Moving Viksjö

The road to sustainable travels

An AI's vision of sustainable transportation in Viksjö (Generated by OpenAI's ChatGPT 4.0)

AG2809 Project Sustainable Urban Planning - Assessments, Processes and Plans

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Abstract

In response to international and national goals aiming to reduce greenhouse gas emissions, municipalities are making an effort to provide citizens with sustainable travel options and reducing the use of cars. In this study, it has been investigated how public transportation in the Viksjö residential area can be made more efficient and what can be done to increase the proportion of sustainable trips made by the residents of the area. The purpose of the study has been to develop relevant strategies that Järfälla municipality can implement to achieve these goals. Through an extensive survey study, an idea has been created about how Viksjö residents travel today and their need to be enticed to make more sustainable trips.

Furthermore, an observation study was carried out in the area together with interviewing a traffic planner at Järfälla municipality to create a clear picture of the situation in Viksjö.The survey study showed dissatisfaction with public transport regarding travel times, number of departures and unreliable service. On a 5-point scale, the average satisfaction level of people using public transport was 3.1. The observation study made it clear that there was an inefficiency in how the buses were used, as many buses ran close to empty during rush hour. During the observation study, it was also discovered that the cycle paths were used little, while at the same time many cars were driving in the area, cementing what surfaced during the interview that Viksjö is a car-dependent area.

In addition to the interview, the observation study and the survey, an extensive literature study was conducted, exploring strategies related to promoting sustainable travels, such as electric buses, bicycle pools, nudging and AI in public transport. The literature study has contributed with an overview of how these strategies had worked out in Järfälla. Based on these results, together with the literature study, a number of recommendations have been drawn up for Järfälla municipality which aim to increase the efficiency of public transport and to increase the proportion of sustainable trips made by Viksjö residents. These recommendations are to reorganize bus timetables, implementing direct buses to Jakobsberg, attracting people through active information, offering bicycle pools and reducing emissions of buses by using electric fuels.

Sammanfattning

Som ett svar på de internationellt och nationellt uppsatta målen som strävar mot att minska utsläppen av växthusgaser samt minska användandet av bilar anstränger sig kommuner att erbjuda sina medborgare hållbara resealternativ. I den här studien har vi undersökt hur kollektivtrafiken i Viksjös bostadsområde kan effektiviseras samt vad som kan göras för att öka andelen hållbara resor som görs av invånarna. Syftet med studien har varit att ta fram relevanta strategier som Järfälla kommun kan implementera för att uppnå dessa mål. Genom en omfattande enkätstudie har en uppfattning skapats kring hur Viksjöbor reser idag och deras behov för lockas till att göra fler hållbara resor.

Vidare har det genomförts en observationsstudie i området samt en intervju med en trafikplanerare på Järfälla kommun för att ytterligare skapa en utförlig bild av hur den nuvarande situationen ser ut. Enkäten visade ett missnöje över kollektivtrafiken gällande restiderna, antalet avgångar samt opålitlig trafik. På en 5-gradig skala över den genomsnittliga nöjdheten (satisfaction level) bland kollektivtrafikresande personer var nöjdheten i genomsnitt 3,1. Observationsstudien gjorde det uppenbart att det fanns en ineffektivitet i hur bussarna användes då många bussar körde närmare tomma under rusningstrafik. det upptäcktes även att cykelbanorna nyttjades lite samtidigt som många bilar körde i området, vilket bekräftar det som framkom under intervjun, att Viksjö är ett bilberoende område.

Utöver intervjun, observationsstudien och enkäten har en omfattande litteraturstudie gjorts av strategier relaterade till att främja mer hållbart resande såsom elektriska bussar, cykelpooler, beteendeförändring (nudging) samt användning av AI i kollektivtrafik. Litteraturstudien har bidragit med en överblick över strategier som kan implementeras i Järfälla. Baserat på dessa undersökningar tillsammans med litteraturstudien har ett antal rekommendationer tagits fram för Järfälla kommun, som syftar till att öka effektiviteten av kollektivtrafiken samt att öka andelen hållbara resor som görs av Viksjöbor. Dessa rekommendationer är att omorganisera busstidtabeller, införa direktbussar till/från Jakobsberg, välkomhetsbrev för nyinflyttade angående hållbart resande, erbjuda cykelpooler samt att minska koldioxidutsläpp från busstrafiken genom elektriska fordon.

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1. Introduction

Climate change has enormous consequences worldwide. A decrease in fossil fuels was proposed by the national governments participating in the COP26 climate conference in Glasgow. Therefore, countries and consequently municipalities need to step up their efforts in order to reduce the amount of fossil fuels (Achakulwisut et al., 2023). It is critical to limit the usage of carbon dioxide emissions since climate change impacts the entire world (IPCC, n.d). Unfortunately, a lot of fossil fuels are still needed in the transportation sector (Naturskyddsföreningen, 2021). Therefore, municipalities are attempting to encourage public transportation use in order to minimize carbon dioxide emissions as a result of climate change- and other climate goals, both nationally and within the European Union. Reducing emissions also corresponds with Järfälla's goals to promote sustainable travel and reduce the climate effect per person (Järfälla Kommun, 2014).

According to Fan and Machemehl (2008), public transportation is widely recognized as a possible solution for reducing air pollution, lowering energy use, bettering mobility, and reducing traffic congestion. The Oxford dictionary defines public transportation as *"Buses, trains, and other forms of transport that are available to the public, charge set fares, and run on fixed routes"* (Oxford languages, 2024). According to Eurostat, 80-85 % of movements in Europe are made using cars, and only 15-20 % using public transportation (Archetti et al., 2015). The authors state that the low usage of public transportation is a consequence of the inflexibility of the public transportation system. The typical mass mobility system runs on fixed schedules, not assumed to satisfy the users' dynamic demand. The consequences listed by the authors are a low frequency and significantly longer travel time compared to private modes of transport. The authors also mean that public transportation systems have an inherently inefficient nature: Buses are overcrowded during peak hours, and close to running empty during the rest of the day. The consequences of this are the operational costs and the sustainability of the system being affected. The authors conclude that there is a need to redesign the public transportation system, making it more tailored to users' needs, thus increasing its efficiency.

Furthermore, transport infrastructure is failing to function properly. it is often faced with issues such as insufficient capacity, -dependability and pollution. The employment of diverse Artificial Intelligence (AI) can improve the efficiency in public transportation (Ushakov et al., 2022). The transition to sustainable travel faces significant challenges, especially when it comes to getting people to choose public transport over private vehicles. In order to address the environmental and operational inefficiencies found in the current transportation system, it is critical to understand the factors that influence these choices. By exploring these issues, strategies and incentives can be identified to make public transport more attractive and profitable.

A number of the sustainable development goals are connected to our project. The project's objective is to make ecologically friendly modes of transportation more appealing and popular. This pertains to SDG 11: *Sustainable Cities and Communities*, as our suggestions are meant to encourage a greater proportion of sustainable forms of transportation among Viksjö's citizens. SDG 13: *Climate action,* is closely linked to the use of bike pools and sustainable fuels in public transportation (Global goals, n.d).

