Issue 26(2), 2026
ISSN: 1567-7141
DOI: [10.59490/ejtir.2026.26.2.8222](https://doi.org/10.59490/ejtir.2026.26.2.8222)

TU Delft OPEN Publishing
Research Article

Exploring accessibility conditions for bike–train commuting: A qualitative study among university staff in Belgium

Stijn Rybels [1,*], Thomas Vanoutrive [1]

[1] Faculty of Design Science, University of Antwerp, Belgium
* corresponding author stijn.rybels@uantwerpen.be

Keywords
bike-train commuting
perceived accessibility
station accessibility

Publishing history
Submitted: 13 June 2025
Revised dates: 17 October 2025, 19 November 2025
Accepted: 19 November 2025
Published: 24 April 2026

Cite as
Rybels, S., & Vanoutrive, T. (2026). Exploring accessibility conditions for bike–train commuting: A qualitative study among university staff in Belgium. *European Journal of Transport and Infrastructure Research, 26*(2). https://doi.org/10.59490/ejtir.2026.26.2.8222

Abstract

The integration of cycling and rail transport is a key element of sustainable commuting, yet its success depends on the accessibility of stations, their surrounding environments, and destinations. While quantitative studies have extensively analysed infrastructural and behavioural determinants of bike–train use, fewer have examined how users perceive accessibility in practice. This article explores how accessibility conditions shape the bike–train commuting experience in Flanders, Belgium. Drawing on five focus groups with university staff across four campuses with varying levels of bike–train accessibility, the analysis identifies critical accessibility dimensions at both the home-end and activity-end of trips. Physical accessibility factors, including bicycle parking availability, visibility and proximity to platforms, strongly shape users' evaluations of station quality. Accessibility is further influenced by the presence of cycle highways, multiple station entrances, and the availability and coverage of shared bicycle systems. Beyond physical elements, perceived accessibility is affected by train frequency and reliability, ease of use, perceived safety, legibility and design of the public realm, and the atmosphere and services provided at stations. The findings demonstrate that accessibility challenges and expectations differ substantially between home-end and activity-end stations: the former is primarily evaluated based on functional access to platforms, while the latter is judged more broadly on service reliability and the comfort of the station environment. While limited to current users, this study offers qualitative evidence on how accessibility conditions shape the usability of bike–train commuting, informing policies aimed at strengthening multimodal integration.

1 Introduction

Cycling is on the rise in Flanders, supported by large-scale investments in infrastructure and the growing popularity of the e-bike (Samyn et al., 2025). With electric assistance, even longer (commuting) distances have become feasible by bicycle (Rybels et al., 2024). Yet when commuting distances extend further, public transport and particularly the train have the potential to become a viable alternative to the private car (Kager & Harms, 2017; Martens, 2004). Organising high-quality public transport, however, requires a critical mass of users. In a spatial context such as Flanders, characterised by a fragmented urbanisation pattern and dispersed settlement structure, commuting distances are long, while the organisation of frequent and high-quality public transport services is challenging (Verachtert et al., 2023). In such contexts, two strategies can be distinguished to strengthen sustainable mobility: enhancing accessibility through proximity (e.g., transit-oriented development - TOD) and expanding the catchment area of public transport through complementary modes such as the bicycle.

From an accessibility perspective, most research and policy attention has traditionally centred on the pedestrian. Active accessibility is often equated with walkability (Vale et al., 2015), and in TOD approaches, the focus typically lies on creating compact, walkable station areas (Calthorpe, 1993). The bicycle, despite its potential to extend the catchment area of public transport far beyond walking distance, remains relatively underexplored in accessibility research. Yet, as Kager et al. (2016) argue, the bike–train combination can offer a form of high door-to-door accessibility, blending the flexibility of cycling with the speed and capacity of rail transport.

Academic interest in this integrated mode has grown in recent years. Studies have examined the conceptual foundations of bike–train integration (e.g., Kager et al., 2016), as well as the characteristics of users and their trips (e.g., Shelat et al., 2018; Jonkeren et al., 2019). However, this body of research is geographically uneven. The vast majority of empirical studies have been conducted in the Netherlands. Dutch research has flourished partly because of the country's historically high cycling rates and the national railway company's long-standing strategy of bicycle-oriented development (Ploeger & Oldenziel, 2022). Methodologically, most studies rely on quantitative measures (Kosmidis & Müller-Eie, 2023), offering valuable insights into trip characteristics, parking capacity, and user profiles, but leaving a gap in understanding the qualitative nuances of accessibility, such as how facilities, services, destinations, and station environments are perceived in practice.

These findings cannot simply be generalised to other settings. Flanders differs markedly from the Dutch context. Its fragmented spatial structure (Verachtert et al., 2023) has resulted in long commuting distances and a high mode share for the private car. At the same time, the region is served by a dense rail network, and the rise of the e-bike (Samyn et al., 2025) enhances the potential of cycling as a complementary access and egress mode. Together, these conditions suggest that the bike–train combination could become a credible alternative to car commuting in Flanders, but only if the accessibility conditions are favourable.

This study, therefore, examines how current bike–train commuters experience accessibility conditions. By focusing on the perceptions and practices of university staff in Flanders who already combine cycling and train travel, the study provides qualitative insights into the infrastructural, service-related, and perceived factors that influence the usability of this multimodal mode. Understanding how current users experience the accessibility by bicycle of train stations in Flanders is a necessary first step before strategies can be designed to encourage wider adoption. In doing so, the paper contributes to a more nuanced understanding of bike–train accessibility, focusing on experiences instead of on objectively measured indicators such as service frequency and distance. Furthermore, the spatial and institutional context differs significantly from the well-studied Dutch case and offers policy-relevant insights into the conditions that support sustainable commuting.

2 Literature review

Within the last few decades, there has been a growing body of research on the integration of cycling and transit. These studies differ based on their geographical scope, considering the type of transit system and the spatial context (Kosmidis & Müller-Eie, 2023; Nello-Deakin & te Brömmelstroet, 2021). In Asia, for instance, the vast majority of studies are conducted in China and focus on the integration of shared bicycle programs with subways in expanding urban areas. Studies, originating from the United States, have their primary focus on bike-bus integration (Kosmidis & Müller-Eie, 2023). European studies, on the other hand, mainly target the bike-train integration (Kosmidis & Müller-Eie, 2023). As the scope of our study lies on the bike train combination in a region with generally high cycling rates. Consequently, the focus of our literature review is on European studies.

To identify the key factors influencing the bike-train mode within a European context, we initially drew upon two recent systematic review papers (Kosmidis & Müller-Eie, 2023; Moinse, 2024). The first provides a comprehensive analysis of factors and policies affecting the combined use of bicycles and public transit, while the second focuses specifically on the integration of micromobility modes within European transit station areas from a Transit Oriented Development perspective. Building on this, we employed a snowballing technique to expand our literature base, allowing us to identify additional relevant studies.

Four strands of literature can be distinguished: conceptual contributions, empirical studies of bike-train trips and users, Transit Oriented Development (TOD) approaches, and accessibility perspectives. Within this section, we will review these four strands of literature, highlighting the key elements that shape the bike–train integration. This overview not only identifies the factors most often considered in previous research but also points to dimensions that remain underexplored. Building on this review, we then present a conceptual framework that organises the determinants of station accessibility by bicycle into three interrelated dimensions: physical accessibility, accessibility through proximity, and perceived accessibility. Finally, we use the literature to highlight important gaps that guide the research design of this study.

2.1 *Conceptual contributions*

At the conceptual level, Kager et al. (2016) challenged the idea that the bicycle is merely a feeder mode to public transport. Instead, they conceptualised the bicycle and train as an integrated, distinct transport system, in which each mode complements the other: the bicycle extends the reach of the rail network, while the train facilitates longer-distance travel that would be unfeasible by bicycle alone. Within a spatially dispersed context, such as Flanders, train stations are often located at a considerable distance from both users' origin and destination (Verachtert et al., 2023). The accessibility of train stations through effective first- and last-mile solutions is therefore a critical link in ensuring the competitiveness, attractiveness, and effectiveness of this public transport system. The flexibility of the bicycle for both access and egress, in combination with the speed, comfort, and rigidity of a train network, can thus be seen as an alternative to private car use (Kager et al., 2016).

2.2 *Empirical studies of bike train trips and users*

A vast majority of the identified empirical studies underline the critical role of bicycle parking in facilitating bike train travel. Research in the Netherlands (Geurs et al., 2016; La Paix et al., 2020; La Paix Puello & Geurs, 2015; Molin & Maat, 2015) and Denmark (Halldórsdóttir et al., 2017) shows that the availability, proximity to platforms, and security (e.g., covered or guarded parking) significantly increase the likelihood of cycling to train stations. For instance, Halldórsdóttir et al. (2017) quantify this effect, noting that each additional 100 parking spaces raises the likelihood of cycling to a station by 2.5%. Cost and convenience are equally influential. La Paix et al. (2020), and Molin and Maat (2015) found that parking fees and longer walking distances from parking areas to platforms negatively impact the bike train uptake. Whereas free bicycle parking was shown by Geurs et al. (2016) to increase the likelihood to cycle to a train station by up to 11%. Another study in the Netherlands (Jonkeren & Kager, 2020) provides insights into the parking behaviour of bicycle-train travellers, particularly about the phenomenon of "activity-end bicycles" (also called "second bicycles"). This study argues, amongst others, to provide more shared bicycles at the activity-end in order to increase the bicycle parking capacity as they may replace the second bicycles at the activity-end.

