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Accessibility, how it is understood by planners and experienced by citizens

Planners' and citizens' perceptions of how Demand Responsive Transport can increase accessibility in suburban areas.

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Albin Reinhardt

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Abstract

Accessibility is a well-established concept that appears frequently in urban planning. It refers to the ability of citizens to actively participate in society. Nevertheless, inaccessibility is experienced in many places, which can lead to exclusion of citizens. Against this background, this master's thesis aims to center on the concept of accessibility and examine it from two perspectives - strategic urban planners and individuals. The thesis examines how accessibility is interpreted by strategic urban planners in the two suburban municipalities of Botkyrka and Huddinge and how it is experienced by a group of "low-skilled" workers in an area where there are identified shortcomings in traffic planning. The thesis studies how this group experiences their accessibility in their daily commute before and after they test a Demand-Responsive Transport (DRT) service. The theoretical framework consists of the concepts of accessibility strategies, transport and accessibility, objective accessibility, perceived accessibility, accessibility barriers and social exclusion, which are used to analyze the two different perspectives. The results show that strategic planners view accessibility as the relationship between citizens and destination points, and that inaccessible places are mainly associated with rural or sparsely populated areas. At the same time, the thesis shows that the workers experience inaccessibility in their daily trips, despite living in surrounding municipalities. The results also show the identified potentials and risks of DRT in suburban environments from the perspective of both strategic planners and individuals. The results show that DRT reduced travel times for the workers. Furthermore, perspectives such as reliability, safety and equity are highlighted as important aspects in the design of DRT services.

Keywords: Accessibility, Demand-Responsive Transport, Low-skilled workers, Strategic urban planning, Suburban

1 Introduction

For decades, the focus in the transport sector has mainly been centered on the efficiency and performance of the transport system rather than the people who aim to use transport services (Martens, 2016). Although the established conceptualization of sustainable development has been identified as resting on three pillars (UN, 2015), a large body of previous research shows that this is not the case in transport planning. Rather, previous literature shows that the social dimension has received less attention than, for example, environmental and economic sustainability (Eriksson et al., 2021; Berg et al., 2022; Levin & Gil Solá, 2021). The social perspective, often centered on equity aspects, has thus been noticeably absent from contemporary planning policies aimed at contributing to the transformation of the transport system (Eriksson et al., 2021).

Within the context of Swedish planning practice, accessibility is a key concept that relates to the principle of equal opportunities and participation in society (Swedish Planning and Building Act [PBL], 2010; Boverket, 2021). This means that planning should enable all municipal residents to use the common social environment in an equal way. Thus, accessibility relate strongly to social perspectives such as justice and equality. This is nothing new, there is longstanding literature describing the relationship between accessibility and equity. See for example David Harvey who conceptualized this through the notion of 'spatial justice' in his famous book *Social Justice and the City* from 1973, nearly half a century ago (Harvey, 2010). The concept of accessibility is also central to the body of literature that, related to equity, also points to the reverse consequence of accessibility i.e., inaccessibility, which has instead contributed to phenomena such as social exclusion, inequality, and segregation (Manzi et al., 2010; Lucas, 2012; Henriksson, 2019). Public transport plays a central role in the functioning and development of society. It allows people to bridge

geographical distances and enables them to reach important everyday destinations (Golub and Martens, 2014). It also reflects inequalities, contributes to tensions in terms of how groups are advantaged and disadvantaged, and highlights power relations in society (Henriksson and Lindkvist, 2020).

The Swedish legislation on public transport (2010:1065) emphasizes that public transport should be accessible to all groups of passengers. Nevertheless, literature shows that inadequate public transport is a real problem, which can generally be attributed to more rural areas (Schasché et al., 2022; Dytckov et al., 2022). Studies show that rural residents rely to a low degree on public transport in favor of the car (Ridderstedt & Pyddoke, 2017). In parallel, recent travel surveys by the Stockholm Region (2015, 2019) show that the further away from the regional center people live, the more they drive and the less they use public transport. But what is the alternative for people who are unable or unwilling to rely on anything other than public transport? Groups of people who face transport-related challenges, because for example they cannot afford their own car or lack a driving license, or because of age or physical or mental disabilities. Furthermore, how does this affect suburban municipal planning in the work on accessibility and equality? This is a pressing issue, especially in areas that can be described as socially and spatially isolated.

Demand responsive transport (DRT) is a concept that, according to previous research, holds the potential in meeting the needs of people suffering from limited accessibility (Schlüter et al., 2021, Dytckov et al., 2022). DRT is the term for a more dynamic form of public transport solutions that, in contrast to traditional services with fixed routes and schedules, are instead adapted to passengers' needs (Berg, 2017; Dytckov et al., 2022). Historically, DRT has mainly been used to improve accessibility for groups with special needs and limitations, such as the elderly or disabled (Schlüter et al., 2021). However, in terms of accessibility, the potential of this type of service goes beyond that as it can target specific groups as well as the wider population (Dytckov et al., 2022). At the same time, this type of solution has mainly been adapted to rural areas, where the need has been considered to be greatest. There is limited literature on how DRT can be adapted in areas closer to urban centers. However, there is research suggesting that such a solution holds potential and that the attributes of DRT services can work well in suburban contexts with connections to urban city centers (Schlüter et al., 2021). Furthermore, the previous literature is also scarce on how DRT could affect work commuting, especially for groups of people who are limited in their accessibility due to social or contextual factors.

This master’s thesis is done in relation to the research conducted within the Mistra SAMS research program, which is co-led by The Swedish National Road and Transport Research Institute (VTI) and the Royal Institute of Technology (KTH). The Mistra SAMS research program aims to initiate transformation processes for sustainable and equitable accessibility and mobility in collaboration with citizens, market actors, and public stakeholders. Within Mistra SAMS, a Living Lab is set up that tests different solutions for different groups of citizens. One part of the living lab aims to explore how it is possible to change and improve everyday travel for workers in the health care, education, and service sectors. This is explored by providing a DRT service in a specific area located in Botkyrka in the southern part of Stockholm County. This provided the author of this thesis with the opportunity to study the Mistra SAMS Living Lab, as the DRT service constitutes a good example to explore the concept of accessibility from different perspectives and new mobility services. The area where the Living Lab is carried out, i.e., the service is being tested, has been selected by Mistra SAMS researchers because of its shortcomings in traffic planning and public transport

frequency. These shortcomings have proven to affect the general mobility of people in the area, contributing to car dependency for those who have access to a car and problems for those who commute and is reliant on public transport. Furthermore, it has consequences for employers' recruitment of staff. The context of the research program will be explained in more detail in the background chapter.

This thesis centers on the concept of accessibility, which will be examined from two perspectives, the individuals, and the urban planner's perspective. It examines the individual perspective through a specific case of demand responsive public transport, as described above, and how it can have value for people's accessibility and for everyday life. The focus will be on work-related journeys involving groups of people who have jobs where physical presence is required but where municipal structures (e.g., lack of public transport or pedestrian and cycle paths) contribute to either low accessibility or car dependency. From the urban planners perspective, accessibility will be studied based on how it is interpreted, and taken into account, in planning in two suburban municipalities in Stockholm County. Suburban is defined in this thesis as an area on the periphery of the regional city center, but within the metropolitan region. The municipalities that will be studied are Botkyrka (where the DRT service are tested) and the neighboring municipality of Huddinge, both of which have identified areas where accessibility needs to be strengthened. The choice to examine the two perspectives of planners and individuals is seen as valuable for exploring whether there are discrepancies between how individuals experience accessibility in comparison with planners' interpretations.

1.1 Aim and research questions

The aim of this study is to explore accessibility as a concept from the perspectives of individuals, and from the urban planners perspective. The study will examine the concept of accessibility in a suburban context and provide examples of how strategic urban planners and municipal officials in the two municipalities of Botkyrka and Huddinge perceive and consider accessibility when planning. From an individual perspective, the study will examine whether and how DRT has the potential to increase accessibility for a group of individuals who commute to work in an area with low accessibility. The research questions that the thesis aims to answer are:

- How do urban planners in Botkyrka and Huddinge interpret the concept of accessibility in urban planning? How do they understand the role of DRT in enhancing accessibility?
- How is accessibility perceived by a group of low-skilled workers employed in an area with low public transport accessibility? In what ways can DRT improve accessibility for this group?
- How do perceptions of accessibility and the potential of DRT differ between strategic planners and individuals?"

1.2 Thesis outline

This thesis is structured as follows: **Chapter 1** has contained an introduction to the master's thesis, its purpose and research questions, as well as the main focus. **Chapter 2** gives an overview of the previous research that has been important for this study. The chapter describes the emergence and dilemmas of transport planning, the concept of Demand Responsive Transport, and transport disadvantage. **Chapter 3** describes the background to the study, its geographical context and the research context. In **Chapter 4** I present my theoretical

framework. The theoretical framework contains five theoretical concepts that revolve around accessibility and transport-related social exclusion that I use to analyze the findings of the study. **Chapter 5** is where I will describe how the study was conducted. In this chapter I present my methodological choices and give a detailed account of the study's design, chosen method and analytical approach. In **Chapter 6**, I present my results and analyze them throughout with the use of the theoretical framework. In the results and analysis, I first present the planning perspective, followed by my findings from the interviews with the workers (the individual perspective). After that, in **Chapter 7**, I discuss the results from the two studied perspectives in a joint discussion. Finally, in **Chapter 8**, which is the last chapter of the thesis, I present the conclusions of the master's thesis in relation to the study's research questions. The chapter is concluded with recommendations for further research.

2 Previous research

In this chapter I will outline previous research relevant to this thesis. It will cover a literature review of traditional transportation planning in relation to accessibility, the concept of DRT, and transport disadvantage. The previous literature aims to provide relevance to the thesis, and the concepts presented will be relevant to the research context.

2.1 Conflicting interests in transport planning

The car has historically had a dominant position in transport planning, especially in Sweden (Gil Solá, 2020). Through transport planning, society has for a long time been adapted to the car (Walker, 2012), which has been portrayed as a 'solution' to problems of accessibility and individual mobility (Berglund-Snodgrass, 2022). As urban areas have grown, the car has become a symbol of freedom and accessibility. This has consequently shaped society, its spatial structures, and people's way of life (Berglund-Snodgrass, 2022). This has also shaped today's ideals of transport planning, which have emerged as a response to the ever-increasing car use and its consequences (Martens, 2016). As urbanization continues to expand, the presence of the car in urban areas has contributed to accessibility problems and increased the importance of public transport (Walker, 2012). Public transport has thus come to be seen as an effective solution in traditional transport planning to meet the accessibility needs of large numbers of people in limited spaces (Walker, 2012). Previous research shows that traditional transportation planning was developed as a response to congestion problems in the 1950s and has since had the goal of creating the best possible traffic flows (Martens, 2016). However, the traffic system is highly constrained by resources, requiring priorities and trade-offs (Walker, 2012). Just as it is not spatially possible to design a transport infrastructure that generates equal accessibility across a region (Allen and Farber, 2020), it would only be possible to create a free flow of traffic in a utopian world that is not constrained by resources (Martens, 2016). Instead, another approach that can be found in the literature is Black's definition, where he states that the goal of traffic planning is to "search for the best solutions given the resources available" (Black, 2018, p.21). But what constitutes the “best solution” in traffic planning, for what purpose, and for whom? That is a question that, according to the literature, is still being contested. All regions offering a transit system contain areas where the travel demand is high and where it is lower (Walker, 2012). In most cases, authorities have clear missions, but they may also have to balance conflicting interests and meet contradictory objectives (Ibid). According to previous research, traffic planning faces such a dilemma.

The Swedish legislation on public transport (2010:1065) emphasizes that public transport should be accessible to all groups of passengers. However, as previously discussed, research shows that traffic planning is largely based on the issue of efficiency, where the focus has historically been on the performance of the transport system rather than the people who aim to use these services (Allen and Farber, 2020; Martens, 2016). This has been reflected in transport planning through policies that have sought greater efficiency, increased mobility, and reduced emissions and climate impact (Allen and Farber, 2020). This has become well established in research as a large body of literature within the field of transport planning shows that social aspects have received less attention than environmental and economic perspectives (Eriksson et al., 2021; Berg et al., 2022; Levin & Gil Solá, 2022). Transport planning is thus characterized by two contradictory objectives, which Walker (2012, p. 118) describes as the "Coverage goal" and the "Ridership goal". There are multiple tensions of planning addressed in the literature, for me, the coverage goal and the ridership goal as described by Walker (2012) is the most relevant.

These objectives constitute two complementary but also opposing interests in transport planning (Walker, 2012). The coverage goal is described as the authority's responsibility to offer equal services to all citizens, regardless of where they live in the region. The ridership goal refers instead to concentrating infrastructure to where there is great need in order to "Maximize ridership with our fixed budget" (Walker, 2012, p. 118). The two goals thus stem from two different approaches. The coverage goal emphasizes aspects of equity. This is based on two main arguments. Firstly, regarding how tax money is distributed geographically in relation to service provided and infrastructure investments. Secondly, consideration of social aspects such as equal access for people who are dependent on public transport. The ridership goal is instead based on getting as many people as possible to use public transport. It is based on the principle that infrastructure is built to create incentives to use public transport and thus compete with the car. This goal is justified in terms of environmental sustainability, but it also pursues economic efficiency as it aims to optimize the number of passengers to the service's set budget (Walker, 2012). Martens (2016) argues that an approach such as the ridership goal is a response to a growing awareness of the carbon footprint of the transport sector. The concentration of transport infrastructure close to homes provides an incentive to choose public transport over cars (Martens, 2016; Walker, 2012). Both Martens (2016) and Walker (2012) argue that the ridership goal is centered on the aim of taking market share from the car. This approach has been criticized from several perspectives. It has been criticized because this planning method, which advocates a modal shift, paradoxically focuses on the car and its users, the motorists, which has implications from a justice perspective (Martens, 2016, p. 18). Similarly, Hine and Mitchell (2003) point to the paradox that this approach contributes to a restructuring of public transport from poorer areas to new employment areas targeting residents considered to have skills to contribute to the economy. Thus, accessibility increases in areas where car ownership is already high and gives legitimacy to modal shift arguments in contrast to the more disadvantaged areas where car ownership is low (Hine and Mitchell, 2003). The coverage goal is instead an approach that Martens (2016) argues focuses on all people and their accessibility to different destinations. It can be understood by Martens (2016) that a key aspect of planning for accessibility in transport planning is to recognize, identify and address different levels of accessibility. For example, Martens (2016) argues that such an approach can grow as a response to unequal conditions that can be conceptualized by the social exclusion of vulnerable groups. Successful examples of this have been when local authorities evaluate the accessibility of important societal functions and take action in areas where accessibility is lacking. It may also involve clear definitions of accessibility, thus setting a standard for maximum distances or travel times (Martens, 2016).

2.2 Transport disadvantage

Transport disadvantage is a concept emerging in previous literature, which relates to the difficulties that individuals and/or communities face in accessing affordable and efficient transportation options (Currie et al., 2007; Lucas, 2012). Transportation is fundamental to equity in society, as today's societal norms mean individuals are expected to be highly mobile to reach important everyday destination points (Henriksson and Lindkvist, 2020). Accessible transportation can mean opportunities for jobs, school and social gatherings or well-being. Similarly, inaccessible transport can mean a lack of opportunities to participate in these basic activities of society (Golub and Martens, 2014). Transport disadvantage is a widely discussed area in the previous literature. In its essence, it can be understood as "the absence of adequate transportation services" (Lucas, 2012, p.106). It arises, for example, from insufficient public transport services, or not having personal access to a car (Allen and Farber, 2020). Previous literature suggests that there are links between transport disadvantage and other forms of social deprivation which consequently results in social exclusion, often referred to as transport

poverty (Lucas, 2012; Allen and Farber, 2020). Social exclusion is a concept that "reflects the existence of barriers which make it difficult or impossible for people to participate fully in society" (Hine, 2007, p.41). As such, inequality is often manifested in physical structures within the urban context, usually through differences in the distribution of access to basic services (Dempsey et al., 2011; Golub and Martens, 2014). Previous literature suggests that this contributes to more tangible inequalities between different social groups. For example, Lucas et al. (2016) show that personal finances determine where individuals are able to settle. Often low-income people are forced to settle in peripheral areas where opportunities for employment and basic services are limited. When this coincides with insufficient access to transportation, it limits their access to essentially basic activities such as work, study, social interaction, and urban amenities (Lucas, et al., 2016).

The availability and quality of transport is determined by demographic and socio-economic aspects, employment and unemployment levels, as well as the location and form of housing (Hine & Mitchell, 2003). The groups that are most socially and financially vulnerable in a society are the ones who experience transportation disadvantage, i.e., they have the least transportation options available and are the least mobile (Lucas et al., 2016). The performance of everyday tasks is hampered by not having access to adequate transportation facilities (Henriksson, 2019). Transportation is crucial for employment and education (Lucas, 2012; Hine, 2007). At the same time, research on transport-related social exclusion in Sweden is scarce, not least regarding citizens' experiences of transport poverty (Henriksson, 2019). This thesis should be seen as a contribution to this research area where transport disadvantage is further explored, in particular focusing on experiences in a Swedish context.

