

Evaluation and Improvement of Platform Area Accessibility at Yogyakarta Station: Towards Inclusive Design

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ABSTRACT : The rules that become a reference in the development of accessibility of Indonesian railway transportation are from the laws and regulations of the Ministry of Transportation and the Ministry of Public Works. These rules support that transportation must be accessible to all users. Accessibility to transportation can improve economic levels and social justice, especially for people with reduced mobility. Therefore, it is necessary to evaluate and propose infrastructure improvements that meet government standards. The purpose of this article is to evaluate the level of accessibility and improve the infrastructure in the platform area of the railway station. Auditing from direct observation of accessibility at Yogyakarta Station which then results in an inclusive design on the platform. The accessibility index obtained is included in the less accessible category with a value of 1.50 which consists of eight sub-aspects of platform infrastructure assessment. The final design is made considering the convenience, safety, and comfort of passengers to boost the index value in accessibility to become an accessible station.

Keywords - accessibility, infrastructure, improvement, platform area, train station

1. INTRODUCTION

Transportation systems play an important role in the conditions of dynamic development of the national economy, reliability and regularity of transportation provision for a country. (Petr Kurenkov 2019). Various studies have shown that the impact of transportation infrastructure on national economic growth, this proves that the positive benefits of infrastructure investment in transportation networks (Zahra Dehghan Shabani 2018). Railway transportation has now received greater attention from the Indonesian government through the Ministry of Transportation in recent years to improve the sustainability and quality of its services (Fauziawati, R., Rifai, A. I., & Handayani, S. (2022). Especially in serving passengers who have disabilities or people with limited mobility.

Yogyakarta Station is a station located in the city of Yogyakarta - Indonesia, where local income relies on the tourism sector for economic balance (Raharti, R., Nurwiyanta, N., Nugroho, J. P., & Septiadewi, F. A. Z 2021), (Rahayu, N. (2018, March). By relying on the tourism sector, the surge in tourists as well as the increase in population has led to an increase in demand for mobility (Ineke, P., & Winda, F. N. 2018). If the transportation infrastructure is unable to meet this demand, it leads to increased waiting times and congestion on public

transport and roads (Samek Lodovici and Torchio, 2015) (Saif, M. A., Zefreh, M. M., Torok, A. 2019). The availability of good infrastructure is one of the important factors in providing attractive public transportation ((Jackiva) Yatskiv et al., 2017). Especially if the infrastructure emphasizes universal design so that everyone can use it without exception, including PRMs.

Research in high-income countries shows that PRMs tend to prefer private cars or taxis (Behrens, R.; Görgens, T. 2019) over public transportation such as trains. This is due to infrastructure limitations that prevent them from mobility freely and independently (Dejeammes, M. 2000). Access and inclusion of transportation infrastructure in low-middle income countries is often poorly regulated, poor infrastructure, and limited availability and access to emergency services. (Kett, Maria, Ellie Cole, and Jeff Turner. 2020)

Some PRMs and those accompanying their trips said that there is a lack of safety and comfort when using public transportation, due to unmet infrastructure that includes passengers in terms of safety and convenience. (Kett, M.; Deluca, M. 2016). Problems that look trivial but have a big impact on accessibility by passengers are on the platform. There are too large gaps and height differences on the platforms (Ruger 2016, V Moug 2016, Seriani 2022, Wrobel Iwona 2019, Ruger 2012, H M Isa 2016, Matsika 2020, Matsika 2022, Palmer 2018). Almost every station has the same accessibility issues that make it difficult and even injurious for passengers. This happens when passengers are in a position to board the train from the platform or vice versa. (RSSB 2008, Seriani, S 2015, Seriani, S 2015, Larue, G.S 2021, Seriani, S 2022). They need inclusive spaces and infrastructure that make it easier to get on or off the train. (Valdivieso, J, 2021, Seriani 2021)

Indonesia has defined accessibility and is always working to improve the accessibility of rail transportation. Then the rules are more specific to embrace the PRMs to not hesitate to use the train. The concept of accessibility is contained in Law no. 8 of 2016, PerPUPR no 14 of 2017 and PerHub no 63 of 2019. If the rules are obeyed properly, many PRMs may do mobility using trains. But in reality, there are many irregularities, especially the infrastructure dimension that violates the rules or is not appropriate. Only a few have paid attention in the form of evaluations and proposals for improvements to infrastructure on platforms that are useful for many passengers, especially PRMs, which is the main purpose of this article. The evaluation is based on direct observation and the existence of an assessment rubric with consideration of government regulations. Improvement proposals are then made in the form of a design that is inclusive for PRMs passengers, but can also be used by other normal passengers.