Also, trip distance is identified by some studies to be influential. Giansoldati et al. (2020) and Martens (2006) report an average access distance between 2 and 5 km, highlighting the function of bicycles in bridging medium-range gaps to rail transit. Meanwhile, Krygsman et al. (2004) found that access and egress distances increase in proportion to the total travel time (up to 60 minutes), with cycling accounting for 30–50% of that time. Shelat et al. (2018) also emphasize distance, reporting an average bike-transit trip of 41 km. Some studies specifically focus on characteristics of the bike train users. Both Shelat et al. (2018) and Jonkeren et al. (2019) report that bike-transit users are generally younger, more educated, and from higher-income groups. The primary purpose of travel in this cohort is commuting for work, education, or business (van Mil et al., 2020). Furthermore, personal attitudes and perceptions, such as positive attitudes toward cycling and public transport, are strong predictors of uptake, while car-oriented attitudes tend to suppress it (Heinen & Bohte, 2014).

While these studies provide valuable insides in which factors influence the bike-train travel, they also reveal a strong dominance of quantitative methods (Kosmidis & Müller-Eie, 2023). Less is known about the qualitative experiences of bike–train users, such as how they perceive station environments, or how infrastructural design interacts with everyday practices. Moreover, as argued by Jonkeren et al. (2019), most studies target only one particular part of the combined trip, such as bicycle parking facilities, the station area, or access/egress, without considering the integrated journey as a whole. This fragmentation limits our understanding of how different elements interact across the full multimodal trip chain. The present study seeks to address both gaps: first, by adopting a qualitative approach that captures the experienced accessibility of bike–train users, and second, by considering the entire door-to-door trajectory rather than isolated components. Taken together, this approach tries to provide a more nuanced account of how accessibility conditions shape the usability of the bike–train system.

2.3 TOD and the node–place framework

A third strand of literature stems from Transit-Oriented Development (TOD) approaches, which evaluate station areas in terms of their integration of land use and transport. The node–place model (Bertolini, 1999) has been widely used and adapted (e.g. Vale et al., 2018) to classify and assess stations based on quantitative indicators such as land-use mix, transit frequency, and the availability of facilities. Traditional TOD design strategies typically assume high densities in the immediate, walkable proximity of the station (Jacobson & Forsyth, 2008). This pedestrian-oriented focus has contributed to the frequent underrepresentation of the bicycle in node-place frameworks (Robillard et al., 2023).

In response to these limitations, Lee et al. (2015) proposed the concept of Bicycle-based Transit Oriented Development (BTOD). BTOD builds upon TOD principles by extending the catchment area of stations beyond walking distance into the broader bikeable environment. In doing so, it compensates for lower densities in the immediate surroundings by improving the accessibility of transit hubs through cycling, thereby enabling a larger share of the population to benefit from high-quality public transport.

Despite these important advances, the node-place frameworks remain heavily quantitative, relying primarily on measurable indicators such as the number of bicycle parking spaces or the presence of cycle infrastructure. As a result, qualitative dimensions of accessibility are largely absent from this line of research. A notable exception is the work of Groenendijk et al. (2018), who added an experience dimension to the node–place model, focusing on travellers' perceptions of waiting times in stations in the Netherlands. Yet, this perspective still does not take into account the perceived accessibility of stations themselves. Similarly, a Flemish application of the node–place model by Caset et al. (2019) integrated bicycle accessibility, but only through quantitative indicators of parking supply and infrastructure provision, without considering user perceptions.

Taken together, these studies illustrate that while the node-place frameworks provide valuable tools for assessing multimodal accessibility, they remain insufficient to capture how users experience the design, safety, and atmosphere of stations. The present study addresses this gap by integrating these qualitative dimensions of perceived accessibility into a broader framework alongside physical and proximity-based indicators.

2.4 Accessibility perspectives and perceptions

Finally, a smaller but growing body of work recognises that perceptions of accessibility are as important as its objective conditions. While traditional research has extensively examined objective accessibility indicators such as travel time, distance, and service frequency (van Wee, 2015), less attention has been paid to how individuals experience these accessibility conditions in practice. Recent studies argue that accessibility should not only be measured as a spatial or temporal construct but also as a perceived capability that reflects users' feelings of safety, comfort, and ease of movement within the transport environment.

Emerging work on perceived accessibility (Jamei et al., 2022) explicitly conceptualises accessibility as a subjective evaluation of how easily opportunities can be reached, integrating both psychological and experiential dimensions. This approach resonates with studies showing that the design and atmosphere of station areas, the legibility of shared spaces, and feelings of safety all shape whether facilities are perceived as usable and attractive (Sherwin et al., 2011; van Mil et al., 2020). Together, these findings underscore the need for qualitative and user-centred perspectives that capture the lived experience of accessibility, which is currently absent from conventional, indicator-based approaches.

3 Conceptual framework

Building on the literature, we adopt a conceptual framework that distinguishes three interrelated dimensions of station accessibility by bicycle (Figure 1):

1. **Physical accessibility**: refers to the tangible infrastructure and facilities that enable bike–train commuting. Key indicators include bicycle parking (availability, proximity, and visibility), cycling infrastructure (cycle highways, direct connections), and the ease of accessing the station and it platforms.
2. **Accessibility through proximity**: captures the spatial and functional positioning of stations in the urban fabric. This includes the distance to the station, the diversity and location of destinations, and the connectivity provided by shared bicycles and transit service quality.
3. **Perceived accessibility**: refers to the subjective evaluation of the built environment and services, including perceptions of safety, legibility, design quality, and the atmosphere of station areas. We hypothesise that perceptions mediate the effect of physical and proximity factors: for instance, secure bicycle parking may exist but be underused if it feels unsafe, hidden, or inconvenient. At the same time, these perceptions may vary according to the user's profile.

This framework reflects and systematises findings from previous research, while explicitly recognising the role of perception, which has received less attention in quantitative, indicator-based studies.

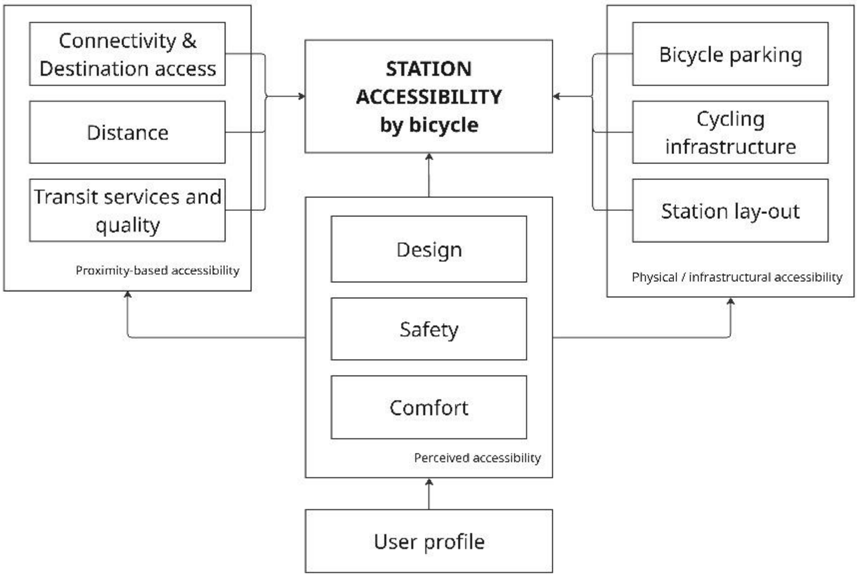

Figure 1. Conceptual framework for station accessibility by bicycle

3.1 Research approach

To explore how these accessibility dimensions shape the bike–train experience, we employed a qualitative research design. Five focus groups were conducted with university staff across four campuses in Antwerp, representing a range of accessibility contexts. Thematic analysis of the discussions was structured around the conceptual framework, allowing us to examine how participants described physical accessibility, proximity, and perception-related factors, and how these interact in practice.

3.2 Hypotheses

While the study is exploratory, four guiding hypotheses informed the design:

1. H1: Physical accessibility factors (e.g., bicycle parking, cycle highways, platform access) are critical enablers of bike–train use, but their effectiveness depends on perceptions of convenience and usability.
2. H2: Accessibility through proximity (e.g., distance to stations, service frequency, last-mile connectivity) influences station choice and mode integration, but commuters may accept longer distances if they perceive higher service quality or safety.
3. H3: Perceived accessibility (safety, design, atmosphere, legibility) mediates the impact of physical and proximity factors, such that even well-equipped stations may be avoided if they are perceived as unsafe, confusing, or unpleasant.
4. H4: The perception of the accessibility indicators may depend on the profile of the bike train-users (e.g., in terms of access and egress mode).

