiatives to encourage walking and cycling should be adapted to everyone's needs, resulting in a larger number of potential users. Furthermore, because one of the UN SDGs is to safeguard the environment, enhancing active mobility would help to achieve this objective. As a result, several recommendations are made based on the study undertaken by the author of this thesis, notably for the Elgeseter district, to fulfill these environmental goals and progress toward higher sustainability.

Findings from the thesis show that people care about the walking environment therefore, some measurements were presented in various respects. First, current techniques ignore components of urban design such as sidewalk quality, walking buffers, and other characteristics that influence people's walking behavior. Second, knowing the purpose of the area and, more importantly, local people's preferences for the walking environment is critical for evaluating walkability. People have different walking needs and expectations in a corporate district, a residential neighborhood, and a university campus. Thus, I attempted to examine this issue from the perspectives of several target groups, with a particular emphasis on listening to Elgeseter district daily commuters to understand their requirements, concerns, and wishes for a better neighborhood for active mobility.

Urban development plans must be rethought and redesigned to enhance traffic flow by including and promoting non-motorized, less polluting means of transportation like cycling and walking. In other words, between Professor Brochs gate in the south and Klostergata in the north, the main roadway directly south of Trondheim city center must be changed to incorporate walkways, crossing junctions, and distinct bicycle and pedestrian lanes with

end-to-end connections. Second, in order to minimize reliance on unsustainable means of transportation, Trondheim kommune must build a more affordable, accessible, and appealing transit infrastructure that is always available to commuters in the Elgeseter neighborhood. In rural areas where physical activity and active mobility options are severely limited, planners should prioritize building paths to connect residences with services and investing in more recreational facilities within walking distances.

In my work during my master's thesis, I discovered how appealing it is for residents to get involved. As a result, I can urge that citizens be more involved in decision-making in the future by holding workshops, debates, hackathons, creative activities, and direct conversation. Furthermore, empowering citizens and guiding them to become co-managers and co-designers in the co-creation of public places should be a priority in future work.

As a result of these findings, it will be possible to use the ideas for implementing more effective policies in the Elgeseter area to encourage and develop active modes of transportation. Therefore, infrastructure and regulations must meet the expectations of current and future users to provide an acceptable walking and bicycling transportation network service and encourage people to use it. Furthermore, given the significant public health, economic, and climatic ramifications of transportation behavior, academics and funders should focus their efforts in the future on developing specific motivators for active mobility.

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PART 2: Conference Papers

During my master's degree, I wrote four papers, one of which is pertinent to my master's thesis and has been included to this document at the end of PART 2.

The papers that are already published:

- Afshari, Mahgol. (2021) Importance of Facility Management in renovation projects. *6th Conference of Interdisciplinary Research on Real Estate. https://www.researchgate.net/publication/357807636_Importance_of_Facility_Management_in_renovation_projects*
- Afshari, Mahgol; Goubel, Benjamin; Lille, Théo; Kauffmann, Ambre; Jacques, Alexandre; Desissert, Céline; Gaillard, Corentin; Vedeau, Pierre; Beaugrand, Alexis; Germain, Lucas; Muniz, Elbes. (2021) Sustainable Building Engineering A healthy and beautiful district in a healthy and beautiful historical environment. *6th Conference of Interdisciplinary Research on Real Estate. https://scholar.google.com/citations?view_op=view_citation&hl=en&user=TouM6osAAAAJ&citation_for_view=TouM6osAAAAJ:u5HHmVD_uO8C*

The paper that is not published yet:

- Afshari, Mahgol; Temeljotov Salaj, Alenka. Non-technical tools and guidance for positive energy district implementation – scoping literature review. Real Estate Research Quarterly (ahead of print)

Relevant conference paper

Identifying methods and tools toward more people friendly environment – a scoping review

This conference paper was presented in The 11th Nordic Conference on Construction Economics and Organization on 18/19-20 May 2022 in Copenhagen and Malmö

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Cities are contending with issues such as traffic congestion, air pollution, road accidents, and urban sprawl as the world's population grows at a rapid rate. Cycling and walking are non-motorized modes that use no fossil fuel energy and require comparatively little infrastructure. They also have lower implementation and maintenance costs for users and governments than motorized forms of transport. Therefore, this study aims to identify methods and tools for more active mobility. The identification of approaches that can be used as incentives to increase walkability or bikeability in the Elgeseter district in the City of Trondheim, has been done through a scoping literature review. The analysis is carried out according to the following research question: What can motivate citizens that commute

to or travel inside the Elgeseter district to change their behavior toward more walking or biking. The findings are divided into four groups: active mobility advantages, bikeability motivators, walkability motivators, and active mobility barriers. Though almost all cities around the world are eager to address these issues, they will need integrated planning approaches that include everything from land use to city infrastructure design. Such approaches are necessary to encourage people to embrace green-sustainable modes of transportation as a lifestyle choice rather than a forced obligation. The study contributes to the knowledge about determinants that are important for encouraging commuters towards active mobility in the Elgeseter district.

KEYWORDS: Active Mobility, People Friendly Environment, Walkability, Bikeability

Introduction

There is an ongoing trend all over the world that people are moving into cities and there is a focus on the development of smart cities in many countries in Europe (Collins et al., 2021). The location, design, and operation of a residential or commercial complex have an impact on how often people walk, bike, take public transportation, or drive, as well as whether their commuting experience is pleasant or unpleasant. Many other factors can also influence people's travel behavior, such as geographical characteristics, cultural backgrounds, and awareness of traveling habits' effect on climate change. Active mobility including walking and cycling may result in cost savings, lower CO2 emissions, less noise and air pollution, and less car congestion (Rabl et al., 2012).

In accordance with the Trondheim city commitment to reduce Greenhouse Gas (GHG) emissions based on (Trondheim kommune. 2017), the city is attempting to overcome the effects of urbanization, city expansion, and highways as barriers to efficient collaboration in a part of the city called the Elgeseter district. In the area, the largest university and the largest hospital in Norway as well as many technologies and other companies are situated. There are different goals for the Elgeseter project and the project is moving towards Sustainable Development Goals. Achieving zero-emission, consolidation of sustainable lifestyles, supporting mental and societal health, moving towards innovation and development in an urban context, and achieving a systemic change towards a sustainable society are some of the targets of the project. Furthermore, improving active mobility in the Elgeseter district will achieve three Sustainable Development Goals at the same time which are Good health and wellbeing, Sustainable cities and communities, and Climate action.

Elgeseter gate is an urban thoroughfare just south of Trondheim city center, between Professor Brochs gate in the south and Klostergata in the north. The road is a continuation of main road from the city center toward south. In this paper, the term Elgeseter district will be used to refer to the area surrounding Elgeseter gate. Figure 1 depicts the case study area, with the whole red circle representing Elgeseter gate and surrounding area; the red dotted circle includes the connecting routes to Elgeseter gate.

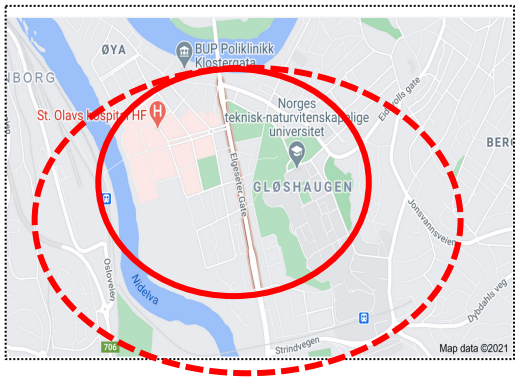

Figure 1: The focus area of the case study

Scope of the study

This paper reports on a scoping literature review focusing on identifying methods and tools that increase people-centric and active mobility that is relevant for the Elgeseter district. More specifically, the analysis ambitions to recognize incentives towards increasing walkability or bikeability in the Elgeseter district. Based on this, the research presented in this paper addresses the following main research question

"What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking?"

In the upcoming chapter, a theoretical background about active mobility as part of developing a new town area is discussed according to previous studies.

Active mobility as part of developing new town area (Theoretical background)

In 122 nations around the world, more than 30% of adults were found to be physically inactive (Hallal et al., 2012). A considerable proportion of people in countries all over the world have adopted sedentary and physically inactive lifestyles (Van Dyck et al., 2013). This chapter provides a theoretical background on the relevance of physical activities in people's daily life, as well as how active mobility might meet this requirement. Furthermore, walking and cycling as two major types of active transportation are discussed, with bikeability being the more popular way of transportation among the general public. Finally, a summary of active mobility as part of the development of a new town area is presented.

Physical activity has been shown to increase emotion, sense of recognition, overall life quality, anxiety neurosis (Ohmatsu et al., 2014), as well as lower depression (Dunn, Trivedi, & O'Neal, 2001). Regular physical activity can assist to reduce the risk of a variety of chronic diseases and their risk factors, thereby improving global public health. On the other hand, *Active mobility* (i.e. walking/cycling to get from one place to another) can be done regularly, is a low-cost and easily accessible form of physical activity. It is simple to incorporate into adults' daily lives, it may be an important contributor to meeting the daily physical activity guidelines for health (Mertens et al., 2016). Active mobility (also known as non-motorized mobility) is critical to the development of efficient and equitable

transportation networks as well as the transition to more sustainable communities (Victoria Transport Policy Institute, 2016).

Walking and cycling activities, among other sorts of physical activities, have recently gotten more attention from both civic and academic sectors to increase people's physical activity levels. Their popularity has been aided by a variety of factors. First, walking and cycling are suitable for people of all ages because they do not necessitate any special skills or equipment. Second, even though cycling is better for longer excursions, walking and cycling allow people to choose their preferred movement intensity. Finally, walking and cycling can assist people, particularly those from low-income groups, in breaking free from sedentary and inactive lifestyles (Brownson et al., 2000).

From the perspective of commuter cyclists, a city's cycling culture is the most important determinant in commuter riding levels (Sager., 2002). In various places throughout the world, policies and initiatives targeted at boosting the use, accessibility, and safety of cycling have increased during the previous decade (Pucher and Buehler, 2017). Furthermore, according to Waitt et al., (2022), barriers to commuter cycling' as 'stop-start' journeys filled with interruptions from traffic lights, crossing main roads, sharp corners, or pedestrians in the same lane as the bikers are important elements to be considered to increase bikeability in an area.

In sum, the natural and manmade environments, as well as individual and household characteristics, all have an impact on the decision to travel by bicycle (Heinen et al., 2009). Bicycling infrastructure can help reduce greenhouse gas emissions, while other measures that promote human-powered modes can help improve air and noise pollution. These advantages motivate towns to encourage greater riding but doing so necessitates legislative changes that bring bicycling on par with other modes of transportation (Desjardins et al., 2021).

During the research presented in the paper, walkability and bikeability motivators and barriers appears to be little analyzed in the literature. Not many papers are identified focusing solely on the methods for motivating people towards more active mobility. Therefore, the current paper tries to fill this knowledge gap by, firstly, identifying the methods and tools for increasing active mobility, and secondly, analyzing the factors which can affect citizens' commuting behavior. This latter concerns especially the factors that can motivate and encourage towards more walking and biking.

Methodology and Research design

Scoping literature reviews are useful when the research intends to overview an existing body of literature within a specific field to find potential research gaps (Munn et al., 2018). The structure of the scoping review was inspired by the framework developed by Arksey and O'Malley (Arksey et al., 2005). Scoping reviews are also adequate methods when the research questions asked are broad and holistic without the intention of confirming or denying existing practices within the selected field (Arksey et al., 2005; Colquhoun et al., 2014; Munn et al., 2018).

Systematic search

Four databases were chosen for the scoping literature review: Google Scholar, ScienceDirect, Web of Science, and Scopus. The study was limited to articles and books that have been published in the last 10 years. By defining *"motivation AND commute AND walkability AND bikeability"* as the main search string, 447 results appeared in GS, 694 results appeared in SD and no results in WoS and Scopus. Based on the Research Question, the titles of the findings were read to select the most relevant literature for the topic. After transferring all 346 relevant articles based on their titles to Mendeley, 5 sets of duplicates have been found. So, for the next step, we started to read the abstracts of the 341 remaining documents and transfer the relevant ones to the comparison table. By reading abstracts, 53 final documents were chosen as the most relevant to the research topic. The framework for the scoping review performed in this paper is visualized in Figure 2. In addition, two studies with pertinent data were added to the references after a particular search with the keyword "cycling commuter" in Google Scholar.

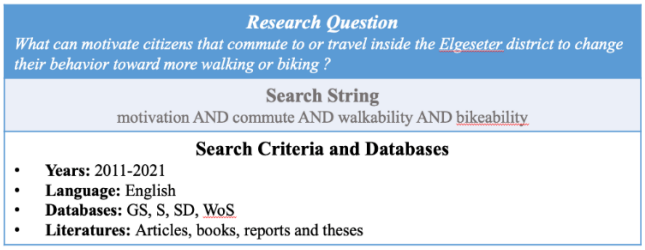

Figure 2: Framework scoping study

Search procedure

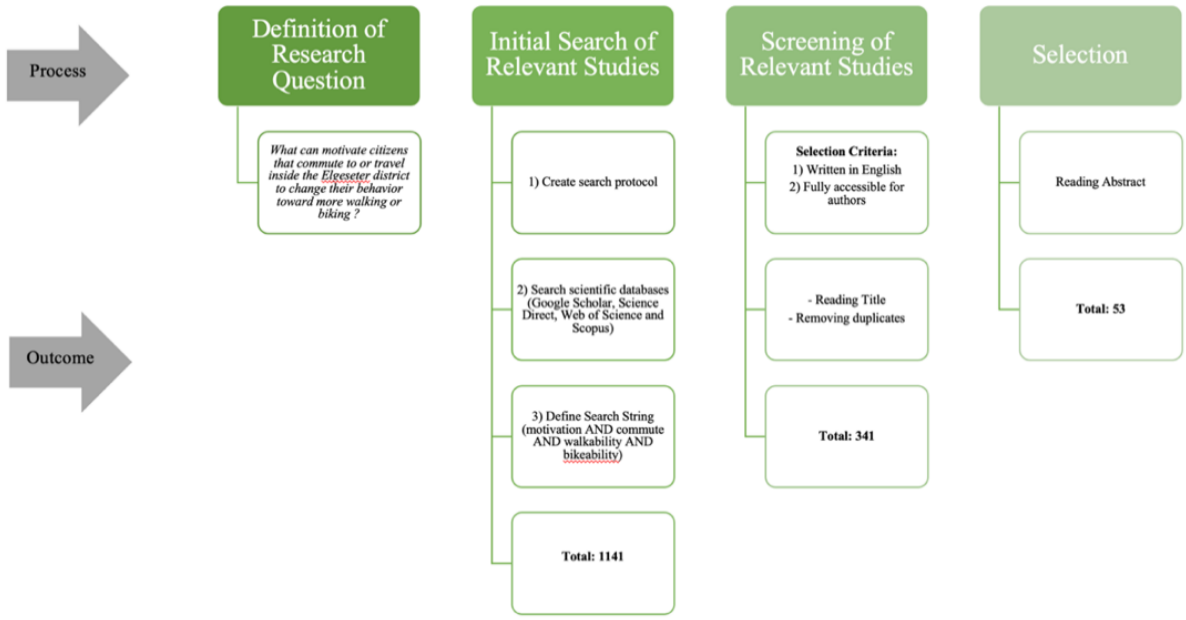

Figure 3. Scoping review process as followed in the research presented in this paper

Following the protocol of the scoping review (Arksey et al., 2005), the steps are explained as follows (Figure 3):

5. One research question is defined.

6. After several trials and errors, an initial search of relevant studies were conducted using available scientific databases with the following search string: "motivation AND commute AND walkability AND bikeability"
7. The selected databases were Google Scholar (GS), Scopus (S), Science Direct (SD), Web of Science (WoS).
8. The language is limited to English, and the year of publication was set from 2011 to 2021.

