

Evaluating Public Transport Facilities For Wheelchair Users At Palmerah–Sudimara Stations Using Universal Design Standard

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Abstract

The Indonesian government try to improve public transportation, especially in Jakarta and surrounding cities. However, public facilities in Jakarta still do not fully meet accessibility standards for people with disabilities, limiting their mobility and participation in society. One of the most widely used transport systems is the electric railway, which accommodates large numbers of passengers and connects Jakarta with cities like South Tangerang, where many workers commute daily. This study examines the accessibility of railway facilities for people with disabilities, focusing on Palmerah–Sudimara Stations. Through an observational study and architectural analysis, this study evaluates existing facility designs, studies, reports, and regulations, including Universal Design principles and Indonesia's disability laws. The research assesses whether these facilities comply with accessibility standards and identifies gaps in implementation. By highlighting these challenges, the study likes to contribute to more inclusive urban mobility and provide recommendations for improving accessibility in public transportation, ensuring equal opportunities for all individuals, including wheelchair users.

Keywords: Accessibility, Electric Railway Facilities, Public Transportation, Universal Design

INTRODUCTION

People with disabilities make up a relatively small percentage of Indonesia's population, with approximately 22.5 million individuals, or 5% of the total population. Despite their smaller numbers, they have the same rights as other citizens, including access to public transportation. Some of them also need to work to fulfill their needs but they have limited access to their work and social [1]. Public transportation plays a crucial role in enhancing social and economic mobility, reducing access inequality, and increasing community engagement [2-3]. To support inclusivity, the Indonesian government has implemented several regulations, including Law No. 8 of 2016 on Persons with Disabilities and Ministry of Public Works and Housing Regulation No. 14/PRT/M/2017, both of which emphasize accessibility in public infrastructure.

Law No. 8 of 2016 sets the rights and services available to people with disabilities, get employment opportunities, and requires that at least 2% of government and state-owned enterprise employees be individuals with disabilities. Meanwhile, Ministry of Public Works and Housing Regulation No. 14/PRT/M/2017 ensures that buildings and public infrastructure are designed for universal accessibility without requiring modifications. However, despite these regulations, accessibility issues still exist, particularly in the public transportation sector [4]. Despite regulations regarding accessibility, little research has been conducted to assess the quality and implementation of standards in accessibility facilities, especially in densely populated commuter areas such as Jabodetabek.

The electric railway system is one of the most widely used public transportation modes in Indonesia, particularly in the Greater Jakarta area. According to PT KAI Commuter, in the first half of 2024, the Jabodetabek Commuter Line served 156.8 million passengers, with an average of 961,051 daily users on weekdays and 709,730 on weekends. This high usage makes stronger the importance of good accessibility for all commuters, including individuals with disabilities. However, the lack of the quality of the facilities for disabilities on public transport can make them take

longer time to get to their destination using public transport [5]. One of the reasons is the manual access door for wheelchair users, wheelchair space availability, toilet size, emergency button, and arrangement seats and isle [6].

Universal Design aims to create environments that can be used by all people, regardless of their abilities [7]. Universal Design Principles are Equitable Use, Flexibility in Use, Simple and Intuitive Use, Perceptible Information, Tolerance for Error, Low Physical Effort, and Size and Space for Approach and Use [8].

Historically, Universal Design concept gained traction in the 20th century after World War II, when a significant number of soldiers returned home with disabilities [9]. Pioneers like architect Ron Mace recommended accessible housing, while Selwyn Goldsmith consulted wheelchair users to implement dropped curbs for improved mobility. Principles of Universal Design, including step-free access, tactile guidance, and ample wheelchair spaces, are essential in train stations to facilitate independent movement for wheelchair users.

Universal Design itself still not fully implemented in Indonesia [10-11]. Besides that, Universal Design has good impact on public transportation in other country such as Singapore if implemented well that also have a lot of public transportation [12]. By integrating Universal Design principles into Indonesia's public transportation system, especially its railway facilities, accessibility barriers can be minimized, ensuring equal opportunities for all individuals, including wheelchair users and other persons with disabilities. This study evaluates wheelchair accessibility at Palmerah–Sudimara stations using Universal Design standards to identify gaps and recommend improvements with technology-based solution.

OBJECTIVES

This study evaluates the accessibility of Jakarta's commuter railway stations for wheelchair users through the lens of Universal Design principles and Indonesian National Standards (SNI), with the following objectives:

- Assess compliance of critical facilities such as ramps, toilets, pedestrian paths, elevators with SNI and ISO accessibility standards, identifying gaps in implementation.
- Quantify deviations from UD principles by measuring key parameters, revealing systemic failures in 'Size and Space for Approach and Use' and 'Equitable Use'.
- Document real-world challenges through field observations and staff interviews, uncovering operational barriers.
- Analyzing policy-practice gaps with better compliance can model scalable solutions.
- Propose actionable technology-based solution that bridge Universal Design principles with sustainable urban mobility.