4 Introduction to the case

Focusing on commuting is crucial when examining the factors influencing bike train uptake, as work-related travel represents a significant share of daily mobility patterns. In Flanders, only 3% of commuting trips are made by train (Janssens et al., 2023), but this level is considerably higher in city centres, during peak hours, and in activity sectors such as universities, (regional and federal) government, and the financial sector (Vanoutrive et al., 2011). Moreover, research by van Mil et al. (2020) indicates that the primary motive for bike-train use is commuting, reinforcing the importance of understanding commuting-specific barriers and facilitators. Unlike leisure or short-distance trips, commuting often involves longer travel distances (e.g., Ewing & Cervero, 2010), making multimodal solutions particularly relevant. Moreover, universities are frequently the subject of travel behaviour studies (e.g., Manaugh et al., 2016; Nematchoua et al., 2019; Rybels et al., 2024) as they are major employment hubs with large numbers of daily commuters and maintain transport data on their staff. Given their commitment to sustainability, universities actively promote sustainable commuting options, including public transport initiatives. In this study, staff members of the University of Antwerp, a medium-sized university in the city of Antwerp, centrally located in the northern Region of Belgium, are recruited to explore the factors that influence the perceived accessibility by bicycle of train stations.

4.1 The bike-train system in Belgium

Belgium is characterized by an extensive rail network. In Flanders, the Northern Region of Belgium, 79% of the population lives within a 5km (bikeable) radius around a train station (Labo Ruimte, 2021). All railway stations in Flanders provide free bicycle parking; however, the quality, type (covered or uncovered), and availability of these facilities vary considerably across locations. Major stations additionally often offer access-controlled, secured bicycle parking.

Bike Points (*Fietspunt in Dutch)* and bike repair stations serve as supplementary facilities for individuals who access the station by bicycle, intending to promote the integration of cycling and public transport. Following the 'homecoming' principle, each Bike Point provides a bicycle repair service that aims to ensure that a commuter can bike back home in case of a flat tire, broken brakes, or other minor problems. Moreover, they oversee the bicycle parking facilities to enhance the security of these facilities. There are currently 34 stations equipped with a bike point and 27 stations with a bike repair station.

Passengers are permitted to bring a folding bike on board at no additional cost. However, taking a regular bicycle on the train requires an additional fee of €4 for a one-way ticket. The possibility of taking a bike on board depends on the availability of designated bicycle spaces on the train, which vary according to the type of train carriage. While transporting a bicycle on the train is possible, it is not a common practice among commuters, as the additional cost and restrictions make it less convenient. However, for recreational trips, bringing a bicycle on the train is growing in popularity.

To facilitate the bike-train combination, Blue-Bike offers bike-sharing services at 113 train stations. This national bike-sharing program provides rental bicycles and e-bikes in a back-to-one system (except for the transport region of Ghent, where they implemented a back-to-many system), making it particularly suited as a last-mile solution. However, an additional membership is needed to make use of the system. In addition to Blue-Bike, the city of Antwerp (Velo) and the city of Brussels (Velib) have their own station-based bike sharing system (back-to-many). Furthermore, a free-floating e-bike sharing system (Donkey Republic) is active in, amongst others, the Antwerp transport region.

The expanding network of cycle highways in Flanders, alongside broader investments in cycling infrastructure, also plays a crucial role in supporting and enhancing the bike-train integration. These high-quality cycling routes are often developed alongside train corridors connecting suburban and urban areas directly to each other and to (major) railway stations.

4.2 The University of Antwerp

The University of Antwerp has four campuses, each with a distinct geographical setting and different accessibility levels by train. The main city campus (CST) is situated in the historical city centre, with an intercity (IC) train station (Antwerp Central Station) located less than 1 km away. This campus benefits from excellent public transport accessibility, with multiple bus, tram, and (pre)metro (BMT) stops in its vicinity. In contrast, the Campus Middelheim (CMI) and Campus Groenenborger (CGB) have an IC train station (Antwerp Berchem) at approximately 2km. These campuses are adjacent to each other within the city's 20th-century urban expansion belt, an area defined by a low-density, space-consuming urban layout. The most peripheral campus, Campus Drie Eiken (CDE), is located 5.9 km from the nearest IC train station, making it the least accessible by rail.

Compared to the general modal split for commuting in Flanders, the train has a substantial share in the modal split for the university. With 30% of the employees commuting to CST campus by train, 15% to CMI, 14% to CGB, and 9% to CDE, the share of train commuters differs significantly according to the accessibility levels of the campuses, but is significantly higher than the Flemish average of 3% (Janssens et al., 2023). Additionally, 55% of these train commuters use the bicycle as an access mode, and 35% uses the bicycle also as egress mode (UAntwerp Mobiliteit, personal communication, March 17, 2025).

Many employers try to influence the travel behaviour of their employees through mobility management measurements (Vanoutrive et al., 2010). Also, the University of Antwerp actively encourages its employees to commute sustainably through bicycle allowances and through the full reimbursement of the costs for public transport (train and/or BMT). Additionally, every campus is equipped with a range of amenities for cyclists, including secure staff-only bike parking, charging stations for electric bikes, repair kits, as well as showers and lockers.

5 Method

The spatial variation and different accessibility levels of the four university campuses in combination with an extensive recruitment area, and high prevalence of bike-train commuting make the university an ideal case study for identifying factors that may influence the bike-train adoption. Consequently, a series of focus groups were conducted with university staff to explore how they experience, navigate, and evaluate the bike-train commute, and to identify the factors that shape their mode choice decisions. Prior to the focus groups, participants completed a short survey to collect socio-demographic information (age, gender, occupation) and details about their commuting behaviour. Based on responses, participants are grouped by their commuting destination (university campus) and their travel behaviour, ensuring that each focus group includes individuals with similar travel patterns. Table 1 provides an overview of the participants per focus group; the focus group column (e.g., CST1) refers to the campus on which the focus group was conducted. The table also reports participants' mode choice for the home- and activity-end trip.

Table 1. Descriptives of the focus group participants per university campus

	Gender		Age	Home-end mode choice				Activity-end mode choice			
Focus group	**M**	**F**	**Mean**	**Car**	**Bicycle (*)**	**Foot**	**BMT (**)**	**Shared bike**	**Bicycle**	**Folding Bicycle**	**Foot**
CST1	1	3	40	0	4	0	0	1	1	0	2
CST2	1	5	36	1	3	1	1	1	0	2	3
CMI	0	4	43	1	1	1	1	2	2	0	0
CGB	3	0	42	0	3	0	0	0	2	1	0
CDE	2	3	46	1	3	1	0	0	2	3	0

(*) Bicycle: when a folding bike is used at the activity side, it is also used at the home-end side
(**) BMT Bus Metro Tram

Five focus groups with a total of 22 participants were organized, including 11 administrative staff members, 7 researchers, and 4 professors. Figure 2 provides an overview of the different home-end stations and the number of participants per station. The focus groups were organized at the respective campus locations, creating a familiar setting that encouraged open discussion. The official language of the region (Dutch) was used, and all quotes used in the paper were translated into English after coding.

It is important to acknowledge that the study includes only current users of the bike–train combination, and that all participants were university employees. This sampling strategy aligns with the aim of the study: to understand the experiences of those already engaging in multimodal commuting. However, it does limit the scope of the findings. Because non-users were not included, the study does not capture barriers related to non-adoption of the bike–train system. Furthermore, although the sample included a mix of academic, administrative, and technical staff, university employees represent a relatively homogeneous and highly educated group. Their travel patterns, resources, and flexibility may differ from the wider commuting population. These limitations should be kept in mind when interpreting the results; they are addressed more fully in the conclusion.