2.3 Demand Responsive Transport

Demand-responsive transport (DRT) is a concept for public transport solutions that, unlike regular public transport, are not always based on a fixed timetable but are instead driven by the needs of passengers. (Berg 2017; Kaufman et al., 2021). Thus, it is a more flexible mode of public transport where the service is booked and adapted to the traveler, instead of relying on the public transport timetable (Dytckov et al, 2022). There is no distinct and unambiguous definition of the concept because a DRT service can have varying designs (Schasché et al., 2022). A DRT service can be organized differently in terms of flexibility related to the timetable, routing, geographical coverage area, as well as boarding locations (Berg, 2017; Dytckov et al., 2022). What may characterize DRT is that the service usually needs to be ordered in advance as it adapts to the needs of travelers rather than a timetable. Thus, such a service has dynamic attributes similar to the service traditionally offered by taxi companies. However, there are apparent differences between DRT and, for example, traditional taxi services in that fares are fixed, and passengers cannot book trips exclusively (Schasché et al., 2022).

Previous research shows that the concept of DRT holds potential from several perspectives of sustainability. There are studies showing the environmental benefits of DRT compared to private car use, as well as the potential to reduce carbon emissions compared to e.g., regular bus services in rural areas (Dytckov et al., 2022). DRT services as a dynamic form of public transport with flexible characteristics make it possible to limit idling at times and places of low demand and optimize vehicle routing to reduce time and distance (Dytckov et al., 2022). DRT also has potential from social perspectives. The concept has been developed as a way to meet the needs of citizens who suffer from low accessibility (Kaufman et al., 2021), and historically this type of service has been targeted mainly at sub-populations to meet the needs of those who are hindered, either by age or disability (Schlüter et al., 2021). Technological

developments have led to the optimization of DRT services, contributing to higher functionality. Thus, this type of service has started to be re-evaluated in its potential to be targeted to the general public as a natural alternative for public transport solutions (Dytckov et al., 2022). Yet, despite the suggested potential of the DRT concept, previous studies have mainly focused on fully urban or distinctly rural settings (Schlüter et al, 2021). The concept of DRT in suburban settings has been largely unexplored in previous research (Thao et al., 2023). However, recent research indicates that DRT has begun to be explored to promote equity in suburban and rural settings where public transport provision is poor (Kaufman et al., 2021). The flexible attributes of the service are considered to contribute to its wider potential, allowing it to have increased coverage and ridership and promote social inclusion. (Thao et al., 2023, p.142). At the same time, DRT has the potential to be a cost-effective option for meeting needs in low-demand environments (Thao et al., 2023). There is research suggesting that DRT has the potential to serve as a complement to public transport where the population and/or ridership base is insufficient to deploy high frequency public transport solutions (Schlüter et al., 2021; Thao et al., 2021).

This study draws on the knowledge provided by the previous literature, attempting to fill knowledge gaps where the literature is scarce or incomplete. As previously mentioned, DRT services have mainly been implemented towards groups that suffer from low accessibility due to physical, age or mental limitations. At the same time, it has been established that there is potential for the concept to work with a wider audience. Relatively few studies have been made on whether DRT could work for work travel, and for groups that are limited in their accessibility in their daily commute. However, a recently published work by Calvert et al. (2022) examines perceived accessibility for job seekers in Bristol, England. The study examines how employer-subsidized DRT services could affect accessibility for job seekers. They found that this type of service would have the greatest potential in remote locations, where the connection between home and work is affected by a lack of public transport, and car use is low (Calvert et al., 2022).

3 Case background and context

This chapter aims to provide a context for the study and a deeper understanding of the geographical setting. First, I will present the geographical context and reason about the delimitations made. After that, I will describe the research context of the thesis, where I will present the research program Mistra SAMS, and more deeply the project that I am writing my master's thesis in relation to. During my last academic year, I have had the benefit to participate in Mistra SAMS research, which has given me the opportunity to formulate my master's thesis in relation to their research. It is important to emphasize that this study is designed and conducted independently by me as a student within the scope of my master's thesis.

3.1 Geographical context

The geographical context of my thesis is limited to the southern part of Stockholm County, namely the two adjacent municipalities Botkyrka and Huddinge.

Both Botkyrka and Huddinge are located in a suburban environment, as part of the county and the Greater Stockholm region but located outside the regional center. Thus, the two municipalities are located so that they are covered by the regional infrastructure and public transport, with connections to commuter trains and bus lines. Region Stockholm classifies Huddinge as an 'inner suburban municipality' while Botkyrka is classified as an 'outer suburban municipality' (Region Stockholm, 2019). Both municipalities are thus classified as suburban municipalities. Travel surveys conducted by Region Stockholm in recent years (2015, 2019) show a clear trend, namely that the propensity to use public transport is strongest towards the regional center, while the further away from the inner city one gets, the greater the proportion of people use motorized vehicles, i.e., the car. In other words, the further out from the regional center one lives, the lower the tendency to use public transport in favor of the car. At the same time, both municipalities have areas within each municipality where spatial connections need to be strengthened. This is reflected in their main governing planning documents. In Botkyrka, this is expressed in the municipality's traffic strategy (2021), which recognizes that the car has been given priority in planning over the past half century. This has contributed to shortcomings in the built environment that have affected the possibilities for more sustainable modes of transport, such as walking, cycling and public transport. Botkyrka recognizes challenges in connecting new and existing developments and acknowledges that there are barriers that affect the mobility of residents, making it difficult to move within and between municipalities (Botkyrka municipality, 2021). In Huddinge, similar challenges are expressed. Not least in the current adoption document for the municipality's revised comprehensive plan (Huddinge municipality, 2023). In the revised comprehensive plan (2023), the municipality points to a strategic development direction for 2050 that reveals the need to strengthen social and spatial connections in the municipality. It shows that routes for public transport and cycling need to be strengthened between many of the municipality's different areas, as well as links to adjacent municipalities. One of which is the link between Huddinge and Botkyrka, on the section between Flemingsberg and Tullinge (Huddinge municipality, 2023). A background report prepared for the revision of the new comprehensive plan shows that areas with weak spatial connections coincide with several areas with low socio-economic status within the municipality (Spacescape, 2021). Thus, there is an explicit need in both municipalities to strengthen the connections and accessibility between different places within and between the municipality's borders and areas. This thesis, which aims to investigate initiatives for improved accessibility, thus has social relevance for these municipalities. As the municipalities are adjacent to each other and face similar challenges in

relation to accessibility, they are also from several aspects comparable. At the same time, the involvement in the Mistra SAMS project makes information accessible, as it takes place in Botkyrka, one of the two municipalities studied. In summary, this contributes to a strong justification of the geographical delimitation of the study.

3.2 Research context

This section will first provide a background to Mistra SAMS, and the research conducted within the program. Then it will provide a deeper background to the specific case in relation to the geographical context.

3.2.1 Mistra SAMS research program

As previously mentioned, my master's thesis is written in relation to the research carried out in the research program Mistra SAMS, which is led by the Royal Institute of Technology (KTH) and the Swedish National Road and Transport Research Institute (VTI). Mistra, the Swedish Foundation for Strategic Environmental Research, is the financier of the program (Mistra SAMS, 2022a). SAMS is an acronym for Sustainable Accessibility and Mobility Services. The Mistra SAMS research program aims to initiate transformation processes for sustainable and equitable accessibility and mobility in collaboration with citizens, market actors and public stakeholders. The core vision of the Mistra SAMS research program is that technology development and the implementation of other actions for sustainable mobility and accessibility should be carried out in a way that contributes to achieving Sweden's climate goals by 2030 (Mistra SAMS, 2022a). In addition to the ambition to contribute to a climate-neutral transport system, there is also a strong emphasis on social justice. The program has an urban focus, targeting services that have a disruptive capacity to foster the transition towards sustainable development in both urban and suburban areas within the Stockholm region (Mistra SAMS, 2022a). Its empirical work uses Greater Stockholm and in particular the municipality of Botkyrka as the geographical focus of the data collection (Mistra, n.d.; Mistra SAMS, 2021a) The research explores how new services can be utilized in a context to change behavior and contribute to sustainable development, and what role different actors, public and private, have in such a context. This means that the research is aimed at exploring how different actors can contribute to society's transition and how accessibility can be created through new innovations and mobility services (Mistra SAMS, 2022a).

The program is based on a Living Lab approach in its research (Mistra SAMS, 2021a). The Living Labs is viewed as a form of "experimental governance" in its methodological approach (Mistra SAMS, 2021a, p.6). Within the research program, several sub-projects to achieve transformation processes have been tested. For example, in the first phase of the research program, research was conducted on how a local job hub, which was set up during the years 2019-2022, could reduce work travel (Mistra n.d.; Mistra SAMS, 2021b). In another ongoing Living Lab, initiated during the second phase of the program, a smart bicycle hub was established. This project involves 14 households in the Riksten area in Botkyrka municipality to explore how everyday needs could be met without using the car (Mistra SAMS, 2022b). A third Living Lab, now being initiated, is a project exploring how a DRT solution can affect existing work-related travel. This is the project addressed in this master thesis.

3.2.2 Living Lab: Enhanced Public Transport

In this section, I will provide a deeper explanation of Mistra SAMS Living Lab "Enhanced Public Transport". As mentioned above, several sub-projects within Mistra SAMS have been carried out to investigate how to disrupt travel patterns and promote an environmentally and

socially sustainable transition within the transport sector. The current Living Lab initiated in the first half of 2023 is an attempt to improve accessibility for essential work travel through an enhanced form of public transport using a DRT service. The site where the Living Lab is implemented is an area where problems in traffic planning have been identified, both by the Botkyrka municipality itself and by the residents who live and work in the area. The problem in the area is based on a lack of public transport frequency, as well as cycling and walking connections. Traffic planning has thus prioritized car access within the area, similar to what Botkyrka in its traffic strategy (2021) has described as a historically problematic approach to planning. This has consequently contributed to difficulties in relying on sustainable modes of transport and instead citizens operating in the area have developed a strong dependence on cars.

The background of the research project is based on previous research carried out within the Mistra SAMS program. Earlier interviews with workers in the area have shown that travel encroaches on leisure time as well as family life, which consequently affects the general well-being of the people. The poor connections in the area are the result of a combination of several factors, such as a mismatch between the different public transport modes, poor bus frequency, and unconnected walking and cycling routes. This affects work-related travel, not least for those who work inconvenient hours and in professions where physical presence is required, such as health care, schools, grocery stores, etc. Workers in the area testify to how long travel and waiting times affect commuting and have consequences for their daily lives. At the same time, a workshop was conducted with employers in the area before the DRT service was tested. The results of the workshop gave a reinforced picture of the problem and the employers state that the traffic situation affects staff recruitment and makes staff scheduling difficult. The workshop will be described in more detail in the next section, together with the design of the service.

3.2.3 Living Lab – Workshop and DRT design

The workshop was done as part of the Mistra SAMS Living Lab prior to the implementation of the DRT service, in which I was involved. It has been important for the design of the DRT service and thus relevant to describe for this study. However, it is not part of the empirical data for this master's thesis and is therefore described here in the background chapter.

The workshop was organized with employers from the area in Botkyrka where the problems in traffic planning were identified, as described in section 3.2.2. The workshop was designed to explore the concept of demand-responsive public transport, and how the Mistra SAMS service could be designed to increase accessibility for workers during times of the day when there was a low frequency of public transport. The employers invited were identified as relevant because their staff work at times of the day when public transport services are sparse, such as early mornings and late evenings. The workshop had a co-creative approach where the employers' knowledge of the area and the working conditions at the workplaces were considered crucial for the design of the DRT service.

The results of the workshop contributed to the development of the DRT service. It was used to identify the specific times that public transport in the area does not match the organizations' employee schedules, as well as the closing and opening times of all businesses. This resulted in the DRT service timetable, see Table 1. The timetable takes into account the departure and arrival of the commuter train, as the mismatch between modes of transport is one of the key issues for the area. To protect the privacy of the participants in the study, I have named the

two areas that the service travels between Area 1 and Area 2. Area 1 is the area where the businesses are located, and Area 2 is the area where the commuter train leaves from.

Weekdays			
Journey	DRT-service	Commuter train from/to Stockholm C	Commuter train from the opposite direction
Area 2 - Area 1	Departure 05.50	Arriving 05.46	Arriving 05.44
Area 1 - Area 2	Departure 21.15	Departure 21.29	Departure 21.31
Area 1 - Area 2	Departure 22.15	Departure 22.29	Departure 22.31
Weekends			
Journey	DRT-service	Commuter train from/to Stockholm C	Commuter train from the opposite direction
Area 2 – Area 1	Departure 06.50	Arriving 06.46	Arriving 06.44
Area 2 - Area 1	Departure 21.07	Arriving 21.02	Arriving 20.59
Area 2 - Area 1	Departure 22.07	Arriving 22.02	Arriving 21.59
Area 1 - Area 2	Departure 07.05	Departure 07.14	Departure 07.16
Area 1 - Area 2	Departure 21.15	Departure 21.29	Departure 21.31
Area 1 - Area 2	Departure 22.15	Departure 22.29	Departure 22.31

Table 1. Timetable of the Mistra SAMS DRT service and its relation to the departure and arrival times of commuter trains.

The Living Lab has been designed to explore the potential of a DRT service to meet the needs arising from the overall problem in this area, increase accessibility, and investigate the impact on the daily lives of commuters. Thus, the study has been limited to a specific location in Botkyrka municipality. The study has also been limited to studying a specific population, which is people who have occupations where physical presence is mandatory and little or no formal education is required, so-called "low-skilled labor" (Maxwell, 2006; Bureau of Labor Statistics, U.S.).

3.3 Academic and societal relevance

This study takes an exploratory approach where the thesis aims to fill knowledge gaps, but also contributes to an academic as well as societal relevance. According to Farthing (2016), there are two motives for justifying research. The first is in an academic sense, i.e., that there are knowledge gaps in the previous literature in the chosen field, see beneath. The second motive is that the research contributes to society in a practical sense, i.e., "it might help to improve a problem in planning or a policy of some sort" (Farthing, 2016, p.62). I argue that this study contributes to both. This thesis aims to meet several identified knowledge gaps in the previous research. Previous research has mainly studied the functionality of DRT in either urban or rural environments (Schlüter et al., 2021). This study instead examines the potential of DRT in a suburban setting, which Schlüter et al. (2021) suggest is promising and worth exploring. As well as being something that can improve accessibility for individuals living in suburban environments, this study will examine the potential for municipal planning. This will be explored in two neighboring suburban municipalities, which both experience a need to increase accessibility between intra-municipal areas and are located on the periphery of Stockholm's regional city center. At the same time, since its introduction almost half a century ago and still today, DRT services have mainly been used as a social service aimed at special groups that are limited in their mobility, e.g., elderly, and disabled people (Dytckov et al., 2022; Schasché et al., 2022). This study instead examines how DRT can be used to increase the accessibility of work-related travel in a service sector that often employs "low-skilled

labor". The service is thus aimed at people working in occupations such as health care and grocery retail, which usually do not require higher education but do require physical presence. In this sense, the study fulfills academic as well as practical relevance (Farthing, 2016). In summary, the thesis includes issues related to municipal development as well as individual accessibility, which I argue are important considerations to highlight to plan for sustainable development, both socially and environmentally.

4 Theoretical framework

In this chapter, I present the theoretical concepts that I will use to analyze accessibility from both a planning and an individual perspective. I will first explain the concept of *accessibility in transport* and *accessibility strategies*, which I will use to analyze the planning perspective. These concepts will be used to analyze the approaches and working methods that planners use in planning. Then I will describe the theoretical concepts of *objective* and *perceived accessibility*, *accessibility barriers*, and *social exclusion*, which will be used to analyze the individual perspective. These concepts will be used to analyze the workers' perceived accessibility, subjective experiences, and barriers. Taken together, these concepts will form the theoretical framework for this thesis.

4.1 Transportation and accessibility

Transportation shapes the spaces around us and creates a geography of opportunity to access important destinations beyond our immediate surroundings. In modern urban settlements where important land uses and residences are dispersed in space, a lack of transportation can mean a lack of opportunities for work, school, recreation, and social interaction, profoundly impacting the prospects for communities and individuals (Golub and Martens, 2014, p.10).

I think that the above quote by Golub and Martens (2014) captures the relationship between transport opportunities and accessibility in a valuable way. Accessibility is a concept, that since its introduction by Hansen (1959), has received considerable attention and remains central to academic fields such as urban planning and transport planning (Geurs and van Wee, 2004; van Wee, 2016; Núñez et al., 2022). As the following sections in this chapter will show, there are different perspectives on accessibility. From one perspective, accessibility can be considered as a matter of mobility, where accessibility is realized through the provision of a service in the built environment (Núñez et al., 2022). Similarly, in 1959 Hansen described accessibility as a "measurement of the spatial distribution of activities about a point, adjusted for the ability and the desire of people or firms to overcome spatial separation." (1959, p.73). Viewed from such a perspective, accessibility can thus be facilitated through various services in the built environment, ranging from roads, public transport, or bicycle lanes, etc. (Núñez et al., 2022; Martens, 2016). Transportation is a key facilitator of accessibility (van Wee, 2016), and the concept of accessibility relates to the out most fundamental aspect of cities i.e., the ability to move to, and between, given destinations and activities (Geurs and van Wee, 2004; Allen and Farber, 2020; Wang et al., 2019). Thus, transportation enables for individuals to participate in every day lives activities (Allen and Farber, 2020). Martens (2016) as well as Geurs and van Wee (2004) point out that accessibility can be attributed to places as well as people. A place may be more or less accessible to certain people and, similarly, a person may have a higher or lower accessibility to certain places. Martens (2016) states that the degree of accessibility experienced by a person depends on the context as well as the person. Although, as Núñez et al. (2022) argue, the degree of accessibility of people is governed by the provision of the transport infrastructure and the range of services, Martens (2016) argues that this ability is also largely governed by the attributes of the person. Martens (2016, p.12-13) exemplifies this by saying that it is governed by the individual's income, gender, knowledge, to physical possibilities and more. Individuals' characteristics and conditions differ greatly, which consequently results in their perceived accessibility also differing equally (Martens, 2016).