METHODS

Study Area

This study examines accessibility conditions along the Jakarta-Rangkasbitung commuter line, with particular focus on South Tangerang stations that serve as critical transit points for Jakarta-bound commuters.



Figure 1. Palmerah-Sudimara route from Google Maps



Figure 2. Palmerah-Sudimara route from Google Maps

As shown in Figure 1, Figure2, and Figure 3, the study’s analysis concentrates on Zone South Tangerang of Jabodetabek’s from five zone KRL network, which collectively handle 58% of total ridership, based PT KAI Commuter data on 2023. Station selection prioritized high-traffic nodes including Sudimara with 15,200 daily users and Jurangmangu with 12,800 users in South Tangerang, along with their Jakarta counterparts Palmerah with 32,000 users and Kebayoran with 28,500 users, based on Central Bureau of Statistics South Tangerang, 2023 and PT KAI Commuter data in 2023. These stations represent a compelling study area as they demonstrate significant ridership volumes warranting quality accessibility, huge gap between urban and suburban infrastructure, and typical commute patterns of South Tangerang residents working in Jakarta

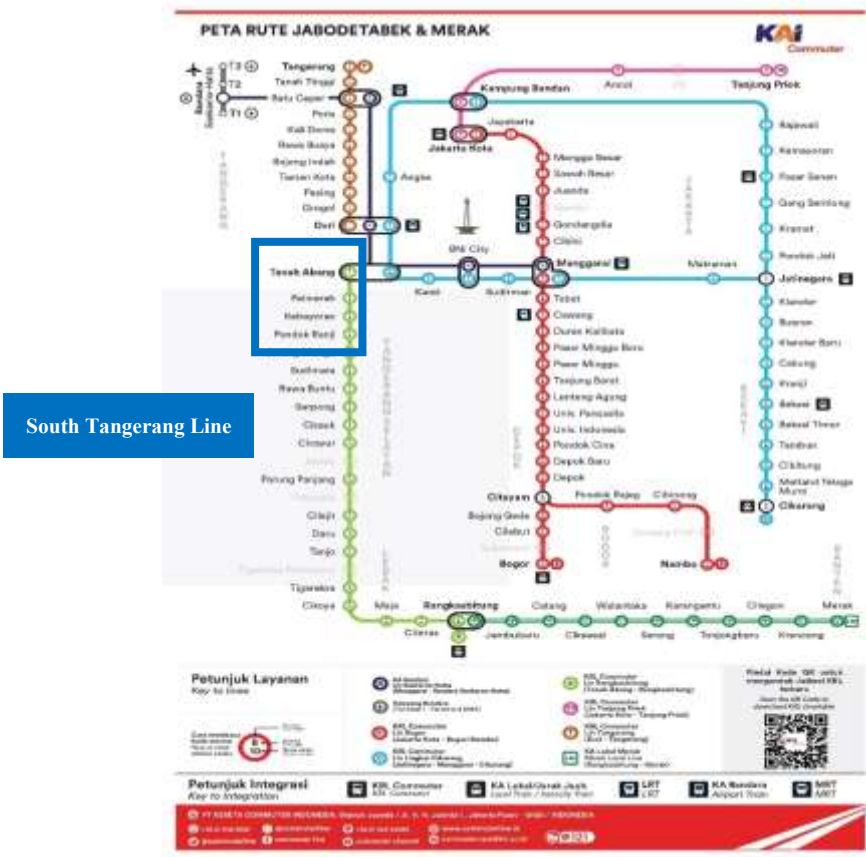


Figure 3. Palmerah-Sudimara route from Commuter Line route on the KAI commuter website

Data Collection

This study uses a qualitative approach with observational analysis, field measurements, and interviews to assess the accessibility of railway facilities for people with disabilities. The research was conducted at Palmerah Stations, Kebayoran Stations, Pondok Ranji Stations, Jurangmangu Stations, and Sudimara Stations, focusing on compliance with accessibility standards based on Indonesian regulations and Universal Design principles.

Field Observations

Direct observation was conducted at both stations to document existing accessibility facilities, such as ramps, guiding blocks, elevators, railing, toilet availability, and lift.

Facility Measurements

Key accessibility parameters were measured, including ramp slopes, handrail heights, and pedestrian path widths. These measures were compared against national and international accessibility standards.

Interviews

Semi-structured interviews were conducted with security officers stationed at Palmerah until Sudimara to gather insights into the daily challenges faced by people with disabilities in using railway services. The interviewees were selected based on their frequent interaction with passengers requiring assistance.