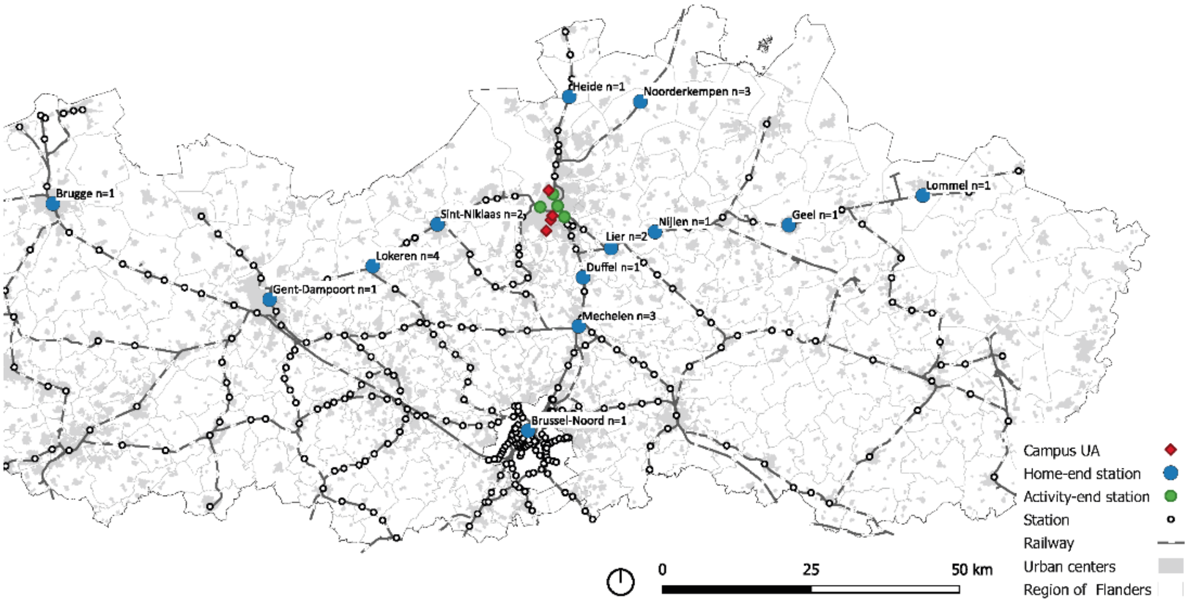

Figure 2. Geographical location of home-end stations and the number of recruited participants (total n=22)

Each focus group followed a semi-structured discussion guide (Table 2), developed in collaboration with members of our research group and based on best practices for focus groups as recommended by Krueger and Casey (2015). Each session was audio-recorded and transcribed, resulting in a rich qualitative dataset.

Next, a thematic analysis is conducted, following the approach outlined by Braun and Clarke (2006). This method involves identifying meaningful patterns in participants' descriptions through a systematic coding process. The data is manually coded based on a pre-established list of indicators drawn from relevant literature (see section 'Literature view') that could influence bike-train commuting. When participants introduced new indicators or themes not present in the initial list, these were incorporated into the coding framework. Unlike in-depth interviews, focus groups allow participants to build on each other's experiences. For instance, participants using shared bikes or folding bikes often confirmed or elaborated on each other's statements, revealing shared challenges and validating common perceptions. This dynamic interaction enriched the data and highlighted collective patterns in commuting behaviour.

Table 2. Semi-structured discussion guide

Question type	Purpose	Question	Timing (min.)
Opening	Welcoming the participants, explaining the purpose of the focus group, and the 'ground rules'. Explanation about data protection and collecting 'informed consent' forms.		5′
Introduction	icebreaker	What is your name? Describe how you came to the campus today	5′
Transition	start the discussion	Rank these photographs of station environments: to which station are you the most likely to cycle, and to which station the least likely to cycle?	5′
Key	Factors influencing the bicycle friendliness of station areas	What factors made you decide to rank station X the highest? What factors made you decide to rank station Y the lowest? Add your own departure station to the ranking. Where would you place this station and why? Describe your arrival at station XX (depending on where the participants arrive) What adjustments to this station would enhance your experience?	15′
Transition Key	start the discussion Factors influencing the egress trip	Draw your egress route to the campus How do you experience this route? What obstacles do you encounter? Have you considered alternative modes/routes?	5′ 15′
Transition Key	start the discussion Factors influencing the destination	Describe how you arrive on campus How do you experience your arrival on campus? What obstacles do you encounter? What adjustments can be made to enhance your experience when arriving on campus?	5′ 15′
Transition	start the discussion	Think about a recent trip - besides your trip to campus – for which you took the train	5′
Key	The bike-train mode for other trip purposes	What was your experience with the train? Did you consider using a bicycle for the first or last mile of your journey? What adjustments/improvements would have made you choose the bicycle for the first and/or last mile of your journey? Are there specific routes or destinations where you find the combination of bicycle and train particularly suitable or unsuitable?	10′
Ending	to identify key points of focus and to conclude the discussion	Choose one aspect from everything we have discussed that most influences the choice for a bicycle-train journey and explain why. Is there anything that hasn't been discussed but could influence the choice for using the combination of the bicycle and the train?	10′

6 Results

6.1 Physical accessibility

Bicycle parking

Consistent with earlier studies (e.g. Geurs et al., 2016; Halldórsdóttir et al., 2017; La Paix Puello & Geurs, 2015), bicycle parking emerged as an essential link in the multimodal trip chain. Yet while most research emphasises capacity and availability, our findings point to the importance of design, visibility, proximity, and flexibility as experienced by users.

Participants appreciated sheltered parking near platforms but highlighted gaps for non-standard bicycles, especially e-bikes: *"The bike parking isn't very practical because I can't fit my e-bike into an official spot."* (woman, e-bike–train–bike, CMI). This echoes Jones et al. (2016), who note that unsuitable parking remains a barrier for e-bike adoption. Participants also stressed the importance of visibility, aligning with Molin and Maat (2015): *"I find it convenient when the bicycle parking facility is above ground, so you can see it immediately. That also seems safer to me."* (woman, bike–train–shared bike, CST1).

While previous research (La Paix et al., 2020; Molin & Maat, 2015) highlights the deterrent effect of paid parking, our participants often turned to secured facilities following negative experiences. However, the drawbacks of these facilities were also clear. One participant, whose bike had been stolen despite using two locks, shared that although he now uses a guarded parking facility, it is "*very cumbersome to get there and retrieve my bike – you have to go through the station, then outside, and back down a small staircase*" (man, bike-train-bike, CGB). The issue was not so much the cost as it was their inconvenience and inaccessibility. Moreover, the current system of secured bicycle parking can reduce flexibility: *"If I want to go home from [Antwerp] Central Station, I first have to cycle all the way back to Berchem because I can't use my subscription elsewhere."* (woman, car–train–bike, CMI)

These findings suggest that beyond supply, the design and organisation of parking strongly influence perceived accessibility, confirming Heinen and Buehler (2019) that qualitative user perspectives remain underexplored.

Station layout (platforms & entrances)

Ease of platform access was decisive, particularly for folding bike users. Long corridors and stairs were described as barriers: *"It's really not ideal with a folding bike when you have to walk a long distance or use stairs to reach the platform."* Such constraints also carried *perceptual consequences*, shaping users' sense of inclusion to access a platform from the train: "*Some older people almost have vertigo getting off those trains. It's really not okay.*" (man, folding bike–train–bike, CDE)

Multiple, well-connected entrances were appreciated for offering flexibility and shorter walking routes: *"I anticipate – so I leave my bike on the side where I arrive in the evening. You can choose where to park, and it's very conveniently located."* (man, bike–train–shared bike, CST1). This resonates with TOD critiques (Pojani & Stead, 2015) where many stations remain asymmetrical, with a clearly defined front and back. This asymmetry can limit accessibility and hinder seamless integration with the cycling network, particularly when the rear entrance is underdeveloped or poorly connected.

While much of the literature focuses on the accessibility of the station itself (e.g. Brons et al., 2008), our findings suggest that the accessibility of the bicycle parking facility itself warrants equal attention. Participants preferred bicycle parking that is directly connected to the station via dedicated bike paths at both the home- and activity-end stations.

Cycling infrastructure

Participants frequently described the quality of cycle routes as a crucial part of accessibility. Direct, segregated cycle paths and cycle highways were highly valued: *"There's a bike path right next to it, leading directly to the station, like a kind of bicycle highway."* (woman, bike–train–shared bike, CST1).

The quality of the cycling infrastructure along the route influenced comfort and perceived safety, particularly in transitions between local streets and station areas. Moreover, surface quality influenced comfort and safety perceptions, especially for folding bike users: *"With cobblestones, my folding bike almost breaks apart."*(man, folding bike-train-folding bike, CDE).

At the destination end, smooth, direct cycling routes were seen as essential to *"arrive comfortably*", whereas busy roads or unclear crossings discouraged use. The recently installed bicycle bridge at Antwerp Berchem Station, near Antwerp's ring road, for instance, was repeatedly mentioned as an improvement, showing how infrastructure investments can transform perceived accessibility.

6.2 Accessibility through proximity

Distance (to station)

The focus groups revealed that distance interacts strongly with mode choice and perceived accessibility. All participants who cycled to the station at the home end lived in the immediate vicinity of a train station, typically within five kilometres. Those living further away most often used the car for the access trip, confirming earlier findings that distance remains the key determinant of multimodal integration (van Mil et al., 2020). One participant explained:

"I live about 15 kilometres from the station. If the weather is good, I sometimes take my e-bike instead of the car, but there aren't really good facilities for e-bikes – no charging points, and I don't like leaving it outside." (woman, car/e-bike–train–bike, CMI)

This illustrates that while e-bikes extend the feasible cycling range, their potential is limited by the lack of supporting infrastructure, such as charging options and secure parking.