2. Aim

This project aims to explore the challenges and what measures could be implemented to increase the use and attractiveness of sustainable transportation in the Viksjö residential area, located in Järfälla Municipality, Stockholm. The decision to focus on Viksjö was based on information from a study visit prior to the project start and from personal communications with a traffic planner at the municipality with insights in the Viksjö area, indicating that Viksjö is a car-dependent area (Roos, 2024). As a result, it was decided it would be interesting to analyze the travel habits in Viksjö and further suggest relevant recommendations to encourage the use of more environmentally friendly forms of transportation.

We will in this report investigate the travel habits of the residents in Viksjö as well as sentiments and opinions on public transportation, which will provide a basis for recommendations that will be presented at the end of this study. Additionally, this study will investigate potential recommendations for Järfälla Municipality and other actors to encourage the use of sustainable modes of transportation. In order to fulfill the aim of the project, two research questions have been developed to lead this study. They are presented in section 2.1 below.

2.1 Research questions

- *What are the primary challenges to increase the usage of environmentally friendly forms of transportation in Viksjö?*
- *What initiatives can Järfälla carry out to promote the usage of environmentally friendly forms of transportation?*

3. Case background

3.1 Viksjö residential area

Insights gained from a study visit and an interview with Johanna Roos (2024) revealed that the Viksjö residential area is heavily reliant on cars for transportation. Drawing from this insight, we were motivated to develop a project aimed at identifying the challenges in the area and providing recommendations to enhance the appeal of sustainable transportation options.

Viksjö is situated in the Järfälla municipality, southwest of Jakobsberg north of the Stockholm metropolitan area, and is home to approximately 16,000 residents (Järfälla kommun, n.d.a). The area is primarily composed of single-family houses, with over 50% of these homes being privately owned (Järfälla kommun, n.d.b). To evaluate socio-economic conditions across various parts of Järfälla, Statistics Sweden (SCB) and the Delegation against Segregation have developed a *socio-economic index*. This index considers factors such as the proportion of individuals with low income, limited education, and long-term reliance on financial aid or unemployment benefits. Higher index values indicate lower socio-economic conditions.

In 2021, Viksjö recorded a socio-economic index of 6.8. Specifically, 9% of its population had attained only pre-secondary education, 6% were classified as having a low economic standard, and 4% were long-term unemployed. By comparison, Jakobsberg exhibited the highest index value of the municipality at 19.5, while Stäket recorded the lowest at 4.8 (Järfälla kommun, n.d.b).

3.2 Public transportation in the Viksjö residential area

The Viksjö residential area is integrated into the Stockholm County public transportation network, managed by Nobina. In order to easily connect to neighboring commuter rail stations and have access to central Stockholm and the surrounding areas, residents of Viksjö take advantage of SL bus services currently operated by Nobina.

However, the bus services in the Viksjö residential area seem to be running inefficiently. One indication of this is bus 564HV running as a “loop” from Jakobsbergs commuter train station, to Viksjö and back, only averaging 19 boarding passengers per departure (Nobina, 2023). During the peak hours 07:00 to 09:00 however, this number spikes to 31,2 passengers per departure, showing an imbalance in the capacity (Nobina, 2023). Broader statistics indicate that public transportation is a vital component of daily life in the Stockholm region with two million trips made daily by Stockholm citizens (Stockhoms stad, n.d).

Viksjö offers residents a variety of convenient **public transportation options**, making it easy to get around the area and beyond. There are four different bus lines running to and from Viksjö (Moovit, 2024). From Viksjö to Jakobsberg station, it is approximately a 35 minute walk. Residents can take the commuter trains from Jakobsberg directly to central Stockholm or the surrounding suburbs. It is also possible to take the train towards Bålsta Station or Nynäshamn station, which provides commuters with opportunities to reach other parts of the Stockholm region (Moovit, 2024). By looking at different indications it has been shown that 97% of residents in Järfälla live close to a public transport stop (Miljöbarometern, 2024a).

For those who prefer to bike, Viksjö is **bike-friendly**, with an extended bike route network as seen in figure 1. The infrastructure is made up of dedicated lanes and bike racks at major stops and train stations. The time to bike from Viksjö centrum to Jakobsbergs commuter train station is only around 12 minutes (Google Maps, 2024). Furthermore, like many others, Järfälla municipality strives to increase the use of sustainable modes of transportation with ambitious targets one of which is for bicycle traffic to make up 20 % of the total traffic in 2030, this number was 12 % in 2020 (Järfälla kommun, 2024). The great biking ambitions even lead to Järfälla being awarded Region Stockholm's annual bicycle prize for long-term and ambitious work to promote increased cycling (Järfälla kommun, 2023).

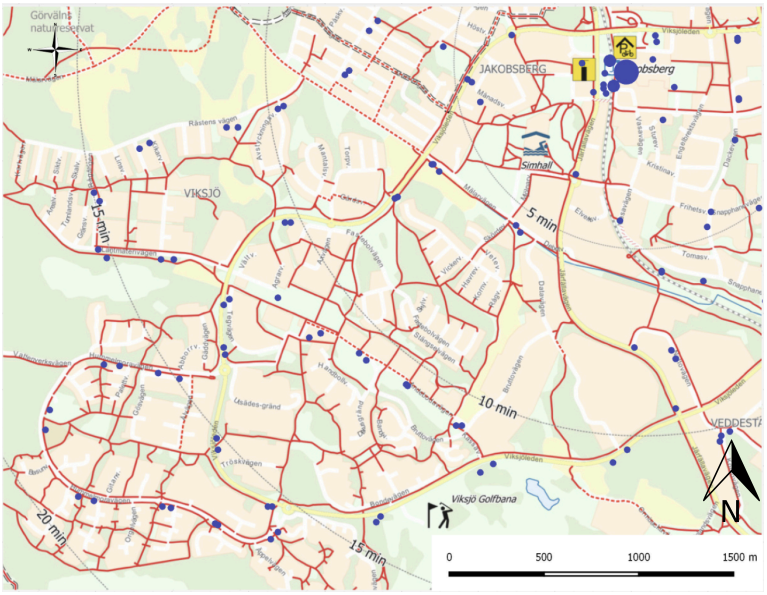

Figure 1. *Map displaying bike routes (red lines) and bus stops (blue dots) in the Viksjö residential area (Järfälla kommun n.d.c, edited by authors)*

Altogether, Viksjö's blend of buses and cycling infrastructure seem to provide residents with a flexible and efficient way to travel across the Stockholm region.

4. Methods

To fully assess and enhance public transportation efficiency in Viksjö, a mixed-methods approach will be used, integrating quantitative and qualitative data collection and analysis. These methods aim to capture a holistic understanding of current travel behaviors, residents' perceptions, and potential areas for improvement (Harvard, 2025). Surveys were used to gather quantitative data from residents about their preferred modes of transportation, travel habits, and factors influencing their choices, providing a broad overview of trends and community behavior. Observational studies complement this by capturing real-world usage patterns, such as the frequency of car use, bus stop activity, or cycling infrastructure engagement, offering objective insights into how transportation is utilized in practice.

Interviews with stakeholders add depth to this analysis by identifying areas that are car dependent and exploring the underlying reasons behind car dependency, including perceptions of convenience, barriers to alternative transportation, and attitudes toward public transit. Finally, a literature review connects these local findings to global best practices, identifying evidence-based strategies for promoting sustainable travel, such as improved public transport and active travel infrastructure. Together, these methods provide a comprehensive understanding of car reliance in Viksjö and inform actionable solutions to reduce dependency and encourage more sustainable mobility choices.

