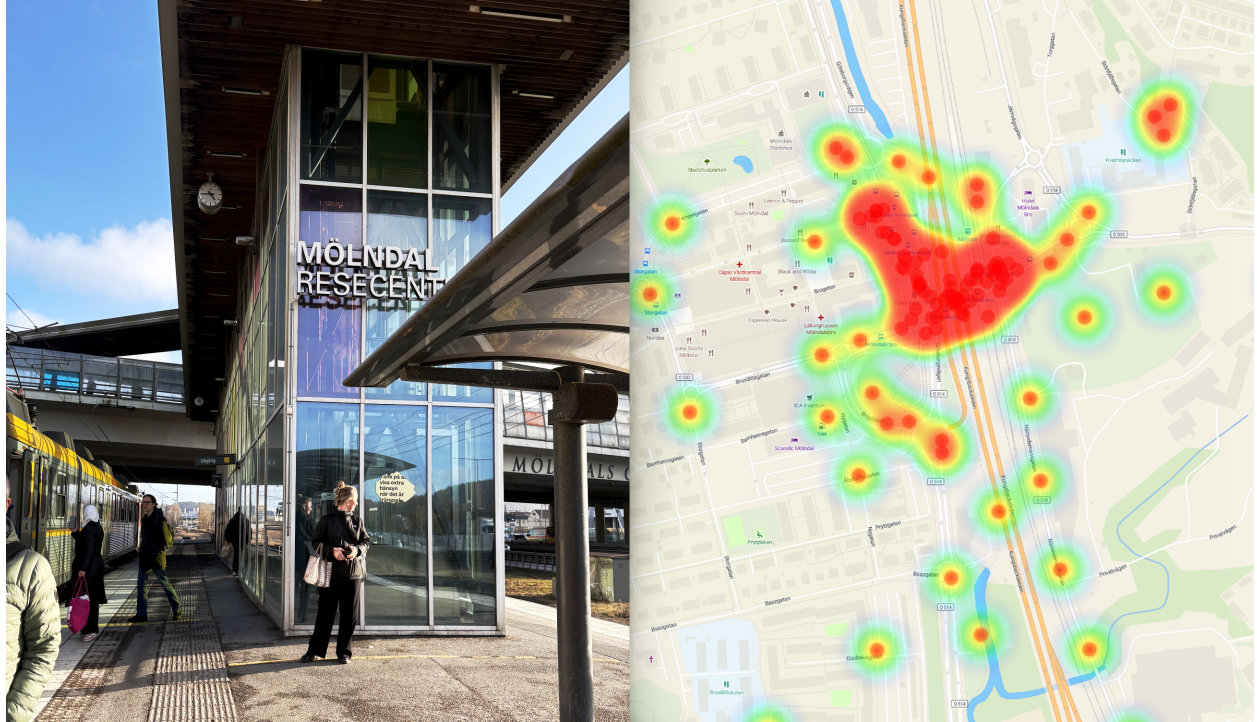




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Walkability Beyond the Platform

Enhancing Multidisciplinary Planning Processes for Pedestrian Networks Around Station Areas Through Expert Insights and Resident Perspectives

Master's thesis in Infrastructural and Environmental Engineering and Design and Construction Project Management

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CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2026

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MASTER'S THESIS ACEX30

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for Pedestrian Networks Around Station Areas Through Expert Insights and
Resident Perspectives

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Cover: Photograph of Mölndal station (on the left). Heatmap of experienced hinders
around Mölndal station, generated from Maptionnaire (on the right).

Department of Architecture and Civil Engineering
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Abstract

Walking plays a central role in access to public transport, yet barriers in the built environment continue to limit pedestrian accessibility to station areas. While previous research has identified factors influencing walkability, less attention has been given to how these factors shape pedestrian behavior in the context of public transport station areas. This study examines walkability and barrier effects in pedestrian access to public transport station areas, with a focus on Mölndal station. The aim is to understand which factors influence individuals' willingness to walk to stations and to identify how multidisciplinary planning processes and governance can be improved to enhance walkability and address barriers. A mixed-method approach was applied. Data were collected through expert interviews with planners from various organizations, a web-based survey targeting travelers in the area, site audits, and spatial mapping of perceived hindrances. The survey data were further analyzed using binomial logistic regression to identify relationships between perceived walking conditions and barrier effects. The result reveals a mismatch between planners' and users' perceptions of walkability. While professionals emphasize directness in pedestrian networks, users place greater importance on short distances and the quality of walking paths. Regression analysis shows that factors such as good lighting reduce the probability of avoiding routes or choosing alternative stations. The findings also highlight spatial differences in barrier types and demonstrate that walkability is shaped by the interaction between environmental conditions and individual abilities. From a governance perspective, the study identifies fragmented responsibilities and insufficient integration of user perspectives as key challenges in multidisciplinary planning processes. These issues can result in suboptimal solutions and discontinuities in the pedestrian environment. The study concludes that improving walkability requires a holistic and user-centered planning approach that combines quantitative and qualitative data. Barrier effects should be understood as multidimensional and context-dependent, emerging from the interaction of infrastructure, perception, and human capabilities. At the same time, the pedestrian journey needs to be treated as a seamless whole, which requires improved collaboration across actors to ensure continuous and well-integrated routes, where the interfaces become unnoticeable to pedestrians. Strengthened collaboration, clearer responsibility distribution, and increased use of qualitative user data are essential for creating accessible and coherent pedestrian networks around station areas.

Keywords: walkability, Mölndal station, pedestrian accessibility, public transport stations, infrastructural barriers, barrier effects, governance, multidisciplinary planning, walking environment, binomial logistic regression analysis

Acknowledgements

This master's thesis was conducted at the Department of Architecture and Civil Engineering at Chalmers University of Technology in Sweden, in cooperation with WSP. We would like to express our sincere gratitude to our supervisors, Annie Lindfors Ljuhs at WSP and Job van Eldijk at Chalmers, for their guidance, commitment, and constructive feedback throughout the process. Their shared interest in pedestrian movement and barrier effects played a central role in shaping the scope and direction of this study.

We would also like to thank the other colleagues at WSP who contributed to this project through engaging discussions, methodological support, and valuable feedback. Furthermore, we are very grateful to all individuals who participated in interviews and to everyone who took the time to respond to our survey. Your insights and contributions have been essential in this research.

Klara Högberg & Johanna Sparlund, Gothenburg, May 2026

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1

Introduction

As accelerating climate change, environmental degradation, and growing social inequalities threaten both societal development and the Earth's ecological systems, cities around the world are growing at a rapid pace (United Nations, 2015). While these metropolitan areas expand, planners face the challenge of creating accessible, sustainable, and socially equitable mobility networks (van Eldijk et al., 2020). The United Nations Sustainable Development Goals (SDGs) address these challenges, with two goals in particular: Goal 11, to make cities and human settlements inclusive, safe, resilient, and sustainable, and goal 13, to take urgent action to combat climate change and its impact. In this context, public transportation plays a crucial role in sustainable city development, both ecologically, as it is an alternative to car-bound travel, and socially, as it mobilizes people (Västra Götalandsregionen et al., 2018).

However, rapid urbanization is placing increasing pressure on local and regional transport systems. Traditional, car-oriented development has fragmented urban environments, where highways and railways create barriers that reduce local accessibility within pedestrian networks (van Eldijk et al., 2020). These barriers can hinder access to facilities and workplaces, possibilities for urban expansion, and negatively affect both economic activity and public health (van Eldijk & Gil, 2020). However, the impact of a barrier is not only determined by the barrier itself, but also the characteristics of the routes in the close surroundings, and the road to and from it can therefore reinforce the barrier effect. Accordingly, minimizing both physical and perceived barrier effects has been identified as a key quality goal in regional planning frameworks such as Målbild Koll2035 (Västra Götalandsregionen et al., 2018).

In recent years, walking has attracted increasing attention in both research and policy, driven by contemporary urban challenges (Lindelöw, 2016). Despite this growing interest, pedestrian planning is still often given lower priority than motorized transport, with comparatively less developed knowledge and planning tools. Although walking is a fundamental component of everyday mobility, it has historically received far less attention than motorized transport (Lo, 2009). In this context, walkability has emerged as a key concept for understanding how well the built environment supports pedestrian movement.

Walking constitutes a fundamental component of public transport journeys, with the vast majority of users walking to and from stations as part of their trip (UNECE, 2024). In fact, more than 90 percent of people using public transport walk

from their starting point, and as much as 98 percent walk from the public transport to their final destination.

Despite this close relationship, walking and public transport are still often treated as separate components in planning and research, overlooking their interdependence within the same journey. In line with this, the connection between walking as a transport mode and access to public transport has become vital. Differences in travel time between transport modes are an important factor affecting their competitiveness, and walking distance to public transport stops plays a central role in individuals' willingness to choose public transport over car travel (Tennøy et al., 2022). Studies also show that travelers perceive the waiting time or the time it takes to walk to the station twice as convenient as the time onboard (Kunskapssammanställning, n.d.). Therefore, it is important to plan and design accessible and effective walking networks around stations. Studying how pedestrians perceive their walking environment is an important step in order to make more people travel with public transport.

However, a gap still remains in the research regarding how walking distances are understood by planners and applied in practice. This motivates a closer examination of walking as a transport mode to station areas, where the design of pedestrian environments and presence of barrier effects significantly influence the accessibility of sustainable mobility choices. In planning practice, these conditions are shaped through complex processes involving multiple actors, disciplines, and decision-making levels. However, it is important to consider both experts' and users' perspectives to understand and address these challenges. Against this background, the thesis aims to examine how walkability and barrier effects influence pedestrian access to public transport areas and what is needed in the planning process to increase the walkability to station areas.

1.1 Aim and research questions

This study adopts two complementary perspectives: a user perspective and a governance and planning perspective. The user perspective focuses on the factors shaping walking behavior and attitudes. Additionally, the governance and planning perspective explores how these challenges can be addressed, and what types of knowledge, tools, and supporting material are needed to improve pedestrian networks and enhance accessibility and walkability in station areas.

To achieve the aim, the following research questions that the thesis will address are:

- Which factors influence travelers' choice to walk to public transport stations?
- What supporting material and approaches are needed for multidisciplinary stakeholders to handle barriers in pedestrian routes and enhance walkability to stations, given governance challenges?

1.2 Scope and limitations

The thesis focuses on pedestrian routes and walkability around Mölndal station as well as how barriers are perceived by pedestrians. The study aims to identify which factors influence pedestrians' choice of walking as a mode of travel to stations, in combination with how improved decision-making and planning can contribute to higher accessibility and a better walking experience. Mölndal station has been selected as a case study, and even though the results may be applicable for this site, the station is considered representative of similar mid-sized stations in Sweden.

Several limitations should be acknowledged. The study is limited to the perspective of pedestrians and does not address the accessibility aspects for other active transport modes, such as cycling. Furthermore, the study does not aim to evaluate all walkability issues in Gothenburg and Mölndal, nor to provide a full planning strategy for the city. Although the theory includes general walkability concepts, the case study approach imposes certain boundaries on the scope of the analysis. The study is therefore limited to examining accessibility and walkability on a local scale. In addition, the scope is restricted to the current pedestrian environment, meaning that future plans or proposed development are excluded. Economic and ecological aspects are also beyond the scope of this project.

1.3 Background

This chapter provides background information on the case study and contemporary planning practices, establishing the contextual foundation for the thesis. It includes a description of the ongoing project as well as an overview of how infrastructural planning processes are currently approached.

1.3.1 Case study: The Almedal - Mölndal railway project

Based on the focus of this thesis on walkability, barrier effects, and accessibility to public transport, the Almedal-Mölndal railway project has been selected as a relevant case study. The project is located within the Gothenburg metropolitan area and is geographically close, which enables a detailed understanding of local processes and contextual conditions.

The Almedal-Mölndal project represents a planning context in which multiple actors, disciplines, and levels of decision-making are involved. The highway, which divides Mölndal into an eastern and western part, constitutes a major infrastructure barrier in the area. While Mölndal station offers a wide range of public transport options and shopping services, it also reinforces the barrier magnitude further. The eastern and western sides of the station area are primarily connected by a bridge, Mölndals bro, which functions as a key pedestrian link, due to the tracks, highway, and level difference between the two sides. The Gothenburg railway network is currently undergoing a major expansion, not only through the grand infrastructure project Västlänken, but also with the addition of a new railway between Gothenburg and Borås (Trafikverket, 2025). This development is expected to significantly increase the number of travelers passing through both Gothenburg and Mölndal, placing Mölndal station at the center of this transformation.

Mölndal station is therefore a particularly relevant site of study, as the planned Gothenburg-Borås railway will include a stop there (Mölndals stad, 2026). Construction is planned to begin between 2029 and 2031 and will transform Mölndal Station into a major public transport hub, integrating rail, bus, tram, and metro bus services. Passenger forecasts indicate at least a doubling of daily public transport ridership, with train services expected to operate at a frequency of approximately one train every three minutes. Today, more than 5.500 people travel to and from Mölndal on a daily basis for study or work, and this is estimated to increase to 30.000 on an average day (Trafikverket, 2025). To accommodate this growth, the station area will be expanded, and the surrounding area will be affected. The number of tracks will be doubled from three to six in order to meet the increased traffic volume, and the station will therefore need to expand in the eastern direction. Such large-scale changes are likely to intensify pedestrian flows through the station area, making the quality of the walking environment and its connections to surrounding areas increasingly important.

Additionally, there is currently a new bridge being planned North of Mölndals bro that will connect the East side of E6 and E20 to Mölndals centrum (Trafikverket, 2025). There is also an already planned bridge south of Mölndals bro – which will become Forsåkerbro, a road bridge with a walking and biking path. These are being studied and planned by Mölndals stad.

Studying pedestrian accessibility at this stage – before redevelopment – provides a valuable baseline understanding of existing barriers and conditions. This makes Mölndal Station not only a relevant but also a well-timed case for exploring how

walkability can be considered and improved in the planning of station areas.

1.3.2 The contemporary multidisciplinary planning of station areas

The responsibilities of transport infrastructure developers are driven by two overarching objectives: enhancing accessibility, and ensuring that traffic safety, environmental conditions, and public health are maintained or strengthened (Antonson & Levin, 2020). However, the planning of a station area in Sweden is a complex process, involving several different actors with different responsibilities, expectations, and goals (Trafikverket, 2017). While the planning procedure varies between different projects, it is typically described as a process consisting of four main stages (Urban Futures, 2024):

1. Problem definition: Identifying central challenges and objectives. Such problems can be barrier effects, missing pedestrian links, or unclear navigation.
2. Planning: Developing collaborative solutions to the identified problems. A central task in the planning stage of station area development is designing effective transfer functions, where walking, cycling, public transport, and rail traffic are well coordinated.
3. Implementation: Addressing responsibility, financing, and executing construction.
4. Use and management: Operating and maintaining the station building and station area for long-term use, typically involving several actors such as the station building owner, the municipality, and Trafikverket, each responsible for different parts of the station environment.

The municipality has the central authority of coordination in the multidisciplinary planning, as its area of responsibility reaches beyond the platform – meaning the municipality also manages the planning of the remaining city and its infrastructure (Trafikverket, 2017). The Swedish Transport Administration, Trafikverket, is the national authority responsible for the long-term planning, development, and management of Sweden’s transport infrastructure, including railways and roads. In the planning of station areas, Trafikverket is responsible for the railway and its necessities – meaning the platform and its equipment, including connecting elements such as bridges and tunnels to the platform. While these are typically the two main collaborating actors in a station area project, other relevant actors manage public transportation supply in the city, and another owns and manages the station building and its commercial operation and growth.

To help coordinate multidisciplinary communication between Trafikverket, municipalities, and the state, an Åtgärdsvalsstudie (ÅVS) is executed (Trafikverket, 2015). This translates to "Strategic Choice of Measures" and is a preparatory, early-stage planning methodology used to analyze needs and shortcomings before any formal planning or design work begins. ÅVS highlights the importance of multidisciplinary communication early on in the planning process, as the different expertise of the var-

ious organization members is valuable and complementary, and thus it aims to build a foundation for collaborative planning. Moreover, it includes sorting out problems of higher relevance, which ultimately leads to more efficient planning. Typically, it is not until after the ÅVS that planned actions become concrete and clear enough for contracts and budgeting to be accurately discussed between actors.

The methodology of ÅVS is flexible and unforeseeable, but generally follows four steps:

1. Initiate (initiera)
2. Understand the situation (förstå situationen)
3. Try possible solutions (pröva tänkbara lösningar)
4. Formulate a focus and recommend actions (formulera inriktning och rekommendera åtgärder)

Together, these planning frameworks show how station area development in Sweden is shaped by early problem identification, cross-organizational collaboration, and clear responsibility distribution. This reflects the complex role of station areas as both transport nodes and integrated parts of the urban environment.

Moreover, in interviews, Ekekullsbron in Mölndal was highlighted as an example of inadequate pedestrian planning. According to a consultant involved in the project on behalf of Trafikverket, Ekekullsbron has had a low level of use, with approximately 80 daily passages. The interviewee claims that this is known by both Trafikverket and the municipality of Mölndal. From Trafikverket's perspective, the limited use of the existing bridge did not justify reinvestment, and determined that it was a better idea to spend that budget on a new bridge that would connect to the new platforms of Mölndal station instead. Therefore, there is currently a new bridge being planned North of Mölndals bro that will connect the East side of E6 and E20 to Mölndals centrum (Trafikverket, 2025). The expectation is for the new bridge to be more useful, as it has been planned with more supporting material and analysis.

2

Theoretical background

This chapter explains central concepts and gives a foundation needed to understand the thesis. It first introduces contemporary understandings of accessibility and presents various approaches to achieving it. Barrier effects as a phenomenon are explained together with a conceptual model describing the linkage between determinants and effects. The chapter then turns to walkability and active travel, outlining how these concepts have developed in research and practice. Definitions and key factors influencing walking behavior are explained. Frameworks like the hierarchy of walking and the urban DMA – which stands for Density, Mix, and Access – are discussed to illustrate how the built environment shapes pedestrian activity. Finally, the chapter describes the planning processes relevant to Swedish transport development. Together, these theoretical perspectives form the basis for the assumptions, interpretations, and methodological choices used throughout the thesis.

2.1 Accessibility and barriers

Transport planning has transformed during the last decades, from focusing on mobility and efficient movement of people and goods to emphasizing the accessibility aspect (Van Eldijk, 2023). Walter G. Hansen (1959) first defined accessibility as "the potential of opportunities for interaction", stating that the growth potential of an area is strongly influenced by how accessible it is for different activities. In this context, accessibility can be understood as a measure of the spatial distribution of activities around a specific point, taking into account people's capacity to overcome spatial separation. Handy and Niemeier (1997) further broadened the definition of accessibility to include aspects such as travel choice, destination choice, and travel cost. A high level of accessibility can be achieved by providing a greater number of destinations that are reachable by a wide range of travel modes. Moreover, the less time and money travel requires, the more destinations can be reached within a given budget, resulting in higher accessibility. Accessibility is therefore shaped by both land-use patterns and by the design of the transportation system. However, accessibility remains a complex concept and is strongly influenced by individuals' perceptions, as two people in the same location may experience their accessibility differently.

While Hansen (1959) and Handy and Niemeier (1997) provide a broad conceptual understanding of accessibility, later research has emphasized the role of transport

and land-use. Geurs and Van Wee (2004) views accessibility measures as indicators of how land-use and transport development, as well as policy plans, affect society as a whole. Thus, accessibility is directly related to the spatial design and transport systems, which enable residents to take part in different activities with various destinations. When focusing on passenger transport, accessibility can, according to Geurs and Van Wee (2004), be defined as "the extent to which land-use and transport systems enable individuals to reach activities or destinations". They conceptualize accessibility through four components related to each other: land-use patterns, transport system characteristics, individual characteristics, and temporal constraints. This shows that accessibility is not only a product of infrastructure provision, but also of how people interact with the transport system within specific spatial and temporal contexts.

Given this background, accessibility is clearly defined as a key goal regarding policy and investment on both regional and national levels (Van Eldijk, 2023). This development reflects an increasing recognition that prioritizing mobility alone can undermine accessibility, particularly when it encourages low-density and scattered land-use patterns. Therefore, various approaches have been developed to assess accessibility, typically considering the relationship between destinations, the people who travel to them, and the barriers or frictions that exist between the two. The commonly recognized components include land-use patterns, transport characteristics, time-related constraints such as opening or working hours, and individual conditions like personal abilities. Ideally, accessibility measures should incorporate all of these components, and the tools for measuring accessibility need to be applicable in practice, straightforward to interpret and communicate, and aligned with relevant social and economic considerations.

According to Van Eldijk (2023), accessibility can be obtained through three main approaches: mobility, proximity, and remote access through digital technologies. Both mobility and proximity demand resources and can therefore create tensions with sustainable goals. The assessment of when mobility becomes necessary varies between individuals, depending on their abilities, perceptions of distance, and the destinations they seek. Focusing on local accessibility is therefore essential, particularly when evaluating transport infrastructure investments that primarily aim to enhance regional accessibility.

A central paradox in transport planning is that transport systems designed to improve regional accessibility can at the same time reduce accessibility locally by creating obstacles for everyday movement. These obstacles can limit how easily people move through their immediate surroundings and thereby act as barriers. Infrastructural barriers encompass all forms of transport infrastructure that reduce or remove opportunities for movement from one location to another (Anciaes et al., 2016). These barriers influence accessibility by restricting travel options and by reducing the number of people who can reach certain destinations within a reasonable distance or travel time (van Eldijk et al., 2022). Transport infrastructure can enhance motorized transport in a regional aspect, but can, on a local scale, diminish

accessibility for active transport like walking and biking through creating barriers (van Eldijk et al., 2022). However, a transport feature is only considered a barrier when it hinders people’s movement, and barrier effects arise when someone has a need that requires them to cross a barrier.

As the car traffic in cities has increased, attention to barrier effects has also grown. Barrier effects are associated with effects of transportation systems similar to noise, pollution, and vibration (van Eldijk et al., 2022). However, a key distinction is that the latter three are generated by system traffic regardless of the surrounding conditions. Barrier effects, on the other hand, can be explained as a result influenced by many different factors and can therefore not be evaluated in isolation. Instead, their assessment requires the participation of various stakeholders and professional competencies. Consequently, it becomes important to distinguish the barrier effects from their determinants, the relationship between different determinants, and the multiple levels at which barrier effects manifest.