In the upcoming chapter, the findings from the literature review are presented.

Result - Active mobility – Bikeability and Walkeabilty factors

In this chapter, the results are presented in two different categories. In the first section, the focus is on descriptive analysis, and in the second section, an overview of the overall findings from the literature is presented.

Descriptive Analysis

In this section, the descriptive findings from review are analyzed from two different aspects. In the first part, the number of publications of the examined papers during the last 10 years is provided and in the second part, the top journals are identified.

Number of publications

In general, there was a notable increase in the number of publications connected to active mobility in 2020 and 2021, with 9 and 10 publications, respectively. Between 2011 and 2019, the number of papers published ranged from three to six, except for 2013, when no relevant papers were found. Figure 4 depicts the number of publications trends from 2011 to 2021.

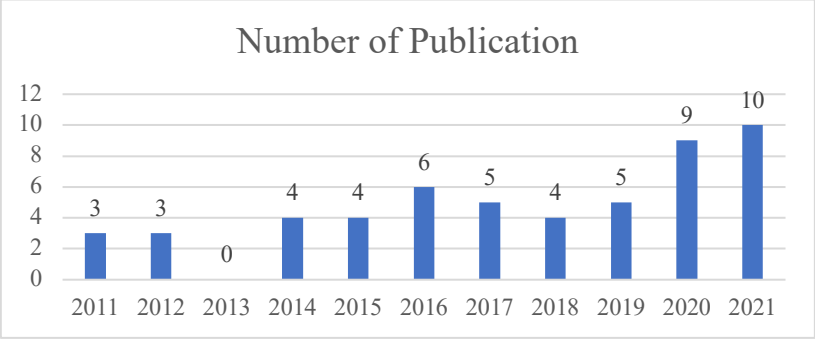

Figure 4. The number of publication trends between 2011-2021.

Top journals of the examined papers

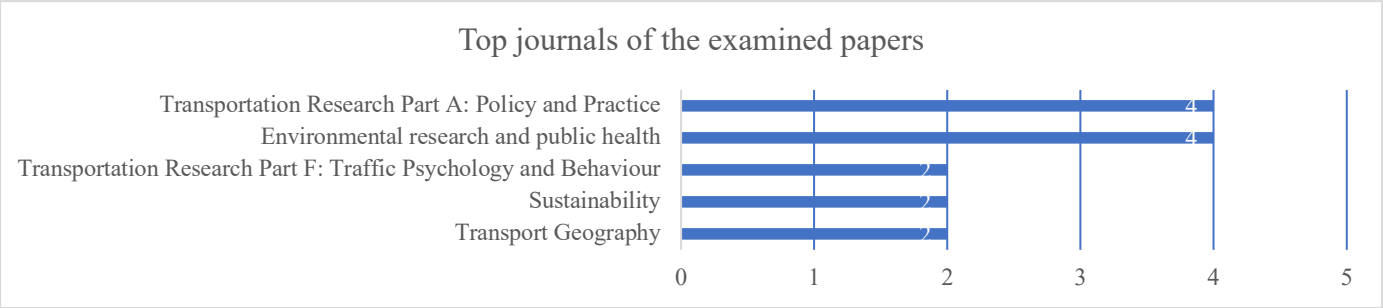

Figure 5. Top journals of the examined paper.

"Transportation Research Part A: Policy and Practice" and "Environmental research and public health," each with four papers, were the top journals in the field of study of this report, according to the analysis. In addition to them, three other journals, each with two papers, were active in this instance. The remaining papers originate from grey papers, other journals, conference proceedings, and publishers, with each having less than two papers. The number of papers in the most prestigious journals for the examined 53 papers is depicted in Figure 5.

By presenting the descriptive analysis in this section, the main focus of the next part will be on four different sets of findings from the literature.

Findings from the literature

In order to identify approaches to increase active mobility, the main findings from the scoping literature review are categorized into four groups. First, the benefits of active mobility are presented. Then, bikeability and walkability motivators are discussed respectively, and finally, the barriers of active mobility are mentioned.

Active mobility advantages

Active mobility modalities are a low-cost means of commuting with a low environmental impact. Because of their low cost, flexibility, beneficial physical and psychological health impacts, and zero emissions, active modes (such as walking and bicycling) are deemed green, economic, equitable, and convenient (Gan et al., 2018). Walking or cycling as an alternative to motorized transportation for everyday journeys are examples of active mobility modes. Based on previous studies, each of these alternatives is beneficial for the communities and they have many advantages for the people, societies, and environment.

Physical activity can benefit people physiologically by having a favorable impact on their mental health, in addition to enhancing their physical health. Therefore, active mobility, which is linked to health, physical activity, and the prevention of chronic diseases, is increasingly being included in transportation and urban planning studies looking for alternatives to motorized transportation (Arbab et al., 2020). Cycling as one of the active mobility modes has been shown to reduce the incidence of obesity, increase cardiovascular fitness, and reduce the risk of heart disease, diabetes, high blood pressure, and a variety of cancer-related side effects (Oja et al., 2011).

Kim et al., (2016) believe that bicycling is critical for creating a city with sustainable development by lowering pollution from motorized vehicle emissions, improving inhabitants' health and physical fitness, and, most critically, minimizing road traffic accidents. As a result, promoting bikeability and walkability as a mode of transportation can help communities become more sustainable and livable.

Bikebility motivators

Changes in travel behavior have been demonstrated to be one of the most effective ways to reduce greenhouse gas (GHG) emissions in transportation. Based on this fact, cycling, in particular, is becoming increasingly popular as a non-automobile means of transportation. Therefore, the main focus of this section is introducing some incentives which can lead to an increase in the rate of biking between people.

According to prior research, there are a variety of bikeability motivators that can encourage people to choose riding as a mode of transportation. Winters et al., (2010) present that in Vancouver, Canada, different sorts of bicyclists, both existing and potential, rated "routes with magnificent scenery" as a top motivator, slightly higher than routes with divided bicycle tracks or a flat slope. In another research, Heesch et al., (2012), compared biking incentives between men and women and mentioned that women were significantly more motivated by fun and enjoyment, getting fresh air, incorporating physical activity into a busy lifestyle, confidence in their cycling abilities, seeing other people cycle, encouragement from others, convenient or inexpensive mode of transportation, and environmental concerns than men.

According to Dill et al., (2013), protected bike lanes, known as "gold standard" bike lanes, are perceived to be safer than their non-protected counterparts because they use a barrier to separate cyclists from motorists. This sense of security, or comfort, could be critical in drawing more bicycles to the roads. In another study, Habib et al., (2014) indicated that people who have a greater perception of a city's bikeability and a low level of safety awareness are more likely to pedal for utilitarian reasons. It is also important to consider the quality of the urban environment.

While many research studies are discussing bikeability motivators without focusing on the specific areas, some other researchers present their findings based on different case studies in different geographical locations. For example, based on research in Brisbane, Australia, shorter distances to destinations, such as a commercial district with jobs and a river with bicycle routes, enhanced the likelihood of riding (Heesch et al., 2015). According to another study, bicyclists in Seattle, Washington choose short, flat routes with well-connected amenities on highways with low traffic speeds. Their research discovered higher variation in preferences for views along routes with mixed land use, street trees, illumination, and city elements (Chen et al., 2017).

Walkability motivators

A neighborhood's walkability is a measure of how walkable it is considered to be for people that walk in the district daily. The availability or absence of footpaths, sidewalks, or other pedestrian rights-of-way, traffic and road conditions, land use patterns, building accessibility, and safety are all factors that can influence people's decision to walk as their

primary means of transportation. According to Hess et al., (1999), in more walkable communities, that have a higher density, and a diversified land use mix, there is a higher use of active modes and transit. Safe accessibility, such as strengthening personal security and improving transportation safety, and physical setting, such as boosting comfort level and providing supporting facilities, can be also some incentives towards active mobility (Arbab et al., 2020).

Hillnhutter (2022) and Vukmirovic approached the stimulators in the urban environment, which influence the experience of walking (non-monotone environment, not boring streetscape, green features, artistic elements, gathering places, good visibility, safety). Alfonzo et al., (2008) believe that sidewalks' width and quality, benches, and crosswalks all had a beneficial impact on the number of pedestrians and/or the amount of time they spent walking. In other words, well-designed green street facilities contributed to more attractive walking environments (Adkins et al., 2012). Moreover, the likelihood of preferring to walk for both access and egress trips was positively and significantly linked with enough perceived walking amenities and comfortable walking space (Wu et al., 2018). Zhang et al., (2020) also mentioned that if it's busy, dark, or hazardous, people will avoid walking. While strolling, pedestrians often consider additional facilities such as a water fountain, a restroom, and shade.

Active mobility barriers

Identifying the constraints that prevent individuals from walking or cycling to their destinations is the first step toward promoting active mobility. Greater distance, increased household income, and increased car ownership are consistently related to lower rates of active mobility among the factors that cannot be controlled for. According to Pucher et al., (2006), bicycle journeys are less common in low-density areas, as there are fewer places that can be visited in a short amount of time. Elgeseter district can be described as a low-density area. There is the potential for some restaurants, cafes, businesses, and perhaps a shopping mall to be built there, but currently, there are not enough places there to be visited or make the district attractive to walk or bike.

Ma et al., (2014) investigated active mobility barriers from an age standpoint. Ma et al. believe that younger individuals are more likely to bicycle. Older adults are less likely to ride a bike, which could be explained by the fact that as people get older, they become more concerned about safety and fear of being injured in an accident. However, Habib et al., (2014) explored cycling barriers from the perspective of gender. Based on his findings, women are more concerned about traffic and safety conditions, which is why they are less likely to cycle.

Based on Rojas et al., (2017), the most commonly reported walking difficulties in Singapore were distance limitations, sluggish transport speeds, and hot, wet weather. The need of carrying stuff (particularly for students) was also emphasized. Users, primarily younger users, stated that they must commute a significant distance to work or education. As a result, walking trips were frequently overlooked. Some people said they have to carry a lot of stuff to go to work (notebooks, lunch, paperwork, etc.), which makes walking more than a few blocks difficult.

Discussion

This study aimed to get a better knowledge of the advantages of active mobility for people and societies as well as the barriers that exist in the growth of walking and biking in the city as a genuine mode of transportation in such a constrained area. Moreover, this paper tries to identify some motivators towards more walkability and bikeability by using scoping literature review as the main research method to answer the research question which is What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking. In this chapter, the results are discussed concerning the theoretical framework.

In comparison to active mobility advantages and barriers, and bikeability motivators, walkability motivators were discussed less in the literature.

Physical activities have been shown to help people's health by lowering the risk of becoming overweight or obese, as well as in the primary and secondary prevention of a variety of chronic illnesses (Warburton et al., 2006). Therefore, in recent years, numerous studies have attempted to discover various techniques for promoting physical activity in the general public, with a particular focus on active mobility as one of the most essential ways to improve an active lifestyle by utilizing walkability and bikeability as modes of commuting.

Trondheim municipality has aimed to introduce Trondheim as a model and a collaborative arena for green value creation and the development of a climate-friendly lifestyle. Furthermore, based on Trondheim kommune (2017), Trondheim municipality’s goal is to reduce the Greenhouse Gas Emissions by 80 % before 2030, compared to the 1991 level. Therefore, improving active mobility in the Elgeseter area will simultaneously entail three sustainable development goals: Good health and wellbeing, Sustainable cities and communities, and Climate action.

According to Zhang (2016), although individuals care about the walking environment, the current metrics are insufficient in several ways. First, present methodologies do not take into account aspects of urban planning such as sidewalk quality, walking buffers, and other elements that impact people's walking behavior. Second, understanding the neighborhood's purpose and, more crucially, local people's preferences for the walking environment is vital for evaluating walkability. In a business center, a residential neighborhood, and a university campus, people have various walking requirements and expectations.

Inactivity and decreased physical activity/active transportation may be caused by poor sidewalk conditions, restricted access to recreational amenities such as parks, and a lack of local attractions (Arbab et al., 2020). Moreover, areas with trees and green space are also associated with more bicycling. Currently, there is not enough green space in the Elgeseter district and the area is mostly surrounded by old buildings which makes it a bit less attractive for the bikers. In other words, more walkable and bikeable communities may increase inhabitants' views toward active commute modes.

As unsafe paths discourage walking and biking, pedestrian safety is crucial to improving active transportation. One of the significant issues which make citizens less motivated to

walk in the Elgeseter district is the lack of walking amenities in the area. In most places, the sidewalk is not divided from bicycling paths, and the sidewalks are either too wide or too narrow. As a walkable city is one with safe, accessible, and comfortable walkways, trails, and street crossings for people of all abilities, planners should emphasize constructing paths to connect residences with services and investing in more recreational facilities within walking distances in rural regions, where physical activity and active mobility alternatives are severely limited (Pavlick et al., 2020).

Finally, findings indicate that it's crucial to recognize that various users have distinct travel habits and requirements. As a result, measures to encourage walking and cycling should be tailored to the requirements of everybody, resulting in a greater number of prospective users.