4.1 Field Study in Viksjö

Since a number of factors to examine had already been decided upon, a structured observation study was carried out. The study visit took place on two separate occasions

during peak hour traffic on Thursday, November 14, 2024, in the morning between 7:00 and 9:00 and in the afternoon from 15:00 to 18:00. Focus was mainly on the route between Jakobsberg Station and Viksjö residential area, particularly buses and cars passing the *Viksjö Gård* bus stop along Viksjöleden. These hours were chosen to observe transportation during a high-demand period when people were traveling to or from home to their desired destination, which is presumed to be between work or school and their homes. Since numerous individuals were traveling to and from Jakobsberg train station, it was assumed that the train station is a popular route of transportation among Vikjsö locals.

The observation was conducted by positioning ourselves at key locations along the Viksjöleden, a main road for travels to and from the residential area of Viksjö. From this vantage point, both private vehicles and public transportation vehicles were observed as they passed. Our goal was to get an idea of usage patterns, traffic flows, and the interaction between private and public transportation in real-time. During the observation period, detailed notes on the types of vehicles observed were taken, as well as notes over the frequency of public transportation services and an estimated number of passengers visible in buses. Additionally, photographs and videos were captured to provide visual documentation of the observations.

It was aimed to see how various modes of transportation were distributed and whether there were any obvious gender or age-related disparities in the modes of transportation that people choose. Furthermore we wanted to observe the Viksjö residential area in order to observe passenger numbers, demographic patterns, and variations in usage to identify inefficiencies within the public transportation system. By carrying out direct observations, we aimed to uncover specific challenges such as capacity problems and transitions between different modes of transport.

This information would help identify areas for improvement to enhance efficiency in public transportation. The study visit was useful to help understand which mode of transportation residents were using, and to what extent. The observation was performed during the winter which has the potential to reduce ridership. Therefore seasonal influences will be considered to differentiate between weather-related challenges and systemic issues, ensuring recommendations address both immediate and long-term needs.

4.2 Online Survey

A semi-structured survey was developed to gather data on Viksjö residents' travel behaviors, attitudes, satisfaction levels, and suggestions for public transportation improvements. The survey was available in Swedish and English to reach a broader population of Viksjö. It was produced using the *Google Forms* software, where responses were gathered in an excel format for further analysis. According to Stantcheva (2023) one advantage with online surveys is the option to review responses prior to ending the poll, which is what was done during our study.

The survey comprised three sections. The first section containing four questions was answered by all respondents, examining the demographics, car ownership as well as the respondents' stated primary mode of transport (by car *or* by public transportation). The indicated mode of transportation decides which one of the following two sections are presented. One of these sections is directed to car users (seven questions), aiming to capture their travel patterns and preferences, whereas the other of these sections answers similar questions for public transportation users (nine questions). The last question of both of these

sections allowed respondents to voluntarily write any additional input in free text. Survey questions are presented in full in appendix 1.

In order to reach as many respondents as possible, the survey was posted in two facebook groups aimed at residents of Viksjö: *"Viksjös anslagstavla"* and *"Vi som bor i Viksjö"* with around 6 200 and 2 400 members respectively (as of 2024-11-19). In addition to the Facebook groups, the survey was posted using a QR code in 20 different locations in and around Viksjö Centrum; at bus stops, at sports facilities as well as on municipal public bulletin boards. The survey was posted in both Facebook groups on the 11th November, and the QR codes were distributed in Vikjö the following morning. After 1,5 weeks a reminder was posted in the facebook groups, which generated even more answers. After two weeks it was decided to close the survey on the 25th november, and it had by then gathered 102 total responses.

4.3 Interview

An interview with Johanna Roos, traffic planner at Järfälla municipality was conducted online through Zoom, following a semi-structured method with predetermined questions based on the study research questions. The meeting was initially set up as an informal conversation, but turned into an interview since there was sufficient time to ask interview questions. Sticking to pertinent questions while maintaining flexibility is according to Kallio (2016) a benefit of an organized interview, as it allows the participant to lead the conversation to topics that they feel are relevant. Our inquiries were based on our prior understanding of Järfälla municipality and the field of public transportation. The interview questions are presented in appendix 2.

4.4 Literature review

Our literature review was first and foremost based upon the group members' own previous literature reviews, which covered different topics within sustainable transportation. We have looked into how we can decrease the environmental impact from public transportation, both in terms of fuel and the benefits with implementing a bicycle pool. Which is also in line with Järfälla Municipalities' goals to improve sustainable travel and reduce the climate impact per person is in line with Järfälla Municipality goals (Järfälla Kommun, 2014). We have also examined several transportation stages and evaluated how we could alter travel behaviors to promote sustainable travel. This review helped us understand how these strategies can be adapted to improve transportation efficiency in Viksjö, directly addressing our research question on attractive and efficient public transportation.

Furthermore, we also looked into other successful strategies from other cities around the world in terms of creating a more attractive public transportation. We believe that including this type of literature study would be beneficial since it is preferred to provide Järfälla Municipality with appropriate recommendations based not only on our findings but also on strategies that have proven successful in other places.

4.5 Ethical considerations

The survey adheres to ethical standards, including informed consent, anonymizing the personal data meaning that no personal data uniquely identifying a user was collected. Furthermore, participation was completely voluntary. Moreover, participation will be entirely voluntary as the link/QR-code will be openly available, with no penalties for

non-participation or withdrawal. The survey will require respondents to be above 15 years old in order to participate. In regards to the interview, there was full transparency of the work being conducted and the participant was made aware that the interview was recorded for internal transcription and following translation. The interviewee was informed that the interview will be used in our report, and it was confirmed that the full name of the respondent could be written in the report.

5. Results

5.1 Literature Review

The following literature review focuses on analyzing strategies that can be used to increase the use of sustainable modes of transportation as well as strategies seeking to reduce emissions from personal transportation. This is to explore factors that influence the residents' choice to drive by car as well as solutions that may be relevant and important to reduce greenhouse gas emissions in Järfälla municipality. The review helps to understand how certain solution strategies can be developed and implemented to improve transport in Järfälla, which addresses our research questions about how to increase the use of environmentally friendly forms of transportation in Viksjö.

5.1.1 Electric buses

Using electricity in their buses is one way that Järfälla Municipality can work to improve sustainable mobility. **Local emissions** from public transportation are far lower compared to private transportation such as cars. This demonstrates that electrification represents a positive step forward (Xylia et al., 2019). The authors mention that electrifying road transport, along with a modal shift toward public transportation, has the potential to drastically reduce carbon emissions and boost energy efficiency in the transport industry.

One advantage of electric buses is that they are much **quieter** than buses that run on other fuels and produce minimal pollution (Region Stockholm, 2024). They can drive closer in residential areas because of their quiet operations, which can help those with limited mobility because it shortens the commute to the bus terminals (Västtrafik, 2021). The use phase of an electric bus from the Swedish network mix represents 30% of the climate impact, compared to 90% for a diesel bus. The most effective way to lessen eutrophication and acidity at the regional level is through electrification. Nordelöf et al (2019) argues that reducing exposure to high levels of air pollution in metropolitan areas is one health benefit of using less fossil fuels (Nordelöf et al., 2019).

