Untangling the relationship between regulation, design, and lived experience of accessibility for disabled public transportation riders in Greater Boston and Brussels

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Abstract

Public transportation is an essential method of mobility in many cities. Yet, access to public transportation is not evenly distributed, and many residents who already face marginalization in society experience additional barriers to effectively accessing mobility through public transportation. Of these barriers, physical access to public transportation stations and vehicles is one of the most fundamental. Disabled people face a wide variety of barriers in society, and public transportation access can be a critical gatekeeper to full participation in society. Physical accessibility of public transportation sits at the intersection of policy, design, and human rights, yet it remains an under-studied area of research in transportation geography.

This thesis analyzes the relationship between 1) formal regulation of accessibility "from above", 2) internal "accessibility planning" at the level of organizational policies, and 3) the "on the ground" lived experience of accessibility for disabled public transportation users, using the MBTA (Greater Boston, USA) and the STIB-MIVB (Brussels, Belgium) public transportation systems as case studies. These themes are investigated through document analysis, interviews, and on-the-ground participant observation fieldwork with disabled public transportation users.

This research finds that while public transportation agencies can independently shape real-life accessibility through institutional policies and priorities, regulatory requirements can provide useful minimum standards and are an important source of accountability. Furthermore, it finds that there is not always a direct translation of planned accessibility to actual real-life accessibility for disabled users, and that real life accessibility (or lack thereof) is often mediated through interactions between design on the one hand and public transportation staff behavior on the other.

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List of Acronyms

ADA - Americans with Disabilities Act

CAWaB - Le Collectif Accessibilité Wallonie Bruxelles (French) - the Accessibility Collective Wallonia-Brussels

CRPD - Convention on the Rights of Persons with Disabilities

IAM - Internal Access Monitoring program

MBTA - Massachusetts Bay Transportation Authority

PMR/PRM - Personne à mobilité réduite (French)/Person with reduced mobility

RRU - Le Règlement Régional d'Urbanisme (French) - Regional urban planning regulation

STIB-MIVB - Société des Transports Intercommunaux de Bruxelles (French)/Maatschappij voor het Intercommunaal Vervoer te Brussel (Dutch) - Brussels Intercommunal Transportation Company

SWA - Department of System Wide Accessibility

TRSE - Transportation Related Social Exclusion

UNIA - Interfederal Centre for Equal Opportunities (Belgium)

WMD - Wheeled Mobility Device

Chapter 1

Introduction

Much of the 21st century world lives in a society that requires a great deal of mobility. While generations past lived in a "pedestrian" world where daily life was necessarily located within a radius of a few kilometers, modern transportation technologies that allow us to travel faster have expanded the geographic circle where our daily lives take place. Unfortunately, rather than meaning we spend less time traveling, greater mobility generally has meant that we simply travel farther distances to complete our daily routines. Moreover, access to this high level of mobility in societies today is not evenly distributed (Kenyon, Lyons, and Rafferty, 2002, Denmark, 1998). In the words of geographer Relph (1981), "Modern landscapes seem to be designed for forty-year-old healthy males driving cars," (in Freund, 2001, p. 695). That matters, because, as the field of Transportation-Related Social Exclusion (TRSE) research has shown, being excluded from high-quality transportation options in a world that requires a great deal of mobility has meaningful consequences for these life opportunities (Lucas, 2012): access to jobs, medical services, groceries, even access to a meaningful social life.

Public transportation plays an essential role in the mobility patterns of residents in many cities. When implemented well, public transportation has the capacity to move many people at high speeds at scale, and it has the potential to be a tool that can even the mobility playing field more than car dependency. Not only can public transportation be significantly cheaper than all of the costs associated with owning and maintaining a car, it also has the potential to be an emancipatory mobility tool for anyone for whom driving a car is difficult or impossible. Yet, like "modern landscapes" broadly, 20th-century public transportation systems have also been designed for an "ideal commuter" who likely reflects the 20th-century transportation planner *him*self: an able-bodied man commuting to work. This vision leaves out many people, but one of the groups that has traditionally been most thoroughly ignored by public transportation planners is disabled people. While there can be many barriers to accessing public transportation, from the cost of using it to the time it takes to complete a journey, one of the very most fundamental barriers comes from not even being able to physically board the transportation.

Figure 1.1: "Gang of 19" protesters block a bus in Denver, Colorado, USA in 1977.
(Denver Public Library Western History Collection Archives)

The history of ignoring the needs of disabled people in public transportation follows a much broader pattern of making disability invisible in modern society. Disabled people in the 19th and early 20th century were largely viewed as objects of charity or pity, rather than equally worthy and valuable, autonomous members of society; moreover, many countries embraced policies that institutionalized people with physical and mental disabilities, (Oliver, 1986, Hahn, 1996, Gleeson, 1999, Shakespeare, 2013). This "out of sight; out of mind" mentality made it easy for able-bodied planners to build cities and transportation systems without considering the barriers they were creating for disabled people.

A lot has changed in this respect in the last 50 years, as disabled activists in the global disability rights movement in countries around the world have forced mainstream able-bodied society to confront the barriers that prevent disabled people from fully participating in public life. Central to that change has been a shift towards recognizing that design of the built environment and social attitudes contribute to the exclusion and lack of access associated with disability, not a person's medical condition alone (Shakespeare, 2013, Gleeson, 1999). Given transportation's central role in accessing life in the public sphere, it is no coincidence that disability political movements have often highlighted the inaccessibility of public transportation systems, "such as the Gang of 19" protests against inaccessible buses in Colorado in the 1970s (see Figure 1.1).

The focus of disability activism has often pursued a rights-based approach, pushing to enshrine equal access and equal participation in society for disabled people as a civil or human right. This is particularly true in the US political context, but also

globally, in the push for the creation and ratification of the UN Convention on the Rights of Persons with Disabilities (CRPD) (Zola, 2005). This strategy has resulted in legal wins, with formal recognition of disability rights at the UN international human rights law (CRPD), and in some countries at the national level, such as the passage of the Americans with Disabilities Act (ADA) in the United States. At the same time, over the past 50 years there have been great advances in accessible design for buildings, transportation vehicles, and public space.

But formal recognition of the rights of people with disabilities to participate fully in society and a stated obligation to correct disabling practices alone does not always translate into actual on-the-ground reality in every country that has nominally promised to protect and enforce these rights. Indeed, the built environment of many cities demonstrates how much of everyday public space remains inaccessible.

So what types of interventions result in tangible changes in real, on-the-ground accessibility for disabled people when it comes to the realm of public transportation?

1.1 Research Question

My research examines the relationship between legal rights and official policies, design practices, and lived experiences of people with physical disabilities in urban public transit systems. In this research, I ask the question: What is the relationship between:

1. Formal legal accessibility regulations "from above" at the governmental level;
2. "Accessibility planning" at the transportation organization-level, including design guidelines and staff policies;
3. The actual real-life experiences of accessibility (or lack therof) for disabled transportation users?

Through this research, I examine how these three levels interact. I look at what processes are effective in translating a theoretical vision of disability rights into an implemented reality for daily users, and what allows gaps to persist. I analyze these factors by examining the case of two public transportation systems in two distinct countries:

Case 1: Massachusetts Bay Transportation Authority (MBTA) public transportation system in Greater Boston, Massachusetts USA, and

Case 2: Société des Transports Intercommunaux de Bruxelles/Maatschappij voor het Intercommunaal Vervoer te Brussel (STIB-MIVB) public transportation system in Brussels Capital Region, Belgium.

1.2 Scope

This research focuses on accessibility for disabled people with *mobility* and *sensory* (hearing, vision) impairments. Although equally crucial, assessing accessibility parameters for people with mental and developmental disabilities is beyond the scope of this research project.

1.3 Case Selection

For this topic relating law, design, and disability, I wanted to include a case in a US city, because I wanted to understand the implications of the unique scope and power of that country's ADA civil rights law, and a European city, which did not have an equivalent comprehensive disability rights law. However, public transit service in many US cities is poor and few US cities have public transit networks of a similar complexity to similar-sized European cities; for instance, many medium-sized US cities only have bus networks. Greater Boston was an ideal choice, because the MBTA system is a complex multimodal network, incorporating underground heavy rail (metro), light rail (tram), and buses. This made it a good comparison from the American context to compare with a European city like Brussels, which also has a multimodal system of underground metros, trams, and buses.

These two public transportation systems are both located in mid-size city regions with some similar characteristics. The MBTA service area, which includes Boston and 175 smaller communities, has a population of 4.7 million inhabitants ("MBTA LinkedIn," n.d.), while the STIB-MIVB serves the Brussels-Capital Region population of 1.2 million inhabitants ("Statbel," 2021). Both cities serve a comparable number of riders, although the STIB-MIVB has a larger ridership: pre-pandemic, the MBTA rider took 362 million trips in FY 2019 (*MassDOT Tracker 2019*, 2019), whereas STIB-MIVB riders took 433,5 million trips in 2019 (*Statistiques 2019*, 2019). Both cities are regionally and internationally important hubs, with populations including both long-term residents but also elite transplant populations – in Boston, people working in the city's biotech and pharmaceutical industry, and in Brussels, employees of EU institution and related organizations. Both cities also have extensive, complex, and relatively old public transportation systems dating back to the 19th century.

There are some ways in which the services differ: the MBTA serves a significantly larger geographic area than the STIB-MIVB, in part because the MBTA includes a suburban/regional commuter rail service, whereas the equivalent S train service in the Brussels region is run by a different company. However, even just the MBTA's "core service area", which is the area served by bus and rapid transit services, covers 2041 km^2 ("MassMapper," n.d.), more than an order of magnitude more than the STIB-MIVB, which serves the Brussels-Capital Region's 162km^2 area ("About the Region — Région Bruxelloise - Brussels Gewest," n.d.).

Both the MBTA and STIB-MIVB are also both run as quasi-public agencies ("public interest organization" in Belgian context), funded by the state or regional government, but with a degree of organizational autonomy from the state/regional government proper.

1.4 Research Gap

This thesis sits at the intersection of several different academic fields: the Disability Studies field, Transportation-related social exclusion (TRSE), and Transport Justice. The disability and transportation social science fields have largely not been in conversation with each other, despite their mutual relevance for the topic of accessible public transportation. Most of disability theoretical literature does not focus heavily on the built environment and particularly not on transportation systems, in general suffers from a problem of "aspatiality" that has been noted by Gleeson (1999) and Freund (2001). At the same time, despite the focus in social geography broadly and TRSE in particular on studying the spatial effects of oppression and deprivation on marginalized groups such as low-income people, women, racial and ethnic minorities, and immigrants, social geography has largely not engaged in a meaningful way with disability (Gleeson, 1999). Nonetheless, given transportation system's role in mediating mobility and opportunity accessibility in cities, there is clearly have a very high potential for transportation systems to either being a force of inclusion or an instrument of social exclusion for disabled people. This research gap from both disciplines calls for further research on the relationship between disability and transportation-related social exclusion, and I hope this thesis will begin to address this research gap.

Chapter 2

Literature review

This literature review has primarily considered English language academic publications on both the topic of disability and transportation-related social exclusion. Thus, while this can hopefully provide a good overview of the state of these topics in anglophone academia, it may not encompass potentially differing perspectives that have been taken up in other languages, which may particularly be a shortcoming for the Belgian context, as I was not able to review literature in either French or Dutch.

2.1 Theorizing disability

Until the mid-twentieth century, academic discussion of disability was primarily carried out by members of the medical establishment and rehabilitation field. These fields conceptualized disability as an individual, medical problem defined by the person's physical or medical limitation. Social exclusion was considered to be due to the individual's impairment, so solutions focused exclusively on individual medical treatment and rehabilitative interventions. Meanwhile, individuals with complex disabilities who could not be "cured" or normalized would be relegated to care facilities and segregated from the rest of society (Oliver, 1986, Hahn, 1996, Gleeson, 1999, Shakespeare, 2013). This understanding of disability (referred to as the "medical model of disability" by disability studies theorists) and resulting treatment of disabled people began to be challenged in the mid-20th century by disability rights activists and advocates for deinstitutionalization, especially in the US and the UK (Shakespeare, 2013, Gleeson, 1999). In the United States, the beginnings of the disability rights movement were closely tied with the Civil Rights Movement of the 1960s for racial justice, as disabled activists began to see similarity between their struggles and those of Black Americans and other racial minorities (Terzi, 2004, Barnartt and Seelman, 1988, Hahn, 1996).

Concurrently with policy activism, advocates began developing alternative interpre-

tations of the nature of disability that deviated from the traditional medical perspective. Gleeson (1999) identifies the beginnings of disability studies as a"coherent discipline" in anglophone social sciences as emerging in the 1950s. A critical turning point in this academic treatment of disability was the development of a "social model of disability". Coined by the by British disabled scholar Mike Oliver in the 1980s (Terzi, 2004, Shakespeare, 2013, Gleeson, 1999), the notion of a"social model of disability" reconceptualized disability not purely an individual, medical condition, but a social condition that emerges from the interaction of a person's physical or mental impairment with the society and the built environment. Oliver argued that disability in the early 20th century was ignored because it was viewed as a "personal tragedy" rather than a socially imposed situation, but argues that "disability is...a particular form of social oppression" (Oliver, 1986, p. 6), where disablement is not the natural result of a person's impairment, but a social phenomenon imposed externally on people with impairments by society. The social model as articulated by Oliver and allied activists breaks the concept of disability into two pieces: *impairment*, meaning the physical, mental, or sensory functional limitation that exists within the individual's body, and *disability*, meaning the limitations or restrictions of life activities that are caused by social organization and the physical structure of the built environment, which exclude people with impairments from participation in mainstream society. (Terzi, 2004, Bickenbach, Chatterji, Badley, and Üstün, 1999). While Oliver claims that the"social model" is not meant to be a social theory (Terzi, 2004); nonetheless, the concept of a social model has become one of the preeminent theoretical conceptualizations of disability within the disability studies field and social sciences more broadly. This inclusion of a societal element in the construction of disability has been a radical framing shift for practical, political, and academic understandings of disability in the last half century.

The social model of disability was first conceived by disability rights activists to advocate for policy change, and several scholars point to these political origin both as a strength and a weakness of the model. On the side of strengths, the social model is a politically effective argument: while the individual medical model "served to individualise the problems of disability and hence to leave social and economic structures untouched" (Oliver, 1986, p. 16), the social model puts responsibility on governments and societies to change to become inclusive for people with disabilities (Shakespeare, 2013). This leads to clear political demands for structural change. The responsibility of government and society to fix disabling societal features implied by the social model has been central to policy changes and the creation of laws such as the Americans with Disabilities Act (ADA) in the United States and the Convention on the Rights of Persons with Disabilities globally. In addition, the promulgation of the social model has been radically inspiring and affirming for disabled people, because it posits that the social exclusion they may have faced is not their own fault but the fault of a disabling society.

Yet Bickenbach et al. (1999), Gleeson (1999), and Shakespeare (2013) all argue that the activist origin of the social model means while it is practically effective, in its original form, it lacks the nuance needed to operationalize as a theoretical and analytical tool to study disability within the social sciences. Bickenbach et al.,

1999, highlight some of the practical questions early framings of the social model present for researchers, asking "How precisely does the social environment create disablement? Should we expect patterns of disadvantage linked to specific physical or mental conditions? How do we identify which aspects of the social environment are responsible for disadvantage?" (Bickenbach et al., 1999, p. 1174).

In the years since the proposition of a "social model of disability", many researchers have attempted to further untangle this relationship between the social environment and disability. Indeed, as Gleeson (1999) and Shakespeare (2013) note, today, it is more accurate to talk about social models (*plural*) of disability, as many different conceptualizations of disability as a socially-constructed condition have been proposed, and a variety of debates have emerged in the discipline as scholars try to analyze the relationship between the social, the embodied (physical/mental), and the built environment.

Within these academic debates, I see three main tensions in the theoretical framing of social models, which I will discuss further in the following sections:

- **What is the social origin of disability?:** If disability is socially constructed, from what specific aspect of society does the "disabling" effect originate?
- **The social versus the embodied:** how big a role does impairment play in the experience of disability?
- **Who is "disabled"?** Are disabled people a minority, or is disability a universal experience?

The next sections will explore the theoretical debate between disability scholars along these three axes.

Short note on terminology

Within anglophone disabilities studies and the broader English-speaking disability community, terminology has coalesced around using the term "disability" as opposed to using older terms such as "handicapped", although this terminology is still used contemporaneously in other languages such as French and Dutch. There is also widespread rejection by disability advocates of euphemistic terms "differently abled"[1] or "special needs" that are seen as patronizing and ignoring the reality of disability ("Disability-Inclusive Language Guidelines," 2021). The reasons for this relate to foregrounding disability as a social phenomenon that has come out of the social model.

[1]This may also vary from region to region, as a quick scan of literature on Google Scholar shows the term "differently abled" to be used primarily in English-language scholarship by Indian authors.

There is, however, some variation in the literature as well as broader public discourse around using the term "disabled people" versus "people with disabilities". In the disability studies academic literature and activism community in English speaking countries, there seems to be a strong preference for using "disabled people" over "people with disabilities", despite the "person-first" term "people with disabilities" is often recommended and used broadly in public and institutional discourse in English-speaking countries in an attempt to minimize the stigma associated with disability (Sharif, McCall, and Bolante, 2022, Gleeson, 1999).[2]

There also does seem to be a slightly stronger preference of disabled members of the general public for identity-first language, though this is by no means a hegemonic preference. In their review of recent literature, Sharif et al. (2022) found across several different academic surveys of disabled people about their language preference, small pluralities prefer "identity-first" (disabled person) language over "person-first" langauge, though authors also found variation amongst English speaking countries; this trend was backed by data in the author's own recent study.[3]

Disability studies academics and disability rights advocates in English strongly, though not universally,[4] seem to prefer the term "disabled people". In explaining his decision to use "identity-first" terminology in his writing, non-disabled academic Gleeson (1999) looks to disabled scholars such as Abberly and Morris, who argue that the term "disabled people" is more appropriate because it highlights the social oppression (disability) people with impairments face, and has more political power than the more apolitical "people with disabilities". Similarly, Shakespeare (2013) argues that "medical model thinking is enshrined in the liberal term "people with disabilities," (216), because it treats disability as something individual and medical inside of the person. Following the practice largely promoted and used by disabled writers in the disability studies field, I will primarily use the term "disabled person" in this thesis, while recognizing that not everyone, including perhaps non-academic and non-activist members of the public with disabilities whose voices are not represented in the academic literature, may prefer person-first terminology.

[2]For instance, policy bodies and documents such as the United Nations Disability Inclusion Strategy recommends the use of "person with a disability", because it emphasizes the personhood over disability, ("Disability-Inclusive Language Guidelines," 2021).

[3]For example, Sharif et al. (2022) found that while overall 42% of the 519 respondents from 23 countries preferred identity-first language compared to 38% who preferred identity first language (the remaining 20% expressing no preference). However, when disaggregated by country, they found that a greater portion (43%) of American respondents preferred identity first and a smaller portion preferred person-first (33%); this trend was flipped amongst UK respondents, where 60% preferred person-first and 45% preferred identity first; Canadian respondents were evenly split in their preferences.

[4]Amongst the disabled academics cited in this literature review, Oliver (1986), Crow (1996), Hahn (1996), Shakespeare (2013), and Hamraie (2016) all use the terminology "disabled person", while only Zola (2005) uses "person with a disability", likely a reflection of his universalizing perspective on disability discussed later.

2.1.1 What is the social origin of disability?

Amongst anglophone literature on the role of society in the construction of disability, there has been historically a major difference between US and British understandings of the social origins of disability. This academic divergence seems to follow the political origins of the disability activism movements in each country: whereas US disability rights activism brew out of the US Civil Rights Movement and thus strategically focused their efforts towards guaranteeing individual rights through an antidiscrimination approach (Bickenbach et al., 1999, Gleeson, 1999, Barnartt and Seelman, 1988), the British "disabled people's movement" has focused less on individual rights and more on collectivist social policy changes (Gleeson, 1999). Similarly, while prominent US scholars like Hahn conceptualize the social component of disability as arising from discrimination (Hahn, 1996), the British materialist social model, following early scholars like Oliver, tend to embrace a more Marxist-inspired materialist analysis (Shakespeare, 2013, Terzi, 2004, Gleeson, 1999), which Gleeson says is likely because of "the long participation by many disability activists in that country with socialist politics," (Gleeson, 1999, p. 24).

Disability under capitalism: British materialist model

Proponents of the British materialist social model of disability see "ableism" or "disability oppression" as arising because of the organization of society under capitalism (Gleeson, 1999, Terzi, 2004). For example, early British theorists of a social model such as Finkelstein and Oliver focus on the emergence of capitalism as a key moment in the "social creation" of disability. Finkelstein argues that in pre-industrial society with agricultural and small industry modes of production, people with impairments were "pitied" but not excluded from production, whereas in industrial era, rationalized work in factories encouraged the exclusion and segregation of people with physical or mental impairments who might need to work at a slower pace, resulting in the creation of segregated medical institutions and asylums (Oliver, 1986). Oliver disputes a number of details of Finkelstein's account, generally taking issue with Finkelstein's "over-romanticize[d]" view of the treatment of disabled people in pre-industrial society (Oliver, 1986, p. 14), and proposing a different causality, arguing that rise of capitalism created a need to control many "disruptive" parts of population, including but not limited to disabled people. Nonetheless, Oliver argues for a social model of disability that takes into account historical processes and modes of production (Oliver, 1986).

The explanation that shift in modes of production drove the social construction of disability raises a number of questions and critiques. Understanding disability as a purely modern phenomenon, as Oliver (1986) notes, risks over-romanticizing the status of disabled people in premodern times and can be reductionist. Moreover, the British materialist explanation generally only considers one set of disabling social practices – residential segregation and economic exclusion – but does not consider not other disabling social arrangements. Particularly relevantly to the topic

of mobility, this explanation is largely silent on the way architecture and the built environment been highly disabling across eras.[5] A different strand of critique from feminist and postmodern scholars, among others, argues that the materialist social model's focus on economic processes underestimates the role of culture in shaping society (Terzi, 2004). For example, Terzi (2004) notes that for Deaf people who communicate using sign language, social exclusion may more related to culture and language because exclusion arises from communication barriers, as opposed to economic structures. Shakespeare argues that cultural stereotypes about disability have played a big role in its social construction that the materialist accounts ignore.[6] These type of ideas about the role of cultural attitudes and beliefs are central to the US "sociopolitical" view of social origins of disability.

Discriminatory attitudes: US sociopolitical discrimination model

The North American social model, which Hahn (1996) refers to as the "sociopolitical approach", also defines disability as "the product of the interactions between individuals and the environment", and, like the British materialist social model, argue that disabling environments are the primary drivers of disability as opposed to individual impairment (Hahn, 1996, p. 45), although they do seem to still see impairment playing a part in disability to a greater extent than the materialists. The US social model proponents argue that disabling environments arise from a discriminatory attitudes and beliefs in society at large about people with physical and mental impairments, which they explain as working analogously to the way discriminatory attitudes shape racism and sexism and the social construction of race and gender (Shakespeare, 2013, Gleeson, 1999, Hahn, 1996, Barnartt and Seelman, 1988). Whereas the British social model sees economic structures as the root cause of social disablement, the US sociopolitical model sees culture, in the form negative and discriminatory attitudes and beliefs, as the root cause, which in turn causes economic, political, and built environment discrimination. In other words, whereas the British materialist model sees economic structural features as primarily shaping the experience of disability, including discriminatory attitudes, the US model sees as the root cause negative societal attitudes from culture that result in discrimination, which then shape structural features.

Though the fact that the US sociopolitical model sees discriminatory policies as ultimately arising from negative attitudes, the remedies these authors propose are not to change the attitudes, but rather on public policy changes through civil rights anti-discrimination legislation, following the model of US civil rights laws prohibiting discrimination on the basis of race. Essentially, the idea is not to directly change these discriminatory attitudes, but to ban any discriminatory policies or actions

[5] Just as one example, both medieval city centers and mid-20th century Brutalist buildings often are designed with steps that block access for people with mobility impairments, showing that both pre- and post- capitalist built environments alike can be highly disabling.

[6] For example, Shakespeare points to historical cases such as "Ugly Laws" in the US, where cultural stereotypes against people with impairments became enshrined in laws that prohibited disabled people from using public space (Shakespeare (1994), in Gleeson, 1999)

individuals or governments may take based on these attitudes, whether through employment discrimination or inaccessible design of the built environment.

There are a number of questions and critiques arising from the US sociopolitical model. Externally, a lot of the criticism of the US model has taken issue with the strategic remedies via civil rights legislation that US sociopolitical model theorists advocate for based on this analysis (Gleeson, 1999), criticizing what Bickenbach et al. (1999) describes as "the peculiarly American penchant for seeing all social problems in terms of legally enforceable individual rights" (1180). This strategic critique is more common in the literature than theoretical critiques disputing the underling causal analysis that discriminatory beliefs are the root cause of the social component of disability. But nonetheless, there are some questions worth raising about this social explanation. In the same way that the British materialist social model may overemphasize the role of economic structures while ignoring culture and attitudes, the US sociopolitical model's heavy emphasis on cultural features like discriminatory attitudes and beliefs risks attributing all policies with discriminatory outcomes directly to discriminatory attitudes, while ignoring the role of economic structures and ideologies, such as the ideal under capitalism that all "good" citizens should be to be productive workers (Oliver, 1986).

Additionally, while theorists like Hahn correctly note that social attitudes shape public policy, the heavy focus on negative and discriminatory attitudes in this model may mask the way that seemingly neutral institutions or structural features that do not overtly imply a negative value judgement can still produce inequitable and discriminatory outcomes. This is a theme that Bickenbach et al. (1999) pick up on in their critique of US discrimination/civil rights analysis of disability, arguing that: "Where neutral forces such as economic factors create the disadvantage, there is no insult, because there is no insulter. To be sure, there is a social evil; there is injustice and inequality; but of a different sort," (1181). While I would take issue with the depiction of economic factors as a "neutral force", Bickenbach et al. (1999) raise a valid concern. Indeed, the social origins of disability described by Hahn and others may fall into the same trap as older modes of thinking about the causes of racism in the US – that racial discrimination is purely attributable to discriminatory beliefs and behaviors and de jure racist policies. This is an understanding of racism that ignores "structural" or "institutional racism", where seemingly neutral or "color-blind" policies can have racially disparate outcomes that perpetuate racial inequity, even when they do not directly convey racist intent (Bailey et al., 2017). Applying this logic to disability seems particularly relevant when looking at the built environment and mobility. Whereas residential segregation and employment discrimination may imply a more direct value judgement about the worth and position in society of disabled people, inaccessible design may reflect ignorance on the part of designers and architects more than overt negative attitudes. But these design features (or lack thereof) nonetheless have a highly discriminatory effect. Interestingly, civil rights-based remedies to combat disability discrimination in the US, which come out of advocacy using the US sociopolitical model, do seem to address the structural discrimination by defining discrimination based on discriminatory *outcomes* rather than just discriminatory *intent* more directly than traditional racial civil rights leg-

islation in the United States. Laws like the Americans with Disabilities Act of 1990 carrying a positive obligation to correct built environment and transportation structures that create barriers for people with disabilities, not just negative obligation to not discriminate ("ADA," 1990, amended 2008). This positive obligation is something that Barnartt and Seelman (1988), writing before the passage of the A.D.A. in 1990, note as a distinctive feature of envisioned disability civil rights legislation, saying that whereas existing civil rights laws for racial minorities and women had attempted to "make the laws as neutral as possible-to force the laws to disregard race (or sex) as a relevant classification," (a goal that can be described as **equality**), for disabled people, "neutrality may not be the most appropriate legal goal: their goal is removing barriers rather than simply ignoring them," (a goal that can be described as **equity**) (Barnartt & Seelman, 1988, p. 46).

The British materialist and US sociopolitical discrimination model both raise valid points about social origins of the societal component of disability. Ultimately, rather than seeking a monolithic explanation entirely attributing the social aspect of disability to the economy or culture, we can take both of these theoretical arguments into account with a level of nuance. Much like the rest of society and socially constructed experiences, it seems likely that the socially constructed elements of disability are both the product of economic forces and historical developments on the one hand as well as cultural values and beliefs on the other. Moreover, economy, historical path dependency, and culture are all social forces that undoubtedly also shape each other in complex ways.

2.1.2 The social versus the embodied

Another major point of debate within disability studies and within social models of disability is the relative weight that should be put on social factors versus embodied experiences in the construction of disability. Because social models are framed in opposition to the individual "medical model", they tend to minimize the role of impairment in order to counteract the traditional medical view of disability. The introduction of the social piece has been revolutionary in disability studies; nonetheless some scholars argue that many of the predominant social arguments may go too far in attributing disability to social factors, and ignore the reality of impairment for disabled people as something that heavily affects their lives. Feminist disability scholar and artist Crow (1996)lays out well some of the misgivings she and some other disabled authors have about an overly-structural theory of disability. Crow says that while traditional medical understandings of disability see "impairment as 'all'", in seeking to reject this understanding, social models embraced by many advocates have gone too far to an opposite extreme, seeing socially-caused "disability as 'all'", erasing the role of impairment in disabled people's experiences, making "impairment as irrelevant, neutral and, sometimes, positive, but never, ever as the quandary it really is," (Crow, 1996, p. 3). Crow argues that that the "silence" she sees from disability advocates embracing the social model " prevents us from dealing effectively with the difficult aspects of impairment," including "pain, fatigue,

depression, and chronic illness," (Crow, 1996, p. 4).

A number of writers point out that early explanations of the social model may overemphasize the experience of people with certain types of physical impairments, while ignoring the experience of other impairments, particularly mental impairments and non-stable, degenerative conditions and chronic illness (Shakespeare, 2013, Freund, 2001, Crow, 1996). Shakespeare, a prominent British critic of the British materialist social model, argues that the materialist social model was primarily developed by white, heterosexual men with spinal injuries and other stable physical impairments, and argues that if the model had been articulated by people with mental disabilities or "more complex physical impairments", it would not diminish the role of impairment so significantly (Shakespeare, 2013, p. 217). From this position, Shakespeare argues that other "socio-political" models more accurately describe disability as emerging from the relationship between bodily impairments and society, rather than the tendency in the British materialist model to see disability as being entirely socially created.