Conclusion

Elgeseter district as one of the most important streets in Trondheim city is experiencing challenges such as increased traffic, toxic pollutants, and noise pollution. Increased active mobility in the area can help solve a lot of these problems. In accordance with Temeljotov-Salaj and Lindkvist (2021) to holistically approach the regeneration of urban spaces, the contribution to health and well-being is important, from both physical causes and symptoms of poor health, and the social, economic and environmental components of individual-community- and overall well-being. In other words, based on the importance of considering walking and cycling as a way to improve the quality of life in cities, particularly Trondheim in Norway, with the added benefits of enhancing public and private health and lowering harmful emissions, traffic congestion, and noise associated with excessive automobility, the main focus of this paper is on looking for incentives that will motivate residents to change their behavior and choose walkability and bikeability as their preferred means of transportation.

According to the practical findings in this study walking and cycling for transportation ('active mobility') are usually thought to minimize CO2 emissions by substituting for at least some motorized travel (de Nazelle et al., 2010). This is only one of the benefits of active mobility in Elgeseter gate. Active mobility may not only boost health as a source of physical activity, but it may also help achieve social and environmental goals such as promoting social cohesion and lowering CO2 emissions by offsetting air pollution from motorized cars on such travels. So, to achieve these environmental goals and move toward greater sustainability, certain recommendations are made based on the research conducted by the authors of this paper, particularly for the Elgeseter district in Trondheim. Moreover, as one of the aims of UN SDG is to protect the planet, by improving active mobility this goal will be more achievable.

It is important that urban area developments be rethought and reconfigured to improve traffic flow by including and supporting non-motorized, less polluting modes of transportation such as cycling and walking. In other words, the main street just south of Trondheim city center, between Professor Brochs gate in the south and Klostergata in the north must be adapted to include walkways, crossing junctions, and distinct cycling and pedestrian lanes with end-to-end connections. Secondly, to reduce dependency on unsustainable modes of transportation, Trondheim kommune has to construct a more inexpensive, accessible, and appealing transportation infrastructure that is available to the commuters of Elgeseter district at any time.

As a result of these insights, policymakers of Trondheim will be able to establish more effective policies for encouraging and developing active forms of transportation in the Elgeseter district. Therefore, it is critical for infrastructure and regulations to match existing and future users' expectations to provide an acceptable walking and bicycle transportation network service and entice people to utilize it. Furthermore, Given the important public health, economic, and climatic implications of transportation behavior, for future work, researchers and funders should pay particular attention to finding motivators for active mobility more specifically.

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Appendices

Appendix 1: Comparison table for the scoping literature review

Appendix 2: Survey form

Appendix 3: Interview guide

Appendix 4: Interview consent form

Appendix 1: Comparison table for the scoping literature review

Number	Title/year	Author	Institution / country	Publisher	Abstract				*Relevance to the issue	Type of publication	Keywords	Link
					Purpose	Method	Result	Implication				
1	"Going through a little bit of growing pains": A qualitative study of the factors that influence the route choice of regular bicyclists in a developing cycling city (2021)	Elise Desjardins	McMaster University, 1280 Main Street West, Hamilton, Ontario L8S 4K1, Canada	Transportation Research Part F: Traffic Psychology and Behaviour	this research explores the case of Hamilton, Ontario and the factors that influence route choice from the perspective of regular bicyclists.	Through semi-structured interviews, this research explores the case of Hamilton, Ontario and the factors that influence route choice from the perspective of regular bicyclists. Major themes were identified using thematic analysis: (i) exclusion from road space; (ii) infrastructure; and (iii) streetscape. Bicyclists highly value infrastructure and seek routes that minimize interactions with cars, while avoiding many arterial roads that prioritize motorists.	Routes that appear to be more human-oriented or that have nature are also attractive. Many regular bicyclists report that current bicycle infrastructure does not meet their preferences. Despite building nearly half of the planned infrastructure network, our findings suggest the built environment is not perceived to be oriented to bicycling.	This study provides policy and practice recommendations for developing cycling cities in North America as they transition towards established cycling cities.	*How to make biking more attractive for the people	Journal article	Bicycling, Perceptions, Built environment, Route choice, Qualitative research	https://www.sciencedirect.com/science/article/pii/S1369847821001455
2	Active Mobility as a Response to Physical Inactivity in Cities (2020)	Parsa Arbab	School of Urban Planning, College of Fine Arts, University of Tehran, Tehran, Iran	–	explore and explain the relationship between built environment characteristics and the active mobility of residents in urban communities.	a literature review on how built environment characteristics and context and socioeconomic conditions are associated to enact physical activity/active mobility.	To stimulate physical activity and active mobility across all social groups, planners and policymakers should address context- and people-specific health-related aspects in planning and governing the built environment in cities and urban neighborhoods, defined as health-oriented urban planning. The importance of this approach will be multiplied by considering urbanization as the predominant way of life for most people in the world on the one hand, and active mobility as an inclusive alternative compared to other individual-based interventions in the area of health on the other.	–	*The ways of increasing physical activities like bikeability and walkability	Proceedings	Physical Activity, Built Environment, Active Mobility, Health-Oriented Urban Planning, City	https://www.corp.at/archive/CORP2020_73.pdf
3	A MULTIDISCIPLINARY ANALYTICAL FRAMEWORK FOR STUDYING ACTIVE MOBILITY PATTERNS (2016)	Daniel Orellana	Universidad de Cuenca, Av. 12 de Abril, Cuenca, Ecuador	–	we introduce the elements for a multidisciplinary analytical framework for studying active mobility patterns comprised of three components: a) Methodological, b) Behavioural, and c) Perceptual.	We demonstrate the applicability of the framework by analysing mobility patterns of cyclists and pedestrians in an intermediate city integrating a range of techniques, including: GPS tracking, spatial analysis, auto-ethnography, and perceptual mapping.	The results demonstrated the existence of non-evident spatial behaviours and how perceptual features affect mobility.	This knowledge is useful for developing policies and practices for sustainable mobility planning.	*mentioning about the motivations towards active mobility	–	Active mobility, Movement Analysis, Spatial Behaviour, Sustainable Cities	https://www.researchgate.net/publication/303869212_A_MULTIDISCIPLINARY_ANALYTICAL_FRAMEWORK_FOR_STUDYING_ACTIVE_MOBILITY_PATTERNS
4	A review on the effects of physical built environment attributes on enhancing walking and cycling activity levels within residential neighborhoods (2016)	Y.Wang	School of Technology, Harbin University, China	Cities	This comprehensive review shows how specific details of the built environment enhance people's walking and cycling.	This was accomplished through identifying the barriers to walking and cycling activities as well as the general and specific characteristics of the major physical built environment attributes within a residential neighborhood that can help overcome these barriers and enhance the walking and cycling activity levels.	–	Of particular value of this study is that its structure and level of details of information laid out in this review can facilitate building designers and neighborhood planners in creating a supportive environment within residential neighborhoods.	*How to enhance people's walking and cycling	Journal article	Walking and cycling, Physical activity, Barriers, Neighborhood design	https://www.sciencedirect.com/science/article/pii/S0264275115001158#!
5	A School-Based Randomized Controlled Trial to Promote Cycling to School in Adolescents: The PACO Study (2021)	Palma Chillón	University of Granada, 18011 Granada, Spain	Environmental research and public health	This manuscript describes the rationale and protocol of a school-based randomized controlled trial called "Cycling and Walk to School" (PACO, by its Spanish acronym) that aims to promote cycling to and from school and physical activity (PA) in adolescents.	A total of 360 adolescents attending six high schools (three experimental and three control) from three Spanish cities will participate in this randomized controlled trial. The intervention (four cycling sessions; 1–2 h per session, one session per week) will be conducted by the research staff; the control group will continue their usual activities. PA levels will be measured by accelerometers, whereas ACS and the other study variables will be self-reported using questionnaires at baseline and post-intervention.	The primary outcomes will be: rates of cycling to school, ACS and PA levels. In addition, SDT-related variables and individual, interpersonal, community, and environment variables relevant to ACS will be based on SEM. The findings will provide a comprehensive understanding of the short-term effects of this school-based intervention on cycling to school behaviour, ACS and PA levels in Spanish adolescents.	–	*The way of increasing cycling and walking to school	Journal article	active transport; youth; bicycle; exercise; school intervention	https://www.mdpi.com/1660-4601/18/4/2066/htm
6	AN ASSESSMENT ON THE ROLE OF BICYCLING LANE PROJECT FOR IMPROVING MOBILITY IN ADDIS ABABA (2020)	Habtamu Yeshitla	ST. MARY'S UNIVERSITY	–	to assess the bicycle lane benefit for improving city mobility after the project implementation	this research use bikeability index to assess bikeability of the bicycle lane using measurements which are the bikeability index variables. In order to make the indexes the research create different variables through detail literature review and validated them through field observation, interview with key informants and questionaries to pedestrian and cyclists in Lebu to Jemo bicycle lane.	Research finding indicate that the need of functional bicycle infrastructure to enhance the mobility specially related to destination density design, environment design and safety issues in the streets that encourage a rider to use bicycle as transport mode. In addition, the finding show that the non -motorized strategy of Addis Ababa city administration.	–	*How bikeability can improve city mobility	Thesis	Bikeability, Bicycle lane, bikeability Index	http://197.156.93.91/bitstream/123456789/5899/1/Habtamu%20yeshitla%20final%20thesis.pdf

7	An Onion Creek Plantation case study: Encouraging physical activity by improving park access (2015)	Adriana Torcat Chavez, B.E.	The University of Texas at Austin	–	to foster physical activity through the construction of a pedestrian low water crossing to improve access to the Onion Creek Greenbelt from the adjacent residential areas.	Data for this analysis were obtained from the U.S Census Bureau, City of Austin's GIS data repository, City of Austin Watershed Protection Department and Children's Optimal Health reports. Three software products were used to process the data; ArcGIS 10.1, HEC-RAS 4.1.0 and HY8 – Culvert Hydraulic Analysis software.	This study explores how built environment interventions and park connectivity strategies could contribute to higher rates of physical activity (PA) in Onion Creek Plantation – a local community located in southeast Austin, Texas – and analyze the incidence of those interventions on public health and obesity rates in the community.	The Onion Creek Park access project demonstrates the benefits of intersecting community planning with walkability, built environment and environmental health considerations to enhance the overall health of a local community. This study shows the value of simulating changes in the natural environment when new features are built.	*Fostering physical activity like walkability	report	–	https://repositories.lib.utexas.edu/bitstream/handle/2152/32249/TORCATCHAVEZ-MASTERSREPORT-2015.pdf?sequence=1&isAllowed=y
8	Analysis of the influence of urban built environment on pedestrian flow in an intermediate-sized city in the Andes of Ecuador (2019)	Carla Hermida	School of Architecture, Universidad del Azuay, Cuenca, Ecuador	International Journal of Sustainable Transportation	This study explores the potential influence of the urban built environment on pedestrian flow in an intermediate Latin American city, Cuenca-Ecuador.	Data from samples of 48 street segments were analyzed to explore how physical and spatial features of streets and sidewalks, as well as land use and occupation conditions influence the number of pedestrians. A quantitative approach was used to model the individual and combined influences of several variables on pedestrian counts using multiple regression models.	Results from statistical modeling indicate that variables related to the physical features of the streets, such as sidewalk width, are positively correlated to pedestrian counts, whereas parking space and front setback are negatively correlated. We conclude that streets in our study area are largely inadequate for pedestrians due to their poor design, scarce walking infrastructure, and the prevalence of all sorts of obstacles on the sidewalks.	We expect that this study will help city planners design better environments for non-motorized travel in intermediate cities.	*How to make side walks more attractive for pedestrians and how to increase them	journal	Cuenca, intermediate city, non-motorized mobility, pedestrians, urban built environment	https://www.tandfonline.com/doi/full/10.1080/15568318.2018.1514445
9	Associations between built environment, perceived walkability/bikeability and metro transfer patterns (2021)	Zuoxian Gan	College of Transportation Engineering, Dalian Maritime University, Dalian 116026, China	Transportation Research Part A: Policy and Practice	Most studies that address the integration of active modes (i.e., walking and bicycling) and public transit tend to focus on either transfer distance or feeder mode choice. Few articles have reported the relationships between the built environment (D-variables) and transfer patterns (e.g., transfer distance and mode choice) in a single study. Furthermore, only very few studies accounted for travelers' judgements of walkability and/or bikeability and distinguished between access and egress trips. This paper fills these gaps in the literature using data collected in Nanjing, China.	A random parameter Tobit and a random parameter multinomial logistic model are estimated to investigate respectively (i) the association of perceived walkability/bikeability and features of the built environment in metro catchment areas on walking/bicycling distance of access/egress trips and (ii) the probability of choosing active modes as transfer modes.	The modeling results reveal that perceived walkability/bikeability and features of the built environment are more significantly correlated with mode choice behavior than with transfer distance. Moreover, walking/bicycling distance and access/egress mode choice tend to be strongly associated with perceived walkability and bikeability as well as with features of the built environment.	The results are helpful in deepening urban planners and policymakers' understanding of how to design built environments that maximize the integration of active modes and metro.	*making connection between building environment, walkability and bikeability	Journal article	Metro-active modes integration, Random parameter model, Land use, Perceived walkability and bikeability, Transfer patterns	https://www.sciencedirect.com/science/article/pii/S0965856421002378
10	Common ground: Eight factors that influence walking and biking to school (2012)	Orion Stewart	Urban Form Lab, University of Washington, 1107 NE 45th St, Suite 535, Seattle, WA 98105, USA	Transport Policy	The primary goals of Safe Routes to School (SRTS) programs are to increase the number and safety of children walking, biking or using other forms of active travel to school (ATS).	This study reviewed quantitative and qualitative research and identified eight common factors that influenced the choice of ATS	eight common factors that influenced the choice of ATS: distance to school, parental fear of traffic and crime, family schedule constraints and values, neighborhood and family resources and culture, weather, and school characteristics.	Suggestions were made as to how these barriers and facilitators of ATS could be integrated into the decision to fund local SRTS programs and to improve their effectiveness.	*motivations and barriers of active transport between students	Journal article	Safe Routes to School, Walk, Pedestrian, Bike, Child, Safety	https://www.sciencedirect.com/science/article/pii/S0967070X12001102
11	Bypassing the Bikelash: Strategies for addressing opposition to bicycle infrastructure projects in Washington, D.C. (2017)	Julia Malmo-Laycock	McGill University	McGill University	this research asks: what strategies can planners use to address opposition to bicycle infrastructure projects?	Through interviews carried out with bicycle planning and project stakeholders in Washington, D.C., a city recently rated as one of the best cycling cities in the United States, this research analyses existing strategies planners use to address opposition to bicycle infrastructure projects and explores additional such strategies. Washington, D.C.'scontroversial Eastern Downtown Protected Bike Lane Project is used as a case study.	Three categories of strategies emerge from the research: planning-stage strategies, communications strategies and meeting facilitation strategies. During the planning stage, it is crucial that planners engage with and educate communities early regarding long-range transportation issues. Comprehensive planning exercises also appear to be useful at this stage. In termsof communication strategies, explaining the purpose and need for bicycle facilities in a thorough manner, as well as tailoring project messaging to the audience in question, can be helpful. Finally, meeting facilitation could be strengthened by selecting a more suitable format and space depending on the audience and context, as well as by coordinating the attendance of officials from a variety of municipal departments and agencies that may respond to questions about related projects.	Through interviews carried out with bicycleplanning and project stakeholders in Washington, D.C., a city recently rated as one of the best cycling cities in the United States, this research analyses existing strategies planners use to address opposition to bicycle infrastructure projects and explores additional such strategies. Washington, D.C.'scontroversial Eastern Downtown Protected Bike Lane Project is used as a case study.	*mentioning some of the encouragements for cycling	–	–	https://escholarship.mcgill.ca/concern/papers/4t64gn387