To strengthen the understanding of barrier effects and to improve the application of assessment tools developed, the components of barrier effects could be conceptualized within the accessibility framework (Van Eldijk, 2023). Within this framework, infrastructure and the street network function as constraints between people and land-use destinations. Situating barrier effects in this way makes it possible to clarify how different determinants – soon to be described – interact and why barriers arise in specific contexts.

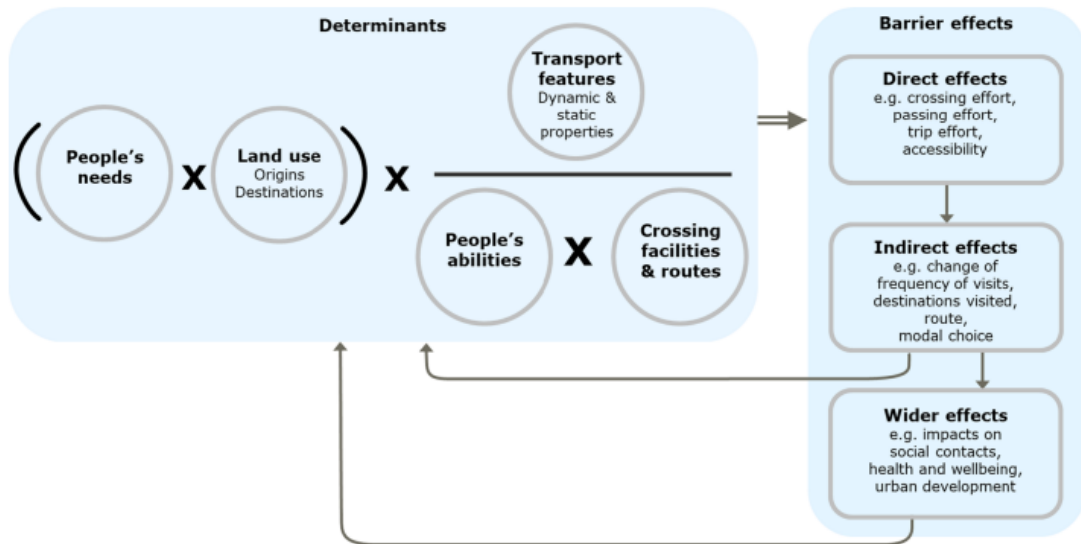


Figure 2.1: Conceptual model of barrier effects and transport infrastructure (van Eldijk et al., 2022)

Figure 2.1 offers a conceptual framework for understanding the barrier effects of transport infrastructure, detailing their determinants and corresponding levels. To illustrate how interactions among the determinants lead to variations in barrier

effects, the relationships between determinants are represented here using mathematical operators. This formulation aims to convey these relationships in a succinct manner that broadens the understanding of barrier effects beyond the transport features.

The five determinants shown in Figure 2.1 are people's needs, land use, transport features, crossing facilities and routes, and people's abilities. The most critical determinant influencing the extent of barrier effects is "transport features" (van Eldijk et al., 2022). As mentioned before, the focus on barrier effects has increased alongside increased car traffic in cities. The existing literature is therefore often focused on the determinant role of this transport mode. All transport infrastructure that either reduces or removes movement from one point to another can be seen as an infrastructural barrier. The transport features can therefore be grouped into either physical or psychological barriers. Psychological barriers can be defined as subjective barriers that are strongly linked to human presence and highly dependent on individuals' perceptions of the urban environment. These capture how elements or features are perceived by people in the urban environment. The psychological aspects of transport features relate to conditions that can trigger various psychological responses. Traffic nuisances – such as accident risk, noise, pollution, dust, and vibrations – can create a sense of separation even without physically restricting movement. A physical barrier, on the other hand, is a barrier that exists regardless of a person's presence or not. These can be both static – like motor and railways – or dynamic, along or across a feature, like traffic flow or direction.

Land use influences barrier effects both passively and actively (van Eldijk et al., 2022). Passively, the spatial distribution and density of housing and facilities determine where and to what extent barriers arise. Actively, changes in land use – such as expanding residential areas or relocating schools and sports clubs to the opposite side of major roads or railways – can increase, reduce, or shift the need for people to cross these infrastructures. Functional separation in cities further reinforces barrier effects by locating residential areas apart from retail, services, and industry. This results in longer travel distances and an increased need to cross the transport infrastructure located between these zones.

Furthermore, the ability to cross a barrier is influenced by the design and overall quality of available crossing facilities (van Eldijk et al., 2022). The importance of crossing frequency and location differs between transport modes. For car users, travel time is the dominant factor, while for slower, muscle-powered modes, distance is more critical. These two principles – travel time and travel distance – together with the need to ensure safe traffic environments, have led many cities to develop two distinct traffic networks. One is a hierarchical, tree-like network for fast modes, allowing differentiation of speeds for connecting and distributing traffic. The other is a finely gridded network for slow modes, enabling shorter routes and frequent shortcuts. When these networks overlap, they create numerous longitudinal and transversal conflicts. The latter are typically managed through various crossing facilities, which often introduce extra effort, detours, or waiting times for slower modes.

Barrier effects are further shaped by people's ability to move through the environment (van Eldijk et al., 2022). The impact of a transport feature – its separating characteristics, the availability of crossings, and the suitability of surrounding routes – depends on individuals' capacity to cross or navigate along the infrastructure and through the wider area created by safety zones around it. Age is identified as one of the most important factors in handling barriers. Other defining factors are mobility restrictions, which refer to physical or psychological capabilities, transport mode, and limited access to a car.

Although the four determinants discussed above each contribute to the potential for a transport feature to create barrier effects, these effects are only realized through the determinant 'people's needs' (van Eldijk et al., 2022). An actual barrier effect is created when an individual needs to reach a destination on the opposite side of a road that is too busy to cross, when they are unable to use a bridge's stairs, or when no appropriate crossing facility is available, for instance. This determinant can be grouped into three broad categories of human needs: self-fulfillment, consumption, and social interaction. To meet these needs, a set of destinations, including health, education, services, social and leisure facilities, shops, and transport hubs, can be set. Impact assessments tend to focus on the resident perspective, but barriers can also affect businesses and visitors in different ways.

Furthermore, Figure 2.1 illustrates three categories of barrier effects: direct, indirect, and wider effects (van Eldijk et al., 2022). A direct barrier effect is when people retain their ordinary travel behavior and generally accept the inconveniences that arise because of the barrier. An indirect barrier effect is when people alter their travel behavior because of a barrier, such as different routes, travel frequencies, or transportation modes. Barriers can thus force people to opt for car-bound travel instead of walking or cause them to detour (van Eldijk et al., 2022). Finally, the wider barrier effects are those that arise due to the changes in travel behavior that affect individuals, certain groups, and society at a wider scale. They can affect the way people interact or where groups move around, which ultimately can result in societal effects, such as isolation.

Barrier effects can reinforce themselves by influencing the determinants that create them (van Eldijk et al., 2022). Roads dominated by motorized traffic function as barriers themselves, meaning a busy road may discourage walking or cycling and instead motivate more people to drive (Anciaes et al., 2016; van Eldijk et al., 2022). This illustrates an indirect barrier effect, where increased car use alters the transport feature determinant. The resulting higher traffic volumes reduce the accessibility and crossability for pedestrians and cyclists, constituting a direct barrier effect. Thus, it is the indirect and wider barrier effects that alter people's travel behavior (van Eldijk et al., 2022).

2.2 Walkability

Since barrier effects emerge when these determinants hinder everyday mobility needs, understanding how they operate in relation to pedestrian movement becomes essential. To assess what shapes the quality of these elements for walking, the analysis must therefore draw on the extensive body of research on walkability.

Despite its central role in everyday mobility, walking has historically received far less attention than motorized transport. Over the last 70+ years, a lot of work has been done to understand and utilize the design of transportation space for motorized vehicles, while walking has been overlooked, according to Lo (2009). Lo adds that the lack of funding and the limited prioritization of pedestrian planning have made it appear like pedestrian planning is not as important as planning for other transportation modes. Only with the emergence of postmodernist planning did walking and walkability gain recognition as vital components of accessible and sustainable communities.

This shift also aligns with the growing use of the term active transport, which has gained prominence over the last two decades among researchers and policy-makers (Cook et al., 2022). Earlier terms used for cycling and walking have been “slow modes” and later “non-motorized modes”. Even though the term active transport includes a lot of different travel modes, it is often used as a shorthand for walking and cycling. A possible reason for this is the emerging emphasis on health, combined with the fact that accessible data is primarily available for those modes. Research examining active travel patterns – through transport counts, surveys, or similar approaches – also tends to focus on walking and cycling. As a result, the active transport modes that can be discussed and analyzed with confidence are walking and cycling.

This limited data availability for other types of active mobility creates a vicious circle in which funding and policy attention continue to concentrate on walking and cycling, further entrenching their status as the dominant active travel modes and marginalizing others (Cook et al., 2022). Because data on wider modes – such as run-commuting or skateboarding – is so limited, walking and cycling ultimately become treated as the primary modes within the term “active travel.” Therefore, whether or not they are truly the most common active modes, other forms of active transport are viewed as less worthy or less serious in both academic and policy contexts. Cook suggests that, in a broader sense, active transport can be formulated as travel in which the traveler’s own sustained physical effort provides the primary source of movement (2022).

Since active travel is such a new term, it is likely that a thorough definition has not been prioritized by the transport community, Cook argues (2022). Early on, the combination of walking and cycling was considered sufficient to represent active transport, as any attention to the area was novel and valuable. However, this narrow framing is no longer adequate.

Further on, the term *walkability* is also a quite young term, not really defined or specified in dictionaries but commonly used in society and by planners (Lo, 2009). The conflicting definitions between this term and the much older term *walkable* create a lack of clarity in the field of research. Since walking is a multidisciplinary activity, multidisciplinary indicators are needed to investigate the walkability of different areas. The great variety of actors involved in discussions and processes regarding pedestrians results in different perceptions of what walkability really is, often depending on the context. In practice, the issue of defining walkability is often overlooked. Instead, pedestrian environments tend to be shaped indirectly by priorities such as maximizing vehicle flow, ensuring access for emergency services, controlling land use, or generating revenue. Although these considerations do not explicitly concern pedestrians – and therefore may not appear to contradict pedestrian-focused planning – they frequently end up determining the actual form and quality of pedestrian spaces.

A lot of research regarding walkability has been centered around health or transport planning, often focusing on quantifying urban morphology (Dovey & Pafka, 2020). These approaches aim to identify morphological conditions linked to higher levels of walking, seeking to test cause-and-effect relationships between urban form, walking behavior, and resulting impacts on health and transport. The morphological factors that consistently correlate with increased walking are therefore treated as the defining components of walkability. Combining these complex factors and their effects into one measure is challenging since they all interact with each other.

In a Norwegian study, authors define walkability as to what extent the surroundings feel comfortable, enjoyable, and engaging for people to walk in (Knapskog et al., 2019). Moreover, it is important to consider the definition of pedestrians to understand walkability (Lo, 2009). In the urban planning context, the definition of a pedestrian affects how pedestrians are supported in infrastructure design and urban environment at a higher level. A pedestrian is generally understood as anyone who travels on foot, for transportation or other purposes. Walking functions as a mode of travel similar to driving or cycling, used for commuting, transferring between modes, or accessing destinations. People also walk for non-transport purposes such as recreation, exercise, leisure, or social interaction. Modern perspectives on walking further include individuals who use wheelchairs or mobility aids, which aligns with a more inclusive view of pedestrian activity.

2.3 Inclination to walk

To what extent a place is walkable is strongly connected to individuals' different perceptions of places and influenced by the characteristics of the urban form, the context, the activity, and the people (Knapskog et al., 2019). Since walking requires physical effort, people can be more or less inclined to choose walking as a transportation mode. Gehl (2011, p. 137) states that the walking distance that people are willing to accept depends not only on the physical distance, but also on the experi-

enced distance. This means that willingness relies on a combination of route length and qualities, as this determines how great the distance feels to the pedestrian, and if it is tolerable or not. Thus, increased walkability not only shortens the distance that people need to walk, but it may also increase the distance in which people are willing to walk (van Soest et al., 2020). Acceptable walking distance, however, is not to be confused with the route that pedestrians eventually choose. According to Gehl (2011, p. 137), pedestrians generally choose the shortest route, and provide an example of how a survey in Copenhagen found that pedestrians would cross a rectangular area diagonally, even though this means that they had to use two sets of stairs. He summarizes that pedestrians will choose the shortest route unless there is a major obstacle in the way, such as dangerous traffic or large physical barriers.

Which factors generally have an impact on the attractiveness of a pedestrian environment have been touched upon in previous studies. In studies investigating walking related to health, researchers found a distinction between factors affecting commuters and those that walked for exercise (Lo, 2009). Physical factors like sidewalk width seem to matter for commuters, while those walking as a form of physical activity found the phenomenological and aesthetic factors – like weather, temperature, or closeness to water more important.

According to a study conducted in Copenhagen, the features affecting people’s willingness to walk can be divided into necessary and optional factors (Hillnhütter, 2016). The necessary factors include:

- A continuous and complete pedestrian network
- A sense of safety, protection from motorized traffic
- A sense of security by social surveillance and activity, especially when it is dark outside
- Direct pedestrian routes with sufficient space, free from obstacles
- Barrier-free paths, smooth surfaces, clearly marked, and convenient for disabled individuals to use

Optional features that were touched upon were such that enhanced the emotional experience of walking, thus making the studied residents of Copenhagen more inclined to do so. Optional features include:

- A dense and well-linked pedestrian network
- Stimulating and detailed facades, large windows on the ground floor, services and facilities that face the pedestrian environment
- Increased comfort through low noise, good air quality, cleanliness, weather protection, and pedestrian facilities such as drinking fountains or toilets.
- Public and commercial seating places
- Features that invite leisure activities and play
- Art that creates an identity for locations
- Greenery
- Historical elements such as old buildings and facades, sculptures, and other historic features that convey the history of a place

However, Hillnhütter (2016) points out that regardless of the distinction between necessary and optional features, all features should be considered opportunities for improvements if the goal is to encourage more walking.

2.3.1 The hierarchy of walking

The hierarchy of walking is illustrated in Figure 2.2, according to Mariela A. Alfonzo's model. The model presents factors that make people inclined to choose walking as a means of transportation. The bottom and most fundamental factor is feasibility (Alfonzo, 2005). It is the only element in the category limits, as it determines if walking is even possible at all. The remaining four factors reach from accessibility, to safety, to comfort, to pleasurability at the top of the pyramid. Alfonzo (2005) adds how these variables can be perceived differently, where some individuals may consider certain needs met while others may not.

The five levels serve as antecedents in the walking decision-making process (Alfonzo, 2005). This implies that lower-level needs, such as feasibility and accessibility, must generally be satisfied before an individual considers the higher-level needs like comfort or pleasurability. Therefore, an attempt to enhance a higher-level element, according to Alfonzo (2005), would not increase walkability, unless a lower-level need is already met sufficiently.

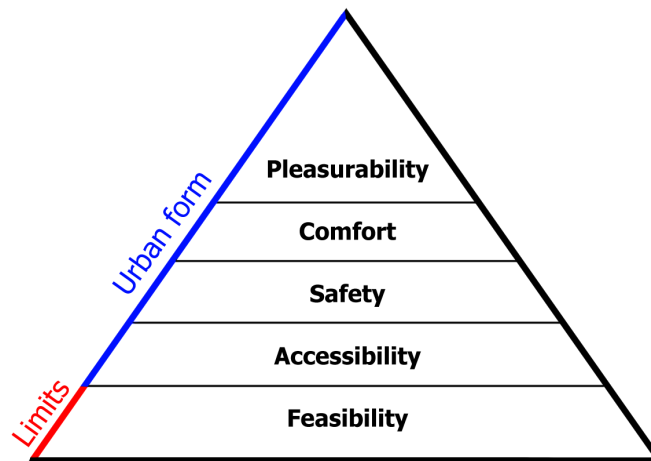


Figure 2.2: Conceptual model of The Hierarchy of walking by Alfonzo (2005).

After all, a space is planned and structured to suit the people inhabiting and using it. Children and the elderly are groups with particular needs, and therefore, a rule of thumb is to base the adaptation of the public space accordingly (Gehl, 2011, p. 131). Cobble road, loose gravel, and other uneven surfaces can negatively impact accessibility, especially for those with walking difficulties or users of wheeled mobility (Gehl, 2011, p.134-135). Simultaneously, when faced with level alterations, pedes-

trians often prefer slightly slanted ramps over stairs, which also allows for wheeled traffic (Gehl, 2011, p.145).

Moreover, a great public area should generally have opportunity for rest, such as benches, every 100 meters (Gehl, 2011, p. 162). Thus, people have different abilities to overcome barriers, and age is a dominant attribute that impacts this ability. Other than age, gender is also a prominent factor that affects one's ability to overcome barriers because of circumstances such as pregnancy, household roles, and car access, differing responsibilities, and physical capabilities (van Eldijk et al., 2022). Because of this, whether a need in the hierarchy of walking is met is determined by a potential pedestrian's individual perceptions, motivations, and habits (Alfonzo, 2005).

2.3.2 The dimensions of walking and the urban DMA

In the academic world of city planning and transportation, there are several dimensions that are recognized when it comes to affecting the travel demand: density, diversity, and design (Cervero & Kockelman, 1997). The common objectives of the dimensions are to reduce trips by motorized vehicles, increase non-motorized trips, and reduce the distance of the trips that are made by motorized vehicles (Cervero & Kockelman, 1997). Lately, a fourth and fifth dimension have also been recognized. These are destination accessibility and distance to transit (Jaiswal et al., 2025).

Together, these dimensions are important components in Transit Oriented Development (TOD), a neighborhood development model where the TOD area should be a place for public transport, but also human interaction and services (Kamruzzaman et al., 2014).

- **Density** is defined by several factors: The population per developed acre, employment per developed acre, and accessibility to jobs (Cervero & Kockelman, 1997). The purpose is to use the surface and resources efficiently (Jaiswal et al., 2025).
- **Diversity**, in this context, means that an area should have a varied selection of services and commerce to accommodate the neighborhood, which ultimately reduces the amount and length of trips (Jaiswal et al., 2025).
- **Design** is the elements that contribute to an increased quality of life (Jaiswal et al., 2025). It can include factors such as the street layout, light sources, vegetation, bicycle lanes, slants, sidewalk widths, and so on (Cervero & Kockelman, 1997).
- **Destination accessibility** is the number of opportunities reachable within a certain time frame (Jaiswal et al., 2025). This can refer to the nearest bus stops, bus rapid transit stations, bike paths, and the number of jobs in the area.
- **Distance to transit** refers to the average shortest route from point A to point B, with point B being a transit station (Jaiswal et al., 2025).

High pedestrian flows coming from the public transport support the node commerce,

which, according to Pont et al. (2022) creates a positive spiral, where users of the system become even more inclined to use public transportation because of the local services around the station. Pont et al. (2022) also points out how urban density within the station area is a key driver in this positive spiral. The denser the area, the greater the demand for public transport will be, and thus the customer base, helping local services to thrive.

Closeness centrality and betweenness centrality are two measurable indicators that correlate well with pedestrian flow (Pont et al., 2022). Closeness centrality measures how easily a street can be reached from all other streets within the network, based on network distance rather than geographic proximity. A high closeness value indicates that the street is well spatially integrated in the street network, meaning it can be reached directly from many other locations with few detours. This allows for direct access with few detours from many other locations. Betweenness centrality measures how often a street lies on the shortest paths between other streets. A high value of betweenness centrality indicates the street's importance as a vital link in the network, as many potential movement paths depend on it. It therefore reflects the strategic importance of a street.

As a city is changing, long-term morphological conditions shaped by earlier urban design – like street layouts, block-patterns, and overall physical framework – remain fixed, which often form a spatial structure difficult to alter once development is established (Dovey & Pafka, 2020). These morphological conditions can be grouped as density, mix, and access and have, in studies, been referred to as the urban DMA.

Urban density is a vital parameter to walkability since it brings more people and destinations within walkable distances, but its measurements can alter significantly depending on the urban morphology and building types involved (Dovey & Pafka, 2020). Yet understanding of density is often limited, leading to confusion about what exactly is being measured – buildings, residents, or pedestrians; perceived or calculated. While planning discussions usually focus on net density, the benefits and challenges associated with density in everyday neighborhood life are shaped mainly by gross density, which also includes public space. Furthermore, when comparing the average density of cities, there are a lot of different parameters playing a vital role. For example, population density often changes geographically during the day, so the time aspect becomes crucial for a fair comparison.

Another important factor in the urban DMA concept is the functional mix, which refers to the combination of different uses and activities within the same area (Dovey & Pafka, 2020). Aiming to help shorten the distances between where we are and where we want to go, this idea has become central to urban planning. Despite this, there's still no consensus on how to define the components of urban mix or on the best methods for measuring and mapping it. Previous work has therefore narrowed those functional categories to the three primary factors in people's lives: work, live, and visit. By aiming to distinguish different kinds of mixes, urban activities are to be understood as affected by each other rather than just individual functions.

Focusing on the mix rather than the functions is really the essence of this process.

The pedestrian flow is deeply affected by the city's access networks, which shape walkability by reducing travel distances and increasing the speed of movement (Dovey & Pafka, 2020). Building on this fact, the accessibility for walking increases as the streets get wider, indicating that walkability is at its top when there is no city to get access to. This paradox reveals that factors for walkability are way more complex than just accessibility or connectivity. The accessibility parameter, therefore, needs to be more defined, specifying what we get access to.

These three morphology parameters, which constitute the urban DMA, serve as the foundation for many of the current measures in today's walkability studies. But it is important to separate walking and walkability (Dovey & Pafka, 2020). The relation between the DMA factors is based on the reasoning that can either limit or enhance walking. However, they do not directly result in people walking. The urban DMA is mainly a diagrammatic tool for understanding how cities function, in which walkability is a necessary condition. The key idea is that the potential to walk easily between places in a city – its walkability – should not be mistaken for the actual amount of walking people do. Even highly walkable areas may see very little pedestrian activity, while less walkable ones might experience quite a lot.

Although real walking behavior is what leads to health and other positive outcomes and is therefore essential to measure in urban studies, it must still be treated separately from indicators of walkability. Walking capacity can never be calculated only based on measures of walking (Dovey & Pafka, 2020). Since the term walkability is expected to cover so many factors and interrelationships, one way of narrowing this scope down is to treat walkability as just one component of the urban DMA framework.