At the same time Freund, coming from the perspective of sociology of health and illness, warns that while social models are "silence about some complex relationships between self, body, social context and deeply seated cultural attitudes," sociological perspectives on bodies, health, and illness have had a tendency to overemphasize what he describes as a " post-structural love affair with differences," (Freund, 2001, p. 690). By overemphasizing difference, Freund argues, post-structuralist theorists may miss commonalities and the potential for institutional, social, and built environment changes to increase access and inclusion in significant, meaningful ways for people with a broad range of types of impairments. Both Freund (2001) and Gleeson (1999) ultimately advocate for the value of a social model that sees disability as a social, not uniquely individual, experience heavily informed by societal structures and spatial and temporal arrangements of the built environment, but argue these theories need to incorporated more of an "embodied" perspective.

Shakespeare draws parallels to other theories of socially constructed identities like race and gender to point out another analytical limitations of predominant articulations of the social model. He argues that social construction of race and gender has happened a way that *is shaped and informed* by the experience of oppression, but that gender identity or racial identity can exist beyond just the experience of oppression. However, Shakespeare argues, the original definition of disability in the social model, as articulated by Oliver and others, essentially *defines* disability *as oppression*. Therefore, he argues, in this formulation of disability, "only people with impairments who face oppression can be called disabled people," making it difficult to research the extent of oppression or whether oppression exists in certain situations for disabled people since, by this definition, to be disabled they must oppressed (Shakespeare, 2013, p. 218).

The tying of disability directly to oppression raises additional questions when it comes to understanding disability as a type of social identity. Hamraie, writing from the perspective of Critical Disability studies, argues that traditional social models

do not push back on the "ableist" idea disability as a problem to be "solved" rather than valid way to live, and argues that the critical perspective to disability studies requires "treating disability itself as a valuable way of being in the world, one that societies must work to accept and preserve rather than cure or rehabilitate," (Hamraie, 2016, p. 4). Seeing disability as a valid way to live would require redefining disability significantly from the materialist definition of "loss or limitation of opportunities...due to physical and social barriers," (UPIAS, 1976 in Bickenbach et al., 1999, p. 1176), though Hahn's North American socio-political definition of disability as "the product of the interactions between individuals and the environment" (Hahn, 1996, p. 45) does maybe offer more promise. Yet, as Shakespeare (2013) and Crow (1996) point out, reclaiming disability "pride" as other oppressed groups have done is complicated by the difficult experience of impairment for many disabled people. Shakespeare argues that emancipation for disabled people requires more than just the elimination of social discrimination; additionally, "society will have to provide extra resources to meet the needs and overcome the disadvantage which arises from impairment," (Shakespeare, 2013, p. 220).

2.1.3 Who is "disabled"? Minority group analysis versus universality

A final theoretical debate within the realm of social models of disability is the question of who is included in "disabled people" or "people with disabilities". A prominent interpretation, coming predominantly from North American authors, is the "minority model", which sees disabled people as being part of a social minority with an analogous position to racial or ethnic minorities or sexual or gender minorities. Barnartt and Seelman (1988) define minority groups as "different physical or cultural characteristics which are of lower socioeconomic status, politically powerless to the point of being oppressed, negatively stereotyped, discriminated against, and aware of that discrimination," (37), and argue that though there are some differences in the experience of people with disabilities and ethnic and racial minority groups, the minority group analysis is a useful lens. Both Hahn (1996) and Barnartt and Seelman (1988) make the case that the minority model is a useful framework to understand social position of disabled people . Though slightly different theoretical constructions, the minority model is closely related to the socio-political model of disability promoted by Hahn (1996), as it sees disability as a minority category as being socially constructed through discrimination.

However, the minority model analysis has also been questioned by other scholars, both within and outside of the United States. One critique relates to whether disabled people have a group social identity, a topic explored to some extent in the previous section. Bickenbach et al. (1999), who strongly critique the minority model, argue that the minority categorization is not appropriate because " there is almost no commonality of experience, or feelings of solidarity, between people with diverse disabilities," (1181). While it is certainly true that there are a wide variety of distinct, individual embodied experience of impairment and not a unifying

"disabled experience" as discussed in previous sections (as is the case, arguably for race and gender as well!), it seems provably false that there are "no feelings of solidarity" or "prospects for transdisability solidarity" amongst disabled people.[7] It seems quite clear that disability activism movements in a number of countries have clearly created group feeling and solidarity across types of impairments for at least some disabled people.

Various other authors raise questions about whether disability is really the experience of a small minority of the population, or a common or even universal experience. In terms of numerical considerations of how many people are disabled, Gleeson (1999) cites an estimate from Golledge (1993) that 10-15% of the population of most countries disabled, and UN statistics that globally nearly 500 million people are disabled. Numerous authors note the difficulty of identifying an accurate number of people with disabilities, though, because some people will avoid self-identification as disabled due to stigma (Zola, 2005, Freund, 2001).[8] Nonetheless, these authors note that with an aging population worldwide, the number of people with disabilities will continue to grow (Bickenbach et al., 1999, Zola, 2005, Freund, 2001)[9] Moreover, Zola argues the number of people with disabilities has been and will continue to grow because of higher rates of survival of babies with certain medical conditions, as well as further testing and identification of children with learning and mental disabilities. Additionally, various authors argue that impairment is what Gleeson (1999) describes as an "unstable category" that has the potential to grow, both numerically in terms of the number of members but also in terms of the type of health experiments that can be considered impairments under the social model; for example, chronic illness and a variety of mental and impairments that may not have originally be considered by early disability scholars. Gleeson notes that there is the possibility to"keep adding specific conditions and experiences until the category embraces the entire population," (Gleeson, 1999, pp. 7–8); whether that is a useful analytical framework and/or political argument is a topic of debate between the minority model camp and advocates of a universalizing approach. Universalizing proponents argue that it is more useful to consider, as Bickenbach et al. (1999) put it, that "disability is not a human attribute that de-marks one portion of humanity from another (as gender does, and race sometimes does); it is an infinitely various but universal feature of the human condition," (1182). Authors such as Zola (2005), Bickenbach et al. (1999), and Freund (2001) argue that everyone is at risk of developing an impairment and that nearly everyone will at some point in their life, even temporarily, experience disability.

Zola (2005), one of the foremost proponents of the universalizing approach, and other

[7]For example, numerous authors cite a 1986 survey of people with disabilities in the United States, which found that 45% of respondents believed they were part of a "minority group, like blacks or Hispanics" (Hahn, 1996, p. 48, Zola, 2005); a significant number even at an early date in the disability activisms movement.

[8]For example, Zola (2005) notes that many people who could benefit from using wheelchairs situationally may avoid doing so because of perceived stigma of being seen as disabled (Zola, 2005).

[9]for example, Zola (2005) notes that while 3-5% of people aged 65-74 need assistance, this number jumps to more than one in three once people reaches the age of 85.

authors (including Bickenbach et al. (1999), Gleeson (1999), acknowledge that the US minority model and its often-corresponding call for a civil rights remedies, has led to significant political successes in codifying disability rights and expanding access for people with disabilities, with US laws such as the Rehabilitation Act of 1976 and particularly the Americans with Disabilities Act (ADA) of 1990 as examples of what Gleeson (1999) describes "probably the strongest rights legislation" at that time (Gleeson, 1999, p. 143). Nonetheless, Zola (2005) and others argue that there are limits to the political potential of viewing disability as a minority experience and that an "exclusively special needs approach to disability is inevitably a short-run approach," (Zola, 2005, p. 1).

Strategically, these authors' approach often leads them to advocate for a "Universal Design" approach to correcting disabling aspects of society and especially the built environment, as opposed to more legalistic civil rights interventions. Universalizing proponents point out that the built environment today is only designed for a limited subset of the population. Instead, they argue for designing for "many bodies, not few" (Freund, 2001, p. 692), spaces that are"flexible for many" (Zola, 2005, p. 21). These ideas follow the concept of Universal Design, first articulated by architect and wheelchair user Ronald Mace. Mace argued that accessibility should be considered "good design", not just a technical legal requirement to be fulfilled. (Hamraie, 2016). In new construction, this strategy advocates for not only following accessible design mandates from laws such as the ADA, but embracing "inclusive design", or "designing products and services for the needs of the widest possible audience, irrespective of age or ability,"(Audirac, 2008). Universal Design proponents argue that people should not have to prove they are disabled to have access to spaces or to use accessible products; rather, architecture and products should inherently be designed to serve the broadest possible audience (Hamraie, 2016), a reflection of the view of disability as a universal experience.

However, the universalizing model of disability and the Universal Design approach it suggests has also received some pushback, largely on its political merits. Hamraie (2016), writing from the perspective of critical disability studies, argues that focusing on reminding non-disabled people that at some point in their life they could become impaired to some degree (through aging, accident, etc), it is still privileging the needs and desires of non-disabled people over currently disabled people (Hamraie, 2016). Similarly, Imrie argues that Universal Design treats the discriminatory implication of barriers to access for people with disabilities "less as a socio-political issue and more as a function of inappropriate design technologies, their applications and management," (Imrie, 2012). This could take some of the power and urgency out of accessibility demands and turn a radical political demand for inclusion into a depoliticized technical problem for designers to solve. Moreover, he argues that Universal Design advocates' focus on marketability may move accessibility to the built environment out of the realm of basic rights and into the realm of a "right to be exercised through a market presence or transaction," (Imrie, 2012).

The universalizing approach may also minimize the specific discriminatory experience that visibly disabled people face by equating it to more common, widespread

experiences. As previous sections discussing the role of culture and stigma have indicated, the experience of disability for many people is more than just the practical experience of facing barriers. Certain groups facing barriers may receive more sympathy or support in society (for instance, the elderly), while others may be more stigmatized, even if they are practically facing the same environmental barriers. The universalizing approach risks making the utilitarian moral argument that disability rights and accessibility are necessary (only) because they apply to a large group of people, and accessibility would be less of a moral imperative if it only applied to a small group of people (a theme discussed more in section 2.3). On the other hand, a minority approach may ignore people with "invisible disabilities" and their need for accessibility, leaving those who are not viewed socially as "disabled people" without sufficient access, even if those with visible disabilities are accommodated. Finally, across all social models of disability, there is a need to consider more thoroughly the concept of intersectionality. The experience of disability in society is also be shaped by race, gender, age, socioeconomic status, and other factors, while being disabled in turn also can shape a person's socioeconomic status. This intersectional approach, while identified as lacking in the disability studies by authors such as Gleeson (1999) beginning to be explored more in the "Critical Disability Studies" field today (Hall, 2019), and specifically within the context of mobility and transportation, can benefit greatly from the insights of social exclusion research, discussed further in the following section.

2.2 Transportation, social exclusion, and justice

The idea that transportation plays an essential role in people's ability to participate in society broadly has been an active area of research in transportation geography over the past several decades. A variety of terms have been applied in attempts to define and study the way transportation relates to people's social and economic opportunities in society, including "transportation disadvantage" and "transportation poverty" (Luz & Portugal, 2022). In the British and European context many authors have converged around the concept of "transport-related social exclusion". However, the term "social exclusion" broadly is generally not used in literature from the US, which tends to focus on "equity" or "environmental justice" in similar contexts to where British European literature discusses social exclusion (Lucas, 2004, Aman and Smith-Colin, 2020). "Transportation justice" is also a general term that has been used by activists in the US particularly in relation to socioeconomic disparities in access provided by transportation (Martens, 2016), although a more robust theoretical concept of "transport justice" has been more fully developed by Martens (2016). In this section, I will briefly mention some influential early work in this field before honing in on the influential body of social exclusion literature, and look at theories of transportation justice. I will also discuss the extent to which both the social exclusion and transport justice literature considers disability, and note some limitations in how disability has been theorized in the context of these frameworks.

Short note on the meanings of Accessibility

In the context of public transportation, the term "accessibility" can take on a number of meanings. On the one hand, broadly in public transit literature "accessibility" refers to users' proximity to transit, related to the space and time it takes for them to reach a transit stop, as well as the extent to which that transit effectively and efficiently gets users to their desired destination (Fransen et al., 2015), discussed further in subsequent sections. In the context of disability, accessibility must specifically consider the presence or absence barriers to physically accessing transit stations and stops as well as the process of boarding and riding the transit vehicle itself. Iwarsson and Stahl's define disability-focused accessibility as "the encounter between the person's or group's functional capacity and the design and demands of the physical environment," (Iwarsson & Ståhl, 2003). This presents some semantic challenges in discussing disability and public transit together, as the term "accessibility" is very frequently used in both transport geography literature and in disability studies literature, but to mean two distinct if related things.[10] In this paper I will try to refer to "locational" or "opportunity" accessibility as compared to (physical, sensory) accessibility to differentiate the concepts.

2.2.1 Theorizing social exclusion

Lucas (2012) and others credit the academic interest on social exclusion to the creation of a Social Exclusion Unit (SEU) by Labour government in the late 1990s. This governmental social policy research unit was active in the early 2000s and had a specific focus on the role of transportation in creating social exclusion (Kenyon et al., 2002, Lucas, 2012, Luz and Portugal, 2022). The SEU's often-cited 2003 report, "Making the connections", argued that social exclusion is both a cause of lack of access: for example, poverty or lack of bus service can deny people access to basic services, and that lack of access (to employment or education, for example) in turn can reinforce social exclusion (Unit, 2003). However, the report does not actually explicitly define what it considers social exclusion to be.

Writing at the time of the Social Exclusion Unit's activities, Kenyon et al. (2002) argued that the lack of a shared understanding of the meaning of social exclusion was hampering research. The authors thus define social exclusion as (emphasis my own):

> The unique interplay of a number of factors, whose consequence is the *denial of access*, to an individual or group, to the opportunity to participate in the social and political life of the community, resulting not only in diminished material and non-material quality of life, but also in

[10] Dutch has two separate terms to refer to these concepts: *bereikbaarheid* refers to access provided by transportation to desired destinations, while *toegankelijkheid* refers to the absence of physical barriers. Unfortunately, such a distinction does not exist in English.

> tempered life chances, choices and reduced citizenship. (Kenyon et al., 2002, p. 209)

The term "denial of access" emphasizes the structural nature of the constraints individuals face and the failings of society and governments as a whole, rather than putting the burden on individuals that is implied in terms like "inability to participate". While not specific only to people with disabilities, this conceptualization of exclusion as a social and structural problem as opposed to an individual problem aligns with the social model of disability. Levitas et al. (2007) also emphasize the relative nature of exclusion: it happens in comparison to the activities and relationships "available to the majority of people in society". This relational nature is a theme picked up by writers when it comes to the relationship between social exclusion and transportation (in Lucas, 2012, p. 106).

2.2.2 Linking transportation with social exclusion

So what does social exclusion have to do with transportation? Literature from the 1990s and earlier began to identify relationships between transportation and exclusionary processes through the idea of "transportation disadvantage". In an early paper on the topic, Denmark (1998) describes a group of "transport disadvantaged" "outsiders" who are left behind in a world of high levels of automobility, defined as "those who due to poverty, disability, frailty, or other conditions found mobility increasingly restricted as the shift to automobile dependence continued unabated" (231) for whom reduced mobility prevents access to "employment, commerce, health, community, and recreational services," (234). Kenyon et al. (2002) build on this idea of exclusion from economic, social, and public life in their concept of "mobility-related exclusion", arguing that this exclusion arises "due in whole or in part to insufficient mobility *in a society and environment built around the assumption of high mobility*" (210-211, emphasis my own). This concept has come to be termed "transport(ation)-related social exclusion" (TRSE) (Luz and Portugal (2022), Lucas (2012)).

There are several features of transportation-related social exclusion articulated by Kenyon et al. (2002), Lucas (2012), Luz and Portugal (2022) and other writers that are worth highlighting:

1. Mobility itself does not cause exclusion or inclusion, but rather the access to opportunities provided by mobility (Luz & Portugal, 2022). Lucas (2012) states that transportation-related social exclusion researchers "are less interested in the fact that there is no transport available to people per se but rather the consequences of this in terms of their (in)ability to access key life-enhancing opportunities," (Lucas, 2012, p. 106)

2. Transportation-related social exclusion comes from the relational disparities produced by a highly-mobile society in which some people have less access

to mobility (Kenyon et al., 2002, Lucas, 2012). It is not a lack of mobility itself that produces the social exclusion; rather, it is the fact that enough people are highly mobile that this becomes the expected norm, and those who are less mobile thus experience exclusion. Indeed, increased mobility on average can actually lead to greater transportation-related social exclusion, particularly if that increased or even hypermobility is the result of car use, because it creates a society where it is assumed everyone has access to a car, and undermines funding and usage of affordable public transportation and walkable communities (Luz & Portugal, 2022).

3. Social exclusion is not synonymous with poverty (Kenyon et al., 2002, Lucas, 2012, Luz and Portugal, 2022). Whereas poverty describes disparate access to material and economic resources, Kenyon et al. (2002) argue that social exclusion measures the unequal access to *participation* in society. This can be an effect of poverty, but can also be related to other barriers. This point is crucial when it comes to disability, as the social exclusion related to disability can exist across income groups (Kenyon et al., 2002).

2.2.3 Developing causal linkages between public transportation systems and social exclusion

Authors studying TRSE look at mobility across modes, with a particular focus on the impact of building society around an assumption of automobility. In general, heavily car-based societies are at greatest risk of transport-related social exclusion. In car-based societies, public transportation and "active mobility" (walking, rolling, biking) is de-prioritized and often provides much worse opportunity accessibility than driving, leaving people who cannot travel by car with significantly worse opportunity accessibility. A system where high-quality public transportation provides competitive levels of mobility to automobility has the potential to be less exclusionary, because it doesn't require car ownership. Still, well-resourced public transportation systems themselves can also be drivers of TRSE as well, depending on the design, prioritization, and price of the system. What nodes are prioritized to be directly linked, which aren't? Which parts of the system run with high-frequency, and which are infrequent? And what physical barriers prevent people from using the system? Identifying these barriers lead to exclusion is an important point of focus within TRSE research.

Lucas (2012) relates a list of seven barriers developed by Church et al. (2000) that cause transportation-based social exclusion which are particularly relevant from the perspective of public transportation systems: 1) physical exclusion, 2) geographical exclusion, 3) exclusion from facilities, 4) economic exclusion, 5) time-based exclusion, 6) fear-based exclusion, and 7) space exclusion. Of these, physical exclusion ("whereby physical barriers, such as vehicle design, lack of disabled facilities or lack of timetable information, inhibit the accessibility of transport services" (108), is most specifically relevant for exclusion faced by people with disabilities within

the context of public transportation, although people with disabilities may also encounter other barriers including those experienced by non-disabled travelers as well such as fear-based exclusion, high-cost of travel, or long distances to facilities. In their recent paper, Luz and Portugal (2022) expand upon Church et al. (2000)'s list, adding the following three barriers to their list: 8) informational exclusion, 9) digital divide exclusion, and 10) social position-based exclusion.

However, Lucas (2012) brings valid criticism of the utility of Church et al.'s categories for further analysis, saying "it does little to express at which level or layer of activity it occurs and, thereby, fails to identify where the policy attention should be directed;" (for example, should policies focus on individual assistance, or land use planning?) (Lucas, 2012, p. 108). Indeed, simply listing all of the possible reasons people may face transportation-related exclusion gives us very little insight into the disparate changes that would be necessary to remove each of these barriers. This critique of the lack of information about the level at which exclusion is occurring and how it could be addressed could be extended particularly Luz and Portugal (2022)'s category of "social position-based exclusion," which they define as "prevention from moving in public spaces due to censure, social control, or any other restriction based on one's social position (e.g. gender, race, nationality, age, ethnicity, caste, religion)," (Luz & Portugal, 2022, p. 515). Outside of de jure discriminatory policies explicitly relegating people in certain social groups to inferior transportation options, the mechanisms by which this type of exclusion would actually take place today overlap substantially with categories of barriers already described (such as fear-based exclusion, geographic exclusion, or informational exclusion, for instance), but that are systemically and disproportionately affecting certain social groups in particular ways.

To better understand the causal mechanisms behind TRSE, it's useful to consider Lucas (2012)'s explanation of the structure of interacting factors from which social exclusion arises the interactions of (emphasis original):

> *factors which lie with the individual*, such as age, disability, gender and race,[11] *factors which lie with the structure of the local area*, such as a lack of available or inadequate public transport services, the failure of local services and *factors that lie with the national and/or global economy*, such as the re-structuring of the labour market, cultural influences, migration and legislative frameworks, (Lucas, 2012, p. 106)

In the case of disability, while it is important to know that disabled people as a group face many barriers to public transportation, to remedy these barriers requires

[11]Note that Lucas (2012)'s categorization of disability as a "factor which lies within the individual" more closely follows the medical model of disability than a social model understanding. However, if we consider impairment rather than disability as a "factor which lies in with the individual" and include physical barriers to accessibility in the "factors which lie within the structure of the local area", we can see disability as understood by the social model emerge from the interaction of these two levels.

understanding precisely what those barriers are that arise from the interaction of individual impairments with the design and functioning of the transportation system. While it is important to know whether or not a marginalized group faces social exclusion, that cannot be an end in itself; the aim must be to understand why.

A challenge here is identifying whether patterns of social exclusion observed are symptomatic of broader patterns of structural prejudice (such as a correlation between race or ethnic identity and income and wealth), or whether there is a specific mechanism by which transportation itself is causing or exacerbating exclusion. To determine where and why transport-related social exclusion is happening, it is important to identify which groups (racial, ethnic, migrant status, ability, gender, etc) are facing disproportionate rates of social exclusion. When these disparities persistently appear, we can identify that a structural form of discrimination is at play. Yet the key here is that this is structural form of discrimination, and to adequately remedy the structural problem we must understand what mechanisms within the structure actually are producing the discriminatory effect. Untangling this type of nuance, as (Lucas, 2012) points out, seems to be still an issue for fully theorizing and operationalizing social exclusion. In the case of disability exclusion, incorporating the concept of a social model helps give insight into how structural factors can shape exclusion and discrimination, a causal explanation that is often lacking in the transport geography literature.

2.2.4 Disability and transport-related social exclusion

The treatment of disability specifically in the major transport disadvantage and social exclusion literature reviewed is surprisingly minimal. In most of the broad theoretical discussions of social exclusion, disabled people are often nominally included amongst the socially excluded groups that are considered in authors' writing, yet disability not adequately theorized or discussed. People with disabilities are often treated as one of many "ands" in a long list of excluded groups.[12]. In some of major social exclusion papers, people with disabilities are discussed as an useful example of a particular type of exclusion factor or as an interesting counterexample, but their inclusion seems primarily to be for illustrative purposes to bolster a theoretical argument without the actual accessibility barriers people with disabilities face being a primary focus of the discussion.[13] People with disabilities are often quickly mentioned alongside marginalized group that have been examined more thoroughly in social geography literature, such as low-income groups, migrants, women, or the elderly.[14] In particular, "the disabled and the elderly" are often mentioned together.

[12] In the model of "the poor, the elderly, the handicapped, and especially those in minority groups," (Denmark, 1998, p. 231)

[13] For instance, Kenyon et al. (2002) explaining why poverty and exclusion are not mutually exclusive: "Mobility-related exclusion is not only clustered within poor neighbourhoods, but also scattered amongst individuals within the population...in particular, lone parents, older people and people with disabilities," (Kenyon et al., 2002, p. 211).

[14] "...Isolated women with children, migrants, less educated people and people with disabilities," (Lucas, 2012, p. 109); "elderly, disabled, and illiterate," (Luz & Portugal, 2022, p. 513).

In some ways, this makes sense as elderly people experience higher rates of disability than the general population. However, the frequent pairing of discussions of disability in this literature with the elderly can risk giving the impression that the situation of people with disabilities is only now relevant to consider because many countries face "aging societies" which will include a growing number of elderly people with impairments. While it is relevant that a higher proportion of the elderly have disabilities, it's important to be clear that barriers faced by people with disabilities is a relevant concern for social exclusion regardless of whether they are a growing segment of society or not, an issue raised by the debate between universalizing versus minority model theories of disability. This concern also arises in the transport justice literature, as discussed further below.

2.3 Transport Justice

A different type of theoretical examination of the relationship between accessibility of life opportunities and transportation is the "transport justice" approach as developed by Martens (Martens, 2012, Martens, 2016). The motivation behind transportation justice research is essentially the same as the reasoning found in social exclusion research: lack of transportation options and the accessibility it provides limits people's life opportunities. But whereas the subject of social exclusion research is how lack of transport accessibility affects the life chances of people who are excluded, the transport justice literature focuses on accessibility as a good, and how it should justly be distributed to people. In a variety of papers such as Martens (2012) and culminating in the influential book *Transport Justice* (Martens, 2016), Martens argues there is a need for a new framework for transit planning based in principles of justice. This is framed in opposition to traditional 20th-century transit planning methods, including cost-benefit analyses and extrapolating demand from current usage, which Martens argues do not produce a just system, but rather one that provides unfairly unequal levels of access to different people. Certain privileged groups (especially well-off car-owners) receive high levels of mobility and therefore accessibility to life opportunities. Hypermobility requirement that generally requires a car in turn limits accessibility for other marginalized groups, including low-income people and people with disabilities (Martens, 2016). Like the social exclusion writers, Martens argues that opportunity accessibility is the relevant metric rather than purely mobility, as it captures whether or not the mobility people are or are not experiencing actually links them to necessary and meaningful life opportunities.

Taking seriously the need for a justice-based approach to transportation identified by Martens, this section will examine critically Martens' theory of transportation justice, and then look at what alternative understandings of transportation justice might look like.

2.3.1 Luck Egalitarianism: Martens' proposal for transport justice

Martens turns to theories developed by a variety of philosophers of social justice to ask what just transportation system could look like. Martens notes that most philosophical theories of social justice do not take into account the way space profoundly effects people's life, but argues existing aspatial theories can be leveraged to develop a new spatial theory of transportation justice. Martens turns to a set of philosophical theories of justice and equality that are referred to by Anderson (1999) and others as "Luck Egalitarianism". This philosophy of equality aims to achieve justice by guaranteeing not equality of outcomes, but "equality of fortunes". Luck egalitarians advocate for structures that would compensate for "brute bad luck" or negative "natural" conditions that are beyond the control of the individual, while accommodating personal freedom and choice by allowing for inequality due to "bad option luck", or bad outcomes that come as the result of deliberate choices the individual made knowing there was a risk of a negative outcome (Anderson, 1999).

Martens primarily follows Ronald Dworkin's 1981 theory of Equality of Resources to develop a theory of how opportunity accessibility through transportation could be fairly distributed amongst society (Martens, 2016). This theory assumes that people in a hypothetical society will freely choose options such as housing, housing location, and transportation on a competitive market (what Dworkin refers to as "the domain of free exchange"), though they are not guaranteed equal success in life, and may experience "brute bad luck". This includes lack of skills that lead to high incomes (which will affect their ability to pay for the future transportation systems) and disabling impairments (which Martens assumes will prevent them from using the transportation systems).[15] Dworkin suggests the just way to prevent suffering based on "brute bad luck" is a society system of offering "insurance policies" against the risk of "brute bad luck". In practical terms, these insurances, at least in Martens' conception, would be essentially welfare state programs based on an income tax. Martens suggests these would include interventions such as a subsidized public transportation system, housing subsidies, and physical accessibility improvements for people with disabilities or parallel transportation services (Martens, 2016, Vanoutrive and Cooper, 2019). Both Dworkins and Martens argue that while societies would likely choose to "insure" against most forms of "brute bad luck" they might face, they may not choose to insure against certain types of bad luck that is particularly rare or particularly costly if they judge the cost to outweigh the risk. While Martens see a competitive market of transportation options working for most citizens, without the "insurances", some especially unlucky people would fall be-

[15]Note that while Martens (and Dworkin) specifically refer to individual "impairments" rather than disability, their conceptualization of the impact of disability follows the traditional medical model– a personal, individual misfortune, outside of a social context of discrimination and oppression. Along these lines, Martens assumes the natural state of all these transportation systems to be by default inaccessible to people with "travel-related impairments" unless they receive insurance against this possibility. This does not consider the position put forward by universal design proponents–that physically accessible design should be a best practice and good design, not just an accommodate on or modification for a specific group of individuals.

low a threshold that would not give them sufficient accessibility to have meaningful opportunities in life. The people who would be reliant on the social safety net "insurances" fall into what Dworkin and Martens refer to as the "domain of justice," (Martens, 2016, p. 142) where distributive principles must be implemented to insure accessibility is justly available to "nearly all". We can imagine transportation system might look like in Marten's hypothetical world: "luckier" people in the domain of free exchange could choose between different mobility options in a market setting, such as choosing between taking public transportation or driving with congestion pricing. However, the domain of justice would at least ensure that the "unlucky" people are insured a "sufficient level of accessibility", though this would not necessarily guarantee the "highest level of transportation" that people in the domain of free exchange could choose to buy into. This would likely through a decently robust subsidized public transportation system (though Martens says this could also be achieved through other modes) likely through a decently robust subsidized public transportation system (though Martens says this could also be achieved through other modes, such as subsidized taxis, etc.).

2.3.2 Critiques luck egalitarian approach

Caveats for disability

Martens concludes that "all persons are entitled to a set of insurance schemes that guarantee a sufficient level of accessibility in virtually all cases," (Martens, 2016, p. 126), implying that a just society has an obligation to provide physically accessible transportation to "nearly all" (in Marten's words) people, including those with disabilities. However, Martens argues that though "sufficient level of independent accessibility" must be provided to people with impairments, it can be "substantially lower than the accessibility level provided to persons experiencing the 'normal' spectrum of travel-related abilities," (Martens, 2016, pp. 104–105). While this "substantially lower" level of opportunity accessibility certainly may reflect the current state of affairs, even in many public transportation systems that promote some level of physical accessibility for people with disabilities, that this inferior level of opportunity accessibility is an acceptable outcome for a *just* transportation system is a somewhat astounding conclusion. Moreover, because disability is essentially seen as an individual medical problem in Martens' approach, the systemic question of the responsibility of a government and society rests merely in whether they have an obligation to provide minimal safety-net remedies through "insurances", rather than seeing the disabling, barrier-laden "normal" public transportation system that is apparently envisioned by Martens as a cause of disability in society itself that must be addressed.

