Accessibility for Persons with Mobility Impairment at Bus Stops

Z M Utari and N R Kusuma

1Department of Architecture, Faculty of Engineering, Universitas Indonesia, Depok 16425, Indonesia

Abstract. The bus stop is one of the public transportation facilities that is aimed to meet the mobility needs of all people in public spaces. Many people with disabilities still find it challenging to access these facilities. The application of inclusive design must be implemented correctly and adequately to meet the mobility needs of individuals with limited abilities. The purpose of this scientific paper is to identify the application of accessibility to meet the mobility needs of persons with disabilities in public transportation facilities. The method used in this paper is a qualitative analytical method by conducting a literature study and study on Kampung Melayu TransJakarta Bus Stop. The analysis undertaken refers to the result of a literature study conducted on the provisions of public transportation facilities accessibility. Based on the result of such scientific studies, the availability of access elements is an important thing to provide. This research found that meeting the mobility needs of persons with disabilities can be done by paying attention to several elements of public transportation facilities access with the provisions of the five variables in it (dimensions, surface, lighting, orientation, and signage).

1. Introduction

In public space, some facilities support people to do activities, one of them is helping people to move by using public transportation. The State is obliged to provide public transportation that can cover all society's needs, including accessibility [1]. However, the inclusive design is not implemented properly on the public transportation facilities accessibility, especially bus stops. Such accessibility is still to meet the mobility needs of people with disabilities. Currently, people with disabilities are still difficult to gain access to public transportation [1]. In designing these facilities, user's diversity must be integrated from the start to achieve equality in using public transportation. According to Hithcock et al. (2001), inclusivity in public transportation facilities can overcome the barriers faced by persons with disabilities during the move [2].

1.1 Research Objective

The purpose of this paper is to identify the application of accessibility at bus stops. Based on the facts on the field, access to public transportation is still not inclusive. Therefore, the author will further discuss the application of accessibility at bus stops in meeting the mobility needs of people with disabilities.
2. Literature review

World Health Organization (1980) published the International Classification of Impairments, Disabilities, and Handicap (ICIDH), which contains a conceptual framework to inform the classification and description of three aspects of disability, namely impairment, disabilities, and handicaps [3]. This disability can be a flaw in the form of mobility, physical dependence, and economic dependence. Impairment, relating to the physical individual with abnormalities, deficiencies, or damage to bodily functions or structures. Disabilities are the impact of impairments that result in the disruption of individual activities. Handicap means where the loss experienced by individuals as a result of impairments and disabilities that limit individuals in interacting and adapting to their environment. Based on these explanations, disabilities are defined as conditions where an individual whose activity is disrupted due to the impact of the disorder on physically and mentally [3].

The word disability comes from the word ‘disability’ in English, which means disabled. In Kamus Besar Bahasa Indonesia (KBBI), disability is a deficiency that causes the value or quality is less than perfect (found in the body, objects, mind, or morals) [4]. Thus, the term disability can be defined as the condition of an individual who loses physical or mental ability. The European Committee for Standardization (CEN) / European Committee for Electrotechnical Standardization (CENELEC) (2014) and Fischer (2009) discuss a variety of disabilities. They categorize it into three types, namely sensory dysfunction, restricted organ and mobility functions, and cognitive difficulties [5,6]. The word 'mobility' in Kamus Besar Bahasa Indonesia (KBBI) is a readiness to move; movement [7]. Thus, the term mobility impairment can be interpreted as a condition of individuals who have lost the ability to move. Based on the explanation of the variety of disabilities above, those who are included in mobility impairment are sensory and physical disabilities. The people who lose the ability to move require special needs, such as dimensions of space and accessibility to help their mobility [8].

J. Kent Fitzsimons (2016) argues that access can be deemed a means to get to a destination in the form of a pathway to facilitate human functional movement and can be part of the meaning-making experience of material space [9]. Meanwhile, The Regulation of Minister of the Public Works Number: 30/PRT/M/2006 on the Technical Guide of Facilities and Accessibilities in Buildings and Environments argues that accessibility is a convenience provided for all people including people with disabilities and the elderly to realize equal opportunities in all aspects of life and livelihood [10]. According to the opinion of Goltsman and Iacófano (2007) accessibility is a basic principle to make the cities become more inclusive and to meet the mobility needs of all people, including those with limitations [11]. Several provisions regarding the required accessibility should be in place.