2.3.3 Governance in Swedish infrastructure projects

The term institutional interplay refers to the interactions between governance arrangements operating at different levels, such as local, regional, and national institutions (Young, 2006). These institutions do not necessarily operate the same way at different scales, but often differ in their mandates, knowledge bases, and decision-making logics. Young (2006) describes how different forms of interplay can be described as vertical and horizontal. Vertical institutional interplay refers to interactions between these institutions, where higher-level and lower-level governance arrangements overlap and influence each other. The differences in the organizations often create tensions, dominance, negotiated agreements, or coordination challenges. Horizontal interplay, however, refers to interactions between institutions operating at the same governance level, such as different authorities, departments, or sectors with parallel responsibilities. These interactions require coordination across organizational boundaries and are often challenged by sectoral fragmentation, differing mandates, and competing priorities, which can create coherent decision-making challenges.

In the Swedish multidisciplinary planning context, similar vertical and horizontal interplays can be identified between national agencies, regional authorities, and municipalities, as well as between transport planning and urban development sectors (Antonson & Levin, 2020). While Trafikverket is responsible for the planning and delivery of transport infrastructure, municipalities retain planning authority over land use and the surrounding urban environment, and private actors often own and manage station facilities (Trafikverket, 2017). This institutional division requires extensive coordination across administrative levels and sectors, particularly in project contexts where transport infrastructure directly affects urban areas, such as station environments (Antonson & Levin, 2020). As a result, planning processes are characterized by sectoral fragmentation, where the transport planning process is handled by different organizational units with limited integration. Thus, responsibilities that concern social impacts, such as accessibility and barrier effects, often get forgotten, marginalized, or fall between organizations.

3

Methodology

The following chapter outlines the methodological approach used to investigate the research questions of this study. The methods used are explained and motivated. Figure 3.1 illustrates the project's key phases, which are described in more detail in the following sections.

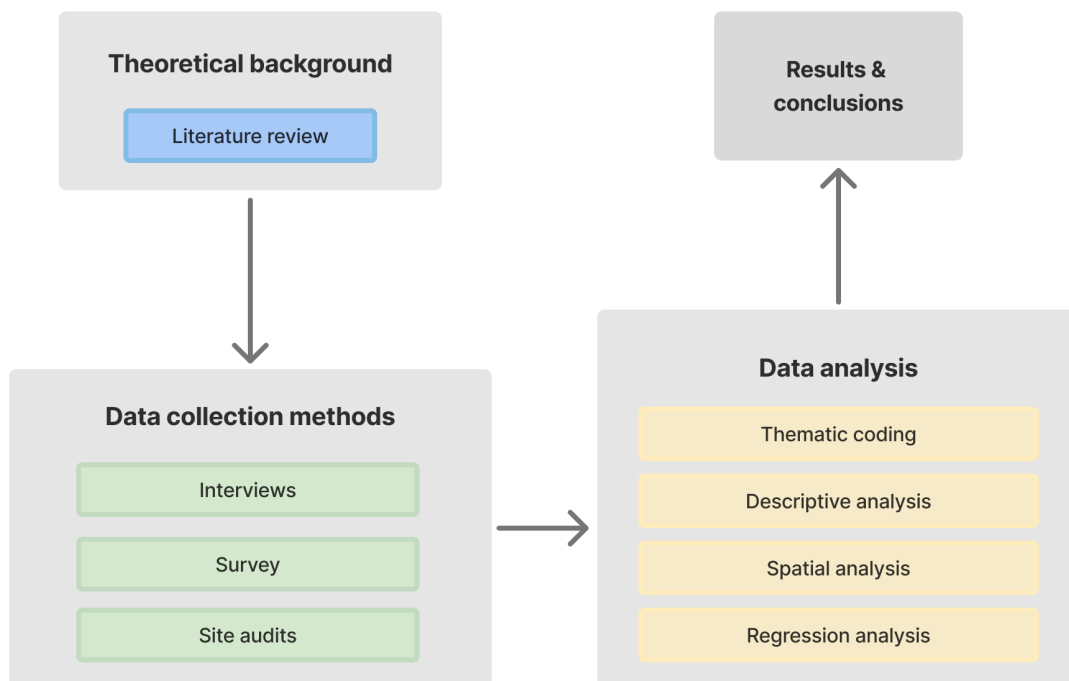


Figure 3.1: Flow chart of the methodology of the thesis, in which the gray boxes illustrate the project's main phases and the arrows the flow of the process.

To achieve the research aim, it is crucial to select a research strategy that is likely to be effective. As noted by (Denscombe, 2014), the choice of strategy should be guided by how well it supports the achievement of the stated research objectives. A research strategy, distinct from a research method, can be understood as an action plan for accomplishing a specific goal and can only be evaluated in relation to its intended purpose. Therefore, careful consideration of the strategy's suitability and usefulness for the research purpose is essential. A mixed-method strategy is suitable when the research purpose is to compare different perspectives and aspects of an occurrence or combine aspects from other strategies.

Since this thesis aimed to capture both stakeholders' expertise and residents' perspectives and thoughts, a mixed-method research strategy was considered a feasible research strategy. Mölndal Station and its surrounding area serve as a case study throughout the study, chosen as a concrete and accessible context to explore questions that are relevant to station areas more broadly. Mölndal, which is located South of Gothenburg, is visualized in Figure 3.2. Moreover, Mölndal Station as a case study also supported the chosen research strategy. The geographical proximity of the site facilitated access to both professional expertise and everyday user perspectives, as well as direct engagement with the local context. This made it possible to combine insights from planning practice with observations of pedestrian conditions in the station area.



Figure 3.2: Map of Mölndal with the station circled and the E6 highway marked out.

3.1 Data collection methods

The theme studied in this thesis is inherently complex. Understanding pedestrian accessibility around stations – which is often a great infrastructural barrier – involves both technical and physical dimensions – such as infrastructure, walking routes, and spatial barriers – as well as human dimensions, namely how people perceive, experience, and respond to their built environment. Capturing this complexity requires methods that go beyond physical indicators alone. Since this study focused on people's perceptions of and attitudes towards walking to station areas, the human and

social dimensions were central to the research design and were therefore primarily examined through qualitative methods.

The research questions guiding this thesis operated on two distinct but interrelated levels. One level concerned the lived experience of individuals moving through the environment, while the other addressed the processes and practices of those who plan and shape that environment. Given the strong emphasis on human behavior and perceptions of the built environment, a predominantly qualitative approach was considered most appropriate. Qualitative methods allowed for deeper engagement with experience, meaning, and planning processes – elements that are difficult to capture through quantitative measures alone. However, the study also incorporated a quantitative element, as a regression analysis was conducted on the survey data to identify patterns and relationships between variables that may not be visible through qualitative analysis alone.

To address both levels of the research questions, methods were selected that could capture these complementary perspectives. Expert interviews were conducted to gain insight into the knowledge and viewpoints of stakeholders involved in the planning process. These interviews focused on how planning professionals work, how they collaborate across disciplines, and how they currently address barriers related to pedestrian accessibility. To capture the traveler’s perspective, a survey was distributed to people in the area. This made it possible to collect firsthand accounts of how individuals experience the walking environment, which factors they perceive as problematic, and what conditions might encourage them to choose walking. The survey data were further analyzed through regression analysis to explore which factors most strongly relate to walking behavior and perceiving barrier effects. In addition, two site visits were conducted to ground the analysis in direct observation of the physical environment.

Together, these methods enabled an examination of pedestrian accessibility from two complementary angles: those who plan the environment and those who use it. By combining expert knowledge with the experiences of everyday users, the study aimed to develop a more comprehensive understanding of existing barriers and to identify potential measures that could enhance walkability in the area. Together, these methods reflected the dual nature of the research – the processes that shape the built environment and the human experience that unfolds within it.

3.1.1 Interviews

To get a clearer picture of the planning process, ten interviews with experts within the field of urban planning were conducted. Experience, areas of responsibility, and job tasks formed the basis for selecting relevant candidates for interviews. Participants from municipal and private disciplines were selected to create a wide and comprehensive understanding of the planning process. Interviewees were partly contacted through snowball sampling, where existing participants were asked to recommend further relevant professionals considered useful to the study (Denscombe,

2014). Their different expertise allowed for a unique insight into how the decision-making process regarding barriers around station areas works and how the involvement of different stakeholders looks.

The design of an interview can vary in terms of both its level of standardization and its degree of structure. Standardization refers to how similar the conditions are when interviews are conducted and the extent to which the questions remain the same. The structure of the interview concerns how fixed or open the response options are, as well as whether the questions follow a predetermined sequence (Bill Gillham, 2008).

Thus, a semi-structured interview approach was chosen, which created a solid base while still allowing for adjustment and flexibility. This allowed for comparability across interviews while still enabling follow-up questions and elaboration depending on the interviewee's response. Each interview included both general questions, asked to all participants, and more targeted questions tailored to the respondent's role and expertise. The general interview questions are presented in Appendix A.

Two interviews were conducted physically at the interviewee's workplace, while the remaining were conducted online through Teams Meetings. All interviews were recorded in real time and subsequently transcribed. These were transcribed by uploading the recordings to various AI transcription services.

The respondents were:

- Linda Andersson - Traffic planner at AKKA planering
- Karin Dahlin - Architect and process leader at Ramboll
- Frida Forsman - Urban planning architect at Mölndal stad
- Viktor Hultgren - Urban planner at Göteborgs Stad
- Wilhelm Häggander - Transport strategy planner at Västtrafik
- Samuel Lundberg - Urban planner at Trafikverket
- Karin Malmquist - Project manager at Trafikverket
- Sara Nero - Traffic engineer at Mölndal stad
- Maria Olsson - Pedestrian strategy planner at Göteborgs Stad
- Anna Pollack - Infrastructure project manager at Mölndal Stad
- Lina Tomczak - National coordinator and landscape architect at Trafikverket

3.1.2 Survey

Surveys are a well-established and widely used method in social research for collecting information from individuals. Denscombe (2014), describes surveys as a key instrument in empirical research, as they enable the systematic collection of data from relevant participants and research settings. As this thesis partly focused on understanding pedestrians' behavior and their perceptions of walking routes, a survey constituted a feasible and appropriate research tool.

Web-based questionnaires, often designed using specialized software or online platforms, are particularly well-suited when the aim is to collect data in a fast and efficient manner (Denscombe, 2014). They also provide opportunities to capture variations across different demographic groups and to achieve broader representativeness. Since the aim of this survey was to capture a wide range of residents' and travelers' opinions, and given the project's time constraints, a web-based questionnaire was chosen for this master's thesis. The following subchapters will present the design, structure, and distribution of the questionnaire.

3.1.2.1 Questionnaire design

The general aim of a survey is to achieve a sufficient number of answers. It is therefore important to consider the design of the questionnaire (Denscombe, 2014). According to Denscombe (2014), web-based questionnaire surveys involve three distinct processes: design of the questionnaire, distribution of it, and the retrieval of the data. The quality of a questionnaire depends on its response rate, completion rate, and the validity of the responses provided. From a research perspective, minimizing respondent burden is essential. Key considerations, therefore, include the time required to complete the questionnaire and the format of the questions.

The survey in this study was designed to capture the user perspective – how people who live or move in the area around Mölnådal Station experience the walking environment and what factors influence their choice to walk. The questionnaire was developed to be inclusive and not include questions that could be perceived as sensitive for the respondent. In addition to this, all questions were optional to answer, and all respondents' answers were anonymous. The survey primarily consisted of multiple-choice questions to facilitate comparability and improve completion rates, as such questions generally require less effort from respondents compared to open questions (Hagevi & Viscovi, 2016).

Furthermore, the survey was designed using Maptionnaire, a digital survey tool that supports both standard survey questions and map-based interactions. Using this software, both qualitative and quantitative questions could be asked, and the map allowed respondents to provide geographical information. The questions were developed based on two sources – insights gathered from the expert interviews and the theoretical framework on walkability. This ensured that the survey addressed themes that were both empirically grounded and theoretically relevant.

3.1.2.2 Questionnaire structure

The questionnaire followed a structured, multi-section design, where questions were grouped by themes across separate pages. It began with an information page describing the aim of the project, estimated completion time, and ethical considerations such as anonymity and voluntary participation. The themes of the pages were and lastly demographics. Those will be described in more detail in this section.

The first page of the questionnaire asked whether the respondent had visited Möl-

ndal station within the last five years. Respondents who answered “No” were automatically directed to the final page of the survey and were unable to complete the remaining questions. This filtering mechanism was implemented to ensure that only respondents with sufficient familiarity with the site participated, thereby increasing the reliability and quality of the collected data.

The following page included a question about how often the respondent passes through Mölndal station. The next page had one choice question regarding the respondent’s travel patterns. It also held a grading question in which the respondent had to estimate the extent to which different factors influence their choice of route when walking to the station. Following that, the next section of the questionnaire examined the respondent’s walking experience through a grading question with different statements that the respondents had to choose between "*Strongly agree*", "*Partly agree*" or "*Do not agree*". Those statements were formed based on the theory and the determinants provided in van Eldijk’s model in Figure 2.1, in order to capture all determinants. The statements, therefore, covered the determinants of transport features, crossing facilities and routes, and people’s abilities.

This section also included a map-based question where the respondent could mark out where in the area they perceived it was an issue affecting the walkability. If a respondent marked out a problem, a following open-text question followed where it could be further specified. In addition to this, an open question was incorporated at the end of this section, where the respondent was encouraged to specify what would make them more inclined to walk to Mölndal station. The last section included three statements regarding perceived barrier effects, in which the alternatives were "*Always*" "*Often*" or "*Never*". Demographic questions – including age, gender, and occupation – were placed on the final page of the survey so that respondents would not be met with personal questions at the outset before engaging with the substantive content. The questionnaire structure is presented in Appendix B.

3.1.2.3 Questionnaire distribution

To ensure that the survey collected valuable and relevant responses, it is essential to consider how the research population is reached (Denscombe, 2014). The survey aimed to capture a broad and representative sample of individuals moving within the area, reflecting diverse travel patterns and user groups. The survey was therefore distributed through multiple techniques to reach a broad group of respondents as possible. Digital distribution included sharing the survey in local Facebook groups targeting residents in the Mölndal area. These community-based groups were used to reach people with direct experience of the surrounding environment. In addition, the survey was distributed via email to businesses, educational institutions, and organizations in the area, with a request to share the survey with their employees.

To further broaden the reach, in-person interactions were also conducted in the station area, during which QR codes linking to the survey were handed out. Posters with QR codes were also placed at strategic locations around Mölndal station. This combination of digital and physical distribution methods was chosen to reduce the

risk of reaching only a narrow subgroup of respondents and to enhance the overall representativeness of the sample.

3.1.2.4 Incentives

According to Denscombe (2014), the use of rewards or material incentives can increase response rates in survey studies. Therefore, to increase the likelihood of participation, respondents were offered the opportunity to enter a lottery for a movie theater ticket upon completing the survey. Participation in the lottery was voluntary, and respondents who wished to take part were asked to provide an email address. The inclusion of an email address meant that the survey responses were no longer fully anonymous for those participants; however, providing an email address was optional and only used for the purpose of administering the lottery. Once the survey was closed, a winner was randomly selected, and email addresses were not used for any other purpose.

3.1.3 Site audits

In order to complement the survey and interview data with direct observations of the physical environment, two site audits were conducted in the area surrounding Mölndal station. The site audit focused on the immediate surroundings of the station and pedestrian routes connecting the station to the surrounding urban area, as shown in Figure 3.2, in order to capture conditions relevant for walkability and access. The audits were carried out by the two authors of this thesis on two separate occasions, both during the afternoon of a weekday. The first visit took place on the 25th of March, lasted approximately one hour, and focused on observing and documenting the current conditions of the pedestrian connections leading to and from the station. The second was on the 15th of April and had a more interactive approach. The site audit used both concepts from a systematic observation as well as a participant observation, which are described in more detail below.

According to Denscombe (2014), data collected during observations may vary depending on the observer rather than the event being observed. To minimize this risk, the use of systematic observation is recommended, as it helps reduce discrepancies in results that may arise between researchers and limits the influence of individual perceptions. In line with this approach, the first audit was conducted using systematic observation, with no interaction taking place with the members of the public.

Events in social settings tend to be complex and multi-faceted, and to address this complexity and achieve the study's aim, an observation schedule that clarifies which aspects to focus on during the observation can be helpful (Denscombe, 2014). A structured checklist was therefore used during the site visit to ensure that all relevant aspects of the pedestrian environment were consistently assessed. The content of the checklist was developed from the walkability theory and insights gathered during prior expert interviews. The checklist included lighting, pedestrian crossings and passages, connectivity to the surrounding pedestrian network, and signage and wayfinding both within the station and in its immediate surroundings. This

ensured that the observations were both theoretically anchored and responsive to themes identified earlier in the research process. Documentation was made both by field notes and photographs of the walking routes in the area, focusing on the physical characteristics and potential barriers relevant to walkability.

The second visit involved directly approaching residents and visitors in the vicinity of the station in order to encourage participation in the survey. This on-site distribution method was chosen to reach regular users of the area who may not have been reached through the online and email-based distribution channels. Consequently, the visit took a more interactive approach. In addition to continued observation, this audit also included the distribution of the survey to people present at the site and engaged them in brief, informal conversations regarding their experiences of walking in the area. Participation was voluntary, and no personal or identifying information was collected during these interactions. This approach allowed for a more nuanced understanding of how the space is perceived and used by its visitors. Together, the two visits provided complementary layers of empirical data, combining systematic spatial analysis with user perspectives.

3.2 Data analysis

To complement the analytical interpretation of the data, several tools were applied to provide supporting or alternative perspectives. The data were thus analyzed and interpreted by the authors using a combination of qualitative and quantitative analytical methods.

3.2.1 Thematic coding

After all interviews were conducted, five frequently mentioned topics were identified and categorized.

1. **Barriers and barrier effects**

This category covered whether barriers and barrier effects were a topic of discussion within the organization, and in which way, and to what extent they are spoken of. Moreover, the category included types of barriers, how barriers are experienced, and the consequences of barriers and barrier effects.

2. **Pedestrian perspective in planning**

This category included topics such as what makes potential pedestrians inclined to walk, pedestrians' experience walking, pedestrians' needs, and user behaviors, but also attributes of the walking environment – such as directness, the pedestrian network, and infrastructure capacity.

3. **Planning tools and methods for analysis**

This category included all types of tools and methods that the different organizations used as part of their planning process and development of decision-making materials. It also covered the shortcomings of their current decision-making basis materials, what the organization might be in need of, and how such new material could potentially ease the decision-making process and planning.

4. Collaboration and distribution of responsibilities

Quite straightforwardly, this category covered the organizations' different responsibilities, but it also included the raised collaboration problems and what might be potential solutions to these. Moreover, it briefly covered how politics can interfere in the collaboration and planning process.

5. The function of the station, placement, localization, and design

The final identified category included a collection of attributes that a station can possess, which ultimately affect how people move. These could be factors such as safety, how easily the station can be navigated, capacity, how well integrated the station is in the city, and the overall role of the station in the city.

These categories were used in the analysis of the interviews to thematically code the transcriptions. Thematic coding was conducted because of its flexibility, and as the method is designed to identify patterns across qualitative data sources such as interview material, it was deemed appropriate for the semi-structured style of the conducted interviews (Braun & Clarke, 2006). As the categories had been identified after the interviews were conducted, the thematic analysis was inductive. This means that themes were developed from the data rather than defined in advance, allowing patterns to emerge based on the interviewees' responses.

3.2.2 Descriptive analysis

Data was extracted from the survey in Maptionnaire and visualized in graphs and tables using both Maptionnaire's graph generation function and Excel. This was done to provide a comprehensive understanding of the results. Demographic data were visualized to depict the respondent population and reveal the potential risk of bias due to insufficient representation of certain societal groups.

Some visualizations were made solely to enhance the understanding of collected data, whereas others served to illustrate and communicate results. Group differences were analyzed using cross-tabulations, or pivot-style analysis, by filtering survey responses by demographic variables in Maptionnaire.

3.2.3 Spatial analysis

The map-based survey question, in which respondents were asked to identify perceived hindrances along their route to the station, generated spatial data for analysis. A spatial analysis was conducted using Maptionnaire, where the reported hindrances were visualized through a heat map illustrating the relative intensity and concentration of responses. As respondents were able to place multiple markers, the spatial data reflected both the location and frequency of perceived hindrances. When indicating a hindrance on the map, respondents were also asked to describe it in a free-text response. Although these answers constituted qualitative data, they were in this analysis treated as comments linked to specific spatial points. The free-text responses were analyzed thematically and categorized into overarching themes. This approach enabled the identification of recurring patterns and facilitated comparison

with the results of the rest of the survey.

3.2.4 Regression analysis

A binary logistic regression analysis was employed to analyze the quantitative survey data. This was executed via the statistical analysis software platform Jamovi. Binomial logistic regression was deemed appropriate as it is a statistical method used to examine the relationship between independent variables and a binary dependent variable (Laerd Statistics, 2018). The model estimates the probability that a specific outcome occurs, rather than depicting precise values. The results are commonly interpreted using odds ratios, indicating how changes in the independent variables affect the probability of the dependent variable.

The variables in question were formulated as statements. The regression examined the relationship between perceptions of the built environment and perceived barrier effects, based on the survey answers. The dependent variables in the regression were the horizontally listed statements, as shown in Table 4.1, and were defined as a binary outcome. These variables were barrier effects that fell into the categories *direct* and *indirect*. The independent variables consisted of survey statements that captured perceptions of the built environment, such as directness, safety, traffic conditions, lighting, and spatial quality. Those were the vertically listed statements.

The respondents graded the degree to which they resonated with the dependent variable statements. The options ranged from: *Never*, to *Rarely*, to *Often*, to *Always*. The same process was executed for the independent variable statements, where the grading ranged from *Do not agree*, to *Partly agree*, to *Strongly agree*.

When performing the regression analysis, the answers to the grading questions had to be translated into binary outputs. The options *Never* and *Rarely* equal *No*, 0, and the options *Often*, and *Always* equal *Yes*, 1. Meanwhile, the option *Do not agree* equals *No*, 0, and the options *Partly agree* and *Strongly agree* equal *Yes*, 1. Even though this regression analysis only comprehends binary inputs, a grading answering system was chosen to give the authors' analysis and discussion more nuance.

4

Results

This chapter presents the empirical results of the study, based on interviews, survey responses, and site audits conducted in the area surrounding Mölndal station. The results are structured according to data source and analytical approach, reflecting the mixed-methods design of the study. Interview results provide insight into planning practices, priorities, and perceived challenges among key stakeholders, while survey results capture pedestrians' perceptions, experiences, and reported behavior. The site audit results complement these findings by documenting physical and spatial conditions relevant to walkability. Together, the results present a comprehensive overview of pedestrian accessibility, barriers, and planning conditions, using the case area as an empirical example.

