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Walkability Assessment of Differently-abled People within a Public Transport District: A Case Study of Colombo Pettah, Sri Lanka

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Abstract

This research investigates walkability within Public Transport Districts (PTD), focusing on the needs of differently abled individuals. PTDs are essential for urban mobility, alleviating congestion and promoting sustainable transportation. The research highlights a significant gap in the attention given to inclusion of people with disabilities in urban environments, particularly in developing nations. This study examines Pettah, a key transportation hub and economic centre in Colombo, Sri Lanka. Using a walkability checklist, the study assesses six walkability factors: Sidewalks and Pathways, Crosswalks and Pedestrian Crossings, Pedestrian Safety, Accessibility, Amenities and Comfort, and Land Use and Destination, across five zones within the PTD. Findings reveal that current walkability conditions inadequately serve differently abled pedestrians, underscoring the urgent need for improvements. The research provides urban designers and policymakers with critical insights into the challenges faced by differently abled individuals, aiming to pave the way for more inclusive urban environments.

Keywords: Public Transport Districts, Differently Abled People, Walkability

1. Introduction

1.1 Background to the Study

Transportation is crucial for urban functionality, facilitating movement through various modes such as walking, non-motorized vehicles, private cars, public transport systems, taxis, and informal modes (Geography Notes, 2014). This ensures that residents enjoy convenient access to workplaces, schools, shopping centres, recreational venues, and more.

Public Transport Districts (PTDs) are essential in this landscape, typically featuring a central transit hub within a high-density mixed-use area (Lamour et al,. 2019). These districts aim to reduce reliance on private cars and promote sustainable urban development (Cervero et al., 2002), prioritizing pedestrian accessibility to enhance last-mile connectivity.

In this regard, the concept of walkability has garnered increasing attention in the planning of public transport districts. It encompasses the creation of pedestrian-friendly infrastructure, including well-maintained sidewalks, safe crossings, clear signage, and adequate lighting (Lamour et al,. 2019). This not only improves physical

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access but also fosters healthier, more vibrant communities, enhancing liveability, sustainability, and equity.

However, many individuals with disabilities face significant walkability barriers in urban pedestrian environments, impeding their mobility and access to transportation services (Dyess, 2018). This issue is exacerbated by the heavy reliance of differently abled individuals on public transit due to their inability to drive. Approximately 15 percent of the global population are persons with disabilities, rising to nearly 20 percent in low- and middle-income countries where many reside in urban areas (Artieda et al., 2022).

While walkability has gained attention in urban planning globally, there remains a significant gap in addressing the specific needs of differently abled pedestrians in developing nations. This research contributes to filling this gap by tailoring a walkability assessment framework to assess the current walkability for differently abled individuals within a city's PTD, identifying areas for improvement to ensure a more accessible environment, focusing on a case study from Sri Lanka. This study is novel in its focus on differently abled pedestrians within a PTD in a developing nation, a demographic often overlooked in urban planning literature. It is expected that this research and its assessing framework not only acts as a singular case study but also offers a replicable framework for urban transport hubs worldwide, contributing to the international discourse on inclusive mobility.

1.2 Research Question and Objectives

The main research question of this study is: "How does the current condition of walkability factors within a public transport district contribute to the overall mobility and accessibility of differently abled individuals?". Accordingly, the following three (3) objectives have identified to address the main research question:

- To evaluate the existing pedestrian infrastructure within the public transport district.
- To assess the level of walkability for differently abled individuals within the public transport district.
- To investigate the specific challenges and barriers faced by differently abled individuals when navigating pedestrian facilities within the public transport district.

1.3 Limitations and Scope

It's essential to acknowledge that in this study, the term "differently abled" is used to specifically examine the walkability of urban public transport districts for individuals with physical and visual disabilities, thereby narrowing the scope. While recognizing other disabilities and navigation challenges, these are not extensively explored here. Furthermore, the data collection for this study predominantly relies on a walkability checklist. Therefore, future investigations could expand the depth of the research by including a wider spectrum of disabilities and utilizing alternative assessment methodologies.

2. Review of literature

The literature review explores the relationship between pedestrian environments and their impact on differently abled individuals, identifying key factors to assess walkability for this group and supporting the primary research objective.

2.1 Walkability and built environmental concerns

Walkability describes the extent to which the built environment facilitates and encourages walking by ensuring safety, accessibility, and seamless connectivity to diverse destinations (Jamei et al., 2021). In public transport districts, walkability is particularly critical, as the physical design of these areas focuses on creating pedestrian-friendly spaces that promote activity and ensure functional connections

between various land uses (Dittmar, H., & Poticha, 2004). The goal is to enable fluid linkages between pedestrian areas and transit points, thereby enhancing the overall pedestrian experience.

Walkability is inherently tied to the physical attributes of the built environment. Its quality depends on a variety of factors and components. Global Designing Cities Initiative (2016) and Yıldırım et al. (2023) highlight key elements, including sidewalks, pathways, crosswalks, pedestrian crossings, durable paving materials, pedestrian amenities, street lighting, parking provisions, rest areas, shade structures, and public amenities such as water fountains and restrooms. Other factors, such as proximity to destinations, access to public transportation, and the diversity of land uses, also play significant roles in shaping the walkability of an area (Yıldırım et al., 2023).

Numerous frameworks and methodologies have been developed to measure walkability. However, there is no universally accepted method or framework for analyzing the various aspects of the built environment that contribute to walkability. Researchers and practitioners employ diverse approaches and criteria tailored to the context, location, or purpose of their study (Shashank & Schuurman, 2019). For example, Fonseca et al. (2022) identify seven built environment attributes that influence walkability: land-use density, land-use diversity, accessibility, street network connectivity, pedestrian facilities and comfort, safety and security, and streetscape design. Similarly, Southworth (2005) proposes six criteria for assessing walkability: connectivity, linkage with other modes, fine-grained and varied land-use patterns, safety, path quality, and path context. Cambra (2012) expands on these frameworks, including factors such as continuity, cohesion of developments, and safety, while Bahrainy & Khosravi (2013) emphasize connectivity, convenience, comfort, conviviality, and coexistence as critical components of walkability.