4.2 Accessibility strategies

Accessibility is a concept that includes different definitions and meanings (Geurs and Van Wee, 2004; Lättman, 2018). In this way, accessibility is an umbrella concept that encompasses individual opportunities to reach important activities (Gil Solá and Vilhelmson, 2018). It is important that the traditional transport system is not seen as an isolated entity, separated from other transport modes and their development (Gil Solá et al., 2020). To promote both environmentally and socially sustainable development of the transport system, it is necessary to understand how accessibility can be achieved. As a way of thinking about this, Gil Solá et al. (2020) describe three basic strategies that urban planning has at its disposal to create accessibility for its citizens.

The first strategy described by Gil Solá et al. (2020) for achieving accessibility is through *mobility strategies*, i.e., planning enables the bridging of geographical distances and time through travel and transportation. This is a way of planning for accessibility that has historically dominated Swedish planning and involves promoting people's mobility by planning transport infrastructure that enables time-efficient and flexible travel. Mobility is a closely related concept with accessibility, often used interchangeably (Gil Solá et al., 2020). Although mobility as a concept is also difficult to define when taken out of context, it essentially implies movement, most often in a physical sense (Haley, 2017). In a geographical context, mobility can be associated with transport, as transport enables mobility between different geographical points (Gonçalves et al., 2017). In a planning context, people's needs for increased accessibility to key destinations have often been met through mobility-seeking measures, i.e., more transport and travel (Gil Solá et al., 2020). Urban planning has sought to promote accessibility through mobility by historically adapting city functions and infrastructure to the car (Allam, et al., 2023). Thus, the planning ideal has led to better accessibility for individual means of transport, such as private cars, and has had consequences such as more sparsely populated urban structures, as highlighted by Gonçalves et al. (2017). Accessibility can also be achieved through *strategies for geographical proximity*, i.e., planning that promotes proximity between people, important activities, services, and places. A spatial structure that involves proximity (i.e., short geographical distances) between homes, activities, and facilities that are accessible by sustainable transport modes such as walking and cycling is considered beneficial to society and is reflected in a large body of literature (Gil Solá and Vilhelmson, 2018, p.3; Banister 2008; Van Wee, 2016). From such a perspective, accessibility in planning can be considered interchangeable with geographical proximity and thus as a counterpart to mobility (Gil Solá et al., 2020). This planning approach has become increasingly influential and is evident in, for example, the growing debate about the 15-minute city (Allam, et al., 2023), or planning approaches such as Transit Oriented Development (Curtis et al., 2016). Both these approaches emphasize a proximity approach. The 15-minute city is an example of urban planning enabling essential city functions by walking or cycling within a 15-minute radius (Allam, et al., 2023). Transit-oriented development is when housing is built near transit stations to create proximity to travel (Curtis et al., 2016). Finally, accessibility can also be achieved through *virtual strategies*, where ICT (Information and Communication Systems) complement and replace physical alternatives by making it possible to overcome geographical differences through the internet (Gil Solá et al., 2020). Virtual approaches are described as having an increasing impact on accessibility. It promotes accessibility between people as well as to activities and enables individuals to access services without physical movement or limited by temporal factors (Gil Solá et al., 2020).

These three strategies as described by Gil Solá et al. (2020) are a way for practitioners to think about accessibility in relation to mobility and proximity. For example, there is value in analyzing mobility strategies because it can increase the understanding of specific areas Gonçalves et al., 2017). Since different population groups have different needs in terms of travel, this can contribute to a deeper knowledge of the individual needs of these groups and, by extension, urban development (Gonçalves et al., 2017). At the same time, Gil Solá et al. (2020) introduce a conceptual model with three essential dimensions that planning practitioners are encouraged to consider in accessible and sustainable urban development. This model emphasizes the questions: what is needed to be close to in order to live a good everyday life; for whom and which groups does accessibility need to be improved and how does it affect other groups; and finally, by which means of transport should sustainable accessibility be achieved? (Gil Solá et al., 2020, p.125-126).

4.3 Objective accessibility

Historically, the measurement of accessibility has been limited to what Lättman et al. (2016) call objective measures, or what Olsson et al. (2021) call calculated accessibility, i.e., spatial measures such as travel time and distance. This is also what Núñez et al. (2022) argue when they describe that the concept of accessibility has historically been perceived as the connection between time and space that constituted indicators and measures of functionality. Accessibility that is considered achieved and measured with a focus on the built environment, transportation options or temporal factors is often referred to as *objective accessibility* (Lättman et al., 2018).

Objective accessibility is provided and determined by indicators in the built environment or by the characteristics of transportation options for the general population. It is measured using metrics such as distance, public transport frequency, and travel times (Lättman et al., 2018, p. 503). When accessibility is considered from an objective point of view, the measures are reduced to focus on the relationship between space and time, and thus citizens are usually considered a homogeneous group (Curl, 2018). Although there is a value in objective indicators of accessibility to identify which measures determine the accessibility of the spatial environment (Lättman et al., 2018), there are shortcomings in that implemented measures and analyses are made on the assumption that accessibility is objective for everyone in these areas (Curl, 2018). Both Curl (2018) and Lättman et al. (2018) state that objective measures are often inaccurate when it comes to reflecting the actual perceived accessibility. Lättman et al. (2018) argue that time and distance rarely reflect contextual factors or individual preferences that determine individuals' choice of travel mode. This relates to Curl (2018) who argues that perceived accessibility includes several factors that determine the level of accessibility experienced by the individual and which are rarely included in accessibility models based on objective measures. Curl (2018, p. 1150) exemplifies these as "cost, frequency or quality and comfort".

4.4 Perceived accessibility

In contrast, perceived accessibility is instead centered on individuals' subjective experiences, where citizens are considered a more heterogeneous group with different conditions and preferences (Lättman et al., 2018; Olsson et al., 2021). Thus, perceived accessibility is about how individuals experience or interpret their own accessibility, i.e., how accessible areas are considered from the individuals' point of view (Jamei et al., 2022; Curl, 2018). Lättman et al. (2016) argue that individuals' subjective experiences have been missed in the objective approaches to measuring accessibility in planning. This constitutes a limitation where the

reality of different individuals and groups is not taken into account, thus also the link between accessibility and social inclusion (Lättman et al., 2016). The concept of perceived accessibility can be applied to analyze needs and levels of accessibility in a more nuanced and heterogeneous way for different population groups (Lättman et al., 2018). From this perspective, accessibility is thus not only determined by physical factors such as environment, geography, and infrastructure, but is also influenced by individuals' preconditions and personal preferences (Olsson et al., 2021). The perceived accessibility can be, similar to objective accessibility, based on indicators such as time and distance, but where these indicators are based on the individuals experience in relation to these (Jamei et al., 2022). Also, Lättman et al (2018) argue that the concept of perceived accessibility can complement objective accessibility. Objective measures of accessibility can thus be complemented by citizens' subjective experiences of them. Thus, perceived accessibility includes more than measures of time and distance, by incorporating subjective values such as "personal preferences, attitudes and abilities" (Lättman et al., 2018, p. 503). Examining how individuals perceive, benefit from, and what factors make up perceived accessibility should thus form the focus of transport system functioning (Lättman et al., 2016).

4.5 Accessibility barriers

Accessibility barriers are a related concept that has an impact on people's accessibility, especially for perceived accessibility. Olsson et al. (2021) argue that from a strategic planning perspective, it is important to understand how accessibility barriers covary with, and affect, perceived accessibility to plan for social sustainability and inclusion. A number of different important accessibility barriers can be identified in the literature as described by Olsson et al. (2021), but these also occur frequently in other literature, which I will review below. Several of these barriers can be found in the conceptual framework by Church et al. (2000), which will be described in the following section on the theory of social exclusion, as it relates to the theme of social exclusion.

First, it concerns *individuals' personal resources*, financial and temporal (Lucas et al., 2016; Lucas, 2012; Olsson et al., 2021). Accessibility constraints related to financial resources include the expenses and costs associated with traveling, which are often dependent on income and the constellation, size, and location of the household (Olsson et al, 2021; Martens, 2016). Income plays a major role in individual accessibility and shapes mobility, contributing to differences in travel behavior of low-income groups compared to higher-income groups (Lucas et al., 2016; Martens, 2016; Gil Solá et al.,2020). Another barrier is *time*, as affordable travel options can contribute to loss of time for the individual (Lucas et al., 2016). This can contribute to disadvantages and difficulties in reaching destinations or everyday activities in a reasonable time or with ease (Lucas et al., 2016). Accessibility barriers can also stem from the perception of *insecurity and safety*, ranging from the risk of being the subject of a crime, to the risk of being involved in a traffic accident or being a victim of unsafe traffic conditions (Olsson et al., 2021; Lucas et al., 2016). In addition, Gil Solá et al. (2020, p.136) argue that barriers commonly related to fear and insecurity in the urban environment often affect already vulnerable groups in society, such as children, women, the disabled, the unemployed or those on low incomes. This in turn reinforces their exclusion (Gil Solá et al., 2020). Furthermore, the *physical context and structures* constitute accessibility barriers. This is described by Lucas (2012, p.106) as "factors which lie with the structure of the local area" while Olsson et al. (2021, p.3) describe it as "organizational and temporal functions of public transport". It thus refers to the functionality of the transport system in terms of accessibility to different modes, stations and stops, as well as insufficient bus services and pedestrian environments (Olsson et al., 2021; Lucas, 2012). Lastly, *geographical conditions* are an accessibility barrier, in which

the location of residence can prevent individuals from accessing transport services, for example if one lives in rural or suburban areas (Olsson et al., 2021).

4.6 Social exclusion

Social equity is fundamentally derived from the concept of social justice and relates to the fair distribution of resources (Dempsey et al., 2011). It is about fairness in how the costs and benefits of a resource are distributed among people (Allen and Farber, 2020). Dempsey et al. (2011, p.292) provide a definition of a socially equitable society as "An equitable society is one in which there are no 'exclusionary' or discriminatory practices hindering individuals from participating economically, socially and politically in society". In parallel, social exclusion refers to the lack and/or denial of functions and services essential to participate in society on the same terms as the majority of society's population (Lucas, 2012; Hine, 2007). In that sense, the concept of social equity is inevitably related to social exclusion (Dempsey et al., 2011). As previously discussed, social exclusion is a consequence of transport disadvantage as transport can be seen as fundamental for people's participation in society (Allen and Farber, 2020). Social exclusion is a multidimensional concept (Church et al., 2000). When people are prevented from participating in society due to a combination of transport disadvantage and forms of social deprivation (e.g., money, unemployment, health, etc.) it leads to social exclusion (Allen and Farber, 2020). Lucas (2012) argues that the concept of social exclusion is useful to consider in relation to transport disadvantage and highlights three factors and their interaction that are central to understanding transport-related exclusion. These are factors that lie with the (1) individual, (2) structures of the local area, and (3) national and/or global economy (Lucas, 2012, p. 106). These factors are explained in Table 2.

The interaction of causal factors crucial to understanding transport-related exclusion.	
Individual	"Such as age, disability, gender, and race"
Structures of the local area	"Such as lack of available or inadequate public transport services, the failure of local services."
National and/or global economy	"Such as re-structuring of the labour market, cultural influences, migration and legislative frameworks."

Table 2. *The interaction of causal factors crucial to understanding transport-related exclusion*. Lucas (2012, p. 106).

Adopting a perspective of transport-related social exclusion is valuable from three main perspectives (Lucas, 2012). The first is that the concept is *multidimensional*, meaning that it can be attributed to the conditions of the individual concerned as well as to the structures and functions of society. The second is that the phenomenon is relational, meaning that the disadvantage is considered in comparison with the conditions regarded as normal for the rest of the population of society. Finally, Lucas (2012) argues that social exclusion is dynamic concept, and that "it changes over time and space, as well as during the lifetime of the person who is affected" (Lucas, 2012, p.106).

Church et al. (2000) argue that social exclusion goes beyond poverty. Poverty implies a lack of material resources, while social exclusion instead often means that the individual/household is poor to the extent that they are cut off from participating in society (Church et al., 2000). Nevertheless, Church et al. (2000) argue that it is unfavorable to focus only on how transport-related social exclusion affects certain social groups because these groups are rarely homogeneous. This is supported by Lucas et al. (2016) who argue that transport-related social exclusion is individual. For example, one party in a household may

experience it and the other may not. Furthermore, Church et al. (2000), like Lucas (2012), argue that social exclusion is a multidimensional concept that is not only experienced as a result of one's personal attributes but how social and economic factors interact. Finally, an important focus is the geographic context, where people's households are located in relation to the features of the spatial environment that are essential to participate in community activities (Church et al., 2000).

Church et al. (2000) have developed a conceptual framework consisting of seven factors that are particularly influential in limiting individual mobility. This framework can be used to analyze the multidimensional relationships that contribute to social exclusion. The seven factors identified by Church et al. (2000, p.198-200) are:

1.	Physical exclusion	Refers to the physical barriers in the physical environment that limit and/or restrict certain groups from using the transport system. Church et al. (2000) suggest that these barriers can particularly affect groups hindered by age or disability.
2.	Geographical exclusion	Refers to inaccessibility in a geographical sense, usually in the form of long distances combined with inadequate provision of transport.
3.	Exclusion from facilities	Refers to the social exclusion of groups who do not have access to basic services such as shops, education, recreation, and health facilities. This type of social exclusion originates from limitations in time, money and proximity.
4.	Economic exclusion	Relates to limitations in income and transport access which limits accessibility to the labor market. This contributes to reduced employment opportunities and affects commuting patterns.
5.	Time-based exclusion	Refers to limitations in organizing daily life and difficulties in performing essential tasks due to long travel time. This can affect the ability to enter the labor market and maintain family life.
6.	Fear-based exclusion	Relates to perceived insecurity in public places, which contributes to the reluctance to use the transport system and its facilities. Fear of unsafe environments can contribute to social exclusion and varies according to social characteristics, particularly gender.
7.	Space exclusion	Relates to the management and design of public spaces. This type of exclusion is also about safety, but also the sense of ownership and can be both hindered and promoted depending on how the space is managed, designed, and monitored.

Table 3. *Conceptual framework of factors contributing to social exclusion*. (Church et al., 2000, p.198-199).

This conceptual framework consists of factors that in many cases can be experienced as accessibility barriers when it is analyzed in terms of perceived accessibility. The theoretical concept of perceived accessibility and a deeper insight into accessibility barriers is provided in the previous sections (4.4 and 4.5). Furthermore, I consider it important to point out that Lucas (2012) and Church et al. (2000) theorize about social exclusion in a similar way. In relation to social exclusion, I will draw on the conceptual framework of Church et al. (2000) to analyze exclusion. I will also use the causal factors described by Lucas (2012) in order to be able to analyze exclusion more deeply based on individual characteristics and local structures.

4.7 Theoretical position

The theoretical framework presented in this chapter consists of several concepts that together demonstrate the overall theoretical position of this thesis, namely that accessibility can be viewed from a variety of perspectives. In addition, these perspectives on accessibility can differ widely between urban planners and citizens. To provide a foundation for how the concepts are considered, this section will provide an account of how the individual concepts will be used in relation to the two perspectives of urban planners and low-skilled workers.

The concept of transportation for accessibility emphasizes how transportation is seen as a cornerstone of planning for accessibility in spatial environments, allowing citizens to bridge distances and access important activities to participate in society. At the same time, accessibility strategies as described by Gil Solá et al. (2020) are about how planning can enable accessibility in other ways, for example through proximity, as a counterpart to transport. Together, these two concepts contribute to a theoretical perspective on how planners can work with accessibility from different approaches, which in turn opens up the possibility of analyzing their understanding of the concept. At the same time, in relation to the concepts of objective and perceived accessibility, it is described how planning has historically been based on the beliefs of objective measures (Lättman et al., 2016), while the subjective experience of public transport users has been overlooked (Olsson et al., 2021). In light of the arguments that is made by Curl (2018) and Lättman et al. (2018) that objective measures are often inaccurate in reflecting the actually perceived accessibility, this theoretical approach allows for analyzing if and how the perspective of individuals differs from that of planners. Furthermore, as the case is based on the DRT service being implemented in an area where public transport is reported to be inadequate and aimed at a group of low-skilled workers, this study explores how they perceive accessibility. Thus, the concepts of accessibility barriers and the theory of transport-related social exclusion is theoretical concepts that is considered to be useful in analyzing individuals' perceived accessibility and identifying potential barriers in more depth. While the causal factors presented by Lucas (2012) are important for a comprehensive understanding of transport-related exclusion, the conceptual framework of factors contributing to social exclusion by Church et al. (2000) is considered particularly valuable in identifying factors that are important for accessibility.