One additional benefit with using electric buses is based on the **decreased use of petroleum** compared to a diesel bus, with a possible reduction of up to 87% petroleum (Zhou et al., 2016). The authors argue that approximately 30-45% reduction in fossil fuel use can result in CO2 emissions savings of up to 35% across the entire life cycle.

Amnesty (n.d) states that issues regarding **human rights** and working conditions have been raised in several of the mining regions for key minerals in electric batteries. Child labour is common, children as young as seven years are carrying heavy sacks in small tunnels without enough safety equipment. The adult workers are facing similar working conditions. The

mining causes dust and without any safety equipment it can cause dangerous lung diseases to the workers.

5.1.2 Transportation stages

The **"first-and-last mile problem"** refers to the gap between a person's origin or destination and public transit stops. This issue significantly impacts the overall accessibility and convenience of public transportation (Kåresdotter et al., 2022). The first mile connects an origin to public transit, while the last mile connects transit stops to final destinations as visualized in figure 2.

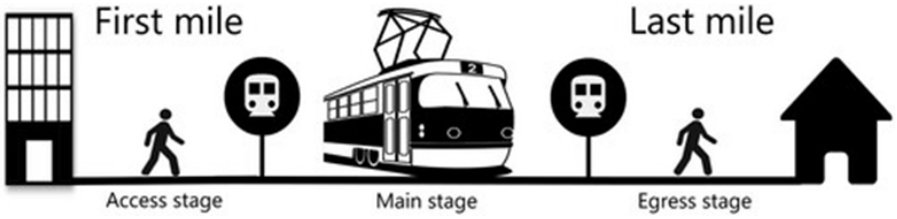

Figure 2. *First- and last mile definition. (Kåresdotter et al., 2022, p. 116)*

Kåresdotter et al. (2022) considers everyone willing to walk the distance to public transportation as having access to public transportation. The willingness to walk varies between cities and countries. The authors found that lacking connectivity in the transport system leads to increased car use, which in turn results in lower use of public transportation. This is stated to be especially true for groups with lower mobility, for example the elderly. It is concluded that high connectivity leads to reduced first- and last mile problems and higher use of public transportation.

5.1.3 Bicycle pools

Bicycle pools represent another sustainable transport solution, particularly for short-distance trips. They offer a cost-effective alternative to private bicycle ownership, which can help mitigate emissions and reduce reliance on cars (Chardon, 2019). The availability of shared bicycles also encourages cycling, addressing the concern of bike theft raised by Roos (2024), possibly detering some residents from using personal bikes.

Bicycle pools can integrate seamlessly with public transit systems, easing first-and-last mile challenges and reducing traffic congestion (Zheng & Li, 2020). Additionally, they promote healthier lifestyles and greater mobility equity by reducing barriers to access for low-income individuals. Cities like Paris and Hangzhou have demonstrated the effectiveness of bike-sharing systems, with Paris observing a 70% increase in bike use and a 5% decrease in car use after launching its program (ULI Americas, 2016).

Table 1. *The impacts of bicycle sharing observed in urban areas.*

City	Main findings	Source

Paris	The *Vélib* bike-sharing program was introduced in 2007 with 7,000 bikes. By 2008, a 70% increase in bike use and a 5% decrease in car use was observed. In 2013, the highest market penetration globally with one bicycle per 97 people, by 2015 the number of bicycles tripled. The program's success led to similar systems worldwide.	(ULI Americas, 2016)
Hangzhou	The Hangzhou Public Bicycle was launched in 2008 as China's first IT-based rental system. By 2015, it had 78,000 bicycles and 3,131 stations. Stations integrate well with public transport, holding over 100 bikes each. In 2011, over 30% of commuters combined bicycle rental into their daily journey.	(ULI Americas, 2016)
Malmö	Malmö offers 10 box bikes across six residential areas for flexible, sustainable transport. Bikes can be booked, picked up, and unlocked via a mobile app. Repairs are handled within two days; rental costs SEK 10 per hour, with a maximum 12-hour booking per day. Malmö plans to expand the box bike pool as part of its sustainable travel goals.	(Allmännytta, 2018)

5.1.4 Nudging

Strategies focusing on **behavioral changes** can provide a holistic approach when seeking to enhance the use of public transport and more specifically nudging can be applied as a strategy (Lehner et al., 2016). Nudging is an approach that can be used to change people's behavior through policy design that encourages a specific choice (Lehner et al., 2016). It is called a type of soft policy that does not limit peoples' options but rather steers them towards one. Nudging is considered less intrusive than "hard" and doesn't require any legal change which makes it a cost effective option (Forward, 2023). There are different types of nudging, norm and moral nudging. The former draws on social pressure to nudge for an option, creating appeal based on what the majority choses. The latter is rather about choosing an option based on the benefits, either for oneself or the group.

Norm nudging has been found to be the most effective type of nudging for active modes and public transportation Steffen (2024). However, in comparison to economic incentives economic incentives have been found to be the most effective out of the two (Gravert & Collentine, 2021; Hauslbauer, 2022). It is further concluded that nudging might not be effective at all, though with some potential if economic incentives are not an option (Steffen, 2024). Still, if nudging is chosen as a strategy to go forward with, there are aspects that can increase the effectiveness of nudging and these aspects have been considered with a varied level in the literature.

Culture, acceptance, ideologies, employment, gender, and possession of a drivers' license have been identified to affect the **susceptibility for nudging** towards sustainable modes of transportation (Steffen, 2024). Positive attitudes towards a transportation mode are also found to be related to higher susceptibility as well as culture and acceptance in the shift to public transportation and active modes. More specifically, women show to have a higher susceptibility for moral nudging, younger for moral arguments and older people are generally less willing and less susceptible for nudging, in this study attitudes were investigated and in Flanders the attitudes for active modes were already positive (Steffen, 2024).

Lieberoth (2018) concludes that “soft” policies such as nudging will not be enough to shift car usage and “hard” policies are still necessary to provide sustainable travel opportunities which highlights the importance of how nudging is implemented into a strategy. Nudging should therefore be combined with other interventions in policy packages to ensure effective implementation (Lieberoth, 2018; Steffen 2024).

5.1.5 AI in Public Transportation

Artificial intelligence (AI) offers transformative potential for public transportation by enhancing efficiency and sustainability. AI can optimize operations through real-time data analysis, adaptive routing and leading to reduced emissions (Nikitas et al., 2020). AI integration improves the passenger experience by providing real-time updates on bus locations, arrival times, and seat availability, increasing trust in public transport systems. It can also address inefficiencies, such as traffic congestion, through adaptive signal controls that prioritize public transit vehicles (Maity et al., 2020). By leveraging advanced analytics, AI-driven systems have the potential to reduce fuel consumption, optimize routes, and encourage greater use of public transportation (Dhanasekaran et al., 2024). Incorporating AI into Järfälla’s public transportation infrastructure could significantly enhance its efficiency, accessibility, and environmental impact.

5.2 Observation study

It was decided to observe Viksjö, both in the morning and afternoon during the rush hours to better understand the traffic dynamics. We assumed that many people commuted to the Stockholm city center daily for work or education, so we were surprised when the morning traffic didn't start by 7:00. However, by around 7:30, morning traffic had begun. Some observations are shown in figure 3.