In addition to these frameworks, various tools have been developed to measure walkability, each with its own set of criteria. These include audit tools, checklists, inventories and surveys (Cambra, 2012). The methods used by these tools are diverse and include surveys, direct observations, Geographic Information Systems (GIS) analysis, motion detectors, and self-reported measures (Özçelı, 2018). These tools provide valuable insights into the interplay between the built environment and pedestrian behavior, offering practical applications for enhancing urban walkability.

By integrating these diverse approaches and tools, researchers can gain a comprehensive understanding of walkability and its impact on urban spaces, particularly in contexts where inclusive and accessible environments are paramount.

2.2. The need of prioritizing disability consideration in public transport districts

Urban environments are meant to act as equalizers, providing equitable access to amenities, services, and opportunities for all individuals, regardless of economic status, gender, ability, race, ethnicity, or religion (Amado et al., 2013). This vision aligns with the United Nations' advocacy for inclusive urban spaces, which aim to empower individuals to fully participate in social, economic, and political life (United Nations, 2009).

However, the inclusion of individuals with disabilities in urban pedestrian design and planning often remains inadequate, receiving far less attention than it deserves. People with disabilities encounter numerous challenges in navigating daily urban environments. These include physical barriers that hinder mobility, social barriers that fail to foster safe, inclusive, and equitable interactions, and institutional barriers, such as the absence of dedicated experts, inadequate design guidelines, and insufficient institutional

support for improving accessibility (Hristensen, 2014; Naami, 2019; Pineda & Dard, 2016).

Moreover, research underscores that transportation barriers and exclusion in urban settings profoundly impact individuals with disabilities, restricting their autonomy and limiting access to education, employment, economic participation, emergency evacuation, and meaningful social engagement (Artrieda et al., 2022).

Differently abled individuals encompass a broad spectrum of physical (difficulties with movement, limited use of hands and arms, challenges with speech, issues with the back or joints, chronic pain, and individuals who are either exceptionally short or tall), sensory (challenges with hearing or deafness, issues with vision or blindness) and cognitive (neurological disorders, developmental challenges, brain traumas, dementia, mental health disorders, and difficulties with learning impairments) impairments (Health and Peace Initiative, 2015). These impairments frequently impede an individual's complete and equitable engagement in society.

In many urban environments, the safety and well-being of differently abled individuals are jeopardized due to insufficient consideration, with the focus often placed on the general population instead (Schreuer et al., 2019). This calls for an urgent paradigm shift, especially considering projections indicating that by 2050, an estimated 6.25 billion people with disabilities will inhabit urban areas, necessitating a fundamental rethinking of urban priorities (Inclusive Urban Agenda, 2016).

Moreover, given that many individuals with disabilities rely heavily on public transportation due to their inability to operate a vehicle independently, ensuring disability considerations within public transport districts is imperative. By prioritizing the planning and design of walkable pedestrian environments within public transport districts through an inclusive lens, these spaces can be rendered more user-friendly, offering equal opportunities for individuals with disabilities to navigate and utilize them effectively.

Since the research is focused on Sri Lankan context, it is indeed crucial to identify the specific regulations and legal frameworks pertaining to differently abled individuals within the country's urban contexts. There, disabled Persons (Accessibility) Regulations, No. 1 of 2006 established by the Minister of Social Services and Social Welfare in Sri Lanka emphasizes the importance of accessible design in public buildings, public places, and areas where common services are provided. The act mandates that such spaces should be designed to facilitate ease of access for individuals using mobility devices like wheelchairs, crutches, and walkers, as well as those who require assistance from another person. The act specifies design requirements outlined in regulations pertaining to various aspects, including parking areas, pathways, corridors, pavements, ground and floor surfaces, pedestrian crossings, public roads, handrails and grab bars, ramps, steps and stairs bus stops, railway stations, toilets and more.

2.3. Walkability criteria for differently abled people in public transport districts

Considering the scope of this research, which focuses on the physical and visual impairments of individuals utilizing public transportation districts, it is imperative to recognize that pedestrian environments must cater to the diverse accessibility needs of individuals with various disabilities. This encompasses wheelchair users, individuals relying on canes or gait trainers for mobility, and those with impaired vision. Moreover, it is crucial to account for their abilities concerning balance, coordination, endurance, flexibility, and strength. Additionally, pedestrian facilities should be designed with the understanding that speed plays a significant role in

determining walkability, given that individuals with disabilities may have a lower walking speed (Global Designing Cities Initiative, 2016).

Drawing from research by Gray et al. (2012), Jeong et al. (2018), Heart Foundation (2011) and Ozawa et al. (2021), this study has formulated a more comprehensive set of criteria for walkability, categorized into six main factors: sidewalks and pathways, crosswalks and pedestrian crossings, pedestrian safety features, accessibility features, amenities and comfort, and land use and destinations. Each factor there is focused on specific accessibility considerations for a disability friendly pedestrian environment as below.

2.3.1. Sidewalks and pathways

Designing sidewalks is critical for individuals with disabilities who heavily rely on pedestrian infrastructure due to limited transportation options. It is important that the sidewalks feature smooth textures and level surfaces to ensure easy mobility. Ample width, preferably exceeding 2 meters on low-traffic streets allow for comfortable passage of two wheelchair users simultaneously. Clear pathways, never narrower than 1.8 meters, must remain obstacle-free for safety (U.S.Department of Transportation, n.d.). Additionally, incorporating curb ramps at elevation changes is important to aid wheelchair access to streets from sidewalks (United Nations Enable, 2015). Moreover, the use of tactile paving, or standardized surface features, serves as vital warning indicators for visually impaired individuals, enhancing safety and accessibility (U.S.Department of Transportation, n.d.).

2.3.2. Crosswalks and pedestrian crossings

Pedestrian crossings are essential for ensuring safety and accessibility for individuals with disabilities. They must be clearly visible and marked to indicate their presence, with auditory signals and tactile features provided for visually impaired individuals. Additionally, installing proper signage and pavement markings, including guide strips, is vital to clearly indicate the location of these crossings. (Figure 1) Allocating sufficient crossing time is also crucial, considering the slower walking conditions of individuals with disabilities. Moreover, elevating the road surface at crossings to align with pathways can reduce height differences, eliminating obstacles for wheelchair users (United Nations Enable, 2015) (Figure 2).