In summary, the theoretical concepts of *transportation and accessibility* and *accessibility strategies* are considered useful to analyze the interviews with the strategic planners. This is to analyze their interpretations of accessibility based on working methods, objectives, and practices. These theoretical concepts thus aim to help in the analysis of how strategic urban planners reason about what is accessible and inaccessible, and how they work to create accessibility. At the same time, the theoretical concepts of *objective* and *perceived accessibility* are considered valuable for exploring how individuals' subjective experiences differ from planners' views of accessibility. Furthermore, the concepts of *accessibility barriers* and *social exclusion* are considered particularly valuable in analyzing the interviews with the workers testing the DRT service provided by Mistra SAMS. This is to contribute to the analysis of what they perceive as accessible, as well as what potential barriers to accessibility exist in their daily journeys. In conclusion, as planning provides the conditions for spatial structures and consequently the experience of individual citizens, these concepts may overlap and provide insight to other perspectives in the analysis.

5 Method

In this chapter I will present and justify my methodological choices for the thesis. This includes a detailed description of the research design, chosen methods, and analytical approach. Furthermore, the chapter also includes a reflection on the methodological choices, and the limitations of the study. I will also present and reflect on the ethical considerations of my conducted research.

5.1 Research design

The research design of the thesis is based on a case study approach. Case studies are in-depth studies that are delimited and intended to provide deeper accounts and investigation of specific cases (David and Sutton, 2016; Denscombe, 2018; Bryman, 2016). Since the study will investigate a specific phenomenon (i.e., Mistra SAMS DRT service) and its effect on accessibility in a delimited geographical location, with limitations to a specific population and during a specific time period, a case study approach has been considered appropriate. Denscombe (2018) states that case study research constitutes exploring an event or outcome of an occurrence in a society. To this, Denscombe (2018, p.85) suggests that the purpose of case study is to "highlight the general by looking at the specific". This is relevant to emphasize in relation to my study because it also aims to explore the potential of DRT from a strategic planning perspective. Thus, although the results of this thesis do not claim to be generalizable to other municipalities, they may indicate how the DRT concept is perceived by planners in suburban municipalities and whether it may reflect a potential for areas with low accessibility. Denscombe (2018) describes how a case study needs to be delimited and framed to allow it to be studied in isolation from its context. While Denscombe (2018) states that a case can be an event, process or place, Bryman (2016, p.96) states that a case can be about "a particular part of a society". This case study fulfills these descriptions because it is limited to studying Mistra SAMS DRT service within a specifically delimited area. At the same time, the geographical framing of the study is the two municipalities of Botkyrka and Huddinge. The reason why the case includes both these adjacent municipalities, and not only Botkyrka, is because the two municipalities have identified similar challenges regarding accessibility and lack of connection within municipal areas and borders. Thus, the study seeks to answer whether DRT may have potential for other areas with similar challenges.

A case study is a research design that can accommodate several different methods of data collection (Bryman, 2016; David and Sutton, 2016; Denscombe, 2018). The case study design can thus be based on both qualitative and quantitative methods, and it is not uncommon for them to include both, so-called mixed methods (Clark et al., 2021). Nevertheless, it is common for them to be based primarily on qualitative methods (Bryman, 2016). Qualitative interviews, such as the semi-structured form, are commonly used in the design of a case study (David and Sutton, 2016). The method I have used to collect data for this study have been qualitative, in the form of semi-structured interviews.

5.2 Data collection

This study uses a qualitative research strategy designed as a case study, with the main method of data collection being semi-structured interviews. The semi-structured interviews have been preceded by a literature study as well as minor observations made in connection with the interviews.

The literature study has been of great importance to gain a deeper knowledge of the key concepts covered in the study, such as DRT and accessibility in urban planning. The literature review has also been important to identify knowledge gaps in the previous research and to gain a deeper knowledge of the local conditions and geographical context. Furthermore, the data collection of the interviews has been based on two studied populations, namely low-skilled workers testing the DRT service and municipal officials. Thus, two perspectives crucial to the study's purpose have been included, contributing to a comprehensive empirical material.

The study has also included a smaller field-based observation that took place in connection with the interview of the workers, as I conducted the interviews physically at their workplace. These observations are presented in the introductory part of section 6.3 and in the last paragraph of chapter 6. The choice to include smaller field observations was made to create a sense of place for the area where the workers commute to work, as the name of the area has been omitted to protect the workers' privacy. At the same time, a choice was also made to include observations of the initial conversations with the planners leading up to the interviews in section 6.1. The choice to include this section was to show their attitude towards the topic, as well as the topicality and breadth of the accessibility concept that permeated the conversations. Overall, the observations were included to give a taste of what the results will cover, both for the planners and the workers. Although these observations are included to give an introductory feeling for the different parts of the results, the observations do not claim to reflect the realities of the interviewees but are rather written from my subjective experiences.

The choice to conduct semi-structured interviews was made considering the exploratory purpose of the study (Farthing, 2016), as well as the features that the method offers (Clark et al., 2021). Semi-structured interviews have the advantage of being a flexible form of interviewing that allows, even encourages, respondents to provide in-depth answers that reflect the interviewee's views and opinions (Clark et al., 2021). It is based on a fixed list of questions but where I have been flexible in the sequence of the questions and where the interviewees have been allowed to develop their answers in detail (Denscombe, 2018). Considering the purpose of the study, two groups have been included in the study, individuals and urban planners. The selection criteria as well as the methodological approach have therefore been different for the two study populations.

5.2.1 Interviews – Workers testing the Mistra SAMS DRT service.

Against the background previously stated in section 3.2.2 the research project "enhanced public transport" is limited to a specific location and a specific population. The population studied has thus been the people who took the opportunity to test Mistra SAMS DRT service. It has been a purposive sample (Bryman, 2016) limited to a population that commutes on a daily basis, works in a suburban area where accessibility is low for commuters, and holds jobs that require physical presence and no formal education. Again, it is important to emphasize that although I have been given the opportunity to conduct my study in relation to this research project, I have independently collected the material and consistently made the methodological choices of this study.

Fourteen persons that signed up to test the DRT service have been asked to be interviewed. I established contact with the research participants to book an interview in two stages, on site at their workplace and by telephone. Initially, I visited the workplace where a majority of the participants worked. During the visit, I collected signed consent from those present who had not formally agreed to participate in the study. Together with the participants, I also scheduled

a suitable date when I would return to the workplace for face-to-face interviews. As a second step, I phoned those who were not present during my visit to schedule interviews. This also included the one participant who worked at another workplace in the area. During the telephone calls, I also informed them of their written consent to participate in the study and the interview. All fourteen people were contacted for interviews by email and telephone and of these, eleven participants consented to be interviewed. Within the scope of my thesis, I felt that I had obtained sufficient material to answer the research questions. Most of those who agreed to be interviewed were able and willing to be interviewed in person at their workplace on the date set during my visit. However, there were two people who preferred telephone interviews.

During the interviews, I used an interview guide (see Appendix 2) designed to gain an in-depth understanding of the people's experience of the service in light of their previous experiences and life situation (Denscombe, 2018). The interview guide was carefully designed with questions to gain an understanding of the interviewees' reality before and after testing the service (Clark et al., 2021). The interview guide was designed with mainly open questions and room for follow-up questions (Clark et al., 2021). Each interview lasted around 10-15 minutes. The interviews were thus relatively short for qualitative interviews. This may be due to several reasons. Although I encouraged the interviewees to develop their answers, and I continuously asked follow-up questions, many of the respondents gave short answers. In addition, many of the interviewees had a foreign background, which resulted in occasional language barriers, a contributing factor. The people who were interviewed are a group that is relatively inexperienced in interviews in comparison to municipal officials. It is also a group that is not usually represented in research. I therefore consider interviewing them as important in order to emphasize their perspective on accessibility. The study thus contributes to highlight perspectives on accessibility that have not been sufficiently highlighted, or at all.

5.2.2 Interviews – Strategic urban planners and municipality officials

The second perspective that this study explores is a strategic urban planners perspective. For this reason, a purposive sample has also been made for this population (Clark et al., 2021). The sample can be described as a selective sample where I as a researcher have chosen the interviewees according to their competencies. This selection has been made based on my knowledge of the research field in relation to the purpose of the study (David and Sutton, 2016). Interviews as a method are appropriate when you want to obtain what Denscombe (2018, p.268) calls "privileged information", i.e., from people who have key competencies in the field.

As previously described in section 3.1. the geographical delimitation to the municipalities of Botkyrka and Huddinge has been made due to common features regarding the problem of the lack of physical connections. At the same time, both municipalities are adjacent to each other and share the characteristic of being suburban municipalities to the regional center of Stockholm. I have thus made a choice to include a sample of municipal officials with relevant competences from these two municipalities. The aim of the interviews has been to get an in-depth understanding of the concept of accessibility in relation to its local suburban conditions. The number of interviewees included was based on the scope and design of the study (Secor, 2010). Thus, a total of six people, three from each municipality, were requested to be interviewed. Five of them agreed to be interviewed. The individuals were selected based on their professional roles, key competencies, and knowledge in urban planning and traffic planning (see Table 4).

Profession	Organization	Role
Official 1	Botkyrka municipality	Climate and Environment Strategist
Official 2	Botkyrka municipality	Traffic planner
Official 3	Huddinge municipality	Strategic traffic planner
Official 4	Huddinge municipality	Strategic traffic planner
Official 5	Huddinge municipality	Strategic comprehensive planner

Table 4. *Interviewees municipal officials.*

Initial contact with the interviewees was made by email, and well in advance. For this study, where the majority of the material would be collected through interviews, it was considered important to make early considerations regarding who to interview and establish contact (Phillips and Johns, 2012). First contact with the interviewees was made between late February and mid-March and all interviews were conducted in early April. Four of the five interviews were conducted digitally, and one was held on site at the municipality's office. Each interview lasted between 40-80 minutes. The interviews were semi-structured in their design. I based the interviews on an interview guide mainly consisting of open questions (see appendix 1). The questions were aimed at investigating how the municipalities plan for and reason about accessibility. The questions were largely based on the literature review done initially in the study and addressed topics such as local objectives, priorities, challenges, and possible conflicts in planning. I had also included questions on demand responsive transport to explore attitudes toward DRT as a concept. Although the questions were pre-prepared, the sequence allowed for flexibility and space for deep reasoning and follow-up questions (Philips and Johns, 2012).

5.3 Analysis

The material collected in the study has been analyzed through a qualitative content- and thematic analysis method. Thematic analysis is a form of qualitative content analysis that emphasizes thorough processing of data to allow themes to emerge from the material rather than analyzing it into pre-determined themes (David and Sutton, 2016). There are several reasons for using thematic analysis. Braun and Clarke (2006) state that the method is advantageous to use to thoroughly organize the material and identify patterns in the analysis. The methodology of the analysis has thus centered on processing the material by coding the transcripts carefully to allow the themes to emerge (Denscombe, 2018; Bryman, 2016).

I have treated the material systematically through a multi-step procedure, as described by Braun and Clarke (2006). The first step has been to familiarize myself with the material by transcribing and deeply engaging with the raw data. The analytical work already started in the beginning, where I took notes simultaneously while conducting the interviews, as when I transcribed all the interviews. As a second step, I compiled the material and generated the initial codes. In this step, a first screening took place where I broke down the material into smaller pieces (Denscombe, 2018). The third step was to start searching for themes in the material. I did this by going through all the interviews one by one and writing out keywords and quotes to get an overview. I used post-it notes with color coding to find patterns in the material, such as recurrent statements or differences and discrepancies. The final steps were to review the themes and do a further screening. Here adjustments were made where some themes were further broken down, while some themes were merged. The objective was to create a coherent and logical structure. After that I broke down the final themes into their essence to make the analysis and presentation of the results as concise as possible.

I used the same approach for the two perspectives studied – strategic urban planners and workers. The findings from these two perspectives are presented under four subheadings in the results and analyses chapter (Chapter 6). They are organized according to the research questions. The findings from the two different perspectives have been brought together and analyzed in relation to each other in the discussion chapter (Chapter 7), where I also discuss the results in relation to the last research question. The themes associated with each research question are shown in the figure below:

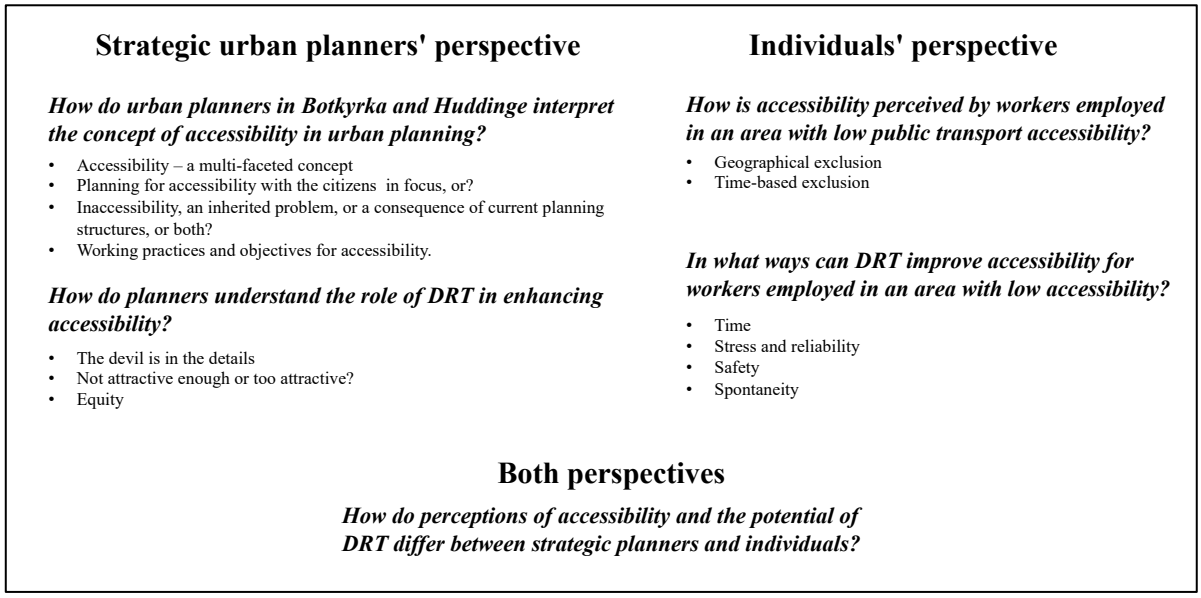

Figure 1. *Themes in the result and analysis*.

5.4 Ethical considerations

In this study, ethical perspectives have been given special consideration and careful thought. I have taken very seriously my responsibility to act ethically towards the participants in the study, but also towards those who may be influenced or rely on my research results (Swedish Research Council, 2017; Philips and Johns, 2012). The study has strived to have a high ethical standard and has been designed and conducted in line with the Swedish Research Council's principles (2017), as well as Linköping University's guidelines.

Since all empirical material has been collected through interviews, special consideration has been given to ethical aspects related to personal integrity, informed consent, and harm (David and Sutton, 2016). I have been transparent with the study participants and given them information about the purpose, form, and execution of the study. The interviewees were informed about the study on at least two occasions before the interviews were conducted - at the written invitation and after agreeing to participate when the informed consent form was sent out (Leavy, 2017). Furthermore, the interviews began with me summarizing the purpose of the study, ensuring that they were aware of what their participation entailed and informed consent was assured. Thus, informed consent was collected both in writing and verbally from all participants.

In the informed consent, the participants agreed that I as the author of the master's thesis could process their personal data in the form of: *name*, *email address*, and *professional title*, as well as *image and/or sound recording*. Confidentiality was promised to the interview participants. The participants were guaranteed that their names would be anonymized in the thesis and that their statements would not be traceable back to the interviewee. The privacy of the

participants was protected by assigning them identification codes (David and Sutton, 2016). For the strategic planners and municipal officials who participated, their professional title and the municipality they worked for were shared. This is because this information was important for the relevance of this case study and its geographical focus. Confidentiality can mean withholding personal data as well as the location of the project (Smith, 2010). Regarding the workers participating in the study, it was actively chosen not to reveal the name of the workplace, their occupation, or where specifically in Botkyrka they work, in order to protect the integrity of the participants. I also made the judgment that this type of specific information was more likely to compromise the participants' privacy than to add any relevance to the study.

5.5 Method discussion

5.5.1. Validity and reliability

For qualitative studies, it is important to address issues of generalizability and reliability. This study has been designed as a qualitative case study with an inductive approach and exploratory research questions. It has employed a qualitative approach with interviews as the empirical basis. I have strived for a high internal validity, i.e., that the research results should correspond to the perceived reality of the two studied populations (David and Sutton, 2016). Given that this study has been geographically limited to two suburban municipalities in Stockholm County, the study does not claim to be generalizable to other municipalities. A total of five planners with different strategic competencies have been interviewed from the two municipalities. Thus, it is not possible to generalize the results from the participants in this study to represent the wider population, i.e., all planners in the two municipalities studied (David and Sutton, 2016). Furthermore, Farthing (2016) states that qualitative research tends to be characterized by the researcher's own interpretations and subjective assessments. Since I have made the choice of interviewees through a selective selection, it is my own interpretation of which competencies have been relevant to this study. The coding and analysis of my material are my interpretation of the interviewees' statements, so it is possible that other codes and themes would have been made visible by other researchers if they had carried out the study. However, systematically coding the material has been a way to strengthen validity, seen as the match between data and reality (David and Sutton, 2016). Also, when producing my research results, I have verified the interviewees' statements by going back and listening to the recordings again.