Figure 3*. Site visit along Viksjöleden (Photo by authors)*

It was noticed that there were a lot of cars and quite many buses towards Jakobsberg which were nearly full. At the same time, the buses in the opposite direction (from Jakobsberg to Viksjö) were almost empty. In the afternoon we observed a similar pattern, that by 15:00 the rush hour had not started. The rush hour started slowly by 16:30. By 15:00 the buses were close to empty in both directions, but around 16:30 the buses from Jakobsberg to Viksjö

started to fill up with people while buses in the opposite direction remained empty. Just as in the morning there were a lot of cars, this pattern aligns with the statement by the traffic planner from Järfälla Municipality that Viksjö is a car dependent area.

The patterns we observed from the study visit highlights an **inefficiency** in the current public transportation system. There is a need to reorganize the buses based on the needs of the residents of Viksjö, in order words more bus capacity towards Jakobsberg in the morning and more capacity the afternoon/evening from Jakbosberg towards Viksjö. The shift might encourage car users to travel with public transportation more often. Additionally, this could create a higher satisfaction level among Viksjö locals who commute to work everyday.

5.3 Survey results

The survey gathered responses from 102 participants, split into 58% car users and 42% public transportation users. The survey results further illustrate the challenges facing public transport in Viksjö:

- **Satisfaction with Public Transport:** On a scale of 1 to 5, the average satisfaction rating was 3.1, indicating moderate dissatisfaction. Key issues highlighted include delays and unreliability as well as unsuitable timetables.
- **Motivations for Car Use:** Car users cited convenience, shorter travel times, and lack of reliable public transport as primary reasons for preferring private vehicles. Seasonal variations were noted, with 34% of respondents using cars more during winter.
- **Public Transport Drawbacks:** Respondents identified long travel times and lack of frequent departures as significant barriers to public transport use. Additionally, 28.8% of car users indicated that shorter distances to public transport stops might persuade them to switch modes.

The survey revealed that public transportation is a significant mode of travel for many respondents, with 67% using it three to five days per week and nearly one-third traveling daily. However, satisfaction with public transport was moderate, averaging 3.1 on a scale of 1 to 5. The most commonly reported issues included delays, unreliability, and schedules that failed to align with commuters' needs. Additionally, over 80% of respondents indicated that their trips lasted between 30 and 90 minutes, often requiring a combination of buses, commuter trains, and subways for shopping, leisure, and commuting. A notable positive aspect was the accessibility of public transport stops, with only 7% of respondents living more than 600 meters away. Nevertheless, 28.8% of car users stated that shorter distances to public transport stops could motivate them to switch to public transit.

Car users, who accounted for 59% of respondents, primarily cited convenience and faster travel times as their reasons for driving, with 49% using their cars daily and 41% driving three to five days weekly. Seasonal factors also played a role, as 34% of car users reported increased reliance on their vehicles during winter due to unfavorable weather conditions. Suggestions for improving public transportation focused on enhancing reliability, increasing the frequency of departures, and reducing costs.

Key comments emphasized dissatisfaction with reduced bus services and itinerary changes, such as:

- *“A direct bus is needed from Viksjö to Barkarby.”*

- *"I would use public transport more if buses had shorter travel times and more frequent departures."*

5.4.1 Gender analysis

The survey revealed that women use cars more than men, with 60% of female respondents relying on cars as their primary mode of transport compared to 45% of males. Public transport usage was similar between genders, with both rating their satisfaction at an average of 3.1 on a 1–5 scale. Both groups cited delays, long travel times, and unreliability as key issues.

Women often used public transport due to a lack of a driver's license or car access, while the largest group of men, 31 %, prioritized cost savings. Commuting, shopping, and leisure were the main reasons for public transport use, with women incorporating walking into their journeys more frequently.

Regarding car usage, 48% of women and 60% of men traveled by car daily, with convenience and travel time being primary motivators for both. Women used cars more for leisure activities, while men primarily commuted to work as seen in figure 4. To switch to public transport, both genders highlighted the need for more frequent departures and shorter travel times, with women also valuing closer stops and men emphasizing reliability. Seasonal variation was more evident among women, with only 51% using cars consistently year-round compared to 70% of men.

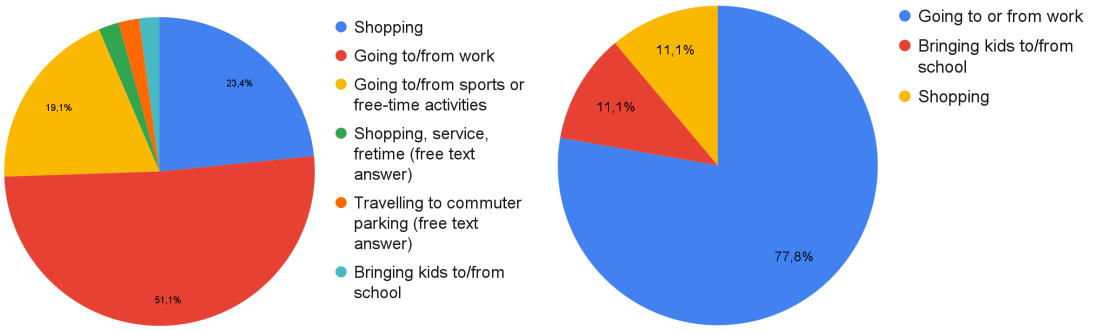

***Figure 4**. Female (left) and Male (right) car users' patterns.*

5.4.2 Car ownership analysis

There were also some differences in public transportation usage depending on **car ownership**. Respondents stating their household did not have access to any car reported travelling by public transportation daily or 3-5 times per week at a 90 percent frequency. Public transportation usage generally became lower as the number of cars in a household increased. 75 percent of respondents stating having one car in their household reported travelling by public transportation daily or 3-5 times weekly. This number was 100 percent for households with two cars. Only one respondent reported having 3 or more cars in their household, travelling by public transport 1-2 times weekly.

Table 2. *Car ownership vs. travel frequency using public transportation (PT).*

Cars owned/ PT frequency	**0**	**1**	**2**	**3+**
Daily	70 %	17 %	37,5 %	0 %
3-5 times weekly	20 %	58 %	62,5 %	0 %
1-2 times weekly	0 %	17 %	0 %	100 %
Less than once weekly	10 %	8 %	0 %	0 %
Sum	**100 %**	**100 %**	**100 %**	**100 %**

5.4.3 Age group analysis

The age group distribution of the respondents highlights that 70 % of survey participants fall within the 31-64 age group. The next most represented group is those aged above 65, accounting for 16% of the respondents. The age group 16-20 were 7% of all the respondents, see figure 5.