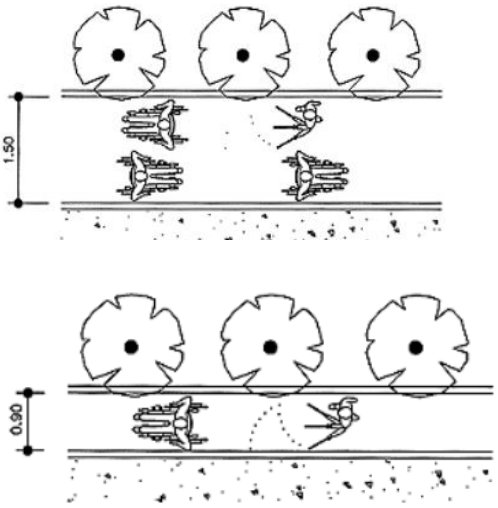


Figure 1. Sidewalk Widths for Disabled Users, Source: United Nations Accessibility Guide

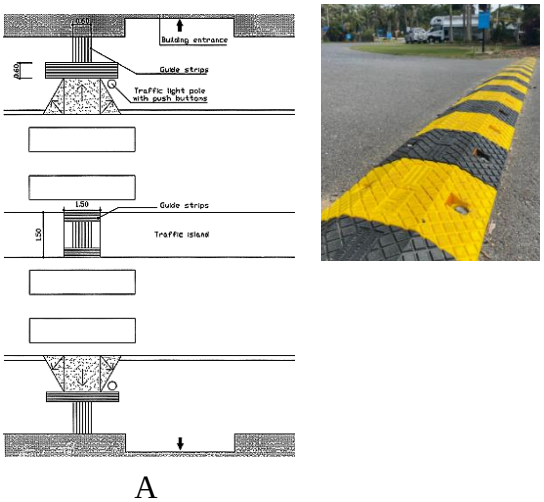


Figure 2. A) Guide Strips B) Road Humps, Source: United Nations Accessibility Guide

2.3.3. Pedestrian Safety features

For individuals with impairments, street safety is paramount and necessitates additional considerations beyond standard guidelines. These include ensuring adequate lighting, enhancing the visibility of pedestrian crossings, establishing safe and clearly defined pedestrian-only areas where feasible, and creating safe and accessible pedestrian routes (Mitchell, 2007). Particularly, in public transport districts, it is vital to provide accessible infrastructure such as obstacle-free routes, curb ramps, designated passenger loading zones, tactile surfaces, priority seating, and wheelchair spaces (Mampearachchi & Suman, 2014), (Awang et al., 2013). These measures are essential for promoting inclusivity and convenience of individuals with impairments in urban environments.

Figure 3. Pedestrian Ramp for Disabled, Source: Google Images

2.3.4. Accessibility features

Installing infrastructure such as accessible parking spaces, ramps, and entrances to transit stations and other necessary spaces is vital for differently abled people to navigate safely through street environments. Moreover, providing seating areas and resting spots is crucial, ensuring they are accessible and wide enough for wheelchair users to move freely and without obstruction. Appropriate signage placed at key areas further enhances accessibility, facilitating easier navigation for individuals with disabilities (Department of Engineering Service Ministry of Work and Human Settlement, 2014), (Awang et al., 2013), (United Nations Enable, 2015).

2.3.5. Amenities and comfort

Amenities and comfort are essential elements of a pedestrian environment, benefiting everyone, particularly differently abled individuals who may experience fatigue more easily due to their physical impairments. Providing public amenities such as resting areas with suitable furniture is crucial. Specifically, ensuring accessible transportation stops and user-friendly seating at strategic points throughout the transport district is vital, considering the considerable distances individuals may need to navigate. Additionally, accessible drinking water facilities, restrooms, and shade and shelter are important considerations. Notably, in transport terminals, at least one wheelchair-accessible toilet should be provided at each location. (Department of Engineering Service Ministry of Work and Human Settlement, 2014), (Awang et al., 2013), (United Nations Enable, 2015).

2.3.6. Land use and destination

Ensuring equitable access to essential services and facilities is critical for individuals with physical disabilities, who often face barriers due to inadequate land-use policies (Shahraki, 2021), (Ozawa et al., 2021). Understanding their frequent needs such as healthcare, access to local fresh food sources, and other essential services is paramount. Proximity to these facilities is essential, but equally important is ensuring they have accessible entrances and other accommodations for differently abled individuals (Artieda et al., 2022b). Facilitating accessibility to diverse destinations such as restaurants, shops, community centres, and various open spaces like parklets and green areas is vital (Artieda et al., 2022b), to meet various social needs of the disabled, thereby reducing their isolation (Shahraki, 2021). Given that individuals with disabilities may

rely more on walking and public transportation, it's imperative to ensure abundant and accessible public transportation options. Moreover, incorporating disability-friendly design principles into these developments is essential to maximize their usability and inclusivity (Artieda et al., 2022b).

2.3.7. Walkability Assessment methods

Walkability, a complex concept influenced by various parameters, can be evaluated through both objective and subjective data types (Saadi et al., 2021). Objective assessment tools typically focus on measuring physical characteristics, offering a rigorous approach to improving pedestrian environments (Gao et al., 2022). These data can be analysed via checklists to identify the areas where improvements can be made to enhance walkability for all pedestrians. In line with the research objectives, this paper focuses on objectively measuring factors that determine the walkability of differently abled individuals in public transport districts.

3. Research Methodology

3.1. Walkability assessment

The walkability factors and relevant indicators for walkability checklist is a summary of findings discussed in the literature review, aligning with the accessibility considerations for differently abled people. Selection of appropriate walkability factors were also inspired by similar research done by Heart Foundation (2011) regarding neighbourhood walkability levels and Ozawa et al. (2021) regarding Evaluation of walking environments around urban railway stations in Bangkok (Table 1).

3.2 Site Selection

Accordingly, Pettah, a bustling urban hub situated in Colombo, was chosen as the focal point for this case study due to its pronounced urbanization challenges (Dayaratne, 2011).