The collected data was analyzed by comparing the existing facilities with the accessibility standards outlined in Indonesian laws and Universal Design principles. The findings were categorized into compliant and non-compliant aspects, followed by recommendations for improvements in accessibility infrastructure.

RESULTS

Field Observation and Facility Measurements

1. Pedestrian Path Width

Measurements are taken by finding the narrowest path that allows a wheelchair user to pass through and the widest path on the station.

Table 1.1

Station	Narrowest	Widest
Palmerah	150 cm	1080 cm
Kebayoran	50 cm	3000 cm
Pondok Ranji	60 cm	550 cm
Jurangmangu	60 cm	1260 cm
Sudimara	180 cm	420 cm

2. Ramp Slopes

Measurements are made by measuring the ramps found on the station, then measuring the length of the slope and the length of the flat. Selected from the most frequently passed by wheelchair users.

Table 1.2

Station	Length of Sloping Area	Length of The Flat Area
Palmerah	480 cm	420 cm
Kebayoran	260 cm	250 cm
Pondok Ranji	120 cm	118 cm
Jurangmangu	1320 cm	1290 cm
Sudimara	265 cm	160 cm

3. Railing Heights

Measurements were taken by looking for handrails around the station.

Table 1.3

Station	Heights
Palmerah	100 cm
Kebayoran	120 cm
Pondok Ranji	80 cm
Jurangmangu	100 cm
Sudimara	80 cm

4. Wheelchair Availability

Checking how many wheelchairs are on each platform and their precise location.

Table 1.4

Station	Quantity	Location
Palmerah	2	Each platform
Kebayoran	4	Two platforms and second floor
Pondok Ranji	2	Each platform
Jurangmangu	2	Each platform
Sudimara	3	Platform 1

5. Lift Availability

Checking how many lifts are on each platform and their precise location.

Table 1.5

Station	Quantity	Location
Palmerah	2	Each platform
Kebayoran	3	Each platform
Pondok Ranji	2	Each platform
Jurangmangu	2	Each platform
Sudimara	0	-

6. Tactile Paving

Checking tactile paving availability and their condition.

Table 1.6

Station	Status
Palmerah	Available on the second floor.
Kebayoran	Available on the second floor.
Pondok Ranji	Available on both platforms.
Jurangmangu	Available on both toilets but no ramps to get there.
Sudimara	-

7. Toilet for Disabled

Checking toilet for disabled availability on the toilet area.

Table 1.7

Station	Status
Palmerah	Available on the second floor.
Kebayoran	Available on the second floor.
Pondok Ranji	Available on both platforms.
Jurangmangu	Available on both toilets but no ramps to get there.
Sudimara	-

Interviews

1. Wheelchair User Intensity

This question is about knowing how often wheelchair users use the railway station.

Table 2.1

Station	Wheelchair users' intensity per day
Palmerah	5 persons
Kebayoran	10-15 persons
Pondok Ranji	4-5 persons
Jurangmangu	0-1 person
Sudimara	2-5 persons

2. The Most Common Type of Disability Encountered

This question is to find out the variability of disabilities that usually use train stations.

Table 2.2

Station	The most common type of disability
Palmerah	Elderly
Kebayoran	Unable to walk, have physical disabilities, or have become disabled due to accidents.
Pondok Ranji	Visual impairments
Jurangmangu	Elderly, visual impairments.
Sudimara	Visual impairments

3. Obstacles and Responses of Passengers

This question is to find out obstacles when security guard helping the wheelchair user and other passenger response to wheelchair user needs when needed.

Table 2.3

Station	Obstacles	Responses
Palmerah	-	Responsive
Kebayoran	-	Responsive
Pondok Ranji	-	Responsive
Jurangmangu	-	Responsive
Sudimara	-	Responsive

4. Suggestion and Hopes

This question is to understand security guard's perspective that helping wheelchair user about the facilities itself and their hopes.

Table 2.4

Station	Suggestions and hopes
Palmerah	-
Kebayoran	Area and facilities improvement.
Pondok Ranji	Facilities improvement and added more wheelchair.
Jurangmangu	-
Sudimara	It is hoped that the number of disabilities on the station will decrease. The crossing areas between platforms for passengers requiring special assistance should be replaced with safer alternatives, as the current design, which involves crossing directly over the tracks, not safety.

5. Procedure

All stations have the same procedures. Passengers requiring wheelchair assistance arrive at the departure station, where the security team coordinates with the central command. The central team relays information to the destination station, including carriage location, number of passengers, and security escort arrangements. Upon train arrival, security assists the passenger in boarding. At the destination station, a designated security team awaits to help the passenger disembark and exit the station.

6. Special Training

All stations have the same procedures. Training sessions are conducted at Depok Station, focusing on emergency situations such as assisting collapsed passengers, wheelchair users, and other individuals requiring special handling. Only selected security personnel are eligible to attend these sessions. Following the training, participants are required to disseminate the knowledge and skills acquired to other security staff members.