Additionally, though Martens also concludes that "all persons" are entitled to sufficient opportunity accessibility "in virtually all cases", he notes that "the caveat 'in virtually all cases' refers to situations in which only a limited number of persons experience insufficiencies in accessibility and a reduction and elimination of these

insufficiencies would be inhibitively expensive to society," (Martens, 2016, p. 126). That justice in Martens' proposal is determined by financial calculations in which the society decides whether it has an obligation to provide "insurances" seems bound to result in discounting the needs of numerically small groups, particularly if the accommodations or subsidies that would bring them to the "level of justice" would be expensive. Because the insurance levels come from a calculation that weighs the cost of the insurance provisions against the likelihood of needing to use them, while the unjust levels of accessibility that would otherwise be experienced by larger groups of people (such as low-income earners) would be insured against, inaccessibility for very small minorities (for example, people with certain profound physical impairments) do not carry the same weight, because the hypothetical participants can to some extent discount the very low probability they end up in this numerically small group. Indeed, Anderson (1999) raises just this concern with regards to Dworkin's insurance scheme proposal (on which Martens' transport justice proposal is based), arguing that "the proposal discriminates between people with rare and common disabilities," (303). This is not just a hypothetical question; indeed, the cost argument of accommodating a small minority of riders has echos of real-world debates about whether public and mass transportation companies have an obligation to provide accommodations to people with disabilities in a justice-based legal setting.[16]

Questioning separate "domains" of transportation access

More broadly, Vanoutrive and Cooper (2019) discusses how Martens (2016) theory of transportation justice divides transportation users into two domains, those to whom the "domain of justice" would apply and those who the "domain of free exchange". While those who Marten would consider "normal" in terms of income and lack of impairment would purchase their transportation and thus accessibility in the market-based "domain of free exchange", those who experience what Dworkin and Martens consider the "brute bad luck" of low-income or impairment would be subject to the "domain of justice", where justice would be provided by redistribution through "insurances" in the form of government subsidies or interventions to assure sufficient and affordable accessibility (Vanoutrive and Cooper, 2019, Martens, 2016).

Vanoutrive and Cooper (2019) question why a just system requires two separate spheres where individuals in each group are treated differently. Following Anderson (1999)'s critique of luck egalitarians such as Dworkin, they argue that creating a separate sphere of justice for certain marginalized groups is paternalistic. In this influential critique of luck egalitarianism, Anderson (1999) argues that luck egalitarians judge those they deem to be victims of "brute bad luck" as unfortunate, inferior members of society requiring paternalistic assistance while discounting any victims of "bad option luck" who they deem to have chosen and therefore deserved

[16] We can see this in the debate over the passage of the Americans with Disabilities Act ("ADA," 1990, amended 2008) in the United States, when private mass transportation providers such as Greyhound Bus argued that the law would create an undue financial burden by requiring them to retrofit their buses to be wheelchair accessible (Milden, 2022).

their fates. She argues this view undermines what she identifies as an essential part of egalitarian principles: assuming the "equal moral worth of persons" (312). Anderson argues that redistribution under luck egalitarianism is based on two disrespectful and undesirable emotional impulses: pity on the part of the more fortunate towards the less fortunate, and envy on the part of the less fortunate to the more fortunate. Redistribution on this bases, she argues, is a paternalistic and "mean-spirited, contemptuous, parochial vision of a society that represents human diversity hierarchically," (Anderson, 1999, p. 308).

Following this line of logic, Vanoutrive and Cooper (2019) argue that Martens' conception of transportation justice would mean that people in the domain of free exchange get to make choices in their methods of transportation and level of opportunity accessibility, those in the "domain of justice" face humiliating and paternalistic treatment. Following Anderson (1999), they argue that a domain of justice approach to transportation creates a "regime based on pity instead of compassion. With this, compassion is compatible with dignity, but pity is not since it involves a comparison with someone who is considered superior," (Vanoutrive & Cooper, 2019, p. 114). This is particularly relevant in the case of disability, as people with disabilities have historically been treated with paternalistic disdain, as "unfortunates" to be paternalistically cared for and pitied (for example, through residential institutionalization). A major thrust of the disability rights movement has been arguing that people with disabilities are citizens equally worthy of opportunities, respect, and dignity as anyone else, and indeed the social model of disability argues that the lack of physical accessibility as well as accessibility of opportunities people with disabilities experience lies not in their impairment itself but in disabling societal and architectural norms that discriminatorily exclude them. In making their argument, Vanoutrive and Cooper (2019) specifically cite cases where disability activists fought for requiring accessible lifts on public transportation buses as opposed to only accepting an equivalent, separate subsidized paratransit service. The authors argue that even though paratransit could hypothetically provide "better" accessibility by being demand-responsive, "the disability movement campaigned for dignity, meaning that the disabled ought to be seen as regular citizens," 116. They argue that the transportation justice sought by disabled activists was not based purely in sufficient accessibility, but in seeking equal dignity.

Moreover, following Anderson (1999), Vanoutrive and Cooper (2019) question the underlying method of insurance auctions in determining the bounds of a system of justice, and put forward Anderson's argument that Dworkin (and subsequently Martens) don't convincingly defend "why a hypothetical market, based on a comparison and valuation of individual tastes and preferences, defines what we owe each other and what we are morally obliged to give to others," (Vanoutrive & Cooper, 2019, p. 114). Following Anderson, they question whether the self-sufficiency assumed by the domain of free exchange is really the norm. Instead, they cite Anderson's conceptualization of "society and the economy as a system of cooperative production where virtually nothing is produced by a single person, where no one is able to live independently, and where you need others to be free," (Vanoutrive & Cooper, 2019, p. 114).

Alternative visions of transport justice: "democratic equality"?

Although Anderson (1999)'s writing on equality does not specifically relate to public transportation, as Vanoutrive and Cooper (2019) argue, it suggests an alternative theoretical approach to transportation justice than Martens (2016)'s luck egalitarian approach, particularly when it comes to the situation of disabled people's access to transportation. Anderson argues that because luck egalitarians focus on "starting-gate" equality, or equal shares of fortunes at the start of life, it does not provide remedies when people face unacceptable outcomes in the course of their life, particularly if it is judged to be their own fault through "bad option luck". Anderson argues that because luck egalitarians focus only on correcting what they see as "natural injustices" such as lacking skills to earn a high wage or having a physical or mental impairment, they neglect fact that much of inequality is socially created, a sentiment that is core in social model conceptions of disability. She this argues that leads luck egalitarians to ignore what she sees as the actual imperative of justice: abolishing oppression. Instead, Anderson advocates for what she refers to as "democratic equality" following Amartya Sen's capabilities approach, and calls for equality in the space of capabilities, specifically those capabilities required for participating as a citizen in civil society over the course of a person's life. Anderson argues the capabilities approach better allows an understanding of equality not just in division of material goods, but also with regards to social norms and public spaces.

Anderson specifically cites the disability movement's "aim to reconfigure public spaces to make them accessible and adapt work situations to their needs, so that they can participate in productive activity," (Anderson, 1999, p. 320) as an example of a need for justice beyond just "redistribution of divisible resources." Although Anderson also frequently refers to disability through an essentially medical model lens, she indirectly argues for a social model understanding that "people, not nature, are responsible for turning the natural diversity of human beings into oppressive hierarchies. [Democratic equality] locates unjust deficiencies in the social order rather than in people's innate endowments," (336). This is important, in Martens' and Dworkin's view, disability is essentially seen through a medical lens, where disability is the medical impairment and the ultimate source of "brute bad luck", whereas Anderson hints at a social model perspective, where arrangements in the social order result in oppressive structures like inaccessible transportation systems.

Transportation justice based on Anderson (1999)'s vision of equality rather than luck egalitarianism would suggest that a just public transportation system is one that allows for equality of capabilities to participate as a citizen in public life. This would suggest that "normal" public transportation in society would need to be configured in a way that allows disabled people "to function as equal citizens" (Anderson, 1999, p. 320) in their use of transportation to access civil society and economic opportunities, rather than simply seeing inaccessible public transportation as the norm, and then compensating disabled people with some sort of sufficiently accessible service (as in Vanoutrive and Cooper (2019)'s example about accessible buses versus exclusively providing paratransit). Approaching transportation justice from a

"democratic justice" perspective would not fall into the same trap as Martens (2016) assertion that a just public transportation system could exclude a small number of disabled people if the cost of of accommodating them was judged too high by society. Although the different visions of equality and justice espoused by the luck egalitarian perspective versus the "democratic egalitarian" perspective is a philosophical debate, I would argue that this moral framework has very practical implications for public transportation system planners when they consider what real-world obligations they have to provide accessibility to disabled customers, and reminds us that dignity for users, and not just sufficient accessibility, is an important factor to consider in whether a public transportation system can be considered just.

Chapter 3

Methodology

This thesis analyzed three aspects of public transportation accessibility: 1) legal requirements (laws, regulations) and governance, 2) internal accessibility planning by the transportation system, including the design of infrastructure, rolling stock, and institutional policy, and 3) the "on-the-ground" lived experience of accessibility for disabled transportation users. A number of different methods were used to gather this data, including document analysis, semi-structured interviews, and participant observation.

To understand the legal side and the planning and policy piece, I conducted interviews with a number of experts whose work focuses on accessibility in public transportation, both within and outside of the public transportation system in both Greater Boston and Brussels. These interviews were paired with document analysis of a number of relevant legal and policy documents for each system. This was followed by extensive participant observation in each city, which formed the basis of the on-the-ground accessibility analysis.

3.1 Expert interviews and document analysis

3.1.1 MBTA - Greater Boston

I conducted interviews with a number of experts both within the MBTA and outside of the transportation organization. For expert perspectives on MTBA accessibility outside of the organization, I interviewed Joanne Daniels-Finegold and Taramattie Doucette. Daniels-Finegold was the lead plaintiff in the class-action lawsuit ("Daniels-Finegold v. MBTA" (2006)) against the MBTA which led to the settlement agreement about accessibility under which the system is currently functioning. Doucette is an attorney for the nonprofit Greater Boston Legal Services (GBLS), and was one of the lead attorneys who developed and argued the case. Both have

been very heavily involved in the settlement since the agreement, meeting on an annual basis with the independent monitor and the MBTA to discuss the system's progress and compliance with the settlement terms (see section 4.1.2).

External interviews		
Daniels Finegold v. MBTA lawsuit	Lead plaintiff	Joanne Daniels-Finegold
	Lead counsel (GBLS)	Taramattie Doucette
Internal interviews		
MBTA Department of System-Wide Accessibility (SWA)	Assistant General Manager	Laura Brelsford
	Director	Rob Sampson
	Senior Program Manager (IAM)	Glennda Campbell
	Customer Engagement Coordinator	Jennifer Ross
	Director of Coordinated Mobility	Aniko Laszlo

Table 3.1: Expert Interviews- MBTA, Boston, USA

These external interviews were paired with interviews with members of the MBTA Department of System-Wide Accessibility (SWA), which was created out of the settlement agreement. I conducted interviews with Assistant General Manager Laura Brelsford; Rob Sampson, Director of the SWA; Jennifer Ross, the Customer Engagement Coordinator[1]; Aniko Laszlo, the Director of Coordinated Mobility[2]; and Glennda Campbell, Senior Program Manager of the Internal Access Monitoring (IAM) program (discussed more in depth below).

Based on the interviews with experts, I consulted legal and policy documents identified as relevant in shaping accessibility policy and infrastructure and rolling stock design at the MBTA. In the case of the MBTA in Boston, I looked at the Americans with Disabilities Act (ADA) law as well as supplementary US federal regulations that set out design requirements and specifications for compliance with accessibility required by the ADA. Specifically relevant for the case of Boston, I reviewed the Daniels Finegold et al. v. MBTA lawsuit and the resulting settlement agreement. I also looked at a number of MBTA internal policies, such as the MBTA Bus Stop Planning documents.

[0]No data available from FY 2015

[1]Compiles and responds to customer complaints related to accessibility, a key source of information on infrastructural and human barriers to accessibility

[2]Laszlo led the creation of a new "Mobility Center", which does travel training courses for elderly people and customers with disabilities who need help learning to navigate the public transportation system.

Policy training

Additionally, in January 2023, I attended eight hours of MBTA Internal Access Monitoring monitor training, which went through accessibility policies in place at the MBTA, which the monitors must check for during their shifts. The slide decks from this training were a key source of information on MBTA accessibility policies. I later shadowed the IAM program manager in administrative tasks to understand better both the disciplinary and corrective processes that stem from the IAM program, as well as the quantitative data-gathering and analysis from the program. In addition, I observed a bus operator "Accessibility in Motion" training course, which is the 8-hour long course provided to bus operators about the accessibility rules that they must follow while operating the bus. The class is given both to new drivers but also to drivers who have improperly followed the accessibility rules during their work, according to investigation results. The class I attended was with three bus operators, all of whom had been sent to the class because monitors observed them improperly following accessibility policies. I observed the way the course was presented by the instructor and the operators' responses and questions during the course. I participated in the hands-on part of the course (practicing proper scooter securement on an out-of-service bus), and I spoke with the bus operators attending the class and noted their comments and attitudes. After the class, I also did a short interview with the bus instructor.

3.1.2 STIB-MIVB - Brussels

External interviews		
Nonprofit disability advocacy	Chargé for advocacy on mobility and accessibility policy (CAWaB)	Pierre Genty
European Commission	member of cabinet, Commissioner for Equality	Nora Bednarski
Internal interviews		
STIB-MIVB	Accessibility Manager	Christian de Strycker

Table 3.2: Expert Interviews - STIB-MIVB, Brussels, Belgium

For external perspectives in the case of the STIB-MIVB in Brussels, I interviewed Pierre Genty from the CAWaB (Le Collectif Accessibilité Wallonie Bruxelles), which is an umbrella organization for organizations representing people with various disabilities in francophone Belgium, allowing these organizations to speak collectively with a single voice in their policy advocacy. Accessibility in public transportation is one of CAWaB's focus areas, and they participate formally in an accessibility

task force and counsel the STIB-MIVB on accessibility issues. Genty is CAWaB's chargé for advocacy on mobility and accessibility policy. Additionally, for a legal perspective on European accessibility legislation, I interviewed Nora Bednarski, a cabinet member for European Commissioner for Equality. Within the STIB-MIVB, I interviewed the Accessibility Manager, Christian de Strycker. De Strycker is the main person responsible for STIB-MIVB accessibility planning and policies.

Based on the context of these interviews, I reviewed a number of laws and regulations that govern aspects of public transportation accessibility in Brussels, including Belgian federal antidiscrimination law, several European regulations and directives related to transportation equipment standards and transportation policies, Brussels-Capital Region regional planning regulation, and the STIB-MIVB Strategic Plan for Accessibility.

3.2 Participant Observation

3.2.1 MBTA, Greater Boston

In January 2023, I shadowed the Internal Access Monitoring (IAM) Program in the MBTA's System-Wide Accessibility Department. The IAM is an internal "secret shopper" program, where monitors employed by the MBTA are sent to covertly ride the MBTA's buses, subways, commuter rail, and ferry services to check their accessibility for customers with disabilities. Monitor teams consist of two monitors. The first monitor is a "tester" with a disability, who travels as if they were an ordinary MBTA customer and makes accessibility requests to the bus operators and rail motorpersons (such as for a bridgeplate[3] or for sighted guidance). The second member of the team is an "observer", a person with or without disabilities, who discreetly observes and records each step of the trip to determine whether accessibility requirements are being met The observer submits a report via Google Sheets for each trip, and if a "Serious Violation" of the accessibility policies occurs, each monitor writes a separate statement describing the incident and submits it to the program manager, who then shares the monitor statements with the relevant bus or train supervisors. The supervisors complete their own investigation, and determine if mechanical issues or the operator was at fault. If the violation occurred due to operator behavior, the supervisors consult with the IAM program manager to determine the appropriate disciplinary steps. These disciplinary steps can range from reinstruction and being required to attend an "Accessibility in motion" course, to suspension and more in the case of many repeat violations by the same operator. ("IAM Senior Program Manager Interview," 2022, "Diciplinary Guidelines for Accessibility/Disability Related Violations - Subway," 2013, "Diciplinary Guidelines for Accessibility/Disability Related Violations - Bus," 2013). I joined four different monitoring groups for their 4-5 hour long monitoring shifts. In each of these

[3] A small movable ramp-like device to bridge the gap between the platform and the vehicle

cases, I shadowed the observer monitor, following along and filling out the fields in the Google Forms (though not officially submitting the forms), and participating in the groupchat texting between the monitors and the program manager during the monitoring shift as they discussed potential violations. The program manager also showed me the followup steps and communication with supervisors that took place when violations or other issues were documented by the monitors, allowing me to see the progression of addressing accessibility issues identified by the monitoring. Following the monitoring shifts, I conducted short interviews with each of the testers. A description of the monitoring shift, including the tester's initials, impairment and assistive device, modes tested, etc. is given in Table 3.3. Figure 3.1 shows a map overview of where each of the testing trips was conducted, and the modes tested.

Monitoring shifts					
Tester	**Impairment type**	**Assistive device**	**Modes tested**	**Hours**	**Data formats**
LC	Blind/low-vision Reduced mobility (Ambulatory)	White cane	Rapid transit (red, orange, blue) Bus Mattapan Trolley	5	Written notes (during and after observation) Group message thread Emails Violation statements Interview (audio recording) Photos
KR	Mobility impairment	Electric wheelchair	Rapid transit (red, green, blue) Commuter Rail Bus Shuttle bus	3.5	
ZG	Mobility impairment	Mobility scooter & ambulatory	Rapid transit (green - special green line monitoring	5	
BG	Mobility impairment	Electric wheelchair	Rapit transit (red, orange,green) Bus Commuter rail	4	

Table 3.3: Shadowing: Monitoring shift participant observation - MBTA, Boston, USA

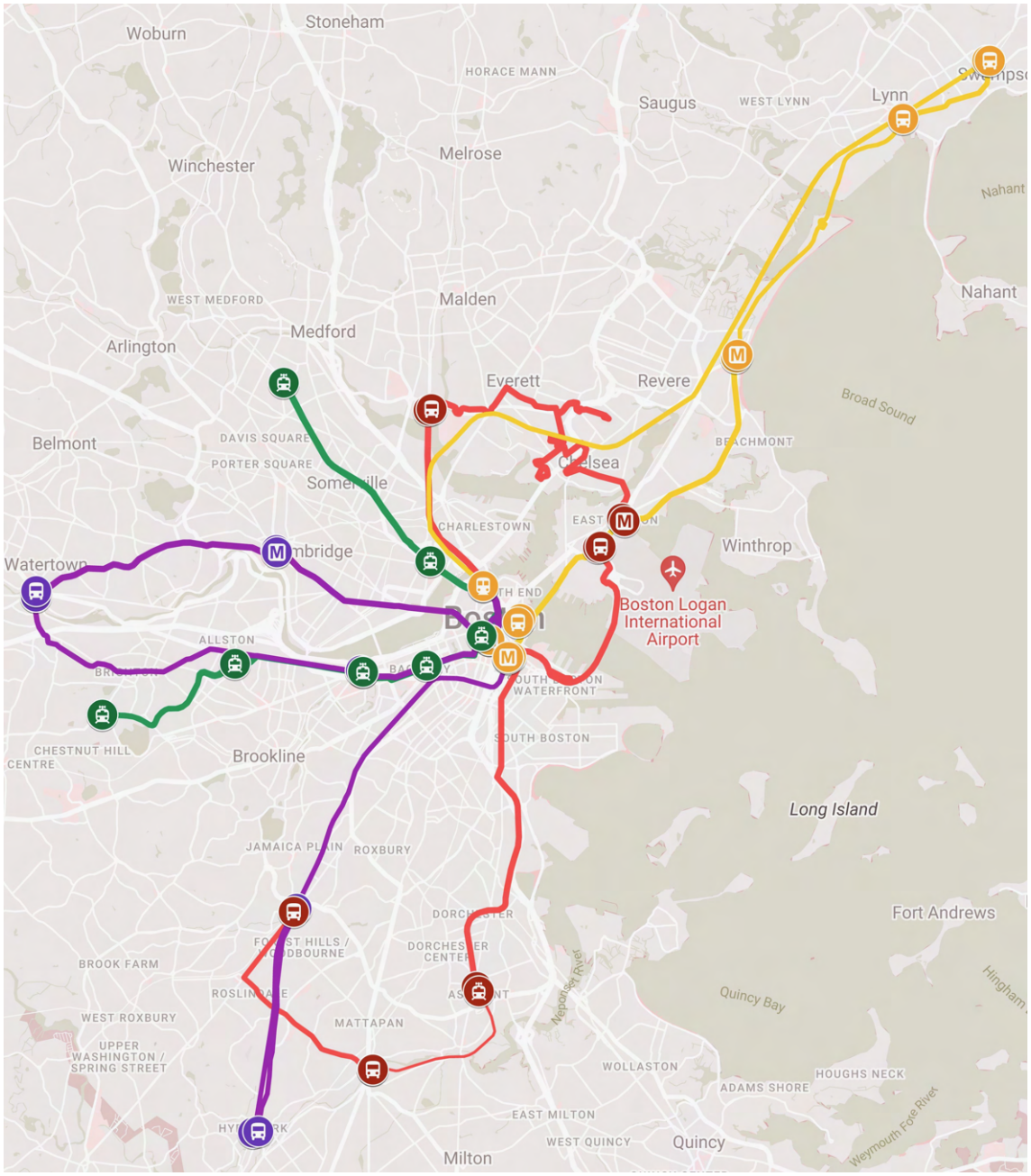


Figure 3.1: Overview of trips conducted with testers on the MBTA, Greater Boston, USA

■ LC, ■ KR, ■ ZG, ■ BG

- Bus
- Heavy rail
- Light rail
- Commuter Rail

3.2.2 STIB-MIVB, Brussels

In the second part of my participant observation research, I collaboration with the CAWaB to adapt the testing/monitoring trip methodology I observed when shadowing the monitoring program at the MBTA. With the CAWaB chargé for mobility and accessibility policy, I developed a set of monitoring forms in OneNote for buses, metros, and trams that we could use during testing trips (See Appendix .1). The type of questions on the monitoring forms varied from the MBTA forms because of differences in the accessibility planning at the STIB-MIVB.[4] We then conducted monitoring/testing trips with volunteers with disabilities to try this method of gathering data about real-life accessibility on the STIB-MIVB. CAWaB assisted me in recruiting volunteers with physical disabilities from their membership and social media following who were willing to participate in a testing trip on the STIB-MIVB.[5] The recruited volunteers took the role of the tester, following the protocol from Boston, and the observer role would be filled by me (sometimes Genty of CAWaB and me together). These testing trips were conducted over two separate weeks in April 2023.

Because the testers in Brussels were volunteers rather than MBTA employees as was the case in Boston, and because these tests were done in collaboration with the CAWaB, the format of the testing trips was slightly different than the testing trips in Boston. The length of the trips was generally significantly shorter, in order to respect the volunteers' limited availability (1.5 hours versus 4 hours), and trips were generally planned near to the testers' home or preferred area, and often on lines and modes they used and felt comfortable with, unless the tester wished to try new routes. For testing trips conducted alongside the CAWaB, we primarily targeted buses for trips, as this is the mode they are most interested in observing the real-life "human factor" accessibility, while trips conducted by me alone as observer included other modes such as subway and tram.

[4]For instance, a primary feature of accessibility for blind/low vision riders on the STIB-MIVB is that accessible bus stops include tactile markings for blind riders, and bus operators must pull to a stop line on the pavement to align these tactile markings with the front door, a system that does not exist at the MBTA. On the other hand, wheeled mobility device (WMD) users board via a ramp to the back door of the bus rather than the front in the STIB-MIVB buses, and there are no securement straps for WMDs on the buses, a major focus of the MBTA monitoring observations.

[5]The purpose of these testing trips was twofold: for me, this was an opportunity to gather participant observation data on the STIB-MIVB system of a similar nature to the data I gathered from my participant observation on the MBTA monitoring trips. For the CAWaB, this was an opportunity to see if this would be a feasible data-gathering strategy for an organization like CAWaB, which represents the interests of public transportation riders with disabilities. The chargé for accessible mobility explained to me that the CAWaB currently lack very good data sources for assessing the human factor of accessibility on the public transportation networks in Brussels and Wallonia. While they are able to get concrete and detailed information from the STIB-MIVB about the status of infrastructure and rolling stock, they have significantly less data about the actual real-life accessibility of the system, and in particular the way which the actions and behaviors of public transportation employees affect customers with disabilities.

Monitoring shifts					
Tester	**Impairment type**	**Assistive device**	**Modes tested**	**Hours**	**Data formats**
FC	Blind Auditory impairment	White cane	Bus	1.25	Written notes (during and after observation) Interview (audio recording) Photos
AS	Mobility impairment	Manual wheelchair with electric wheel on front	Premetro (tram) Metro Bus Tram	1.5	
CC	Mobility impairment motor function impairment	Electric wheelchair and assistance dog	Bus	1.5	
AD	Mobility impairment	manual wheelchair wheelchair as walker (ambulatory)	Bus	1.3	
IT	Blind	White cane	Metro Bus Tram	2.5	
DG	Blind	White cane	Metro Bus Tram Premetro (tram)	1.5	

Table 3.4: Shadowing: Volunteer testers participant observation - STIB-MIVB, Brussels, Belgium

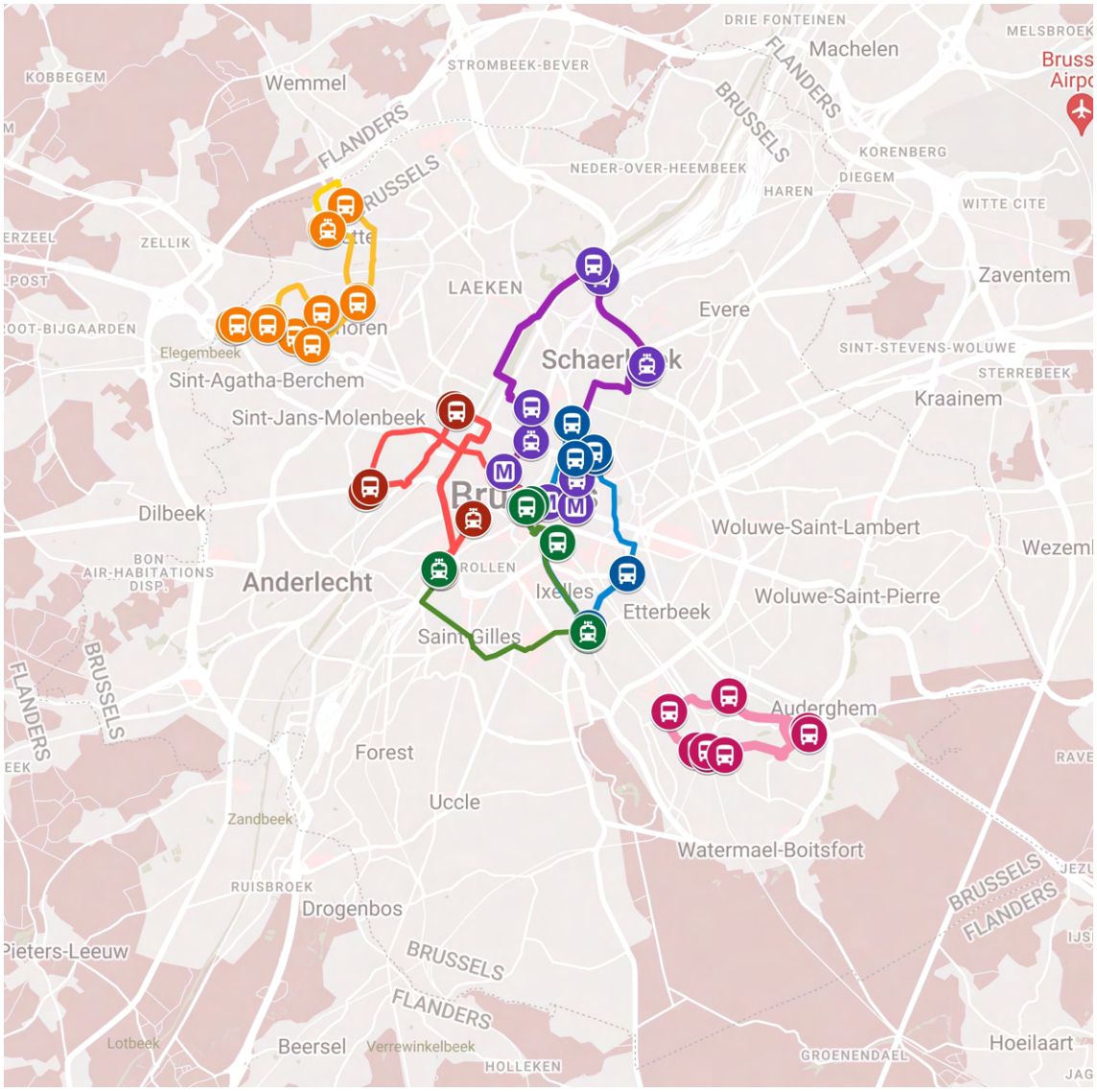


Figure 3.2: Overview of trips conducted with testers on the STIB-MIVB, Brussels, Belgium

FC, AS, CC, AD, IT, DG

- Bus - Metro - Tram

There were a number of unique challenges to replicating monitoring on the STIB-MIVB. While the IAM monitoring at the MBTA being done from within the organization, the monitoring on the STIB-MIVB was conducted from the outside without the participation of the STIB-MIVB. In the case of the MBTA, the monitors very clearly are checking to see whether a specific set of internal rules and regulations for accessibility are playing out in real life as intended. With CAWaB, our initial intention was to request a list from STIB-MIVB of the accessibility related regulations and norms for their bus operators and tram and metro motorpersons, and use this as the basis of the questions for the monitoring form we would develop. However, the Accessibility Manager of the STIB-MIVB has told CAWaB that they do not

feel comfortable making this information available to us, as he feels the accessibility regulations for staff are not yet sufficiently developed. Nonetheless, we hope our findings from this can perhaps be the basis of recommendations to the STIB-MIVB for future accessibility policies.