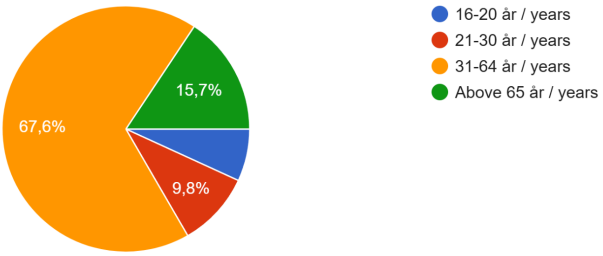

Figure 5. *Respondents based on age group distribution.*

The age group 31-64 state that they mainly use public transportation for daily commuting, work-related activities, or other activities. In contrast, the lower participation of younger respondents (16-20) may reflect a reduction in reliance on public transportation due to alternative transportation means, such as cycling or walking, or limited survey engagement. In terms of satisfaction with public transportation, respondents over 65 may have different expectations or needs, potentially focusing on accessibility and comfort. On the other hand, the large middle-aged demographic (31-64) likely prioritizes reliability and efficiency, which aligns with their potential commuting and work-related needs. The relatively smaller proportions of younger respondents suggest that their feedback might emphasize affordability or availability during school hours. To conclude, which can distinguish different opinions and needs based on the age group, which can depend on several reasons.

5.4.3 Satisfaction based on age group analysis

Looking at satisfaction levels across different age groups, it's clear that public transportation in Viksjö resonates most with older respondents. The **age group 65+** reported the highest satisfaction level, with an average score of 4.10. This suggests that public transport is catering well to their needs, likely focusing on accessibility, comfort, and reliability. Younger respondents, aged 16–20 and 21–30, showed moderate satisfaction levels, with average scores of 3.35 and 3.25, respectively. While their feedback suggests they are generally content, there might be room to address areas like affordability or more suitable services for younger users.

However, the **31–64 age group** stands out as the least satisfied, with an average score of just 2.70. The demands of this group, which are frequently related to work and commuting, point to areas that can be improved in order to make public transportation more suitable for their way of life. Satisfaction by age group is presented in figure 6.

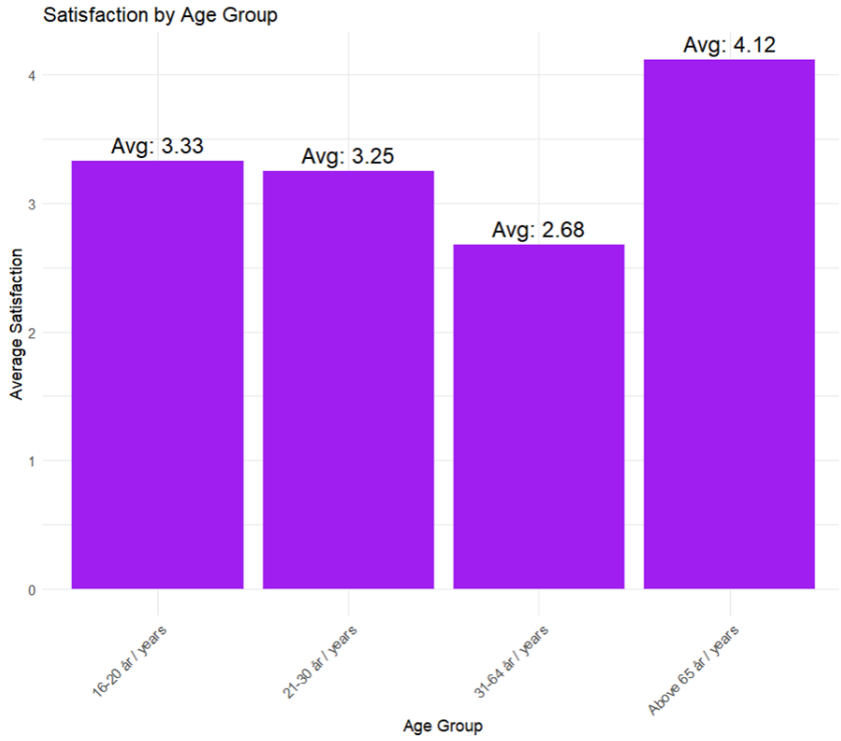

Figure 6. *Public transportation satisfaction by age group.*

The 65+ respondents are clearly happier with the current services, but there's a pressing need to focus on the needs of people between 31-64 years old due to their lower satisfaction. By addressing their concerns, whether it's more reliable schedules or faster commute times, public transport can become a better fit for everyone. Balancing the needs of these diverse groups will ultimately create a system that works well for all age groups hence incentivizes people to incline more to public transportation as opposed to their private cars more. In line with this, the average satisfaction among residents in Viksjö appears also to be lower compared to both Järfälla and the national average, where Järfälla residents rated public transport at 7.75 on a scale of 1–10 in 2023 (Miljöbarometer, 2024b). In comparison, the national level was lower, at 6.69 in the same year. This may be compared with 3,9 and 3,5 respectively, on a scale from 1 to 5. This indicates that although public transport in Viksjö

may not meet the residents' expectations as well as in the whole of Järfälla, there is still an opportunity for improvement to increase overall satisfaction.

6. Discussion

6.1 Connecting to the research objectives

What are the primary challenges to increase the use of sustainable travels in the Viksjö residential area?

The interview with the traffic planner, the study visit, and the survey all provide the same image of the usage of transportation in Viksjö and what the challenges are in increasing the use of public transport. The area is car-dependent, and the satisfaction level of the current transportation system in Viksjö is low among frequent users of public transport. Two reasons for low satisfaction of public transport amongst the residents of Viksjö are the delays and unreliability of the service. This is made more challenging by the fact that the residential area of Viksjö only has traditional buses. Buses can easily become caught in traffic, which could affect the schedule, causing unexpected delays.

This further creates challenges related to converting car users to environmentally friendly modes of transportation and attracting them to other options than the car. The challenge lies in motivating car users to choose another option as cars offer comfort while using public transportation is perceived as difficult and less comfortable than cars regarding time, reliability and service. Moreover, there are also challenges regarding bike use in Viksjö. Bike thefts in Jakobsberg created a reluctance for biking and associates biking with a risk.

What initiatives can Järfälla carry out to promote the usage of environmentally friendly forms of transportation?

As stated above, there are several measures that can promote usage of environmentally friendly forms of transportation in Viksjö. Increasing the number of buses in the most popular direction, such as in the morning from Viksjö to Jakobsberg station could lessen the time which is perceived as a shortcoming in public transport today. Another possibility is to provide a direct bus service from Viksjö to Jakobberg or the other way around depending on the time of the day, potentially shortening travel times.

Another measure that has shown potential to boost public transportation is to relieve the buses from croudedens during peak hours by offering bike pools in strategic areas. The traffic planner and study visit revealed that Viksjö had good bicycle lanes, however it was also evident from the study visit that they were not very used. Offering a bike pool could also eliminate the personal risk of losing your own bike to theft. Offering a user-friendly application is crucial when implementing a bike pool, and Malmö provides a good example. It is crucial that the user can easily pay, report any issues and see the availability of bikes.

Another way to give more attention to public transportation is to use nudging strategies. These can be used to encourage new residents and make them aware of how many people utilize public transportation in the region, as well as the satisfaction rate of those who do. This can create appeal and so steer people to using other options than cars. Lastly, an implementation of electric buses will decrease the carbon dioxide from transportation, which can have positive effects on the environment and human health. It also addresses Järfälla

Municipality's climate goal of promoting sustainable travel and decreasing the climate impact per person.