12	ChalkTalk: A Participatory Design Framework for Designing Resilient Sustainable Transportation Infrastructures (2019)	Jacob Edward DeGeal, M.F.A	The University of Texas at Austin	–	American cities looking to reduce car congestion, improve air quality, and increase safety on the road are focused on shifting car commutes to sustainable "human-scaled" transportation modes like biking, and walking.	It is my hypothesis that public life studies, participatory democracy, and tactical urbanism are by nature methods of observation, ideation, and rapid prototyping and iterating respectively that can be used to adapt design thinking to the transportation sector.	emerging transportation technologies like ride-hailing and micromobility, in addition to fraught histories of grass-roots advocacy, have challenged the way cities communicate with their neighborhoods and residents about sustainable transportation. Contemporary practices of holding open houses, utilizing online commenting systems, and partnering with local advocacy groups help to disseminate information, but still fall short in encouraging active participation and engagement from the public, resulting in a failure to attract the 51% of commuters mentioned above.	By using the ChalkTalk framework, designers, residents, and planning professionals alike can collaborate on an innovative way to capture evolving transportation patterns, and create a rich set of qualitative data that lays the groundwork for a better participatory design practice.	*Reducing car commuting and increasing walking and biking	report	design, urban design, design thinking, sustainable transportation, emerging transportation, transportation research, transportation planning, infrastructure, micromobility, tactical urbanism, participatory design, participatory democracy, public outreach, public input, bicycles, scooters, systems design, public policy, collaboration, codesign, commuting, commuter cycling, pedestrian	https://repositories.lib.utexas.edu/handle/2152/78205
13	Chasing Sustainability: Do New Transit-Oriented Development Residents Adopt More Sustainable Modes of Transportation? (2015)	Myriam Langlois	McGill University, Montreal, Quebec H3A 2K6, Canada	Transportation Research Record: Journal of the Transportation Research Board	This study attempted to find out whether new residents adopted more sustainable modes of transportation after their relocation to a TOD. The analysis determined which factors influenced travel mode switching decisions by specifying a multilevel multinomial logistic regression model.	Data for the analysis were drawn from a travel behavior survey conducted on residents in seven North American TODs in 2013.	The results showed that newcomers adopted more sustainable travel modes for amenities and leisure trips after they relocated to a TOD but that they were less likely to do so for work and shopping trips. To encourage more sustainable travel modes, the study findings suggested that transit incentives coupled with workplace parking charges needed to be considered.	The findings provided new insights into TOD planning and its link to travel behavior; these insights could benefit planners, engineers, and policy makers who have adopted the TOD approach to development with the goal of mitigating car usage.	*the factors which can influence the choice of travel mode	Research article	–	https://journals.sagepub.com/doi/pdf/10.3141/2531-10
14	Correlates of bicycling trip flows in Hamilton, Ontario: fastest, quietest, or balanced routes? (2021)	Elise Desjardins	–	–	A feature of the analysis is the use of CycleStreets to compare the distance and time according to different routes inferred between trip zones of origin and destination. In addition, network autocorrelation is accounted for in the estimated models.	Using bicycle trip records from the most recent regional travel survey, a spatial interaction model is developed to investigate the built environment correlates of bicycling flows in Hamilton, Ontario, a mid-sized city part of the GTHA.	The most parsimonious model suggests that shortest-path quietest routes that minimize traffic best explain the pattern of bicycle trip flows in Hamilton. Commercial and office locations and points of interest at the zone of origin negatively correlate with the production of trips, while different land uses and the availability of jobs at the zone of destination are trip attractors.	The use of a route planner offers a novel approach to modelling and understanding bicycling flows within a city. This may be useful for transportation planners to infer different types of routes that bicyclists may seek out and consider these in travel demand models.	*Only focusing on cycling and the ways of increasing it	article	–	https://link.springer.com/article/10.1007/s11116-021-10197-1
15	Could there be spillover effects between recreational and utilitarian cycling? A multivariate model (2021)	Francesco Piras	University of Cagliari, Via San Giorgio 12, Cagliari 09124, Italy	Transportation Research Part A: Policy and Practice	to investigate the impact of socioeconomic and bike infrastructure-related factors on the choice to cycle for different purposes (commuting, errands and leisure/sport) and explores the interplay between these three choices.	The data used in this study are drawn from a survey conducted by the University of Cagliari in two mid-size urban areas in Sardinia (Italy). We analysed a sample of 1,105 individuals with prerequisites useful for the study at hand.	Model results show that different socio-demographic variables such as gender, age, level of education, household composition and vehicle ownership influence our dependent variables.	In particular, we find that the adoption of an independent model that ignores the presence of unobserved effects among dependent variables leads to a small overprediction of the number of people cycling for utilitarian purposes.	*Focusing on the factors which increase cycling	Journal article	Bike commuting, Leisure cycling, Cycling for errands, Multivariate ordered probit model, Spillover effect, Unobserved effects	https://www.sciencedirect.com/science/article/pii/S096585642100080X
16	Cycling for transport: the role of the physical environment (2016)	Lieze Mertens	–	–	to get a better insight in how the physical environment, especially the micro-environment, influences cycling for transport among the adult population, and to verify the interplay between socio-demographics, psychosocial and physical environmental factors to explain cycling for transport.	–	The results of this PhD-thesis indicate that the most important strategy to create supportive microenvironments and to stimulate cycling for transport is to improve the traffic safety for cyclists. This can be done by providing separated cycle paths (even if they are only marked with white lines on the road) or by reducing the authorized speed of the motorized traffic.	These results suggest that generic environmental interventions could benefit most population subgroups, even across urban regions in the five different investigated countries (Belgium, the Netherlands, Hungary, France, and UK). Therefore, from our results we can carefully conclude that tailored environmental interventions may not be required in this research context since environmental adaptations (e.g. improving cycle path type) appear to have a favorable effect for the whole adult population.	*Only focusing on cycling and the ways of increasing it	PhD thesis	–	https://biblio.ugent.be/publication/8500315/file/8500316
17	Environmental characteristics and school travels made by foot and bicycle (2018)	Agnes Landefjord & Marit Ripel	Swedish University of Agricultural Sciences	–	It is not clear to what extent characteristics of the environment are influencing children's school travel behaviour. This thesis aims to study this relationship by comparing children's travel mode choice at four Swedish compulsory schools, with characteristics of the environment around the schools	The study is based on travel mode data collected by the research project Kidscape II. GIS-based methods were used to map environmental variables around the schools. These were based on Mitra's (2013) conceptual framework of the environment and school travel behaviour.	The findings from this test indicate a relationship between walking and cycling and the environmental variables child population density and proportion of buildings with an "eyes on the street"-effect	The indication of a relationship in this data does not demonstrate evidence in a general sense, but shows variables that would be interesting to study on a larger scale, using more spatially detailed travel data	*influences of environment on travel behaviour	Master project	Children, School transportation, Walking, Cycling, Built environment, Independent mobility, Sustainable mobility, GIS.	https://stud.epsilon.slu.se/13573/11/landefjord_a_ripel_m_180705.pdf

18	Experiential Graphic Design: Generating Urban Renewal by Improving Safety and Connectivity in Bicycle Pathways (2016)	Lawrence, Molly	Kent State University	–	–	This study uses design research tactics and prototypes to further understand how design can improve the user experience of Cleveland's bicycle pathways.	This investigation explores the value that environmental graphic design elements can contribute to the development of safer bicycle pathways, and further examines the role of wayfinding increasing the connectivity of urban bicycle networks.	–	*making the city more walkable and bikable	Thesis	environmental graphic design; graphic design; urban design; bicycle infrastructure; bicycle facilities; bicycle safety; bicycle wayfinding; urban connectivity; Rust Belt; Cleveland; urban regeneration	https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=kent1460734967&dispositon=inline
19	Exploring Bikeability in a Suburban Metropolitan Area Using the Active Commuting Route Environment Scale (ACRES) (2014)	Lina Wahlgren	The Research Unit for Movement, Health and Environment, The Swedish School of Sport and Health Sciences, GIH, SE-114 86 Stockholm, Sweden	Environmental research and public health	the aim of this study is to assess the potential associations between appraisals of the overall route environment as hindering or stimulating for bicycle commuting, with both perceptions of commuting route environmental factors in a suburban area and background factors.	The Active Commuting Route Environment Scale (ACRES) was used for the assessment of bicycle commuters' perceptions and appraisals of their route environments in the suburban parts of Greater Stockholm, Sweden. A simultaneous multiple regression analysis was used to assess the relationship between the outcome variable whether the overall route environment hinders or stimulates bicycle commuting and environmental factors (e.g., exhaust fumes, speeds of motor vehicles, greenery), as well as background factors (sex, age, education, income) as predictor variables.	The results indicate that in suburban areas, the factors aesthetics, greenery and bicycle paths seem to be, independently of each other, stimulating factors for bicycle commuting. On the other hand, flows of motor vehicles, noise, and low "directness" of the route seem to be hindering factors	A comparison of these results with those obtained from an inner urban area points to the importance of studying different types of built-up areas separately.	*more focus on biking	Journal article	active transport; bicycle commuting; bikeability; perception; route environment; suburban area	https://www.mdpi.com/1660-4601/11/8/8276/htm
20	Cycling characteristics in cities with cold weather (2015)	M.Amiri	Department of Civil Engineering, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, Canada	Sustainable Cities and Society	This study focuses on cycling in cold weather and aims to develop an understanding of characteristics of cyclists and their cycling behavior in cold temperatures.	An intercept survey is conducted among cyclist on a newly implemented bike lane under close-to-freezing temperatures in Calgary, Canada.	The results of the survey provide a baseline for understanding the characteristics of winter cycling. Cross-tabulated analysis of the data identified a number of statistically significant relationships between different variables.	The result of this study can help with future planning and policy making in regions with cold climate or long and cold winters.	*more focus on biking	Journal article	Sustainable transportation, Cycling, Cold weather, Intercept survey, Cross-tabulated analysis	https://www.sciencedirect.com/science/article/pii/S2210670713000784
21	Exploring Singapore's Green Mobility Preparedness (2018)	Poornima Singh	Department of Architecture, School of Design and Environment, National University of Singapore, Singapore	Sree Journal of Spatial Perspectives	This study is an attempt to check Singapore's preparedness for green mobility system with the example of Tampines Town of Singapore city.	It explores the walkability and bikeability scenario of the town through 'Space Syntax Analysis Modelling method'.	The results of the modelling demonstrate that space syntax model is a promising tool for modeling pedestrian behavior, choice, cyclists' cognitive understanding and road infrastructure by showing integration and connectivity of the road networks in the Tampines town and elsewhere.	Though one cannot just rely on solely the results of space syntax analysis model for accurate results, as various other influencing factors may alter the results, however, its role as powerful tool in urban planning and transport modeling can not be denied.	*focusing on green mobility	journal	Green mobility, active transport, walkability index, space syntax, sustainable urban planning	https://www.researchgate.net/publication/338556043_Exploring_Singapore%27s_Green_Mobility_Preparedness
22	Heading in the Right Direction? Investigating Walkability in Galway City, Ireland (2018)	Mike Hynes	School of Political Science & Sociology, Room 323, 2nd Floor, Áras Moyola, Central Campus, National University of Ireland Galway, H91TK33 Galway, Ireland	urban science	this paper seeks a richer understanding of issues relating to existing topographies of walkability and the barriers and pressures that exist with regards to the further development of walking in the city—a healthy and pleasurable way of getting about.	Using data from the Mobilities and Liveability in Galway project	By promoting and encouraging people to walk more, we achieve the benefits of better personal health and safer, more convivial neighbourhoods and communities. Making cities more walkable involves incorporating features into urban landscapes that make walking an agreeable experience and bringing a range of necessary and interesting destinations within walking distances of homes and workplaces.	–	*more focus on walkability and making the areas more attracted for the people to walk more	Journal article	walkability; urban design; planning; transport; quality of life	https://www.mdpi.com/2413-8851/2/2/31/htm
23	HEALTHY & EQUITABLE DEVELOPMENT (2017)	Wardoku, Maria	University of Minnesota	Resilient Communities Project (RCP), University of Minnesota	In this report, researchers share the thoughts of community members, elected officials, city staff, and developers in first-ring suburbs of the Twin Cities of Minneapolis and St. Paul on problems and opportunities around affordable housing and active transportation.	–	–	In this report, cities, developers, and other stakeholders will find suggestions for overcoming obstacles to healthier, more equitable development in the suburbs.	*The ways of making the ways more walkable or bikeable	report	Healthy communities Equity Affordable housing Active living Community engagement	https://conservancy.umn.edu/handle/11299/208851
24	How Can Psychological Theory Help Cities Increase Walking and Bicycling? (2014)	Jennifer Dill	–	Journal of the American Planning Association	Planners need a clear understanding of what influences walking and bicycling behavior to develop effective strategies to increase use of those modes.	Using data from a random phone survey of three neighborhoods in Portland (OR), we test whether TPB explains the possible causal relationships among the built environment, socio-demographics, and active transportation.	We find that both the built environment and demographics influence cycling and walking, although indirectly, by influencing attitudes and perceived behavioral control.	Practitioners cannot rely solely on changing the environment to increase bicycling. Programs such as public events and individualized marketing that influence attitudes may be necessary to reinforce positive environmental features. This is particularly true for women and older adults. Moreover, adding bike lanes to an otherwise poor bicycling environment may not increase bicycling in any significant way.	*the things that influence bikeability and walkability	article	bicycling, walking, psychology, travel behavior, built environment	https://www.tandfonline.com/doi/full/10.1080/01944363.2014.934651?scroll=top&needAccess=true