3.3 Analysis methods

Although a limited number of quantitative results came out of the fieldwork, this is primarily a qualitative research project. Interviews and documents were analyzed using key-word coding of interview transcripts and documents, where specific themes were identified across interviews, policy documents, and design standards.

Participant observation data was collected using the MBTA IAM monitoring forms in Boston, and the monitoring forms developed in collaboration with CAWaB in Brussels, which can be seen in Appendix .1, and supplemented by personal notes I took during the trips. Although the IAM monitoring forms are not publicly available, the general format of these forms was very similar to the forms developed for the STIB-MIVB monitoring trips.

The trajectory of these trips and the observed accessibility features were presented geospatially using the My Maps feature of Google maps, with visual symbolic representations of the accessibility features observed at each stage of the trip. These maps are presented as figures in the results section. Summary data of accessibility features observed across trips are also presented in tables in the findings section. Interactive maps of trips and accessibility features observed can be found here for the MBTA participant observation trips and here for the STIB-MIVB participant observation trips.

3.4 Positionality

Both the way I conducted my research and the way I interpreted the data I gathered was shaped by my own position and world view. Particularly relevantly for this research – I am able-bodied and do not have any close family members with a disability. Throughout my research, and particularly during the participant observation portion, I tried to reflect on how moving through the world as an able-bodied person has shaped my assumptions about what accessible transportation might look like.

I came into the research project largely considering law and design (of infrastructure and rolling stock) as the relevant factors related to whether a transportation system would be accessible or not: initially, I assumed that accessibility was largely a matter of mandating ramps and elevators. The interviewees with disabilities who I spoke

to quickly began to show me that whether a journey is accessible is dependent on many other features than just station design. I soon realized I needed to widen my research question much more significantly to look at the relationship between policies and actual on-the-ground travel experiences.

During the participant observation experiences in both Boston and Brussels, I quickly realized just how many practical factors I had never considered shape the experience of disabled transportation riders. I learned a lot from the interviewees and participants I worked with in this research, but I also know this research project–as it stands today–is still reflected through the lens of an able-bodied person who is still in the early stages of learning about what navigating the world with a disability looks like.

I am also a young, white woman, who is generally perceived by people who do not know me as younger than I am and a non-threatening person. This is something I easily take for granted when it comes to interactions with authority figures, especially in potentially confrontational situations. During this research, I also tried to reflect on the fact that my expectations and considerations are shaped by the way I can assume most people will perceive me. I tried to keep in mind that the level of comfort and safety I might feel asking a bus operator to make an accessibility accommodation for me may not be the same as a middle-aged Black man, for instance. During this research I have tried to be aware how societal perceptions of race, ethnicity, or perceived immigration background, as well as gender, may also affect the practical experience of accessibility accommodations, particularly those that are dependent on human behavior.

Finally, I am also an American citizen who has lived the vast majority of my life in the US This has some clear practical impacts and limitations on my research process: I only reviewed academic literature published in English. Although my intermediate French and my knowledge of Spanish allowed me to review documents in French (often with the assistance of Google Translate and Deepl), in interviews with Belgian interviewees, I generally either had to conduct the interviews in English or in a combination of English (my questions) and French (the interviewee's responses); moreover, I was unable to read any documents or conduct interviews in Dutch.

But my national background has probably also influenced the research project in another way, in terms of the topics I focused on and my assumptions about disability and effective strategies. Working on the literature review section, I found myself realizing how much I have generally unquestioningly thought about disability from the "US-sociopolitical" and "minority model" perspective (discussed in 2.1.1 and 2.1.3), which is generally how disability is viewed and discussed in the US in the broader historical context of our Civil Rights movement. Because of the context I grew up in, I definitely am guilty of Bickenbach et al. (1999)'s description of "the peculiarly American penchant for seeing all social problems in terms of legally enforceable individual rights" (1180) in terms of the assumptions I hold about what a path towards social justice and equity would look like. Nonetheless, through conversations with Belgian interviewees and conducting the literature review, I have

realized I need to also consider the merits of other approaches and perspectives towards achieving justice and equity such as a more universal view of "persons with reduced mobility" that includes non-disabled people who face similar mobility challenges using inaccessible public transportation, something I try to reflect on throughout this thesis.

Although this is an academic research project, my approach to managing researcher-participant relationships has been shaped heavily by my experience working as a journalist. Throughout this project, it has been very critical to me to make sure participants understand why I am conducting the research and what I hope to gain from it. All participants in the participant observation portion consented to participate in the project, and I always received verbal informed consent from participants before recording interviews. In terms of confidentiality of participants, I have taken two approaches for participants in different positions. For "expert interviewees" in prominent/public positions or positions of authority, who consented to recorded interviews on the basis of their job position, I am using their full first and last name, as I believe it is fair for them to be accountable to their words if they have agreed to an interview on the record. On the other hand, for observation participants – testers in Boston and volunteers in Brussels – I am preserving their anonymity by only referring to them by first and last initial, and only using non-identifiable pictures of them in the report. I have tried to continue to communicate with participants throughout different stages of this research, sharing updates and asking for clarification and follow-up questions during the process. I plan to contact participants at the conclusion of this project to update them and share the results with them if they are interested.

Chapter 4

Findings: MBTA - Greater Boston

The first section of this chapter presents the findings on the formal legal and regulatory context surrounding accessibility at the MBTA. The section section presents the internal accessibility policies and planning within the MBTA. Both of these sections are based in data gathered from document analysis and semi-structured interviews with experts. The third section will present findings on real-life accessibility based on data collected during participant observation with testers with disabilities. This section will be presented in narrative form, with short summary narratives of three trips with three individual testers. A final section will summarize the real-life findings from the participant observation.

4.1 Accessibility by law: Regulatory and governance context

Accessibility policies and governance at the MBTA are the result both of US national law and a specific enforcement regime in place at the MBTA due to the 2006 settlement of a lawsuit against the agency, in which disabled plaintiffs alleged the agency was discriminating against them (see Section 4.1.2).

4.1.1 The Americans with Disabilities Act (ADA)

The most significant legal mandate for the MBTA to provide access to disabled customers came from the passage of the Americans with Disabilities Act (ADA) in 1990 by the US Congress. The ADA is a civil rights anti-discrimination law, modeled on other civil rights legislation in the US such as those barring discrimination on the basis of race or ethnicity. The ADA treats disability essentially through a the US sociopolitical social model and a "minority group " lens, explaining that "people with physical or mental disabilities are frequently precluded from doing so

because of prejudice, antiquated attitudes, or the failure to remove societal and institutional barriers," ("ADA," 1990, amended 2008, Sec. 12101). The law makes a direct comparison to discrimination on the basis of "race, color, sex, national origin, religion, or age" ("ADA," 1990, amended 2008, Sec. 12101), but argues that unlike these groups, who have specific legal protections from discrimination, there is not yet equivalent legal protections for disabled people. On this basis, the law establishes a broad mandate to create "clear, strong, consistent, enforceable standards addressing discrimination," ("ADA," 1990, amended 2008, Sec. 12101). It requires public agencies and private businesses alike to make "modifications to existing facilities and practices" ("ADA," 1990, amended 2008, Sec. 12101), both socially and architecturally, in order to not discriminate on the basis of disability.

Practically, the ADA requires the creation of enforceable minimum standards that architects, planners, engineers, designers, and others must adhere to both in public facilities and private businesses. The ADA applies to both in new construction and procurement as well as retrofitting of old facilities and vehicles. With regards specifically to public transportation, it requires all new public transportation vehicles purchased after 1990 to be accessible, including for people in wheelchairs, and for companies to make a "good-faith effort" to purchase or lease accessible used vehicles ("ADA," 1990, amended 2008, Sec. 12142). The law also requires any new stations constructed to be physically accessible, and for existing stations built before 1992, "key stations" must be made accessible. If substantial alterations are done to any other station, the renovated sections must be accessible ("ADA," 1990, amended 2008). In general, while the ADA did not immediately require public facilities to become 100% accessible overnight, it does provide a pathway which should result in the conversion of public facilities to full accessibility over time. The ADA is accompanied by specific design standards and guidance, which have been updated since the passage of the law. Architectural design standards ("2010 ADA Standards for Accessible Design," 2010) and guidance ("Guidance on the 2010 ADA Standards for Accessible Design," 2010) are issued by the US Department of Justice, providing enforceable minimum standards publicly and privately owned facilities open to the public must meet. Meanwhile, ADA transportation vehicle standards are issued by the US Department of Transportation, providing minimum standards for public transportation vehicles, both those owned by public and private agencies ("ADA Accessibility Specifications for Transportation Vehicles," 2023).

4.1.2 Daniels-Finegold Settlement Agreement

Despite the federal legal requirements imposed by the ADA on public transportation agencies to become accessible to riders with disabilities, over the 15 years following the law's passage, disability advocates argued that the MBTA system was making insufficient progress towards the accessibility required by under the civil rights law ("Amended Complaint — Daniels Finegold v. Massachusetts Bay Transportation Authority," 2004). In 2002, a group of MBTA riders with disabilities and a nonprofit advocacy organization filed a lawsuit against the MBTA, which became

Daniels Finegold et al. v. Massachusetts Bay Transit Authority. In the lawsuit, the 13 individual named plaintiffs detailed their usage of the MBTA fixed-route system, and the ways that inaccessibility of the stations and rolling stock (as well as the lack of maintenance of accessibility features such as elevators) caused them extreme difficulty, and in some cases, even injury. The plaintiffs arguing that this constituted illegal discrimination under the ADA law, and therefore violated their civil rights. The plaintiffs filed a "class-action" lawsuit, a type of case in the US legal system where the named plaintiffs file the lawsuit not just as harmed individuals, but on behalf of their entire "class" of people affected: in this case, "all individuals with mobility, hearing or visual disabilities," who would use the MBTA fixed-route services ("Amended Complaint — Daniels Finegold v. Massachusetts Bay Transportation Authority," 2004, p. 5). The use of the class action lawsuit was significant, because it meant if settled, the MBTA would had to provide recourse to the entire class (people with disabilities who would use the MBTA), not just compensation to the individual named plaintiffs. In 2006, the MBTA and the plaintiffs reached an unusual settlement agreement to resolve the case.

Rather than awarding financial damages to the plaintiffs (or in this case, to all members of the class), the settlement agreement detailed a list of improvements to their service that the MBTA was obligated to make in order to achieve greater accessibility, including bus and train purchase and operation, improvements to audio and visual announcements, elevator and call box maintenance, staff training, internal performance monitoring, and more ("Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2006). The court appointed a retired Massachusetts Superior Court Judge to act as an independent monitor to oversee the application of the settlement agreement. The independent monitor would submit regular reports[1], and hold meetings open to the public to give these updates on the MBTA's progress towards completion of the settlement agreement conditions. The settlement agreement has been in force since 2006, and still is in effect up through today under the independent monitoring, making for a highly unusual governance structure surrounding governing accessibility at the MBTA not seen in most other public transportation agencies.

4.1.3 Accessibility Policy Creation and the Department of System-Wide Accessibility

The settlement agreement led to the creation of a Department of System-Wide Accessibility (SWA) within the MBTA, which helps create and monitor accessibility policies and interventions. The MBTA has developed a significant set of internal policies around stop and station design ("Bus Stop Planning and Design Guide," 2018) and maintenance, rolling stock procurement, and staff policies ("Subway Policies and Customer Journey," 2023, "Bus Securements and Violations," 2023) in

[1]Originally quarterly reports;every six months since the settlement agreement was modified in 2018 ("Amended Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2018, "MBTA Amended Agreement Press Release," 2018)

order to meet the Settlement Agreement requirements. The SWA is an internal department inside the transportation authority but with independence to critique from within.[2] The SWA houses the "secret shopper" Internal Access Monitoring program (IAM), described in Section 3.2.1.

4.1.4 Civil society governance

The independent monitor and, by extension, named plaintiffs in the Daniels-Finegold v. MBTA lawsuit have an unusually prominent role in the governance of accessibility at the MBTA. Under the settlement agreement, when the MBTA believes that they have addressed or completed terms of the settlements, they must provide documentation to the independent monitor. The plaintiffs then must comment to both the monitor and the MBTA about whether they believe the MBTA is compliant or not, to be reviewed by the monitor. Either party (the MBTA or the plaintiffs), or the judge may request a conference of all parties facilitated by the independent monitor ("Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2006; "Amended Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2018). Amendments to the settlement agreement are signed off on by the plaintiffs as well as the MBTA ("Amended Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2018). This means that the named plaintiffs' group the play a very major role in assessing the status of accessibility on the MBTA and critiquing or recommending improvements. Due to their role in the Settlement Agreement, the plaintiffs' role has gone from adversarial critics during the lawsuit, to more collaborative though critical advisors and regulators during the Settlement Agreement. The unique arrangement of the settlement agreement and the plaintiff group (and advocacy/legal groups that support them) creates an interesting role for bottom-up civil society participation in the governance of accessibility at the MBTA. Members, at least of this particular group of advocates, play a much more formalized and powerful role than is typically seen by civil society actors in participatory processes, with a level of actual level of "veto-power" over the MBTA (as mediated through the independent monitor). However, while this has been the case for the last 17 years under the settlement agreement, it remains to be seen whether any civil society actors will play this direct of a role in governance of accessibility in the MBTA once the settlement agreement ends, which according to the Assistant General Manager of the MBTA, may happen as early as late 2023 ("Interview with SWA Staff," 2023).

In 2018 a new customer organization called "Riders Transportation Access Group" (RTAG) created by the "RTAG Planning Committee", which included members of the named plaintiff group and representatives of a number of disability advocacy civil society organizations ("RTAG MOU," 2018; "RTAG Bylaws," 2018). RTAG is a customer organization with general membership open to any riders who wish to apply ("RTAG Bylaws," 2018). The organization has two purposes: to both

[2]The head of the SWA, the Assistant General Manager of System-Wide Accessibility, reports directly to the General Manager of the MBTA("AGM SWA Interview," 2022).

present a forum for the general membership to receive updates from the MBTA about accessibility projects and share feedback, but its executive board also meets directly with MBTA leadership and the SWA to determine priorities and develop accessibility-related projects ("RTAG MOU," 2018). If this group is able to continue functioning effectively, they may be able to take some of the civil society governance function that the plaintiffs' group currently plays in the post-settlement era.

4.1.5 Relationship between law and practice

Both interviewees from the settlement group and from the SWA agreed that in the context of the MBTA, the ADA law and its legal standards were a necessary but not sufficient step towards widespread accessibility on the MBTA for disabled customers. "We love to have the ADA, of course," the lead counsel for the plaintiff's group in the Daniels Finegold et al. v. MBTA lawsuit told me. "But remember ADA was there for a while, but they were violating it and no one cared," ("Interview with Daniels-Finegold et al. v. MBTA Plaintiff and Attorney," 2022).

On the other hand, the Assistant General Manager of SWA told me that she does not think the MBTA would have taken significant steps towards accessibility if the ADA hadn't been an enforceable legal standard to refer to:

> One thing that is always clear to me is that we would have never gotten here, and I don't think we would remain where we are, if it weren't for the fact that we know that that that this is the law and that we could get, you know, get sued... Like this would have never happened just because people thought it would be the right thing to do or nice to do... at the end of the day, like, as a large agency with many competing demands, the ADA and other major regulations like that are what keep us in a headed in the right direction. And the advocates that are willing to use those as tools for holding us accountable, ("AGM SWA Interview," 2022).

The interplay of legal standards and enforcement is central to the accessibility process at the MBTA, making for an interesting contrast with the case of the STIB-MIVB in Brussels, where accessibility modifications have largely been done on a voluntary basis.

4.2 Accessibility by design: infrastructure, rolling stock, and institutional policy

The MBTA public transportation network consists of a number of distinct modes:

Services run directly by the MBTA:

- **Bus**

The MBTA serves 245 bus lines (plus the BRT Silver Line, discussed below). Bus service ranges from bus rapid transit (Silver Line) to high-frequency buses, to neighborhood routes and commuter express buses.[3]

- **"The T": Rapid transit**

Rapid transit, also known as"The T"[4] or subway, which consists of 3 heavy rail (metro) lines and 2 light rail lines, plus a BRT system of 6 lines that branded as part of the subway system. The rapid transit system is the most heavily utilized mode on the MBTA. Although referred to as a subway by the MBTA, only part of the rapid transit system is underground, and at different points most lines run both underground, grade-separated surface level, and on elevated tracks. The T rapid transit system is composed of heavy rail (metro) lines (Red, Orange, and Blue lines) and light rail (tram) lines (Green line and the Mattapan trolley). Additionally, the Silver Line Bus Rapid Transit (BRT) line[5], is branded by the MBTA as part of the T "subway", although it does not run on tracks.

The light rail Green Line shares many similarities with the tram system in Brussels, including many of the accessibility challenges of that mode. Like some trams in Brussels, the Green Line light rail runs in two different types of conditions: through underground tunnels and elevated platforms or surface-level dedicated stations (analagous to the "premetro" in Brussels described in section 5.2), and at surface level as a streetcar or tram.[6]

The MBTA also has two services run under contract through public-private partnerships

- 12 suburban **commuter rail** lines, operated through a public-private partnership with Keolis (Powers, 2014; "Keolis, MBTA Commuter Rail Operator, What We Do and Do Not Do — Keolis Commuter Services," 2020).

[3]The frequency of service on these buses can very substantially–for example,"key routes", buses run every 10 minutes during peak commuting hours, while local buses only run every 30 minutes on weekdays and commuter buses may only run three trips during the morning and afternoon peak ("2021 Service Delivery Policy," 2021).

[4]"the T" can also refer to the entire MBTA system and the public transportation agency, but often is used to refer specifically to the rapid transit service ("Beginner's Guide to the Subway," n.d.)

[5]The Silver Line runs partially in underground tunnels as a trolleybus, and partially on the streets mixed with traffic using a diesel engine.

[6]For the Section of the system that west of Kenmore on the B, C, and D lines and west of Symphony on the E line. The streetcar portion of the Green Line generally on dedicated tracks, usually in the center of a boulevard, but in some parts of the E line it runs through the street, mixing with traffic.

- 3 **ferryboat** lines, operated by Boston Harbor Cruises (Vaccaro, 2018)

These modes were not a primary focus of my research, but information about accessibility policy on these modes can be found in Appendix .2.

Accessible transportation design not only requires accessible stations and stops and accessible vehicles, but also ensuring the connection between station and vehicle is navigable. The accessibility design and policies for modes are laid out below, focusing on the modes run directly by the MBTA (bus and the heavy and light rail rapid transit).

4.2.1 Station and stop design

There are three categories of stops or stations passengers board MBTA-run transportation vehicles:

- **Bus stops**, including on-street bus stops, dedicated busways, and bus stops inside of stations. Passengers are generally boarding from a sidewalk onto the vehicle.
- **Rapid transit platforms inside of dedicated stations** - heavy rail and "premetro"-style sections of the Green Line
- **Surface-level "streetcar"-style stops** on parts of the Green Line and Mattapan Trolley. These stops are accessed directly from the street, and, in the case of the Green Line, are usually located in the center of a boulevard street.

The accessibility features (or lack thereof) are described in Table 4.1, below, focusing on access for Wheeled Mobility Device (WMD)[7] users and others with mobility impairments on the one hand, and sensory impairments (blind/low vision and Deaf/hard of hearing) on the other.

[7]includes manual wheelchairs, powered electric wheelchairs, and mobility scooters

Mode	For WMD users/mobility impairment	For blind/visual impairment
Bus	• Stops should have "accessible landing pad" with enough space for ramp, plus space for WMD users to turn (see Figure 4.1) • Not all MBTA stops meet this standard • When new stops are created or renovated, must meet standard[8]	• No podotactile[9] guiding features on MBTA bus stops (as in some STIB-MIVB stops)
Rapid transit stations	• Elevators (lifts) in most stations (see Table 4.2 • Accessible fare gate (wider) in each station • If accessible fare gate is broken, must be left in open position (even if passengers enter without paying fare) • Heavy rail: high platforms (level with vehicle) • Light rail ("premetro" Green Line): Slightly raised low-height platforms (level with low-floor vehicle)	• Podotactile warnings on edge of platform • Visual announcements on platform electronic marquee • Audio announcements on platform speakers
Green line "street-car" stops	• On WMD-accessible stops: Slightly raised low-height platforms (level with low-floor vehicle) • Many stops not WMD accessible (see Table 4.3)	• No podotactile markings
Mattapan trolley	• Stops low-platform, with high-platform vehicles • Accessible stops other than Ashmont have "mini-high" platform: small section of the platform which is raised to level height with the floor of the trolley	• Podotactile warnings at edge of platform

Table 4.1: Station/Stop accessibility features by mode

[9]these stop design requirement are based both on ADA technical requirements as well as the Daniels-Finegold Settlement Agreement requirements and a number of internal MBTA design rules ("Bus Stop Planning and Design Guide," 2018).

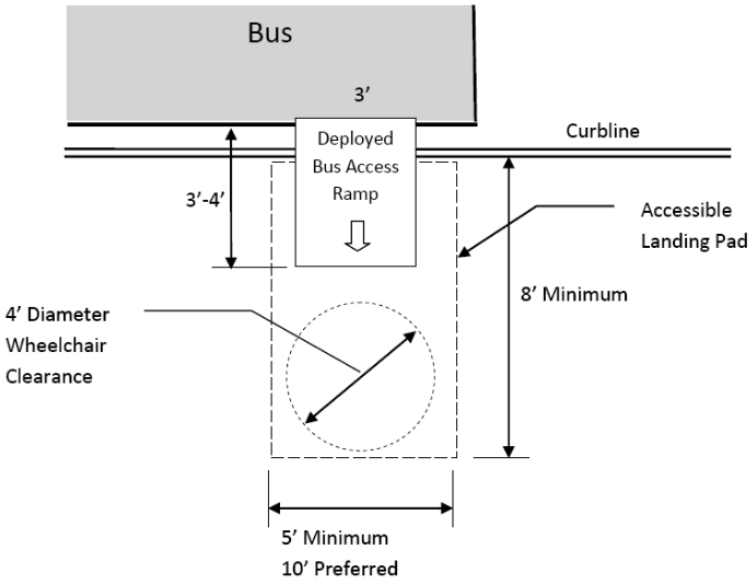


Figure 4.1: Diagram of an "accessible landing pad" at a bus stop from the MBTA "Bus Stop Planning and Design Guide" (2018)

Figure 4.2: WMD accessible stops on the T Image adapted from "MBTA Subway Maps" (2022).

⊗ WMD inaccessible stop

■ Red Line and Mattapan Trolley

■ Orange Line

■ Green Line

■ Blue Line

■ Silver Line (BRT)

Rates of accessibility vary significantly between these different types of boarding locations. For rapid transit in particular, station-based stops are significantly more accessible to WMD users today than streetcar-style Green Line stops, many of which have still not been adapted to include platforms level with low-floor vehicles. Table 4.2 shows the portion of heavy rail stations that are inaccessible for WMD users because they lack an elevator/left. Table 4.3 shows the portion of light rail stops that are inaccessible (because of lack of elevators in "premetro"-style Green Line stops, lack of adapted raised platforms on "streetcar"-style Green Line stops, and because of a lack of "mini-high" platforms on the Mattapan Trolley).

	Total # no elevators	**Total # stations**	**% no elevators**
■ **Red Line**[10]	0	22	0%
■ **Orange Line**	0	20	0%
■ **Blue Line**	1	12	8%

Table 4.2: WMD inaccessible stations: heavy rail lines

	Total # not accessible	**Total # stations**	**% not accesible**
■ **Green Line ("premetro")**	3	19	16%
■ **Green Line ("streetcar")**	21	46	46%
■ **Mattapan Trolley**	1	8	13%

Table 4.3: WMD inaccessible stations: light rail lines

[10] Although the Mattapan trolley is branded as part of the Red Line on MBTA maps, it is light rail – a different mode

Figure 4.3: Green Line "married couple" of a type 7 high-floor (right) and type 8 low-floor vehicle (left)]
Photo via Wikimedia Commons

Note that a much greater portion "streetcar"-style Green Line stops are inaccessible than "premetro"-style or heavy rail stations. Overall, WMD accessibility on the "premetro" section of the Green Line is a bit worse than heavy rail lines, but largely accessible. On the other hand, in sections of the Green Line that run as a streetcar or surface-level tram are significantly inaccessible for passengers who use WMDs.

4.2.2 Vehicle design

All buses and train sets in the MBTA should theoretically be accessible to wheeled mobility device users if boarded from an accessibile platform/stop. A variety of platform-to-vehicle systems are used for boarding for different modes (See Table 4.4).

For riders with sensory impairments, all newer vehicles feature automated visual and audio external and internal announcements, but the prevalence of older vehicles means that a significant number of vehicles still are missing these automated systems, which must instead be announced manually by moterpersons (See table 4.5).

(a) Bridgeplate deployed on a low-floor "type 8" Green Line train

(b) Type 7 vehicles have inaccessible steps, but are paired with accessible type 8 vehicles; see 4.4a

Figure 4.4: Green Line vehicle types
Photo (a) courtesy of MBTA SWA. Photo (b) via Wikimedia Commons)

Figure 4.5: 1940s-era Mattapan Trolley vehicle
Photo via Wikimedia Commons

Mode	Platform - vehicle Connection	On board vehicle
Bus	• Low-floor • Can kneel • Ramp at front door • Ramp automatically deployed by the operator. • If automatic deployment broken, operator must fold down the ramp by hand ("Bus Customer Journey," 2023).	• Priority seating in front • Priority seating chairs fold up to WMD securement area (at least one on all vehicles) ("Bus Customer Journey," 2023). See Figure 5.7. • WMDs face forward • WMDs secured using four securement straps • Lap and shoulder strap available.
Heavy rail (red, orange, blue lines)	• All stations high-platform; vehicle door level with platform • if verticle or horizontal gap, bridgeplates available • bridgeplates manually deployed by station personnel	• Newer cars have designated WMD space • Older cars do not have designated space
Green Line	• Stations low platform approximately level with low-floor cars • Accessible stops low (slightly raised) platform approximately level with low-floor cars • Green Line trains run in "married couples" (Figure 4.3) of high-floor "type 7" trolleys with steps (see Figure 4.4b) and low-floor "type 8" cars (see 4.4a) • All trains sets should have one "type 8" low-floor car • Built-in bridgeplate under "type 8" vehicle • Blue wheelchair button on side of vehicle to request bridgeplate • Motorperson must exit vehicle to deploy bridgeplate with key	• Low floor "type-8" vehicles have designated WMD space
Mattapan Trolley	• All vehicles high-floor with steps- heritage trolleys dating to the 1940s (Figure 4.5) • At Ashmont, must board via "mobile lift": small, hand-cranked elevator operated by station personnel (see Figure 4.8) • At other accessible stations, can board via "mini-high" platform: small section of the platform which is raised to level height with the floor of the trolley	• No dedicated WMD space

Table 4.4: Vehicle accessibility features: WMD/mobility impairments

Mode	External - at station/stop	Internal - on board
Bus	• Visual electronic marquee on front and side of bus • External speakers • Both speakers and visually marquee automatically announce bus number, name, and destination • If automated system is broken, operator must announce verbally via external PA ("Bus Customer Journey," 2023).	• Automated visual stop announcements (upcoming and on arrival) • Automated audio stop announcements (upcoming and on arrival) • If automated system broken, operator must verbally announce stops via PA ("Bus Customer Journey," 2023)
Heavy rail (red, orange, blue lines)	• If automated audio announcement system in station is broken, operator must announce verbally via external PA on the side of the train	• On newer trains (blue, some orange and red line), automated visual stop announcements • On newer trains, automated audio stop announcements • If automated system is broken, operator must announce verbally via external PA on the side of the train • On older trains (most red line and old orange line)[11] operator must verbally announce stops via PA ("Bus Customer Journey," 2023)
Green Line	• If station automated system is broken, operator must announce verbally via external PA on the side of the train • Street-level stops: automated external audio announcements	• Automated visual stop announcements • Automated audio stop announcements • If automated system is broken, operator must announce verbally via PA
Mattapan Trolley	• Motor person must verbally announce arrival	• Motor person must yell stop announcements

Table 4.5: Vehicle accessibility features: sensory impairments

[11]The new orange and red line cars purchased by the MBTA under a contract with a Chinese company have been plagued by a variety of issues, from delivery dates pushed several years overdue

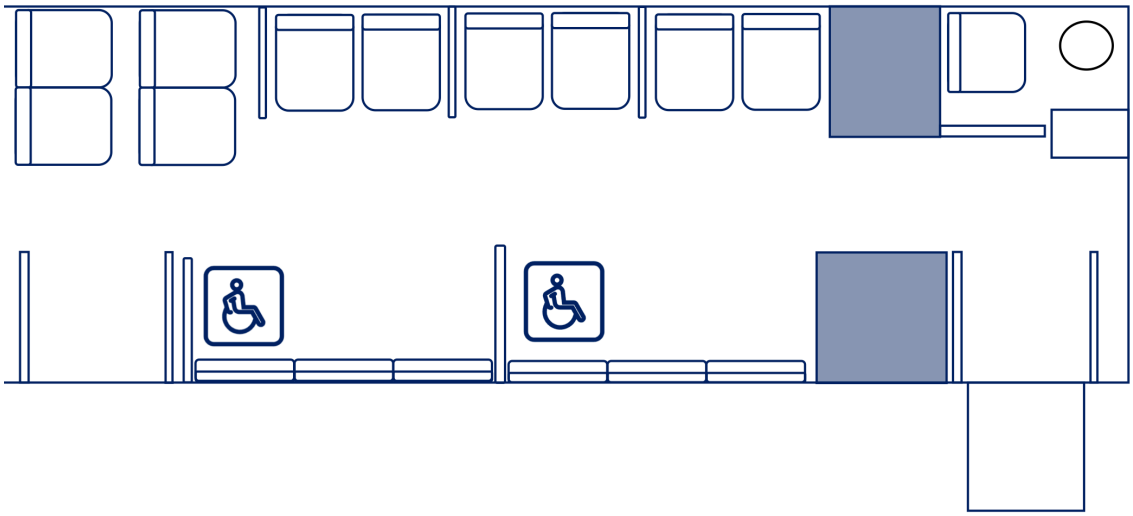


Figure 4.6: Placement of WMD securement areas in MBTA buses

4.2.3 Accessibility policies

Policies governing staff behavior and expectations can be the difference between a mode being accessible or inaccessible, particularly in the way accessibility is designed at the MBTA. Broadly speaking, MBTA staff are required to fulfill"reasonable accommodations" for disabled customers under the ADA and Settlement Agreement. When fulfilling reasonable requests, staff are also not permitted to ask the person for proof of their disability, because they may have a "hidden" or "invisible" disability . MBTA employees receive training upon hiring about accessibility policies they must follow, and in recent years, will also begin to receive regular refresher courses. In addition, if an operator is found through an investigation of a monitoring incident or customer complaint to have committed "serious violations" of accessibility policies, they will usually receive retraining from their supervisor and attend an "Accessibility in Motion" course, and may also face disciplinary consequences ("Interview with SWA Staff," 2023).