When it comes to the second interviewed population, the workers, my selection of interviewees has been the 14 people who had signed up to test Mistra SAMS DRT service. Of the 14 participants, 11 accepted to be interviewed. All interviewees worked at the same workplace and therefore the results cannot be generalized beyond this organization. At the same time, the research project was carried out in a limited geographical area, and the results cannot be generalized to other locations. However, this has consistently been the premise, where even if the results cannot be generalized, it can highlight the situation of the workers and the effects of DRT in an area where accessibility is low. Nevertheless, there may be parallels with other groups working inconvenient hours, especially where public transport is not well developed, as is the case in many parts of Sweden. As with the worker interviews, the aim has been to achieve a high level of internal validity rather than generalizability.

David and Sutton (2016) argue that it can be difficult to achieve reliability if the qualitative research methods are too unstructured. However, it is difficult to achieve deep reasoning if the methods are too structured. I have kept this in mind both in the design of the study and its

execution. I have thus used a semi-structured method, where I have been consistent with my questions but allowed follow-up questions and development of reasoning. Simultaneously, I am aware that qualitative research is characterized by interpretations and subjective ideas and experiences (Farthing, 2016). While I believe that my approach has been consistent, it is not possible to exclude that the result maintains a constant value and that the same result can be achieved at a later date or other circumstances (David and Sutton, 2016).

5.5.2. Reflection on the interviews

As mentioned before, I have chosen to conduct interviews with both planners and individuals. One possibility would have been to study accessibility based on purely objective measures (such as time and distance) in relation to subjective experiences of low-skilled workers. Instead, I have chosen to study strategic urban planners' interpretations of the concept of accessibility in comparison with how individuals experience it. I made this choice because their interpretations of accessibility can point to discrepancies between the views of individuals compared to planners, which in turn can lead to some perspectives being prioritized in planning and not others. I consider qualitative interviews as the best method for capturing and visualizing these two perspectives. I made the design of the interview guides for the planners and workers different. The planners work with accessibility issues on a daily basis while the individuals experience it. Consequently, the nature of the interviews also differed. Below I will discuss the reflections from the interviews with the planners and with the individuals.

Interviews with individuals (workers)
The interviews with the individuals were conducted with a group of people who are, compared to planners, relatively inexperienced in being interviewed. Furthermore, a majority of the interviewees have a foreign background and are women. Given that transport-related social exclusion is a topic that is not well researched in Sweden, this justified the decision to use qualitative interviews as a method. As previously mentioned, the interviews were relatively short, varying between 10-15 minutes. I had designed an interview guide containing 16, mostly open-ended, questions. David and Sutton (2016, p.118) state that factors related to personal attributes, appearance and behavior can affect how the interviewee experiences the situation and thus how much they speak. For an interviewee to feel comfortable and at ease, it is important to adapt the interview situation to the respondents (David and Sutton, 2016). I did this by suggesting to conduct the interviews at their workplace - an environment they are familiar with. Nine of the eleven interviewees agreed to schedule the interview at the workplace, while two felt it was more appropriate to do it by phone. I adapted the interview schedule to the interviewees. I had arranged an undisturbed room in their workplace and tried to create an inviting and calm environment (Clark et al., 2021). While I felt that I had the trust of the interviewees, I reflect that the reason the interviews were short was that most people did not say much more than they needed to which can reflect that they are not used to being interviewed. I asked continuous follow-up questions, and many developed their answers, albeit briefly. There were also language difficulties among several of the interviewees, which may be a reason why they were short. When I and the interviewees had difficulties understanding each other, I rephrased the question or asked the respondent to develop or clarify the reasoning. Thus, an understanding was created between me and the interviewees. However, I felt that I got the most out of the interviews, and the respondents answered all my questions gave me insight into how they experienced commuting before and after testing the DRT service. The interviews together created an overall picture where the results pointed in the same direction, while only details differed between the individuals' accounts. Thus, a

recurring pattern emerged from the individual interviews, which strengthened the feeling that I had captured the accessibility experienced, which was the purpose. Thus, even though the interviews were short, a saturation was achieved.

Interviews with strategic urban planners

In the interviews with the planners, I also adapted to a time and place that the interviewees would feel comfortable with. Most interviewees wanted to hold the interviews digitally, although one preferred to do so at the municipality's office. According to Bryman (2016), a digital interview contains many of the same advantages as a physical interview, such as achieving equal trust. There is also greater flexibility and benefits of saving time and resources associated with digital interviews (Clark et al., 2021). David and Sutton (2016) suggest that it is customary to set a time limit for the interview, which I had estimated to be between 45 minutes and one hour for all strategic urban planners. However, several of the planners went over time, as opposed to the individuals. The discussions became extensive during some sequences. I used structuring questions (Clark et al., 2021) to move the conversation forward, pointing out time as the main limiting factor. I could discern that the municipal officials were used to talking about their profession and issues related to it, in contrast to the interviewed individuals. I reflect that this may have contributed to the fact that several of the planners talked for the entire hour, or even stretched the time, unlike the individuals. However, several people found the topic interesting, which made it possible to obtain in-depth information and ask follow-up questions. I experienced all interviews with the planners as dynamic conversations between me as interviewer and them as respondents.

6 Result and analysis

The structure of this chapter is organized in two parts taking into account the planners and individuals' perspectives on accessibility and DRT. First, results will be presented for the planning perspective. Here, I examine how the concept of accessibility is interpreted and understood in current planning practice. After that, the results from the individual perspective will be presented, where the experiences of low-skilled workers are central. The chapter continues by examine how their accessibility is perceived and affected by Mistra SAMS DRT service.

6.1 How do planners in Botkyrka and Huddinge interpret the concept of accessibility in urban planning?

Already before the interviews with the planners, in the email correspondence and the conversations that lead to the scheduling of the interviews, it is possible to sense a hint of the topicality and width of the concept of accessibility. I sense certain ideas about the concept of accessibility associated with the interviewees' areas of expertise and different perspectives. I receive comments such as "I understand that this is the subject of your thesis, accessibility in urban planning is complex". These types of comments set the tone for several of the conversations with the planners, and this is also where I will begin this chapter.

6.1.1 Accessibility – a multi-faceted concept

Although accessibility in urban planning is a well-established concept, the results of this study note that it is not always clear what it means. Indeed, it is a broad concept by nature, and as Geurs and van Wee (2004) suggest, different meanings and definitions can be applied. As an initial step in the interviews, respondents were asked to describe how they interpret accessibility. This revealed the scope and complexity of the concept, as expressed by several interviewees. One interviewee expressed it as "It is included in our strategies, i.e., "increased accessibility". It's such a concept like you might throw around. So, it's like this: it's something you say and then what does it actually mean?" (Official 3). Another interviewee stated that "There are so many different aspects. Therefore, you almost always have to ask at least one follow-up question when you use the word to see how it is used in the context" (Official 4). However, closely resembling Hansen's (1959) widely quoted definition of accessibility, all respondents finally suggested that it can be understood as the spatial relationship between people and destinations. Almost everyone argued that accessibility can be considered as people's ability to get to activities, destinations or functions that are important in their daily lives. This is in accordance with Gil Solá and Vilhelmson (2018) who suggest that accessibility is an umbrella concept that encompasses individual opportunities to reach essential activities. However, several of the respondents also stated that it can be viewed from a disability perspective, and that was their initial thought. A lot of perspectives was made visible by this question through the associated reasoning. While one interviewee mentioned that the ease of reaching destinations can be considered from both objective and subjective measures, another mentioned that this is not only achieved through transport but also proximity, while a third reasoned about "who do we build accessibility for?".

6.1.2 Citizens in focus when planning for accessibility, or are they?

In the interviews it is possible to discern a relatively strong focus on social perspectives when talking about accessibility. The social perspective with the individual in focus is what most of the interviewees initially associated with the concept. This became particularly visible when the interviewees were asked what the purpose of planning for accessibility is. While Official 2

described it as "the main purpose is to facilitate people's everyday life", Official 5 described it as "people should be able to reach the functions they need to have a good life". From this perspective, urban planning thus aims to enable people to participate in society by creating access to essential activities and functions as described by Geurs and van Wee (2004). However, one of the interviewees, Official 4, started the reasoning with "Well, you always want as much public transport travel as possible at the expense of car travel". In relation to the other respondents, a distinction can be discerned here where the statement is not primarily focused on the people who aim to use the services but instead on the performance transport system, an approach that has been criticized in previous literature, see e.g., Martens (2016). It suggests that the purpose of public transport is to take market share from car travel, an approach that Walker (2012) argues is justified by environmental and economic motives. In the further reasoning of Official 4, citizen´s accessibility was continuously implied as a latent goal, even though the arguments were presented in terms of attractiveness. It became clear that the focus was on the performance of public transport as well as planning to enable efficiency:

> […] an even more important factor might be: on which of the roads could the bus have the highest accessibility? Where can we make sure it runs as smoothly as possible? And sometimes it may be that the major road is not the best, because there may be accessibility problems there, but also a lot of conflicting objectives, because sometimes there may be a regional cycle route, and then you have to compete for space with it. (Official 4)

This constituted a distinction where, in contrast to the other respondents, the reasoning centered on attributing accessibility to the vehicle and the physical environment instead of to the citizens who aim to use the service. This reasoning supports the argument presented in previous research suggesting that accessibility can be attributed to places as well as people, and that transport planning is largely focused on performance and efficiency (Martens, 2016; Allen and Farber, 2020). Furthermore, the results show that several other aspects of accessibility were considered important. Interviewee 2 said that while the main purpose is to facilitate people's everyday lives, planning for good accessibility is also a matter for municipal development. Accessibility contributes to increased well-being and security, which encourages citizens to stay in the municipality. Interviewee 2 summarized it as: "I would say that the purpose of making good accessibility is that you build for the population, for housing, and in the long run for the development and growth of the municipality". Accessibility is thereby presented as a mutual benefit between the individual and the municipality. This supports the theoretical assumption that accessibility is provided through services in the built environment (Núñez et al., 2022) and that the degree of accessibility experienced by individuals depends largely on the spatial context (Martens, 2016).

6.1.3 Inaccessibility, an inherited problem, or a consequence of current planning structures, or both?

To understand how planners in the two municipalities interpret the concept of accessibility, I found it equally valuable to examine what the respondents perceived as inaccessibility. Given that both municipalities in their strategic policy documents (Botkyrka municipality, 2021; Huddinge municipality, 2023) express weak spatial connections and linkages between areas, it raises the question: what characterizes such a place?

Inaccessibility in the built environment is recognized by all planners in both municipalities. The interviewees also identify similar characteristics of the places considered inaccessible in

each municipality, it is rural areas or sparsely populated areas that are characterized as inaccessible. Nevertheless, these areas are described by all the planners as highly accessible by car. The reason why these areas are perceived as inaccessible is seen as a result of several factors. A common denominator for both municipalities is the old way of planning, or the lack of planning. One of the interviewees from Botkyrka municipality describes it as follows:

> There is of course old infrastructure that has existed since the 1950s, 1960s and 1940s, and so on. And then there are narrow streets, there are residential streets, there's a lot. At that time, no one was thinking about accessibility, and no one was thinking about good pedestrian and cycle paths or that there would be room for a carpool or mobility hub, or similar things. Instead, they just built pure tarmac streets, which were kind of narrow. (Official 2)

While another official, from Huddinge municipality, puts it more succinctly: "The problem with these areas is that they are usually not planned at all from the beginning. They have grown organically" (Official 4). The problem is described as an inherited path dependency, where old infrastructure is difficult to manage in today's planning. The old infrastructure is seen as favoring the car, while land ownership limits the municipality's control over development. The consequence is that these areas have inherited inaccessibility built into the spatial structure. While the results show that planning is influenced by old structures and approaches, the officials also describe a different focus in current planning practice. Both municipalities currently have municipality-wide objectives and strategies that mean that sustainable modes of transport such as walking, cycling and public transport should increase while car traffic should decrease. The two officials from Botkyrka also point to the possibility that shared mobility services and mobility management measures can be incorporated into development agreements.

Chicken and the egg

The results show that accessibility is not only a consequence of old structures. Although the interviewees initially attribute poor accessibility to rural areas, it appears from the interviews that accessibility is also a key issue in new developments. In areas that are densified or where completely new areas are built, there are certainly possibilities for the municipality to plan for good accessibility in the spatial structures. However, the officials argue that the municipalities are limited in their authority over planning for accessibility as the region has a mandate over public transport services. The implementation of public transport is governed by requirements for a certain population base by the region, which the interviewees believe is based on commercial viability. It is thus a question of resources, where the region has requirements for a certain population base that govern the implementation of bus services in new developments. Hence, what guides regional public transport planning and, by extension, municipal planning is the population density, its structure and concentration in the municipalities. One of the planners in Huddinge describes how there is a gap in current planning practice when it comes to accessibility in new developments:

> Then there must be a sufficient number of inhabitants to justify having a bus there, so there is a gap in the planning, I would say. This is the chicken and egg question - that you want to develop but there is not enough population to justify running a bus there. (Offical 3)

The same problem is identified by several planners. The traffic planner in Botkyrka testifies to the same phenomenon and describes how it affects the behavior of the people settling in these new developments:

> I don't like that. I don't like it. I would have preferred that the public transport authority had redesigned it and perhaps included a bus line from the start. Because if you see a bus stop when you move in, you might think: "Oh perfect, here's the bus! I can use the bus here". Then you may already be able to inculcate such behavior, a sustainable travel behavior. But when you move in and there are no bus stops, no bus streets, nothing. It's just paved roads and car parking. Then of course you become car-dependent unless you decide to cycle. (Official 2)

As Walker (2012) has established, the planning of the transportation system is limited by resources, which arguably explains the population requirements that guide the region's priorities. At the same time, the Swedish legislation on public transport (2010:1065) states that public transport should be accessible to all groups of citizens. The requirements set by the region's public transport authority can be seen as paradoxical in the light of the municipal investments made, since new developments are preceded by calculated assumptions that citizens will move in. Based on Black (2018), the question arises as to whether the best possible solution in the transport system is utilized in relation to available resources when municipal and commercial investments in housing are made. Undoubtedly, public transport plays a central role in whether an area is perceived as accessible or not (Núñez et al., 2022). Thus, as can be understood by the municipal planners, accessibility in new developments is a 'chicken and egg' situation that is as problematic as old infrastructure and lack of planning.

6.1.4 Working practices and objectives for accessibility.

All municipal officials point out that the municipality's role is rather to act as an enabler of public transport infrastructure, while it is the regional public transport authority and the contractors who control where, how, and when public transport is to be provided. How both municipalities work with accessibility is visible in their statements during the interviews and can be summarized in a quote from Official 5 describing the purpose of accessibility: "That it should be, well, easy to reach what you need regardless of whether you have it within walking distance in your neighborhood or if you need to travel to it, it should be easy to reach". This revealed two approaches that both municipalities use as working methods to create accessibility - namely mobility and proximity.

Mobility

Both municipalities are working to incorporate conditions for sustainable mobility, i.e., being able to move between areas in the municipalities to access essential functions, destinations and activities in the community. Mobility thus implies movement in physical terms (Haley, 2017) in order to bridge geographical distances through traveling (Gil Solá et al., 2020). The interviews show that both Botkyrka and Huddinge have municipal objectives for walking, cycling and public transport, and for reducing the proportion of car traffic. Official 2 in Botkyrka states that: "We have a goal throughout Botkyrka that the proportion of walking, cycling and public transport should increase, and the proportion of car traffic should decrease". Huddinge has the same objective which Official 5 refers to as a hierarchy of transport modes: "And Huddinge has a hierarchy where we priorities walking, cycling and public transport the most. These are the modes of transport that will be prioritized in the planning based on the space they will take up." (Official 4)

In the practical implementation of this, existing spatial structures play a major role. Local conditions of the areas determine how this can be achieved. Official 2 who works in Botkyrka describes how there is a big difference between the northern and southern parts of the municipality in terms of how many people own and use cars. While northern Botkyrka has a very low proportion of cars, there is a much higher proportion of car owners in the southern parts. Official 2 describes: "So there are different local conditions. We have to plan in different ways depending on different areas". The same thing is described by the officials in Huddinge who explain how local conditions determine how to work with accessibility. Official 4 describes it like this:

> It depends very much on what geography you are in when it comes to, like cities, rural areas, and so on. [...] But what type of urban development you have, especially when it comes to density and population density, you have to work with different traffic concepts to be able to achieve this balance that you must always have (Official 4).

The balance that Official 4 refers to is between different traffic concepts, something that is not only determined by geographical and spatial conditions. What can be understood as even more decisive is the population density that forms the basis for the quality of public transport operations. Higher population density enables the transport authority to achieve a high proportion of travelers, which is referred to as *The Ridership Goal* by Walker (2012). This goal is driven by economic motives and generates incentives for more frequent service and faster journeys. Official 4 argues that faster modes are perceived as more attractive and reliable, but that different traffic concepts can complement each other. This highlights how the municipality can work with accessibility by creating connecting journeys or complementary transport options in the existing environment. Official 3 adopts the same reasoning and summarizes it by describing how they usually talk about: "the right type of the right traffic in the right place". This highlights how municipalities are forced to work with accessibility through a holistic perspective, where several modes of transport complement each other rather than the various services being seen as isolated units (Gil Solá et al., 2020). From this perspective, they work with mobility strategies, which admittedly revolve around traditional means of transport and where accessibility is sought through more transport and travelling rather than non-travelling accessibility strategies (Gil Solá et al., 2020).