According to the European Conference of Ministers of Transport (ECMT) (2006), there are several elements within the environment of public transportation facilities such as sidewalks, crossroads, and tactile surfaces that are known to be problematic oftentimes and need to be considered to meet the needs of disabled persons in performing their activities [12]. Besides, the built infrastructure (stairs, ramps, and elevators) should be considered as well to increase the fulfilment of the accessibility for disabled persons [13]. The National Disability Authority (NDA) revealed similar things that some of these elements have accessibility provisions that need to be applied correctly and adequately [14]. Manley (2011) also argues that the variables in the provision are divided into two, namely, the objective (quantitative) and subjective (qualitative) variables in each element [2]. Objective (quantitative) variables include the dimension, surface, and signage, while subjective (qualitative) variables cover the lighting and orientation. The following are provisions on the accessibility for persons with mobility impairments according to their needs, based on the three provisions set forth by the European Conference of Ministers of Transport (ECMT) (2006), the Building and Construction Authority (BCA) (2016), and the National Disability Authority (NDA), which are equipped with objective variables and subjectivity according to Manley (2011).
Table 1. Accessibility provisions for every person with mobility impairments [2,12,13,14].

| Persons with sensory impairment (vision) | Pedestrian route | Pedestrian crossing point | Ramp | Staircase | Lift |
|-----------------------------------------|------------------|--------------------------|------|-----------|------|
| Dimension: minimum width dimension of 1200 mm | | | | | |
| Surface: the surface must be non-slip and avoid elevation differences that are not too far away | | | | | |
| Lighting: the room must be bright and free of shadow glare | | | | | |
| Orientation: orientation assistance tools (such as signs, buttons, and handles) must be recognizable with a minimum dimension of 850 - 1000 mm above the base surface and the use of tactile components on the floor is required | | | | | |
| Signage: the use of Braille letters to facilitate receiving information, placement of signage and the use of contrasting colors for easy recognition | | | | | |

| People with physical impairment (ambulant disabled people) | Pedestrian route | Pedestrian crossing point | Ramp | Staircase | Lift |
|-----------------------------------------------------------|------------------|--------------------------|------|-----------|------|
| Dimension: minimum width dimension of 700 mm for stick users and 900 mm for crutches users | | | | | |
| Surface: the surface must be non-slip and avoid elevation differences that are not too far away | | | | | |
| Lighting: the room must be bright and free of shadow glare | | | | | |
| Orientation: orientation assistance tools, such as handles, must be reachable with a dimension of 850 - 1000 mm above the base surface | | | | | |
| Signage: placement of signage and the use of contrasting colors for easy recognition | | | | | |

| Persons with physical impairment (chair-bound disabled people) | Pedestrian route | Pedestrian crossing point | Ramp | Staircase | Lift |
|---------------------------------------------------------------|------------------|--------------------------|------|-----------|------|
| Dimension: minimum width of 750 mm for one individual pathway, 1,200 mm for a pathway to meet individuals without wheelchairs, and 1,500 mm to meet other wheelchair users | | | | | |
| Surface: the surface must be non-slip, avoid gaps or vertical differences larger than 5 mm so that the small wheels of the wheelchair are not stuck | | | | | |
| Lighting: the room must be bright and free of shadow glare | | | | | |
| Orientation: orientation assistance tools, such as handles, must be reachable with a dimension of 850 - 1000 mm above the base surface | | | | | |
| Signage: placement of signage and the use of contrasting colors for easy recognition | | | | | |

The table detailed the required design planning for persons with mobility impairments in the elements of public transportation facilities based on the provisions described in the previous paragraph. Accessibility needs for every disabled person are different from one another and depend on their respective characteristics. There are five variables (dimension, surface, lighting, orientation, and signage) that can be used as a reference to fulfill the right of disabled persons to public transportation accessibility. By paying attention and applying the five provisions of these variables to public transportation means, their rights will be fulfilled.

3. Method
The method used in this paper is a qualitative analysis method by conducting a literature study and study on Kampung Melayu TransJakarta Bus Stop. The analysis undertaken refers to the result of a literature study conducted on the provisions of public transportation facilities accessibility. Disabled persons with mobility impairment (physical and sensory) is the focus of this paper. The data obtained will subsequently be processed as a comparison.

4. Case Studies Analysis
The case study discussion will identify the application of inclusive designs related to public transportation facilities accessibility. The mobility needs of every disabled user with different physical conditions should be considered in public transportation facilities, especially for people with mobility...
impairments. Therefore, an in-depth analysis is required to find out in detail about the accessibility provisions that should be applied to public transportation facilities in meeting the mobility needs of all users.