4.1 Interview results

The following chapter covers the results of the interviews conducted with the different multidisciplinary stakeholders. The thematic coding resulted in five categories that have been concentrated to three subsections, where frequently brought up points as well as unique individual perspectives are presented anonymously.

4.1.1 The walking perspective in planning

Municipal actors described that barriers are a frequently discussed issue within the organization. The interviewees employed by Mölndal stad stressed how significant the matter was, considering how major barriers, the E6 highway and railway, split the city into two halves. One municipal respondent highlighted that some barriers are experienced as more pleasant and accepted than others, while still being barriers that hinder mobility, and used water and parks as examples. Another respondent mentioned the river Mölndalsån as an example of a barrier in Mölndal, other than the highway and railway.

The respondents of Trafikverket were divided in the amount of attention they claimed to dedicate to the issue of barriers. One of these respondents highlighted the importance of handling barriers, while others answered that it is not Trafikverket's responsibility, and that such responsibility often falls on the municipality or property owner. One of these respondents mentioned how that was a problem, as the said respondent considered barriers a collective, societal issue. It was, however, mentioned that Trafikverket considers barriers more when addressing entirely new,

large infrastructural projects, as opposed to remodeling projects or smaller-scale projects.

Several respondents brought up another perspective on barriers – that while the railway is a barrier that restricts mobility, the railway station plays an important role in overcoming barriers. This can be tied to the transport planning paradox stated by Anciaes et al. (2016) and van Eldijk et al. (2022); while transport infrastructure can locally reduce accessibility, it can regionally enhance it. The same respondent also stated that the station is important in overcoming the barrier that itself is creating – this being the rails, and that the design of the station therefore becomes vital.

Many respondents agreed that the common effects stemming from the Mölndal barriers are that they prevent people from moving between the West and East side of Mölndal, a barrier effect that could range from direct to indirect to wide, according to the model by van Eldijk et al. (2022). Several respondents highlighted that careful planning is vital for handling barrier effects. It was further emphasized that prior experience in addressing barriers in city planning, as well as an interest in the topic, are important for understanding the issue of barrier effects and enhancing how they are addressed in planning processes.

Developing and enhancing walkability can meanwhile reduce barriers, a municipal worker claimed, and brought up the bridge Mölndals bro as an example. By improving the pedestrian flows on the bridge to the platforms, they are simultaneously reducing the bottleneck problems, which the respondent described also as a form of barrier, although not the large infrastructural construction one that is typically discussed in the case of Mölndal.

When discussing walkability, most respondents mentioned several design elements in the pedestrian network that correspond to the necessary factors for willingness to walk, by Hillnhütter (2016). These included direct and continuous pedestrian routes, protection from motorized traffic, wide sidewalks, sufficient lighting, and paths free from potential physical obstacles, such as uneven ground or level changes. Out of Hillnhütter’s optional features for willingness to walk, the interviews brought up dense and well-linked networks with commercial activity, seating, noise levels, greenery, and elements that would ultimately make the environment aesthetically pleasing. Moreover, these elements align with the levels in the hierarchy of walking by Alfonzo (2005). Respondents at Trafikverket explained that their way of reassuring sufficient walkability is by following regulations that are adapted to suit the user perspective of someone with special mobility needs. They argued that if these special needs are met, the design will qualify for other pedestrians as well. This policy enables feasibility and accessibility, the bottom and second level of the hierarchy of walking. Several of the other respondents described Trafikverket’s approach as primarily addressing walking from a basic, functional perspective. This perception further reinforces the relevance of the hierarchy of walking, as the higher, more experience-oriented levels are rarely addressed when the lower levels are considered

sufficient by their official regulations.

An important aspect of the walking perspective is the experience of pedestrians. While there are objective factors that make a path walkable, humans are ultimately the ones who decide if their mode of transportation should be by foot or not. Several planners interviewed described how humans generally opt for the route that feels the most natural to take. This is not necessarily the geometrically shortest route, but perhaps the route that feels the shortest or most convenient to the pedestrian. One respondent describes that pedestrians often say that they choose "the closest path", but in practice, this actually means the most intuitive path. Directness and changes in levels are factors that strongly influence the perceived closeness, while factors such as safety, lighting, and environment are factors that influence how natural the route choice feels to pedestrians.

According to many interviewees, motorized traffic has been highly prioritized in street network planning in the past. Moreover, several respondents pointed out how there has been a lack of separating biking traffic from pedestrians. This has forced pedestrians to use roads that are planned for another transportation mode, and having to walk simply where they can access, whether that is on a narrow sidewalk next to a heavily trafficked road, or on a combined biking and walking path. Some stakeholders brought up the bridge Mölndals bro as an example. They described how the bridge is heavily trafficked by both cars and buses, which has, and still makes, it difficult to prioritize walking on the bridge today. One interviewee pointed out how, to make room for or favor one mode of transportation, another typically has to suffer. This is particularly relevant regarding the example of Mölndals bro, where potentially removing car-bound traffic on the bridge has been a topic of discussion within the municipality – a decision that would favor pedestrians, but cause complications for car travelers.

Lately, however, the respondents described how the mindset has changed within the field of urban planning, and walking is now the transportation mode that is prioritized. One respondent described how the consideration of walking as a transport mode in both planning and science is gradually increasing, but that there are still major improvements to be made.

4.1.2 Decision-making materials

In the industry, there are tools used to simulate and analyze traffic, walking flows, and thus potential improvement areas in the network. The two most frequently mentioned software were Viswalk and Space Syntax. Viswalk is a pedestrian simulation software that is used to simulate how people move in a city environment among different modes of transportation. It enables the identification of bottleneck problems and crowded areas. It is described as a tool that is used across organizations and in collaboration with other actors. Space Syntax analysis is used to analyze connections in the network, such as which streets are the most trafficked.

Despite tools that simulate and analyze situations and environments, respondents expressed a lack of decision-support materials. The interviewees reflected on this, noting that the user perspective is sometimes missing from planning processes and that technical analyses rarely tell the whole story. This reinforced the need to directly engage with people in the area and gather firsthand accounts of their experiences. A respondent from Trafikverket noted that they lack sufficient data on how people move through their facilities, and another respondent from Trafikverket supported the view that their follow-up processes are poor.

Many respondents expressed that the decision-making process often lacks a qualitative user perspective. Several municipality interviewees say that this is a matter of budget, as communication with users and people living in the municipalities is costly. However, many municipal workers mentioned how a user perspective would be a valuable resource, if performed or given. Several respondents emphasized that while quantitative data gives one perception of how people move, there is a lack of qualitative data that paints a picture of how people experience walking or how they actually move. A municipal worker with a particular focus on the walking perspective underlined the importance of investigating a specific area and the human experience there, instead of just using such data from a previous project in a new planning process. Moreover, one respondent pointed out how technical analyses are executed in the early stage of a planning process, but that these can become inaccurate as the project progresses and changes.

Several respondents involved in the remodeling of Mölndal's station area pointed out how information about the user experience was missing. In the case of Mölndal, respondents said that user-based decision-making material would give important insights into the safety aspects of the area and thus help them redesign it to promote the experienced safety.

4.1.3 Multidisciplinary collaboration

Planning for walkability in station areas involves several different actors, each with mandates, responsibilities, and priorities of their own, reflecting both vertical and horizontal institutional interplay. It is therefore emphasized that collaboration between municipalities, public transport authorities, and other stakeholders is crucial for achieving smooth building processes and an optimized walkable outcome. Meanwhile, the interviews revealed significant challenges related to responsibility distribution, differing organizational focuses, and misaligned expectations. This section explores how respondents describe multidisciplinary collaboration, including both perceived shortcomings and conditions for successful cooperation.

Interviewees from municipalities expressed that they care about making sure that people move smoothly across the entire city, but that other actors, like Trafikverket and Västtrafik, disregard this issue and concentrate their focus on how people use and move on their platforms. While interviewees from the other organizations agreed that walkability in the rest of the city lies outside their area of responsibility, one in-

interviewee from Trafikverket stressed how a walkable city should be a societal matter to improve together, rather than Trafikverket focusing solely on walkability on the platform. Different goals and priorities were problems that were frequently brought up during the interviews. Several stakeholders brought up the issue that prioritizing one objective often means that another actor's needs are compromised. As station areas are spatially constrained, decisions that would favor walkability may affect attributes like traffic capacity. For instance, respondents explained that this was deemed uncompromisable in the case of Mölndals bro, when it had been suggested to remove car traffic to enhance the walking experience on the bridge. From a governance perspective, these differing priorities and responsibility boundaries illustrate how walkability in station environments is shaped by fragmented decision-making rather than by a shared problem definition. This reflects a governance challenge where strategic coordination across organizations and levels is limited, leading to outcomes that prioritize single-sector performance over integrated solutions.

Ultimately, these differing priorities are not described as a lack of willingness to collaborate, but rather as a consequence of organizational conditions. Several respondents emphasized that actors tend to focus on fulfilling their assigned responsibilities, even when this limits the possibility of addressing pedestrian movement. Many respondents pointed out that setting up common goals across the organization is an effective way to handle the issue of differing priorities and objectives colliding. These are meant to complement the different organizations' own goals. One respondent said that it had been done in the case of the remodeling of Mölndal station and that it has affected what should be commonly prioritized. Several interviewees mentioned how understanding the other parties' goals and perspectives is crucial. A respondent from Trafikverket mentioned that groups with the municipalities, where perspectives and common goals are discussed, have been effective for collaboration. In addition, one planner stated that common goals lead to a common solution. A respondent from Trafikverket summarizes that there is a need for not only a mutual agreement, but a mutual frame of working between the parties.

The common goals, however, need to be realistic. Several respondents mention how ambition levels are often too high and how the project thus fails to live up to the set ambition. This is partly an outcome of an unclear perception of what should and should not be done in the project. Therefore, it is important to have correct and rational expectations for the project and be transparent regarding what the parties think is possible to achieve within the given budget and time frame. One of the interviewees noted that this requires parties to sort specific matters out of the discussions with different parties to identify a mutual problem, as well as save time and resources.

Many respondents expressed how unclear division of responsibility is a problem that frequently occurs, and that can make certain issues fall between the cracks and be forgotten or de-prioritized. Moreover, it is described that lacking clear frames of each party's responsibility creates frustration, especially when a problem arises, and there is no particular department to be held accountable. Several respondents

pointed out that clearly establishing areas of responsibility and having a solid contract early on in the project is important. Moreover, several respondents stated that there is a lack of an overall perspective in these processes. This results in a governance issue where responsibility risks becoming situational rather than institutionalized. This increases the probability that issues requiring coordination lack ownership, particularly when they span across organizational boundaries, such as how pedestrians should smoothly move from the platform to the Mölndals bro, for instance. Others highlighted that having the same people involved throughout the project also enhances the collaboration and overall perspective and prevents. In contrast to this, one municipal interviewee noted that the overall perspective in their organization improved once the municipality merged from being divided into several sub-organizations to being under the same organizational roof, as it simplified communication and common understanding.

As for walking, one interviewee further described a lack of forums dedicated to discussing pedestrian issues across organizations. Many of the respondents pointed out good, transparent, clear, and consistent communication as one of the main success factors. One participant suggested the need for tools for a structured dialogue between parties, but did not specify any particular tools. Furthermore, another interviewee highlighted site-based coordination as an important factor for improving communication.

4.2 Survey results

This section presents the results from the survey, describing respondents' perceptions, experiences, and reported behavior related to walking to and from Mölndal station. The findings are presented using visualizations such as graphs and pivot tables, while also being analytically interpreted by the authors to identify patterns and relationships in the data.

4.2.1 Survey population results

The survey population is displayed to identify any potential bias that could come from insufficient representation of particular groups in society. Moreover, out of the total 423 who started the survey, 226 respondents answered the whole survey. The first question of the survey asked respondents whether they had been to Mölndal station during the last five years. A total of 51 respondents answered "No", which resulted in them being directed to the last page of the survey, thus unable to answer any further questions.

The gender distribution among the respondents, illustrated in the left pie chart in Figure 4.1, was fairly even, with 51.1 percent of respondents identifying as female, and 47.6 percent identifying as male. 0.9 percent chose the option "Other". However, every respondent chose to display their gender identity, as no respondents picked the option of not preferring to say. Furthermore, the occupational distribution is presented in the pie chart to the right in Figure 4.1. It can be seen that 77.4

percent ticked the box "*Employed*" and 14.9 percent ticked the box "*Student*".

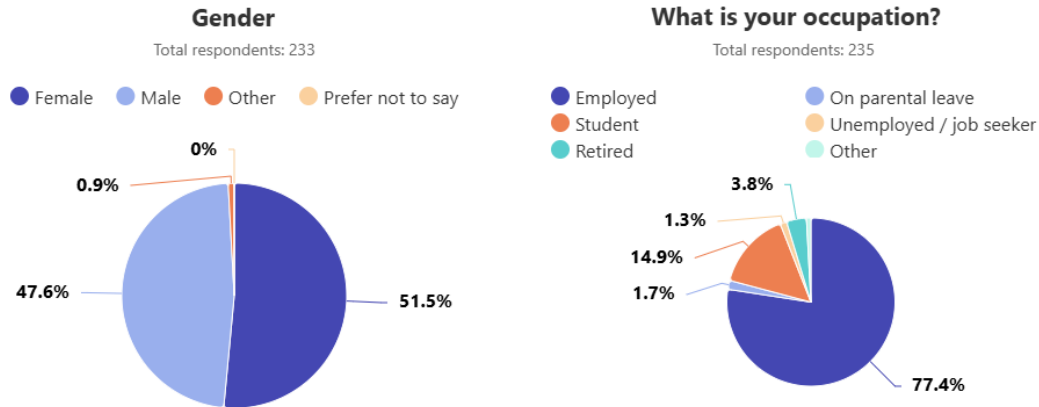


Figure 4.1: The gender distribution and occupation of the survey population, generated from Maptionnaire.

This data could potentially be slightly skewed, as flyers with a QR code to the survey were handed out between 16:00 and 18:00 on a Wednesday. It is therefore likely that a large portion of the people present at the station during the visit were people commuting home from work and school.

In addition, the survey was sent out by e-mail to companies and municipal departments, which would attract only employed respondents. This hypothesis is supported by the percentage that chose the option "*Unemployed/Job seeker*", which was only 1.3 percent, compared to the national statistic of 8.8 percent unemployed (SCB, 2026). Even though the unemployment rate is lower in Mölndal than the national average, the 1.3 percent displayed in the survey is still below what is estimated to be the unemployment rate in Mölndal. By comparing municipal unemployment statistics from Arbetsförmedlingen (2026) with population statistics of Mölndal gathered from "SCB, Statistikdatabasen" (n.d.), the unemployment rate is roughly estimated to be 4.6 percent.

Furthermore, Figure 4.2 presents the age distribution of the survey population. Assuming that the average age of each interval lies in the middle of the two ends of the interval, that would result in a total average respondent age of 37.4 years. This correlates rather well with the official statistics from Mölndals Stad (2026), which says that the average age in the city is 40 years.

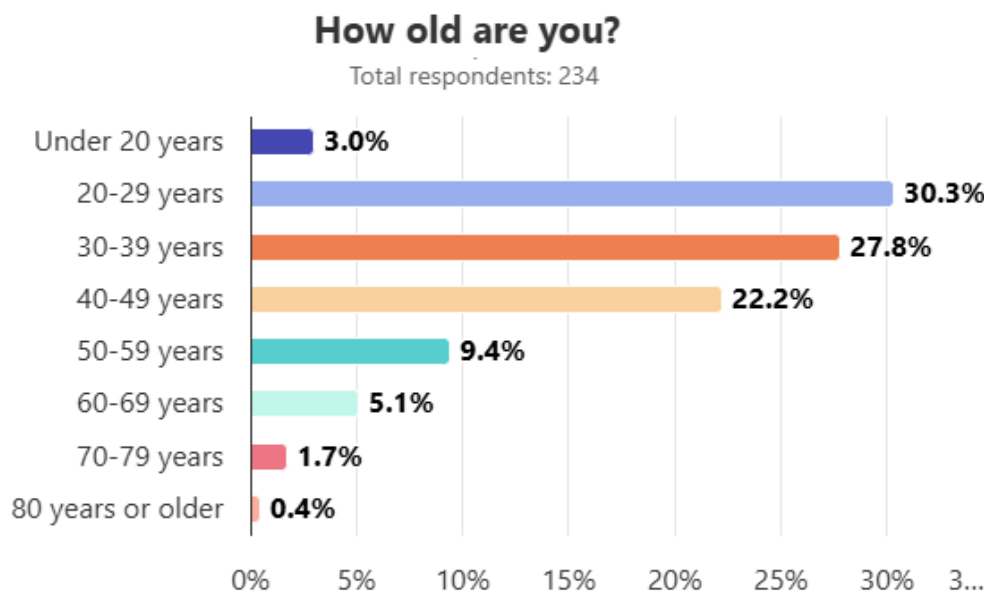


Figure 4.2: The age distribution of the survey population, generated from Map-tionnaire.

Out of the total of respondents answering the question regarding which direction they are coming from, 198 respondents said that they came from the western side, and 94 from the eastern side of E6. Out of those, 26 respondents from the western side, and 12 from the eastern side, reported that they walk to Mölndal station using a stroller, walker, crutches, or similar mobility aids. A majority of those were females. Regarding the western side, 21 respondents were female, compared to only 5 male respondents.

4.2.2 Factors effecting walkability

The survey included a question that had respondents rate the degree to which different factors influenced their choice of route when walking to Mölndal station, visualized in Figure 4.3. The total number of respondents to this question was 303, and the four influential factors were short distance, straightforwardness, aesthetically pleasant surroundings, and the presence of good walking paths and sidewalks. Respondents could rate these factors' influence with "*Not at all*", "*A little*", "*A lot*", or "*Very much*".

The two most prominent factors were short distances and good walking paths. The two factors were relatively similarly rated. For short distances, 17.8 percent of respondents stated that it had little or no influence on their route choice, compared to 15.9 percent for good walking paths. In contrast, a clear majority indicated that both factors influenced their route choice either a lot or very much, with a difference of only 0.7 percentage points between the two factors when the answers were compared. However, the strongest level of influence was more pronounced for short distance, as 47.5 percent of respondents stated that it influenced their route choice

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very much, compared to 43.9 percent for good walking paths.

The two remaining factors – straightforwardness and pleasant surroundings – were less prominent factors, where straight routes without turns or maneuvers were the least significant factor in influencing the choice of route. A majority of 55.7 percent answered that the influence of straightforwardness was little or none at all, whereas this number was 44.9 percent for the pleasant surroundings.

When you walk to Mölndal station, to what extent do the following factors influence your choice of route?

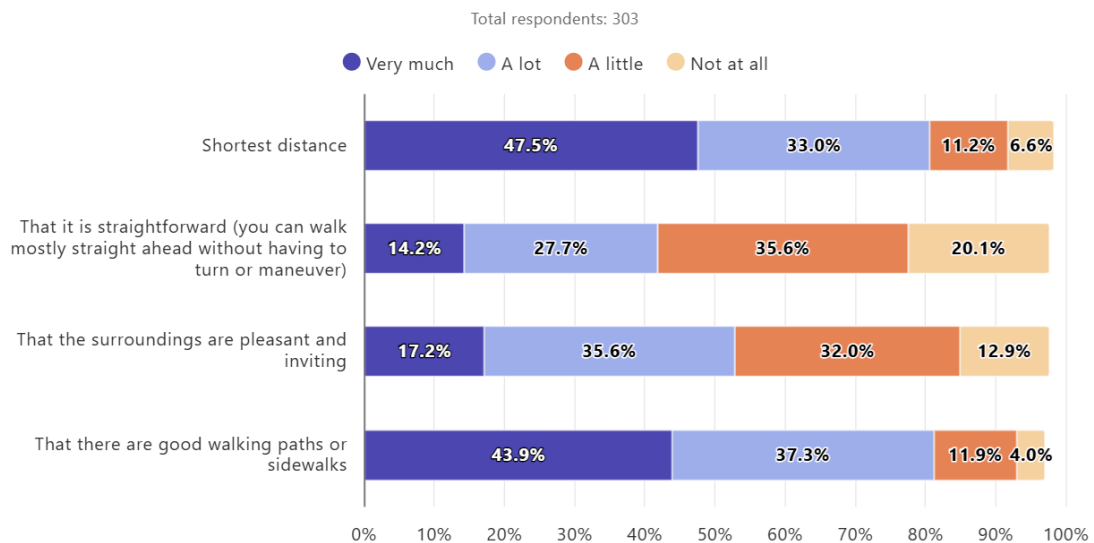


Figure 4.3: Answers to the question "When you walk to Mölndal, to what extent do the following factors influence your choice of route?", generated from Maptionnaire.

When performing cross-tabulations, only respondents who answered both the main question and the cross-referenced variable are included. Consequently, the number of respondents visualized in these figures is lower than the total number of respondents who answered the original question, as some participants did not complete all sections of the survey. The answers to the question "When you walk to Mölndal station, to what extent do the following factors influence your choice of route?" are cross-referenced with departure point and visualized in Figure 4.4. The survey presented that the difference in which factors influenced the route choice when walking to Mölndal station was rather marginal when comparing respondents coming from the East and West sides of the E6 highway. The factor that presented the most significant difference out of the options was the straightforwardness. Respondents with a departure point on the West side of the highway found this to be slightly more significant than respondents coming from the East side.