Proximity

The second approach that both municipalities use for accessibility is proximity. This is described by Gil Solá et al. (2020) as an accessibility strategy that the spatial structures enable accessibility through geographical proximity to services, activities or places that are essential for citizens' participation in society. Official 1, working in Botkyrka, describes how the municipality has worked with proximity as a principle and localization issues for a long time:

> What are the basic services that need to exist in the good city, in the good life? What do you need in order to have a good life? Well, you need food, and you need a certain type of service, and young people have needs, leisure interests, and all that (Official 1)

The approach of proximity is also described by representatives from Huddinge as a clear strategy that permeates their planning. Official 5 describes that they work with accessibility:

> To try to ensure that, as far as possible, you have access to what you need in your everyday life in your local area - it can be schools, preschools, workplaces, health centers, shops. Yes, different types of service functions. And for that we have set up guidelines on how we should plan. For certain functions, we have set up distance specifications, such as a maximum of 300 meters to a park from the home, a maximum of 500 meters to a preschool, etc. So, it is an objective of the planning to try to ensure that everyone living in Huddinge has these functions within that distance (Official 5).

As revealed in the quote, there are clear municipal objectives in Huddinge for this, which are expressed through concrete distance specifications. This is a planning approach that is analyzed centers on the citizens, where their accessibility to important societal functions is in focus. Based on previous research, Martens (2016) describes how successful examples of such an approach have been implemented by local authorities. Martens (2016) describes that a key aspect when planning for accessibility is to identify and address different levels of accessibility and implement measures where accessibility is lacking. Martens (2016) suggests that such an approach may involve setting a standard for accessibility through maximum distance measurements, like Huddinge. At the same time, several of the participants explains that there is a similar proximity principle with distance specifications implemented near stations and bus stops. Proximity thus becomes an approach that not only refers to non-travelling accessibility but also as an incentive for sustainable travel.

Balancing proximity and mobility

What can be concluded from how the officials describe the balance between proximity and mobility is that there are trade-offs and interpretations for which types of functions and services should be planned for according to a proximity principle, while others can be made available through a journey. In order to understand how accessibility is interpreted, I asked the question on what premises this trade-off is made. Official 4 describes:

> It has to do with frequency: how often do you need, or want, to go to these different functions? And what people actually *need* often should be close by and spread out. Then there are things that you might *want* people to use often. Such as wanting people to exercise, so sports facilities and exercise centers should be close by so that people will use them often. (Official 4, emphasis added).

The official's statement indicates that the prioritization is essentially based on the two questions (1). How frequently do people use the functions? and: (2). How frequently do the municipality want people to use the functions? Thus, it is essentially about frequency. According to the interviewed official, the municipality's priorities for accessibility in the physical environment are not only about meeting needs but also about creating incentives for citizens to use certain functions. However, Official 4 described how some of these functions are nevertheless not included. Official 4 states this in a discussion drawing parallels between essential functions, proximity and the 15-minute city:

> And one thing that I think is interesting is how people think about workplaces, because I have seen in the discussion about the 15-minute city that some people think that workplaces are not included – that they should not be included in these 15 minutes. I think that's completely crazy. Of course, it's great that people are close to their work. The fact that they can cycle to work in fifteen minutes is the best thing in the world (Official 4).

It can be interpreted that the prioritization of certain functions is still debated, as in the case of workplaces. As Allam et al. (2023) suggest, accessibility through geographic proximity has become increasingly prominent in the 15-minute city debate. At the same time, social exclusion theory provides strong evidence that accessibility is crucial for education and employment (Lucas, 2012; Hine, 2007). And in previous research on transport disadvantage, there is much evidence that accessibility to workplaces is crucial to avoid social exclusion (Lucas et al., 2016; Golub and Martens, 2014). What can be observed is that both municipalities work according to a proximity approach, where basic services are not only seen to fulfil everyday needs and participate in society, but as a way to create attractiveness and quality of life for citizens. At the same time, there are clear objectives in terms of proximity to basic services, with schools and parks, for example, considered to be important functions. This planning principle is in line with what Golub and Martens (2014) describe as important functions for inclusion and participation in society. In parallel, this approach supports that accessibility can be created through proximity as opposed to mobility (Gil Solá et al., 2020).

6.2 How do planners understand the role of DRT in enhancing accessibility?

How do municipal planners in Botkyrka and Huddinge interpret the concept of Demand Responsive Transport? Initially, the interviews show that knowledge of the concept was divided. While some of the interviewees had better knowledge of the concept, others had rather little knowledge. To the extent that the interviewed officials are aware, neither Botkyrka nor Huddinge has ever tried to implement a DRT service. Nevertheless, quite strong perceptions of DRT were identified, which also revealed a difference in attitude towards the concept between the two municipalities. While the respondents in Botkyrka initially saw benefits, two out of three officials in Huddinge immediately identified which problems they saw with the concept.

6.2.1 The design of DRT

During the interviews, the majority of respondents emphasized that the design of the DRT service is essential for it to work. The urban planners from both municipalities raised key issues such as ownership and financing, but at the same time the essence of the discussions centered on the question "How do we make it attractive enough to use?". Several of the planners thus emphasized that the design is crucial for the success of such a concept: "It really is "the devil is in the details" about these concepts, and they are quite untested so far" (Official 4). Indeed, as many of the interviewees highlighted, a DRT service can take a variety of forms. As both Berg (2017) and Dytckov et al. (2022) describe, DRT can be designed differently in terms of routes and geographical coverage as well as scheduling and booking. The attractiveness of a DRT service was compared to regular bus services by several interviewees. Several pointed out the value of traditional public transport in terms of reliability and predictability, something that Official 4, among others, reasoned about:

> There's also a value in knowing that the bus is going to run and knowing when it's going to run – knowing that it runs every hour on the hour at exactly this minute from my stop. That predictability actually makes people use it. For example, if you have to book your journey and you don't really know when this vehicle will show up, you don't know how many people you will share it with. These uncertainties can lead to many people avoiding it, who might have travelled with a regular bus because there are too many uncertainties. It's a bit difficult to know when it will arrive, when I will arrive, and so on. (Official 4)

A factor of unpredictability linked to pre-ordering of travel was also added to the discussion of reliability. Several participants believe that pre-ordering the trip inhibits the use and is seen as a factor that potentially risks reducing the attractiveness of the service. Depending on how the service is designed, it determines how attractive the service will be. Several of the interviewees said that the lack of spontaneity is a factor that potentially risks reducing the attractiveness of such a service. In addition to the argument based on the reliability of the service, uncertainties such as how many and who will share the vehicle are also recognized.

In further reasoning, the interviewee raises issues related to social perspectives such as safety and anonymity when strangers share smaller vehicles with each other. The interviewee believes that these considerations are important for how the service is designed, whether the service should be aimed at specific target groups or for the general public plays a major role. Thus, a perspective of security is addressed where the design of the service is not only considered important for the attractiveness but also for the perceived safety of the citizens. According to the conceptual framework provided by Church et al. (2000), the risk expressed by Official 4 could contribute to fear-based exclusion. That is, the environment in the vehicles contributes to perceived insecurity that makes the service not used and thus reinforces the exclusion (Church et al., 2000). Consequently, it would be counterproductive to its purpose.

6.2.2 Not attractive enough or too attractive?

A common reflection that many of the interviewees made was whether a DRT service is different from taxi services. While some were critical and questioned the purpose and function, others saw it as having a potential to contribute to positive development.

> I don't understand why taxis aren't public transport [...] It has actually looked exactly the same for many years. I don't understand why you can't rethink public transport. If you travel five people in a car or if you sit five people in a bus? What exactly is public transport? (Official 1)

The official expresses a frustration regarding how public transport has stagnated in its development, seen as limited to traditional means of transport and as an isolated entity, as Gil Solá et al. (2020) argue. This frustration may be caused by the limited influence that municipalities have in comparison to the region over traffic management. In part, it may also have to do with the issue of attractiveness, predictability and reliability that has been a recurring element in the interviews. As the results have previously shown, the recurring key question in the interviews was how to design the service to be considered attractive to citizens. While several of the interviewees see challenges for how to make the service attractive enough, all of them discussed the risk of the concept becoming too attractive.

The results show that all interviewees recognized several values of DRT as a service. Several of these benefits were considered from the perspective of citizens' accessibility. Initially, the potential was considered to be faster journeys, greater freedom of movement and flexibility for individuals. The greatest potential of the service was considered to be in increasing accessibility for citizens living in rural areas. All interviewees identified rural areas, also referred to as the areas with the lowest accessibility, where such a concept would have the greatest potential. This is in line with previous research that suggests that the concept has the greatest impact in sparsely populated and low-demand areas (Schlüter et al., 2021; Thao et al., 2021). In these areas, the service was seen to have potential as a complement to traditional public transport, as a connecting or first and last mile journey.

At the same time, two officials from Huddinge expressed a concern that DRT could undermine the traditional bus system if DRT was introduced closer to the regional center: "if you introduce such a solution in parallel with a regular bus line, travel on that bus line will probably fall, and then you will reduce the number of trips, and then it will fall even more" (Official 4). The interviewees believe that DRT as a service has a clear purpose in rural areas, i.e., to increase accessibility in inaccessible areas. Whereas if the service were to be implemented in parallel with bus lines in a suburban or urban environment, the risk arises that the modes of transport impoverish each other. This was raised by Official 3, among others:

> What is its function? I think that: in rural areas, it is obvious that there is very little other public transport, so it is a very clear complement. But if you think more in the suburbs then. Yes, what purpose does it serve? What happens to the regular traffic if you add that bus? Is there a risk that they deplete each other? (Official 3)

Attitudes towards DRT as a concept, particularly in proximity to regional city centers, were thus divided. While some planners felt that public transport as a concept needs to be developed, others questioned the purpose of this development. At the same time, it can be noted that while several saw risks that the concept would not be attractive enough, several of the interviewees also saw risks that it would become too attractive - thus impoverishing public transport. Furthermore, a common reflection was also the question of the adequacy of the vehicle fleet if DRT were to become too attractive. Several interviewees reflected on the risk of too many people calling in proportion to the capacity of the DRT solution. At the same time, it is not only a question of meeting the demand for travel, Official 2 also emphasized that it is a question of land use.

6.2.3 Equity

As the results have repeatedly shown, the interviewees describe inaccessible environments as the most geographically peripheral and sparsely populated. In accordance with previous research on the concept (Schlüter et al., 2021; Thao et al., 2021), it is also in these areas that the interviewees see the greatest potential in DRT. At the same time, all the officials see potential in the concept based on creating accessibility for certain groups. Previous research shows that DRT was developed as a service to meet the need for accessibility for citizens who had low accessibility (Kaufman et al., 2021). In parallel, Schlüter et al. (2021) show that the service has traditionally been targeted at certain subgroups to meet the need for accessibility for citizens who have been hindered either physically, by age, or mentally. Thus, DRT has historically been used as a social service (Dytckov et al., 2022; Schasché et al., 2022). The results from this study are in line with the previous research. It shows that several of the interviewees initially saw the value of the concept mainly for people who, according to the above definition, are hindered in their everyday lives. Many of the interviewees suggested that DRT could have the potential to increase accessibility among the elderly, while several also described how it could have a value for young people without a driving license. In addition, the majority of interviewees reasoned that DRT could have value for citizens who do not own a car. As Martens (2016) describes, the degree of accessibility is something that can be attributed to the individual and that it can be governed by everything from income, gender, physical conditions, etc. Official 5 describes how DRT could have a value for certain groups based on the perception that car ownership is unequal:

> Yes, it is possible because we know that car ownership is unequally distributed. So of course, public transport solutions favor groups that do not have access to a

> car. And we know that car ownership is lower among women, foreign-born, younger, and much older people. (Official 5)

This highlights factors that are important for individual accessibility, which in addition to age also refer to gender and ethnicity. These are also factors in the individual that Lucas (2012) emphasizes as crucial to understanding transport-related exclusion. In addition to suggesting that public transport solutions can work to benefit groups where car ownership is lower, the results also indicate that DRT has the potential to increase accessibility for groups other than those the service has previously targeted according to Schlüter et al. (2021). This supports the argument that DRT has a potential that needs to be reassessed in terms of its ability to target more groups than those who are hindered physically, mentally or by age (Dytckov et al., 2022).

However, while all of the interviewees saw how DRT as a concept could be of value to target groups that are hindered in their accessibility, not everyone was convinced that this would be the authorities' main motivation for introducing such a service. Official 4 stated: “As a municipal planner, I think it's pretty clear that this is something that currently is pretty much driven to save money, you know, in sparse geographies”. Given that DRT was historically developed as an alternative to increasing accessibility for groups of citizens who suffered from low accessibility (Kaufman et al., 2021; Schlüter et al., 2021), this perception of today's motives for implementing DRT stands in stark contrast. Thus, while everyone saw the value of introducing such a service from a social perspective, not everyone believed that equity was the primary motive in all cases.

6.3 How is accessibility perceived by workers employed in an area with low public transport accessibility?

Prior to my visit to interview the employees who tested the Mistra SAMS DRT service, I go to the area where the workplace is located. I want to get an understanding of the area where public transport is reported not working that well. When I arrive at the commuter station where the employees need to get off, I have 40 minutes left until we set a time for the first interview. I am ambivalent about whether to take the bus or walk, but relatively quickly decide to walk. It's a sunny spring day after all, and it's a good way to get an idea of the area and the only option the employees have if the bus doesn't come. The map function on the phone shows that it will take 35 minutes to walk. Even though it's only about 2 kilometers, the topography is a bit of a challenge, it's hilly and I get a pulse.

The interviews show that my walk to their workplace - in the middle of the day, at lunchtime, and without the stress of being late for work - does not reflect the reality of the interviewees. All interviewees generally work full-time during inconvenient hours - early mornings, late evenings, weekdays, and weekends. The schedule varies from week to week and month to month. Ten of the eleven interviewees are women, and none of them have a driving license. Most of them also have a foreign background. As this chapter will show, all of them experience poor accessibility in their daily commute. Several of the factors that contribute to individuals' poor accessibility can be analyzed based on Church et al. (2000) conceptual framework for social exclusion.

6.3.1 Geographical exclusion

All of the interviewees experience long travel times between home and workplace due to long geographical distances from the workplace. All interviewees except one live in municipalities

in the Stockholm region other than Botkyrka. The long geographical distances require all the interviewees to use several modes of transportation. Travel times are thus long and generally involving several changes of transport on the journey to and from work. Most need to make three or more changes on the way to work and their one-way travel time to or from work generally takes between 60 and 90 minutes on weekdays. All the interviewee's state that travel times at weekends are worse, with some journeys reaching nearly two hours for a single trip. The interviewees state that the geographical distances, which consequently contributes to long travel times, contribute to low accessibility that make the necessary journeys to and from work more difficult. However, long travel times are not only due to geographical distances. What is portrayed as even more problematic is the numerous and sometimes long changeover times between modes of transport. All interviewees describes that the last part of the journey, the bus between the commuter station and the workplace, contributes to the longest waiting time. Thus, public transport is identified as inadequate during the last section, especially during early mornings or late evenings i.e., inconvenient working hours. One of the workers describes the situation during a regular weekend *before* they started using the Mistra SAMS DRT service:

> It was hell on weekends. We were always late for work. The bus arrives at the stop at ten past seven, and we start at seven. There is no bus earlier. So, I was at work at 20-25 minutes past seven, after I changed. So, I was 25 minutes late. (Worker 2)

Several of the workers interviewed also describe how the same problem exists during early mornings, late evenings, and public holidays - times and days that all of the workers regularly work. Based on all the interviewees' accounts, it is possible to conclude that they suffer from transport disadvantage (Lucas, 2012) where all or part of their journey is affected by poor transport services. The geographical distances that the majority of workers need to bridge in their daily lives can, based on Church et al. (2000) conceptual framework, be seen as a form of geographical exclusion, where geographical distances are a factor that contributes greatly to exclusion. According to Dempsey et al. (2011, p.292), this can be understood from a social justice perspective where the local structures of the transportation system exclude individuals working inconvenient hours by obstructing them from getting to work, i.e., participating in society. At the same time, by understanding Lucas (2012), social exclusion is multidimensional and occurs as a combination of factors. Factors inherent to the individual as well as factors inherent to society contribute to social exclusion when they interact (Lucas, 2012). This is supported by the argument of Martens (2016) who argues that the level of accessibility can be attributed to the individual as well as to society. According to Lucas (2012), individual factors come into play, such as gender, age, and ethnicity. And while Church et al. (2000) argue that it is disadvantageous to focus on certain groups, the interviewed population shares some main characteristics. Ten of the eleven are women, many are from foreign backgrounds, and all are without a driver's license. In parallel, transport disadvantage arises from the structures of the local area, which in this case is in line with Lucas' (2012, p.106) example of "such as lack of available or inadequate public transport services". On the one hand, the low accessibility can essentially be argued to lie in the lack of driving licenses in combination with the inadequate public transport in the local area. On the other hand, it can be seen to affect individuals from a gender and ethnicity perspective.