All modes

- If automated audio announcements are not functioning, operators are required to make manual verbal stop announcements over the PA. Neglecting to do so is a serious violation ("Bus Customer Journey," 2023, "Subway Key Features," 2023)

to mechanical issues. As of 2023, almost no red line cars have been delivered, and many of the orange line cars still due to arrive (Kinney, 2023, Drysdale, 2023). Additionally, a number of older orange line vehicles without automated VMS were put back into service in early 2023 when mechanical issues were detected on some of the newly purchased orange line vehicles ("Subway Key Features," 2023, Rousseau, 2023).

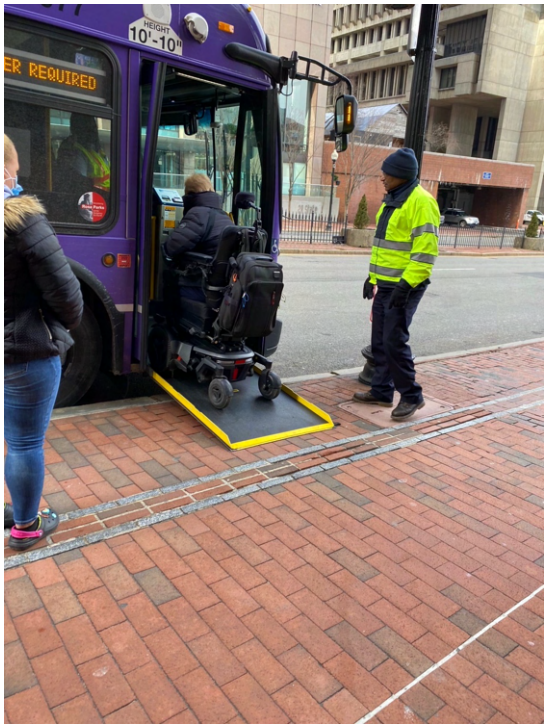


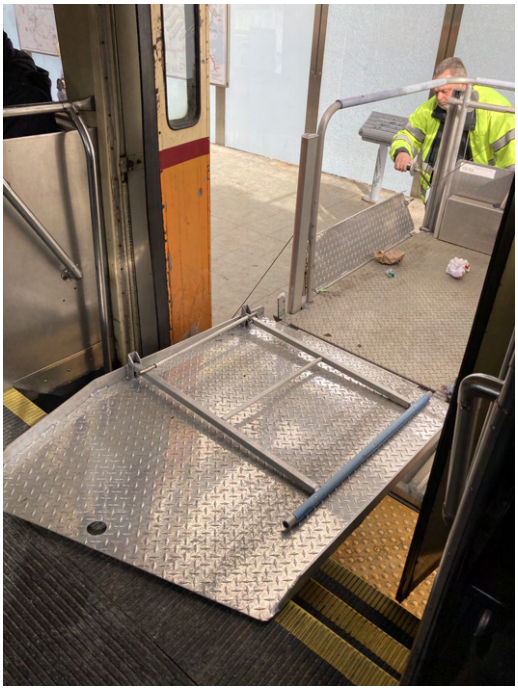
Figure 4.7: WMD user alights bus via ramp
Photo courtesy of MBTA SWA

Bus

- Operators must kneel and/or provide the ramp to any customer who asks, whether or not they use a WMD ("Bus Customer Journey," 2023)
- If automated ramp deployment is not working, operators must leave their seat and deploy the ramp by hand ("Bus Customer Journey," 2023)
- Operators should "pre-board"[12] WMD users before other customers "Bus Customer Journey," 2023
- Operators must manually secure WMDs with at least three of four securement straps (though all four is best practice)("Bus Securements and Violations," 2023)
- If a customer requests help finding a seat in the priority seating area, the operator must request that other customers move, but cannot force customers to move if they refuse ("Bus Customer Journey," 2023).
- Operators must honor "reasonable requests" including asking for verbal orientation assistance or sighted guidance while boarding or alighting, or asking the operator to verbally announce the customer's destination ("Bus Customer Journey," 2023).

[12]If operators see a WMD user at the stop, the best practice taught is to prepare the WMD area and allow the WMD user to board first

(a) Mobile lift demonstrated on a high-floor Green Line car (photo courtesy of MBTA SWA)



(b) Mobile lift being used on the Mattapan Trolley during testing trip with LC

Figure 4.8: Mobile lifts can be used to board a WMD user on a high-floor light rail train

- Operators must always pull close to the curb to board passengers. If the curb is blocked, the operator should pull to the curb at another location. If this is not possible, and the operator must board passengers from the street they must request guidance from dispatch, and then kneel the bus for *all* customers, regardless of apparent disability ("Bus Customer Journey," 2023).
- If a WMD user boards from the street, the operator must leave their seat and follow the WMD user up the ramp to ensure their device does not slip, and must push the device if the person requests it ("Bus Customer Journey," 2023).

Rapid transit - heavy and light rail

In some stations, the vertical and/or horizontal gap between the platform and vehicle may be large enough that WMD users may need to use a bridgeplate.

- Customers can seek out any MBTA station employees to request assistance. In key stations, the MBTA has also contracted "transit ambassadors" (TAs), whose sole job is to assist customers, and these staff are frequently available to

assist with bridgeplate requests at major stations. However, all MBTA station employees should have a key to unlock the bridgeplate in the station.

- MBTA staff must immediately assist customers with bridgeplate request. Station staff should be the first consulted, but if none are available the motorperson driving the train is required to assist the customer after coordinating with the OCC.

- If a customer needing a bridgeplate cannot find a staff member, they can request a bridgeplate using a call box on station platforms. The call boxes contact the Operations Control Center (OCC) who can coordinate staff assistance[13]

- Once a customer requests a bridgeplate, they should miss zero subsequent trains. If the customer misses a train while waiting for a bridgeplate, this is considered a serious violation.

- When staff assist with a bridgeplate request, they should ask the customer their destination and contact station personnel to be ready with a bridgeplate when the train arrives. If no bridgeplate is available at the destination station, this is also considered a serious violation ("Subway Policies and Customer Journey," 2023).

Elevators

The Settlement Agreement requires the MBTA to meet standards with regards to elevators, as at the time of the lawsuit, many stations that were accessible on paper were practically inaccessible due to high rates of out-of-service elevators. Laura Brelsford, the Assistant General Manager for System-Wide Accessibility at the MBTA, is a wheelchair user and was a T commuter at the time of the Daniels-Finegold Settlement Agreement. She recalled that back in those days,"I would be dependent on three elevators to get from my apartment to my office, and every day at least one of the three was out of service," ("AGM SWA Interview," 2022). In order to comply with the Settlement Agreement terms, the MBTA needs to reach high levels of elevator up-time with very minimal outages ("Amended Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2018). In 2019, the MBTA had an annual elevator uptime rate of 99.4% ("2021 Service Delivery Policy," 2021); however, in an interview, Brelsford noted that since the COVID-19 pandemic, elevator up-time is one of a number of "a key areas in which we've been backsliding," ("Interview with SWA Staff," 2023). The settlement also specifically requires the MBTA to create implement a system to ensure

[13]Though the senior program manager of the internal access monitoring program (IAM) reported that in recent months, IAM testers have found that in some cases, call box calls have been going unanswered due to a significant staffing shortage at the OCC ("Subway Policies and Customer Journey," 2023).

that elevators are in clean and safe condition (no urine or other substances in elevators) ("Amended Settlement Agreement — Daniels-Finegold v. Massachusetts Bay Transportation Authority," 2018, "Subway Key Features," 2023).

4.3 Real-life accessibility: monitoring trip narratives

During my on-the-ground fieldwork in Boston, I accompanied four Internal Access Monitoring (IAM) monitoring pairs during their monitoring shifts (see 3.2.1 for explanation of the monitoring program system). These trips alongside testers with disabilities and the notetaking observers gave me an opportunity to collect qualitative data on the way that the on-paper MBTA accessibility features and policies do – or do not– translate into real-life transportation accessibility for people with a variety of disabilities.

Additionally, the monitoring protocol I observed being practiced by the IAM monitoring pairs provided a blueprint for the second part of my fieldwork in Brussels, where we created a modified version of the monitoring protocol to "test" the real-life accessibility of the STIB-MIVB system.

Below, I present short qualitative narratives of three monitoring trips with three different testers. I also observed one other monitoring trip with a tester who uses a mobility scooter; however, this trip was a "special Green Line" testing trip, which focused exclusively on monitoring stop announcements on the Green Line light rail to detect a mechanical issue, which is not included in the trip narratives due to the particular nature of that trip taking the same line many times, though comments from a short interview with the tester are presented in the discussion section.

4.3.1 Trip narrative: LC

LC is a woman in her 40s-50s, who is blind and uses a white cane. She has "some vision, but it usually just gets her in trouble." She also has arthritis, so she uses escalators and elevators. Some days when her knees are bad, she needs to use ramps to board and alight buses and other vehicles. On monitoring trips, LC generally navigates stations and streets fairly independently and does not usually ask for sighted guidance.

On the monitoring trip with tester LC, we tested two heavy rail lines (Red and Orange lines), two buses, and the Mattapan Trolley (see figure 4.9). On one bus and on the Mattapan trolley, LC made ramp/bridgeplate requests as an ambulatory tester. We also paid special attention to the internal stop announcements on Mattapan Trolley and the Red Line, since on both these older vehicles stop announcements must be done verbally by the motorperson.

Figure 4.9: Map of trips conducted with tester LC, showing accessibility features and barriers encountered.

- Bus
- Heavy rail
- Light rail
- Ramp (boarding)
- Ramp (alighting)
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

Accessibility features, barriers, and violations

On the buses we travelled in, external and internal audio and visual announcements all worked well, as was the case on the Orange Line in a new vehicle with automated announcements. Additionally, on the Mattapan Trolley, despite the need for manual stop announcements, the motorperson clearly announced all stops properly. We encountered a number of helpful operators, who responded to reasonable requests as well as some offering assistance unprompted.[14]

However, we also observed a number of barriers on the trip with LC, one of which was a serious violation. The older Red Line train we took did not have automated stop announcements. Although at least some of verbal stop announcements by the motorperson were audible, some were not audible at all, and others were highly distorted. The Senior Program Manager of the Internal Access Monitoring (IAM) program flagged this as a serious violation, and both LC and the observer submitted violation statements about the incident.[15]

On the Mattapan Trolley, LC was able to successfully board and alight the trolley using the mobile lift at Ashmont, and alight at Mattapan via a mini-high platrform. However, LC described the experience as very uncomfortable because it made her feel singled out, particularly as an ambulatory person not using a WMD. It took station personnel about 15 minutes to successfully deploy the mobile lift and board LC, while all the other passengers watched her. Overall, although the staff on the Mattapan Trolley acted courteously and the boarding process was in compliance with accessibility policies, practically it was a very time-consuming process that singled out the disabled customer. while the Mattapan Trolley is technically accessible for WMD users and others with mobility impairments, it is fairly impractical and tedious to do so.

4.3.2 Trip narrative: KR

KR is a man in his 40-50s who uses a power wheelchair. On the monitoring trip with KR, we tested two heavy rail lines, two buses, one commuter rail line, and one commuter rail contracted shuttle bus.

[14]On the Silver Line, after LC asked if there was an open seat on the left side, the operator got up and folded down the priority seats, which had been folded up for wheelchair securement, and told LC she could sit. The operator also identified herself and asked LC her destination. On Bus 28, when LC asked where she could find an open seat, the operator requested a passenger to move from priority seating. And on the Mattapan Trolley, the operator unprompted offered LC sighted guidance to the bus station since she had finished her shift.

[15]Several hours later, the IAM Senior Program Manager received a report back from the Red Line inspectors, saying that they had investigated and found it was caused by a mechanical issue with the PA system. The inspectors said they would remove the train from circulation and take it to the shop for repairs. The motorperson did not receive discipline because the issue was mechanical.

Figure 4.10: Map of trips conducted with tester KR, showing accessibility features and barriers encountered.

- Bus
- Heavy rail
- Light rail
- Commuter Rail
- Ramp (boarding)
- Ramp (alighting)
- Securement straps
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

Accessibility features, barriers, and violations

All of the buses and heavy rail featured correctly functioning external/station announcements and automated internal stop announcements without any issues, as was the case for stop announcements on the commuter rail. Additionally, on all buses including the shuttle, ramps were appropriately deployed. On the Red Line, KR made a bridgeplate request to a TA, who promptly responded and contacted the destination station so a bridgeplate was available for KR to alight. Similarly,

on the Commuter Rail, the staff responded quickly and provided KR a bridgeplate for boarding and alighting.

On the two regular MBTA buses, operators correctly secured KR's wheelchair with the securement straps. However, on the Lynn shuttle, a contracted Yankee shuttlebus to replace Commuter Rail service between two stations, the operator did not correctly secure KR's wheelchair. Unlike MBTA vehicles, the Yankee bus only had three securement straps available, rather than two. While the operator correctly secured two of the straps to the frame of KR's wheelchair, he attached the third strap to a movable part of the wheelchair (see Figure 4.11a). He also did not properly attach the shoulder and lap belt. After consulting SWA staff, the IAM manager determined this would not be classified as a serious violation, since it had not been completely clear that the part the strap was attached to was a movable part. Nonetheless, they issued an FYI to the shuttle contractor, and the operator was retrained on proper WMD securement.

(a) Improperly placed securement strap on KR's wheelchair, Lynn Shuttle

(b) Path of travel barrier: snow blocking curb cut

Figure 4.11: Barriers encountered on trip with KR

We also encountered two path-of-travel barriers during the trip. At Lynn Station, the curb cut leading to a bus stop was blocked by improperly cleared snow (see Figure 4.11b). the IAM manager reported this to the MBTA snow clearing crew. At Wonderland station, the wheelchair ramp at the front of the station was blocked due to construction, and KR had to enter via a ramp on the back side.

4.3.3 Trip narrative: BG

BG is a man 30-40s who uses a power wheelchair. On the monitoring trip with BG, we tested two heavy rail lines, one light rail line, three buses, and one commuter rail.

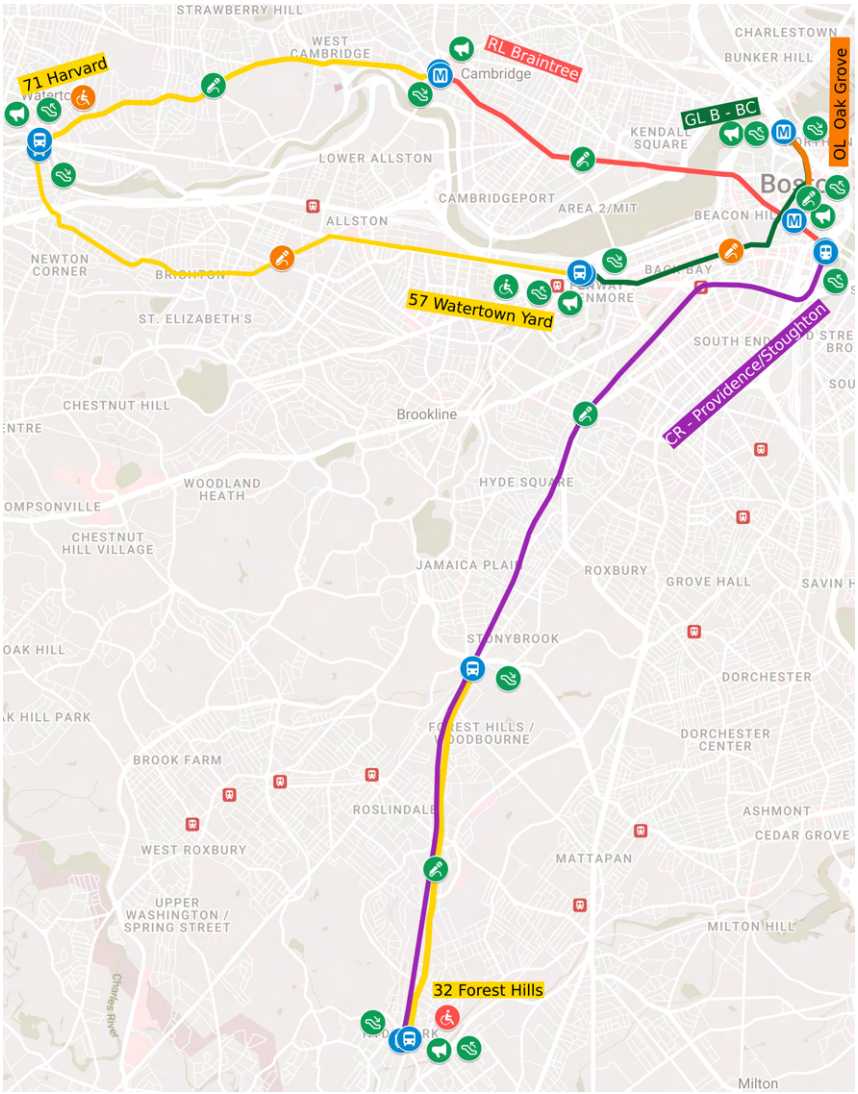


Figure 4.12: Map of trips conducted with tester BG, showing accessibility features and barriers encountered.

- Bus
- Heavy rail
- Light rail
- Commuter Rail
- Ramp (boarding)
- Ramp (alighting)
- Securement straps
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

Accessibility features, barriers, and violations

On most of the buses and heavy and light rail, automated external and internal audio and visual announcements worked properly, and on the commuter rail, automated stop announcements were also correct. However, on bus 57, audio stop announcements played properly, but the visual display malfunctioned. The IAM manager reported the mechanical issue to the bus garage (not a serious violation). On the Green Line, there were mechanical issues with the audio and visual automated stop announcements upon arrival, though not for upcoming stops. This also was not a serious violation, but the mechanical issue was reported.

Ramp and bridgeplate deployment was done properly on all modes tested. However, on two of the three buses, the operator did not properly secure BG's wheelchair. On bus 71, the operator applied three straps tightly, and one loosely. Since MBTA accessibility policy requires at least three correct straps, this was not a serious violation. On the other hand, on Bus 32, the operator only attached two securement straps to BG's wheelchair, a serious violation. The IAM manager reported this to the bus supervisors as a serious violation. After the supervisor's investigation, the operator received retraining on WMD securement and attended an "Accessibility in Motion" course, the course on accessibilty procedures for bus operators at the MBTA.

4.4 MBTA: Summary of real-life data

The MBTA is able to provide a surprisingly high level of accessibility in theory due to the heavy use of human-dependent interventions, even on lines legacy vehicles such as the Mattapan trolley that are highly inaccessible in their design. Because of this heavy use of human-dependant interventions, the MBTA is not anywhere close to "autonomous accessibility" on its system for disabled riders (as is the stated goal of accessibility policy on the STIB-MIVB, for instance), nor does this seem to be the goal of accessibility on the T at this time.

Testing trips found that by and large, these human-dependent accessibility methods do work, though the numerous violations observed and other problems encountered on trips show there will always be some risk of human error that is bound to be present in an accessibility system heavily dependent on staff behavior.

Key:

Green - 90-100% compliance

Yellow - 70 -89% compliance

Red - 50-69% compliance

Purple - under 50% compliance

Bus: audio and visual announcements				
	External		**Internal**	
	Audio	**Visual**	**Audio**	**Visual**
Automated	8	8	8	7
Manual	0	n/a	0	n/a
Incorrect or missing	0	0	0	1
Total observed	8	8	8	8
% correct	100%	100%	100%	88%[16]
% incorrect	0%	0%	0%	12%

Rapid Transit: audio and visual announcements				
	External		**Internal**	
	Audio	**Visual**	**Audio**	**Visual**
Automated	8	8	6	6
Manual	1	n/a	1	n/a
Incorrect or missing	0	0	2	3
Total observed	9	9	9	9
% correct	100%	100%	78%	67%
% incorrect	0%	0%	22%	33%

Table 4.6: MBTA bus and rapid transit: audio and visual announcements observed during participant observation

[16]While malfunctioning or missing automated audio announcements can easily be covered by manual verbal announcements by the operator, there is not an easy manual backup for a lack of automated visual announcements, presenting potential barriers for Deaf riders.

Mobility impairment accommodations			
	Bus ramp	**Bus securement straps correct**	**Bridgeplate request (heavy rail)**
Correct	6	4	2
Incorrect	0	1	0
Total	6	5	
% correct	100%	80%	100%
% incorrect	0%	20%	0%

Table 4.7: Mobility impairment accommodations on participant observation trios

The sample size during participant observation was relatively small, making it hard to make general assumptions from this data alone. However, when the experience of observed trips is compared with data from the IAM in recent years, observations generally seem to fit broader statistical trends that are visible through the monitoring data, as can be seen in Tables 4.8, 4.9, 4.10, 4.11, and 4.12.

4.4.1 MBTA IAM Monitoring Data

Overall, IAM monitoring data has found that on buses, where external and internal audio and visual announcements are automated except in the case of mechanical failure, compliance is very high:

Bus: external audio announcements			
	FY 2015	**FY 2019**	**FY 2022**
Correct	1185	1642	442
Missing	230	83	45
Total	1415	1725	487
% correct	84%	95%	91%
% missing	16%	5%	9%

Bus: internal announcements			
	FY 2015	**FY 2019**	**FY 2022**
Correct (audio and visual, or just audio)	1198	1694	471
Missing (just visual, inconsistent, or none)	16	18	14
Total	1214	1712	485
% correct	99%	99%	97%
% missing	1%	1%	1%

Table 4.8: MBTA IAM statistics: Bus audio (and visual) announcements

In contrast, on rapid transit, where older vehicles persist on both light and heavy rail lines, rates of proper audio announcements are lower:

External announcements (light rail only)[17]			
	FY 2015	**FY 2019**	**FY 2022**
Correct	296	227	115
Missing	265	181	20
Total			
% correct	53%	56%	85%
% missing	47%	44%	15%

Internal announcements (all rapid transit)			
	FY 2015	**FY 2019**	**FY 2022**
Correct	3044	6654	3137
Missing	556	913	445
Total	3600	7567	3582
% correct	85%	88%	88%
% missing	15%	12%	12%

Table 4.9: MBTA IAM statistics: Rapid transit announcements

Monitoring data also counts the number of testers are denied boarding the bus overall. This could be due to the driver passing the tester by, because a stop is blocked by an obstacle, or because the operator fails to properly deploy the ramp, among other reasons. Thankfully, denial of bus service rates are very low.

Denial of service (bus)			
	FY 2015	**FY 2019**	**FY 2022**
Tester denied	10	6	4
Total trips	1447	1725	488
% denied	0.69%	0.35%	0.82%

Table 4.10: MBTA IAM statistics: Bus denial of service

On the other hand, proper securement of WMDs (four straps applied tightly and

[17]Only available for Green Line (light rail), which is the only line that has automated external announcements on the outside of vehicle because of street-level stops. For heavy rail vehicles automated audio announcements are played on station platforms; no data available on this

correctly) by bus operators remains a significant problem area for the MBTA's accessibility policy, according to monitoring data.

Securement straps (bus)		
	FY 2019	**FY 2022**
All applied correctly	358	116
Some incorrect	242	172
Total trips	600	288
% correct	60%	40%
% incorrect	40%	60%

Table 4.11: MBTA IAM statistics: Bus WMD securement[18]

MBTA performs significantly better when it comes to station staff quickly responding to bridgeplate requests.

[18]No data available from FY 2015

Bridgeplate request: staff available			
	FY 2015	**FY 2019**	**FY 2022**
0 trains missed	42	57	54
1 missed	2	1	5
Total	44	58	59
% 0 missed	95%	98%	91%
% 1 missed	5%	2%	8%

Bridgeplate request: callbox			
	FY 2015	**FY 2019**	**FY 2022**
0 trains missed	25	12	20
1 missed	3	2	4
Total	28	14	24
% 0 missed	89%	86%	83%
% 1 missed	11%	14%	17%

Bridgeplate request: all			
	FY 2015	**FY 2019**	**FY 2022**
0 trains missed	67	69	74
1 missed	5	3	9
Total	72	72	83
% 0 missed	93%	96%	89%
% 1 missed	7%	4%	11%

Table 4.12: MBTA IAM statistics: Bridgeplate requests (heavy rail)

Overall, while the MBTA performs fairly well[19] on most aspects of its planned accessibility policies with the exception of WMD securement on buses, it is also clear that having accessibility features automated (rather than relying on staff behavior) helps (for example, compare audio announcement rate on bus versus rapid transit).

[19]On many features, recent data from FY 2022 shows a slight dip from performance in earlier years. The Assistant General Manager of the SWA said she believes this is due to the pandemic, when monitoring was suspended and some procedures changed due to social distancing, a time when operators lost habits around accessibility policies, ("Interview with SWA Staff," 2023).

Chapter 5

Findings: STIB-MIVB, Brussels

The first section of this chapter will present findings on the formal legal and regulatory context relevant to accessibility for the STIB-MIVB in Brussels. The section section presents the internal accessibility policies and planning within STIB-MIVB. Both of these sections are based in data gathered from document analysis and semi-structured interviews with experts. The third section will present findings on real-life accessibility based on data collected during participant observation with testers with disabilities. This section will be presented in narrative form, with short summary narratives of three trips testers. A final section will summarize the real-life findings from the participant observation, including testing trips not presented in the narratives.

5.1 Accessibility by law: Regulatory and governance context

Although there is no single comprehensive law comporable to the A.D.A in the US, in the Belgian context, there are a number of laws and regulations at the (international), European, national, and regional level that govern different aspects of accessibility on public transportation in Brussels. This section will look at a number of these regulations identified by expert interviewees as most relevant for Brussels public transportation accessibility.

5.1.1 International law

The United Nations Convention on the Rights of Persons with Disabilities (CRPD) has been ratified both by the country of Belgium (2009) and the entire European Union as an institution (2010) ("Signatories - CRPD," 2008). This international human rights treaty requires aims to promote "full and equal enjoyment of all hu-

man rights and fundamental freedoms," ("CRPD," 2008, Article 1) of people with disabilities, through removing barriers and discriminatory attitudes. The treaty requires state parties to "facilitat[e] the personal mobility of persons with disabilities in the manner and at the time of their choice, and at affordable cost," ("CRPD," 2008, Article 20). State parties are also required by the convention to remove barriers from "buildings, roads, transportation and other indoor and outdoor facilities," and implementing minimum standards for accessibility of public facilities ("CRPD," 2008, Article 9). Although being a party to this international human rights convention does require Belgium (and the entire EU) to take action to ensure that disabled people have access to public transportation, as is the case with most international human rights conventions, there is no real means to enforce this convention, and hold state parties effectively accountable when they fail to live up to these requirements ("Cabinet Member of European Commissioner for Equality Interview," 2022, "CAWaB Accessible Mobility Chargé Interview," 2022).

However, despite its lack of direct enforceability, the CRPD can function as a guiding principle for European national or regional laws, such as the European Accessibility Act (discussed more below). It can also serve as a guiding principle for organizations, For instance, the STIB-MIVB accessibility manager said that the STIB-MIVB has adopted the general principles of the CRPD into their contract of public service with the city of Brussels since 2013, though, he emphasized, this was done on a voluntary basis ("STIB Accessibility Manager Interview," 2022).

5.1.2 Federal law: anti-discrimination

There are a number of national (federal) Belgian legal documents with bearing on disability through the lens of anti-discrimination, though none is an exact analogue to the US Americans with Disabilities Act (ADA). The main relevant law here is the Anti-Discrimination Law of 2007, which replaced the similar Anti-Discrimination law of 2003, (UNIA, n.d.).[1] This anti-discrimination law applies in a number of different situations including, relevantly, the provision of goods and services available to the public ("Loi tendant à lutter contre certaines formes de discrimination," 2007, UNIA, 2017). That being said, with regards to transposition of this national laws into regional regulation, UNIA, the public interfederal anti-discrimination organization in Belgium, reported in 2017 that in the Brussels region, " there is still no legislation prohibiting discrimination in goods and services such as transport, businesses, etc." (UNIA, 2017, p. 3).

The Belgian federal anti-discrimination law includes "indirect discrimination", defined as when "neutral provision, criterion or practice is likely to entail, in relation

[1]This anti-discrimination law arose from the transposition of European directive EU Directive 2000/78/EC,which prohibits discrimination on the basis of disability, and requires reasonable accommodation for disabled people ("Council Directive 2000/78/EC of 27 November 2000 Establishing a General Framework for Equal Treatment in Employment and Occupation," 2000). However, this national law goes beyond the scope of the European directive, which applies only to the realm of employment.

to other persons, a particular disadvantage for persons characterized by one of the criteria protected," [translation from French] ("Loi tendant à lutter contre certaines formes de discrimination," 2007, p. 29017). This law also defines reasonable accommodation as appropriate measures in the applicable circumstances that allow disabled people to participate, unless it creates an disproportionate burden, ("Loi tendant à lutter contre certaines formes de discrimination," 2007, p. 29017). While this law does not specifically addressing public transportation, these two aspects (indirect discrimination and reasonable accommodation) could imply public transportation operators have a positive duty to make their service accessible to people with disabilities. Unlike the US ADA, this law doesn't have explicit provisions specifying public transportation as space where disability discrimination can take place; rather, most of the specific details of this law focus on employment discrimination.