At the activity end, those working at the city campus typically walked from the station to their final destination when neither shared bikes nor folding bikes were seen as attractive alternatives: *"It's only a ten-minute walk to the campus, and taking a folding bike on the train would be too much hassle." (man, foot–train–foot, CST2).* This reflects how proximity and perceived effort jointly determine accessibility: when walking is fast, cycling becomes redundant.

For those commuting to more distant campuses, such as Campus Drie Eiken (CDE), distance played a different role. Some participants had previously relied on public transport for their trip, but repeated delays and poor service quality led them to switch to cycling: "*I used to take the bus from the station, but it was unreliable – sometimes I waited half an hour. Now I just cycle; it's faster and I know what to expect."* (woman, bike–train–bike, CDE)

Overall, the findings indicate that while proximity to the station remains crucial, the interaction between distance, infrastructure provision, and perceived reliability and comfort determines how travellers construct their door-to-door accessibility

Connectivity and destination access

The quality of connections between the station and the final destination emerged as a decisive factor shaping overall accessibility. This last mile proved to be both a practical and perceptual threshold for many participants, suggesting that the egress segment often determines the success of multimodal trips.

Participants generally expressed satisfaction with the bicycle facilities available at their destinations, describing them as well-located and secure: "*At the campus, there's a big, covered bike parking right next to the entrance – it's very convenient."* (woman, bike–train–bike, CST2) which was echoed by participants at other campuses: *"I never worry about leaving my bike there; it's close and safe."* (man, bike–train–bike, CDE)

Such facilities were appreciated for being close to the workplace and easy to access, suggesting that destination-end infrastructure is an important enabler of perceived accessibility.

However, some participants pointed out that shared bikes, often presented as a sustainable complement to train travel, only function effectively if the system is reliable and convenient, which is in line with a previous study carried out in Belgium (Adnan et al., 2018). Several users described how occasional unavailability or poor coverage reduced their trust in these services: *"At first, I used the shared bikes, but they weren't always there when I arrived. Or I couldn't return the bike in time and risked missing my train."* (woman, bike–train–foot, CST1)

Others underlined that shared bikes were mostly suitable for central, urban destinations: *"No, I don't think [bike sharing] is a good solution for the outer campuses. In the city, sure, but at Campus Drie Eiken, there isn't even a Velo station."* (man, bike–train–bike, CGB)

These observations confirm that availability, predictability, and ease of access are essential for shared mobility to effectively extend the catchment area of stations. When these conditions are not met, participants preferred walking or using their own bicycles instead.

In terms of cycling infrastructure, participants were generally positive about the presence of dedicated and well-maintained routes connecting stations to the main roads or cycle highways. Yet, the last stretch of the journey, especially when entering the campus area, was often described as the most precarious: *"The route to the station is fine, but once you get near the campus, it becomes tricky—cars, pedestrians, and buses all mixed up."* (woman, bike–train–bike, CDE). Another participant described the last mile as most challenging: *"The last few hundred metres are the worst—no clear crossings, and people park [their car] everywhere."* (man, bike–train–bike, CST2)

This reflects a recurrent theme: while cycling infrastructure is appreciated for providing safe, direct connections, the transition zones between public roads and private destinations remain critical weak points in the chain of accessibility. The lack of clear spatial hierarchy or safe design at campus entrances was perceived as stressful and undermined the overall sense of continuity and safety.

Overall, participants' experiences confirm that destination accessibility depends on both the quality of physical connections and the perceived reliability and comfort of the activity-end trip.

Transit service & quality

Transit service quality was another influential factor shaping both the functional and perceived accessibility of the bike–train system. Participants consistently emphasised the importance of reliability, frequency, and safety, not only in determining whether to use the train, but also in choosing which station to access.

As shown in van Mil et al. (2020), cyclists are often willing to bypass the nearest station for higher-quality train service. This was confirmed in our focus groups*: "Despite better bike facilities at the nearest station, I prefer another one because of the train frequency."* (woman, bike–train–foot, CST1)

Whereas transit services (e.g., van Mil et al., 2020) influence the choice for the home-end station regardless of the quality of bicycle facilities, the choice for the activity-end station is not solely based on service frequency or distance to the final destination, but also on perceived reliability and the availability of basic amenities, especially when returning home. One participant explicitly avoided using a nearby station (i.e. Mortsel), despite its covered bike parking and closeness to the destination, due to infrequent train services and the absence of minimal comforts: *"If I miss a train in Mortsel station, I might have to wait an hour—with no toilet, nowhere to sit properly, and barely any shelter," she explained. "At Berchem, I have more connections, there's a toilet, and just more options overall."* (woman, folding bike–train–bike, CDE). Her decision for a more distant station underscores the importance of functional amenities and service frequency in shaping commuter choices.

Delays and cancellations were widely described as a source of frustration, undermining users' trust in the system and, in some cases, prompting them to reorganise their daily routines*: "The punctuality of the trains could definitely be better. I sometimes plan my meetings later, just in case."* (woman, car–train–bike, CMI).

At the same time, participants recognised improvements in comfort and quality of the rolling stock, which positively influenced perceptions of accessibility. Modern trains with low floors and dedicated spaces for bicycles were considered a significant enhancement: *"On the new trains there's more room for folding bikes, which makes a big difference."* (woman, folding bike–train–bike, CST2).

However, older trains with steep steps or narrow entrances remained a persistent barrier, especially for folding-bike users: *"Some trains are still really hard to get on with a bike—it's just not designed for that."* (man, folding bike–train–bike, CDE)

Overall, participants' experiences confirm that transit quality and safety perceptions jointly shape accessibility choices. Reliability, comfort, and station amenities are not only service characteristics, but they also determine whether the train is seen as a dependable and pleasant component of the multimodal trip.

6.3 Perceived accessibility

As discussed in the previous sections, perceptions are embedded throughout the different dimensions of accessibility. Users' evaluations of physical and proximity-based conditions, such as the safety of bicycle parking, the quality of cycling infrastructure, or the reliability of train services, are always filtered through subjective experience. Beyond these embedded aspects, the focus groups revealed additional perceptual elements that significantly shaped how commuters assessed the overall accessibility of the bike–train system. These relate primarily to the design and legibility of station environments, the sense of safety and security, and the atmosphere and comfort of the spaces encountered along the journey.

Design & legibility

Participants consistently emphasized that the design and atmosphere of the spaces surrounding train stations significantly influenced their cycling experience. Shared spaces, often characterized by busy pedestrian flows, undefined spatial boundaries, and interactions with car traffic, were commonly perceived as confusing and unwelcoming to cyclists. The absence of clear infrastructure led to uncertainty about where cycling was permitted. As one put it, *"You're stuck between the cars and the pedestrians… There's a lot of space, but it's not clear who belongs where"* (woman, bike-train-shared bike, CST1). This feeling of disorientation was echoed by many participants, especially by those who were not familiar with cycling in urbanised areas. In line with previous research (Sherwin et al., 2011) a direct and separated cycling route from the stations' exit was also crucial: *"Can I get on a bike path right away… do I have to watch out for cars?"* (woman, bus-train-foot, CST2).

Moreover, locations lacking a visible station area or recognizable urban context made participants feel disoriented as well. *"I had no idea where I was"*, recalled one participant (woman, bike-train-shared bike, CST1), while another framed it as *"arriving in the middle of nowhere"* (woman, bike-train-foot, CST1). It seems that commuters were more familiar with the home-end station and expressed fewer feelings of being disoriented. However, areas that felt active and populated were associated with greater comfort and safety, particularly during off-peak hours: *"I like it when it does not feel deserted"* (woman, foot-train-foot, CST2). While functionality remained central, some participants also appreciated aesthetic qualities, with one stating, *"It's really important to me to arrive somewhere that looks nice"* (woman, folding bike-train-bike, CST2).

Safety & security

Safety concerns influenced station choice, especially at night: "There's only one train per hour in the evening. I had just missed it, so I decided to go to Berchem instead— otherwise I had to wait in the dark. It's a deserted, dark platform, especially at a late hour" (man, folding bike-train-bike, CDE). Suggesting that a combination of factors influences one's choice for a specific and sometimes more distant activity-end station when returning home. Interestingly, some participants appeared to substitute waiting time with cycling time, suggesting a preference for active travel over passive waiting. In this sense, cycling can serve as a productive way to fill the perceived unproductive or unpleasant waiting period. It raises the hypothesis that some might prefer cycling an extra loop rather than waiting on a deserted platform.

However, it should be noted that this flexibility only applies for those using a folding bike or a shared bicycle within a back-to-many system. In cases where a personal station bike is used, the commuter is typically bound to return to the same station where the bike was initially parked, limiting the flexibility to adapt the return journey in response to delays or discomfort. This may be related to the possibility that commuters have a secured bicycle facility at a specific station, or that their initial station choice might be driven by other factors (such as proximity to the destination and transit services in the morning), which then implicitly determines the return station as well. As a result, the return trip remains tied to the original arrival point.