Table 1. Theoretical Framework

Walkability factor	**Indicators**
Sidewalks and Pathways	Smooth and even surfaces, Sufficient width for wheelchair, No obstacles or obstructions, Clear and unobstructed curb ramps, Presence of tactile paving.
Crosswalks and Pedestrian Crossings	Clearly marked and visible crosswalks, Pedestrian signals with auditory and tactile features, Sufficient crossing time, Flat and level crossing surfaces, Adequate signage, and pavement markings.
Pedestrian safety features	Adequate lighting, Clear visibility of pedestrian crossings, Clearly defined and protected pedestrian areas, Safe and accessible pedestrian routes, Accessible pedestrian infrastructure near bus stops and transit stations.
Accessibility features	Accessible parking spaces, Accessible ramps and entrances, Adequate space for wheelchair users, Accessible seating areas and resting spots, Adequate signage.
Amenities and comfort	Sufficient resting areas, Accessible drinking water and restrooms, Sufficient shade and sheltered areas, Accessible public transportation stops and stations, Accessibility features at public amenities.
Land use and destination	Proximity to essential services and facilities, Good availability of accessible entrances and services in nearby buildings, Diverse range of destinations (restaurants, shops, community centres) with accessibility features, Good availability of accessible public transportation options, Good inclusion of disability-friendly design principles in nearby developments.

Source: Compiled by Authors

Renowned for its vibrant urban landscape and serving as a major transport hub cantered around the Colombo Fort Railway Station and essential bus terminals, Pettah plays a major role in accommodating

various public transport modes. This makes it an ideal location for examining the challenges encountered by differently abled pedestrians in urban settings and striving to enhance the inclusivity of the transport system. Aligning with research limitations, the study's scope includes major transport hubs (Fort Railway Station, Major Private Bus Stop Infront of Railway Station, Bastian Bus Stand and Ceylon Transport Board Bus Stand), along with the two major connected streets (01. Olcott Mawatha and 02. W.E. Bastian Mawatha). (Figure 5)

3.3 Data analysis

The research uses both direct observations and visual documentation to evaluate walkability using objective data. For direct observations, the complete observer method was employed, involving a team of four observers, including qualified assessors and subject-matter experts, ensuring reliable data. Given the research's emphasis on physical characteristics and associated user behaviours, visual documentation (field notes, maps, sketches, and photographs) was used to record additional observed data. While collecting data, the research involved a walkability checklist—tailored to obtain a comprehensive understanding of the pedestrian accessibility considerations present or absent within the study context.

For the walkability checklist, the observations were made under 06 walkability factors: Sidewalk and Pathways, Crosswalks and Pedestrian Crossings, Pedestrian Safety, Accessibility, Amenities and Comfort, and Land Use and Destination. (Figure 6) Observations were done by covering the 2 major streets (01. Olcott Mawatha and 02. W.E. Bastian Mawatha).

According to the observations conducted by the observers, evaluating walkability levels of differently abled people for each identified zone was carried out under below steps:

a. Adopting a 5-point Likert scale, each observation is assigned a score reflecting the level of agreement. The scores range from 1, indicating the lowest level of agreement, to 5, representing the highest level of agreement.
b. This scoring process is performed for all six walkability factors, providing individual scores that contribute to the overall assessment of walkability level in the zone. The below equation can be applied to evaluate the total score.
c. And the overall walkability scores are analysed to determine the walkability levels between each zone. The below equation can be applied to evaluate the total score.
d. Observers were assigned to mark their agreeing levels for each criterion. The scores obtained for each walkability factor contribute to the overall evaluation of walkability levels and form the basis for recommendations and interventions to enhance the overall walkability for differently abled people. (Equation 1 and Equation 2)

$$a = \frac{b}{c} * 100 \qquad \text{equation 1}$$

a = Walkability Score for Olcott Mawatha
b = Walkability score for all 6 factors
c = Number of factors

$$x = \frac{y}{z} * 100 \qquad \text{equation 2}$$

x = Walkability Score for Factor (x)
y = Calculated Score
z = Number of factors x Highest Score