6.3.2 Time-based exclusion

What was repeatedly mentioned by participants was the long travel times between home and work, which was portrayed as the key problem. As described in the above section, the long

travel times are partly caused by long geographical distances, but also due to inadequate public transport and multiple changes. A common statement repeated throughout the interviews was the problem of the long waiting time on the bus between the commuter station and the workplace, and vice versa depending on whether they were going to or from work. This was described by all interviewees as affecting their family and leisure time and everyday life. One of the workers describes how, when they finish at 21:00, staff have to wait a long time for the bus to even start the journey home by commuter train: “If I miss this bus, I have to wait about 30 minutes. [...] In winter we wait outside for almost 30 minutes” (Worker 11). The quote highlights how the unavoidable travel burdens staff even after the end of the shift. One of the other workers describes how transportation disadvantages disrupt daily life, and how recovery and health unavoidably become a secondary priority between shifts:

> And if I miss the 21.07 bus, I have to wait until quarter to ten. I'll be here for almost an hour. Then I will be home at eleven/half past twelve. And if I work a day shift the following day, it will be very difficult for me. If I finish at 21.00 and the next day I start at 07.00, it will be hard. The body does not rest. I usually only sleep five or six hours. (Worker, 7)

The quote highlights what Church et al (2000) describe as time-based exclusion, where long travel times limit everyday life and the activities that come with it. The quotation highlights the fundamental importance of the transport system for the individual to move, and thus participate in society (Geurs and van Wee, 2004; Allen and Farber, 2020; Wang et al., 2019) In light of the inaccessibility expressed by the interviewee, the importance of public transport and the transport system as a facilitator of accessibility is reinforced (van Wee, 2016). Nevertheless, the reality described reveals a form of social injustice (Dempsey et al. (2011), where the well-being of the individual suffers at the expense of transportation disadvantage. It should be emphasized that several of the interviewees express the same problem and have similar experiences. Seen from the theory of transport-related social exclusion, Allen and Farber (2020) as well as Lucas (2012) and Church et al. (2000) argue that social exclusion arises as a result of the interaction of individual and social factors. In these cases, as described by the interviewees, the transport disadvantage contributes to other social deprivations that reinforce vulnerability and inequality - resulting in social exclusion.

6.4 In what ways can DRT improve accessibility for workers employed in an area with low accessibility?

I interviewed the workers after they had tested the service for just over three weeks. Based on their accounts, four themes emerged that all interviewees continuously returned to. These themes were *time*, *reliability*, *security*, and *spontaneity*. In this section I will present the results of the data collection based on these four themes.

6.3.1 Time

All interviewed workers had a positive experience of the DRT service. Against the background of the poor accessibility described in the previous section, where many experienced long travel times in their journeys to and from work, they all reported that they could save time. How much time they saved daily depended, naturally, on how far from work they lived. Table 5 below presents a summary of the workers' estimates of how much time they saved per single trip.

Interviewee	Time saved (one way)

Interviewee 1	approx. 30 minutes
Interviewee 2	approx. 10-20 minutes
Interviewee 3	approx. 30 minutes
Interviewee 4	approx. 45-60 minutes
Interviewee 5	approx. 30-40 minutes
Interviewee 6	approx. 20 minutes
Interviewee 7	approx. 30 minutes
Interviewee 8	approx. 20 minutes
Interviewee 9	Unable to estimate
Interviewee 10	approx. 15 minutes
Interviewee 11	approx. 30 minutes

Table 5. *Workers' estimate of time saved per single trip*.

In general, it can be analyzed that the more changes they had from the beginning, the more time they save in comparison to the length of the original trip. The majority of respondents are able to save more than 40 minutes of travel time per day by using the DRT service. More than half of the interviewees are able to save more than one hour daily. Several interviewees describe how this frees up time especially in the mornings and evenings. They describe how they can sleep longer and feel they have more free time in the evenings and between shifts. Thus, it can be concluded that the DRT service counteracts time-based exclusion (Church et al., 2000), by reducing travel time for workers and increasing leisure time. In addition to viewing accessibility as an objective measure of time and distance (Olsson et al., 2021), the subjective experience, i.e., the perceived accessibility, can be regarded as improved based on the workers' accounts (Lättman et al., 2016).

6.3.2 Stress and reliability

A common reflection was that daily commuting was associated with stress. This was particularly evident in the interviews where a common concern for all workers was about traveling to work. The stress involved concerns about being late, the long journeys, or getting home on time. When workers were asked how they perceive the DRT service, the initial response was that they experienced reduced stress. Worker 4 reflects on the Mistra SAMS DRT service in relation to the regular bus:

> I don't feel stressed anymore. For example, sometimes I thought if the bus is coming or not? What time is it coming? Will I make it or won't I make it? But now I don't feel stressed. I know what time it will come, which I have booked. I know what time. I feel that it works really well. (Worker 4)

This quote reflects the uncertainties that many of the interviewees are facing in their everyday journeys to work. Eight of the eleven interviewees explicitly describe how the DRT service has reduced their stress and/or made them feel calmer in their everyday journeys, while the other three implies it. It is evident that they feel a sense of reliability with the DRT service, something they do not feel with the regular bus service in the area. The reliability is based on a sense of predictability, i.e., they know that the shuttle will be there and when it will be there. As Lättman et al. (2016) argue, perceived accessibility is about the individual's subjective experiences. The factors that enable or hinder the individual's perceived accessibility should form the focus of the transport system's measures (Lättman et al., 2016). Based on the results, it can be concluded that reliability and predictability is a crucial factor for individuals' perceived accessibility. Just as it is possible to conclude that the reliability of regular bus services is lacking, it is also possible to conclude that the DRT service contributes to the

reliability required in the area. Thus, in addition to the fact that the bus service in this area should be the focus of an evaluation of its functionality, this demonstrates the potential of the DRT concept. It also demonstrates the value of accessible transport for well-being (Golub and Martens, 2014).

6.3.3 Safety

Another recurring theme was the issue of safety. When the interviewees were asked "How do you experience the DRT service?" several of them initially mentioned that they felt safe with the journey. Although they did not explicitly state that they felt unsafe with the regular bus service, safety was mentioned as one of the values of the DRT service.

> “It's nice. I don't know, I feel safe. Special. For example, if the others don't book and I'm alone booking - they come. They don't think "now only one person has booked". They come anyway.” (Worker 4)

> “It is a safe journey. Plus, it stops outside of work directly, so that's nice.” (Worker 2)

> “[...] and you feel safe. Sometimes it's other colleagues who go, and you know your colleagues, so you feel safe.” (Worker 3)

The above quotes show how the DRT service is perceived as safe by the workers. At the same time, they highlight different perspectives that they value in relation to security. While Worker 3 feels that the presence of other colleagues adds to the safety of the service, Worker 4 points out that there is safety in being able to rely on the shuttle as a lone traveler. Security is an important aspect of travel. Fear-based exclusion is one of the Church et al. (2000) factors that can contribute to transport-related social exclusion. The perception of insecurity in public places contributes to refraining from traveling. Insecurity thus contributes to transportation disadvantage and consequently exclusion. Church et al. (2000) argue that perceptions of insecurity create exclusion based on differences in individuals' social characteristics and contribute to how public places and transport are used. Gil Solá et al. (2020) argue that accessibility barriers related to fear and insecurity often affect women and children or other already vulnerable groups. In this case, the respondents who emphasize the security perspective are all women. Nevertheless, the results from the interviews indicate that DRT enhances the feeling of safety in traveling. Thus, the perceived accessibility can be considered to benefit from using the DRT service in relation to public transport.

6.3.4 Spontaneity

Finally, a recurring theme was spontaneity. As previously established, a DRT service can have different designs (Berg, 2017). The Mistra SAMS DRT service has been designed with adaptation to the businesses' work schedule, opening and closing times (See chapter 3.2.3). This has meant that the service needs to be booked with 24 hours' notice and spontaneous travel is not possible. A recurring reflection made by all interviewees was that this was too long in advance. Most respondents considered it a barrier to have to book one day in advance. It was seen as a problem not to be able to book work trips with the DRT service more spontaneously. Several interviewees emphasized how it becomes problematic if you forget to book, and that you usually need to book two days earlier if you start work very early in the morning.

> For example, if I am going to work on Saturday at 7:00 am, on Friday I will not order at 7:00 am because I am sleeping. I will want to order at 10:00 or 11:00. That's the problem. (Worker 10).

> Yesterday I finished at 21:00, and I had forgotten to book. But I arrived with it in the morning, but I should have booked it in the evening as well. So that's the only thing that's a bit difficult. A little shorter time would be better, because sometimes you miss or forget, and at the last minute it's not possible. The time for booking is already closed, then I can't do anything. (Worker 8)

These are two of a number of examples that show the staff's problems with booking a day in advance. Several also said that it is not uncommon for there to be changes in the schedule, or for staff to be called in. Therefore, it becomes impossible to use the service in these cases, as it usually happens at short notice.

> What I would like to get better is to make an appointment 24 hours before... Sometimes, if there is a shortage of staff, they call and say "Can you work?" and then we can't book after 24 hours. (Worker 6)

The results show that the service has shortcomings as it only takes into account planned trips. Accessibility for workers remains unchanged in terms of spontaneous needs. However, some had aligned their bookings with their schedules for the coming month and booked all trips in advance accordingly. This can be identified as a feature of the transport service design that constitutes a barrier for the individuals to travel. Although the evidence from the study supports that the DRT service has made traveling to work easier for participants, it identifies a barrier that nevertheless complicates everyday travel. Thus, while there is potential in the flexible attributes of DRT services (Thao et al., 2023), it is important to note that the degree of flexibility can be determined by the design of the service (Berg, 2017; Dytckov et al., 2022). Therefore, it can be concluded that the design of the service is crucial for the degree of accessibility experienced by the citizen.

After the visit, after saying goodbye and thanking the last participant, I come out into the afternoon sun again. All impressions have created a better understanding of the workers' perceived accessibility. On the way back, I think that I should take the bus. When I am halfway to the bus stop, I see the bus pass me by. I think back to the interviews and imagine if I was on my way from work after finishing late at night, it was snowing and I would have to wait for 45 minutes, and I knew that my family would have to wait, and my sleep would suffer.

7 Discussion

In this chapter I will discuss the results of the study from the two perspectives. Since the study has been structured to study accessibility from two perspectives, those of planners and individuals, there are several aspects that interact, overlap, as well as differ. I have identified and thematized these aspects in four sections, around which I have built the discussion chapter. These themes are: Perspectives on accessibility, DRT in suburban environments, Reliability and spontaneity, and Equity.

The first theme "Perspectives on accessibility" is used to discuss the results of the interpretation of accessibility by the municipal planners in relation to the perceived accessibility of individuals. The second theme, "DRT in suburban environments", discusses the value of DRT in a suburban context from the two different perspectives. The third theme uses the results to discuss issues of reliability and spontaneity, which were prominent in the results of both the planners and the workers. Finally, equity is a theme that emerged in relation to the concept of accessibility as well as DRT.

7.1 Perspectives on accessibility

Although there is a strong focus on citizens when planners interpret the concept of accessibility, the interviews show that it was perhaps easier to identify accessibility by characterizing inaccessibility. It is possible to conclude that from the strategic urban planners' perspective, rural areas and sparsely populated areas are characterized as the most inaccessible areas. The reason why these areas are characterized as inaccessible is due to long geographical distances, lack of transport facilities, inadequate infrastructure, and lack of basic social functions. At the same time, some of the same factors were raised from the individuals' perspective. The perceived inaccessibility was described in terms of long geographical distances between home and work and inadequate transportation services (including multiple changes) that make everyday life difficult. Nevertheless, a distinction can be made between the strategic urban planners' perspective and the individuals perspective. To understand the strategic planners, rural areas and new development areas are the most inaccessible, where the common factor can essentially be attributed to the lack of public transport. At the same time, from understanding the participating workers (individuals), they have de facto access to means of transportation, but it is the long distances and many changes that make them experience inaccessibility. All the workers lived in other surrounding municipalities or the same one they worked in, and no one reported living in rural areas or in new settlements. Nevertheless, they experienced inaccessibility.

This raises the question of whether the planning perspective of accessibility needs to be nuanced or shifted in its focus. There was an obvious distinction between how the planners viewed accessibility compared to individuals. It can thus be concluded that the perspectives differ. The municipalities' strategies and working methods for planning for accessibility were either through greater mobility or proximity to basic functions, often seen from "objective" measures. Accessibility was considered to be achieved by setting targets for distances to key functions, or by prioritizing modes of transport. On the other hand, individuals experienced low accessibility due to the length of trips and changes in modes of transport. Thus, there is a discrepancy between how the planners interpret accessibility and individuals' perceived accessibility. Accessibility has often historically been associated with "objective" measures of travel time and distance (Lättman et al., 2016; Olsson et al., 2021). For the municipalities studied, this also seems to be true in current planning practice. However, there are arguments that accessibility is best captured from the individuals' own perspectives, which constitute

perceived accessibility (Olsson et al., 2021). The results show that the planners perspectives on accessibility, i.e., objective measures, principles of proximity, and hierarchies of means of transport, differ from individuals' perspectives on what constitutes accessibility.

7.2 DRT in suburban environments

All planners recognized the potential of DRT as a concept based on citizens' accessibility. They understood how DRT could contribute to faster travel and greater flexibility. The greatest potential was considered to be in increasing accessibility for people living in rural environments, i.e., the areas the planners regarded as most inaccessible. In addition to confirming previous research that suggests that rural settings are the context where DRT has the greatest potential (Schlüter et al., 2021; Thao et al., 2021), it was notable that no one initially mentioned that it could work as an option in suburban or urban settings. In fact, the results show that some of the planners believed that there was no clear purpose for DRT in suburban settings. Nevertheless, the interviews with workers show that DRT has a real potential to improve accessibility in a suburban municipality within a metropolitan region. All workers felt that they saved a lot of time in their daily commute by using DRT instead of the regular bus for a part of a whole trip. While the person who saved the least amount of time still saved half an hour a day, there were several who could save up to one to two hours.

In addition, it should be noted that the planners mainly considered DRT to have potential in connecting trips, and rather serve as a complement to regular public transport. This is supported by the previous literature suggesting that DRT has the greatest potential for connecting trips in remote areas that cannot accommodate high-frequency transport solutions (Schlüter et al., 2021; Thao et al., 2021; Calvert et al., 2022). It is also such a service that is examined in this study, where Mistra SAMS DRT service has been implemented in an area where public transport is lacking due to low frequency of bus services. Thus, the results of the study show that DRT has a value and not least a purpose in suburban environments. The study also revealed a potential of DRT for work trips, which was not mentioned by any of the planners. The opening and working hours of many workplaces extend beyond the normative office hours of 8.00-17.00. A crucial factor why workers experienced poor accessibility was their working hours in combination with the frequency and schedule of public transport. In addition, none of the workers interviewed had a driving license. Thus, it is possible to argue whether regular public transport is best suited for all business sectors, or whether DRT could be a more suitable solution for businesses where it is common for workers to work inconvenient hours. This opens up the question of responsibilities and employment benefits. As well as the regional public transport authorities having a responsibility to make public transport accessible to all (2010:1065), it is also possible to discuss whether such a service could be subsidized by the employer (see e.g., Calvert et al., 2022). Some organizations offer employment benefits, and this could be considered as such. This is particularly relevant for businesses that have difficulty recruiting or retaining staff due to inconvenient working hours or unfavorable travel conditions.

7.3 Reliability and spontaneity

The results of this study particularly highlight the importance of reliability in public transport. The value of reliability is clearly emphasized by both planners and individuals, especially in relation to DRT. While several of the strategic planners used the reliability of traditional public transport as an argument to question the purpose of DRT services, the workers instead described how they felt that DRT services were more reliable than regular public transport. The strategic planners highlighted how traditional public transport has a predictability that

maintains its function and attractiveness, and consequently its value. The planners argued that DRT as a concept entailed too many uncertainties, and that the concept needed to be carefully designed to be successful. In contrast, the results from the interviews with all workers who tested Mistra SAMS DRT service showed that they perceived traditional public transport as more uncertain and less reliable than DRT. A recurring reflection among workers was that their everyday commute was associated with stress. The traditional means of transportation were considered to contain too many elements, making journeys long and cumbersome. It was common that the stress was caused by multiple uncertainties in public transport and that this consequently contributed to late arrivals at work. Eight of the eleven workers interviewed explicitly stated how their stress had been reduced because of the implementation of the DRT service.

Hence, a gap can be discerned between the planners' perceptions and the individuals' experiences. Planners argued that the value of public transport is its reliability, i.e., if public transport is scheduled to run at a certain time, it will run at that time. At the same time, the interviews with the workers show that this is not the reality for the interviewed participants. The connecting trips they had to make daily contributed to delays or the bus not arriving at all. This shows a distinction between the planners' perception of public transport as reliable, in contrast to the individual perception where public transport is rather seen as unreliable and affecting accessibility. The interviews with the planners reflected a notion of how public transport should, or perhaps does, function on a general level. Whereas in the interviews with the individuals, a picture was given of how they actually experience it. This supports the theoretical argument that planning for accessibility is based on objective measures and beliefs (Lättman et al., 2016) and that planning needs to consider accessibility through individuals' subjective perceptions (Olsson et al., 2021).