The public transportation used as a case study is Kampung Melayu TransJakarta Bus Stop. In this case study, the author will analyse the bus stop conditions related to the user's mobility needs. This analysis is based on the five elements of access to public transportation that has been discussed previously. Then the accuracy of its application is analysed at the bus stop by referring to the existing provisions.

4.1 Pedestrian route

The European Conference of Ministers of Transport (ECMT) (2006) explains that a clear path without obstacles with a precise location can provide convenience to the users when they walk alone or side by side [12]. In the case of the Kampung Melayu TransJakarta Bus Stop, this aspect was lack of consideration. The path is only available in the entrance area of the bus stop. The provision of these elements is not equipped with accessibility provisions, so the pathway becomes less friendly, especially for disabled persons.

The path has a minimum width, so it does not fit the required accessibility requirements. Besides, the provisions that the pathway must be clean of obstacles is not given much attention to its application at the bus stop (figure 1). User mobility, especially for disabled people, is impaired. Furthermore, lighting on the path must be bright and free of shadow glare. The path lighting conditions are shown in figure 1.

Figure 1. Pedestrian route condition
Source: Personal processing based on POLAR UI Team (2019)

- Spot A: the direction and location of the path are not given much attention. At spot A, the path of the light is quite bright and free of shadow glare.
Spot B: the condition of the pathway has an uneven width, there is a wide section and then it becomes narrow.

Spot C: the path narrows in this section so that people who pass must take turns due to its restriction. Such conditions also do not allow wheelchair users, crutches, and canes to pass this path. Their mobility will be impaired because the size is much less than required.

Based on the provisions set by the European Conference of Ministers of Transport (ECMT) (2006), the Building and Construction Authority (BCA) (2016), and the National Disability Authority (NDA), orientation assistance tools need to be provided to help the mobility of disabled people on the pathway. The railing is provided to help user orientation. However, there are no tactile surfaces available in place, so persons with visual impairments will find it difficult to access the bus stop entrance. Their mobility and security will be disturbed because it is difficult to receive information on the direction and position of bus stops.

The pathway must have a non-slip and flat surface to avoid slippery path. The material used on the path is concrete (figure 2). Texture concrete has good slip-resistance in dry and wet conditions [15]. This is found on the surface of the track, finishing the textured concrete, so that the application is appropriate. Mobility of users, especially disabled people, will not be disturbed.

![Figure 2. The use of textured concrete material on the surface of the pathway](Source: Personal processing based on POLAR UI Team (2019))

4.2 Pedestrian crossing point

Based on the provisions set by the European Conference of Ministers of Transport (ECMT) (2006), the Building and Construction Authority (BCA) (2016), and the National Disability Authority (NDA), these elements need to have a precise and secure location, so that users can cross easily, comfortably, and safe. Bus stops do not provide clear and safe crossing points that interfere with the safety and comfort aspects of the user (figure 3). In addition to location, lighting at the crossing point must also be adjusted. The crossing point must have bright lighting and free of shadow glare. In figure 3, it appears that the condition of the area that is generally used for users to cross is quite bright and free of shadow glare.

![Pedestrian Route, Entrance, Bus Stop](image)
The crossing point must provide crossing assistance tools, such as audio signals and tactile surfaces. This tool was not found in the bus stop area (figure 3). The direction and position of the entrance area become unclear and confusing to the users. For persons with visual impairments, it will be challenging to access the entrance area of the bus stop, because there is no guide for them. In addition to crossing assistance tools, the surface of the crossing area also needs some attention. According to the provisions set, the surface must be non-slip to provide safety to the user during their walk. The material used in the crossing area is concrete with textured finishing (figure 4). Textured concrete has good slip-resistance in dry and wet conditions [15].
4.3 **Ramp**

The application of ramps at the entrance area is sufficient to facilitate the mobility of persons with disabilities within adequately bright lighting and free from shadow glare. This is compliant with the provisions set forth by the European Conference of Ministers of Transport (ECMT) (2006), the Building and Construction Authority (BCA) (2016), and the National Disability Authority (NDA). The ramps must have a non-slip surface on the wet and dry conditions to determine the quality of accessibility on it. The material used is steel profiled (diamond plate) (figure 5). The material has good slip-resistant values in both dry and wet conditions [15]. Orientation assistance tools, such as handles, need to be provided as well on both sides of the ramp. This is not the case in the location as there is only one handle available on one side (figure 5).