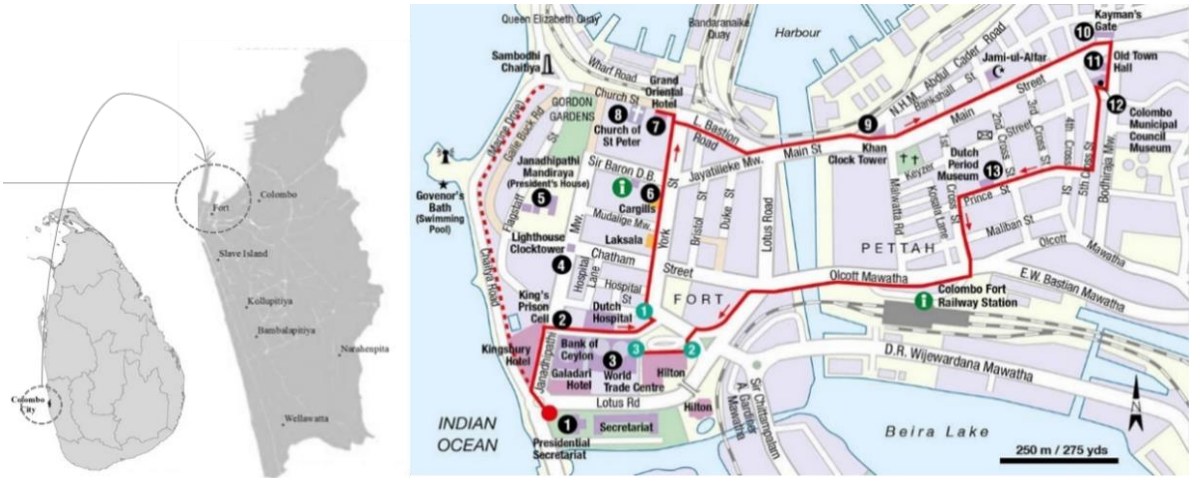


Figure 4. Pettah Location Map,
Source: Google Images

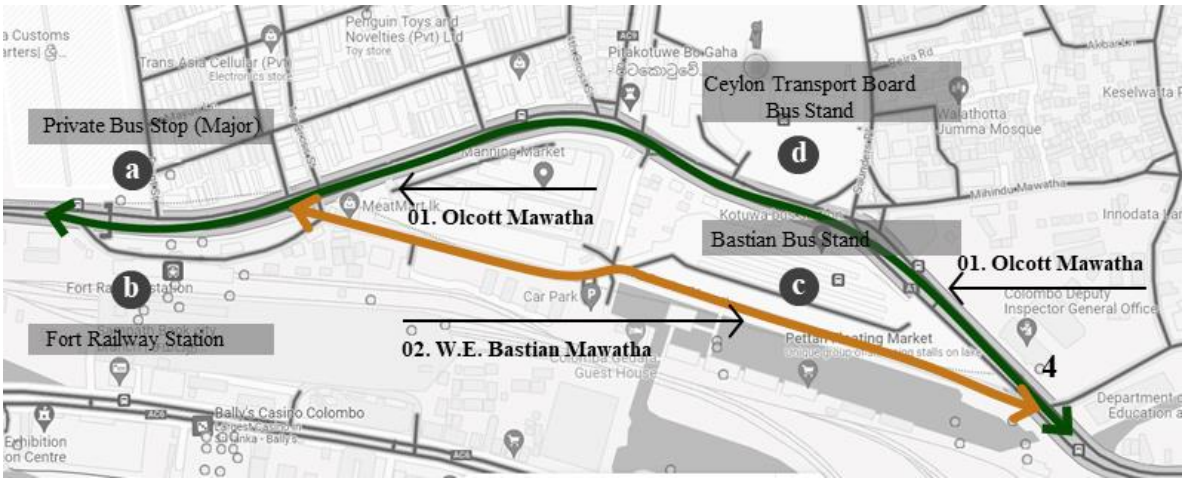
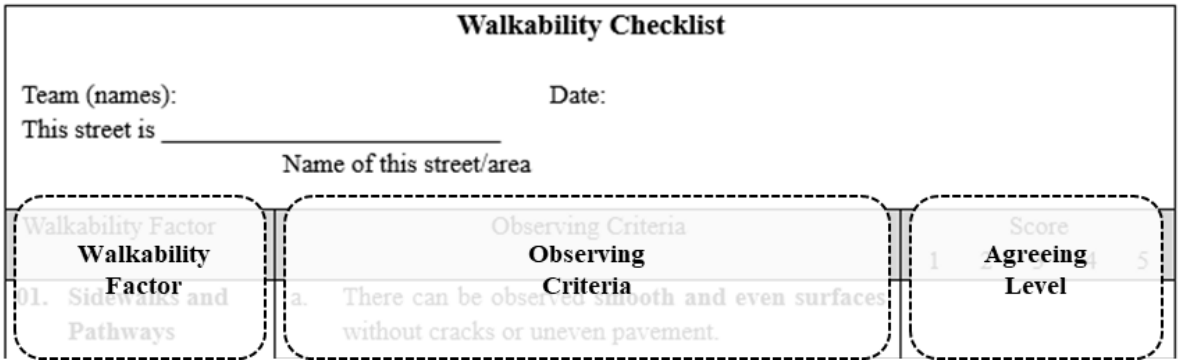


Figure 5. Site Boundaries with Major Bus Terminals and Stops in the Pettah Area
Source: Compiled by the Author



Walkability Checklist

Team (names): Date:

This street is _____

Name of this street/area

Walkability Factor	Observing Criteria	Score
Walkability Factor	**Observing Criteria**	**Agreeing Level**
01. Sidewalks and Pathways	a. There can be observed smooth and even surfaces without cracks or uneven pavement.	1 2 3 4 5

Figure 6. Formation of the Walkability Checklist
Source: Compiled by the Author

4. Findings

Olcott Mawatha is a bustling street renowned for its vibrant atmosphere and diverse commercial offerings. It serves as a vital transportation route in Pettah, connecting numerous major streets and facilitating the movement of pedestrians and vehicles. As one of the main streets in Pettah, Olcott Mawatha experiences high levels of pedestrian and vehicular traffic. The street is also lined with various commercial establishments such as shops, stalls, and marketplaces, offering a wide array of goods and services. Given its central location and accessibility, Olcott Mawatha plays a vital role in facilitating public transport within Pettah. It is often frequented by buses, providing connections to different parts of Colombo and beyond. The proximity of Olcott Mawatha to the Colombo Fort Railway Station further enhances its significance as a major transportation corridor.

Similarly, Bastian Mawatha holds immense importance as a key link between the railway station and the Bastian Bus Stand. In the past, its importance was further magnified due to the presence of Manning Market, which was relocated in 2017. Today, the road remains essential as it caters to a considerable volume of motor traffic and pedestrians, particularly those who rely on buses for their daily commute. Moreover, the presence of the iconic floating market in Colombo attracts a substantial number of pedestrians who utilize the road to access this vibrant urban public space.

The case study underscored a notable disparity between the existing pedestrian infrastructure and the desired walkability standards, particularly concerning sidewalks and pathways, crosswalks and pedestrian crossings, pedestrian safety, accessibility, amenities, comfort, and land use and destinations.(Figure 7) These shortcomings pose significant challenges for differently abled individuals, hindering their mobility and overall pedestrian experience.

Figure 7. Walkability Score for Olcott Mawatha and W.E. Bastian Mawatha

4.1. Sidewalks and pathways

Along Olcott Mawatha, a notable lack of smooth and even surfaces on sidewalks and

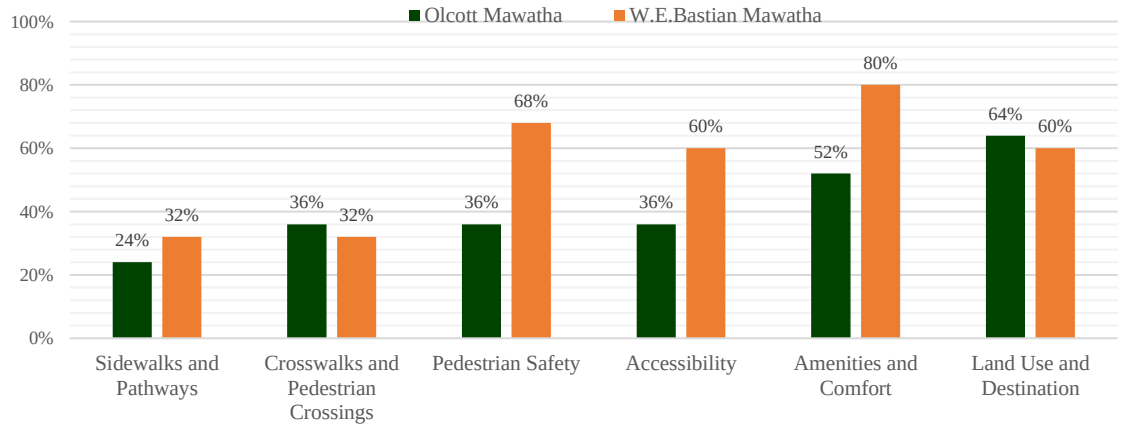


Figure 8. Observed Crossing Barriers for Pedestrians along Streets
Source: Compiled by Authors