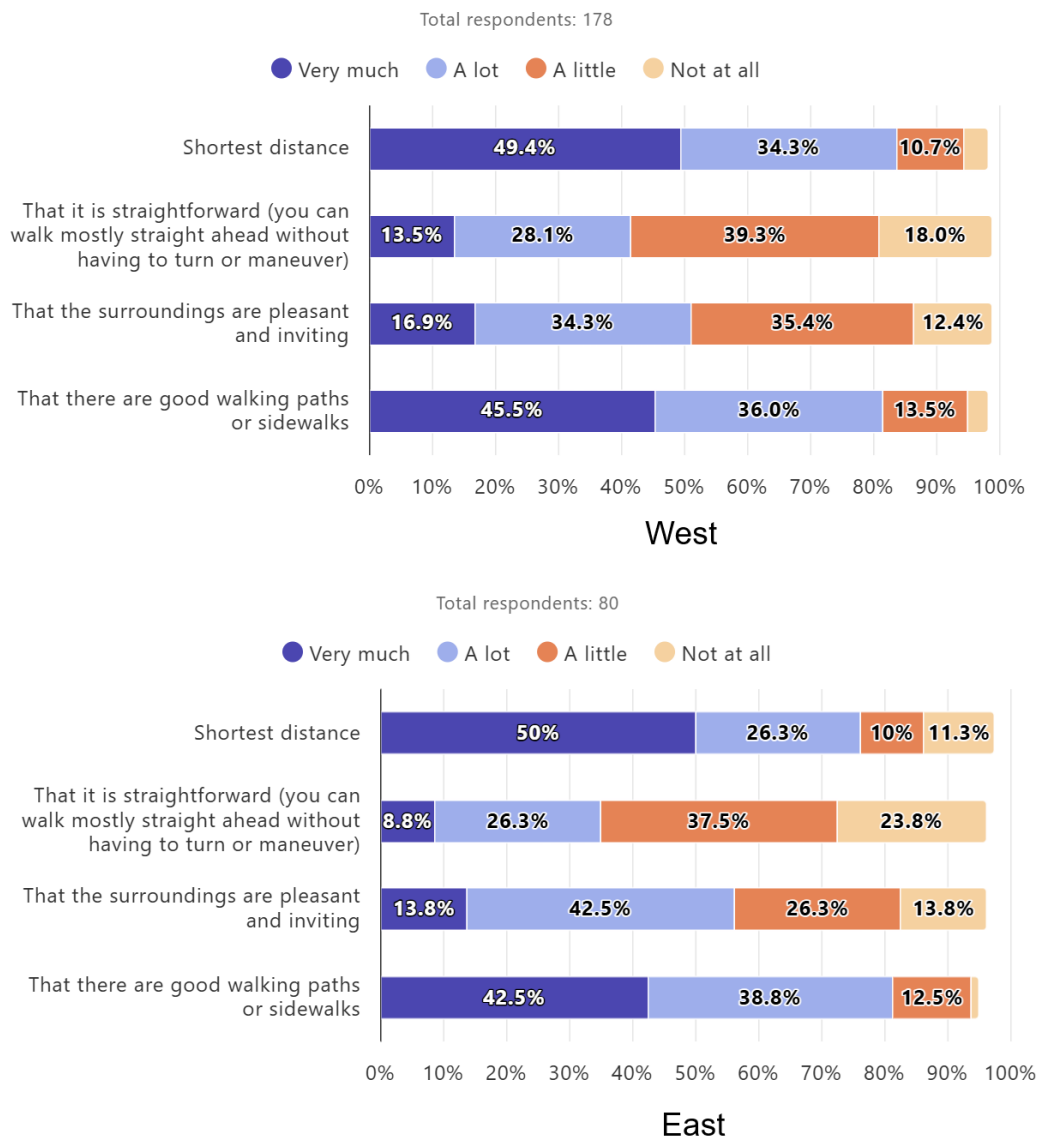


Figure 4.4: Factors that influence the route choice to Mölndal station, divided between people coming from the western and eastern side of the E6 highway.

This difference could be related to variations in street network structure, where the western side is characterized by a grid-based street network, while the eastern side consists of a more irregular and topographically constrained network with less direct routes towards the station. The difference is highlighted in Figure 4.5. This result could indicate that people coming from the East side are more used to having to take turns and maneuvers than people on the West side.

However, the difference between men's and women's influential factors was more present. Figure 4.6 presents the answers cross-referenced with gender and shows that men valued straightforward routes more so than women did, while women found

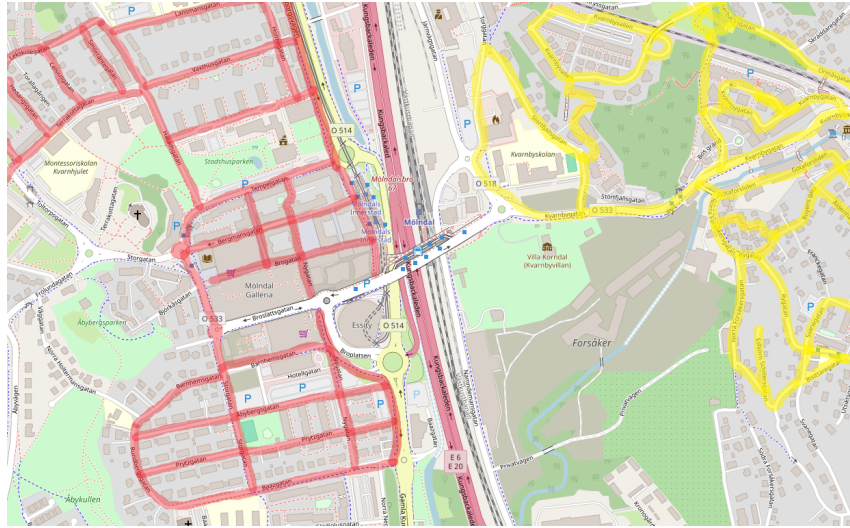


Figure 4.5: The street network structure highlighted on each side of the E6 highway, in OpenStreetMap.

good walking paths and sidewalks to be more important than men did. Another observation is that women tended to opt for the middle-ground options, such as "*A lot*" and "*A little*" more than men did.

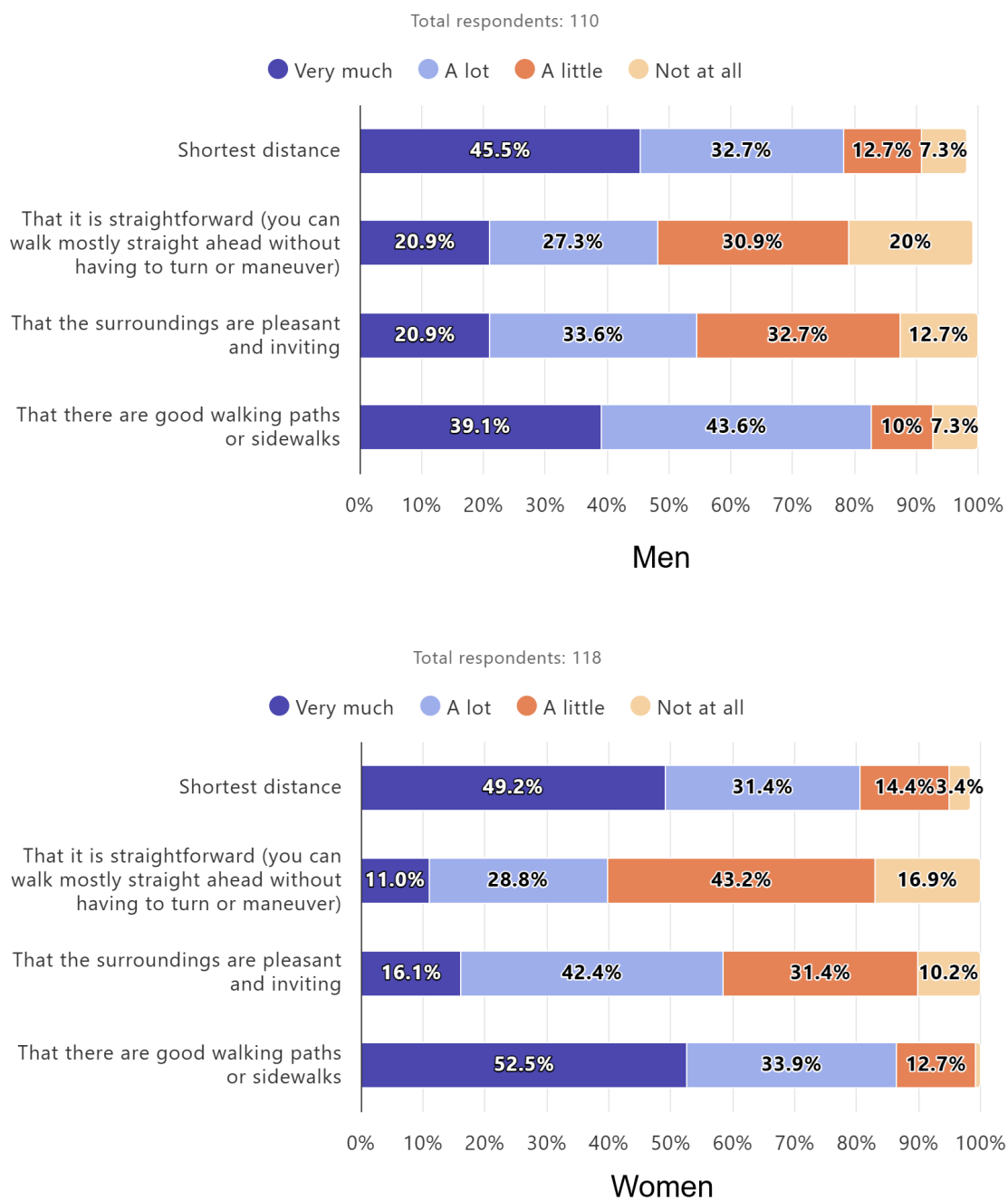


Figure 4.6: Factors that influence the route choice to Mölndal station, divided between men and women, generated from Maptionnaire.

The respondents who picked "Other" for gender were not cross-referenced or visualized for this question, as the number of such respondents was only two. This was deemed an insufficient number of respondents to provide an accurate or representative image of the answers.

4.2.3 Factors influencing barrier effects

In the following section, the responses in the survey focusing on the perceived walking conditions along the route to Mölndal station are presented. The analysis is based on respondents' levels of agreement with a set of statements, all of which are framed as continuations of the question: "*When I walk to Mölndal station, I experience...*". The statements are grouped in four analytical categories, based on the barrier effect framework and the conceptual model of van Eldijk et al. (2022). Each statement captures a specific aspect of the walking environment perceived by pedestrians and is grounded in one of the determinants within the conceptual model in Figure 2.1. Those determinants are linked to either direct or indirect barrier effects.

The results from this question are therefore structured in three main themes: transport features, route characteristics, and the interaction between the walking environment and people's abilities. This reflects how the perceived barriers are complex and are created not only from poor physical infrastructure but also depend on the route design and the different capabilities of individuals.

All graphs in this section are based on respondents who completed the whole survey, including the age-span question. The total number of respondents in each age span is presented in a number above each chart to show differences between age groups. For all graphs, the majority of respondents are between 20 and 49 years old. There is a bit of variation in how many statements each respondent has answered, however small enough not to generate any larger biases.

4.2.3.1 Crossing facilities & route structure

This category refers to the continuity, clarity and directness of the pedestrian routes, emphasized in the statements "*It is unclear where you are allowed or expected to walk*" and "*I can walk the most direct route*". These statements concern how clearly the walking environment communicates where to walk and how easy it is to move on foot and choose the right path. Therefore, those are strongly linked to the determinant *crossing facilitates and routes* in Figure 2.1. A lack of clear pedestrian priority and direct routes in the walking environment increases the cognitive effort and the trip effort, and therefore reduces the perceived accessibility. This is described in the theory of van Eldijk et al. (2022) as direct barrier effects, since they affect the ease and efficiency of walking.

Figure 4.7 presents respondents' answers to the statements shown in a chart for each age span. Regarding the first statement, the majority of respondents say that they partly agree or do not agree. Only a small fraction strongly agrees with the statement. This indicates that the majority of respondents do not experience uncertainty, but rather a partial lack of clarity in pedestrian space.

For the statement "*I can walk the most direct route*" there is a higher level of agreement among respondents in all age groups. This pattern indicates that the route is generally perceived as spatially direct and continuous. This shows that the pedestrian network provides physical connectivity and therefore generates low trip effort in terms of distance and route continuity.

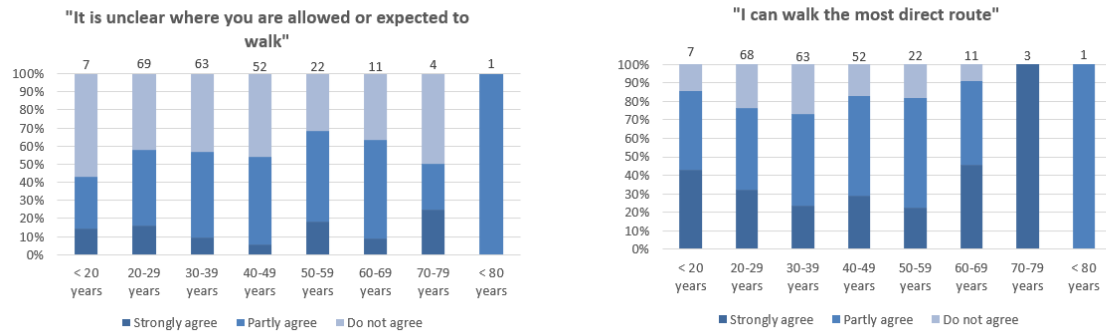


Figure 4.7: Graphs over the statements categorized as *Crossing facilities and route structure* with each graph showing each age span. The number above the graph shows the number of respondents in each age span.

Overall, responses show only small variations between age groups. These differences should be interpreted as indicative tendencies rather than statistically tested differences. Responses are largely consistent across age groups, and the graphs do not reveal a clear or systematic pattern. However, a slightly higher proportion of respondents in the youngest and oldest age groups strongly agree that they can walk the most direct route, compared to respondents in the middle age groups.

4.2.3.2 Transport features - static properties

The statements in this category relate to fixed elements of the transport infrastructure that form the built environment. Since these elements are constant, they do not change regardless of surrounding factors such as traffic conditions. The suitable statements in this category are therefore: "*The surroundings are aesthetically pleasing*", "*There are sidewalks and walking paths available for me to use, where I am separated from other traffic*", "*Sidewalks and walking paths are wide enough*", and "*There is good lighting along the route*". All of these statements concern the design of the physical environment and how the transport infrastructure is built. These aspects influence the effort required for pedestrians to move through the environment, the walking comfort, and the perceived security among people in the urban environment. While they do not always have to hinder walking, they affect the overall attractiveness of walking and how frequently people choose to walk. Therefore, they can give rise to both direct and indirect barrier effects.

Figure 4.8 shows that the majority of respondents' perceptions are positive across age groups. For the statement "*The surroundings are aesthetically pleasing*", a slightly higher share of respondents indicate that they do not agree compared to the

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other statements. In addition, the proportion of respondents who "*Strongly agree*" is noticeably lower than for the remaining three statements. Respondents' overall low rate of "*do not agree*" answers regarding the statement "*There are sidewalks and walking paths available for me to use, where I am separated from other traffic*" stands out positively in the context, showing that respondents have an overall positive experience regarding this aspect.

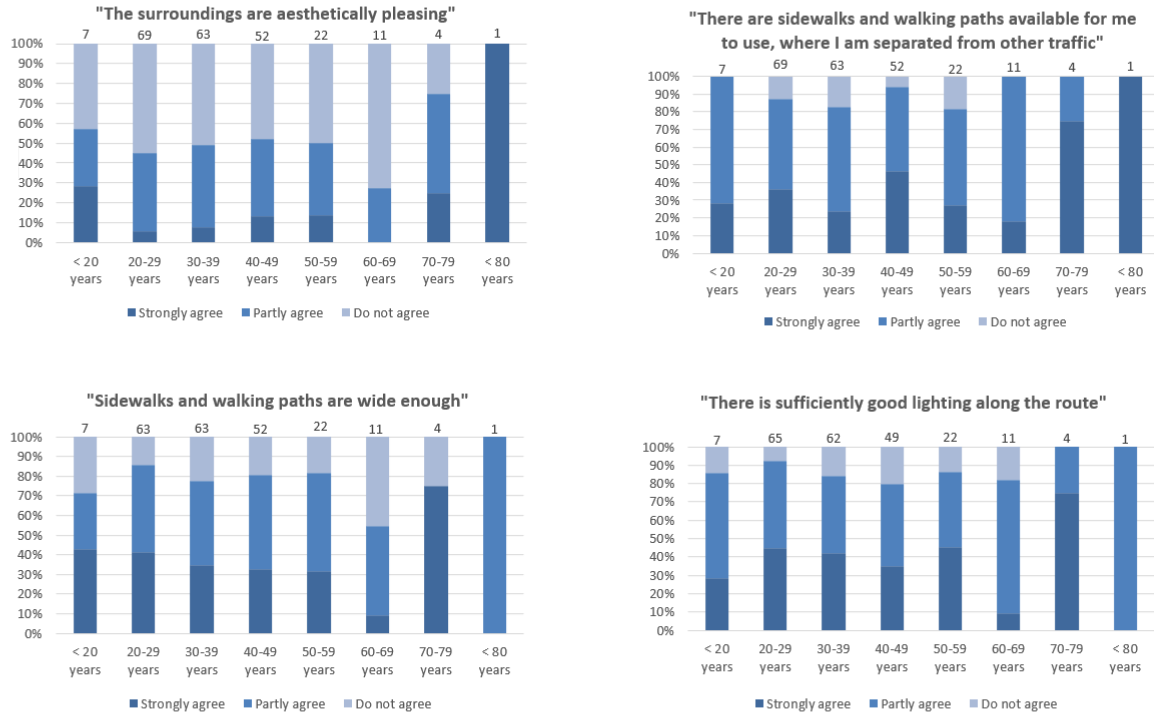


Figure 4.8: Graphs showing the statements categorized within the determinant *Transport features* regarding the static properties, with each graph showing each age span. The number above the graph shows the number of respondents in each age span.

4.2.3.3 Transport features - dynamic properties

In contrast to static transport features, dynamic properties are changeable and strongly influenced by the intensity of ongoing traffic-related activities within the transport infrastructure. These properties can vary over time and include factors such as traffic volume, perceived traffic safety, and noise levels. Within the conceptual framework by van Eldijk and Gil, motorised traffic intensity is identified as a key source of direct barrier effects (van Eldijk et al., 2022). The statements addressing these aspects are "*There is too much motorized traffic*", "*I feel unsafe in terms of traffic safety*", and "*The noise level from traffic is disturbing*".

Figure 4.9 shows a clear difference between the three statements, while no clear age-related pattern can be identified. Compared to the other statements, a larger share of respondents report that they do not agree with the statement "*I feel unsafe*

in terms of traffic safety". In contrast, a higher proportion of respondents agree that there is too much motorized traffic and that traffic-related noise is disturbing. Responses to these two statements are largely similar across age groups, indicating consistent perceptions regardless of age.

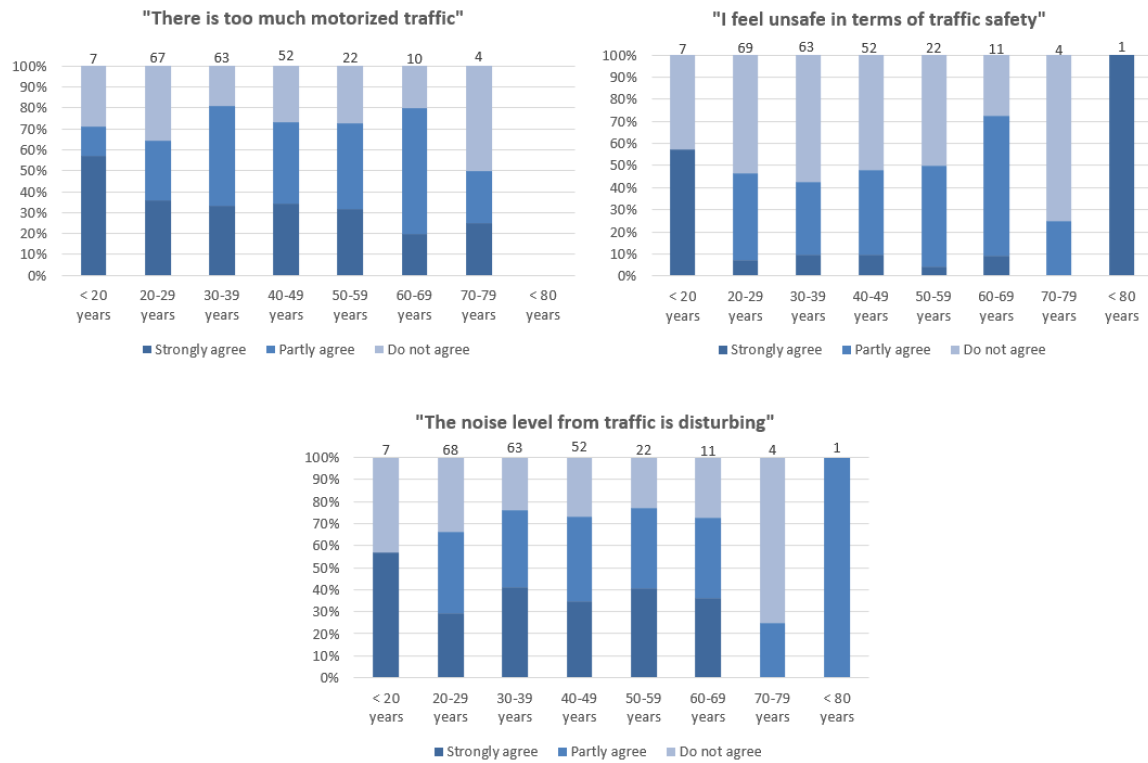


Figure 4.9: Graphs showing the statements categorized within the determinant *Transport features* regarding the dynamic properties, with each graph showing each age span. The number above the graph shows the number of respondents in each age span.

Compared to the statements addressing static transport features in Figure 4.8, responses related to dynamic transport features show higher levels of agreement with negative statements, especially regarding motorized traffic intensity and traffic-related noise. This indicates that dynamic transport features are more frequently perceived as problematic elements of the walking experience.

4.2.3.4 The combination of People's abilities and Transport features

The statements "*My ability to get around on foot is limited*" and "*There are changes in elevation that make it difficult to walk*" show the interplay between the infrastructure design and the people using it. This set of statements shows that the interaction between the two determinants can generate barrier effects to different extents, depending on the person and their abilities in the environment. A transport feature like the inclination can be easily overcome by some, while for some it may pose a major barrier in the streetscape.

Figure 4.10 presents respondents' agreement with the statements and shows that responses to both statements are dominated by "Do not agree", indicating that most respondents do not perceive their general ability to walk as limited, nor do they experience changes in elevation as a major difficulty along the route. Strong agreement remains low across all age groups for both statements. Some variation between age groups can be observed, though. For "My ability to get around on foot is limited", partial agreement is slightly more common among older respondents compared to younger age groups, and younger respondents more frequently report disagreement. However, there is no clear age-related pattern. Compared to the previously presented categories, statements addressing the interaction between people's abilities and transport features show some of the lowest shares of respondents agreeing with negatively framed statements.