Atmosphere & comfort

Participants frequently linked their travel experience to the atmosphere of station areas and the surrounding public realm. Pleasant, well-maintained, and lively environments were associated with comfort and satisfaction, whereas desolated or neglected spaces reduced motivation to use certain routes or facilities: *"It's really important to me to arrive somewhere that looks nice."* (woman, folding bike–train–bike, CST2) and *"I like it when it doesn't feel deserted – when there are people around, cafés, or just some activity."* (woman, foot–train–foot, CST2)

Such statements extend Groenendijk (2018) experiential approach, demonstrating that a positive sensory and social environment enhances perceived accessibility. The atmosphere of the station and its surroundings influences not only comfort but also the willingness to combine cycling and train travel, especially at the activity end.

6.4 Motivations and constraints

Beyond the structural and perceptual dimensions of accessibility, participants also discussed their motivations and constraints for using the bike–train combination. These narratives highlight behavioural and attitudinal factors that complement the accessibility dimensions, revealing how the system functions in everyday life and beyond commuting routines.

Environmental considerations also played a supporting but meaningful role in users' modal choices. While not always decisive, sustainability was cited as an additional reason to favour the train over the car: *"I could be a bit faster by car, but I just don't like driving. I like reading the newspaper on the train, and for me, the environment is the main reason"* (man, folding bike-train-bike, CGB). These pro-environmental attitudes were confirmed by participants having no private car at their disposal.

While rail season tickets are free for university employees, the cost of train travel emerged as a significant factor influencing participants' mobility choices for travel motives other than commuting. For some, the high price of tickets made the train an unattractive option—especially when traveling with others. As one participant explained, "*When you're with more than one person, the financial advantage disappears really quickly*" (man, folding bike-train-bike, CDE). Others echoed this sentiment, emphasizing how affordability directly impacted interest in using public transport: *"I think that if it weren't so expensive, a lot more people would want to take the train"* (woman, bike-train-shared bike, CST1). The cost barrier was particularly evident when comparing the train to personal car travel. Even among those who preferred the train for environmental or lifestyle reasons, cost remained a limiting factor especially when travelling with their family: *"We always try to take the train, and the kids ask for it, but yeah… it can be a bit expensive sometimes so we mainly take the car because it's cheaper than the train…"* (woman, bus-train-foot, CST2).

In contrast, participants noted that because of the corporate season ticket, the train became a more viable and appreciated option for commuting: *"It's nice that we get reimbursed for our train travel, but otherwise I'd probably find it too expensive"* (woman, bike-train-shared bike, CST1). Contrary to those possessing their own car, the combination of car-sharing with public transport was experienced as both convenient and economical: *"For me, the choice is simple—mainly because of the environment, but also convenience. And actually—especially if you use a shared car—it's just cheaper"* (man, bike-train-bike, CGB).

Others also highlighted the experiential dimension of cycling, noting the mental break it offers during a commute: *"After work, it's nice to unwind for ten minutes with the wind in my hair"* (woman, car-train-bike, CMI). For many, the bike-train combination was also perceived as faster and more direct than multimodal routes involving buses or trams or commuting by car.

Besides, some participants expressed appreciation for the ability to work during their train ride, even if it meant a slightly longer journey: *"I take the local train, which has a low entry and room for* bikes. I hate the direct train because I have to throw my bike in, and I like being able to do some emails on the train" (woman, car-train-folding bike, CDE).

6.5 A door-to-door accessibility experience

The findings can be summarised through the door-to-door experience of bike–train commuters, illustrated in Figure 3. This schematic representation follows the commuter's journey from home to workplace, highlighting how objective accessibility conditions and subjective experiences are intertwined throughout the trip. The rectangular elements represent the more tangible, physical, and proximity-related factors such as bicycle parking, station layout, cycle infrastructure, and train service reliability, while the rounded shapes reflect the experiential and emotional dimensions of accessibility, including comfort, safety perception, frustration, and overall ease of travel.

Across the different stages of the trip, participants' perceptions of accessibility were strongly influenced by these experiential aspects. For example, well-designed bicycle parking or reliable train connections were valued not only for their functional convenience but also for the sense of security and predictability they provided. Conversely, technical or infrastructural shortcomings often translated into feelings of discomfort or stress. The figure, therefore, visualises accessibility as a dynamic and lived process, rather than a fixed property of infrastructure or distance. Each stage of the multimodal chain contributes to the overall experience, underlining that improving the quality of bike–train integration requires attention not only to physical design but also to the subjective and emotional realities of daily travel.

7 Conclusion

This study examined how accessibility conditions shape the experience of bike–train commuters in Flanders, using focus groups with university staff as a lens to explore the everyday realities of multimodal travel. By interpreting the results through three interrelated dimensions: physical accessibility, accessibility through proximity, and perceived accessibility, the study provides a nuanced understanding of how users construct their door-to-door mobility.

The findings show that accessibility is not merely determined by physical infrastructure or service frequency, but by the interaction of these with users' perceptions of safety, comfort, and convenience. Physical accessibility, bicycle parking, station layout, and cycling infrastructure set the enabling conditions for seamless multimodal travel. However, its effectiveness depends on users' subjective experience of design quality and usability. Accessibility through proximity expressed in distance, transit service, and connectivity, defines the functional reach of the bike–train system. Yet its success depends on perceived reliability and the smoothness of connections between modes. Perceived accessibility emerges as the interpretative layer linking both: how legible, safe, and pleasant the environment feels determines whether infrastructural and service conditions translate into actual use.

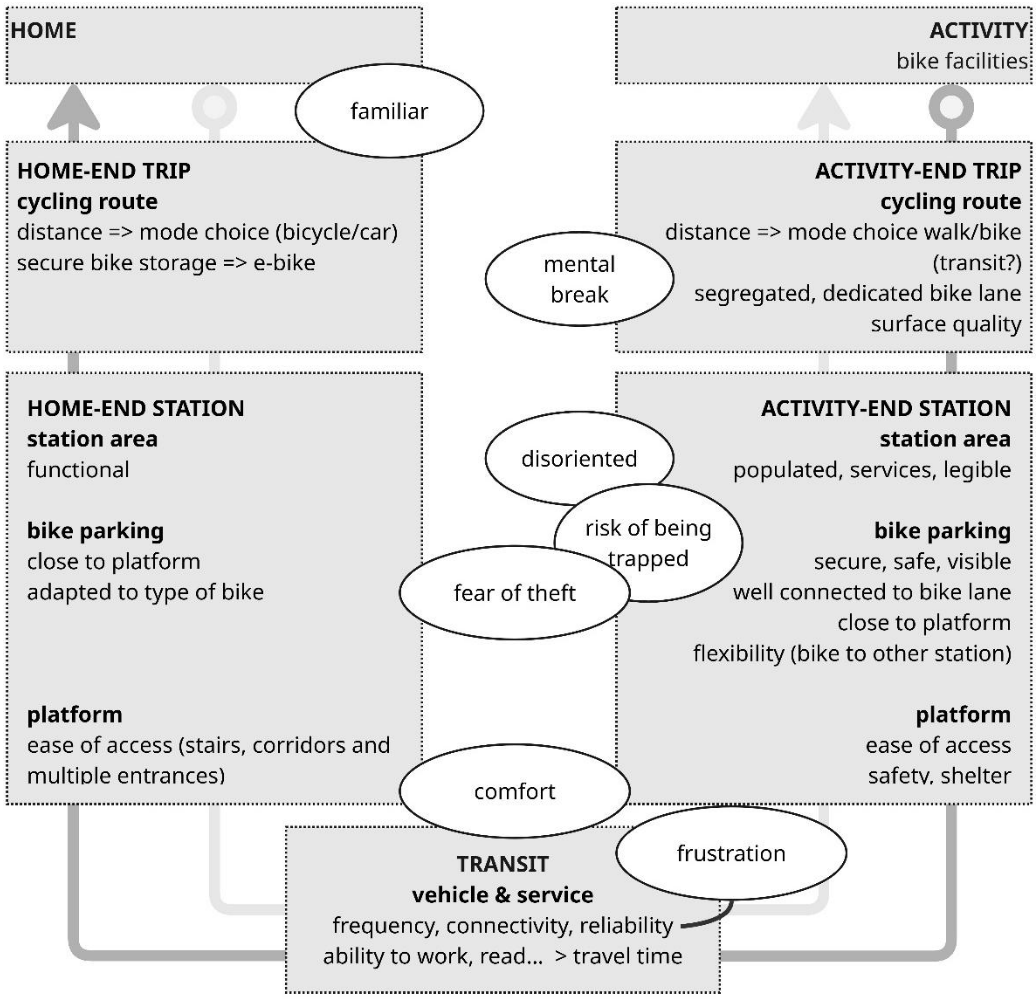

Figure 3. *Schematic overview of the door-to-door bike–train commuting experience, showing how objective accessibility factors (rectangles) interact with perceived experiences (circles) across the journey from home to workplace.*

While characteristics such as comfort, safety, and reliability are generally valued, a key finding is that accessibility challenges and experiences differ fundamentally between the home-end and activity-end stations. At the home end, the primary determinants are physical and proximity-based: station distance, route quality, and parking usability. Commuters tend to prioritise reliability and convenience in station choice, often bypassing nearby stations with inferior service or facilities. At the activity end, on the other hand, accessibility is shaped less by infrastructure and more by perceptions of comfort and safety. The activity-end trip from station to workplace was described as the most precarious, especially where cycle routes blend with heavy traffic or poorly designed (urban) spaces. Here, atmosphere and environmental quality strongly affect perceived accessibility.