pathways presented significant challenges and safety concerns for differently abled pedestrians, earning a low score of 24% on the walkability checklist. The high volume of pedestrian traffic, coupled with the presence of adjacent shop fronts, further hindered wheelchair accessibility. Additionally, numerous obstacles such as temporary vendor shops and carts, pits, cracked surfaces, unsafe intersections, and a lack of amenities such as warning indicators for disabled individuals near light poles further impeded navigation. Of utmost importance, the absence of tactile paving significantly impacted the ability of differently abled pedestrians to navigate level changes or safely cross the street.(Figure 8)

Conversely, the sidewalks and pathways along Bastian Mawatha generally displayed commendable maintenance, earning a score of 32%. Nevertheless, certain sections experienced obstructions, such as rough paving patterns and sudden level changes, proving inconvenient for those with mobility and vision impairments. Despite having adequate width, the sidewalks posed challenges for wheelchair users due to activities causing significant hindrances. Additionally, street amenities like streetlights without tactile signs, garbage, and adjacent shopfronts further posed barriers to walkability. Particularly around the Railway Station, pedestrians encountered challenges due to the absence of designated walking spaces. The presence of shopfronts that opened directly onto the sidewalks created obstacles and inconveniences for those on foot. However, the presence of curb ramps at intersections represented a notable improvement in accessibility.(Figure 9)

Figure 9. Observed Obstructions Along the Street Sidewalks in Olcott Mawatha
Source: Compiled by the Author

4.2. Crosswalks and pedestrian crossings

When it comes to crosswalks and pedestrian crossings, Olcott Mawatha scored 36% of a score. It was observed that there were several clearly marked crosswalks at major intersections, providing visible indications for pedestrians to cross the street. Furthermore, the crossing surfaces were relatively flat and levelled, reducing potential hazards and unsafe conditions. However, notable deficiencies in crosswalk accessibility were identified, particularly the lack of sufficient crossing time. This time constraint can pose difficulties for individuals with mobility impairments or those who require additional time to cross the street safely Moreover, no auditory or tactile features were present at the crossing areas, significantly impacting accessibility and safety for differently abled individuals.

In comparison, Bastian Mawatha received a score of 32%. While marked crosswalks were present at major intersections, there were no pedestrian signals or auditory cues. Instead, traffic police officers played a crucial role in ensuring adequate crossing time. Nonetheless, a notable issue was the considerable level gap between the sidewalk and the main street along Bastian Mawatha, creating obstacles for people with disabilities when crossing.

4.3. Pedestrian safety

In the assessment of pedestrian safety along Olcott Mawatha, a score of 36% was assigned, reflecting a mixed picture of safety measures along the thoroughfare. Notably, certain sections of Olcott Mawatha demonstrated commendable efforts in ensuring pedestrian safety, particularly in proximity to the railway station and transit hubs. These areas boasted well-designed pedestrian infrastructure, including separated walkways from vehicular traffic and accessible facilities such as ramps, enhancing overall safety for pedestrians. However, despite these positive aspects, significant deficiencies in pedestrian safety persisted along Olcott Mawatha, primarily attributed to the challenges posed by heavy traffic flow and inadequate infrastructure management. Observations uncovered significant gaps, notably in sections where pedestrian zones lacked clear demarcation. This absence of distinct boundaries raised safety concerns, especially as pedestrians navigated areas intermingled with commercial activities and vending carts. Furthermore, issues concerning the visibility of pedestrian crossings emerged as a key safety concern. In certain instances, both drivers and pedestrians faced challenges due to insufficient visibility of designated crossing points, potentially jeopardizing safety for all road users.(Figure 10)

In contrast to Olcott Mawatha, Bastian Mawatha presented significantly safer conditions for pedestrians, attaining a commendable score of 68%. The thoroughfare boasted several notable features contributing to enhanced pedestrian safety, including well-lit streetlamps, and clearly marked pedestrian crossings, particularly noticeable at ladder crossings.These measures significantly augmented the overall safety of pedestrians by improving visibility and guiding both pedestrians and drivers. Moreover, Bastian Mawatha excelled in providing clearly marked and protected pedestrian areas, with particular emphasis on sections adjacent to the Floating Market. These areas were equipped with disability-friendly infrastructure, further enhancing accessibility, and ensuring inclusivity for individuals with diverse mobility needs. However, despite these positive attributes, some sections along Bastian Mawatha still exhibited deficiencies in accessibility infrastructure. These areas lacked the necessary amenities and features to cater adequately to the needs of all pedestrians, highlighting areas for potential improvement.

4.4. Accessibility

In the evaluation of accessibility, Olcott Mawatha received a score of 36%. While the thoroughfare showcased certain favourable attributes such as accessible parking spaces situated near entrances and ramps facilitating access to buildings, significant shortcomings were also noted. These deficiencies encompassed the absence of designated areas providing comfortable directional changes for wheelchair users and a scarcity of accessible seating and resting pods along pedestrian pathways. Additionally, the insufficiency of clear and prominently displayed signage posed challenges for individuals with disabilities in safely navigating the area.