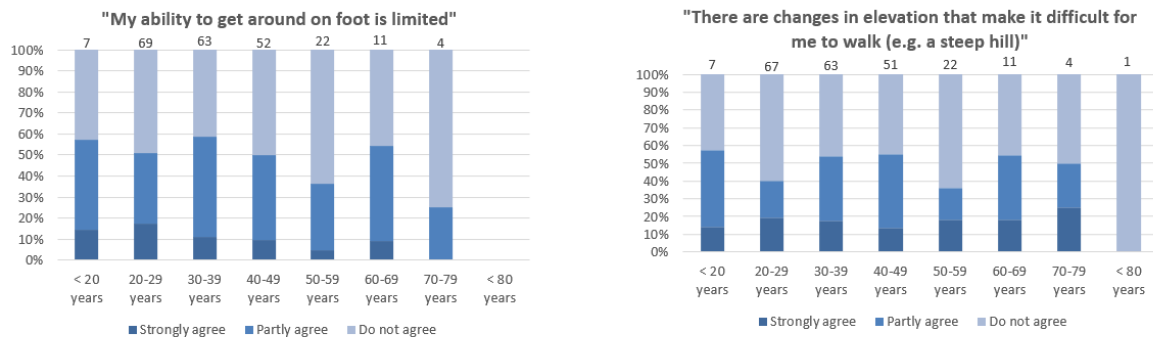


Figure 4.10: Graphs over the statements for the combination of the determinants *Peoples' abilities* and *Transport features* with each graph showing each age span. The number above the graph shows the number of respondents in each age span.

4.2.4 Regression analysis result

This section presents the results from the binary logistic regression analysis that was performed on respondents who had provided their demographic information. In total, a number of three analyses were conducted. One analysis included all answers from those respondents who had completed the survey, regardless of which direction they said they were approaching the station from. This analysis is shown in Table 4.1. In addition to this, two regression analyses were made, representing the respondents answering that they are coming from the eastern, versus the western side of the motorway. Those are presented in Appendix C. The following subsections first present the main regression results, followed by a comparison between the western and eastern analysis results.

4.2.4.1 Main regression results

Table 4.1 presents the results from the regression analysis for the full sample. The statements in the vertical direction are continuous statements asked as a part of the question "When I walk to Mölndal station, I experience..." in which respondents were

asked to grade the statements "*Strongly agree*", "*Partly agree*", or "*Do not agree*". The options "*Strongly agree*" or "*Partly agree*" were both coded as 1, while "*Do not agree*" was coded as 0. Those statements are the independent variables in the analysis.

Gender and access to a car were included as explanatory variables in the analysis, as they increased the R^2 value, which is a measure of how well the model explains the variation in the data. This value indicates the proportion of variation in the dependent variable explained by the independent variables, where a higher value means a better model fit. However, age was not included in the regression analysis, as it is a continuous variable and therefore couldn't be transformed into the binary format required for the model.

The overall percentage indicates how well the model correctly predicts the data. As can be seen in Table 4.1, both the overall percentages and the R^2 value are relatively high, suggesting that the model provides a good fit to the data and achieves a satisfactory level of predictive accuracy. The odds ratio (OR) values in the analysis indicate the direction of the association. Values greater than 1 indicate a positive association, while values below 1 indicate a negative association. In other words, an OR value greater than 1 means that the odds of the outcome increase, whereas an OR value less than 1 means that the odds decrease, as the independent variable increases. To determine whether an independent variable has a statistically significant effect on the dependent variable, the value must be less than 0.05. In this analysis, six statistically significant results were identified.

The horizontal row in the analysis consists of statements regarding the experienced barrier effects, which in this analysis are categorized as dependent variables. Respondents were asked to grade how often they experience those, where answer options were "*Always*", "*Often*", "*Rarely*", and "*Never*". The alternatives "*Always*" and "*Often*" were coded as 1, and the options "*Rarely*" and "*Never*" were coded as 0. The questions regarding gender, answering "*Female*" was coded as 1, and "*Male*" as 0. Similarly, for the question regarding access to a car, answering "*Yes*" corresponds to 1 in the analysis, and "*No*" to 0. Worth noting is that some of the statements are positively framed, and some are negatively framed. Regardless of this, a value of 1 was assigned respondent answered "*Fully agree*" or "*Partially agree*", while "*Do not agree*" was coded as 0 in the analysis. This means that the interpretation depends on whether the statement is positively or negatively framed. This implies that respondents agreeing with positively framed statements would show a significant association with the dependent variables, interpreted here as barrier effects. Several of the statements are biased, and it should be acknowledged that respondents may interpret statements differently, as individual perceptions of what constitutes "*too much*" can vary.

Table 4.1: Regression analysis output of perceived barrier effects experienced on the way to Mölndal station, including the odds-ratio (OR), significance (Sig.), R^2 value, and overall percentage of the model's correct predictions.

Statement	"I find it complicated to walk to Mölndal station"		"I avoid walking to Mölndal station"		"I choose to walk to other stations or stops instead of Mölndal station"	
Overall percentage [%]	77.8		76.1		74.8	
R^2	0.452		0.178		0.200	
Statements	OR	Sig.	OR	Sig.	OR	Sig.
That it is unclear where you are allowed or expected to walk	0.760	0.526	0.798	0.570	1.375	0.405
That I can walk the most direct route	0.377	0.034	0.932	0.873	0.828	0.644
That there is too much motorized traffic	1.843	0.254	1.083	0.866	1.162	0.738
That my ability to get around on foot is limited	7.004	<0.001	1.425	0.393	2.261	0.040
That I feel unsafe in terms of traffic safety	1.289	0.534	1.561	0.263	1.008	0.928
That the noise level from traffic is disturbing	1.415	0.492	1.518	0.372	1.576	0.304
That the surroundings are aesthetically pleasing	0.605	0.185	2.081	0.043	1.325	0.413
That there are sidewalks and walking paths available for me to use, where I am separated from other traffic	0.652	0.475	0.364	0.038	0.760	0.599
That sidewalks and walking paths are wide enough	1.373	0.481	0.750	0.494	1.286	0.547
That there is sufficiently good lightning along the route	0.386	0.071	0.496	0.130	0.329	0.014
That there are changes in elevation that make it difficult for me to walk (e.g. a steep hill)	2.224	0.056	1.630	0.221	1.255	0.544
Gender	1.570	0.235	1.404	0.329	1.358	0.358
Access to car	0.874	0.725	0.812	0.554	0.617	0.151

In Table 4.1, it can be seen that all three dependent variables, being the barrier effects, show significant results with two independent variables each. A factor standing out is the one regarding limited availability to move on foot, which shows a significant association with both direct barrier effect statements, *"I find it complicated to walk to Mölndal station"* and *"I avoid walking to Mölndal station"*. These dependent

variables are direct barrier effects statements. Regarding the association with the statements of how complicated it is to walk to the station, the significance is less than 0.001, which shows that this is the most powerful of all independent variables for this dependent statement. It indicates that the perception that it is complicated to walk to the station can be strongly influenced by how accessible the street network is for pedestrians. The OR value for this factor is 7.004, and by far the highest value among all variables in the analysis. This number indicates that respondents agreeing with that their ability to get around by foot is limited are seven times as likely to agree that walking to Mölndal station is complicated. The factor of being limited to moving by foot strongly influences the agreement to walk to other stations. In fact, the likelihood of agreeing with this indirect barrier effect is doubled, since the OR value is a bit above 2.

The perception of finding it complicated to walk to the station shows a higher R^2 value compared to the other dependent variables in the analysis, but indicates that about 45 percent of the outcome can be explained by the model and the independent variables, meaning that roughly 55 percent of the outcome depends on other factors. Furthermore, the perception of whether it is complicated to walk to the station or not is also strongly influenced by the perception of the directness of the route. However, since this is a positive framed statement, this variable has a low OR value indicating a negative association. This means that respondents finding it easy and direct to walk to the station are less likely to find it complicated to walk to the station.

Furthermore, the factor of good lighting along the route shows strongly significant values for the dependent variable concerning respondents choosing to walk to other stations than Mölndal station, which is an indirect barrier effect. However, the OR value for this variable is below 1, indicating a negative association. This means that respondents who agree that there is good lighting along the route are less likely to choose to walk to other stations.

Whether respondents said that they avoid walking to Mölndal station or not shows a significance with two of the statements, which are both framed positively. However, only the statement regarding the walking path being wide enough shows a negative association. Even if a respondent perceives the surroundings as positive and their way to the station as easy, there can be other factors influencing their perceptions, which may not be captured in the analysis. The R^2 value is lower for this variable than for the other dependent variables, which indicates that the model's ability to capture this is a bit more limited.

The OR values for gender were consistently above 1 across all dependent variables, suggesting a tendency for women (coded as 1) to have higher odds of the outcomes compared to men (coded as 0). However, these results were not statistically significant and should therefore not be used to form conclusions about the relationship. The dependent variables regarding changes in elevation and the noise level from the motorized traffic show relatively high OR values, which suggests a potentially strong

association. However, since none of those statements shows statistical significance, no clear conclusions can be drawn. This indicates that the observed relationships may be due to random variation and cannot be interpreted as reliable evidence of an effect. Access to a car did not show any statistical significance with the perceived barrier effects.

4.2.4.2 Comparison between analyses

When comparing the results from the regression analysis of all answers with the analysis over people coming from the eastern side of the station, two significant results were found (see Table C.1 in Appendix). Similarly, for the general regression analysis covering respondents' answers from both directions, respondents coming from the eastern side, the factor of limited ability to walk by foot is an important factor influencing the feeling of complicated walking to the station. The OR for this variable is 11, which means that it seems to play a vital role in people's perception of whether it is complicated or not to walk to the station. The second statistically significant result can be found for the dependent variable regarding disturbing noise levels affecting the perception of the barrier effects regarding how complicated it is to walk to Mölndal station. This factor also shows a really high positive OR value of 22. Another difference visualised in this analysis is that the R^2 value is greater for the dependent variable "*I avoid walking to Mölndal station*", which indicates that the model better captures the variations in this analysis compared to the previous one, shown in Table 4.1. Neither of the factors regarding car and gender shows any significant difference here either.

The regression analysis result based on answers including only respondents from the western direction of the station shows a higher overall percentage compared to the previous analysis regarding respondents' answers from both directions and from the eastern direction. Similar to previous analysis, the statement "*My ability to get around on foot is limited*" shows significant outcomes with two of the perceived barrier effects, which are shown in C.2 in Appendix. The independent variable regarding sufficient lightning along the route also showed statistical significances with the direct barrier effect "*I avoid walking to Mölndal station*" and the indirect barrier effect statement "*I choose to walk to other stations or stops instead of Mölndal station*". Despite those being positive framed statements, this shows that lightning influences respondents' perception of those barrier effects a lot. However, this analysis showed significant associations for the gender factor, with an OR value of 4. This indicates that, according to the regression analysis result, women were four times more likely to perceive all three barrier effects than men were.

4.2.5 Spatial analysis result

The survey gave respondents the option to mark out where they may experience potential hinders when walking to Mölndal station. The area which could be marked was approximately 2.3 kilometers wide, West to East, and 1.5 kilometers tall, North to South, with Mölndal station being centered in the middle of the markable area. This resulted in 137 marked out spots, showcased in Figure 4.11.

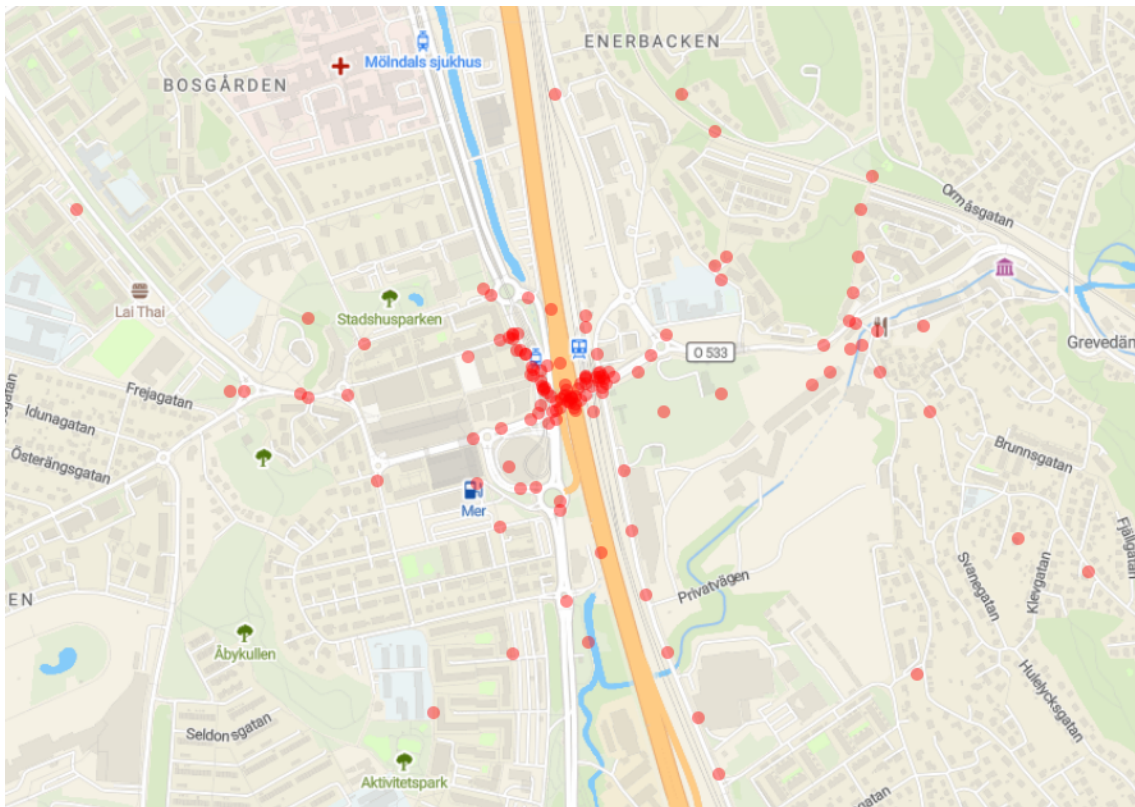


Figure 4.11: Map responses of where respondents experience hinders when walking to or from Mölndal station, extracted from Maptionnaire.

Respondents were then asked to write what they experienced as a hindrance if they marked such a hindrance in the previous question. This resulted in 85 responses. Respondents specified that they experienced vehicles that traveled at too high speed levels, vehicles that did not stop to let pedestrians cross the road, a lack of or unclear pedestrian crossings, as well as attributes, such as roundabouts, fences, and hills, that blocked the view. The second most common identified theme was crowding among the mixed transportation modes, which approximately 30 percent of respondents expressed.

A common, yet specific, theme was how the elevators and escalators were said to often be broken, too narrow, or inaccessible in other ways. 24 percent of the responses brought up this topic, while 28 percent mentioned having issues with stairs and steepness. Thus, many of the responses expressed challenges with level differences in the area.

Furthermore, several respondents answered that they felt unsafe in the area. Sometimes, it referred to traffic safety, sometimes it was in the context of exposure to potential crime, and in some cases it remained unspecified. Factors such as a lack of sufficient lighting were mentioned as a reason for feeling unsafe. It was brought up how the bridge is a construction that creates an unsafe feeling in terms of both exposure to traffic and crime. Other hinders that were mentioned were confusing

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navigation, construction work, and temporary redirecting solutions, an aesthetically unpleasing environment, uncleanness, and noise pollution from the E6 highway. Ultimately, the experienced hinders are barriers that cause direct, indirect, or potentially even wider barrier effects to people who need to use or pass through Mölndal station.

After navigating these individual hindrances, two locations from the mapped responses were investigated. These were concentrated spots where several respondents had marked out and noted the same hindrance. One of the locations was the intersection between Bergmansgatan and Göteborgsgatan, illustrated in Figure 4.12, which then continues parallel to the bus and tram platforms. Respondents said that other transportation modes, such as cars, bicycles, and electric scooters, often cross the pedestrian path, thus making it difficult to traverse by foot, as well as creating confusion regarding where to walk. This problem extended down the road, as respondents also found it troublesome to walk across to the tram and bus platforms on the other side. They expressed that the area was crowded with buses and that there was no set, clear location to cross.



Figure 4.12: The intersection between Bergmansgatan and Göteborgsgatan, where respondents experienced hinders. Retrieved from Google Maps.

The other specific location with the same hindrance mentioned several times was the spiral staircase between the East side of Mölndals bro and the ground level beneath the bridge, illustrated in Figure 4.13. Respondents expressed that the staircase was too narrow, creating a bottleneck issue. One respondent also mentioned how the staircase was rickety and felt uncomfortable using it.

It was also observed that there were four marked spots made by people with departure or destination point on the eastern side, and 80 marked spots made by people with departure or destination point on the western side. However, the total number of eastern respondents was 94, while the total number of western respondents was 198. This results in an estimated answer frequency of 52 percent for eastern respondents and 40 percent for western respondents. Although it is worth noting that the same respondent could make several map response entries.



Figure 4.13: The spiral staircase at Mölndals bro, which respondents point out as a hindrance.

4.3 Site audit results

The first visit took place on March 25th, 2026, and was spent photographing the surroundings and getting an overview of the site and its potential problematic areas. The station area has three railway tracks parallel to the tram tracks and E6 highway, and the platforms are exposed with nothing to separate them, other than the tracks. This created a loud noise level, where normal conversing was difficult when standing on the platforms, which are also beneath Mölndals bro, where car and bus traffic was operating and further contributing to noise pollution. This may negatively affect the perceived comfort of the space, potentially discouraging pedestrians from staying or moving through the area, and leading them to seek alternative routes or spaces.

A notable feature was the spiral staircase in Figure 4.13, also mentioned by survey respondents in the previous section. This staircase was rickety and did not feel like an obvious choice of route, but rather a temporary solution. Carrying suitcases or a child up or down this staircase would be inconvenient, and perhaps even dangerous, which could leave users having to detour to get between the bridge and Eastern

ground level. The spiral staircase could reflect an underlying governance challenge, where divided responsibilities make it difficult to ensure smooth transitions between different actors' respective parts of the station area. Rather than supporting direct and intuitive movement, the staircase appears as a suboptimal solution.

Figure 4.14 depicts the passage between the train platform and Mölndals bro. The area from which the picture was taken was an empty, unused space, whereas the narrow escalators and the gateway within a short distance from these created a bottleneck issue. Moreover, cyclists struggling to navigate between the pedestrians were observed on the combined walking and bicycle path going through the bridge, depicted in 4.15. The uncertainty of where to walk continued as one approached the bus area on the bridge. Pedestrians had to cross the road intuitively to get to the pick-up spot, as there was no visible pedestrian crossing. Figure 4.16 shows a slight difference in the poured concrete, as well as a path for people with visual impairment, indicating where to walk. It was, however, observed that people crossed the road at random instances. This suggests that the intended path was not clear or intuitive.



Figure 4.14: The escalators going from the train platform to Mölndals bro.



Figure 4.15: Combined walking and bicycle path on Mölndals bro.



Figure 4.16: Bus platforms on Mölndals bro.



Figure 4.17: Path from the bridge to Mölndal Galleria.

It was, however, noted that the connections from the city center on the West side to the station area were many and direct, and pedestrians could enter the Mölndal Galleria mall from both relatively direct connections on the ground floor and on the bridge. Figure 4.17 shows the path from the bridge to the top floor entrance of the mall, and displays a direct, clean path, free from obstacles. Mölndal Galleria can function as an attractor, reinforcing pedestrian flows and increasing the likelihood that people choose to walk. This supports continuous movement, demonstrating how directness and destination accessibility contribute to walkability.

Overall, the observations indicate that walkability within the station area is uneven, with particularly strong connections on the western side, while key transition points between levels and functions present significant challenges for intuitive and continuous pedestrian movement. Overall, the observations indicate that walkability within the station area is uneven, with particularly strong connections on the western side, while transition points between levels and functions present significant challenges for intuitive and continuous pedestrian movement.

5

Discussion

This chapter merges the findings from the interviews, survey, regression analysis, spatial analysis, and site audits. The discussion integrates perspectives from both planning professionals and users in order to develop a more comprehensive understanding of how walkability and barrier effects emerge in station environments and how governance works in this context.

Finally, the findings from the interviews and surveys are synthesized into a strategic framework highlighting key success factors based on the experiences of planning professionals across municipal, state, and private organizations, as well as the perceptions of pedestrians, with Mölndal station as the empirical basis.

5.1 Experienced walkability

The findings show that professionals' idea of a walkable path does not necessarily align with the user experience. This highlights a potential mismatch between planned and experienced walkability, suggesting that current planning practices may not fully capture how walking environments are perceived by users. Interviewees often pointed out directness as a prominent contributor to walkability. While this is true according to Hillnhütter (2016) and Gehl (2011), the survey respondents ranked this option as the least influential to their choice of route. This reveals a paradox where directness is theoretically emphasized, but not by the users. One possible explanation for this is that directness is a parameter that planning professionals explicitly work with and analyze when designing pedestrian networks. It is thus a central concept within planning practice. For users, however, the available route is the only option, and they may not have any alternative, more direct route to compare with. This may result in directness being taken for granted or implicitly embedded in the expression of other factors, such as distance or convenience, rather than being perceived as a distinct attribute in itself.

In this sense, directness may become visible to users when it is lacking. The spatial analysis provided an example of this, where pedestrians with departure or destination point on the East side of the E6 highway were less influenced by directness when choosing their route than respondents from the West side. This could possibly be because the routes on the eastern side are more irregular and less direct, as opposed to the western side, where the street network is grid-based, making respondents from the west less accustomed to, and therefore less accepting of, turns and maneuvers.

The two factors that most influenced users' choice of route were distance and the presence of good walking paths. What defines a good walking path was left unspecified in the survey. This was done to keep the survey simple and comprehensible to the respondents and to avoid directing their responses. In this context, the concept of a "good walking path" is therefore subjective in this context and reflects an overall impression of the route rather than specific predefined attributes. This may also help explain why directness, for instance, is emphasized in planning practice but less explicitly recognized by users, as they are instead embedded within the broader understanding of route quality, which also suggests that walkability is experienced differently depending on people's needs and situations.

However, this subjective perception makes it difficult to pinpoint the actual factors that should potentially be improved regarding the walking environment. At the same time, this highlights a methodological challenge, as important aspects of walkability may be overlooked when relying solely on predefined and measurable indicators. Moreover, while "good walking paths" is not defined, it could be interpreted as an accessibility factor, which is the most basal urban form attribute in the hierarchy of walking. However, some users may instead perceive it as a matter of comfort or even pleasure, which would question the theory of these being more secondary needs. This would further illustrate the mismatch between analytical measures and lived experience.