In addition to the 2007 anti-discrimination law, at the national level, the right to inclusion in society for people with disabilities, including through reasonable accommodation, has recently been added to the Belgian constitution through a 2021 amendment, (Forum, 2021).[2]

5.1.3 European Regulations

There number of other European-level regulations, which must be transposed into national law in Belgium, which have implications for the design of public transportation facilities in Belgium. According to an interview with a cabinet member of the European Commissioner for Equality, more recent European regulations relating to accessibility have mostly been done on the basis of the single market function of the EU, rather than through anti-discrimination legislation,[3] ("Cabinet Member of European Commissioner for Equality Interview," 2022). Nonetheless, the existing regulations at the European level leave a number of major gaps when it comes to regulating accessibility on local urban/suburban public transportation, as will be discussed more below.

Standardization of technical requirements for buses and coaches are one such type of single-market regulation at the European level, and these specifications include minimum technical design requirements to accommodate passengers with reduced mobility. "Regulation (EC) No 661/2009" (2019) gives requirements for design of large buses, including accommodating "people with reduced mobility". The technical specifications to meet accessibility as required by this regulation come from

[2] Article 22ter of the Belgian constituion now reads: "Every person with a disability has the right to full inclusion in society, including the right to reasonable accommodation. The law, federate law or rule referred to in Article 134 guarantees the protection of this right," ("Belgian Constitution (Amended 2021)," 2021, p. 11)

[3] The interviewee said this is because some conservative member states oppose expanding equality and anti-discrimination legislation, which would have to be approved through a vote of unanimity and thus could be blocked by individual member states. In contrast, legislation enacted on the basis of single market standardization can be enacted through qualified majority rather than unanimity, giving a clearer path forward for enacting new accessibility legislation

"Regulation No 107 of UNECE" (2017)[4]. Requirements related to accessibility for passengers with reduced mobility include: space for wheelchairs and prams, at least one low-floor entrance, priority seating, ramps or lifts. It also gives specifications for wheelchair restraint systems in forward-facing wheelchair areas, clarifies that vehicles that don't require passenger restraints may have backwards-facing wheelchair areas without restraints, following certain specifications, and gives other specifications for kneeling, ramp design, and lifts, amongst other topics ("Regulation No 107 of UNECE," 2017) However, these requirements do not specifically deal with accommodations for passengers with sensory disabilities (blind and low vision, Deaf or hard of hearing etc).

European Passenger Rights regulations have implications for passengers with disabilities on mass transportation, including short-distance buses that would used in public transportation. On buses and coaches, operators are prohibited from discriminating against passengers on the basis of disability and from charging higher fares to disabled passengers. The regulation also explains that operators can only deny boarding to a disabled person in the case that it would be unsafe for them to do so, and requires reimbursement in that case. It also gives a requirement that operators provide assistance to persons with reduced mobility – provided the passenger gives 36 hours notice ("Regulation (EU) No 181/2011," 2011). There is also European Passenger Rights regulation for trains, also requiring nondiscrimination and assistance with advanced warning("Regulation (EC) No 1371/2007," 2007); however, this legislation specifically applies to long-distance trains; in fact, the category of trains the regulation applies to specifically excludes urban and suburban trains ("Directive 2012/34/EU," 2012), meaning this regulation does not have any real effect on public transportation light or heavy rail such as trams, metros, or suburban rail.

Finally, the European Accessibility Act has some provisions relating to public transportation. This is a relatively recent European directive passed in 2019, and still coming into force. The law was required to be transposed by member states by summer 2022, and will be applied starting in summer 2025 ("European Accessibility Act," 2019). Although the Act comes out of the EU's obligtations under the UN CRPD and references those obligations, it is structured as a single-market harmonization directive for the reasons discussed above.

Despite its ambitious name, the scope of the European Accessibility Act is quite limited. According to the European Commission expert interviewed, the scope of the proposed Act was initially very broad, including fields like transportation, but subsequently the scope was narrowed significantly ("Cabinet Member of European Commissioner for Equality Interview," 2022). The current Act is very focused on accessibility of digital products such as software, apps, and website, and not on the built environment. With regards to public transportation, interviewees noted that while this act will impact digital interfaces such as STIB-MIVB app and ticket vending machines, it will not have any impact on accessibility of public transportation

[4]A UN technical standard that is obligatory in the European Union ("Road Travel Policies," 2020)

infrastructure or rolling stock ("Cabinet Member of European Commissioner for Equality Interview," 2022, "STIB Accessibility Manager Interview," 2022). Experts interviewed, both from the STIB-MIVB and the European Commission, expressed frustration with the limited scope of the European Disability Act's impact. The Cabinet member of the European Commissioner for equality noted that "you could have a situation where one of these ticketing machines or banking machines is in an inaccessible location, and the legislation unfortunately will not prohibit that, ("Cabinet Member of European Commissioner for Equality Interview," 2022). The STIB-MIVB Accessibility manager also expressed doubt, not only on the scope of the law but also the commitment to enforcement: "It's going to be good intentions. Whereas the ADA, if it's not applied, there's a lawsuit, there's a complaint to the court, and it costs money quickly. Here the European Disability Act will be a fiddle, " ("STIB Accessibility Manager Interview," 2022).

5.1.4 Brussels regional urban planning regulation

The regional urban planning regulations (RRU in French) of the Brussels-Capital Region ("STIB Accessibility Manager Interview," 2022) includes a specific section on accessibility for new construction and substantial renovations of buildings serving the public.[5] The RRU focuses specifically on wheelchair users, and is specific to public buildings design, parking garages, and elevators,[6]("Règlement Régional d'Urbanisme Bruxelles Titre IV," 2006). The street design section of the RRU also includes elements relevant to transportation accessibility. Though not focused specifically on accessibility for people with disabilities like the building design regulation, it requires some accessibility features such as sidewalks 1.5 meters in width for wheelchair users, curb-cut ramps for street crossings, and podotactile markings in front of street furniture obstacles that don't reach the ground (such as raised utility boxes). The regulation also encourages, though doesn't require, the use of guiding tactile tiles to indicate street crossing paths. Additionally, STIB-MIVB bus and tram stops are required to have a ramp with an appropriate slope for people with reduced mobility to acccess the stop, and bus stops should be indicated by tactile tiles for blind/low vision riders. These requirements are accompanied by photos demonstrating compliant and non-compliant examples ("Règlement Régional d'Urbanisme Bruxelles Titre VII," 2006)

Overall, this regional planning regulation has implications for public transportation stations as public buildings, as well as some features of bus and tram stops as part of the public streetway. However, necessariy accessibility features such as design of rolling stock and compatibility between rolling stock and boarding platforms are not

[5]Derived out of transposition of the Belgian Federal Building Access Law of 1975 ("Loi relative a l'acces des handicapes aux batiments du 1975," 1975, "STIB Accessibility Manager Interview," 2022).

[6]The design requirements in the regulation include accessible design for building entrances and ramps, turning radius in corridors and entrances to internal doors, bathrooms, and elevators, among other things

covered in the RUR, ("STIB Accessibility Manager Interview," 2022).

5.1.5 Regional public transportation contracts and documents: Contrat de service public

According to interviewees both inside and outside of the STIB-MIVB, the most significant document that governs the accessibility standards the STIB-MIVB must apply is the *Contrat de service public* – the public service contract betweeen the STIB-MIVB transportation company and Bruxelles Mobilité, the regional government agency that oversees mobility and transportation. As a "public interest organization" or quasi-public agency, the STIB-MIVB receives contracts from Bruxelles Mobilité for a period of approximately five years, where the regional government agrees to fund the STIB-MIVB under the conditions laid out in the contract ("STIB Accessibility Manager Interview," 2022).

The STIB-MIVB has created in 2018 an internal ten-year "Strategic implementation plan for accessibility of the STIB-MIVB network", which gives concrete guidance to accessibility requirements in the 2018-2023 and 2024-2029 public service contracts for the STIB-MIVB. This document in itself is not binding, but is meant to provide guidance for the more binding public service contracts' accessibility requirements.

The STIB-MIVB's strategic plan approaches accessibility from a universal perspective, stating that:

> We are all susceptible to encounter difficulties in moving, temporarily or permanently... in the Brussels-Capital Region, more than 30% of the population is considered to be Persons with Reduced Mobility (PMR) and this figure is set to increase sharply in the decades to come, particularly in parallel with the aging of the population." (translation from French) (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018, p. 4).

This focus on universal accessibility that does not just focus on disabled customers was echoed by the STIB-MIVB Accessiblity coordinator, who said that the STIB-MIVB is very careful to not allocate money exclusively for disabled customers or other specific groups: "accessibility, it benefits all customers...we're doing accessibility; it's for everyone...I think it's also important in terms of non-discrimination, to say. The money that we invest is for everyone, so also for people with disabilities," ("STIB Accessibility Manager Interview," 2022).

The STIB-MIVB's strategic plan for accessibility 2020-2030 covers many different accessibility actions, though it does not give specific deadlines by which these should be accomplished. Broadly, its areas of focus are information access, physical accessibility to the network, and receiving occasional help, (*Plan stratégique de mise en*

accessibilité du réseau de la STIB, 2018, p. 7). The strategic plan is also clear that autonomous accessibility is the system's ultimate goal, which it says they do not believe they can within 10 year scope of the strategic plan. Nonetheless, the plan says the STIB-MIVB would aim to achieve 100 % autonomous this within a 30 year deadline, and that modification of infrastructure and vehicles is the largest barrier to this goal (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018). Amongst the specific goals laid out in the strategic plan, a few notable ones stand out (not a comprehensive list):

- Informational goals: harmonizing data about stop accessibility and making it available to end-users (Accessibus/Accessitram ratings, escalator/elevator uptime information, harmonizating informational signs, etc.)
- Developing training for STIB-MIVB staff, including initial trainings and continued learning for existing staff
- Identifying gaps in European standards and developing a document of best practices internally, using research on international standards and best practices
- Creating a physical accessibility plan for existing stops in addition to vehicles
- Improving process for elevator and escalator maintenance, including preventative maintenance
- Finding low-cost investments to improve gaps - including assessing availability of bridgeplates in the metro and developing a system of testing functioning of ramps before buses leave the depot
- Better monitoring of construction projects, making sure plans are followed through (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018)

The strategic plan also called for a changed governance structure for accessibility, and in 2020 the STIB-MIVB established an accessibility task force which includes the CAWaB (Le Collectif Accessibilité Wallonie Bruxelles), STIB-MIVB, and Bruxelles-Mobilité (*Suivi du Contrat de service public: Rapport 2020*, 2020, "CAWaB Accessible Mobility Chargé Interview," 2022, "STIB Accessibility Manager Interview," 2022). Additionally to task force meetings, the CAWaB will also consult with the STIB-MIVB on the ground during construction projects or during vehicle acquisition processes, in order to make sure accessibility designs are carried through properly ("STIB Accessibility Manager Interview," 2022, "CAWaB Accessible Mobility Chargé Interview," 2022).

Contrats de service are a critical opportunity to require accessibility improvements at the STIB-MIVB. Interviewees, both in the STIB-MIVB and in the CAWaB, see these contracts as an opportunity to push for more ambitious accessibility goals, which the chargé for accessible mobility at the CAWaB describes as more ambitious than existing regulatory rules at the European or regional level ("CAWaB

Accessible Mobility Chargé Interview," 2022). For instance, the STIB-MIVB Accessibility Manager told me in 2013 that included adding a provision in the *Contrat de service public* affirming that the STIB-MIVB adopts the general principles of the UN CRPD. He noted, though, unlike the MBTA's obligations to comply with the Americans with Disabilities Act, this alignment with the CRPD is done by the STIB-MIVB on a voluntary basis ("STIB Accessibility Manager Interview," 2022). Nonetheless, these short public service contracts are an opportunity to requiring specific accessibility improvements, which the agency must show progress on. The CAWaB chargé did caution, though, that ultimately the contrat de service is a political agreement and "It depends on the ambition of the government in place. So the contrat de service public is always a negotiation with the budget, etcetera. If the future government doesn't want to make that a priority...that's the problem of the level of this ambition," ("CAWaB Accessible Mobility Chargé Interview," 2022).

5.2 Accessibility by design: infrastructure, rolling stock, and institutional policy

The STIB public transportation network consists of 4 metro lines, 17 tram lines, and 54 bus routes ("STIB-MIVB Dynamic Map," n.d.). Some trams also run"premetro" in some sections, where trams are boarded from metro-like stations with low tram-height platforms; these same trams run as regular street-level trams in other sections. The level of accessibility for people with different types of disabilities varies significantly between these different modes, from mostly accessible (bus) to mostly inaccessible (tram) for WMD users.

5.2.1 Station and stop accessibility

There are three general categories of stops or stations:

- **Bus stops**, generally boarding from a sidewalk onto the vehicle.
- **Rapid transit platforms inside of dedicated stations** - metro and premetro
- **Surface-level tram stops** on the street or dedicated tramways

The accessibility features of these different types of stops are explained in Table 5.1.

(a) An accessible fare gate at de Brouckère metro station

(b) Tester AS waits in a locked fare gate for employee assistance

Figure 5.1: Accessible fare gates in metro and pre-metro stations

Mode	For WMD users/mobility impairment	For blind/visual impairment
Bus	• "Accessibus" rating level indicates accessibility level for WMD user (see Figure 5.2) • Accessibus blue: autonomously accessible. Minimum 150 cm maneuvering space at the stop, and a maximum 10% slope of the ramp • Accessibus orange: accessible with assistance. Minimum 75 cm maneuvering space at the stop and a maximum of 30% slope of the ramp (*STIB Guide PMR*, 2020) • Stops with no Accessibus logo do not meet either criteria	• Some stops have podotactile slab (dalle tactile) – indicates where blind riders stand to be positioned in front of the front door of the bus • These stops must also be accompanied by a "stop" line on the pavement to indicate where the vehicle should stop to align with the tactile slab. • Not all bus stops have these podotactile features
Metro and Premetro	• Elevators (lifts) in many stations, but not all, especially premetro (see Table 5.2) • In larger stations, lifts between different levels may be placed far apart • Accessible fare gate in station (airlock style)[7] • **Metro:** High platforms (level with vehicle) • **Premetro:** Slightly raised low-height platforms (level with low-floor tram)	• Podotactile guiding lines and braille plates in some station buildings (Figure 5.5) • Podotactile warnings on edge of platform • Visual announcements on platform • No audio announcements on station platforms
Above-ground tram	• Four tram lines considered partially accessible (3, 4, 9, 7) ("STIB-MIVB Dynamic Map," n.d.) • On adapted stops: Slightly raised low-height platforms (level with low-floor tram) • Beginning to audit tram station accessibility: "accessitram" (only lines 7 and 9 so far) • Line 9 only: Rubber edge on some accessible platforms to reduce gap between platform and vehicle[8] (See Figure 5.6)	• Some adapted stations may have tactile slab, but not all

Table 5.1: Station/Stop accessibility features by mode

Figure 5.2: Accessibus symbols for bus stops

Rates of accessibility vary significantly between these different types of boarding locations. For station-based boarding, about one in four metro stations do not have lifts for all metro lines except line 5, for which one in seven stations do not have lifts (see 5.2). In contrast, premetro tram lines are significantly less accessible. Trams 3 and 4, which run premetro in the same set of stations between Gare du Nord and Albert, have almost half the stations without lifts, while on tram line 7, which runs premetro for four stations between Diamant and Boileau, three of the four stations do not have lifts.

	Total # no lift	**Total # stations**	**% no lifts**
Metro			
Line 1	5	21	24%
Line 5	4	28	14%
Line 2	5	19	26%
Line 6	6	26	23%
Premetro			
Line 3	5	11	45%
Line 4	5	11	45%
Line 7	3	4	75%

Table 5.2: Stations without lifts: metro and premetro

[7]Wheelchair-accessible fare gates are designed as a box with transparent plastic gates on either side, a bit like an airlock. The WMD user enters and taps their fare card, at which point the front gates open and allow them to exit (see Figure 5.1a). This can be done with a guide (*STIB Guide PMR*, 2020). However, these gates are designed to not function if they detect many passengers trying to pass through the box with one swipe to combat fare evasion, and if this is detected, the front gate will stay shut and the fare reader not work until a metro employee resets the gate, which happened during the testing trip with wheelchair user AS (see Figure 5.1). Tester AS noted this also happens when he travels with a large backpack on the back of his wheelchair.

[8]Pilot project with CAWaB on line 9, will be expanded to at-level platforms on other lines ("STIB Activity Report 2021," 2021)

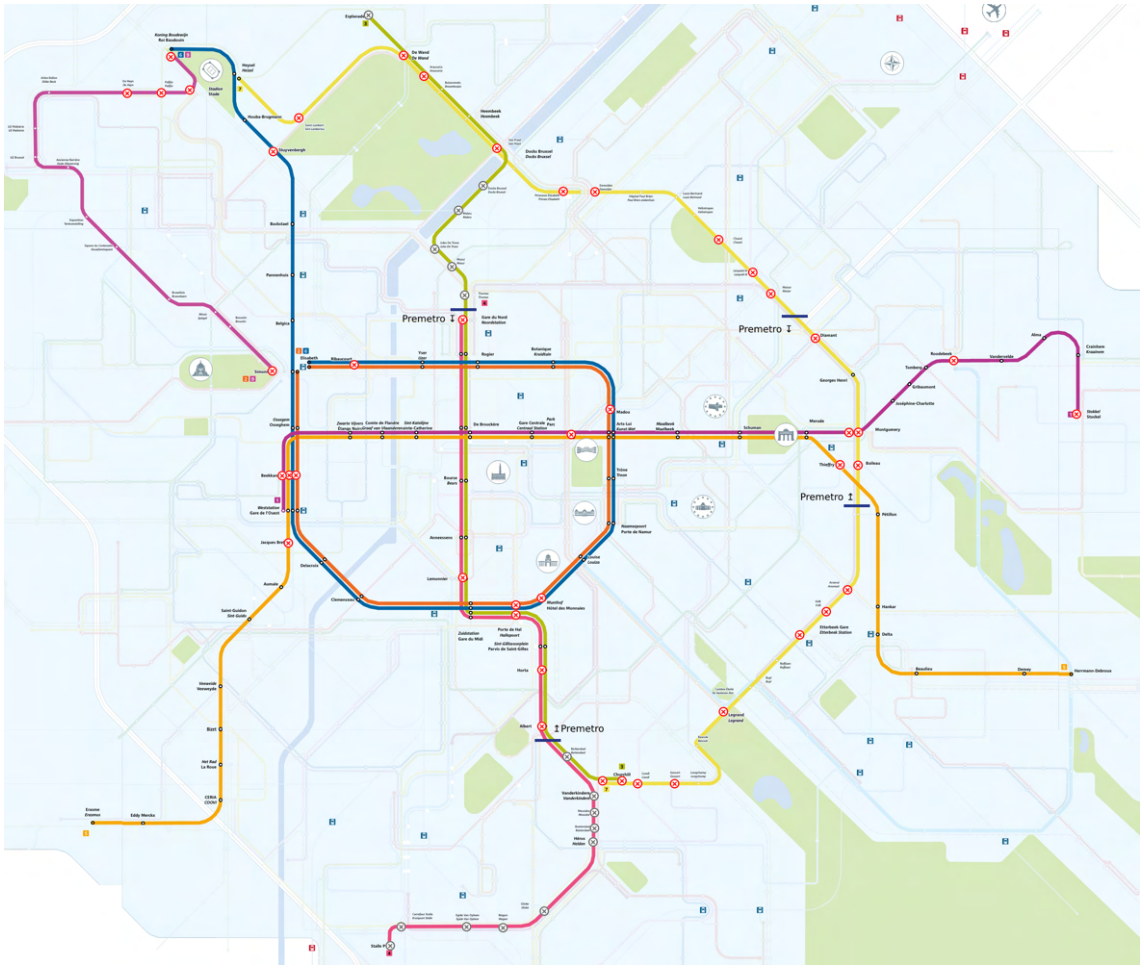


Figure 5.3: Map of WMD accessible metro stops, and and tram stops on "accessible lines".

Image adapted from the "STIB-MIVB Dynamic Map" (n.d.).

⊗ WMD inaccessible stop.[9]

⊗ Aboveground tram stop - accessibility status unknown.

Metro line 1

Metro line 5

Metro line 2

Metro line 6

Tram line 3

Tram line 4

Tram line 7

Tram line 9

[9]For metro and premetro stations, this is based on the absence of lifts. For above-ground trams on "accessitram" rated lines, this is based on "accessitram rating". Grey stops on above-ground trams appear to not yet have received "accessitram" ratings, so their status is unknown. Based on information from the "STIB-MIVB App" (n.d.), "STIB-MIVB Dynamic Map" (n.d.) "STIB Map PRM 2021" (2021). In some cases, however, these three sources disagreed on the accessibility level, particularly of premetro and tram stops.

(a) Metal podotactile markings at the bottom of a staircase, Arts-Loi.

(b) Plastic podotactile markings at the bottom of a staircase, Arts-Loi

Figure 5.4: Podotactile markings in Arts-Loi metro station

(a) Podotactile guiding lines, Gare Centrale

(b) Tester IT reading orientational braille plates at Gare du Midi

Figure 5.5: Guiding references in metro stations

The tram network in Brussels is currently highly inaccessible for WMD users. Of the 17 tram lines, only four lines are currently considered accessible. While the STIB-MIVB has completed an inventory of accessible bus stops rated with the Accessibus system, this process is only beginning with tram lines, so it is more difficult to know the overall accessibility of tram stops across the network outside of the premetro. The STIB-MIVB strategic plan for accessibility identifies modification of station and stop infrastructure as the biggest barrier to the system's goal to reach 100% autonomous accessibility across the network (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018).

(a) Rubber material is attached to the edge of the tram platform (UZ Brussel)

(b) The rubber material significantly reduces the gap between the tram and the platform (Square du Centenaire)

Figure 5.6: New rubber bridging material to reduce gaps on boarding-level tram platforms

5.2.2 Vehicle Design

While all STIB-MIVB bus and metro vehicles should be accessible from accessible platforms, some STIB-MIVB tram lines use inaccessible older, high-floor vehicles in the tram network, contributing to inaccessibility in this mode. The accessibility features (or lack thereof) for each mode of vehicle is described in Table 5.3. Meanwhile, the accessibility features of vehicles by mode for those with sensory impairments is described in Table 5.4.

Mode	Platform - Vehicle Connection	Onboard Vehicle
Bus	• Low-floor • Can kneel • Ramp at rear door • Blue button to request ramp by rear door • Ramp automatically deployed by the operator (from under the bus) • Doors close while ramp deploys to prevent passengers from boarding	• WMD and stroller area in front of rear door (see Figure 5.7 • Chairs in area fold up • Backwards-facing WMD space • No WMD securements • Handrails on either side of backwards-facing spot to hold onto
Metro	• All stations high-platform; vehicle door level with platform • Some platforms may have a significant verticle/horizontal gap • Older style metro trains feature manual pull-handles to open the doors, while newer trains feature push buttons to open doors	• Designated WMD space in newer vehicles in front of first and last door • Older trains do not have designated space
Tram	• Vehicles a mix of high-floor and low-floor. • Most lines run only low-floor • High-floor trams with steps (see Figure 5.9) on line (39, 44, 51, 81, 97), partially on one line (93) • Premetro stations low platform approximately level with low-floor cars • Accessible stops low (slightly raised) platform approximately level with low-floor cars • Some level-boarding platforms/stops may have a significant verticle/horizontal gap • Pilot project: movable ramps available in WMD area inside newer trams to bridge gap; must be deployed by a companion	• Designated WMD space in newer “3000” and “4000”-series trams in front of second door • No designated WMD space in older “2000” series low-flor trams (and high-floor trams)

Table 5.3: Vehicle accessibility features: WMD users

Mode	External - at station/stop	Internal - on board
Bus	• Visual electronic marquee on front and side of bus announcing bus number and destination • External speakers (in theory) can play automated announcements of bus number and destination	• Blind riders should board from front door • Blind riders asked to sit in front to be near driver • Automated visual stop announcements • Automated audio stop announcements • Request stop using button - makes audio sound and visual lights on door
Metro	• On platform, visual signs show upcoming trains • No external audio announcements on platform or vehicle • Older generation trains also have a large gap in between cars, while newer generation trains feature continuous cars with no gap.	• On newer trains, automated visual stop announcements • On newer trains, automated audio stop announcements • Older trains do not have audio stop announcements • Older trains have PA for emergency announcements, but do not announce stops
Tram	• Premetro stops and some street-level stops: visual train times on platform • No audio announcements on station platforms • External speakers on newer trams (in theory) can announce tram number and destination	• Blind riders asked to sit in first car to be near the operator (*STIB Guide PMR*, 2020) • Newer trams have automated visual stop announcements on video screens • Newer trams have automated audio stop announcements • Some older trams have automated audio stop announcements, but not all (*STIB Guide PMR*, 2020) • Request stop using button - makes audio sound and visual lights on door

Table 5.4: Vehicle accessibility features: sensory impairments

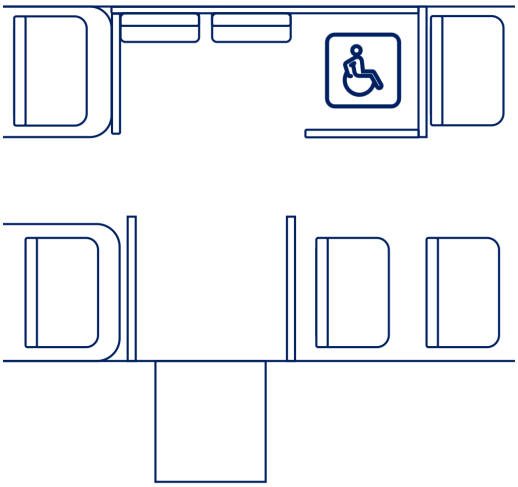


Figure 5.7: Layout of STIB-MIVB bus priority seating area

(a) AS boarding Metro 1 at De Brouckère

(b) AS boarding Tram 3 (premetro) at Rogier

Figure 5.8: Boarding: gap between platform and train

Figure 5.9: Tram 81 uses old-style high-floor cars, which have narrow split doors and steps up into the tram car

Figure 5.10: Tester AS alights Tram 7 - Heysel at Docks Bruxsel. There is a gap but it is passable

5.2.3 Policies

I did not have access to STIB-MIVB accessibility policies for operators, so less is known in this area. However, accessibility training was identified in the STIB-MIVB accessibility strategic plan as an area that needs to be developed (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018),

5.3 Real-life accessibility: monitoring trips narratives

During my on-the-ground fieldwork in Brussels, I accompanied six volunteer testers with disabilities on monitoring trips to observe on-the-ground accessibility on the STIB-MIVB system.

Below, I present qualitative summaries of three trips that featured noteworthy details that are best explained in narrative form. Three other testing trips, with blind tester DG and wheelchair users AS and AD, are not presented as narratives here due to space limitations; however, the quantitative data from these trips are included in summary statistics at the conclusion of this section and in the discussion.

5.3.1 Trip narrative: FC

FC is a woman in her 50s-60s, who is blind and uses a white cane. FC also has an auditory impairment and uses a cochlear implant, which allows her to hear, but she has difficulty understanding speech at low volumes, especially if there is background noise. Her auditory impairment also impacts her balance.

We traveled with FC on five STIB-MIVB buses in the municipalities of Auderghem, Watermael-Boitsfort, and Ixelles in southeastern Brussels, and observed eight other buses.

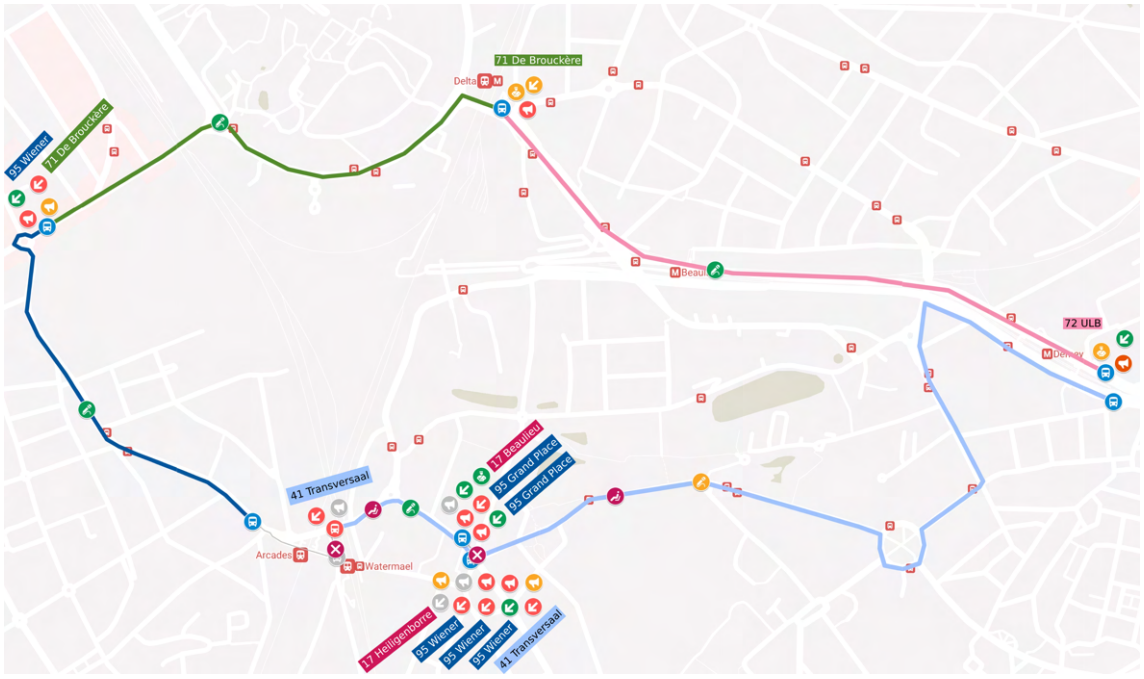


Figure 5.11: Map of trips conducted with tester FC, showing accessibility features and barriers encountered.