The analysis also revealed distinct user experiences depending on bike type and multimodal strategy. Folding-bike users are the most sensitive to platform design and train accessibility, perceiving long corridors or steep steps as major obstacles. E-bike users face infrastructural constraints: limited charging points and inappropriate parking facilities reduce their sense of convenience and security. However, they are less impacted by the distance to the station. Shared-bike users value flexibility but depend heavily on service reliability; when systems fail, their perceived accessibility collapses. Car–train–bike commuters emphasise functional rationality, valuing predictability and comfort over proximity. These profiles illustrate that perceived accessibility is mediated by personal strategies and expectations. A single physical environment may thus be experienced very differently depending on user type and trip purpose.

The results underscore the need to move beyond infrastructure provision towards designing for perceived accessibility. For the home end station, this implies improving usability and visibility of bicycle parking, providing flexible station access from multiple sides, and ensuring smooth connections with high-quality cycle routes. For the activity end, focus should be on creating welcoming, legible, and safe station environments and ensuring continuous, protected cycling access to workplaces and campuses. Finally, at the transit system level, improving the reliability and comfort of train services, including modern rolling stock and functional amenities, can strengthen the perceived integration of cycling and public transport.

By connecting physical, spatial, and perceptual dimensions of accessibility, this study extends the existing literature, which is dominated by quantitative analyses and Dutch case studies, through a qualitative exploration of how users experience accessibility in a dispersed Flemish context. The results highlight the importance of perception as a mediating variable between infrastructure and behaviour, suggesting that active accessibility approaches must explicitly consider experiential dimensions. However, the research also has its limitations: by only focusing on current users, we risk overlooking some barriers for non-users. Moreover, the population of university staff only partially reflects the wider diversity of bike–train commuters. While rail users in higher education institutions tend to be relatively representative in terms of income level and commuting distance, this group does not capture the full heterogeneity of multimodal travellers, particularly regarding socio-economic background, job types, and household structures.

While this study provides valuable insights into how accessibility conditions shape the experience of bike–train commuting, its scope is subject to certain limitations. The focus groups included only current users of the bike–train combination, and all participants were university staff, a relatively homogeneous and highly educated group. As such, the findings primarily reflect the experiences of individuals who have already overcome key barriers to multimodal travel. Future research should therefore incorporate non-users and other occupational or socio-demographic groups to capture a broader range of motivations, constraints, and perceptions. Comparative studies across different institutional settings, regions, or user profiles could further test the transferability of the accessibility framework developed here and deepen our understanding of how both objective and perceived accessibility interact and influence the integrated bike-train mode.

Data Access Statement

The data supporting the findings of this study are not publicly available due to the inclusion of personal data collected from participants in focus groups and surveys. Participants provided informed consent specifying the conditions under which their data could be used, which do not permit public sharing.

All data has been handled and stored in accordance with applicable data protection regulations. While datasets were anonymised prior to analysis, restrictions remain due to the sensitive nature of the original data and the conditions of consent.

Access to (anonymised) data for scientific research purposes may be considered on a case-by-case basis, subject to ethical approval and compliance with the original consent agreements.

Author and Contributor Statement

Conceptualisation: Stijn Rybels, Thomas Vanoutrive; Data Curation: Stijn Rybels; Formal analysis: Stijn Rybels; Investigation: Stijn Rybels, Josefien Hoerée (contributor); Methodology: Stijn Rybels; Visualisation: Stijn Rybels; Writing - Original Draft: Stijn Rybels; Writing - Review & Editing: Stijn Rybels, Thomas Vanoutrive

Use of AI

During the preparation of this work, the authors used NVivo Transcription for the transcription of the recorded focus groups and Microsoft 365 Copilot to translate quotes and to improve language and readability. After using these tools, the authors reviewed, edited, made the content their own, and validated the outcome as needed, and take full responsibility for the content of the publication.

Acknowledgements

The authors would like to express their appreciation to the anonymous reviewers and the editor for their valuable feedback and insightful suggestions.

Conflict Of Interest (COI)

There is no conflict of interest.

References

Adnan, M., Altaf, S., Bellemans, T., Yasar, A.-U.-H., & Shakshuki, E. M. (2018). Last-mile travel and bicycle sharing system in small/medium sized cities: user's preferences investigation using hybrid choice model. *Journal of Ambient Intelligence and Humanized Computing*, *10*(12), 4721–4731. https://doi.org/10.1007/s12652-018-0849-5

Bertolini, L. (1999). Spatial development patterns and public transport: The application of an analytical model in the Netherlands. *Planning Practice and Research*, *14*(2), 199–210. https://doi.org/10.1080/02697459915724

Bonham, J., & Koth, B. (2009). Universities and the cycling culture. *Transportation Research Part D: Transport and Environment*, *15*(2), 94–102. https://doi.org/10.1016/j.trd.2009.09.006

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brons, M., Givoni, M., & Rietveld, P. (2008). Access to railway stations and its potential in increasing rail use. *Transportation Research Part A: Policy and Practice*, *43*(2), 136–149. https://doi.org/10.1016/j.tra.2008.08.002

Calthorpe, P. (1993). The next American metropolis: Ecology, community, and the American dream. Princeton Architectural Press.

Caset, F., Teixeira, F. M., Derudder, B., Boussauw, K., & Witlox, F. (2019). Planning for nodes, places, and people in Flanders and Brussels: An empirical railway station assessment tool for strategic decision-making. *Journal of Transport and Land Use*, *12*(1), 811–837. https://doi.org/10.5198/jtlu.2019.1483

Ewing, R., & Cervero, R. (2010). Travel and the built environment: A meta-analysis. *Journal of the American Planning Association*, *76*(3), 265–294. https://doi.org/10.1080/01944361003766766

Geurs, K. T., La Paix, L., & van Weperen, S. (2016). A multi-modal network approach to model public transport accessibility impacts of bicycle-train integration policies. *European Transport Research Review*, *8*(4), Article 25. https://doi.org/10.1007/s12544-016-0212-x

Giansoldati, M., Danielis, R., & Rotaris, L. (2020). Train-feeder modes in Italy. Is there a role for active mobility?. *Research in Transportation Economics*, *86*, Article 100990. https://doi.org/10.1016/j.retrec.2020.100990

Groenendijk, L., Rezaei, J., & Correia, G. (2018). Incorporating the travellers' experience value in assessing the quality of transit nodes: A Rotterdam case study. *Case Studies on Transport Policy*, *6*(4), 564–576. https://doi.org/10.1016/j.cstp.2018.07.007

Halldórsdóttir, K., Nielsen, O. A., & Prato, C. G. (2017). Home-end and activity-end preferences for access to and egress from train stations in the Copenhagen region. *International Journal of Sustainable Transportation*, *11*(10), 776–786. https://doi.org/10.1080/15568318.2017.1317888

Heinen, E., & Bohte, W. (2014). Multimodal commuting to work by public transport and bicycle: Attitudes toward mode choice. *Transportation Research Record: Journal of the Transportation Research Board*, *2468*(1), 111–122. https://doi.org/10.3141/2468-13

Heinen, E., & Buehler, R. (2019). Bicycle parking: A systematic review of scientific literature on parking behaviour, parking preferences, and their influence on cycling and travel behaviour. *Transport Reviews*, *39*(5), 630–656. https://doi.org/10.1080/01441647.2019.1590477

Jacobson, J., & Forsyth, A. (2008). Seven American TODs: Good practices for urban design in transit-oriented development projects. *Journal of Transport and Land Use*, *1*(2), 51–88. https://doi.org/10.5198/jtlu.v1i2.67

Jamei, E., Chan, M., Chau, H. W., Gaisie, E., & Lättman, K. (2022). Perceived accessibility and key influencing factors in transportation. *Sustainability*, *14*(17), Article 10806. https://doi.org/10.3390/su141710806

Janssens, D., Ectors, W., & Paul, R. (2023). *Onderzoek verplaatsingsgedrag (2021-2022): Analyse Rapport: Vlaanderen* [Travel behaviour survey (2021-2022): Analysis report: Flanders]. Vlaamse Overheid – Departement Mobiliteit en Openbare Werken.