The regression analysis provides additional nuance to this interpretation. While the survey shows that respondents evaluate the walking experience holistically, the regression points out some factors having a greater influence on how respondents perceive the barrier effects. Variables related to walking conditions were found to be significant with both direct and indirect barrier effects, even though they were not explicitly identified by respondents as decisive in their route choice. This further supports the idea of the overall experience as important.

Together, this suggests that walkability is not purely related to design and structure, but also to how the environment is perceived. Lower perceived walkability can therefore be understood as an early stage in the emergence of barrier effects, where reduced route quality increases the perceived effort of movement. This can be understood through the concept of accessibility, which describes not only the physical possibility of reaching destinations but also how easy and intuitive this process is perceived to be. Meanwhile, planning tools and strategies are often centered around measurable factors and not the holistic perspective. This may cause important aspects to be overlooked, or even large sums of funding being spent on analysis that only contributes marginally compared to a potential investigation of the pedestrian experience, which planners suggested was missing due to insufficient finance. This reflects a broader gap between quantitative planning tools and qualitative user experiences.

Furthermore, these insights highlight the need for planning approaches that can

capture and structure these subjective experiences. Reality is way more complex than what structural indicators or measures can show, and therefore, walkability cannot be understood only through measures and designs, but should be approached through a holistic point of view.

5.2 Perceived accessibility and barrier effects

This thesis aimed to investigate how pedestrians perceive walking to Mölndal station and what influences their walking experience. The results show that physical accessibility do not necessarily always align with perceived accessibility. Based on the regression analysis output, respondents report that they can walk the most direct route and that they have access to sidewalks. Despite this, several aspects of the walking environment are perceived as problematic. Noise levels, traffic intensity, and unclear pedestrian prioritization are all factors that seem to affect the walking experience in a negative way. This is further reinforced by results from the spatial analysis, in which bridges, crossings, and level differences are demonstrated as major hindrances and perceived barriers for pedestrians.

The regression results, together with the survey responses and spatial analysis, show a pattern regarding how barrier effects are formed. The spatial analysis identifies specific physical elements as hindrances, and the survey responses highlight the experiential aspects of the walking environment, the regression analysis demonstrates which of these factors significantly influence perceived barrier effects. Rather than pointing to a single dominant cause, the results suggest that barrier effects emerge through the interaction of multiple determinants – both physical and perceptual. This aligns with the theoretical framework used in the study, in which van Eldijk et al. (2022) states that perceived accessibility is a result of the interaction between transport features, routes, and people’s abilities, rather than a single dimension alone.

One of the strongest factors influencing perceived barrier effects was whether respondents felt limited in their ability to move by foot, reflected in high OR values across all regression models. While this result should be interpreted with caution – since the statements "*My ability to get around by foot is limited*" and "*I find it complicated to walk to Mölndal station*" are conceptually similar – it still highlights an important dimension of perceived accessibility. The relationship suggests a strong interdependence between perceived ability and perceived effort. This is supported by van Eldijk et al. (2022), who argues that reduced perceived ability directly increases the likelihood of barrier effects, with *People’s abilities* being a key determinant of the rise of barrier effects.

The regression analysis demonstrates a gender-based difference in how barrier effects are perceived on the western side, as seen in Figure C.2 in Appendix. In general, women were more likely than men to agree with statements reflecting both direct and indirect barrier effects, indicating a higher perceived impact of barriers in the walking environment. This could depend on the fact that the majority of

respondents stating that they walk to Mölndal station with a stroller, walkers, or similar walking aids are women. This suggests that differences in perceived barrier effects may not primarily be driven by gender itself, but rather by differences in walking conditions and physical demands associated with everyday mobility.

This gender difference should not be interpreted as women being less capable in dealing with hindrances or overcoming barriers, but may reflect an unequal distribution of experienced trip effort within the pedestrian environment. The differences may also be influenced by broader social patterns related to gender roles and everyday mobility practices. For example, women are often more likely to engage in trip-chaining activities, such as combining commuting with caregiving responsibilities, which may include traveling with strollers or accompanying others. Although these broader societal measures fall outside the scope of this project, they are important to consider to avoid oversimplified interpretations of the results.

However, walking with a stroller or mobility aid can increase both the physical and cognitive effort required to navigate the environment, which may make the walking experience more challenging and increase the trip effort. Within the theoretical framework applied in this study, this can be understood as an increase in *trip effort*, which is a vital component through which barrier effects arise van Eldijk et al. (2022). As the trip effort increases, so does the likelihood of experiencing both direct and indirect barrier effects – such as perceiving a route as complicated or choosing alternative routes. The survey result, therefore, aligns with the theoretical perspectives of accessibility as a concept strongly influenced by individuals' characteristics and mobility conditions (Geurs & Van Wee, 2004; van Eldijk et al., 2022).

The finding that aesthetically pleasing surroundings were significantly associated with the statement "*I avoid walking to Mölndal station*" may appear counterintuitive, as it suggests that respondents do not necessarily value this aspect in their decision-making. A possible explanation is that other factors, which were not included in the regression analysis, play a more important role in influencing avoidance behavior. These could include aspects such as poor design of the station area, perceived safety issues, or risk of crime. It could also be the case that it is not the walking route itself that is perceived as problematic, but rather the station as a destination. Since these factors were not captured in the regression model, it is difficult to determine exactly what drives this relationship. However, this aligns with the broader theme discussed earlier, where respondents appear to evaluate the walking experience as a whole rather than separating individual attributes. This suggests that even if certain aspects of the environment are perceived as positive, they may be outweighed by other negative factors, meaning that individual variables do not always directly translate into improved perceived walkability. This is also reflected in other parts of the results. Although directness showed statistical significance in the regression analysis in relation to the statement "*I find it complicated to walk to Mölndal station*", it was ranked as one of the least important factors in route choice, which further supports the idea that certain variables may influence perception without being consciously recognized.

When comparing the results from the eastern and western sides, a clear difference emerges in which factors are most strongly associated with the statements regarding barrier effects. On the eastern side, disturbing noise levels were linked to the perceived barrier effect of avoiding walking to the station, indicating that *transport features* play a dominant role in shaping perceived accessibility. On the western side, however, factors related to environmental quality – such as lighting – and individual characteristics – like perceived ability – were more strongly associated with both direct and indirect barrier effects. This can be interpreted as the eastern side being more affected by disturbance-related barriers, while the western side reflects more capability- and quality-related barriers.

These differences are also consistent with the spatial analysis, which identified different types of physical conditions on each side, suggesting that the built environment contributes to shaping which barriers become most prominent. As shown in Figure 4.5, the more grid-based and structured street network on the western side may provide greater route clarity and alternative paths, allowing factors such as lighting and individual ability to become more decisive. The more irregular network on the eastern side may limit pedestrians' route choice, and therefore, traffic-related disturbances become more important. The western side has historically been more developed and is therefore now characterized by residential areas and also the mall of Mölndal, while the eastern side has been dominated by more industries and offices.

This demonstrates that perceived accessibility is highly context-dependent, where similar overall conditions can produce different barrier mechanisms depending on local environmental and spatial structures. While some factors mainly influence the perceptions, others extend into behavior changes; they all contribute to the development of barrier effects. This further supports the idea that different built environments shape how barriers are perceived, since they affect which factors become most relevant in the interaction between environmental conditions and users' abilities. This can also be related to the DMA theory of Dovey and Pafka (2020) where density, mix, and accessibility are described as vital structural conditions influencing walkability. The regression analysis results of wide sidewalks and direct routes reflect and support those perspectives, where basic accessibility conditions seem to be quite fulfilled in the case area. However, these structural conditions alone are not enough to reach perceived accessibility, and respondents report negative walking experiences due to environmental factors. This supports the idea that urban form describes the potential for walking rather than the actual experience (Dovey & Pafka, 2020). This means that structural walkability does not automatically result in perceived accessibility.

5.3 Governance in multidisciplinary planning

Many of the governance problems when planning station areas for walkability ultimately stem from differing goals and flawed communication, which results in unclear division of responsibility. This causes frustration that permeates the industry, but

planners also appear to acknowledge these conditions as an inherent part of the system. Despite recognizing the limitations, there seems to be an acceptance that this governance issue will not be improved unless a party is formally assigned to explicitly do so. This may have caused normalization of an "us and them" mindset, negatively affecting the cross-collaboration. The pragmatic acceptance may stem from another issue highlighted in the interviews – that there is a limit to how much can be done. Prioritizing one matter often comes at the expense of others, given limited resources and budget. Ambitions that are too high, where all the needs of the parties are a priority, are often prone to failure, but the alternative does not have to be a low-effort, completely familiar, already standardized solution. Cross-organizational actors should not only jointly agree on common solutions, but also collectively sort out certain matters to make room for these common solutions.

Failure to set realistic goals and ambition levels and ending up with suboptimal compromises also reflects a planning dynamic where trade-offs are unavoidable, but where the absence of coordinated decision-making may lead to uneven outcomes. The combined pedestrian and bike path on Mölndal bro can be interpreted as an example of such a compromise. Since the bridge has limited space, creating optimal solutions for each transportation mode is not realistic in this case, and many others. As a result, design decisions often prioritize certain functions over others, leading to environments where one mode operates at the expense of another. This highlights the importance of structured prioritization in collaborative planning stages, where not all objectives can be addressed equally, but where there is a process for deciding what to prioritize.

A tension highlighted in the interviews concerns the division between formal responsibility and perceived societal responsibility. While several actors emphasized that walkability beyond their immediate area of responsibility lies outside their scope, others pointed out that creating a walkable environment should be understood as a shared, societal concern. This collective sense of responsibility is reinforced by the broader goal of sustainable ecological and social development, which all organizational actors strive toward.

No single actor is responsible for the pedestrian journey as a whole, which can divide the course into unnatural bits, instead of a fluid, seamless walking experience. Insufficient aspects in governance and planning can ultimately lead to poorly integrated solutions. The spiral staircase observed in the Mölndal station site audit can be interpreted as an example of governance fragmentation. Rather than enabling smooth and intuitive movement, the spiral staircase example reflects how insufficient coordination between different actors can result in suboptimal solutions or afterthoughts. Governance issues may thus ultimately take physical, long-lasting form.

Early and coordinated problem framing is essential for achieving coherent outcomes in multidisciplinary planning, as emphasized in the ÅVS principle. If important measures are not clearly defined and agreed upon between actors early in the process,

later phases are more likely to be dominated by organizational boundaries, responsibilities, and financing constraints. An example from the interviews concerns the replacement of the underused Ekekullsbron with a new bridge and platform connection, which was not contested until later stages of the planning process. Trafikverket reasoned that they did not need to build a new bridge to fulfill their responsibility, but it was well known that a new bridge would create a better connection between both sides of the highway, as well as the platforms. They ultimately reallocated resources from Ekekullsbron to the new bridge, but the collaborative process was described as very complicated, which highlights the importance of early problem framing before later-stage considerations of responsibility and financing arise.

5.4 The Collaborative Walkability Approach for Successful Governance

This section introduces The Collaborative Walkability Approach for Successful Governance, a conceptualized model, illustrated in Figure 5.1, that builds on the identified governance, planning, and collaboration challenges. The model combines insights from the interviewed professional planners, survey responses from pedestrians, and the results from the regression analysis to create a nuanced framework that should work as decision-making support in multidisciplinary planning processes. By combining professional experiences, user perspectives, and quantitative data, a checklist was developed to address common challenges, with a particular focus on accessibility, walkability, and barriers around station areas. The three main points of this consist of closing the user-planner gap, establishing a shared problem definition, and defining clear accountability.

Close the user-planner gap

Barriers are not objective, but perceived. Therefore, the first step is to address the mismatch between planners and the user base and gather an understanding of what pedestrians value in their walking environment and what they experience as a hindrance. This study has proven that performing a survey that collects these user perspectives around any station areas in question is feasible, especially in projects with a longer time frame than this thesis and a proper budget. As this is not usually performed, the challenge becomes establishing this step and constructing relevant questions for such a survey. Inspiration can, however, be drawn from Appendix B. By combining the qualitative data from potential pedestrians in the specific area and experiences from planners, and the quantitative, analytical data that is already a part of contemporary planning processes, planners can assemble a more nuanced understanding of how to design optimal routes and areas for intuitive movement.

Establish a shared problem definition

A common understanding of problems creates common solutions. The findings from the interviews show that different stakeholders often operate with their own perceptions of walkability, while prioritizing the issues concerning their own area of responsibility and what walkability might indicate in their specific context. By

collaboratively defining problems in the walking environment based on both user experiences and professional insights, stakeholders can align their understanding of key challenges and formulate shared, explicit walkability goals to work towards. The survey mentioned in the previous step would be useful in this context as well, as the user perspective represents the common denominator across stakeholders, given that pedestrians ultimately move through and experience all parts shaped by the different actors.

Define clear accountability

When several multidisciplinary stakeholders are in charge of different components of the station area, interfaces between these may not be considered unless each party's area of responsibility is clearly defined from the start. That way, no element of the walking experience is left forgotten with a late-stage makeshift solution, and the traveler's route or transfer becomes seamless. Planning should account for the entire pedestrian journey as a continuous experience, but having all project managers responsible for the entire planning and construction process is a utopia. Therefore, it would be necessary to introduce an overarching role whose sole responsibility would be to have an overview of the entire pedestrian route and the different stakeholders' processes, and make sure that all components of the station are managed and connected.

A common denominator for all steps in this collaborative framework is the challenge of altering long-standing planning traditions and established ways of working. However, acknowledging that the topics are complex is the first step to improvement. Whether the challenge lies in recognizing the mismatch between planner and user perceptions, bridging different professional definitions of walkability, or accepting that the distribution of responsibility is fundamentally tricky, awareness is the foundation for improvement. By making these challenges explicit, stakeholders are better equipped to treat the pedestrian journey as the continuous, interconnected experience it must be.



Figure 5.1: The Collaborative Walkability Approach for Successful Governance model.

5.5 Limitations and Biases

As with all research, this thesis involves certain limitations and potential sources of errors. This thesis is mainly based on qualitative data, produced from interpretative processes. Therefore, the data can never be fully objective (Denscombe, 2014). During interviews or other qualitative research, it is likely that the researcher's self becomes a part of the data collection technique. It is thus impossible to know if the result would be the same if the study were carried out by another researcher. The interviews were conducted in Swedish, since this was the native language for all interviewees. However, as the thesis is written in English, nuances in the original Swedish responses may have been lost in translation.

Regarding case studies, one of the disadvantages is that their findings can be very unique for the specific setting and therefore challenging to draw generalized conclusions from (Denscombe, 2014). A comparative study including multiple case studies would have allowed for more generalized conclusions, but this was not feasible within the time frame of the master's thesis.

5.5.1 Interviews and actors

The selection of interviewees was partly based on recommendations from supervisors at both WSP and Chalmers, and partly through snowball sampling. Even though this approach was effective in identifying knowledgeable participants, it may have resulted in a biased sample, as the interviewees tend to belong to the same professional network and may therefore share similar perspectives. In total, ten interviews were conducted, which provided a solid foundation for the analysis. However, a larger number of interviews could have captured a broader range of perspectives.

Furthermore, the interviews were limited to selected relevant stakeholders within the Gothenburg and Mölndal region, but not necessarily with representatives from every involved discipline. As the case addressed the Almedal - Mölndal project and the redevelopment of Mölndal's station area, most of the respondents worked in Gothenburg or Mölndal, with one exception. While this provided valuable case-specific insights and examples, it also limits the applicability of the findings to other geographical contexts. While these stakeholders are relevant for the study, perspectives from professionals in other regions or at a national level are not captured. Furthermore, the perspective of the property owner and manager of Mölndal station, or in general, was not captured in this study. Jernhusen, which is a property manager responsible for station buildings in Sweden, was contacted, but no interview was carried out. This represents a notable gap, given that several interviewees emphasized the importance of collaboration between all involved parties in the planning process. Finally, since the interviews followed a semi-structured format, different interviewees may have been asked slightly different questions, which may have affected the outcome of the responses.

5.5.2 Survey

A general limitation of conducting a survey is knowing whether the population of respondents is representative or not. When aiming for a representative sample as possible, a random sampling technique is the best option Denscombe (2014). Since it is the respondents actively choosing whether to conduct the survey or not, the sampling can never be fully random. The survey was active for two weeks in April, which possibly skews the answers as they do not necessarily reflect how respondents feel during the colder times of the year. Snow and icy paths could act as obstacles and inconveniences for respondents, but these meteorological conditions may not be considered during spring. Thus, the result may appear more positive than if the survey had been active during the winter.

The survey asked about demographic information at the end. As a result, respondents who did not finish the entire survey could not be considered in the cross-referencing analysis or regression analysis. The analyzed answers were therefore fewer than what they could have potentially been if the question order had been different. Moreover, the survey results should not be interpreted as a reflection of society at large or diverse demographic groups, as responses from certain individuals could not be guaranteed. For instance, the two respondents who answered "Other"

when asked about gender were not analyzed, as these responses were deemed too few. As these respondents were so few, they were also left out to protect their privacy. Neither did the survey consider factors such as socioeconomic demographics, cultural background, or family situation. It is also worth noting that a site visit where the authors handed out fliers with a link to the survey was done during peak commute time on a weekday. This was probably the reason why employed respondents were overrepresented when compared to the estimated employment rate in Mölndal. In addition, it is important to note that the survey results are based on individuals' perceptions and formed by their experiences and personal preferences. Respondents may interpret statements and formulations as "*too much*" very differently, which therefore makes the result skewed. Moreover, the survey relies on stated preferences, which may not fully reflect their actual behavior. Therefore, complementary observations of real-world behavior could strengthen the findings.

Regarding the map-integrated question, there were proportionally more marked out hindrances made by respondents with destination or departure point on the eastern side of the highway than on the western side. At first, this was interpreted as eastern respondents experiencing more hindrance, but this cannot be either confirmed or denied, as respondents had the ability to mark out several hindrances, which many respondents had done. On the one hand, if this opportunity had been limited to one or two map responses, a more accurate image of which side experienced more hindrances could have been analyzed. Moreover, a restriction of the number of map responses that could be made by the same respondent may have made the users more conscious of which hindrances to pick. That scenario could have possibly delivered outputs that were more concentrated in specific locations, and potentially the most problematic hindrances. The option to score the severity of the hindrances could have been added to provide further insight into this. On the other hand, allowing multiple markings per respondent enabled a more comprehensive representation of the range of hindrances experienced, rather than limiting responses to a fixed number that may not reflect actual conditions. It is also worth noting that a reason for the marked out differences being concentrated around the station is that it is the spot where travelers gather, regardless of their point of departure, and not necessarily because these hindrances are more problematic than less frequently mentioned ones. Nonetheless, it says that they are experienced by many.

The regression analysis was based on 207 respondents who completed the questions regarding gender and access to a car. Respondents who did not complete the survey were excluded, which may bring a selection bias. A greater sample would have provided a better fit to the model and more secure OR values. Separate analyses were conducted for respondents approaching the station from the west and east, respectively, while those indicating neither direction were only included in the overall analysis. As with all regression analysis, the results indicate associations between variables, but can not establish causality. The fact that a barrier is significantly associated with avoiding walking to the station does not mean that the barrier causes this behavior – other confounding factors may also affect. Furthermore, the survey statements were coded as binary variables, which means that nuances in respon-

dents' answers may have been lost, since partial agreement was treated the same as full agreement.

5.5.3 Site audit

In addition, there are also limitations related to the qualitative aspect and data collection during the field visits. The authors visited Mölndal stations twice during the project, but more visits would have contributed to a greater understanding of the site. Moreover, the site was only visited in March and April, which may have provided a quite contemporary perspective of the area, given the similar weather conditions of the two visits. Visiting during harsher weather conditions, such as snow or minus-degrees, could have provided the authors with information about other problematic areas or hindrances. The visits also occurred at similar times during the day, these being the peak afternoon commute hours. This may also have skewed the image that the authors retrieved of the station area, which was then busy.

5.6 Further research

The interviewees stated that there is a need to further investigate pedestrians' experiences in the urban environment. It was also mentioned how it is important to research the user perspective in the specific places of different projects, and not just generally, to identify which explicit design elements or components contribute to or inhibit accessibility and walkability in the area. National transport investments often prioritize regional accessibility that can create barriers for local pedestrians, as seen in the case of the Mölndal - Almedal project. Thus, planners need broader decision-support tools that weigh the benefits of regional travel against the costs to local walkability (van Eldijk et al., 2022). Consequently, further research is needed to understand how these different scales interact, ensuring that large-scale infrastructure does not compromise the local pedestrian perspective. This is reinforced by (Lindelöw, 2016), who mentions how the focus on pedestrian transportation is in its infancy and that walking as a transport mode is still subordinate in most urban environments. The knowledge regarding pedestrian planning is therefore still rather sparse, despite a recent increase in interest in the subject. Relatively few studies have examined how research on walking is interpreted and applied in planning practice.

Moreover, this thesis has focused on barriers and walkability in Gothenburg and around Mölndal station, and interviewees were mainly planners working in these cities. Further research on pedestrians' experiences and perceived walkability could examine this on a larger scale or in different contexts. Previous research on the topic has primarily been conducted in the USA and China. Out of the existing studies conducted in Sweden, most tend to focus on general active transportation and accessibility in the city, rather than on walkability in relation to public transport station areas, as in this report. This leaves room to further investigate the subject from a

Swedish perspective, and notably the aspect of walking to public transport nodes.

6

Conclusion

This thesis explored how walkability and barriers in public transport station areas influence travelers and their walking behavior, and how these topics are addressed in planning processes. The study focused on both planning perspectives and user experiences, examining how different actors define and respond to barriers in the walking environment around Mölndal station.

The findings demonstrate that pedestrians' willingness to walk is not determined solely by structural factors such as distance or network design, but is strongly shaped by how the walking environment is perceived. While users emphasized route quality, comfort, and overall experience, planners tended to prioritize measurable factors such as directness. This indicates a clear mismatch between planned and experienced walkability.

At the same time, the study shows that barrier effects are not caused by single factors, but emerge through the interaction of the built environment, people's needs, and perceived trip effort. Both the survey and regression analysis highlight that limitations in people's abilities, together with the environmental quality – such as lighting and traffic conditions – play a key role in shaping perceived trip effort, thus experiencing barrier effects, or changing travel behavior.

The results suggest that governance-related challenges can lead to issues with walkability, particularly when coordination and responsibility are unclear. Such fragmentation in governance and limited integration of user perspectives can result in responsibilities at interfaces falling between the cracks and only being addressed at a late stage, which may lead to suboptimal solutions. This can lead to pedestrian routes often being treated as separate components rather than as continuous systems. Taken together, the study shows that improving walkability requires both better design of the walking environment and improved coordination within governance and planning. This involves integrating a holistic, user-oriented perspective, where the pedestrian journey is understood as a seamless experience.