![Figure 5. Ramp condition](source: Personal processing based on POLAR UI Team (2019))

4.4 **Staircase and Lift**

Both elements play a role as a vertical circulation path. However, stairs cause disadvantages as they cannot be used by all users, such as wheelchair users and people who use crutches and sticks. In this case, these two elements should be readily available. Bus stops only provide stairs in some corridors as a link to the bus entrance due to the elevation difference between the edge of the corridor and the bus entrance. The use of stairs and elevators as main circulation lines there is not available.

5. **Conclusion**

The application of accessibility in public transportation facilities has not been implemented correctly and adequately. Public transportation facilities such as bus stops are provided to meet the mobility needs of everyone including those with impairments. Considering the facts in the field, such an objective is not achieved as disabled people cannot use or access them. Accessibility of the bus stops is still inadequate for them to move easily, safely, and comfortably. Based on the results of the analysis, the authors found that meeting the mobility needs of people with disabilities can be done by paying attention to several elements of public transportation facilities access, such as pedestrian routes, pedestrian crossing points, ramps, staircases, and lift. Among these five elements, there are several variables
(dimension, surface, lighting, orientation, and signage) with special provisions to meet mobility that covers all users. Based on the analysis of the case studies, there are several elements at the bus stops that are only available, but inclusiveness is still not appropriate or even not provided for its application. Therefore, the access element provided at Kampung Melayu TransJakarta Bus Stop is currently not sufficiently qualified and accessible for all users. This can be seen from the number of elements that are still missing that the mobility needs cannot be satisfied.

6. References

[1] Januardy A F et al. 2015 Laporan Pemeringkatan Indeks Aksesibilitas Fasilitas Publik bagi Kelompok Difabel di Jakarta (Jakarta Pusat: Lembaga Bantuan Hukum (LBH) Jakarta)
[2] Nazif J I 2011, June Disability and Mobility: Interaction of Two Public Policies for Sustainable Development (FAL Bulletin)
[3] World Health Organization (WHO) 1980 The International Classification of Impairment, Disabilities, and Handicaps (ICIDH) (Geneva: World Health Organization (WHO))
[4] "disability" 2019 Kamus Besar Bahasa Indonesia (KBBI) Online DOI: https://kbbi.web.id/cacat
[5] European Committee for Standardization (CEN) / European Committee for Electrotechnical Standardization (CENELEC) 2014 Guide 6: Guidelines for Standards Developers To Address the Needs of Older Persons and Persons with Disabilities DOI: https://eurogip.fr/wp-content/uploads/2019/12/CENCLCGuide6_Guide-for-addressing-accessibility-in-standards.pdf
[6] Meuser P 2012 Construction and Design Manual: Accessible Architecture (New York: DOM Publisher)
[7] "mobility" 2019 Kamus Besar Bahasa Indonesia (KBBI) Online DOI: https://kbbi.web.id/mobilitas
[8] Disability, Opportunities, Internetworking, and Technology (DO-IT) Centre Disability: Mobility Impairment (Washington: University of Washington) DOI: https://www.washington.edu/doit/mobility-impairments#block-menu-block-3
[9] Boys J 2017 Disability, Space, Architecture: A Reader (Oxon: Routledge) DOI: https://doi.org/10.4324/9781315560076
[10] Peraturan Menteri Pekerjaan Umum Nomor: 30/PRT/M/2006 tentang Pedoman Teknis Fasilitas dan Aksesibilitas pada Bangunan Gedung dan Lingkungan
[11] Basha R 2015 Disability and Public Space-Case Studies of Prishtine and Prizen International Journal of Contemporary Architecture 2 DOI: 10.14621/tna.20150406
[12] European Conference of Ministers of Transport (ECMT) 2006 Improving Transport Accessibility for All: Guide to Good Practice DOI: 10.1787/9789282101407-en
[13] Building and Construction Authority (BCA) 2016 Chapter Three: Access Around and Within the Building (Building and Construction Authority (BCA): Singapore) pp 44-69
[14] National Disability Authority (NDA) Building for Everyone: A Universal Design Approach DOI: http://universaldesign.ie/Built-Environment/Building-for-Everyone/1-External-Environment.pdf booklet 1: external environment pp 37-84
[15] Canadian Standards Association (CSA) 2012 B651-12 Standards Accessible Design for the Build Environment (Canada: Canadian Staninars Association (CSA))

Acknowledgment

The Study of Accessibility for Persons with Mobility Impairment at Bus Stops is funded by the University of Indonesia through the Directorate of Research and Development through the PUTI PROSIDING 2020 scheme. The author also likes to express to all who contributed to this paper.