25	Human Health and the Transportation Infrastructure (2020)	Drew Pavlick	Department of Civil and Environmental Engineering, University of Delaware, Newark, DE, USA.	Human Resource and Sustainability Studies	he present report explores the many health related problems that are correlated with the current transportation environment, including reduced physical activity, obesity, respiratory problems, and mental health issues, particularly in the United States.	–	The findings indicate that the modern built transportation system indeed influences many aforementioned problems, and that there must be engineering and societal responses to both encourage and allow greater opportunities for active transportation.	–	*mentioning about encouragement for active transport	Journal article	Built Transportation Environment, Health Effects, Active Transportation, Health Index	https://www.scirp.org/journal/PaperInformation.aspx?PaperID=102059
26	Hybrid Oriented Sustainable Urban Development: A Pattern of Low-Carbon Access to Schools in the City of Potenza (2020)	Giovanni Fortunato	School of Engineering, Laboratory of Urban and Regional Systems Engineering, University of Basilicata, Potenza, Italy	International Conference on Computational Science and Its Applications	This study analyzes urban street network of the city of Potenza in Basilicata region to provide input for a sustainable urban mobility-based strategy enabling students to reach schools through the use of low-carbon transport modes' share.	Within urban space morphology research, combining Space Syntax and GIS-methods, Place Syntax allows to perform analyses of the spatial configuration of streets taking into account both street network layout and the location of spatial opportunities.	The paper shows the potential integration between active transport modes and public transport in the city of Potenza.	Ensuring an easy transition between walking, cycling and public transport (e.g. by designing a widespread and direct network of cycle-pedestrian paths to and from the stations) contributes to create a "Hybrid Oriented Sustainable Urban Development" towards low-carbon settlements characterized by a significant reduction in congestion, air pollution and carbon emissions.	*designing the areas more walkable and bikeable	conference paper	Urban space morphology, Place syntax analysis, Sustainable urban development, Sustainable urban mobility, Liveable city	https://link.springer.com/chapter/10.1007/978-3-030-58820-5_15
27	Improving public health through active transportation : understanding the influence of the built environment on decisions to travel by bicycle (2011)	Winters, Meghan Lesley	University of British Columbia	Vancouver : University of British Columbia Library	This dissertation aimed to understand how to design cities to support cycling, to improve public health through increased active transportation	It applied quantitative and qualitative methods to investigate the link between cycling and the built environment. The five studies that comprise this dissertation use data from the Cycling in Cities survey, which captured the opinions and travel behaviours of 2,149 current and potential cyclists across Metro Vancouver.	The route choice analysis found that the majority of trips were less than 10% longer than the shortest distance route, and that bicycle trips detoured toward bicycle facilities and away from major roads, whereas car trips detoured toward highways and arterials. The mode choice analysis (bicycle versus car) made explicit consideration of the built environment around trip origin, destination and en route. Multi-level logistic modeling, adjusted for demographics and trip distance, showed significant associations with topography, cycling facilities, the road network and land use. The fifth study integrated these results with focus group findings to derive an evidence-based "bikeability" measure. The utility of the index was demonstrated through its application as a planning tool.	Taken collectively, these studies contribute to both data and methodological gaps in prior health, planning, and transportation research. This dissertation provides evidence on environments that support cycling and presents a tool to guide strategies to improve conditions.	*Only focusing on cycling and the ways of increasing it	Thesis/Dissertation	–	https://open.library.ubc.ca/media/stream/pdf/24/1.0071676/2
28	Incorporating Online Survey and Social Media Data into a GIS Analysis for Measuring Walkability (2020)	Xuan Zhang	Department of Geography, University of Georgia, Athens, USA	–	We propose a Perceived importance and Objective measure of Walkability in the built Environment Rating (POWER) method, which is a line-based approach considering both the perception of pedestrians and subjective characterizing of the urban built environment.	Incorporating online survey and social media data, we present a built environment walkability study in a specific environment and the potential for more general scenarios. The survey can be customized for the particular urban environment and capture the preferences of a local population. The social media obtain general opinions from a broader audience. Although focusing on the specific setting at a university campus, we also included the general social media results to supplement the POWER structure and survey findings.	Using social media and survey results can bring two scales together to provide a more complete understanding of walkability.	–	*only about walkability and built environment	–	GIS, Walkability, Survey, Social media, Built environment	https://link.springer.com/chapter/10.1007/978-3-030-19573-1_8
29	Integrated strategies to accelerate the adoption of cycling for transportation (2017)	Beth Savan	ERA Architects Inc., Toronto, Canada	Transportation Research Part F: Traffic Psychology and Behaviour	This study synthesizes academic social psychological behaviour change literature with reports on the practical, community-based application of cycling programs.	We identify the combination of psychological tools demonstrated to lead to changes in behaviour in the target population. We compare these tools with reports demonstrating evidence for success from monitored programs to encourage cycling adoption.	Based on the alignment between these two literatures, we developed an adaptable, evidenced-based strategy for program developers to most effectively accelerate the adoption of cycling for transportation in areas where physical barriers are few. A brief case study affirms the effectiveness of this approach.	–	*Only about biking aspect	Journal article	Cycling, Behaviour change, Cycling adoption, Cycling program evaluation, Community based social marketing	https://www.sciencedirect.com/science/article/pii/S1369847817301766
30	Measurement Quality Appraisal Instrument for Evaluation of Walkability Assessment Tools Based on Walking Needs (2021)	Sanaz Tabatabaee	Green Cities and Construction Research Group, Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur 54100, Malaysia	Sustainability	The present study attempts to develop a system to evaluate the quality of the existing tools. The instrument focuses on factors related to walking needs frequently observed in all types of walkability assessment tools.	a pilot measurement quality appraisal instrument (MQAI) is developed and tested by a research team with planning and public health backgrounds. The final MQAI is tested by suitable reliability, criterion, and content validity tests.	Most appraisal scales display moderate to high reliability for both audits and questionnaires.	The MQAI appears as ready for use in several applications, including meta-analyses and systematic reviews. Additionally, the MQAI can be used by practitioners and planners to identify the most comprehensive and efficient assessment tools based on their needs.	*main focus on measuring walkability tools	Journal article	sustainable commute mode; walkability assessment tool; measurement quality appraisal; walking environment; walking needs	https://www.mdpi.com/2071-1050/13/20/11342/htm

31	Networks of Opportunity: A Citywide Vision for Pedestrian and Bicycle Pathways in Chicopee, Massachusetts (2016)	Stephanie Carlisle	University of Massachusetts Amherst	landscape architecture and regional planning	to increase local and regional connections between the City's assets for pedestrians and bicyclists. Additional goals of this project include increasing the number of users of pedestrian and bicycle paths within the City, proposing feasible options that will lead to safer walking paths to school for school-age children living within non-bus service areas, and connecting these paths to existing and proposed green spaces throughout the community	During our study period, Pacer Planning distributed an electronic survey called the Chicopee Student Walker Safety Survey to parents of K-12 students in Chicopee, which received 106 responses, and held 7 in-person and phone interviews with school administration officials and city employees.	Through numerous site visits, Pacer Planning observed that Chicopee's long, auto-centric streets (where cars often speed) inhibit pedestrian and bicyclist safety and limit the connectivity between destinations. Additionally, Pacer Planning has found that Chicopee is home to a variety of naturally beautiful places that we believe should be made more accessible for pedestrians and bicyclists, namely the Connecticut and Chicopee Rivers and the Chicopee Memorial State Park. Although many built environment features such as the Westover Air Force Base and the three interstates divide the City, Pacer Planning believes that the City of Chicopee would benefit immensely through enhancing accessibility to its recreational, educational, and cultural resources. Through our public engagement survey and interview responses, Pacer Planning gained a wealth of information related to parents' and school administration officials' perceptions on student walker safety in Chicopee. Specifically, 80% of parent respondents of the Chicopee Student Walker Safety Survey noted that the speed of traffic along walking routes influenced their decision to allow or not allow their child to	Based on our analysis using Geographic Information Systems (GIS), site visits, and public engagement responses, Pacer Planning makes a variety of recommendations for the City of Chicopee to consider in order to enhance connections between key destinations and pathways in the City.	*focus on increasing the number of users of pedestrian and bicycle paths	–	–	https://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1051&context=larp_grad_research
32	Non-work travel characteristics in Calgary with a focus on trips made on foot and by bicycle (2014)	Martinson, Ryan Joel	University of Calgary, Calgary, AB	–	In this research, the characteristics of non-work travel were explored, with a focus on those trips made on foot and by bicycle, and implications to transportation and land use policy and practices are suggested.	The geographic scope of this thesis was Calgary, Alberta, Canada, with travel behaviour responses (n=410) being collected through the use of an online survey tool.	The specific characteristics of non-work travel explored include: mode split; travel mode to work versus travel mode for non-work; trip distance and trip frequency; time of day and day of week of travel; effect of weather and temperature on travel, and the trip origins of non-work trips.	–	*focusing on creating more walkable and bikeable communities	master thesis	–	https://prism.ucalgary.ca/bitstream/handle/11023/1289/ucalgary_2014_martinson_ryan.pdf?sequence=2&isAllowed=y
33	Perceived Social and Built Environment Correlates of Transportation and Recreation-Only Bicycling Among Adults (2018)	Anna K. Porter	Department of Epidemiology, Human Genetics, and Environmental Sciences, The University of Texas Health Science Center at Houston School of Public Health in Austin, Austin, Texas. Dr. Porter is now with the Department of Epidemiology, The University of North Carolina at Chapel Hill Gillings School of Global Public Health, Chapel Hill, North Carolina	–	The objective of this study was to examine the relationship between perceived social and built environment factors and domain-specific bicycling in a sample of adult bicyclists.	Adults aged 18 to 65 who rode a bicycle at least once in the past year completed an internet-based survey that was developed for this study to specifically assess correlates of bicycling; the study was conducted from October 2016 through January 2017. Perceived environmental factors assessed were residential density, traffic safety, destination, connectivity, safety from crime, aesthetics, and bicycle infrastructure. Multivariable logistic regression models were used to estimate the association of each perceived environmental factor (tertile 1, lowest; tertile 3, highest) with recreation-only and transportation bicycling. Effect modification of the relation between environmental factors and bicycling outcomes by sex was also examined.	The final analytic sample size was 801 participants. All environmental factors examined, including residential density, traffic safety, destinations, connectivity, aesthetics, bicycle infrastructure, and safety from crime showed significantly direct associations with transportation bicycling. Traffic safety, destinations, aesthetics, and bicycle infrastructure showed significant direct and inverse associations with recreation-only bicycling. Effect modification by sex was identified with residential density; a significant direct association with recreation-only bicycling was seen among women.	These findings illustrate that bicycling for transportation is associated with different perceived environmental factors than is recreation-only bicycling, with some significant modification by sex. Comprehensive tools that assess the perceived environment for bikeability in the United States are warranted.	*mostly focusing on bicycling	journal	–	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6266427/
34	PERCEIVED IMPORTANCE AND OBJECTIVE MEASURES OF BUILT ENVIRONMENT WALKABILITY OF A UNIVERSITY CAMPUS (2016)	XUAN ZHANG	BS, Wuhan University, China	–	The research combines the perceived importance and objective measures into a factor-weighted index to quantify walkability.	This study designed a walking preference survey to identify and measure the perceived importance upon built environment factors. Survey results were analyzed with modified Analytic Hierarchy Process (MAHP) and varied statistics and geographic information systems (GIS) methods.	Survey results speak for people's walking preferences, such as sidewalk availability, flat slope and green space in amenities.	–	*focusing on people preferences for walking more	Thesis	Walkability, Health, Geographic Information Systems (GIS), Modified Analytic Hierarchy Process (MAHP), Walk Score®	https://getd.libs.uga.edu/pdfs/zhang_xuan_201605_ms.pdf
35	Physical environmental factors that invite older adults to walk for transportation (2014)	JelleVan Cauwenberg	Department of Human Biometry and Biomechanics, Faculty of Physical Education and Physical Therapy, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium	Journal of Environmental Psychology	The current study aimed to investigate the relationships between environmental factors and invitingness to walk for transportation and the potential moderating effects of gender, functional limitations and current walking for transportation behavior.	Sixty older participants evaluated 40 panoramic photographs on their invitingness in two ways: a forced choice (first impressions) and a rating task (more deliberate evaluation).	Presence of vegetation, benches, and surveillance significantly positively related to both invitingness-measures. Upkeep and presence of historic elements significantly positively related to the assigned invitingness-ratings. For the forced choice task, significant positive relationships emerged for land use and separation between sidewalk and cycling path, but only in functionally limited participants. Environments offering comfort, safety from crime, and pleasantness may attract older adults to walk for transportation.	Experimental and on-site studies are needed to elaborate on current findings.	*how to motivate older people towards more walking	Journal article	Physical environment, Physical activity, Walking, Older adults, Photographs	https://www.sciencedirect.com/science/article/pii/S0272494413001084