By ultimately combining insights from stakeholders and identifying problematic areas across both organizational and user perspectives, factors for successful governance and walkability planning could be pinpointed. This resulted in a checklist-format framework to use in planning processes that aims to support governance and decision-making, with a focus on optimizing walkability. Aiming to ease the collaborative process, the checklist also considers the user insights and how to enhance

the walking perspectives better in the planning process of station areas, while also contributing to this relatively under-researched subject of walkability around stations, which needs more academic attention.

Furthermore, the result showed that walkability and barriers need to be acknowledged as complex subjects, as they are subjective. Their interpretation relies on people's abilities, needs, and the urban environment. Recognizing this complexity is a step towards improvement. It is therefore crucial to not only consider professional opinions but also adopt a holistic, and preferably a local, perspective that stems from the opinions and experiences of the people that the system will serve.

This study draws attention to the growing interest in focusing on walking as a transportation mode in urban planning, where pedestrians are hopefully looking toward a future of more intuitive walking experiences in Sweden – a future where walkability goes beyond the platform.

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A

Interview structure

Namn och kort beskrivning av roll/arbete

- Pratas det om barriärer runt stationsområden och barriäreffekter i planeringsprocessen?
Varför/varför inte? Hur ser den diskussionen ut?
- Vet alla i processen vad som menas med barriäreffekter?
- Hur jobbar ni med barriäreffekter på runt stationsområden?
- Hur kartlägger ni en barriär för gång?
Ingår det alltid? Ett identifikationsstadium?
- Hur jobbar ni tillsammans med Trafikverket för att överkomma dessa och minimera effekterna?
- Vilka faktorer prioriterar ni när ni planerar och analyserar behovet av vägar för gång?
Vilka kriterier kollar ni först på (när det gäller barriärer), och vilka väger tyngst när ni ska planera en väg för gång?
- Finns det något underlag eller kunskap som ni saknar i de flesta planeringsprocesser om barriärer?
Vilket? Underlag från boende/resande? Som ni inte undersöker i dagsläget?
- Om ni fick detta underlag, hur skulle det underlätta för er?
- Hur tar ni fram beslutsunderlag idag?
- Vad har funkat bra i tidigare projekt/vad funkade inte bra?
- Finns det något du tror är relevant för oss att veta?
- Finns det någon du tycker vi borde prata med?

B

Survey design

English ▾

How do you experience walking to Mölndal station?

This survey examines how travelers to and from Mölndal station perceive what it is like to walk to the station. The survey is part of the data collection for a degree project at Chalmers University of Technology, at the Department of Architecture and Civil Engineering.

All responses are anonymous, and all questions are voluntary to answer. The survey takes approximately 5–7 minutes to complete. If you wish, you also have the chance to win a movie ticket!

Thank you for your time and contribution!

Kind regards,
Klara and Johanna

Have you been to Mölndal station in the past 5 years?

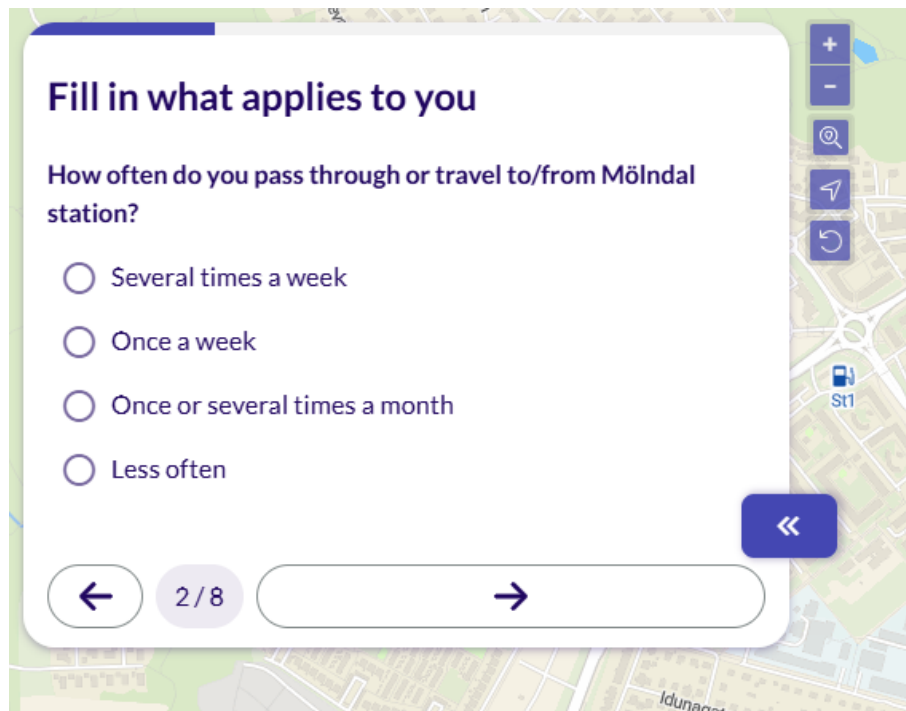
☐ Yes

☐ No

1/8 →

«

Figure B.1: The first page of the survey.



Fill in what applies to you

How often do you pass through or travel to/from Mölndal station?

- ☐ Several times a week
- ☐ Once a week
- ☐ Once or several times a month
- ☐ Less often

Navigation controls: back arrow, 2/8, forward arrow, and a double back arrow button.

Figure B.2: The second page of the survey.

When you travel to Mölndal station

From which side of the E6 do you most often arrive at the station? See the map below

☐ From the west (Väst)

☐ From the east (Öst)

☐ Neither



How often do you walk to Mölndal station?

☐ Several times a week

☐ Once a week

☐ Once or several times a month

☐ Less often

How long would it take you to walk to Mölndal station?
(Think about the distance from where you usually travel from to the station.)

☐ < 5 minutes

☐ 5 -5 minutes

Figure B.3: The first part of page 3 of the survey.

☐ 5 - 5 minutes
☐ 15 - 30 minutes
☐ > 30 minutes

When you visit Mölndal station, do you usually walk with a stroller, a walker, crutches, or similar?

☐ Yes
☐ No

When you walk to Mölndal station, to what extent do the following factors influence your choice of route?

	Very much	A lot	A little	Not at all
Shortest distance	☐	☐	☐	☐
That it is straightforward (you can walk mostly straight ahead without having to turn or maneuver)	☐	☐	☐	☐
That the surroundings are pleasant and inviting	☐	☐	☐	☐
That there are good walking paths or sidewalks	☐	☐	☐	☐

Navigation: 3 / 8

Figure B.4: The second part of page 3.

Your experience of walking to Mölndal station

When I walk to Mölndal station, I experience...

	Strongly agree	Partly agree	Do not agree
That it is unclear where you are allowed or expected to walk	☐	☐	☐
That I can walk the most direct route	☐	☐	☐
That there is too much motorized traffic	☐	☐	☐
That my ability to get around on foot is limited	☐	☐	☐
That I feel unsafe in terms of traffic safety	☐	☐	☐
That the noise level from traffic is disturbing	☐	☐	☐
That the surroundings are aesthetically pleasing	☐	☐	☐
That there are sidewalks and walking paths available for me to use, where I am separated from other traffic.	☐	☐	☐
That sidewalks and walking paths are wide enough	☐	☐	☐

Map labels: Idunagatan, Österängsgatan, Solhemsgatan, SOLÅNGEN, Våsterängsgatan, STAL

Figure B.5: Page 4 of the survey, experiences of walking to Mölndal station.

That sidewalks and walking paths are wide enough	☐	☐	☐
That there is sufficiently good lighting along the route	☐	☐	☐
That there are changes in elevation that make it difficult for me to walk (e.g. a steep hill)	☐	☐	☐

Mark where you perceive that there are any issues that affect the walk to Mölndal station. (Mark, click save, and repeat if you want to indicate several locations.)

Mark where you perceive that there are problems. 

If you marked a problem, please specify the issue.

What would make you more inclined to walk to Mölndal station?



4 / 8



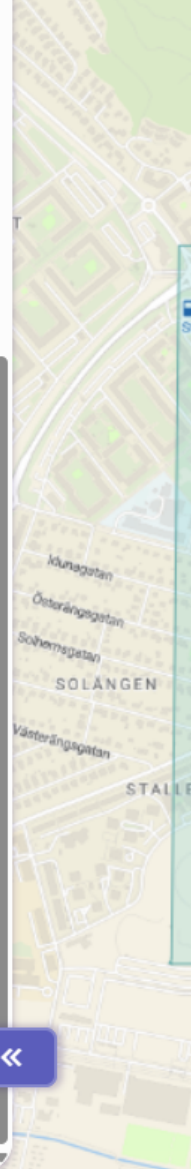


Figure B.6: Second part of page 4, map-based questions.

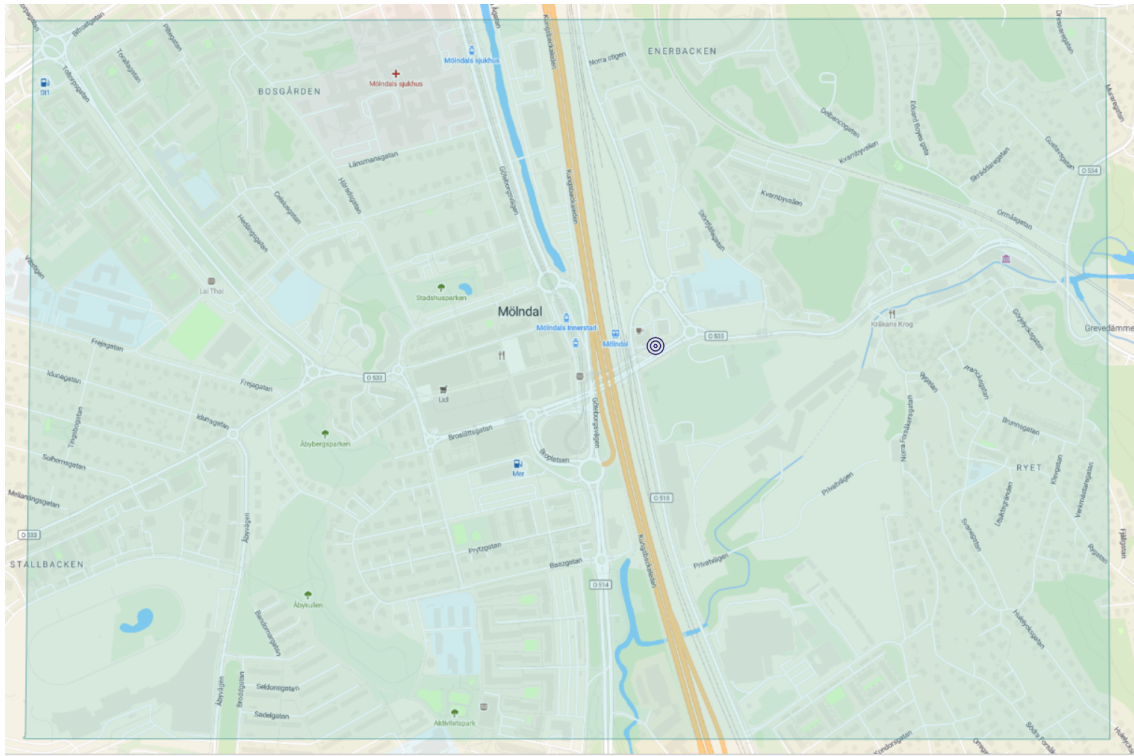
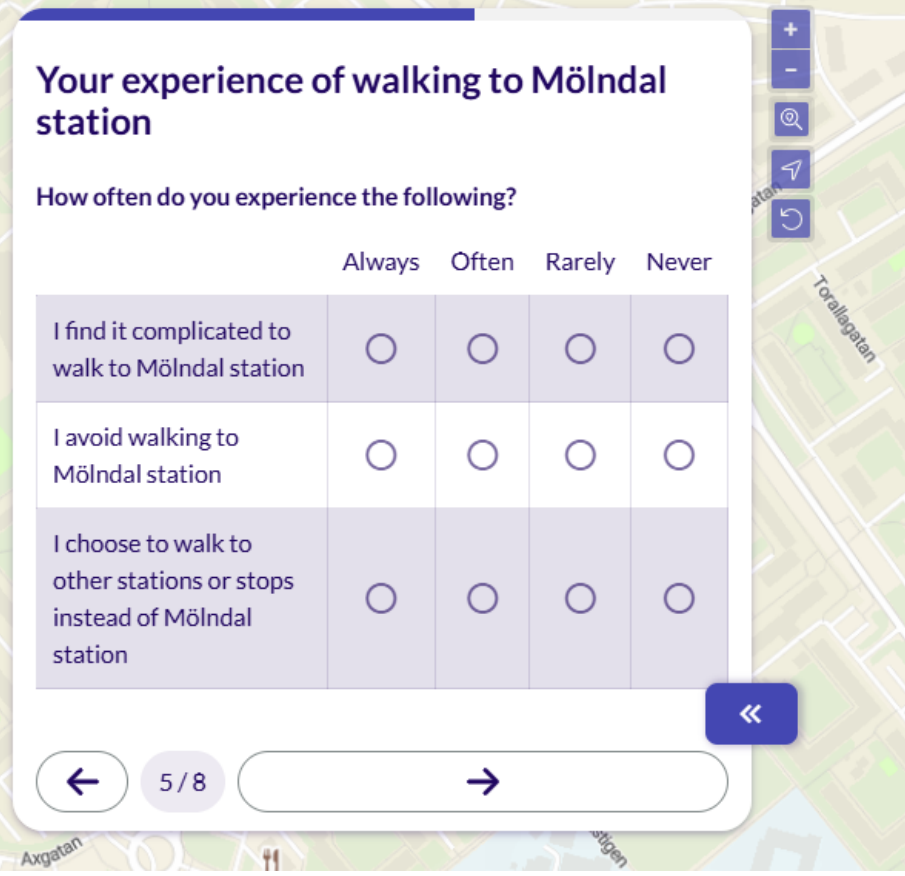


Figure B.7: Catchment area in which the respondents could mark out hinder, Page 5 in the survey.



The image shows a survey interface overlaid on a map. The title is "Your experience of walking to Mölndal station". Below it is the question "How often do you experience the following?". There are four columns of response options: "Always", "Often", "Rarely", and "Never". The survey contains three items, each with a radio button in each column. The first item is "I find it complicated to walk to Mölndal station". The second item is "I avoid walking to Mölndal station". The third item is "I choose to walk to other stations or stops instead of Mölndal station". At the bottom, there are navigation buttons: a left arrow, a page indicator "5 / 8", and a right arrow. A blue button with a double left arrow is also present. The background is a map showing streets like "Torallagatan" and "Axgatan".

	Always	Often	Rarely	Never
I find it complicated to walk to Mölndal station	☐	☐	☐	☐
I avoid walking to Mölndal station	☐	☐	☐	☐
I choose to walk to other stations or stops instead of Mölndal station	☐	☐	☐	☐

Figure B.8: Page 5 in the survey, experienced barrier effects.

The image shows a mobile application interface for a survey. The background is a map. A white overlay box contains the survey questions. The questions are: 'Some concluding questions', 'How old are you?' (with age ranges from 'Under 20 years' to '80 years or older'), 'Gender' (with options 'Female', 'Male', 'Other', and 'Prefer not to say'), 'What is your occupation?' (with options 'Employed', 'On parental leave', 'Student', 'Unemployed / job seeker', 'Retired', and 'Other'), and 'Do you have access to a car?' (with options 'Yes' and 'No'). At the bottom, there is a navigation bar with a back arrow, a page indicator '6 / 8', a forward arrow, and a blue button with a double back arrow. Map controls like zoom in/out and location are visible on the right side of the map.

Some concluding questions

How old are you?

☐ Under 20 years

☐ 20-29 years

☐ 30-39 years

☐ 40-49 years

☐ 50-59 years

☐ 60-69 years

☐ 70-79 years

☐ 80 years or older

Gender

☐ Female

☐ Male

☐ Other

☐ Prefer not to say

What is your occupation?

☐ Employed

☐ On parental leave

☐ Student

☐ Unemployed / job seeker

☐ Retired

☐ Other

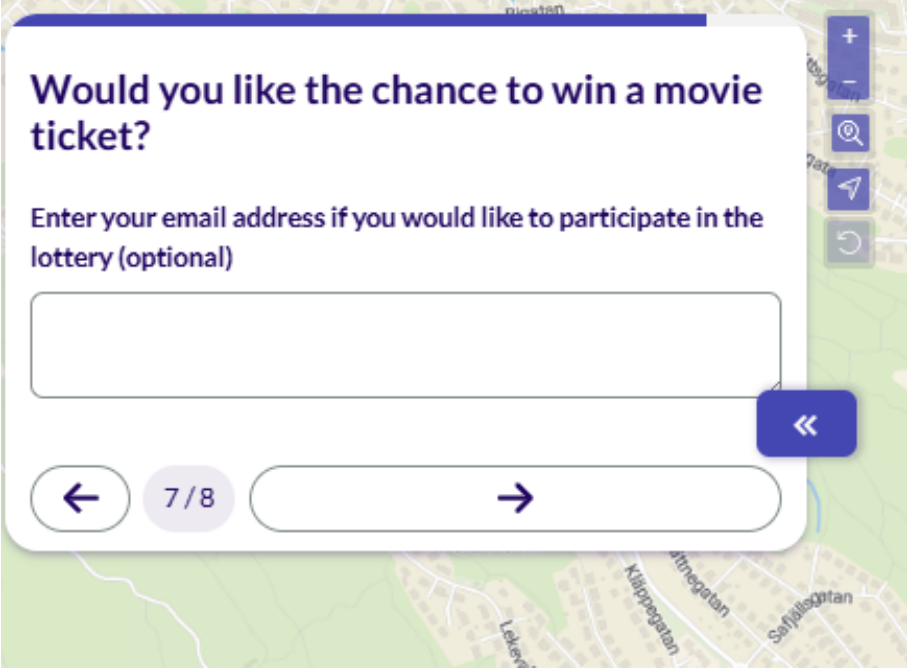
Do you have access to a car?

☐ Yes

☐ No

Navigation: < 6 / 8 > <<

Figure B.9: Page 6, demographics.



The image shows a survey form overlaid on a map background. The form has a white background with a blue header bar. The text on the form is in a dark blue font. The form includes a title, a subtitle, an input field, and navigation buttons. The map background shows a street grid with labels like 'Lekens', 'Kilpeegatan', 'Safjällsgatan', and 'Safjällsgatan'.

Would you like the chance to win a movie ticket?

Enter your email address if you would like to participate in the lottery (optional)

Navigation buttons: < 7/8 > << >>

Figure B.10: Page 7 of the survey, where respondents could fill out their email to participate in the lottery.

C

Results from regression analysis

Table C.1: Regression analysis output of perceived barrier effects experienced on the way to Mölndal station, including the odds-ratio (OR), significance (Sig.), R^2 value, and overall percentage of the model's correct predictions. The analysis is only regarding respondents approaching the station from the east.

Statement	"I find it complicated to walk to Mölndal station"		"I avoid walking to Mölndal station"		"I choose to walk to other stations or stops instead of Mölndal station"	
Overall percentage [%]	75.5		78.8		73.1	
R^2	0.472		0.332		0.208	
Statements	OR	Sig.	OR	Sig.	OR	Sig.
That it is unclear where you are allowed or expected to walk	0.178	0.115	0.596	0.593	1.029	0.593
That I can walk the most direct route	0.145	0.122	1.035	0.976	3.714	0.976
That there is too much motorized traffic	4.192	0.292	0.370	0.495	12.577	0.495
That my ability to get around on foot is limited	11.063	0.024	0.735	0.735	1.832	0.735
That I feel unsafe in terms of traffic safety	0.291	0.209	1.080	0.940	0.248	0.940
That the noise level from traffic is disturbing	1.639	0.602	22.042	0.030	2.577	0.313
That the surroundings are aesthetically pleasing	0.373	0.241	3.058	0.239	0.403	0.239
That there are sidewalks and walking paths available for me to use, where I am separated from other traffic	2.611	0.507	0.293	0.367	3.979	0.367
That sidewalks and walking paths are wide enough	0.450	0.484	0.437	0.441	0.991	0.441
That there is sufficiently good lightning along the route	0.113	0.051	1.017	0.986	0.579	0.986
That there are changes in elevation that make it difficult for me to walk (e.g. a steep hill)	1.303	0.773	1.592	0.607	0.892	0.607
Gender	0.403	0.261	0.330	0.150	1.143	0.150
Access to car	1.122	0.889	0.920	0.921	0.435	0.921

Table C.2: Regression analysis output of perceived barrier effects experienced on the way to Mölndal station, including the odds-ratio (OR), significance (Sig.), R^2 value, and overall percentage of the model's correct predictions. The analysis is only regarding respondents approaching the station from the west.

Statement	"I find it complicated to walk to Mölndal station"		"I avoid walking to Mölndal station"		"I choose to walk to other stations or stops instead of Mölndal station"	
Overall percentage [%]	83.3		81.3		77.8	
R^2	0.549		0.306		0.336	
Statements	OR	Sig.	OR	Sig.	OR	Sig.
That it is unclear where you are allowed or expected to walk	0.871	0.828	0.880	0.816	1.645	0.341
That I can walk the most direct route	0.326	0.087	0.751	0.633	0.523	0.249
That there is too much motorized traffic	1.494	0.615	0.920	0.897	0.505	0.254
That my ability to get around on foot is limited	17.111	<0.001	1.967	0.243	3.333	0.029
That I feel unsafe in terms of traffic safety	1.002	0.998	1.632	0.394	0.546	0.292
That the noise level from traffic is disturbing	1.462	0.650	0.681	0.563	1.476	0.526
That the surroundings are aesthetically pleasing	0.522	0.263	1.900	0.202	1.332	0.552
That there are sidewalks and walking paths available for me to use, where I am separated from other traffic	0.352	0.169	0.508	0.298	0.710	0.612
That sidewalks and walking paths are wide enough	1.774	0.394	0.483	0.209	0.990	0.441
That there is sufficiently good lightning along the route	0.294	0.152	0.239	0.042	0.127	0.006
That there are changes in elevation that make it difficult for me to walk (e.g. a steep hill)	1.940	0.285	1.734	0.314	1.629	0.346
Gender	4.390	0.018	4.005	0.012	3.189	0.021
Access to car	0.601	0.389	0.831	0.717	0.489	0.147

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