In contrast, Bastian Mawatha received a score of 60%. This thoroughfare demonstrated more comprehensive accessibility provisions, encompassing both private and publicly accessible parking spaces conveniently positioned near entrances, coupled with ramps for easy access. Notably, designed seating and

resting areas for pedestrians were present, although none were tailored specifically to

Figure 10. Observed Shortcomings in terms of Safety along Olcott Mawatha
Source: Compiled by the Author

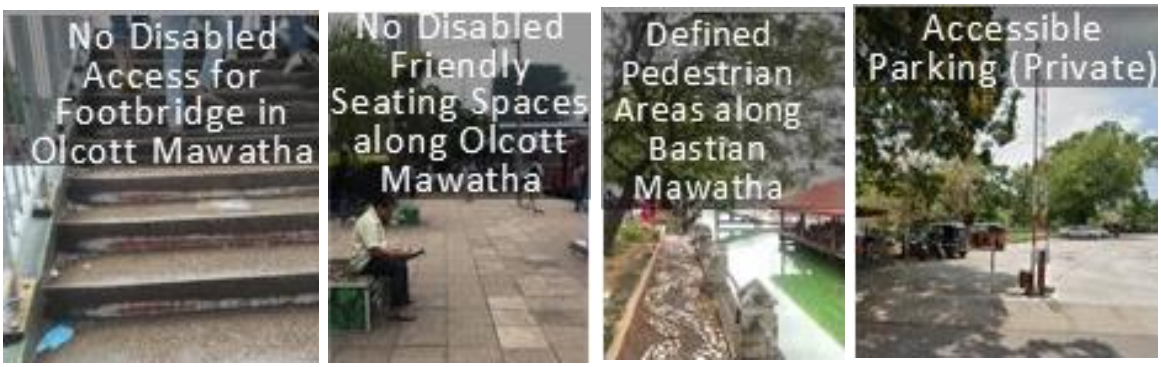


Figure 11. Accessibility Conditions along Streets
Source: Compiled by the Author

cater to differently abled individuals. (Figure 11)

4.5 Amenities and comfort

Based on the observations, Olcott Mawatha received a score of 52% for its amenities and comfort. It was noted that the thoroughfare provided accessible public transportation stops and stations in proximity, offering convenient access for pedestrians. Additionally, there were adequate shade and sheltered areas along pedestrian routes, particularly near the railway station and private bus stands. However, the availability of resting areas with suitable seating was limited, which could have been beneficial for individuals with disabilities. Furthermore, there was a noticeable absence of accessible drinking water facilities, restrooms, and public amenities such as parks, detracting from overall comfort and convenience noticeable absence of accessible drinking water facilities, restrooms, and public amenities such as parks, detracting from overall comfort and convenience.

In contrast, Bastian Mawatha received a significantly higher score of 80% for its amenities and comfort. Observations highlighted the presence of accessible public transportation stops conveniently situated along the thoroughfare, facilitating easy access for pedestrians. Particularly noteworthy were the well-appointed shade and sheltered areas along pedestrian routes, especially in front of the Floating Market, which featured ample resting spaces and appropriate seating. These amenities were particularly advantageous for individuals with disabilities seeking a rest stop. However, to further enhance comfort and

inclusivity, customization of these facilities to accommodate different disabilities, such as providing backrests for seating, would be beneficial. Additionally, the proximity to public washrooms, parking facilities, and food-serving establishments contributed significantly to the overall convenience and accessibility for pedestrians. (Figure 12)

4.6 Land use and destination

In the assessment of land use and destinations, Olcott Mawatha received a score of 64%. The thoroughfare demonstrated commendable accessibility with a notable availability of accessible entrances and services in nearby buildings, promoting inclusivity for individuals with disabilities. Furthermore, Olcott Mawatha boasted a diverse range of destinations, catering to the varied needs and preferences of pedestrians. Additionally, there were satisfactory accessible public transportation options facilitating convenient travel to and from the area, equipped with appropriate accessibility features. However, observations revealed a significant shortfall in the incorporation of disability-friendly design principles throughout Olcott Mawatha. This deficiency highlights a missed opportunity to create a fully inclusive environment, emphasizing the need to address this gap to ensure the thoroughfare is accommodating for individuals with disabilities.

On the other hand, Bastian Mawatha received a score of 60%, with observations indicating areas with relatively long distances to essential services. While the vicinity adjacent to the Floating Market provided excellent destination spaces, certain parts of the street appeared isolated with fewer facilities. Nonetheless, there were accessible transport options available, including bus stops within walkable distances. Despite these positives, the lack of incorporation of disability-friendly design principles persisted along Bastian Mawatha.

4.7 Summery

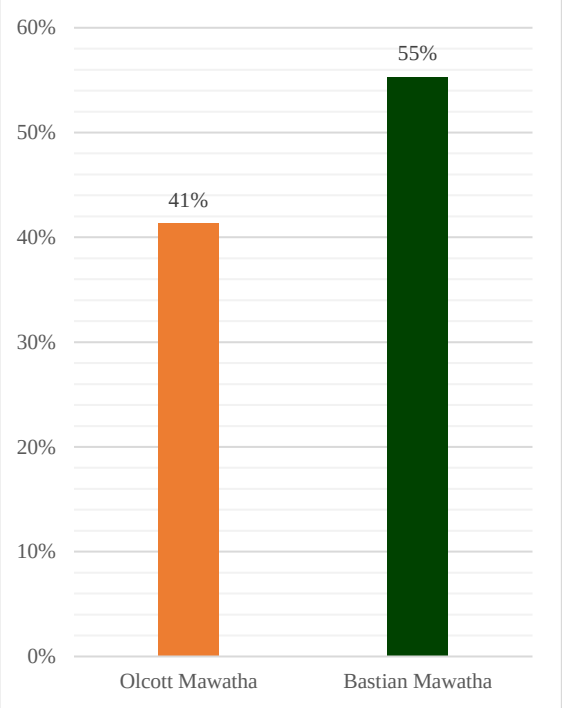
Upon comparing the two major streets, it became apparent that Olcott Mawatha received an overall walkability score of

Figure 12. Existing Amenities and Comfortability Levels
Source: Compiled by the Author

41%, while Bastian Mawatha received a significantly higher score of 55%. (Figure13)

The observations revealed that the bustling nature of Olcott Mawatha presented considerable challenges for differently abled individuals in terms of walkability. Conversely, W.E. Bastian Mawatha stood out as a street with markedly improved walkability conditions, specifically tailored to accommodate the needs of differently abled individuals. The diagram below illustrates the calculated overall score percentages for walkability factors observed along the two streets.

Figure 13. Overall Walkability Score for Olcott Mawatha and W.E. Bastian Mawatha
Source: Compiled by the Author



This comparison underscores the need of implementing measures to enhance walkability and accessibility in urban environments, ensuring that all individuals, regardless of their abilities, can navigate streets safely and comfortably.

5. Discussion

The findings of this study reveal a multifaceted perspective on walkability challenges for differently abled individuals, with a specific focus on Pettah, Sri Lanka (Table 2). These challenges are situated within the broader context of existing literature, highlighting gaps in the urban planning and design of public transport districts.