6.2 Limitations and previous studies

We conducted an observation study as one of our approaches, which has advantages and disadvantages. One of the disadvantages is that we only observe the traffic for a single day, the traffic flow can differ during other days. The number of people who prefer to bike can be influenced by the weather. In general, more people ride bicycles when the temperature rises, according to Stockholm Stad (2022). When we visited Viksjö the weather was quite good but a bit chilly. The fact that we have no data to compare our observations could also be another disadvantage. Furthermore, the observation was done during the winter period which will not be representative of the traffic during warmer periods where the conditions for biking are more pleasant. Lastly, our perceptions of traffic flow can influence how we perceive it. For instance, we were informed that Viksjö is reliant on cars. Which can make us react to situations that are consistent with Viksjö being car-dependent.

The first- and last mile problems seem to have a significant impact on the individuals' choice of transport mode, and bringing the public transportation closer to origins and destinations might increase the travel modes' use. This may be done with on-demand public transportation, where users are also able to select to travel at a time that suits them. Traditionally, these services have been run by minibuses, which can be seen as more cost efficient. However, these still attribute a cost, while existing buses remain unused outside peak hours. Therefore, traditional buses might be used for this, contributing to higher per-trip emissions if not enough passengers fill the vehicle. One solution to this might be electrification of buses, leading to very low greenhouse gas emissions while driving. But, even if emissions are low, other factors must also be considered, mainly the use of scarce minerals mined through questionable practices. However, in terms of administrative effort, implementing on-demand buses is probably more difficult than implementing regular bus lines.

Our findings showing a varying satisfaction levels between different age groups aligns with a previous study also finding a higher satisfaction level among the older age group, further concluding a relation to service related attributes tied to the travel experience (Luo, S. et al., 2023). This was an attribute we did not consider in our study and might indicate that there are varying needs among the age groups that could be further explored to get a better understanding of what can increase the satisfaction levels related to public transport. The complexity to understand satisfaction is further evident through another study showing the variations in satisfaction levels among elderly based on perceived accessibility (Lättman, K., et al., 2019). Gaining a deeper understanding of the needs among the other age groups that showed to be less satisfied could have been beneficial but would have required more time and resources.

Apart from running on-demand point-to-point services, direct buses between Viksjö and Jakobsberg might be an alternative. As a majority of public transportation users are commuting multiple times per week, and to and from Viksjö and Jakobsberg, respectively, during peak traffic. Although, this can be challenging to motivate to Nobina to implement a direct bus since the route is short (3-4 km) and costs money in terms of different administration costs.

One issue that was acknowledged was the risk of bike theft, which may make bike pool, or rental bikes a great option to increase biking. However, it seems that the municipality does not have the authority over such solutions, and instead other actors need to step up. For commercial actors to emerge, there will most likely need to be an economic incentive. If there would have been such, one could argue that such actors would already be established. Therefore, the municipality might need to subsidize such actors, at least in an early adoption stage. On other hand, the risk of bike theft might not disappear. If that´s the case it can be challenging for bike pools to stay over a long period.

To increase the knowledge about transport options, a newsletter distributed to new and existing residents of Viksjö. This can create a more positive experience about public transportation, and hopefully steering people to make the decision of using sustainable travel modes. However, the sender must in some way ensure that it is actually read and not immediately thrown away. As it seems, different groups have different experiences and attitudes towards different modes of transportation. Therefore, the layout, design and contents must be made appealing to different groups, encouraging interactions. Maybe, it could be a bit controversial, so that people start talking about it with their neighbours, colleagues and family, spreading the knowledge "for free". Stated differently, it can be difficult to produce an engaging newsletter that motivates locals to read it and to assess their own travel habits.

Generally speaking, one major issue is the responsibility of the individual actors and people. The municipality and other actors can try to make the usage of environmentally friendly forms of transportation available, easy and at a good price for the residents. Residents, however, get the last word on whether or not it is sufficiently appealing.

It also seems to be up to the bus operator how to schedule buses and routes, and up to the Stockholm region to set the frames. This leaves the municipality's hands tied. However, the bus operator is a commercial actor, which aims to conduct the most efficient service, saving the transport budget from 'unnecessary' costs. There is a need for a greater collaboration between these actors, as what the residents want might not be what is most efficient for the traffic operator.

At last, it can be challenging to increase the use and attractiveness of environmentally friendly forms for transportation. It requires time, effort and money which can be challenging for Järfälla Municipality and other involved actors which is a drawback with our project. If they think our recommendations are good, probably only some of them will likely be used due to financial constraints.

6.3 Recommendations

Based on the results, some specific recommendations have been developed that can be presented for Järfälla Municipality with the purpose to increase the attractiveness of public transportation in the Viksjö residential area. The recommendations in table 3 are based on the results of this paper.

Table 3. *Recommendations to increase the use of public transportation.*

Recomm-endation	Explanation	Actor

Reorganizing bus timetables	Book a meeting with the bus operator Nobina so buses can better match demand during peak hours, and to aim to find alternative solutions during the rest of the day, e.g. on-demand solutions. These solutions may be benefitted by the implementation of AI. During peak hours, non-stop buses from Viksjö to Jakobsbergs station without intermediate stops should be considered, decreasing travel time. Finally, finding measures to increase reliability and limiting delays is a key part to increasing public transportation ridership.	Järfälla Municipality - Hire a *Data Analyst* who will be responsible for analysing passenger flow, peak hour demand and AI based solutions. Nobina - Analyze AI demand and peak hour demand.
Direct bus to Jakobsberg station or Viksjö	The study visit and survey results revealed the same pattern: buses are either full or empty depending on the time of day. According to the survey, one of the reasons why the residents of Viksjö are dissatisfied with public transportation is the long commute time. A direct bus route during the rush hours might be implemented to make public transit more appealing. Viksjö to Jakobsbergs station in the morning, followed by a direct bus from Jakobsbergs station to Viksjö in the afternoon/evening.	Järfälla Municipality - Suggest to Nobina to a trial period with a direct bus. Nobina - Examine the possibilities for a direct bus trial period.
AI Integration	We recommend using AI for dynamic scheduling, real-time traffic monitoring, and predictive analytics. AI can optimize bus frequency, reroute vehicles to avoid congestion, and provide passengers with real-time updates on bus locations and arrival times, enhancing trust and satisfaction among the users.	Järfälla Municipality - Analyze the possibilities for AI scheduling. Hire a Data Analyst or hire a specialized consultant.
Bike Pools	Increasing the use of bikes from Viksjö to Jakobsberg would release some load from the buses. It could also provide a more flexible travel between Viksjö and Jakobsberg dealing with the request of more frequent buses. Concretely, bike pools could be installed in the Viksjö residential areas where buses can't reach and in Jakobsberg centrum, enabling an easy bike commute to Jakobsberg from Viksjö. There could also be a bike pool station in Viksjö centrum to reduce short car trips.This reduces the barrier of acquiring an own bike and removes the personal risk of losing your own bike from theft. This takes advantage of the existing bike network already in place and additionally supports the goal to increase biking in Järfälla.	Järfälla Municipality - Contact a bike pool and suggest them to open up in Viksjö. Private actors - Implement a bike pool in Viksjö. Community facilities - Implementing a bike pool could result in long-term cost savings if parking areas for vehicles are eliminated.
Newsletters to new residents	The recommended strategies could be complemented with nudging strategies, addressing the behavioral changes needed to enhance a successful implementation of the other strategies. New residents can be persuaded using the norm nudging concept and be made aware of how many uses the public transport in the area and the satisfaction rate of public transport users. It could contain information about the options available, statistics regarding positive experiences with public transportation in Viksjö and comparing costs of different modes.This could be sent out in a newsletter to people moving to a new address in Viksjö.	Järfälla Municipality - Utilize the department of communication to produce a newsletter. Try this project for a year and then evaluate the results.
Lower climate impact	We suggest that Järfälla employ electrification as a fuel for their buses in order to work towards their environmental goals regarding a lower climate effect per person. People who live in Viksjö benefit from electric buses since they are quieter and contribute to reducing air pollution compared to other alternative fuels. However, we advise them to demand social sustainability against Nobina in order to guarantee a sustainable battery production.	Järfälla Municipality - Hire a specialized person within electrification and evaluate the possibilities to switch fuels in buses.