36	Multi-Level Action for Increasing Walking and Bicycling Among Low-Income, Ethnic Minority Elementary School Children (2011)	Daniel Alexander, BA	Urban and Regional Planning, University of Hawaii at Manoa,	–	The purpose of this abstract is to apply the social ecological framework to the HO'ALA project in working across multiple levels and acting as a feedback conduit for the policies, plans, and programs being used to increase walking and bicycling to and from school.	This one-year quasi-experimental study consisted of 8 intervention and 5 comparison schools across Hawaii County. By following individual changes in students' commuting behavior and parent's concerns on walking and bicycling to school; institutional changes with SRTS programs; physical infrastructure changes in communities around schools; and policy changes with Complete Streets and SRTS policies, and statewide bicycle and pedestrian plans, the necessary data are provided for a comprehensive analysis of influential variables related to rates of children walking and bicycling to and from school.	After six months of the HO'ALA project, baseline data have been collected on and presented to eleven study schools. Nine schools have held town-hall meeting to initiate SRTS programs. A relationship has been established with the County DPW. Nine policy meetings have been attended, in which HO'ALA project members have given input based on the school findings. Developments in policy meetings have been favorable to improving pedestrian and bicyclist safety statewide; however with the exception of Hawaii SRTS Network meetings developments in regards to specifically serving elementary schools have been minimal.	Through involvement at the public policy, community, institutional, interpersonal and individual levels the HO'ALA project has engaged in comprehensive action and used the feedback for analyses in efforts to increase walking and bicycling to and from school. In this process the importance of such multi-level action and communication between stakeholders for the different levels has become increasingly evident.	*the most focusing on increasing walking or biking to and from school	–	–	https://activelivingresearch.org/sites/activelivingresearch.org/files/ALRConf2011_PosterAbstracts.pdf
37	Realtors' Perceptions of Social and Physical Neighborhood Characteristics Associated with Active Living: A Canadian Perspective (2020)	Gavin R. McCormack	Department of Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, AB T2N 1N4, Canada	Environmental research and public health	Using qualitative description, our study was to explore the perceptions and understandings of neighborhood design (walkability, healthy, bike-ability, vibrancy, and livability) among urban residential realtors.	Nineteen (6 men; 13 women; average age 48 years) self-identified residential realtors from Calgary, Edmonton, and Lethbridge (Canada) completed semi-structured telephone interviews. Content analysis identified themes from the interview data.	Specifically, walkability was described as: perceived preferences, destinations and amenities, and connections; a healthy community was described as: encourages outdoor activities, and promotes social homogeneity; bike-ability was described as: bike-ability attributes, and was controversial; vibrancy was described as: community feel, and evidence of life; and livability was described as: subjective, and preferences and necessities.	Our findings can inform the refinement of universal definitions and concepts used to in neighborhood urban design.	*active commuting from realtors perspective of view	Journal article	walkability; neighborhood; real estate; vibrancy; health; qualitative study; livability; physical activity	https://www.mdpi.com/1660-4601/17/23/9150/htm
38	Residential relocation and travel satisfaction change: An empirical study in Beijing, China (2020)	Fenglong Wang	School of Geography, South China Normal University, PR China	Transportation Research Part A: Policy and Practice	This study investigates whether and how residential relocation leads to changes in travel satisfaction.	Using a two-wave questionnaire survey conducted from 2011 to 2013 in Beijing, we compare home movers' travel satisfaction before and after residential relocation, and further examine how changes in the built environment and that in travel behavior lead to changes in travel satisfaction, taking into consideration the travel-related motivation for home relocation.	We find that almost 70% movers reported improvement in travel satisfaction after relocation, suggesting that residential relocation may serve as an opportunity to enhance travel satisfaction; improved neighborhood environments explain increases in travel satisfaction: higher accessibility to facilities, better physical design, enhanced safety and more interactions between neighbors contribute to improved travel satisfaction. On the other hand, increased travel time by transit reduces travel satisfaction. We also find out that relocation motivated by travel-related reasons did not lead to a significant improvement in travel satisfaction.	This study contributes to the literature by appreciating the role of neighborhood environment in improving travel experiences.	*focusing on travel satisactions	Journal article	Residential relocation, Travel satisfaction change, Built environment, Longitudinal study, Travel behavior	https://www.sciencedirect.com/science/article/pii/S0965856418308358
39	The Contribution of Mobile Apps to the Improvement of Walking/Cycling Behavior Considering the Impacts of COVID-19 Pandemic (2021)	Mohammad Paydar	Escuela de Arquitectura Temuco, Facultad de Humanidades, Universidad Mayor, Av. Alemania 281, Temuco 4780000, Chile	Sustainability	the role of mobile apps is prominent in respect to developing a smart city during this pandemic, which raises the questions of how mobile apps contribute to the improvement of walking/cycling behavior and how such a relationship is influenced by the situation imposed by COVID-19.	–	In regard to transport, mobile apps have the potential to facilitate data collection in macroscale environments. In addition, mobile apps may facilitate people's recognition of positive/negative environmental aspects, and this may in turn lead to greater pedestrian/cyclists' awareness and better organization of their walking/cycling behavior.	based on a participatory approach, the classification of current mobile apps and certain suggestions on the development of future mobile apps are presented. Finally, complementary suggestions are provided for maintaining and improving the use of mobile apps to improve the level of walking/cycling.	*how mobile apps can increase improve willingness fot biking or walking	Journal article	COVID-19; smart city; walking behavior; cycling behavior; mobile apps; participatory approach	https://www.mdpi.com/2071-1050/13/19/10580/htm
40	The impact of urban features in cycling potential – A tale of Portuguese cities (2021)	Miguel Lopes	CITTA - Research Centre for the Territory, Transports and Environment, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, s/n, 4200-465 Porto, Portugal	Journal of Transport Geography	Assuming cycling potential results of a good combination of physical and socio-demographic factors, we set out to identify dominant contexts generating high levels of cycling potential.	The previously developed Gross Potential for Cycling is applied to 21 Portuguese municipalities of different spatial contexts. By looking at the particularities of different typologies of urban territories, a set of k-means clustering analyses investigates which combination of factors contribute to the establishment of a high cycling potential.	The results indicate that, in the set of case studies, high accessibility to schools and urban centralities are common in high cycling potential areas, regardless of spatial context. Three clusters were identified from the combination of the age profile of residents and the connectivity features of the territory, defining the main typologies of high cycling potential areas.	As different urban typologies pose distinct configurations on the performance of the different evaluated indicators, these outcomes are crucial to inform policy makers on where to prioritize investment for the establishment of a new cycling culture.	*look at the potentials for increasing bikeability	Journal article	Starter cycling cities, Cycling potential, Built environment, Cluster analysis, Planning support system	https://www.sciencedirect.com/science/article/pii/S0966692321002027
41	THE INFLUENCE OF URBAN FORMS ON PARENTS' ASSESSMENT OF NEIGHBORHOOD SUITABILITY FOR ACTIVE COMMUTING TO SCHOOL: A CASE STUDY IN EUGENE, OR. (2011)	STEPHEN MAX ABBOTT	Department of Planning, Public Policy & Management of the University of Oregon	–	This study examines the school commuting behavior of students in a mid-sized Oregon City. It seeks to understand the influence that urban forms exert on children's rates of walking or biking to school, on parents' decisions to allow their children to do so, and on the assessments of neighborhood suitability for ASC that inform those parental decisions.	–	. Results show that parents' neighborhood assessment is a strong predictor of active school commuting. Moreover, parents' decisions about school commuting modes may be more influenced by environmental characteristics than by family socioeconomic characteristics.	Recommendations include future research designs that examine the relationship between specific urban forms and parents' perception of neighborhood safety, with a particular focus on street density and block length.	*more focus on school commuting behaviour	TERMINAL PROJECT	–	https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/12047/Abbott_final_project_2011.pdf?sequence=4&isAllowed=y

42	The Malaysian Cycling-Friendly Neighbourhood: A Signal For The Enhancement Of The Convenience Infrastructure. (2019)	Mohd Zahid Mohd Salleh	Centre of Studies for Postgraduate Studies, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, 40450, Shah Alam, MALAYSIA	International Conference on Built Environment and Engineering 2018 - "Enhancing Construction Industry Through IR4.0" (IConBEE2018)	The study aims to identify the cycling-oriented design factors specifically on the cycling infrastructure in Malaysian Residential Neighbourhood through the relationship between the perceived physical environments and cycling participation.	The content analysis through the review of the literature applies in this study. By modifying the Ecological approach in the Cycling-Friendly Neighbourhood enhancement for the cycling infrastructure in Malaysia, the awareness and experience of the people are required to evaluate.	the relationship between perceived environment, cycling participation level and cycling-oriented design factor will take part later to validate the significant relationship for each construct through empirical study. The convenience infrastructure design factors have been highlighted in the study comprises four elements such as safety and security, accessibility and connectivity, attractiveness and aesthetic and convenience and comfort.	it will give interest and facilitate the stakeholders in creating the cycling-friendly environment in the residential neighbourhood through supportive infrastructure for the communities.	*focusing on cycling participations	journal	–	https://www.matec-conferences.org/articles/matecconf/pdf/2019/15/matecconf_iconbee2019_06004.pdf
43	THE RELATIONSHIP BETWEEN SUSTAINABILITY AND WALKABILITY (2019)	Azadeh Nikmanesh Elahi	POLITECNICO DI TORINO	–	The present study aims at analyzing the relationship between the walkability and sustainability in urban planning. It also aims at explaining the possible advantage for both urban environment and people. For residences of cities, it can be highly effective on economic and health of people and for talking about the urban part, it leads to a sustainable community for having secure, comfortable and useful environment. In addition, another focus of this thesis is using mixed-use methodology, not only analyzing quantitative but also qualitative indicators for walkability analysis.	This thesis explores these topics through finding indicators for sufficiently analyzing walkability with comprehensively and systematic literature review methodology such as studying and comparing different protocols, assessment tools and articles and then applying them on case study "San Salvario district in Turin city, Italy". Then, all of the indicators have been assessed and analyzed by ArcGIS software.	The result highlights how it can be improved walkability in this neighborhood towards promoting sustainable urban planning.	–	*the ways of improving walkability	Thesis	Walkability, Neighborhood, mix use methodology, Indicators, ArcGIS	https://webthesis.biblio.polito.it/14771/1/tesi.pdf
44	Toward Active Transport as a Utilitarian and Recreational Form of Sustainable Urban Mobility (2020)	Parsa Arbab	School of Urban Planning, College of Fine Arts, University of Tehran, Tehran, Iran	Conference on Sustainable Urban Mobility	this study aims to explore and explain the association between the built environment and active transport by urban residents through a literature review.	Literature Review	Insights such as there are important natural/physical and macro/micro environmental characteristics that encourage the tendency for active transport as well as socioeconomic and sociodemographic attributes differently affect this indicative relationship, are subsumed in a conceptual framework that can guide future empirical studies.	–	*the ways of encouraging towards active transport	conference paper	Active transport, Physical activity, Built environment, Sustainable urban mobility, City	https://link.springer.com/chapter/10.1007/978-3-030-61075-3_62
45	MENA Region: The Case of Metropolitan Cairo (2015)	Saja Fathy	T.H.E Architects, Planners & Civil Engineers, 122 Mohie El Din Abou El Ezz Street, Mohandessin, Giza, Egypt	True Smart and Green City? 8th Conference of the International Forum on Urbanism	This paper will discuss and analyze the urban fabric typologies in the context of Cairo with a specific number of categories, and show existing problems, potentials to utilize form-based codes, and linking it to its current congestion problems and auto-dependency. Based on that, it will present possible bicycle solutions within the chaotic behavior pattern and transportation grid to promote humanpowered mobility interventions.	–	The outcome is in the form of an analysis of urban fabric forms and street types, and their potential to promote bicycle urbanism by design.	–	*toward having active environment like bikeability	Conference Proceedings Paper	auto dependency, urban, Cairo, human centric mobility modes, active environment, Transportation, urban planning, public health, active design, bicycle urbanism	https://pdfs.semanticscholar.org/1b9f/5f3bf98cdb5fe6c72c46b3ffd4b4adcc271d.pdf
46	Washington County Bicycle and Pedestrian Facility Design Health Impact Assessment (2012)	Barnett, Margot	–	–	Specifically, the goals of this HIA are to understand barriers to biking and walking in Washington County, and research the connections between health, built environment design and transportation policies.	The HIA project included 5 steps: 1) screening; 2) scoping; 3) assessment; 4) reporting; and 5) monitoring. The screening process was conducted by the HIA workgroup which included staff from both Washington County departments of Land Use and Transportation and Health and Human Services. The scoping was conducted by the workgroup and the HIA steering committee which included a broad range of community partners who represented traditionally underserved populations in Washington County. A three-part assessment using a randomized survey, listening sessions, and a literature review on key health outcomes and determinants. There were nearly 1300 completed surveys that provided a variety of perspectives concerning bicycle and pedestrian facility design.	Findings from the assessment included a preference for bike and pedestrian pathways that are separated from traffic. This finding indicates that traffic separation may be a key design issue that could impact a wide range of Washington County residents who do not engage in biking and walking due to safety concerns. Additional barriers to address included cultural perceptions of walking and biking as a lower socio-economic activity as well as the need for a continuous active transportation network with specific focus on distance from transit to preferred destinations.	to conduct more comprehensive outreach and education to Washington County residents about sharing the roadways among pedestrians, bicyclists and motorists. A common misconception is that increased bicycle and pedestrian activity will result in an increase in traffic related injuries and fatalities. This was echoed by findings from the survey across all respondent groups. The survey responses suggest that motorists need more education about safely sharing the roadway with bicyclists and pedestrians, and cyclists and pedestrians need more education about sharing the roadway with motorists.	*the barriers and also the preferences for biking or walking	–	–	https://www.co.washington.or.us/HHS/News/upload/Bike-Ped-HIA-2012.pdf