Jones, T., Harms, L., & Heinen, E. (2016). Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility. *Journal of Transport Geography*, *53*, 41–49. https://doi.org/10.1016/j.jtrangeo.2016.04.006

Jonkeren, O., & Kager, R. (2020). Bicycle parking at train stations in the Netherlands: Travellers' behaviour and policy options. *Research in Transportation Business and Management*, *40*, Article 100581. https://doi.org/10.1016/j.rtbm.2020.100581

Jonkeren, O., Kager, R., Harms, L., & te Brömmelstroet, M. (2019). The bicycle-train travellers in the Netherlands: personal profiles and travel choices. *Transportation*, *48*(1), 455–476. https://doi.org/10.1007/s11116-019-10061-3

Kager, R., Bertolini, L., & te Brömmelstroet, M. (2016). Characterisation of and reflections on the synergy of bicycles and public transport. *Transportation Research Part A: Policy and Practice*, *85*, 208–219. https://doi.org/10.1016/j.tra.2016.01.015

Kager, R., & Harms, L. (2017). *Synergies from improved cycling-transit integration: Towards an integrated urban mobility system* [Working paper No. 2017/23]. The International Transport Forum Discussion Papers. OECD Publishing. https://doi.org/10.1787/ce404b2e-en

Kosmidis, I., & Müller-Eie, D. (2023). The synergy of bicycles and public transport: a systematic literature review. *Transport Reviews*, *44*(1), 34–68. https://doi.org/10.1080/01441647.2023.2222911

Krueger, R. A., & Casey, M. A. (2015). *Focus groups: A practical guide for applied research* [5th ed.]. Sage Publications.

Krygsman, S., Dijst, M., & Arentze, T. (2004). Multimodal public transport : An analysis of travel time elements and the interconnectivity ratio. *Transport Policy, 11*(3), 265–275. https://doi.org/10.1016/j.tranpol.2003.12.001

La Paix, L., Cherchi, E., & Geurs, K. (2020). Role of perception of bicycle infrastructure on the choice of the bicycle as a train feeder mode. *International Journal of Sustainable Transportation*, *15*(6), 486–499. https://doi.org/10.1080/15568318.2020.1765223

La Paix Puello, L., & Geurs, K. (2015). Modelling observed and unobserved factors in cycling to railway stations: Application to transit-oriented-developments in the Netherlands. *European Journal of Transport and Infrastructure Research*, *15*(1), 27–50. https://doi.org/10.18757/ejtir.2015.15.1.3057

Labo Ruimte. (2021). Metro-polis. Naar een spoorgedreven territoriale transitie voor Vlaanderen: Eindrapport verkennend onderzoek [Metro-polis. Towards a rail-driven territorial transition in Flanders: Final report exploratory research]. https://www.vlaamsbouwmeester.be/sites/default/files/2024-10/20230705_Metropolis_FINAL REPORT_web.pdf

Lee, J., Choi, K., & Leem, Y. (2015). Bicycle-based transit-oriented development as an alternative to overcome the criticisms of the conventional transit-oriented development. *International Journal of Sustainable Transportation*, *10*(10), 975–984. https://doi.org/10.1080/15568318.2014.923547

Manaugh, K., Boisjoly, G., & El-Geneidy, A. (2016). Overcoming barriers to cycling: understanding frequency of cycling in a University setting and the factors preventing commuters from cycling on a regular basis. *Transportation*, *44*(4), 871–884. https://doi.org/10.1007/s11116-016-9682-x

Martens, K. (2004). The bicycle as a feedering mode: Experiences from three European countries. *Transportation Research Part D: Transport and Environment*, *9*(4), 281–294. https://doi.org/10.1016/j.trd.2004.02.005

Martens, K. (2006). Promoting bike-and-ride: The Dutch experience. *Transportation Research Part A: Policy and Practice*, *41*(4), 326–338. https://doi.org/10.1016/j.tra.2006.09.010

Moinse, D. (2024). A systematic literature review on station area integrating micromobility in Europe: A twenty-first century transit-oriented development. In F. Belaïd, A. Arora (Eds.), *Smart Cities: Social and Environmental Challenges and Opportunities for Local Authorities* (pp. 171-204). Springer. https://doi.org/10.1007/978-3-031-35664-3_12

Molin, E., & Maat, K. (2015). Bicycle parking demand at railway stations: Capturing price-walking trade offs. *Research in Transportation Economics*, *53*, 3–12. https://doi.org/10.1016/j.retrec.2015.10.014

Nello-Deakin, S., & te Brömmelstroet, M. (2021). Scaling up cycling or replacing driving? Triggers and trajectories of bike–train uptake in the Randstad area. *Transportation*, *48*(6), 3239-3267. https://doi.org/10.1007/s11116-021-10165-9

Nematchoua, M. K., Deuse, C., Cools, M., & Reiter, S. (2019). Evaluation of the potential of classic and electric bicycle commuting as an impetus for the transition towards environmentally sustainable cities: A case study of the university campuses in Liege, Belgium. *Renewable and Sustainable Energy Reviews*, *119*, Article 109544. https://doi.org/10.1016/j.rser.2019.109544

Ploeger, J., & Oldenziel, R. (2022). Bicycle-oriented development: How the Dutch railroad shaped urban planning and discovered cyclists along the way, 1960-1990. *Journal of Urban History*, *50*(5), 997-1017. https://doi.org/10.1177/00961442221133080

Pojani, D., & Stead, D. (2015). Transit-oriented design in the Netherlands. *Journal of Planning Education and Research*, *35*(2), 131–144. https://doi.org/10.1177/0739456X15573263

Robillard, A., Boisjoly, G., & van Lierop, D. (2023). Transit-oriented development and bikeability: Classifying public transport station areas in Montreal, Canada. *Transport Policy*, *148*, 79–91. https://doi.org/10.1016/j.tranpol.2023.12.012

Rybels, S., Vanoutrive, T., Corradi, D., & Coppens, T. (2024). Bicycle commuting beyond short distances: built environment, socio-demographic factors and type of bicycle influencing the choice to cycle to three university campuses. *European Journal of Transport and Infrastructure Research*, *24*(4), 111–132. https://doi.org/10.59490/ejtir.2024.24.4.7013

Samyn, W., Lagrou, R., & Goetgebuer, C. (2025). *Onderzoek verplaatsingsgedrag analyserapport 2025* [Research on travel behavior analysis report 2025]. Vlaamse Overheid – Departement Mobiliteit en Openbare Werken. https://assets.vlaanderen.be/image/upload/v1747834928/repositories-prd/finaal-analyserapport-vg7_x6csy3.pdf

Shelat, S., Huisman, R., & van Oort, N. (2018). Analysing the trip and user characteristics of the combined bicycle and transit mode. *Research in Transportation Economics*, *69*, 68–76. https://doi.org/10.1016/j.retrec.2018.07.017

Sherwin, H., Parkhurst, G., Robbins, D., & Walker, I. (2011). Practices and motivations of travellers making rail-cycle trips. *Proceedings of the Institution of Civil Engineers: Transport*, *164*(3), 189–197. https://doi.org/10.1680/tran.2011.164.3.189

Vale, D. S., Saraiva, M., & Pereira, M. (2015). Active accessibility: A review of operational measures of walking and cycling accessibility. *Journal of Transport and Land Use*, *9*(1), 209–235. https://doi.org/10.5198/jtlu.2015.593

Vale, D. S., Viana, C. M., & Pereira, M. (2018). The extended node-place model at the local scale: Evaluating the integration of land use and transport for Lisbon's subway network. *Journal of Transport Geography*, *69*, 282–293. https://doi.org/10.1016/j.jtrangeo.2018.05.004

van Mil, J. F. P., Leferink, T. S., Annema, J. A., & van Oort, N. (2020). Insights into factors affecting the combined bicycle-transit mode. *Public Transport*, *13*(3), 649-673. https://doi.org/10.1007/s12469-020-00240-2

van Wee, B. (2015). Accessible accessibility research challenges. *Journal of Transport Geography*, *51*, 9–16. https://doi.org/10.1016/j.jtrangeo.2015.10.018

Vanoutrive, T., van Malderen, L., Jourquin, B., Thomas, I., Verhetsel, A., & Witlox, F. (2010). Mobility management measures by employers: Overview and exploratory analysis for Belgium. *European Journal of Transport and Infrastructure Research*, *10*(2), 121–141. https://doi.org/10.18757/ejtir.2010.10.2.2878

Vanoutrive, T., van Malderen, L., Jourquin, B., Thomas, I., Verhetsel, A., & Witlox, F. (2011). Rail commuting to workplaces in Belgium: A multilevel approach. *International Journal of Sustainable Transportation*, *6*(2), 67–87. https://doi.org/10.1080/15568318.2011.555599

Verachtert, E., Mayeres, I., Vermeiren, K., van der Meulen, M., Vanhulsel, M., Vanderstraeten, G., Loris, I., Mertens, G., Engelen, G., & Poelmans, L. (2023). Mapping regional accessibility of public transport and services in support of spatial planning: A case study in Flanders. *Land Use Policy*, *133*, Article 106873. https://doi.org/10.1016/J.LANDUSEPOL.2023.106873