- "Blue Accessibus" stop
- "Orange Accessibus" stop
- Non-Accessibus stop
- Stopped at stopline (bus)
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- Path of travel obstacle
- Passengers will not give seat
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

Accessibility features and barriers

Almost all stops we visited were adapted with tactile slabs which FC stood on to wait for the bus. However, we encountered a number of barriers that made it difficult for FC to successfully board the correct bus. The most common issues were lack of external audio announcements on the outside of the buses, and buses not pulling correctly to the stop line on the pavement to align the bus with the tactile slab. If there is no stop announcement, FC asks the operator the bus number, but if the bus is not at the stop line, she has trouble finding the door. If the operator yells out to her from a distance, FC is not able to hear them because of her auditory impairment. Figure 5.13 shows why correctly pulling to the stop line allows FC to easily access the bus, while Figure 5.12 shows a typical example of the problems caused by not pulling to the stop line.

The bus operator did not pull up to the stop line; tried to get FC's attention by waving his hands and yelling, which she could not see or hear.

Eventually, the operator pulled up to the line and FC boarded

Figure 5.12: Not pulling to stop line at Keym. FC attempting to board Bus 71 De Brouckère at Delta bus stop

Figure 5.13: Correctly pulling to the stop line. FC is able to easily speak with the bus operator, because the front door is positioned in front of the tactile slab.

	External audio?	Pulled to stop line?	Internal audio?
Yes	0	5	4
No	7	7	0
Partial	3 (low volume)	0	1 (audible but incorrect)
Total observed	10	12	5

Table 5.5: Accessibility features observed - FC Trip

While almost all internal stop announcements worked, no buses observed had easily hearable external announcements, and most had none at all. Some buses pulled to the stop line; however, the majority did not. In no case was this because of visible obstructions.

Buses often move before FC has a chance to find a seat. FC's visual impairment combined with the fact that her hearing impairment affects her balance makes this an unsafe situation, where she is at risk of falling.

We also encountered a number of barriers during the path of travel from one stop to another on the public sidewalk (See Figure 5.14).

Construction equipment blocked the pathway to a deviated stop at Watermael Gare

Tactile guiding lines at the Keym street crossing lead FC directly into a potted palm tree

Figure 5.14: Path of travel barriers on the public sidewalk.

5.3.2 Trip narrative: IT

IT is a man in his 20s-30s, who is blind and uses a white cane. As a young person who works in tech, IT navigates the STIB-MIVB system in a very different manner than FC in his daily life. IT makes extensive use of apps on his smartphone in order to navigate the buses, trams, and metros of the STIB-MIVB.[10] IT and I traveled on one metro, two buses, and one tram, traveling from the Pentagon through Ixelles and Saint-Gilles.

Figure 5.15: Map of trips conducted with tester IT, showing accessibility features and barriers encountered.

- "Blue Accessibus" stop
- "Orange Accessibus" stop
- Non-Accessibus stop
- Metro
- Tram
- Stopped at stopline (bus)
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- Path of travel obstacle
- Passengers will not give up seat
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

[10] The other young 20-30s blind tester, DG also made heavy use of these apps.

When IT goes to a stop to wait for a bus, tram, or metro, he uses the STIB-MIVB app with a screen reader. The STIB-MIVB app will show which stops are nearby, how many meters away they are, and which buses will arrive in how many minutes. By playing checking the app using the screen reader, IT can usually determine if he's waiting at the right bus stop (for instance, in an area with multiple stops where different buses stop at different stops). When buses do not play external announcements, IT also uses the STIB-MIVB app to try to figure out whether the bus he hears arriving is the one he should board. By listening to the number of minutes until each bus arrives to the stop, he can often guess if the bus he hears arriving is the right one. IT also uses a third-party app called Moovit if he is on a vehicle without internal stop announcements to know his location (see Figure 5.16b).

Unlike FC, IT often does not always stand on the tactile slab at bus stops and boards from the rear door, because usually he does not need to ask the operator the bus number due to using the SIB-MIVB app. He also often sits in the folding seats by the rear door, which are directly in front of the back door.

(a) IT with the STIB app in front of bus 71. Because the 54 and 71 bus arrived at the same time, the app lists both buses as arriving "now". Without external audio announcements he is not sure which bus arrived in front.

(b) IT demonstrates the Moovit app. It reads the upcoming stops with time estimates.

Figure 5.16: IT demonstrating accessible transportation apps

Accessibility features and barriers

	External audio?	Pulled to stop line?	Internal audio?
Yes	1	4	2
No	3	2	0
Partial	3 (low volume)	0	0
Total observed	7	6	2

Table 5.6: Bus accessibility features observed - IT Trip

The most common type of barrier we observed on all modes of transportation during the testing trip was lack of audio announcements. On the old-style metro 5, IT relied on having memorized the order of the metro stops to know when to alight. The older high-floor Tram 81 was equipped with speakers for internal automated stop announcements; however, directly behind the motorperson's compartment the audio was difficult to hear, though we could hear faintly the stop announcements farther down the tram. IT tracked stops on the Moovit app; however, halfway through our trip on Tram 81, the Moovit app stopped functioning, and IT had to try to listen to ask other passengers to when he had reached his stop.

On buses, while internal automated stop announcements were consistent and audible, external audio announcements were almost never audible buses.[11] Lacking external audio, IT used the STIB-MIVB app to check which bus was arriving. However, during our testing trip, at the Trône bus stop, a 71 Delta bus approached followed directly by a 54 Forest bus. Because the STIB-MIVB app listed both of the buses as arriving "now", IT incorrectly assumed the 54 Forest bus, was the 71 Delta bus (see Figure 5.16a).

Buses observed on the trip with IT did pull to the stop line more frequently than on the trip with FC.

Path of travel

In addition to auditory barriers on the STIB-MIVB rolling stock, we also observed a number of path of travel barriers between STIB-MIVB stops. At Place Flagey, IT

[11] The lack of external stop announcements is a major source of frustration for IT. He said that he had been very excited when the STIB-MIVB first announced that buses would have external announcements and was involved in the communications about the change, but now feels disillusioned by the process, because the external audio so rarely works.

showed me a clear example of how these barriers in the public space make navigating public transportation difficult for blind people in Brussels. We arrived on Bus 71, which arrives near the west edge of the plaza (see Figure 5.18). IT asked me to guide him to the Bus 59 bus stop, which was located on the far side of Place Flagey, so he could try to find his way back to the bus and tram stop on his own. As a sighted person, I guided IT directly across the center of the plaza to the crosswalk and then to the bus stop. However, IT explained to me that for a blind person, on an open plaza without any tactile pathway markings, he would need to navigate along the edge of the plaza in order to feel the street edge and curb with the white cane (see Figure 5.17a). Unfortunately, at Flagey extraneous features like micromobility parking and trash bins are pushed to the edges of the plaza. Navigating back autonomously along the edge of the plaza from the Bus 59 stop to the tram and bus stop on the western size, IT encountered at least 7 physical barriers placed on the border of the plaza he needed to navigate around (see Figure 5.18). We encountered similar barriers at other transportation hubs, such as Gare de Midi (Figure 5.17b).

(a) IT demonstrates navigating Place Flagey by following the edge of the plaza and the street

(b) Dockless scooter parking at Gare du Midi is placed along the edge of the plaza, directly in the path IT was following with the white cane to the crosswalk.

Figure 5.17: Path of travel through the public space - navigation and challenges

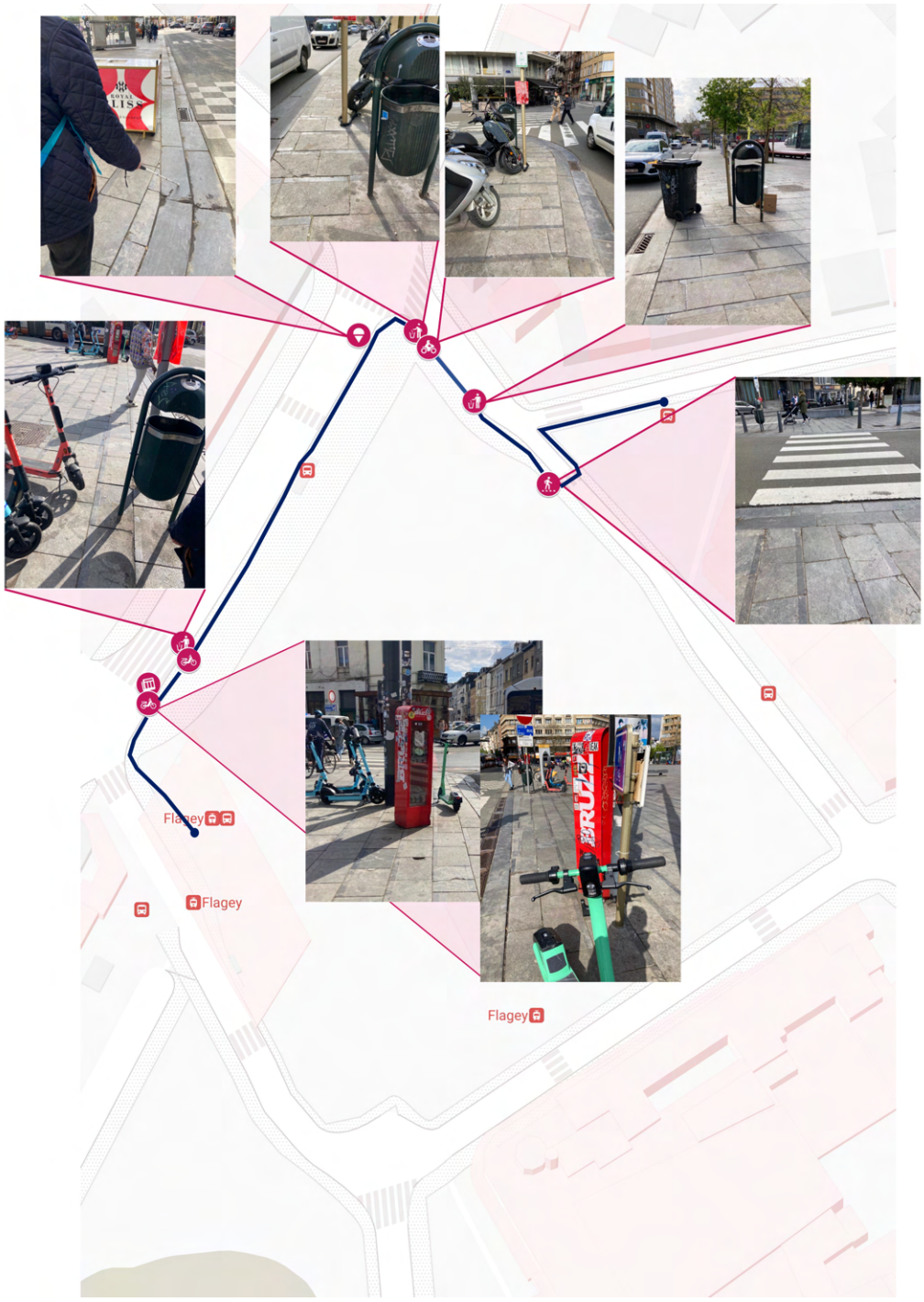


Figure 5.18: Path of travel barriers - Bus 59 to Tram 81 in Flagey

- Crosswalk without tactile strips
- Motorcycles
- Dockless rental scooters
- Trash bin
- Foodcart
- Newspaper box

5.3.3 Trip narrative: CC

CC is a woman in her 30s-40s with cerebal palsy who uses an electric wheelchair. She also has an assistance dog, who accompanied her for our testing trip. We traveled with CC on five buses through Schaerbeek, Brussels city center, Ixelles, Etterbeek, and Saint-Josse-ten-Noode.

At bus stops, CC boards from the back door, where the wheelchair ramp is located.

Figure 5.19: Wheelchair spot on bus is too small for CC's wheelchair.

Figure 5.20: Map of trips conducted with tester CC, showing accessibility features and barriers encountered.

- "Blue Accessibus" stop
- "Orange Accessibus" stop
- Non-Accessibus stop
- Ramp (boarding)
- Ramp (alighting)
- Kneel (bus)
- Close enough to curb (bus)
- Stopped at stopline (bus)
- External audio (bus)
- Internal audio
- Helpful operator (bus)
- Path of travel obstacle
- (Red symbol) incorrect feature
- (Orange symbol) partially correct feature
- (Green symbol) correct feature

Accessibility features and barriers

	External audio?	Pulled to stop line?	Close enough to curb?	Kneel bus? (board)	Ramp? (board)	Internal audio?	Kneel bus? (alight)	Ramp (alight)
Yes	0	1	4	3	4	4	2	5
No	4	1	1	1	0	1	2	0
Partial	1	1	0	1	1	0	1	0
Total observed	5	3	5	5	5	5	5	5

Table 5.7: Bus accessibility features observed - CC Trip

Ramps and kneeling: While the ramp worked on all buses we rode, on the 71 Delta bus from Gare Centrale, the operator initially told CC that the ramp wasn't working. After we continued to wait there for several minutes, he finally told her the ramp had started working and deployed it. While most operators kneeled the bus when CC boarded and alighted, a few operators neglected to do so. In one case, this created a dangerous situation. When alighting from bus 60-Ambiorix at Étangs, the operator did not kneel the bus, causing the ramp to be positioned at a very steep angle to the sidewalk. When CC began backing down the narrow ramp, the steep incline caused her chair to rotate on an angle and a wheel fell off the ramp. CC had to ask our companion to assist her reach the curb; the operator did not attempt to assist.

Securement on moving bus: When CC boards the bus via the back door, she positions herself in the area marked for strollers, or facing forward partially in the wheelchair spot. Although there is a back-facing wheelchair spot with handrails (see Figure 5.7), CC never uses this space as designed. Because she uses a large sized electric wheelchair, it does not fit easily into the narrow spot (see Figure 5.19), and there is not a lot of room in the door/priority seating area to turn around to back into the spot. This was also an issue for tester AD, who uses a manual wheelchair with an electric wheel on the front. Additionally, CC says she cannot sit facing backwards on vehicles as is required by the wheelchair spot on the bus, because facing backwards on a moving vehicle gives her motion sickness. However, this can create safety risks during the journey. During our trip with CC, her wheelchair often rocked side to side, or moved on the floor despite being braked when the bus made sharp turns or stopped suddenly. CC needed to use her arms to stabilize herself in these situations against the handrails, which is not easy to do with a mobility impairment.

Audio announcements Similarly to other buses observed, while nearly all inter-

nal audio stop announcements worked, almost no bus had external audio announcements.

Path of travel barriers Path of travel barriers made navigating between several stops difficult. Particularly challenging was transferring between the 66 Gare Centrale stop and the boarding area for 71 Delta at Gare Centrale, due largely to construction works and scooters. These barriers are shown in Figure 5.21.

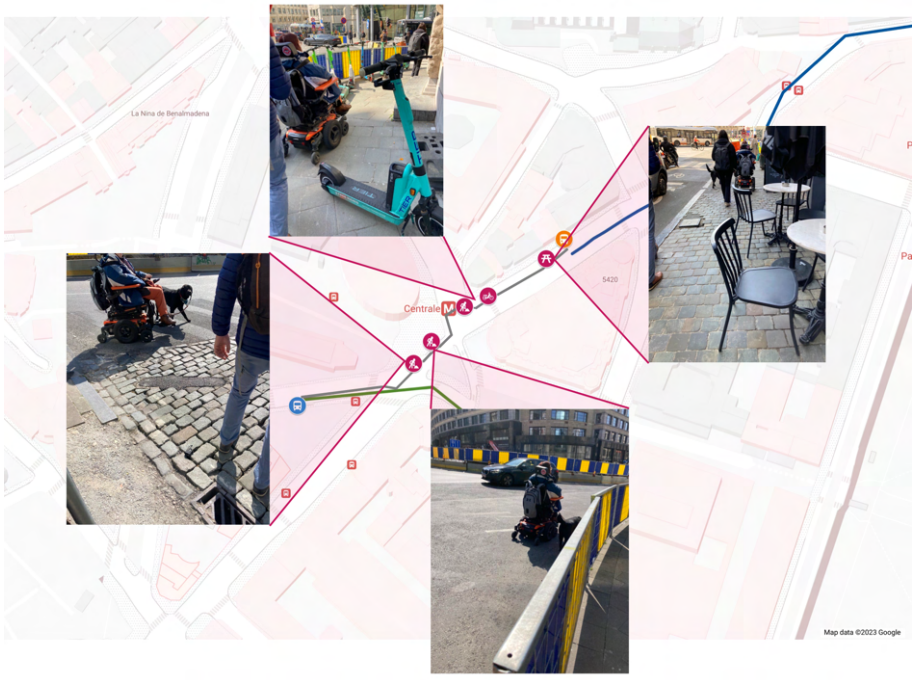


Figure 5.21: Path of travel barriers - Bus 66 to Bus 71 Gare Centrale

- Restaurant terrace - Construction works - Dockless rental scooters

Additionally, at the Houwaert bus stop while alighting bus 59, we found a major obstacle in the sidewalk at a "blue accessibus" stop. There are a line of bollards separating the sidewalk from the street, and initially when the operator stopped the bus and deployed the ramp, the ramp was placed directly in front of a bollard. After CC told the operator, he repositioned the bus in between two bollards. However, once CC backed down the ramp, she found herself surrounded by a restaurant terrace with a raised fake turf platform and plant pots. It was very difficult for CC to turn around and navigate in between the line of bollards to exit the bus stop (see Figure 5.22). Riding from Houwaert to Bossuet, CC had to drive in the street for part of the way, as the cobblestone sidewalk was to narrow for an electric wheelchair to pass.

Figure 5.22: Bollards, terrace, and potted plants in front of the Houwaert bus blocked CC's path of travel

5.4 STIB-MIVB: Summary of real-life data

Compared to the MBTA, STIB-MIVB accessibility policies generally minimize interactions between disabled riders and STIB-MIVB staff. Some of this is through truly autonomous accessibility design (such as adapted tram stops with low-floor trams), while in other cases, access is dependent on staff, but the staff and rider may not interact (for example, bus kneeling and ramp deployment from the rear door). This approach seems consistent with the STIB-MIVB's stated goal of eventually reaching 100% autonomous accessibility on the system (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018).

On metro and trams, most of the barriers for disabled riders are related to design features (infrastructure and rolling stop), especially given the relative lack of emphasis on staff assistance. However, on buses, much more of the accessibility of experience is related to staff behavior, whether directly (deploying ramp) or indirectly (checking functioning of audio and visual messaging systems before the bus leaves the depot). In some cases like missing external audio announcements on buses, it is hard to know whether an accessibility feature not working correctly is due to operator behavior (turning down the volume) or mechanical issues (malfunctioning speakers).

Data on bus accessibility features collected during testing trips are presented here, sorted by features primarily relevant for blind riders, and features relevant for WMD users.

	External audio?	**Internal audio?**	**Pulled to stop line?**
Yes	2	19	16
No	23	1	12
Partial	7 (low volume)	1	1
Total observed	32	21	29
% yes	6%	90%	55%
% no/part	94%	10%	45%

Table 5.8: STIB-MIVB bus accessibility features observed for blind users

	Close to curb?	**Kneel (board)?**[12]	**Kneel (alight)?**	**Ramp (board)?**	**Ramp (alight)?**
Yes	11	6	3	10	11
No	3	4	7	0	0
Partial	0	1	1	1	0
Total observed	14	11	11	11	11
% yes	79%	55%	27%	91%	100%
% no/part	21%	45%	73%	9%	0%

Table 5.9: STIB-MIVB bus accessibility features observed for WMD users

[12] According to the STIB-MIVB, internal systems show operators which stops where they are able to kneel the bus at or not ("STIB Activity Report 2021," 2021). This information is not

While sample size is small, these observations are enough to suggest some important trends showing. Bus accessibility procedures show quite a lot of variability in rates of compliance, from very high (providing ramp) to low (pulling to stop line and kneeling), to almost nonexistent (external audio). It would be valuable to expand this monitoring pilot in order to observe these factors more holistically using a large-scale monitoring audit like the type used at the MBTA.

public, making it difficult to know whether a lack of kneeling is due to this or due to the operator forgetting.

Chapter 6

Discussion

The MBTA and the STIB-MIVB have taken overlapping but distinct approaches to accessibility. Some of these differences are philosophical: who they should focus on providing physical accessibility to, and what ideal accessibility should look like. Other differences are more practical, related to legal standards and funding.

In this discussion, my goal is not determine which system is "better" definitively. Instead, I analyze the theoretical basis of differences in each accessibility approach. I look at several differences in the larger structural contexts of the two systems that extend beyond the scope of agency policy alone. I next note lessons that could be relevant from the context of one case to the other. Finally, I look at some limitations of this study and areas for further research.

6.1 Philosophies of disability

The accessibility policies and interventions at the MBTA and at the STIB-MIVB are, at heart, underwritten by different understandings of the social nature of disability, largely along the minority group/universalizing dichotomy explored in the literature review. Practically, these philosophies both end up suggesting largely similar interventions and outcomes, but with key differences.

The approach to disability taken at the MBTA derives from the legal status of disability in the US via the ADA. As discussed in 4.1.1, the ADA law itself defines disability through the US sociopolitical lens (discriminatory societal attitudes and orientations are at the root of the lack of inclusion and access for disabled people), and the closely related minority model (seeing disabled people as a social minority group analogous to racial, ethnic, or religious minority groups).

The MBTA is obliged to provide physical accessibility to disabled customers because disability is a protected class under US law. Nondiscrimination is achieved by mak-

ing specific positive interventions that allow the inclusion of people in this protected class to have equal access to the transportation system. To protect people with "invisible" or "hidden" disabilities, the MBTA cannot ask customers to prove they have a disability to receive most accommodations or assistance, meaning a broader group of customers may be able to benefit from these accommodations.[1] Additionally, some of the physical modifications that have been done to accommodate customers with disabilities benefit a wider group of people; for instance, elevators in stations or low-floor buses and light rail vehicles also benefit people with strollers and luggage; audio and visual stop announcements also benefit tourists and people distracted during their commute. But the primary imperative for making these accommodations and physical changes is inclusion of disabled customers who would otherwise be excluded from the service.

In contrast, at the STIB-MIVB, the focus of accessibility is accommodating "persons with reduced mobility" (PMR in French). Customers with disabilities are one of the primary groups in the PMR umbrella, and indeed, "person with reduced mobility" is sometimes used essentially as a synonym for "person with a disability", but PMR also includes a wide variety of other customers that have barriers to mobility for a wide variety of other reasons that may not be related to disability, following a "universalizing" understanding of disability. The universal perspective draws a direct contrast with the minority perspective, arguing that "disability is not a human attribute that de-marks one portion of humanity from another (as gender does, and race sometimes does); it is an infinitely various but universal feature of the human condition," (Bickenbach et al., 1999, p. 11823).

The universalizing perspective that frames STIB-MIVB also comes out of definitions within relevant regulatory frameworks. Consider the definitions of (Passengers) with reduced mobility in the "Regulation No 107 of UNECE" (2017), the minimum standards for bus design used in the EU:

> 'Passenger with reduced mobility' means all passengers who have a difficulty when using public transport, such as disabled people (including people with sensory and intellectual impairments, and wheelchair users, people with limb impairments, [sic] people of small stature, people with heavy luggage, elderly people, pregnant women, people with shopping trolleys, and people with children (including children seated in pushchairs), (5).

While the missing close-parentheses makes it unclear where the authors intend their categorization of "disabled people" to end, it is clear that the broader "passengers with reduced mobility" includes a very wide group, including people traveling with unwieldy objects like luggage, shopping trolleys, and strollers, a group that receive

[1] For instance, asking to use a locked bathroom in a station is considered a reasonable request for accommodation, and MBTA staff cannot ask for proof of a disability, meaning in theory any customer can ask staff to unlock a bathroom for them.

no special protections at the MBTA. Similarly, the Brussels Regional Planning Regulation (RRU in French) regulations for street design says that

> It is impossible to include in the definition of a person with reduced mobility all the cases that may be encountered. This concept should be understood in its broadest sense. *It is therefore as much* about disabled people as people accompanied by a pram, elderly people or someone who experiences a temporary difficulty of movement, ("Règlement Régional d'Urbanisme Bruxelles Titre VII," 2006, p. 6, emphasis my own).

The universalizing sentiment of these regulations was echoed in an interview with the STIB-MIVB Accessibility Manager, who argued that accessibility policies needed to benefit a wide range of users, not just users with disabilities:

> Because accessibility, it benefits all customers. And so we decided not to say we put X million euros for this category of population or X million for that other category. No, we don't say that. We say, we're doing accessibility, it's for everyone...I think it's also important in terms of non-discrimination, to say the money that we invest is for everyone, ("STIB Accessibility Manager Interview," 2022, translation from French).

This is quite a contrast to the ADA-derived accessibility mandate at the MBTA, where anti-discrimination requires taking specific positive actions to accommodate disabled riders. In the reading from the STIB-MIVB, nondiscrimination requires funding accessibility projects for everyone, rather than specifically for one group, people with disabilities.[2]

The real-life implications of these differing perspectives on who should be the focus of accessibility policies can be seen clearly by contrasting two types of policies in the MBTA and the STIB-MIVB:

1. In the MBTA, if a wheelchair user wants to request a bridgeplate in a station, MBTA policy requires that staff immediately assist the person. If any subsequent trains are missed after the bridgeplate request is made, this is considered a serious violation ("Subway Policies and Customer Journey," 2023). On the other hand, in the STIB-MIVB, if a disabled person wants to request

[2]This also seems to fit more broadly with differences between US and European approaches to nondiscrimination for other groups, such as racial or ethnic minorities. In the US, the process of collecting statistical data about racial or ethnic identity and relating it to other metrics such as income or housing is seen as an essential to be able to study and address racial disparities and inequity. On the other hand, in Belgium, it is illegal for the National Statistical Institute to collect data on racial or ethnic origin, an approach that is often adopted by other research institutions, even if not subject to the public statistics law (*Improving Equality Data Collection in Belgium*, 2021, pp. 16–17).

staff assistance in a station, they must book it at least an hour in advanced. If they request assistance from inside the station, it may take up to one hour (*STIB Guide PMR*, 2020).

2. In the STIB-MIVB, people with prams (strollers) are specifically identified as PMR who should be accommodated by accessibility actions. Therefore, on newer STIB-MIVB buses, there is a stroller area next to the wheelchair area, marked with a pram symbol on the floor. On the other hand, the MBTA briefly considered banning unfolded strollers from MBTA vehicles in 2011 and requiring parents with strollers to fold them up when boarding the vehicle. The proposal of this was shut down after intense backlash from parents, and the MBTA does not currently have a stroller policy (Moskowitz, 2011, Weir, 2011).

These two examples show some clear benefits and problems with each approach. On the one hand, the MBTA's highly specific focus on providing reasonable accommodations for disabled passengers makes in-station assistance a real, practical accessibility tool for normal, everyday trips, in a way that the STIB-MIVB station assistance policy does not. The minority antidiscrimination approach at the MBTA has led to some clear success: every line of every mode in the MBTA system is theoretically accessible (even if not every stop is), despite the presence of legacy high-floor vehicles on some lines. That's a big accomplishment that the STIB-MIVB has not yet reached.

On the other hand, there is real value to the more expansive view of "people with reduced mobility" the STIB-MIVB has adopted. The example of parents with prams is a good example. Given that on a societal level the distribution of parenting tasks typically fall disproportionately on women, there are clear gender equity and socioeconomic implications to a hostile or even apathetic stroller policy like the one considered by the MBTA. In some cases, the MBTA's policy focusing on reasonable accommodations for disabled riders rather than a more universally accessible approach can leave some people in this broader "passengers with reduced mobility" group struggling even if disabled riders may be able to receive accommodation. After boarding the high-floor Mattapan trolley with a mobile lift, MBTA tester LC pointed out that another woman had struggled to board the trolley carrying a stroller. She felt frustrated because the woman with the stroller deserved access to assistance as well, but "you meet such resistance, because in Boston people don't want to wait for anything," (LC interview, 2023-01-18).

In general, the universalizing view leads the STIB-MIVB to primarily pursue removing barriers and providing accessibility primarily through Universal Design principles (discussed in Section 2.1.3). In the MBTA, universal design principles are also used in stop, station, and rolling stock design, but complemented with other techniques, such as the use of bridgeplates and staffed assistance for disabled customers. This leads to the second major difference in approaches to pursuing accessibility observed between the to transportation agencies: a focus on accommodation vs a focus on autonomy.

6.2 Accommodation vs Autonomy

What achieving full accessibility would look like appears to be different between the MBTA and STIB-MIVB. The STIB-MIVB strategic plan very explicitly says the system's accessibility goal is 100% autonomous accessibility (that is, all customers being able to board, ride, and alight without assistance), and sets a somewhat ambitious goal for achieving this milestone: within 30 years (of 2020).

In contrast, at the MBTA the focus seems to be achieving 100% *accessibility*, but that accessibility may be accomplished with some level of accommodation that involves assistance from staff members. Certainly, making a greater portion of the system autonomously accessible is also a goal within the MBTA, and many of the accessibility upgrades of infrastructure and rolling stock are focused on this. For example, the Assistant General Manager of SWA said in an interview that the MBTA is beginning to design new Green Line vehicles that, with a raised platform, can achieve level boarding without a bridgeplate, and that upgrading platforms and rolling stock in already-accessible stations to reduce the need for bridgeplates and provide autonomous access for WMD users is "a great example of the goalposts shifting a bit," ("AGM SWA Interview," 2022). Other parts of the system, though, seem likely to never be completely autonomous, at least at this stage, most notably the WMD securement system on MBTA buses (discussed more in Section 6.2.2). Broadly, whereas the STIB-MIVB seems to mainly consider a station or line to be fully accessible if autonomous accessibility is achieved, large swaths of the MBTA's accessible network rely to varying degrees on "reasonable accommodation".

6.2.1 Tradeoffs: Accessibility through accommodation

Staff intervention allows the MBTA to make a large portion of its network accessible despite reliance on legacy rolling stock on a number of important lines in the system. A clear example of this is the Red Line, where older vehicles without automated announcements still dominate. MBTA accessibility policy overcomes this issue by requiring motorpersons in these vehicles to make audio stop announcements verbally over the PA. In contrast, in the STIB-MIVB, some metro cars are also older vehicles that do not have automatic visual and stop announcement systems. Although these systems are also equipped with PAs, operators are not required to make manual stop announcements, and on these trains blind customers may not know which stop they are at.