Schreuer et al., (2019) emphasize that walkable neighbourhoods play a vital role in promoting daily activity participation among differently abled individuals. This finding resonates strongly with the observations in Pettah, where the lack of inclusive infrastructure poses significant barriers to mobility and engagement. The absence of fundamental disability-friendly features such as tactile paving and auditory signals exacerbates the issue, contrasting sharply with the practices of many other cities. The deficiencies in Pettah's infrastructure suggest a tangible risk of reduced physical and social activity among differently abled individuals, which may lead to secondary health complications, including weight gain, depression, fatigue, and social isolation. This underscores the urgent need to adopt universally inclusive design principles to mitigate these risks.

The observed inadequacies in crossing times and sidewalk accessibility align with the findings of the Global Designing Cities Initiative (2016), which stresses the importance of equitable pedestrian infrastructure. This research advocates for practical interventions such as integrating tactile paving, increasing crossing times, and adding curb ramps to create a safer and more accessible environment. Addressing these issues not only aligns with global standards but also tailors solutions to the

specific challenges faced in developing nations like Sri Lanka.

An important dimension of the study is the role of community engagement in enhancing walkability (Lamour et al,. 2019) argue that participatory urban design is a critical tool for fostering inclusivity. This study reinforces their assertion by emphasizing the importance of involving differently abled individuals in the planning and design processes. By giving these individuals, a platform to articulate their specific needs, urban planners can create more tailored and effective solutions. This approach ensures that often-overlooked requirements are adequately addressed, providing valuable insights for rapidly urbanizing regions aiming to enhance equity in urban mobility.

The findings of this study not only highlight the gaps in Pettah's current infrastructure but also provide a roadmap for implementing inclusive urban design principles. These lessons are broadly applicable to other developing nations facing similar challenges, thereby contributing to the global discourse on accessible urban mobility.

6. Conclusion

This research underscores the pressing need for inclusive urban design in public transport districts, particularly in developing nations. Often neglected in urban development strategies, creating accessible, pedestrian-friendly environments that cater to diverse needs is essential for fostering inclusivity among all individuals, regardless of their abilities.

Focusing on Pettah, a key public transport hub in Colombo, Sri Lanka, this study aimed to evaluate the current state of walkability and identify the challenges faced by differently abled individuals. In the absence of sufficient literature on tailored walkability frameworks for differently abled pedestrians in public transport districts, this research developed a comprehensive framework grounded in an extensive literature review. The framework integrates six key walkability factors: Sidewalks and Pathways, Crosswalks and Pedestrian Crossings, Pedestrian Safety, Accessibility, Amenities and Comfort, and Land Use and Destination, each with relevant indicators. This tailored framework represents a significant theoretical and practical contribution to the field.

Aligning with limitations, the study's scope included major transport hubs (Fort Railway Station, Major Private Bus Stop Infront of Railway Station, Bastian Bus Stand and Ceylon Transport Board Bus Stand), along with two major connected streets (01. Olcott Mawatha and 02. W.E. Bastian Mawatha). Utilizing a Walkability Checklist as the data collection tool, the study assessed the walkability of the identified pedestrian environment for differently abled individuals.

In summary, Olcott Mawatha received a walkability score of 41%, whereas Bastian Mawatha scored significantly higher at 55%, indicating notable disparities in walkability between the two streets. Key findings under each walkability factor are outlined as follows:

The below findings advocate for targeted interventions, majorly including:

- Implementation of tactile paving and auditory signals particularly at pedestrian crossings.

Table 2. Summarizing the **key** Findings

Table 3. Summarizing the **key** Findings	Table 4. Summarizing the **key** Findings	Table 5. Summarizing the **key** Findings
Sidewalks and Pathways	Olcott Mawatha	Lack of smooth and even walking surfaces, hindered wheelchair accessibility due to pedestrian traffic and shop fronts, obstacles such as temporary vendor shops and carts, pits, cracked surfaces and unsafe intersections, the absence of amenities and tactile paving.
	W.E. Bastian Mawatha	Obstructions such as rough paving patterns and sudden level changes, challenges for wheelchair users caused by street activities, barriers such as streetlights lacking tactile signs, garbage, and adjacent shopfronts, absence of designated walking spaces (around the Railway Station).
Crosswalks and Pedestrian Crossings	Olcott Mawatha	Lack of sufficient crossing time, lack of auditory or tactile features.
	W.E. Bastian Mawatha	Lack of pedestrian signals and auditory cues, obstructions created by a considerable level gap between the sidewalk and the main street
Pedestrian Safety Features	Olcott Mawatha	Heavy traffic flow, inadequate infrastructure management, absence of distinct boundaries, lacking visibility of pedestrian crossings
	W.E. Bastian Mawatha	Deficiencies in accessibility infrastructure
Accessibility features	Olcott Mawatha	Absence of designated areas providing comfortable directional changes for wheelchair users, scarcity of accessible seating and resting pods along pedestrian pathways, insufficiency of clear and prominently displayed signage.
	W.E. Bastian Mawatha	Absence of specifically designed resting areas to cater to differently abled individuals.
Amenities and comfort	Olcott Mawatha	Limited availability of resting areas with suitable seating, a noticeable absence of accessible drinking water facilities, restrooms, and public amenities such as parks.
	W.E. Bastian Mawatha	Customization of available facilities to accommodate different disabilities, such as providing backrests for seating, would be beneficial.
Land use and destination	Olcott Mawatha	Lack of disability-friendly design principles.
	W.E. Bastian Mawatha	Certain parts of the street appeared isolated with fewer facilities, lack of disability-friendly design principles.

Source: Compiled by Authors

- Enhanced crossing times and curb ramp installations to accommodate slower mobility speeds.
- Introduction of accessible public amenities, such as rest areas with backrests and wheelchair-accessible restrooms.

Transforming public transport districts into inclusive spaces requires urgent urban design interventions. These improvements must be complemented by awareness campaigns and community collaboration to further enhance inclusivity and equity. Creating urban environments that offer equal opportunities for all individuals

fosters a sense of belonging and improves overall community well-being.

Future research should expand this study by addressing a broader range of disabilities and leveraging advanced tools such as GIS and 3D modelling to refine the evaluation of walkability for differently abled individuals in urban public transport districts.

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