DISCUSSION

Based some literature about public transportation with disabilities like wheelchair users, mostly in Indonesia, the facility from public transportation is not friendly enough to disabled visitors. Using Universal Design Standard as a solution may help this thing. Unfortunately, after evaluating based on railways station, some of the stations are still not friendly enough for wheelchair users.

Physical Accessibility

Based on the physical accessibility for wheelchair itself, not all stations complete the standard. First, pedestrian paths on table 1.1, Kebayoran station, Pondok Ranji station, and Jurangmangu station do not comply with International Organization for Standardization (ISO)'s minimum width of 60-70cm, which is not suitable with Universal Design's 'Equitable Use' principle, making it unsafe for wheelchair users to navigate or prompt them to certain specific paths. Based on table 1.6, the accessibility already provided with tactile paving floor even though at Sudimara station has bad conditions.

Second, ramp slope on table 1.2, the standard from Indonesian National Standards (SNI), maximum has 1:12 ratio, for one meter height has 12 meter long, means length of the flat area is about 12 meters too. Based on the stations, all ramps already follow the standard because the ratio is not too much.

Third, handrail on table 1.3, based on the SNI, the handrail standard is about 85-95cm from floor. No station fits this standard because Palmerah station, Kebayoran station, and Jurangmangu station are above the standard. Meanwhile, Pondok Ranji station and Sudimara station are less from the standard. Handrail heights that do not meet

compliance according to SNI and ignore Universal Design's 'Tolerance for Error'—users with reduced grip strength might find it difficult if the rails are excessively high or low.

Facilities

Next to the facilities like toilets, lifts, and wheelchair availability on table 1.4, 1.5, and 1.7. All stations already provided with wheelchairs, lift, and toilet for disabled. But need to take note, Jurangmangu station has no toilet for disabled separated by normal. Besides that, Sudimara station has no toilet for disabled at all.

Human Factors

Based on human factors like staff training and passenger attitudes on tables 2.3 and 2.4, other passengers are responsive towards wheelchair users when needed. From security guards have no obstacles and already have procedure and training for wheelchair users.

The most visited station by wheelchair users based on table 2.1 is Kebayoran station, followed by Palmerah station and Pondok Ranji station. It matches their existing facilities because they are prepared and more complete than the other station. It means Palmerah station and Kebayoran station already meet Universal Design Principles.

CONCLUSION

This study evaluates wheelchair accessibility at Palmerah–Sudimara stations through a Universal Design lens, combining field observations with compliance analysis against Indonesian National Standards (SNI) and International Organization for Standardization (ISO). While key infrastructure such as ramp and lifts meets technical requirements, critical gaps persist including narrow pedestrian paths at Pondok Ranji station, missing disabled toilets at Sudimara and Jurangmangu, and unsafe platform access. These findings highlight systemic non-compliance with Universal Design principles, particularly 'Size and Space for Approach and Use' and 'Equitable Use,' not suitable with Indonesia's disability-inclusive mandates under Law No. 8/2016.

To bridge these gaps, we propose technology-aided interventions in engineering solutions:

- Smart Infrastructure: Sensor-based automatic doors and real-time monitoring systems to ensure accessible pathways remain unobstructed.
- Cost-Effective Digital Tools: Mobile apps for wheelchair users to report accessibility issues (e.g., broken lifts) and request temporary ramps, leveraging crowd-sourced data for rapid response.
- Data-Driven Retrofitting: GIS mapping of high-priority stations such as Sudimara station to optimize retrofit investments based on passenger flow analytics.

Future research should explore IoT-enabled accessibility audits and AI-assisted design simulations to predict wheelchair-user mobility patterns. By integrating Universal Design with information systems engineering, Jakarta's rail network can transform into a model of inclusive, sustainable urban mobility with advancing Sustainable Development Goals (SDG) 11 'Sustainable Cities' and Sustainable Development Goals (SDG) 10 'Reduced Inequalities'.

Author Contributorship

Jessica Lie Riyadi: Writing – original draft, Data curation, Visualization, Conceptualization, Methodology; **Gatot Suharjanto:** Writing – review and editing, Supervisor.

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AI Usage Declaration

The authors acknowledge the use of ChatGPT, DeepSeek AI, and ZeroGPT during the preparation of this manuscript solely for improving language clarity and grammatical accuracy. All research design, data collection, analysis, and interpretation were conducted by the human authors. The final content reflects the authors' original scholarly work and intellectual contributions. AI-generated content was carefully reviewed and verified for accuracy before incorporation.

Data Availability

Data supporting this study are included in the article and/or supporting material. And openly available from Zenodo data at <https://doi.org/10.5281/zenodo.15303567>.

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