		Nobina - Evaluate the possibilities to use a fuel with a lower climate impact.

7. Conclusion

In conclusion, exploring the challenges and possible solutions for a more attractive and sustainable mode of transportation in Vikjsö has been an interesting project. The study visit, interview, and survey have given us a clear understanding of the challenges. We have learned that Viksjö is car dependent, although the area has a good distribution of public transportation. There are buses that are going frequently to and from Viksjö, although during the rush hours the buses are full in one direction and almost empty in the other direction. The survey showed an average satisfaction level at 3.1 out of 5, although people between 31-64 are at least satisfied with public transportation. They are unsatisfied with long travel times, delays and unreliability.

With the guidance from our survey and literature review, we were able to develop concrete recommendations for different stakeholders in Viksjö with the purpose to increase the attractiveness of different sustainable modes of transportation. We have suggested recommendations in relation to more effective public transportation, behavioral changes and a lower climate impact from public transportation. To give some examples we suggested a direct bus in the rush hours to/from Viksjö to the commuter station. Furthermore, we suggested a newsletter to new residents in order to attract more people to use public transportation. Although it is theoretically possible to install a direct bus that would slightly increase the journey time, the lengthy transit times after reaching Jakobsberg can be difficult to resolve. The commuter trains are most time consuming and make it difficult to influence in the near term.

For future studies it would have been interesting to interview residents in Viksjö, in order to get a broader understanding of their point of view. To have a more comprehensive understanding of the different types of recommendations that can be implemented regarding bus traffic, it would likely be beneficial to interview Nobina.

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Appendix

Appendix 1: Survey questions

Questions:

Section A: General

1. What is your primary mode of transportation?
    a. Car (Redirects to section C after completing section A)
    b. Public transportation (Redirects to section B after completing section A)
2. How old are you?
    a. 16-20 years
    b. 21-30 years
    c. 31-64 years
    d. Over 65 years
3. What is your gender identity?
    a. Male
    b. Female
    c. Other
    d. Wish not to declare
4. How many cars are there in your household?
    a. None
    b. 1
    c. 2
    d. 3 or more

Section B: Public transportation users

5. How many days per week do you travel by public transportation?
    a. Daily
    b. 3-5 times per week
    c. 1-2 times per week
    d. Less than once per week
6. How satisfied are you with public transportation in Viksjö?
    1 - 2 - 3 - 4 - 5 (5 = Very satisfied, 1 = Very dissatisfied)
7. What are the biggest weaknesses of public transportation, in your opinion? Choose up to 3 options.
    a. Schedules do not fit my needs
    b. Too expensive
    c. Too long travel times
    d. Stops are too far away
    e. Too crowded
    f. Not clean
    g. Cannot bring large or heavy items (e.g. a bike)
    h. Unsafe
    i. Delays and unreliability
    j. Other suggestion (in free-text)
8. What is your primary reason for choosing public transportation over other modes of transportation?
    a. Shorter travel time
    b. Lower cost
    c. Comfort
    d. Convenience
    e. Compatible timetables
    f. Environmental reasons
    g. Do not have access to a car
    h. Do not have a driver’s licence

    i. Lacking parking options
    j. Other suggestion (in free-text)
9. What are your primary aims when using public transportation? Choose up to 3 options.
    a. Commute to work
    b. Commute to school
    c. Bringing kids to freetime activities
    d. Bringing kids to school or preschool
    e. Going to freetime activities
    f. Shopping
    g. Services
    h. Other suggestion (in free-text)
10. What modes of transportation are typically combined in your journeys? Mark all applicable choices.
    a. Bus
    b. Commuter train
    c. Subway
    d. Tram
    e. Cat
    f. Walking
    g. Bicycle
    h. Electric scooter
    i. Other suggestion (in free-text)
11. How long is your average journey using public transportation?
    a. 0 - 15 minutes
    b. 16 - 30 minutes
    c. 31 - 60 minutes
    d. 61 - 90 minutes
    e. Over 90 minutes
12. How close is the closest public transportation station to your home?
    a. 0 - 150 meters
    b. 151 - 300 meters
    c. 301 - 600 meters
    d. Over 600 meters
13. Anything else that you wish to add? (Optional)
    - Free text box

<u>Section C: Car users</u>

14. How many days per week do you travel by car?
    a. Daily
    b. 3 - 5 times per week
    c. 1 - 2 times per week
    d. Less than once per week
15. What is your primary reason for choosing to travel by car over other modes of transportation?
    a. Travel time
    b. Cost
    c. Comfort
    d. Convenience
    e. Environmental reasons
    f. No public transportation where I want to go
    g. Heavy or large amounts of cargo
    h. Other suggestion (in free-text)
16. What is your primary aim when travelling by car?
    a. Commute to work
    b. Commute to school
    c. Bringing kids to freetime activities

    d. Bringing kids to school or preschool
    e. Going to freetime activities
    f. Shopping
    g. Services
    h. Other suggestion (in free-text)
17. What could convince you to choose public transportation for your next journey? Choose the three options most important to you.
    a. More frequent departures
    b. Schedule that fits my needs better
    c. Stations closer to home and destination
    d. Integration with other services (e.g. bike sharing)
    e. Shorter travel times
    f. More reliable
    g. Cheaper
    h. Less crowded
    i. Cleaner
    j. Safer
    k. Other suggestion (in free-text)
18. Do you use your car more depending on the season?
    a. I use my car equally, regardless of the season
    b. I use my car more during warmer seasons
    c. I use my car more during colder seasons
    d. Don’t know
19. What type of car(s) does your household primarily use? Choose all applicable options.
    a. Owned car
    b. Leased car
    c. Company car
    d. Car-sharing services
    e. Rental car
    f. Don’t know
20. Anything else that you wish to add? (Optional)
    - Free text box

Appendix 2: Interview guide for interview with Johanna Roos 20241025

- How is the municipality working with public transportation?
- To what extent is the municipality able to affect/change the PT?
- Have you identified any specific areas with challenges regarding efficiency in PT?
    - What are the specific challenges in this area(s)?
- Do you have any good examples of PT use in Järfälla?
    - What makes it a good example?
- What efforts have you as a municipality made to enhance efficiency in PT?
    - What has worked and what hasn't?
- How have you worked with strategic measures in order to increase the use of PT?
    - What long-term plans and strategies do you have?
    - What challenges have you faced in implementing certain measures (policy challenges? Finance challenges?)
    - How can we access these strategies? Any more documents that could be of relevance for us?
- Can you tell us about the self-driving buses in Barkarbystaden? What was learned?
- Has there been a ”resvaneundersökning” done recently? What were the results?