There are tradeoffs to this strategy of achieving accessibility through reasonable accommodation. On the one hand, using staff to provide accommodations allows a greater degree of flexibility, and often allows accessibility to be achieved in a much shorter amount of time than would be possible if infrastructure and rolling stock had to be upgraded to a completely autonomous level. The potential for staff to bridge otherwise inaccessible infrastructure means a public transportation provider

cannot just dismiss out of hand a portion of its service as unavoidably unusable by people with certain impairments just because they have have not had the time or money to upgrade to the latest infrastructure and rolling stock. On the other hand, when accessibility is more reliant on human behavior, there is more room for error that can make the experience practically more inaccessible. The monitoring program at the MBTA, which focuses heavily on monitoring these human-dependent accessibility features, plays a roll in keeping this human error in check by providing disciplinary consequences and information on where additional training should be necessary for staff. But nonetheless, monitoring statistics (see Section 4.4.1) show that a significant amount of human error inaccessibility remains.

Hypothetical accessibility that requires assistance may not provide practical accessibility if customers do not request assistance, even if it is available in theory. In interviews, IAM testers mentioned that they often feel awkward asking for assistance or feel like they are being a burden on the staff, even though they know because of their work as a tester that they are entitled to it. For instance, Tester B.G., who uses an electric wheelchair, told me that although he requests bridgeplates on the job, in his daily life off, he almost never does: "[When] I'm using the T, I wouldn't request a bridgeplate...If I can't get on to the train because of the distance between the platform and the train, I'll go to a different section of the platform where it is possible. So if I'm by myself, I probably honestly do that before I would request a bridgeplate," (BG interview, 2023-01-27), B.G. explained that this was about maintaining his autonomy: "I'm independent. I'm like, I do a lot of things on my own. I'm just not used to requesting help. I mean, that's just me though...I'm not saying that everyone's like that," (BG interview, 2023-01-27). Disabled customers also may not want to ask for accommodation because they fear the operator will react negatively. Tester Z.G. is a younger person with a mobility impairment who used to use a walker or cane (now Z.G. uses a scooter). Z.G. said when they were still ambulatory, they felt reluctant to ask for accommodation: "[Even though] it said on the bus, 'Hey, you can ask whatever they need to ask for,' but I think a part of me was scared because it felt like a lot of the drivers didn't feel like it was necessary to ask for a ramp or for them to pull down the bus, just so that I can get on the bus with my walker or cane. Sometimes I get, like, eyes kind of just like, 'Oh, they asked for the ramp,'" (Z.G. interview, 2023-01-26). This situation may particularly affect ambulatory people with mobility impairments and other "invisible disabilities". If real-life riders are hesitant to actually make use of human-dependant accessibility features, it may mean real-life accessibility is less extensive than the on-paper accessibility from the MBTA's perspective.

The comments from testers' about their discomfort recalls the criteria of "democratic (transportation) justice" discussed by Vanoutrive and Cooper (2019) following Anderson: that just transportation must be one that allows (disabled) riders "to function as equal citizens" (Anderson, 1999, p. 320), with equal value and dignity, rather than paternalism. While training and monitoring could ensure that staff don't behave in a rude way like ZG experienced with dismissive operators, for riders like BG for whom boarding with autonomy is central to their sense of independence, a public transportation system that requires requesting assistance may not make

them feel like "[an] equal citizen". At the same time, it's important to recognize that having professional assistance is an essential part of daily life for many disabled people. Having access to help with daily tasks like bathing, dressing, etc. allows many disabled people to live independently, and is not inherently undignified. More broadly, people's reactions to asking for and receiving assistance may differ along gender, generational, and class lines. An "ideal" public transportation system would probably offer, but not require, staff assistance.

6.2.2 Autonomous accessibility through design

On the other hand, there are also tradeoffs to the accessibility model that the STIB-MIVB follows. While complete autonomy for disabled passengers, like able-bodied passengers experience, is an obviously desirable outcome, reaching it is a challenging and (in most cases), a still-distant goal. Fully autonomous accessibility through design generally requires renovating existing infrastructure and acquiring or modifying rolling stock, which can be an extremely expensive and slow process compared to policy changes that can be implemented in a shorter period of time.

In some cases, "autonomous accessibility" features are actually more of a "mechanical turk"[3] setup still dependant on humans. For example, on both the MBTA and STIB-MIVB, bus operators push a button to automatically deploy the ramp. On STIB-MIVB buses, the fact that the ramp deploys from the back door, and that a person can push the a button on the side of the bus to request the ramp, may give a feeling of autonomy (you push the button; the ramp deploys), but is ultimately still dependant on the operator. On the other hand, on MBTA buses, the ramp is at the front door, and the driver either automatically deploys the ramp because they see a WMD user waiting, or because the passenger verbally requests it. On the one hand, a lack of interaction could be desirable if customers prefer more anonymity. On the other hand, physical distance makes the operator less connected with what is happening. As we saw on our testing trip with CC, if something goes wrong while boarding or alighting, the operator is much less aware, and this contributed to a dangerous situation. It's not clear whether the rear-door ramp setup really gives disabled passengers greater autonomy, versus simply giving the operator less responsibility.

Accessibility on transportation is particularly complicated because it involves moving vehicles. Observations on both the STIB-MIVB and the MBTA also raised some questions of the extent to which is possible to have entirely autonomous high-quality access on public transportation today. On MBTA buses, WMDs are secured in forward-facing WMD areas with four-point securement. Currently, the securement straps must be applied by the operator, a time-consuming process involving the operator getting out of their seat to prepare the area and apply the straps. Correct application of securement straps is also one of the human-dependant accessibility

[3] A machine that seems to be a full automaton, but is actually controlled by a hidden human pulling the strings, see https://en.wikipedia.org/wiki/Mechanical_Turk

features which features the worst rates of compliance according to data gathered by monitors (see Table 4.11). In contrast, on STIB-MIVB buses, no securement straps are used; instead, WMD passengers are expected to position their WMD in a designated backwards-facing spot with tightly-fitting handlebars on either side (see Figure 5.7). Under European standards, this is considered to be secure enough to not require securement straps. In theory, this is a much more efficient system that avoids the problems related to human error that plague the MBTA securement system. However, during the three testing trips with WMD users using manual, adapted manual, and electric wheelchairs, none of the three wheelchair users were able to to use the wheelchair space as intended, because their wheelchair could not maneuver to fit in tight space, and, in one case, because sitting facing backwards made the person get motion sickness. All three 3 testers observed did not sit in the space properly, and as a result, were not properly secured and had their device shift and rock when the bus made turns or sudden stops. All three had to suddenly grab onto handrails on the side of the bus to steady themselves during the ride. This is clearly a dangerous situation that could, in the worst case, result in a wheelchair flipping over.

The challenge around balancing autonomy with safety was raised by interviewees at the MBTA. Shortly before my period of observation, the MBTA had piloted a new technology called "Quantum", a robotic arm that secures WMDs automatically in a backwards-facing space. "We had high hopes this would work and our customers who use wheelchairs would gain the ability to secure their devices independently and experience a faster boarding and alighting process," the director of the SWA said (personal communication). However, during the pilot phase, the SWA staff found that despite several repairs and modifications by the company, the system was unable to accommodate larger power wheelchairs. Additionally, because users are seated backwards at the front of the bus, some customers felt exposed having to directly face the entire bus of other customers (IAM program manager, personal communication). Ultimately, the MBTA concluded the older manually-applied system was safer and better than the new, theoretically more autonomous technical solution.

6.3 Influence of broader institutional and regulatory setting

6.3.1 High-level standards help...

European interviewees highlighted the challenges presented by a deficit in uniform minimum standards for intra-city public transportation vehicles and infrastructure. The STIB-MIVB accessibility coordinator noted that while the EU does have standards for buses, he thinks they don't sufficiently consider all the needs of disabled customers. Furthermore, when it comes to intra-city subway, he noted that there are no European accessibility standards to reference, either for platforms or vehicles,

though there were standards for other modes such as inter-city passenger rail. When it came to constructing Brussel's new metro line, "we don't know any international rules to build a metro. What we did in that framework, was take the references relating to the railroad...we went to pick and choose, we take this, we take this, we take this, we take this," (translation from French, "STIB Accessibility Manager Interview," 2022). Minimum standards do not only benefit disabled users, they also benefit public transportation agencies that take accessibility seriously by not forcing each one to reinvent the wheel. While congratulating the STIB-MIVB/Bruxelles Mobilité public service contract for being "more ambitious than existing rules," the CAWaB chargé for mobility and accessibility policy argued that the type of rules specified in the public service contract should be implemented at the regional or European regulatory level, where they wouldn't be subject to the volatility of changing political priorities, ("CAWaB Accessible Mobility Chargé Interview," 2022). Ambitious transportation agencies on their own can develop effective, ambitious accessibility policies on a voluntary basis that go above and beyond standards. But the task is much harder when they have to re-invent basic accessibility standards on their own, or fight for accessibility as a funding priority amongst many other needs. Legal mandates can justify prioritizing accessibility even in the face of budget shortfalls.

In the US case, MBTA benefits from the detailed standards put out by relevant federal agencies covering design standards and technical requirements for vehicles. While the MBTA still has internal standards for their vehicles and stations to fit their specific context, the ADA requirements provide a baseline reference point for accessibility in procurement and design. Moreover, the Daniels-Finegold lawsuit shows the very real accountability public transportation agencies can face if they flaunt legal accessibility requirements. Ultimately, the MBTA has been able to stick to their legal accessibility obligations since the Settlement, even in the face of an otherwise overwhelmed and under-funded transportation system.

6.3.2 ...But so does adequate public transportation investment

More broadly, as a public transportation system, the MBTA seems to be in significantly worse shape than the STIB/MIVB in terms the scope and frequency of its service. The MBTA has earned a reputation as a system in severe distress: during the course of this research, the MBTA was investigated by the US Federal Transportation Administration (FTA) after a number of high-profile collisions and the horrific death of a passenger[4] (Murphy, 2022); later that same year (2022), an Orange Line train caught fire ("'Frightening Event'," 2022). The FTA's investigation found that the safety lapses at the T were the result in part of chronic understaffing, particularly of its Operations Control Center (OCC), and due to draining the day to day operating budget in order to fund its large-scale capital projects (Kraegel and Healy, 2021, Fatima and Dolven, 2022). For years, the MBTA reduced its workforce

[4]Who was dragged into the tunnel after his arm got stuck in a Red Line train door

by hundreds of staff to close budget gaps and encouraged early retirement (Cawley, 2023). Now, in order to meet the FTA safety requirements around OCC staffing, the system has made service cuts across the system and faces a major staffing crisis[5] (Cawley, 2023, Dolven, 2022, Kool, 2022).

As admirable and impressive as it is that the MBTA has developed an extensive set of policies and interventions giving a high level of accessibility to all modes, when the service provided by that system as a whole is slower, less frequent, and more dangerous, this is ultimately a less accessible – in the broader, "opportunity accessibility" sense of the word. A transportation environment that provides an more extensive, frequent, reliable, and safer service overall may ultimately provide better overall "opportunity accessibility" for disabled users, even if part of that better service is still physically inaccessible. When chronic underfunding means that undertaking major capital projects to improve facilities can only happen at the cost of staffing, safety, and daily operations, the quality of service the transportation agency can provide suffers for all riders, including riders with disabilities. Indeed, the STIB-MIVB has ambitious plans for capital projects, not just adding new lines but upgrading the physical accessibility of many of its stations and rolling stock (*Plan stratégique de mise en accessibilité du réseau de la STIB*, 2018). This scale of capital expenditures is likely out of reach for the MBTA in its current state of crisis.

6.3.3 The public space built environment and relationship with municipalities

The built environment surrounding public transportation stops also has serious real-life implications for the physical accessibility of the public transportation system for disabled riders. As seen on trips with IT and CC in Brussels and with KR in Boston, barriers in the public sidewalk, plaza, or street curb cuts can make it difficult or impossible to access public transportation bus stops, even if the bus stop itself is best-in-class for physical accessibility. Unfortunately, many of these barriers fall in public right-of-ways under municipal control that are beyond the purview of the transportation agencies, even as they present serious practical challenges to accessibility. Addressing this accessibility barrier requires collaboration between municipal planning authorities and public transportation agencies to solve it in a holistic manner.

6.4 Lessons

There are a number of lessons that can be learned from the experiences of one transportation agency's approach to accessibility that could provide a useful model

[5]The system struggles to recruit younger employees as commercial shipping companies offer more competitive salaries and benefits

for the other.

6.4.1 Information access (STIB-MIVB)

There are various systems of public-facing information that the STIB-MIVB makes available to riders that could be very helpful accessibility tools at the MBTA. The "accessibus" auditing and rating system of bus stops provides riders using WMDs useful information about the physical state of the stops. Making information about bus stop accessibility public-facing would also be an important accountability tool, to give more transparency to users about the overall state of bus stops in the system. While the MBTA Rapid Transit map (see Figure 4.2) gives WMD users information about the accessibility of heavy and light rail stations and surface-level stops, there is not an equivalent public-facing source of information about the state of MBTA bus stops. Given that not all of the MBTA's bus stops are up to the accessible standards in the MBTA stop design policy yet, providing some level of rating system for bus stops could be helpful for WMD users in route planning.

Additionally, for tech-savvy blind users like IT and DG, the STIB-MIVB app is a useful tool for planning trips, but also with unexpected uses. While the app may not have been designed specifically for this purpose, the geolocation features and estimated arrival times helped IT and DG identify buses even in the absence of external audio announcements on buses. The trick did not work perfectly, and ultimately consistent external audio announcements on buses would be a better accessibility solution. Nonetheless, the experience showed the real accessibility potential for tech and app-based information systems. The MBTA does not have its own dedicated app, although it does endorse the third-party "Transit App"; I do not know how easily accessible this app is for blind and low-vision users.

There is a tendency in urban geography to be skeptical of tech-y "panaceas" to urban problems, because these phone-based solutions often exclude those who are not tech literate (especially older people), and those who can't afford smartphones. This skepticism is a well-placed check on uncritical celebrations of tech-based solutions. Yet there is the real potential for app-based interventions to provide meaningful access, including for people who are already otherwise being excluded under the status quo. Solving transportation information access through app-based solutions cannot be the only solution, but it can be one accessibility tool in the toolbox.

6.4.2 Design interventions on the cheap (MBTA and STIB-MIVB)

Upgrading the physical accessibility of infrastructure and rolling stock is generally very expensive, as noted earlier. But in both cases observed, the transportation agency was able to implement some clever, non-traditional solutions that greatly

increased accessibility on certain parts of their light rail/tram system.

Both the STIB-MIVB and the MBTA still depend on many legacy high-floor trams. However, at the MBTA, the solution of pairing one high-floor Green Line car with one low-floor Green Line car (Figure 4.3) allows every train set on the Green Line to be WMD accessible, even though a large portion of the overall rolling stock is still inaccessible legacy equipment.

Meanwhile, at the STIB-MIVB, the solution of installing rubber "fusibles" to bridge the gap between otherwise accessible tram platforms and the low-floor trams (see Figure 5.6) has made a significant number of tram stops that had problematic gaps now easily autonomously accessible. Because they mostly needed to bridge a horizontal, not vertical gap, these rubber bridges didn't require an expensive major renovation of the entire platform, yet they still practically result in a much smoother and safer platform-vehicle transition.

These particular solutions from one transportation agency may not be applicable to the context of other. However, the type of creative thinking embodied by these solutions may result in other out-of-the-box interventions that are low-cost but high impact. Ultimately, major investment in infrastructure and rolling stock is critical to long-term, sustainable, and more autonomous accessibility, but that doesn't preclude achieving some accessibility "quick wins" in the meantime.

6.4.3 Staff can bridge accessibility gaps (MBTA)

Another major lesson from the MBTA's accessibility policy is that staff policies and interventions can practically provide physical accessibility when the technical state of the infrastructure or rolling stock alone cannot. As discussed above in the "Accessibility through accommodation" section (6.2.1), this strategy comes with tradeoffs, and there is value to the autonomy-only approach the STIB-MIVB wants to follow in the longterm. But given the long-term challenges surrounding the rate at which the STIB-MIVB can upgrade physical infrastructure, using staff to provide reasonable accommodations may be a way to achieve greater (if not autonomous) accessibility in the short term, as they work towards the more infrastructure-based accessibility projects in the long term.

6.4.4 Quality control of accessibility (MBTA)

Finally, the experience of the Internal Access Monitoring (IAM) program at the MBTA shows the real value that comes from implementing quality control of accessibility through "secret shopper" testing. The best-laid accessibility plans on paper may be useless if they aren't carried out effectively in real life.

At the MBTA, the monitoring program is a valuable source of data for shaping staff

training, as well as a source of accountability. It does appear that monitoring is effective in making operators more cognizant of the need to follow accessibility rules. At the accessibility training for bus operators I observed, all operators attending were aware of the monitoring program. Anecdotally, the IAM program manager commented that monitors are sometimes asked by operators "are you a monitor?" ("IAM Senior Program Manager Interview," 2022). This presents a challenge for maintaining testers' anonymity in the program, but it also a sign that operators are aware that there are monitors in the system and they may face consequences if they do not follow accessibility policies.

The MBTA has made remarkable progress in compliance on a number of human-dependent areas since the Daniels-Finegold lawsuit. As part of evidence for the lawsuit, the plaintiffs hired a consultancy (Delta Services Inc.) to secretly audit the bus system in 2005. The methodology of this external audit eventually became the basis for the MBTA's internal access monitoring program after the settlement ("Interview with Daniels-Finegold et al. v. MBTA Plaintiff and Attorney," 2022). Comparing elevator uptime data over the years, as well as bus operator compliance data from the 2005 Delta Services audit and recent monitoring shows an enormous improvement in on-the-ground accessibility since the time of the lawsuit (see Tables 6.1 and 6.2), though the rate of WMD securement on buses still needs significant improvement.

Elevator uptime	
FY 2005	*93.92%*
FY 2006	98.92%
FY 2007	98.92%
FY 2008-2021	>99%
FY 2022	98.70%

Table 6.1: Elevator uptime data *before* and after the Daniels-Finegold settlement

Bus: comparisons to Delta study data[6]				
	2005 (Delta)	**FY 2015 (IAM)**	**FY 2019 (IAM)**	**FY 2022 (IAM)**
Failure to board (any reason)	*20.5%*	0.69%	0.35%	0.82%
WMD not properly secured (4 straps)	*91%*	n/a[7]	40.33%	59.72%

Table 6.2: Comparison of several performance metrics in *2005 Delta study* to recent IAM monitoring data

This progress is likely the combination of various factors, including improved policies, training, and the accountability provided by monitoring.

The experimental testing trips on the STIB-MIVB undertaken for this research show the real insights into how on-the-ground accessibility is living up to the on-paper plans and policies at the STIB-MIVB. Although this research only included a limited number of trips, already, testing trips undertaken identified a number of different issues that should be investigated to see if they exist more broadly in the system as a whole, such as:

Operator behavior

- Bus operators not pulling to the stop line
- Inconsistencies in kneeling
- External announcements on buses turned off or at low volume

Spatial planning:

- Incongruities between "Accessibus" logos of bus stops STIB-MIVB app versus logos on the signs
- Discovery of path-of-travel barriers blocking Accessibus Blue stops (see Figure 5.22)

[6] Delta study data from MassDOT (2017)
[7] No data available from FY 2015

The testing trips also raised some questions about the hypothetical versus real-life use of certain vehicle design aspects that would be worth considering for future vehicle acquisition, namely:

- Issues with the usability of designated wheelchair spaces on buses due to their shape, location, and orientation
- Risks associated with current type of accessible ramp on buses, due to the lack of raised edges to prevent WMDs from rolling off

According to the STIB-MIVB accessibility coordinator, the STIB-MIVB already has "secret shopper" programs in place for quality control in other aspects of the agency's service, though these "secret shoppers" do not control for accessibility ("STIB Accessibility Manager Interview," 2022). This suggests that some sort of accessibility testing and monitoring could be incorporated into the STIB-MIVB system, possibly through an expansion of this existing "secret shopper" program.

6.4.5 Representation (MBTA)

The MBTA includes a number of governance structures that formally give disabled customers a voice (see Section 4.1.4). Additionally, the department of System-Wide Accessibility at the MBTA, the department inside the agency responsible for overseeing accessibility, includes a large number of disabled people on staff, including its senior leadership, which shapes the way the department approaches accessibility. The Assistant General Manager of System-Wide Accessibility (herself a wheelchair user), commented that

> One thing that's been interesting and sometimes makes me a little bit nervous, is that...a little over half of [SWA] staff, granted, there's only ten of us right now in my department, have disabilities and use the systems ourselves. So we really often bring a lot of those same considerations [as the Daniels-Finegold lawsuit plaintiffs] automatically to discussions. And I think the plaintiffs have recognized that early on...I don't know that we would have that or should have that same level of trust if we were not also riders with disabilities ourselves...I think internally we may take for granted that we, you know, we are aligned with them at all times because we have similar experiences disability-wise. ("AGM SWA Interview," 2022)

There are two important reflections from this. For the MBTA, there is a need to ensure that the level of accountability that is provided by an internal staff with lived experiences of disability continues, including into the post-settlement era. A great deal of the success of the SWA comes from their ability to be an independent, critical voice within the MBTA.

For the STIB-MIVB, it would be worth considering: how many disabled people are there on the staff and in leadership positions who can shape accessibility policy? The experience at the MBTA shows that representation does really matter, and there may be insights the STIB-MIVB may be missing out on if they do not have staff internally with lived experience of disability.

6.5 Limitations and suggestions for future work

- In both cities, testers who participated in fieldwork had a limited range of disabilities and assistive devices. This study narrowed its focus only to physical disabilities and did not attempt to cover mental or developmental disabilities; even so, there are still a great range of physical disabilities that were not represented amongst the testers in either city. In both Boston and Brussels, testers were limited to people with mobility impairments using wheeled mobility devices and blind testers using white canes. Expanding data collection to testers with a wider range of different types of mobility impairments and assistive devices,[8] would likely reveal other types of barriers that these testing trips didn't capture. Additionally, a major limitation of this fieldwork was the lack of Deaf participants. Although the document analysis of design and policy frameworks did attempt to look at accessibility for Deaf or hard of hearing people by including visual information systems, the lack of Deaf participants meant that the on-the-ground fieldwork was not able to give insight into everyday barriers riders from this group may face.

- This was a small-scale, largely qualitative study. While the on-the-ground experiences of testers observed during the fieldwork on the MBTA can be backed up by the larger-scale body of data collected by the MBTA IAM monitoring program across the entire system over years to see if they were representative of broader trends in the system, the fieldwork at the STIB-MIVB is not backed up by this type of large-scale quantitative data. The six trips on the STIB-MIVB are small enough scale that, while they can point to some repeated issues observed during the trips which should serve as starting points for further investigation, they are not enough data to conclusively make an assessment of the rate of these problems occurring across STIB-MIVB services or to judge the state of the entire STIB-MIVB system. It does, however, suggest that there would be a great deal of value in expanding this type of monitoring/testing data collection to a larger scale, because monitoring would have the potential to reveal the actual on-the-ground state of accessibility in a way that current official and planning-based data sources cannot.

- Although it engaged at a theoretical level with the broader concept of *opportunity* accessibility from the Transport-Related Social Exclusion (TRSE) field, the practical data collection in this thesis focused exclusively on *physical*

[8] such as ambulatory testers who use devices like walkers or canes, blind testers who use guide dogs rather than the white cane, as well as testers with more "invisible" disabilities

accessibility to the public transportation system. Future research could bring together the physical accessibility elements studied in this thesis together with spatial analysis of "opportunity accessibility." Investigating how factors such as location, socioeconomic status, time availability, etc. combine with physical accessibility to impact disabled transportation users would be an important and new contribution to the TRSE field.

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Appendices

.1 Monitoring forms for STIB-MIVB testing trips

.1.1 Form Wheelchair - Bus

Bus number and route direction:

Stop to get on the bus:

Accessibus logo

- Blue
- Orange
- Nothing
- Deviation

Time (take photo of bus number)

External audio?

- Yes
- No
- Yes but low-volume

Pull to stop line?

- Yes
- No

Close enough to the curb?

- Yes
- No

Comment (something blocking the stop?)

Did they ask the person something from their own initiative? (Comment)

- Yes
- No

Kneel the bus? (boarding)

- Yes
- No

Ramp works? (boarding)

- Yes

- No

Internal audio?

- Yes
- No
- Yes but low-volume

Comment (missed stops? Which/how many missed)

Name of stop getting off

Accessibus logo

- Blue
- Orange
- Nothing
- Deviation

Kneel bus? (alight)

- Yes
- No

Ramp works? (alight)

- Yes
- No

Extra comments

.1.2 Form Blind - Bus

Bus number and route direction:

Stop to get on the bus:

Accessibus logo

- Blue
- Orange
- Nothing
- Deviation

Tactile slab (dalle tactile)?

- Yes

- No

Time (take photo of bus number)

External audio?

- Yes
- No
- Yes but low-volume

Pull to stop line?

- Yes
- No

Close enough to the curb?

- Yes
- No

Comment (something blocking the stop?)

Did they ask the person something from their own initiative? (Comment)

- Yes
- No

Internal audio?

- Yes
- No
- Yes but low-volume

Comment (missed stops? Which/how many missed)

Name of stop getting off

Accessibus logo

- Blue
- Orange
- Nothing
- Deviation

Anything blocking the exit? (alight)

- Yes
- No

Extra comments

.1.3 Form Wheelchair Tram

Tram number and route direction:

Stop to get on the tram:

Accessitram logo

- Blue
- Orange
- Nothing

Time (take photo of tram)

External audio?

- Yes
- No
- Yes but low-volume

Pull to stop line? (line 9 only)

- Yes
- No

Is a ramp available inside? (line 7)

- Yes
- No

Internal audio?

- Yes
- No
- Yes but low-volume

Comment (missed stops? Which/how many missed)

Name of stop getting off

Extra comments

.1.4 Form Blind Tram

Tram number and route direction:

Stop to get on the tram:

Accessitram logo

- Blue
- Orange
- Nothing

Time (take photo of tram)

External audio?

- Yes
- No
- Yes but low-volume

Pull to stop line? (line 9 only)

- Yes
- No

Internal audio?

- Yes
- No
- Yes but low-volume

Comment (missed stops? Which/how many missed)

Name of stop getting off

Extra comments

.1.5 Form Wheelchair and Blind Metro

Metro number and route direction:

Stop to get on the metro:

Time (take photo of metro)

Internal audio?

- Yes

- No
- Yes but low-volume

Comment (missed stops? Which/how many missed)

Name of stop getting off

Extra comments

.2 MBTA Contracted Services

Commuter Rail

Figure 1: Wheelchair accessible stops on the MBTA Commuter Rail

⊗ Wheelchair inaccessible stop

The MBTA commuter rail system serves many of the suburban communities surrounding Boston, even extending to nearby regional city, Providence, Rhode Island. Some commuter rail stations are served by dedicated stations, but others are served by simple outdoor platforms. About one-fifth of commuter rail stations are not accessible for WMD users (see Table 3)

	Total # not accessible	**Total # stations**	**% not accesible**
■ **Commuter Rail**	30	140	21%

Table 3: Inaccessible stations: Commuter Rail lines (all)

Accessible commuter rail stations should have ramps to allow WMD users to access the platform. Some stations are high-platform, where passengers board at level with the rail vehicle. Others, especially small, outdoor stations, still have low-platform boarding. On these stations, to be accessible there must be a "mini-high" platform; one area of the platform that is raised to vehicle height and accessible by ramp, from which WMD users can board.

The gap between the station platform and the vehicle on high-platforms and mini-high platforms is often quite significant. All accessible commuter rail cars should be equipped with bridgeplates, which passengers can request from the conductor at the train's arrival and at the alighting station.

On board the commuter rail, there should be a priority seating area. Like other modes, commuter rail trains are required to provide audio stop announcements. Newer trains include automated audio and visual messaging systems, while on older trains, the conductor must make verbal stop announcements. Additionally, on board commuter rail, trains must have an accessible restroom. ("Commuter Rail," 2023).

.2.1 Ferry

The MBTA also has a contracted ferryboat service. Like the other modes, ferry service should also be accessible to riders with disabilities.

Ferries are boarded via floating docks, which should have accessible ramps onto the doc. These docks should be level with the deck of the ferry. Ferries should be equipped with bridgeplates to allow WMD users to cross from the dock to the ferry.

Onboard the ferry, as with other modes, there must be audible stop announcements of all stops. Newer ferries have automated visual messaging systems with automated stop announcements, while on older vessels, stop announcements must be made verbally by staff. Newer ferries have designated priority seating and space for WMD users, but older vessels do not. And like commuter rail, ferries must also be equipped with an accessible restroom ("Ferry Journey and Policies," 2023).

In my field work in Boston shadowing the monitoring program, I did not observe the ferry service, as the IAM program only monitors ferries a few times per year. In theory, all ferryboats should be accessible; however, the IAM program manager told me that they no longer have WMD users monitor ferries, because a past experience of a WMD user boarding a ferry felt very unsafe to the tester due to the movement of the bridgeplate due to the floating motion of the ferry and the dock. Thus, the program currently only monitors ferries with ambulatory testers, although the ferry should be accessible to WMD users ("Ferry Journey and Policies," 2023).

.2.2 Shuttle buses

Contracted shuttle buses generally have to follow the same accessibility requirements as regular buses, although there are a few potential differences. While the MBTA mostly contracts low-floor buses from third-party vendors, in certain high-demand situations like the monthlong shutdown of the entire Orange Line in September 2022, the MBTA may also contract with companies using high-floor buses or accessible vans. High-floor buses and vans should have accessible lifts to raise WMD users from the street to the boarding door. Nonetheless, SWA staff and IAM monitors told me that during the Orange Line shutdown, these lifts were frequently broken on shuttles. Like MBTA buses, shuttle buses should also have WMD securement systems, though in some cases, shuttle buses only have three securement straps rather than the four present on MBTA buses ("Shuttle Buses," 2023).