47	Why Do Students Walk or Cycle for Transportation? Perceived Study Environment and Psychological Determinants as Predictors of Active Transportation by University Students (2021)	Monika Teuber	Institute of Sports Science, University of Tübingen, 72074 Tübingen, Germany	Environmental research and public health	This study tested conditions in the study environment, as well as personal motivators and barriers, as determinants for the active transportation of university students.	Using a cross-sectional convenience sample of a university in the southwest of Germany (n = 997), we applied factor analyses to bundle relevant information on environmental and psychological determinants (adapted NEWS-G; adapted transport-related items from an Australian university survey) and blockwise hierarchical regressions.	Results revealed associations between transport-related cycling and the perceived study environment (e.g., high automobile traffic) as well as certain personal motivators and barriers (e.g., time effort or weather conditions).	The study contributes to the knowledge about determinants that are important for the development and improvement of public health interventions for students in a university setting.	*motivations and barriers of active transport between students	Journal article	active transportation; physical activity; perceived study environment; psychological determinants; motivators; barriers; university students; socio-ecological approaches	https://www.mdpi.com/1660-4601/18/4/1390/htm
48	"Cycling was never so easy!" An analysis of e-bike commuters' motives, travel behaviour and experiences using GPS-tracking and interviews (2017)	Paul A.Plazier	Department of Cultural Geography, Faculty of Spatial Sciences, University of Groningen, Landleven 1, 9747 AD Groningen, The Netherlands	Journal of Transport Geography	This study aimed to assess the potential of e-bikes for low-carbon commuting by analysing e-bike commuters' motives, travel behaviour and experiences.	We GPS-tracked outdoor movements of 24 e-bike users in the Netherlands for two weeks and used their mapped travel behaviour as input for follow-up in-depth interviews.	Results demonstrate that e-bikes can substitute motorized commuting modes on distances perceived to be too long to cover by regular bike, and stress the importance of positive experience in e-bike commuting.	This provides impetus for future actions to encourage commuting by e-bike.	*usage of e-bikes instead of other transportation	Journal article	Electrically-assisted cycling, Commuting, Sustainable transport, Active transportation, Mobility behaviour, Route choice	https://www.sciencedirect.com/science/article/pii/S0966692316307566
49	Active travel as a pro-environmental behaviour: An integrated framework (2020)	Mohsen Fallah Zavareh	Department of Civil Engineering, Kharazmi University, Faculty of Engineering, Tehran, Iran	Transportation Research Part D: Transport and Environment	This study aims to examine the role of symbolic and affective motives, together with other significant theoretical perspectives, to explain the share of active modes of transport in trips to the university.	It adds to the previous literature by considering the share of active modes of transport in different seasons. We collected a total of 316 completely filled questionnaires (response rate = 75.4 percent) from a cross-sectional self-administered survey in February 2019 in Trondheim, Norway.	Environmental self-identity predicted both types of motives. No evidence suggested that personal environmental norms and attitudes towards transportation significantly explained active mode share, although car-related subjective norms reached significance. Furthermore, there was no evidence that environmental attitudes towards transportation had a mediating effect between motives and active mode use. Cycling journey time between place of residence and campus was found significant in the share of active modes of transport in both seasons.	The results have important ramifications for the provision of relevant regulations and raising positive support from society to enhance the share of active modes of travel to the university.	*the things that make the people use active modes in summer and winter in trondheim	Journal article	Active travel, Symbolic motives, Affective motives, Personal norms, Environmental attitudes, Seasonality	https://www.sciencedirect.com/science/article/pii/S1361920920305435
50	Age-proofing a traffic saturated metropolis – Evaluating the influences on walking behaviour in older adults in Ho Chi Minh City (2021)	Thi Phuong Linh Le	School of Science and Technology, RMIT University Vietnam, Saigon South Campus, 702 Nguyen Van Linh Blvd., District 7, Ho Chi Minh City, Viet Nam	Travel Behaviour and Society	This study explores an extension of the Theory of Planned Behaviour (TPB) by incorporating built environment quality and safety constructs, along with proximity to destination types and vehicle availability indicators.	A survey of active older adults (n = 832, aged 55 to 72) was designed and administered within four inner districts in Ho Chi Minh City (HCMC) to elicit socio-demographic, travel characteristics and psychometric data about past walking behaviour and future intention. A partial-least squares structural equation model (PLS-SEM) was used to conduct path and multi-group analyses (MGA) on main activity segments (retired, working at home and working outside), revealing statistically significant paths with satisfactory variance explained in a conceptual extended Theory of Planned Behaviour (eTPB) framework.	The results show that intention to walk can be explained by past behaviour, with mediating effects from other factors, such as built environment and safety, via the standard TPB constructs (attitudes, subjective norms and perceived behavioural control). A clear relationship emerges between the factors examined, but with some exceptions and difference in MGA.	This study demonstrates the importance of understanding older adults through examination of their main activity status. We also call for the development of travel behaviour and urban intervention programs to improve walking uptake and safety for older adults.	*built environment and travel behaviour	Journal article	Ageing population, Walking, Theory of planned behaviour, Partial-least squares structural equation model, PLS-SEM, Vietnam	https://www.sciencedirect.com/science/article/pii/S2214367X20302301
51	Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach (2019)	Andre Neves	Transport for London, 197 Blackfriars Road, London SE1 8JZ, United Kingdom	Transportation Research Part A: Policy and Practice	The aim of this study was to investigate the potential for GHG emissions savings from replacing short car trips with walking and cycling and the extent to which high quality infrastructure for walking and cycling may influence day-to-day travel decisions, change the spatial and temporal nature of local journeys and impact on overall GHG emissions from motorised travel.	To achieve this aim this study conducted an in-depth observational study of a purposively selected cohort of 50 residents in Cardiff, Wales. Using a mixed-method approach detailed quantitative and qualitative data were collected for each participant using personal Global Position System (GPS) devices, 7-day travel diaries and contextual interviews over two seasonally matching 7-day time periods in 2011 and 2012.	We found significant potential of active travel to substitute short car trips, with sizeable impacts on carbon emissions from personal travel. Half of all car trips were less than 3 miles long. Taking into account individual travel patterns and constraints, walking or cycling could realistically substitute for 41% of short car trips, saving nearly 5% of CO2e emissions from car travel. This was on top of 5% of 'avoided' emissions from cars due to existing walking and cycling.	The study contributes to the debate on how to achieve stringent low carbon targets in urban transport. The combination of methods for data collection developed and employed in this study also helps to inform future research on the wider environmental impacts of active travel, including 'co-benefits' of improved air quality, reduced noise and reduced fossil fuel use.	*increasing walkability and bikeability and reducing CO2 emissions	Journal article	Walking and cycling, Active travel, CO2e, Short car trips, Spatial analysis, GPS	https://www.sciencedirect.com/science/article/pii/S0965856417316117
52	Attitudes towards active mobility in Singapore: A qualitative study (2017)	Maria Cecilia Rojas López	Centre for Infrastructure Systems, School of Civil and Environmental Engineering, Nanyang Technological University, Block N1-B1b-09a, 50 Nanyang Avenue, Singapore, 639798, Singapore	Case Studies on Transport Policy	To attract users towards a certain transport alternative, it is important to understand their current perceptions and attitudes towards it and accordingly develop a suitable transport network and related schemes.	This paper employs two qualitative techniques, focus group sessions and one-to-one interviews, to gain a deeper understanding of adults and elders perceived advantages, disadvantages, concerns and opportunities to promote walking and cycling in Singapore.	It was found that users are comfortable with the walking infrastructure, but they expressed that more can be done to improve the cycling infrastructure including provision of wider paths and parking facilities. Overall, more positive attitudes were registered towards cycling than walking. Work incentives such as flexible working hours are preferred by users to promote walking and cycling. Education to all road users (pedestrians, cyclists, and motorists) was mentioned as a key initiative to increase safety and effective sharing of facilities.	–	***attract users towards active commuting	Journal article	Active mobility, Travel behaviour, Qualitative study, Transport schemes, Attitudes, Perceptions	https://www.sciencedirect.com/science/article/pii/S221362431730204 3
53	Bike, Walk, and Wheel: A Way of Life in Columbia, Missouri, Revisited (2012)	Stephen P.Sayers	Department of Physical Therapy, University of Missouri, Columbia, Missouri	American Journal of Preventive Medicine	To examine the extent to which the ALbD intervention was associated with increased active living in children and adults community-wide.	Seasonal pedestrian and bicyclist counts were performed quarterly in January, April, July, and October at four intersections in downtown Columbia from 2007 to 2009.	Pedestrian counts increased significantly during July 2009 and October 2009 compared to 2007 and 2008, whereas cyclist counts increased significantly during only July 2009 compared to 2007 and 2008.	The ALbD intervention in Columbia was associated with modest increases in active living in the community, and continued evaluation of these behavior patterns is warranted. The combination of multiple strategies (social marketing, local programming, and infrastructure changes) may be a critical factor in improving active living in communities.	*factors for improving active living	Journal article	–	https://www.sciencedirect.com/science/article/pii/S0749379712004655

Appendix 2: Survey form

English version:

Dear Participants,

I am inviting you to participate in this research by completing the following survey questionnaires. Currently, I am working on my master thesis. My case study is Elgeseter gate district in Trondheim and my research question is *"What can motivate citizens that commute to or travel inside the Elgeseter gate district to change their behavior toward more walking and biking?"*

The main goal of my research is to find out about active mobility barriers and motivators in the Elgeseter gate district in order to identify methods and tools for more active mobility.
Thank you in advance for taking the time to help with this research. The data collected will remain confidential and used solely for this research paper. All the participants are welcome to get a copy of the survey result. Therefore, if you want a copy of the results of the survey or if you want to talk more about this topic, you can contact me by email.

Yours sincerely,

Mahgol Afshari, Master student in Project Management with specialization in Civil engineering at NTNU, mahgola@stud.ntnu.no

How old are you?

18-24

25-30

31-45

46-60

Above 60

What is your gender?

Female

Male

Prefer not to say

What is your employment status?

Unemployed

Employed

Retired

Student with part time job

What is your marital status?

Single

Married

In a relationship

Other

How many children do you have?

None

One

Two

Three

Four or more

Where do you live?

In the Elgeseter gate

In the area surrounding Elgeseter gate

Up to 4 km away from Elgeseter gate

5-9 km away from Elgeseter gate

More than 10 km away from Elgeseter gate

Not living in Trondheim

Would you please prioritize your primary modes of transportation?

	Never	Rarely	Sometimes	Often	Always
Walking *	○	○	○	○	○
Biking *	○	○	○	○	○
Using scooter *	○	○	○	○	○
Using public transport *	○	○	○	○	○
Using private car *	○	○	○	○	○

How often do you commute to or travel inside Elgeseter gate?

Almost everyday

4-5 times a week

1-3 times a week

Less than once a week

Commute to or travel inside Elgeseter gate before, Not anymore

Never

Why do you commute to or travel inside Elgeseter gate?

For going home

For going to work

For going to university

For going to kindergarten/school

For shopping

For visiting a friend

Using Elgeseter gate just as a passing road to the other side of the city

Other (Please write your reason in the box below)

Other reasons:

How do you commute to or travel inside Elgeseter gate?

	Never	Rarely	Sometimes	Often	Always
Walking *	○	○	○	○	○
Biking *	○	○	○	○	○
Using scooters *	○	○	○	○	○
Using public transport *	○	○	○	○	○
Using private car *	○	○	○	○	○
Using combination of different types of transportation for each trip *	○	○	○	○	○

Which factors can motivate you to walk or bike more in Elgeseter gate?

Existence of more trees and green spaces like parks

Existence of some pocket parks along the street

Better accessibility to the buildings

Presence of good biking facilities

Safe and enough parking space for bikes

Existence of routes with divided bike lanes

Nearby public bicycle sharing stations

Adding shaded components to pedestrian spaces

Improving the state of the sidewalks

Designing the neighborhood area with a diversity of land uses

Improving neighborhood safety

Easy access to shops, places to socialize and places to eat

Having enough light, particularly during the nighttime hours

Other (Please write other factors in the box below)

Other factors:

Which factors decrease your motivation to walk or bike in Elgeseter gate?

Weather condition

Lack of enough trees and green spaces along the street

Noise or air pollution

Absence of restaurants, cafes, shops, etc along the street

The quality of sidewalks

Winter condition maintenance for pedestrians

No divided cycle path and pedestrian path

Lack of enough safe and secure bicycle parkings

Boring area for walking or biking based on the existing buildings

Waiting time at pedestrian crossings

Other (Please write other factors in the box below)

Other factors:

Is there anything in particular that you think will make you more willing to walk or bike in the Elgeseter district if it changes?

Can you tell about the aspects of the areas you have visited that inspired you to walk or bike?

Do you want to read the terms and conditions?

Yes

Purpose of the project

- In my master project, I want to focus on identifying methods and tools that increase people-centric and active mobility in the Elgeseter district.

- Institutt for bygg- og miljøteknikk - NTNU is the institution responsible for the project.

- Your participation will involve an online survey.

- Participation in the project is voluntary.

- We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). The sample will be directly identifiable in the final thesis.

- The project is scheduled to end on 11.06.2022. The personal data will be anonymized at the end of the project.

Your rights: So long as you can be identified in the collected data, you have the right to:

Access the personal data that is being processed about you, Request that your personal data be deleted, Request that incorrect personal data about you be corrected/rectified, Receive a copy of your personal data (data portability), and send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

- We will process your personal data based on your consent.

Based on an agreement with *the Institutt for bygg- og miljøteknikk – NTNU*, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

- Contact information: NTNU via Alenka Temeljotov-Salaj (alenka.temeljotov-salaj@ntnu.no), Our Data Protection Officer: Thomas Helgesen (thomas.helgesen@ntnu.no), NSD: +47 55582117

If you agree with the terms and conditions please tick the box below.

I agree with the terms and conditions.

Norwegian Version:

Kjære deltaker,

Jeg inviterer deg til å delta i denne forskningen ved å fylle ut følgende spørreskjemaer. For tiden holder jeg på med masteroppgaven min. Mitt casestudie er Elgeseter gate-distriktet i Trondheim, og forskningsspørsmålet mitt er «Hva kan motivere innbyggere som pendler til eller reiser innenfor Elgeseter gate-distriktet til å endre adferd mot mer gange og sykling?»

Hovedmålet med min forskning er å finne ut om aktive mobilitetsbarrierer og motivatorer i Elgeseter gate-distriktet for å identifisere metoder og verktøy for mer aktiv mobilitet.

På forhånd takk for at du tok deg tid til å hjelpe med denne forskningen. Dataene som samles inn vil forbli konfidensielle og brukes utelukkende til denne forskningsoppgaven. Alle deltakere er velkomne til å få en kopi av undersøkelsesresultatet. Derfor, hvis du ønsker en kopi av resultatene fra undersøkelsen eller om du ønsker å snakke mer om dette temaet, kan du kontakte meg på e-post.

Med vennlig hilsen,

Mahgol Afshari, Masterstudent i prosjektledelse med fordypning i Anleggsteknikk ved NTNU, mahgola@stud.ntnu.no

Hvor gammel er du?

18-24

19-30

31-45

46-60

Over 60

Hva er ditt kjønn?

Kvinne

Mann

Foretrekker å ikke uttale meg

Hva er din arbeidsstatus?

Arbeidsledig

Ansatt

Pensjonist

Student med deltidsjobb

Hva er din sivilstatus?

Singel

Gift

I et forhold

Annet

Hvor mange barn har du?

Ingen

En

To

Tre

Fire eller flere

Hvor bor du?

I Elgeseter gate

I området rundt Elgeseter gate

Inntil 4 km unna Elgeseter gate

5-9 km unna Elgeseter gate

Mer enn 10 km unna Elgeseter gate

Bor ikke i Trondheim

Vil du være så snill å prioritere dine primære transportmåter?

	Aldri	Sjelden	Noen ganger	Ofte	Bestandig
Går *	○	○	○	○	○
Sykling *	○	○	○	○	○
Bruker sparkesykkel *	○	○	○	○	○
Bruker offentlig transport *	○	○	○	○	○
Bruker privat bil *	○	○	○	○	○

Hvor ofte pendler du til eller reiser innenfor Elgeseter gate?