However, there was also an argument of having to pre-book travel, which was portrayed as a barrier. Several of the planners felt that the design of a DRT service is crucial to its function, and two of the planners (Official 3 and 4) felt that this would be an obstacle to the function and attractiveness of the DRT service. This argument was supported by all the workers who tested the Mistra SAMS DRT service. The pre-ordering of trips 24 hours in advance was seen as a barrier that in several cases was missed or forgotten. Several workers also described how it was common to be spontaneously called into work, making travel with the DRT service impossible. This opens up the possibility of questioning whether DRT as a service is actually more flexible than traditional public transport as claimed by Dytckov et al (2022). Similarly, it can be questioned whether DRT services are more adaptable to people's needs as argued by Berg (2017) and Kaufman et al. (2021). People's needs can in many cases arise spontaneously, as evidenced by the accounts of the workers. Not least, these needs can be linked to active participation in society, such as going to the workplace. Furthermore, it is also possible to discuss what exactly constitutes needs. According to Golub and Martens (2014), active participation in society can be linked not only to work or education, but also to general well-being. This raises the question of whether accessibility should be associated with necessary needs that can always be planned, or whether accessibility is rather the ability to feel spontaneous.

7.4 Equity

In the interviews with the urban planners, all recognized a potential for DRT to have value in increasing accessibility for certain groups. Although most initially saw a value in using the service as a social service for subgroups that are hindered in their accessibility due to physical, mental, or age-related disabilities, other perspectives were also raised. Many of the

planners felt that DRT had potential for people who do not have, or cannot, drive a car. None of the workers had a driving license. Having to rely on public transport for their daily commute was portrayed as a problem. All the workers experienced transport disadvantage (Currie et al., 2007; Lucas, 2012) which contributed to both geographical and time-related social exclusion (Church et al., 2000). The fact that the DRT service facilitated all the workers' commute and reduced their daily travel time indicates that DRT has value for a wider audience than just groups that are physically, mentally, or age impaired (Schlüter et al., 2021; Dytckov et al., 2022). The results thus support previous research that suggests that DRT has the potential for work travel (Calvert et al., 2022). Given that the planners initially described how DRTs would have potential in general terms e.g., by being implemented in rural areas, or towards traditionally inaccessible groups, it is interesting how the issue of equity was also raised. One of the planners reasoned that DRT may have potential where car ownership is unevenly distributed between different groups, and the perception was that car ownership is generally lower among women, foreign-born and younger or older people. As well as indicating that accessibility is affected by individual factors (Lucas, 2012) and unevenly distributed, this highlights the broader potential of DRT, that it can affect the accessibility of specific groups rather than seeing the potential from a general perspective.

The issue of safety was also discussed from the two perspectives. From the planning perspective, the design of the DRT service was highlighted as crucial to whether passengers would feel safe and thus use the service. This argument mainly stemmed from the intimacy that arises when strangers share small vehicles. Indeed, safety is a very important issue when it comes to transportation, something that was also shown in the interviews with the workers. Safety is a factor that can contribute to transport-related social exclusion according to (Church et al., 2000). According to Gil Solá et al. (2020), accessibility barriers related to fear often affect already vulnerable groups, such as women. Ten of the eleven workers interviewed were women and several of them initially and voluntarily raised the issue of safety when asked how they experienced the DRT service. Many of the workers considered that they felt safe both when traveling alone or in groups. The initial mention of feeling safe does not necessarily mean that they usually feel unsafe in their daily commute. However, it does indicate that they experienced a high level of safety which could be attributed to the design of the DRT service. Admittedly, they shared transportation with their own work colleagues, and thus this perspective needs further research. However, given the design of the service, aimed at work travel in a geographically limited area, the DRT service can be said to contribute to personal safety for the workers. Thus, it is a valid argument raised by the planners that the design can be crucial for safety issues, and this should be considered in future DRT services.

8 Conclusions

The purpose of this thesis has been to examine the concept of accessibility from two perspectives - strategic urban planners and individuals. It has also been to explore the potential of DRT, as well as its ability to increase accessibility for individuals commuting to work in an area with low accessibility. In this concluding chapter, I will return to the purpose and discuss the findings in relation to the research questions. I will finally make some recommendations for further research related to the topic of accessibility, and not least DRT.

How do urban planners in Botkyrka and Huddinge interpret the concept of accessibility in urban planning? How do they understand the role of DRT in enhancing accessibility?

The results of the study show that accessibility is a broad concept, where different principles and methods are used in planning at different levels. Accessibility is a concept that is present in planning by being included in the studied municipalities' objectives and strategies. Nevertheless, it is not always clear what it means in practice. All of the strategic planners interviewed saw that accessibility as a concept is about the spatial relationship between people and destinations. In terms of accessibility understood as the relationship between people and destinations, many argued that accessibility can be considered as people's ability to get to activities, destinations or functions that are important in their daily lives. However, several of them also interpreted the concept as being about accessibility from a disability perspective. Thus, many of the planners interpreted accessibility as being fundamentally based on social perspectives, where the focus is on citizens.

The broad nature of the concept was identified to lie in the subsequent issues and trade-offs between different interests rather than the overall goal. The urban planners' interpretations of accessibility were generally characterized by objective measures of accessibility, such as distance and time. It was expressed in terms of local objectives and practices through mobility and proximity. At the same time, the efficiency of the transport system was central to the statements. Unlike the early planning objectives of incorporating the car into the built environment, today's planning practice tends to prioritize walking, cycling, and public transport. While one of the planners described how the purpose of planning for accessibility was to take traffic shares at the expense of the car, other planners described how they worked with different (prioritized) traffic concepts to increase accessibility in urban spaces.

While more general answers were given for how the planners interpreted accessibility, the results show that inaccessibility could be characterized more specifically. Planners characterized inaccessible places as rural and sparsely populated areas. However, these locations were considered to be highly accessible by car. Following the objectives of the two municipalities, rural areas can be considered problematic from an accessibility point of view as these areas are more difficult to plan for good accessibility by means of transport other than the car. Apart from the fact that this approach is in line with the local objectives of both municipalities, this shows that accessibility as a concept is interpreted by planners as the ability of citizens to get to important destinations, functions, and activities in everyday life without the car.

All the interviewed planners saw the value of DRT in terms of citizens' accessibility. The values seen by the interviewees were mainly associated with faster travel and the freedom and flexibility of individuals. Many felt that the greatest potential was in improving accessibility for residents living in rural or sparsely populated areas, i.e., the areas they identified as most

inaccessible. At the same time, the results show that issues related to the design of the DRT service such as reliability, safety, and spontaneity, were consequently considered to influence the attractiveness of the service and were thus crucial. Initially, several planners saw risks that the service would not be attractive enough to operate in suburban areas. At the same time, the same planners saw risks that the implementation of such a service would undermine the regular bus routes, thus depleting each other. Thus, there were many uncertainties associated with DRT in how planners understood and interpreted that it could operate in areas closer to regional centers.

However, all interviewed planners saw that DRT could increase accessibility for certain subgroups in the community. While several saw that it could have value for those who were disabled physically, by age, or mentally, several also suggested that it would have value for people without a driver's license or access to a car. Related to this, an equality perspective was raised where potential was seen against the fact that car ownership is unevenly distributed between different groups. Overall, DRT was understood to have a potential to increase accessibility by targeting areas or groups in society. Nevertheless, this potential was reserved and weighed against the risks and problems that the implementation of such services launched in parallel with regular bus lines, targeting the general public, and/or closer to regional centers.

How is accessibility perceived by a group of low-skilled workers employed in an area with low public transport accessibility? In what ways can DRT improve accessibility for this group?

Answering this question requires an understanding of how the workers involved in the study perceive their accessibility in their daily lives. In the thesis, accessibility is understood as the relationship between individual citizens and important destinations, and their ability to get to them. Based on this notion, the thesis shows that the low-skilled workers experience extensive problems and several barriers associated with everyday travel that contribute to low accessibility. One of the main barriers could be attributed to long geographical distances between home and work combined with inadequate public transport. In particular, it was the area between the commuter train station and the workplace where transportation did not work, mainly during early mornings, late evenings, and weekends. The workers felt that journeys were time-consuming and characterized by long waiting times. Thus, they expressed transportation disadvantages that contributed to temporal and geographical exclusion. The perceived low accessibility caused by the transport disadvantage affected family life, leisure time and, not least, health.

The results showed that all of the workers had positive experiences of the DRT service. Given the perceived problems expressed by the workers, the implementation of the DRT service improved accessibility from several perspectives. Based on temporal measures, it can be concluded that all workers reduced the time they spent on their daily commute - thus saving time. While some could save between 30-40 minutes per day, most could save up to an hour. A few could save even more, and in extreme cases could save up to 1.5-2 hours during weekends. It can also be concluded that the perceived accessibility increased when using the DRT service. Individuals perceived the DRT service as reliable, and stress was reduced or in some cases eliminated. Furthermore, the service was repeatedly described from the perspective of safety. Several of the interviewed individuals initially mentioned that they felt safe using the service. While some mentioned that it felt safe to rely on the DRT service as a lone passenger, others felt that the presence of colleagues added to the safety. The perception

of safety was presented as contributing to the use and attractiveness of the DRT service compared to the traditional bus. Overall, in addition to saving time, the feeling of increased reliability and safety was found to contribute to increased accessibility for individuals. Thus, the DRT service contributed to improved accessibility for the people working in the studied area where public transport was inadequate and accessibility was found to be low.

How do perceptions of accessibility and the potential of DRT differ between strategic planners and individuals?

In relation to the results of this thesis, I would like to emphasize the discrepancy between the interviewed planners' interpretations of accessibility compared to the actual experiences of individuals. This master's thesis has demonstrated how these perspectives differ. Both planners and workers have reasoned on how factors such as time, geographical distance, reliability, and safety affect accessibility, but from different perspectives. All the strategic urban planners talk about and address shortcomings and problems in planning for accessibility. However, work travel is not mentioned as problematic in terms of reliability and safety. In fact, none of the municipal officials raised it, especially for people who commute and work inconvenient hours. At the same time, the interviews with the workers show that they experience public transport as unreliable during certain parts of the journey, which makes the daily commute a burden characterized by stress. The study also reveals a perception among the interviewed planners that the most inaccessible areas are rural areas. In contrast, the interviews with the workers in the study show that inaccessibility is experienced also in suburban areas that by objective standards (should) have good transport links. One conclusion is thus that there is a discrepancy between how the planners in the study interpret accessibility in comparison with how individuals experience it. The conclusion is also that personal factors such as finances, working hours, skills, and conditions affect individuals' accessibility in the spatial environment.

The results also show how planners' interpretations and individuals' experiences differ on the potential of DRT. Both groups addressed factors such as reliability and safety. While the planners expressed that there could be uncertainties related to factors such as reliability and safety that could constitute barriers, the workers said that they perceived DRT as more reliable than the regular bus and that they felt safe when using the service. However, both groups saw pre-booking and spontaneous travel as a barrier. One distinction between planners' understanding and workers' experiences was the purpose and function of DRT in suburban environments. Several of the planners expressed doubts about the potential of DRT to function closer to regional centers, in suburban or urban areas. Some even questioned the purpose of DRTs in these contexts. At the same time, the interviews with workers show that despite living in the surrounding municipalities of the Stockholm metropolitan region, they experienced inaccessibility to their workplace. For the workers, DRT increased accessibility from several perspectives, not least time saving and uncertainties that contributed to stress. While several of the planners expressed how DRT could have the potential for certain groups and areas, none of them raised work travel as a problem. At the same time, the interviews with workers showed that DRT could contribute to greater accessibility from several perspectives in these cases. One conclusion is thus that there is potential for DRT in suburban areas, where commuting for people working inconvenient hours is one example. To return to previous conclusions, individuals' accessibility is affected by personal conditions. It is possible to conclude that the potential of DRT can be nuanced and seen to contribute to higher accessibility for people who, due to personal circumstances, experience a transport disadvantage and regular public transport is not enough.

8.1 Further research

In general, it is apparent that DRT in suburban settings would need further study. In my recommendations for further research, there are some main aspects that I think would be particularly interesting.

First, I think it would be valuable to continue doing research on the understanding and interpretation of the concept of accessibility from a planning perspective compared to a citizen's perspective. Given the regional public transport authorities' mandate over public transport in Sweden, it would be valuable to explore the regional perspective on accessibility in comparison to the municipal and individual perspective.

Secondly, much of the previous literature has seen the potential of DRT as a social service or as a complement in rural areas (Schlüter et al., 2021). Research has been more sparse on its potential to target transportation disadvantaged groups (Dytckov et al., 2022). Thus, I see a great value in further research that focuses on how DRT could be aimed at citizens who are at a transportation disadvantage and/or at risk of transportation-related social exclusion. Furthermore, transport-related social exclusion is an unexplored phenomenon in the Swedish context (Henriksson, 2019). Thus, I see a value in future research investigating this further. It would be valuable if the research in a practical sense examines how factors of the person, such as finances, working hours, and other conditions affect/are in relation to transportation opportunities and active participation in society.

Third, this study has, like the previous research, found that DRT can serve as a complement to regular public transport (see e.g., Dytckov et al., 2022). Thus, I see a value that future research could explore if/and for what purpose DRT could complement public transport in suburban areas. At the same time, it would be interesting to investigate whether, and if so how, DRT could have potential in new development areas as a solution to the "chicken or the egg" question, i.e., the lack of public transport in new developments due to low population base, which contributes to car dependency. Whether it could contribute to a lower car dependency in comparison to other new development areas, and what effects this in turn would generate.

Finally, I believe that more research needs to be done on the design of DRT services - what factors make DRT attractive, unattractive, reliable, or unreliable. Related to this, I believe that important issues that should be raised is the question of safety when sharing smaller vehicles with unknown people, as highlighted in this study. Research on geographical and social context related to DRT services design thus needs to be explored.

Overall, there are several different perspectives that this thesis highlights that are both interesting, relevant, and important for further research. Both regarding transport-related social exclusion, new mobility solutions, planning practices, and different perspectives on accessibility are important issues that need to be addressed and explored more in future research.

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Appendices

Appendix 1

Interview guide
Strategic urban planners and municipal officials

Introductory questions

- Can you start by briefly describing your professional role and what it entails?
    - How long have you been working as a ___?
- How do you view the concept of accessibility in urban planning?
    - What do you think of when you hear the term?

Main questions

- Based on your experience and professional role, how do you approach accessibility in planning? e.g. in the built environment, traffic planning and area development.
- Does your municipality have any local objectives that relate specifically to the concept of accessibility in planning and the physical environment? How are these expressed?
    - What strategy(ies) are used to achieve these objectives?
- Are there any areas in the municipality where a lack of physical connections between places contributes to inaccessibility?
    - What characterizes such a place? How is this handled in planning?
- Have you worked on any specific project where the issue of individuals' accessibility was more prominent?
- What would you say are the main aims/objectives when planning for accessibility?
    - How does planning for accessibility relate to perspectives such as social sustainability or equality?
- In your professional role, can you reflect on how accessibility can take different forms? In terms of proximity, mobility or digital proximity?
    - Is this something you work with? How?
- Are there any functions in society that you prioritize in your planning that you plan through geographical proximity while other functions are considered to be located within commuting distance? If so, what are these functions?
- Are there conflicts of objectives related to the concept of accessibility that you encounter in your planning? How are these managed? Do you have any examples?
- Do you perceive accessibility as a new concept, or something you have "always worked on"?
- Why is this the case? (E.g. why has it emerged now?)

Questions about Demand Responsive Transport

- What is your perception of demand-responsive public transport?
    - What do you see as the benefits of such a service?
    - Is it something you have used before?
- - Do you see a value in enhanced/demand-driven public transport?
    - What is the value/values?
    - Would this be a solution that you see would have a value for the municipality from the perspective of accessibility and planning?
    - In what way?
- Do you think that demand-driven public transport could have potential in some areas of the municipality? Which ones? / How come?
    - Are there any specific areas where you see this would be particularly valuable?
- Do you think this could increase accessibility for certain groups in the municipality?
    - If yes: In what way? Which groups do you think would benefit most from this?
- Do you see any potential for such a solution in terms of social sustainability in municipalities/municipality?
- Could demand-driven public transport influence traffic planning in the municipality/generally in the long term? What values could it fulfill?
- Do you see any risk with such a solution in the municipality?
- Do you see that demand-driven public transport could play a different role in a suburban municipality than in a rural area, for example? (Or in regional centers)

Appendix 2

Interview guide
Low-skilled workers testing Demand Responsive Transport

Introductory questions

- What is your name?
- How old are you?
- What are your working hours?
- Do you work full-time, part-time or hours?
- Where do you live?
- Do you have a driving license?

Main questions

Perceived accessibility - Before testing the DRT service

- How do you usually travel to work?
- Which mode of transport do you usually use to go to work?
    - How often do you have to change modes of transport on your way to work? (One way)
- How long does it usually take to get to and from work?
- How often do you carpool to work with someone? (On average over a month)
- Is there anything in your daily journey that is not working well?
    - What are the main obstacles?
    - Would you rather be closer to work or have good commuting (travel)?
- Is there anything in your daily journey that works well?

Perceived accessibility - When using the DRT service

- How do you feel this service works?
- What is it about this service that you think is working well/not working?
- Is there anything that you think works well with this service?
  For example, the times it runs, the app, finding the vehicle, where it stops, the drivers.
- Is there anything about this service that you think could be improved?
  Something that does not work well, or that could work better.
- How do you feel about having to book your trip 24 hours in advance?
- Has this service made it easier to travel to work?
    - If yes, in what way?
    - If no: Could you elaborate?
- Do you save time by using this service?
    - If yes: How much time do you estimate you save each day?
- If this service were included in your commuter card, would you continue to use the service?
- If this service were included in your commuter card at a cost per month, would you continue to use the service?

Concluding questions

- Will you continue to use this service?
- Is there anything else you would like to add?