Nesten hver dag

4-5 ganger i uken

1-3 ganger i uken

Mindre enn en gang i uken

Pendlet til eller reiste innenfor Elgeseter gate tidligere, men ikke lenger nå

Aldri

Hvorfor pendler du til eller reiser innenfor Elgeseter gate?

For å gå hjem

For å gå på jobb

For å gå på universitetet

For å gå i barnehage/skole

For shopping

For å besøke en venn

Bruker Elgeseter gate bare som en gjennomkjørings vei til andre siden av byen

Annet (Vennligst skriv årsaken din i boksen nedenfor)

Andre grunner:

Hvordan pendler du til eller reiser innenfor Elgeseter gate?

	Aldri	Sjelden	Noen ganger	Ofte	Bestandig
Går *	○	○	○	○	○
Sykling *	○	○	○	○	○
Bruker sparkesykkel *	○	○	○	○	○
Bruker offentlig transport *	○	○	○	○	○
Bruker privat bil *	○	○	○	○	○
Bruke kombinasjon av ulike typer transport for hver tur *	○	○	○	○	○

Hvilke faktorer kan motivere deg til å gå eller sykle mer i Elgeseter gate?

Eksistens av flere trær og grønne områder som parker

Utvikle noen lommeparker langs gaten

Bedre tilgjengelighet til bygningene

Tilstedeværelse av gode sykkel fasiliteter

Trygg og nok parkeringsplass for sykler

Eksistens av ruter med oppdelte sykkelfelt

Offentlige sykkeldelingstasjoner i nærheten

Utvikle skyggefulle komponenter i fotgjengerområder

Forbedre tilstanden til fortauene

Utforme nabolagsområdet med et mangfold av arealbruk

Forbedring av nabolagets sikkerhet

Enkel tilgang til butikker, steder å sosialisere seg og spisesteder

Sikre opplyste gater og fortau, spesielt om natten

Annet (Vennligst skriv andre faktorer i boksen nedenfor)

Andre faktorer:

Hvilke faktorer reduserer motivasjonen for å gå eller sykle i Elgeseter gate?

Værforhold

Mangel på nok trær og grøntarealer langs gaten

Støy eller luftforurensning

Fravær av restauranter, kafeer, butikker, etc langs gaten

Kvaliteten på fortau

Vinter Tilstands Vedlikehold for fotgjengere

Ingen delt sykkelvei og gangvei

Mangel på nok trygge og sikre sykkelparkeringer

Kjedelig område for turgåing eller sykkel basert på eksisterende bebyggelse

Ventetid ved fotgjengerfelt

Annet (Vennligst skriv andre faktorer i boksen nedenfor)

Andre faktorer:

Er det noe spesielt du tror vil gjøre deg mer villig til å gå eller sykle i bydelen Elgeseter hvis det endrer seg?

Kan du fortelle om aspektene ved områdene andre steder du har besøkt som inspirerte deg til å gå eller sykle?

Vil du lese vilkår og betingelser?

Ja

- In my master project, I want to focus on identifying methods and tools that increase people-centric and active mobility in the Elgeseter district.

- Institutt for bygg- og miljøteknikk - NTNU is the institution responsible for the project.

- Your participation will involve an online survey.

- Participation in the project is voluntary.

- We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). The sample will be directly identifiable in the final thesis.

- The project is scheduled to end on 11.06.2022. The personal data will be anonymized at the end of the project.

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Access the personal data that is being processed about you, Request that your personal data be deleted, Request that incorrect personal data about you be corrected/rectified, Receive a copy of your personal data (data portability), and send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

- We will process your personal data based on your consent.

Based on an agreement with *the Institutt for bygg- og miljøteknikk – NTNU*, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

- Contact information: NTNU via Alenka Temeljotov-Salaj (alenka.temeljotov-salaj@ntnu.no), Our Data Protection Officer: Thomas Helgesen (thomas.helgesen@ntnu.no), NSD: +47 55582117

Hvis du godtar vilkårene og betingelsene, må du krysse av i boksen nedenfor.

Jeg godtar vilkårene og betingelsene

Appendix 3: Interview guide

The main Research Question:

"*What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking or biking ?"*

3 main categories:

- Active mobility advantages
- Active mobility incentives
- Active mobility barriers

Active mobility:

Active mobility is the transport of people or goods, through non-motorized means, based around human physical activity. The best-known forms of active mobility are walking and cycling.

The interview began with discussing the master thesis' topic and aims, then ask some questions about the interviewee's background (warm-up questions), and after that begin with professional inquiries. It was likely that some more questions were asked as a result of the discussion, or that some of the prepared questions were changed based on the conversation.

Target groups: Fylkeskommune, Trondheim kommune, Statens vegvesen, ZEN, Involved in Elgeseter area projects

1. How long has he/she worked in his/her current position?
2. How many people commute in and out of Elgeseter gate per day? (by public transport, by their own cars, by bike or by walk)
3. Do you have any information on the approximate number of people that walk or bike in the area at different times of the day?
4. Why the people are biking or walking today? Why do you think the people choose active mobility?
5. What are the advantages of increased active mobility in Elgeseter for Trondheim?
6. What type of city development initiatives can be taken to make the Elgeseter district and the surrounding region more walkable and bikeable?
7. Based on the current situation in Elgeseter district, could you tell me about the factors that decrease people's motivation to walk or bike in the area?
8. Can raising people's desire for increased active mobility be achieved by educating them? If so, how would you think about doing it?
9. Based on the current situation in Elgeseter district, what can be done in the area to attract people to walk or bike more for commuting?
10. What type of government policies and legislation can be implemented in the Elgeseter district to improve bikeability and walkability?
11. What are your ideas in case of making safer and more comfortable environment for pedestrians and bike users?

Target groups: Elgeseter gate residents, Daily commuters, Active bikers, and Active pedestrian

1. What kind of modes of transportation does each of you use to commute? Do you walk, bike, use public transport or your own car? And why?
2. Based on your daily commuting to Elgeseter district, could you tell me about the factors that decrease your motivation to walk or bike in the area?
3. Based on the current situation in Elgeseter district, what can be done in the area to attract people to walk or bike more for commuting?
4. Is there anything in particular that you think will make you more willing to walk or bike in the Elgeseter district if it changes?
5. What are your ideas in case of making safer and more comfortable environment for pedestrians and bike users?
6. Can you tell me about the aspects of the areas in Trondheim, your home country, or other places you have visited that inspired you to walk or bike?

Appendix 4: Interview consent form

Are you interested in taking part in the research project

"Identifying methods and tools for changing mobility behavioral patterns toward more walking and biking - Case Elgeseter gate"?

This is an inquiry about participation in a research project where the main purpose is to identify approaches that can be used as incentives to increase walkability or bikeability in the Elgeseter district in the City of Trondheim. In this letter we will give you information about the purpose of the project and what your participation will involve.

Purpose of the project
There are different goals for Elgeseter Mobility project. These can be named as achieving zero-emission, consolidation of sustainable lifestyles, supporting mental and societal health, moving towards innovation and development in an urban context, achieving a systemic change towards a sustainable society, and developing Elgeseter district as a showcase for urban innovation and sustainability. There are some strategies towards achieving these goals which are empowering citizens to become game-changers, inclusiveness of urban transformation processes, creating people-centered attractive urban living and working environments, and applying technology to support social development sustainable lifestyles.

In my master project, I want to focus on identifying methods and tools that increase people centric and active mobility in the Elgeseter district. More specifically, the analysis ambitions to recognize incentives towards increasing walkability or bikeability in Elgeseter district. Based on this, my master thesis aims to address the following main research question

RQ - "*What can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking or biking ?"*

The collected data will be in the form of sound/ voice and online/physical meetings. The recorded data will be anonymized immediately after the project has ended. No identity will be exposed, and the collected data will only be used in this master project.

Who is responsible for the research project?
Institutt for bygg- og miljøteknikk - NTNU is the institution responsible for the project.

Why are you being asked to participate?
The people with relevant background for this topic and the residents of Elgeseter gate district are going to be asked for interview. The initial contact has been made via email.

What does participation involve for you?
Your participation will involve an online/physical interview with you taking approximately 60 minutes. The survey includes questions about active mobility advantages, active mobility barriers and active mobility incentives. Your answers will be recorded electronically.

Participation is voluntary
Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). The sample will be directly identifiable in the final thesis.
A voice recording of the interview will be stored for a period of time for the purposes of transcription and the writing up of the project.

What will happen to your personal data at the end of the research project?
The project is scheduled to end in 11.06.2022. The personal data, including any digital recordings, will be anonymised at the end of the project.

Your rights
So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

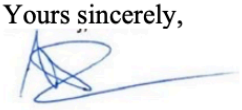
What gives us the right to process your personal data?
We will process your personal data based on your consent.

Based on an agreement with *the Institutt for bygg- og miljøteknikk – NTNU*, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:

- *Institutt for bygg- og miljøteknikk – NTNU* via Alenka Temeljotov-Salaj *(alenka.temeljotov-salaj@ntnu.no)*
- Our Data Protection Officer: *Thomas Helgesen (thomas.helgesen@ntnu.no)*
- NSD – The Norwegian Centre for Research Data AS, by email: (personverntjenester@nsd.no) or by telephone: +47 55 58 21 17.

Yours sincerely,



Project Leader
(Alenka Temeljotov-Salaj)

Student
(Mahgol Afshari)

Consent form

Consent can be given in writing (including electronically) or orally. NB! You must be able to document/demonstrate that you have given information and gained consent from project participants i.e. from the people whose personal data you will be processing (data subjects). As a rule, we recommend written information and written consent.

- *For written consent on paper you can use this template*
- *For written consent which is collected electronically, you must chose a procedure that will allow you to demonstrate that you have gained explicit consent (read more on our website)*
- *If the context dictates that you should give oral information and gain oral consent (e.g. for research in oral cultures or with people who are illiterate) we recommend that you make a sound recording of the information and consent.*

If a parent/guardian will give consent on behalf of their child or someone without the capacity to consent, you must adjust this information accordingly. Remember that the name of the participant must be included.

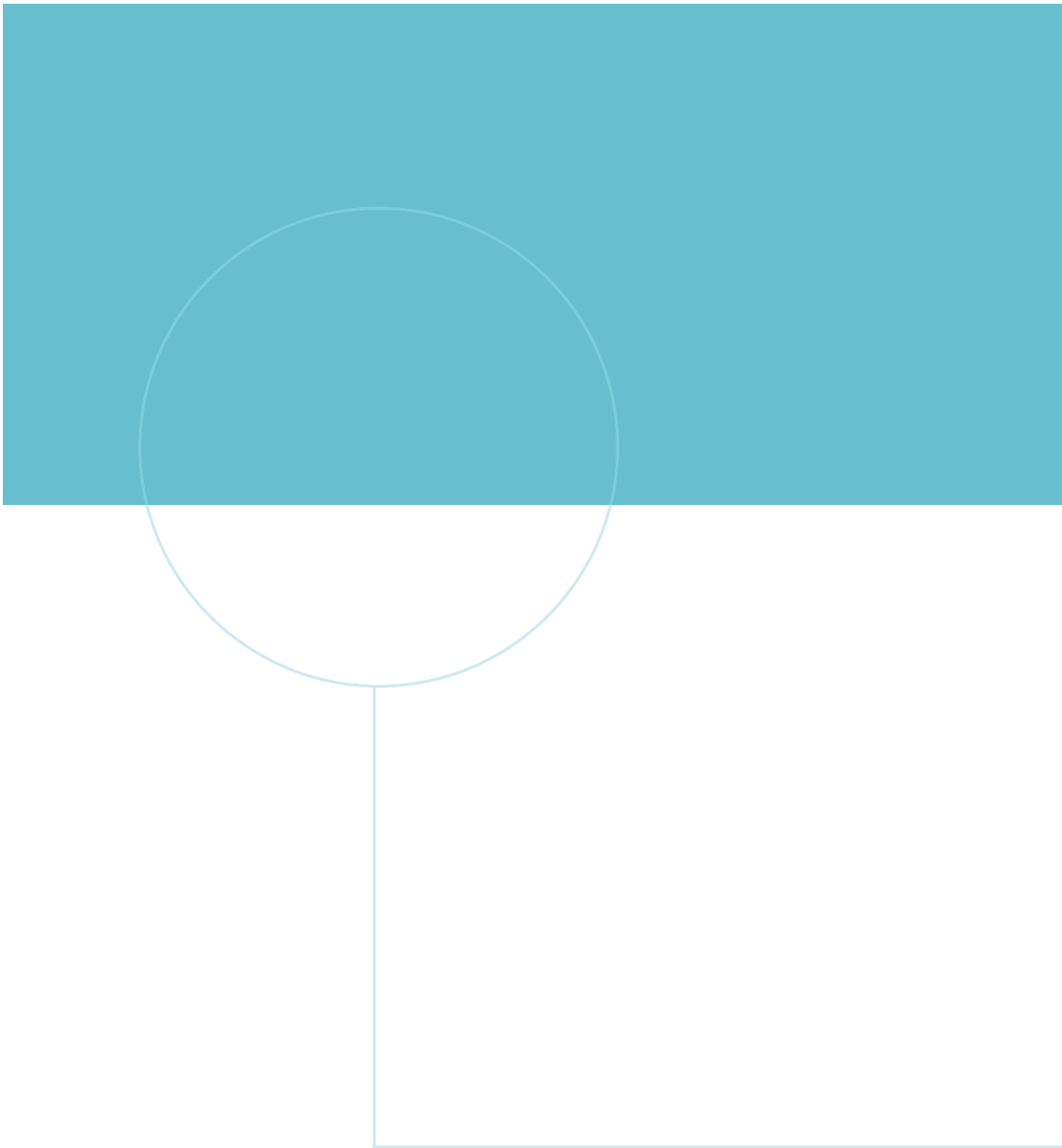
Adjust the checkboxes in accordance with participation in your project. It is possible to use bullet points instead of checkboxes. However, if you intend to process special categories of personal data (sensitive personal data) and/or one of the last four points in the list below is applicable to your project, we recommend that you use checkboxes. This because of the requirement of explicit consent.

I have received and understood information about the project *[insert project title]* and have been given the opportunity to ask questions. I give consent:

☐ to participate in an interview

I give consent for my personal data (voice and/or online meeting recording) to be processed until the end date of the project, approx. *11.06.2022*.

(Signed by participant, date)



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