2. LITERATURE REVIEW

The group of people with limitations or impairments is divided into three. Mobility impairment, perceptual impairment, and cognitive impairment (Kluger 2011). This research only focuses on people who have mobility impairments when doing activities at the Yogyakarta train station. This category includes wheelchair users, people with limb impairments, people with children, elderly people, pregnant women, and people of small stature (including children) (Ruger 2017). Each group with different impairments will have different needs for the built environment, thus emphasizing that it is about inclusive design not universal design. People with reduced mobility believe that the main impairment to their activities lies in physical environmental barriers. This shows how important the perception of accessibility is to them and how it relates to their activity levels (Simonson et al 2013). Some developing countries are beginning to realize the importance of providing an inclusive environment for people with reduced mobility especially in public spaces (Rahim & Abdullah 2009).



Figure 1. the user pyramid approach to Inclusive Design (Yuanyuan liu, 2018)

The figure above explains that the pyramid shape of inclusive design use consists of three levels. The base of the pyramid is surrounded by people who are healthy or have little loss of ability, the center represents people whose mobility is reduced due to illness or age-related impairments, and the top of the pyramid is people with severe disabilities who must receive assistance in performing activities.

A. *Inclusive Design*

Initially, the idea of inclusive design originated from a development made by the originator of universal design, Ronald Mace. Where universal design is a way of designing buildings or facilities with little or no additional cost, so that they function for everyone without discriminating against anyone. Inclusive design has a difference in objects or more aimed at certain parties and not for everyone. Roger Coleman came up with the idea of Inclusive Design on the basis that needs and abilities change throughout the life course (Ann Heylighen et al., 2016). Inclusive Design (ID) always prioritizes optimizing design for individuals with special needs, such as people with limited mobility. Inclusive Design approaches have so far been limited for various reasons such as designers lacking awareness of inclusivity, and it is more difficult to meet the criteria for specific people than design for all or universal (Basnak et al., 2015, Heylighen et al, 2017, Van der Linden et al., 2016, Zallio M 2021). Design that is inclusive of products and environments that embrace multiple people tailored to their needs is relevant and aims to meet the needs of people with limited mobility. In the US, disability standards in buildings for inclusive needs have been established through the Americans with Disabilities Act (ADA) and in the UK the Disability Discrimination Act (DDA). The laws that have been issued in each country are used to avoid discrimination against people with limited mobility in carrying out all activities in public spaces and then also include the provision of goods, facilities and services. The evolution of design for disability into accessibility and then design for inclusion emphasizes the relevance of disability not only in the product design domain but also in the architectural design domain. (Zallio M et al, 2021).

Fully adopting Ronald Mace's idea of Universal Design Principles, 7 principles of Inclusive Design have been constituted (Mace, 1985). 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. From these 7 principles, the main idea of Inclusive Design is not only the accessibility of space, so it raises the formulation of the problem and the idea of whether everyone can enter this space and use it easily.

Commission for Architecture and the Built Environment (CABE) now merged into the Design Council, defined five major principles for successful Inclusive Design:

1. Work with others to increase diversity in the built environment professions
2. Promote inclusive and equitable design through our design review panels, enabling schemes and awards, publications and promotion of best practice
3. Pursue with increased rigor accessible and inclusive design and the involvement of disabled people in the development of major schemes that come to CABE
4. Research the links between inclusive design, equality and sustainability
5. Lead by example by building a diverse and representative workforce and family

The understanding of inclusive design theory still lacks literacy among Indonesians, even to the extent that laws and regulations are revised several times to keep up with positive developments in terms of public awareness of accessibility in Indonesia. Inclusive design in railway station infrastructure is useful for both locals and travelers, especially those with limited mobility or impaired mobility.

A. Access Audit for Evaluation and make Improvement

The access audit was conducted on an important area of the station, namely the platform which plays a major role as a place for passengers to get on & off from or to the train. This is useful for identifying facilities and amenities that do not comply with government regulations. Create a checklist with an assessment rubric in accordance with the minimum requirements so that access and needs for PRMs passengers are met (Kamarudin et al., 2013). The results of the accessibility identification will be evaluated so that later the shortcomings of the existing design can be studied. Then it can produce a new, better model to improve the level of platform accessibility for passengers, especially PRMs. The Minister of Public Works and Public Housing Regulation No. 14 of 2017 and the Minister of Transportation Regulation No. 63 of 2019 are the main references or parameters of the evaluation and proposed improvements (PUPR, PERmenhub).

Table 1. Evaluation scoring rubric for accessibility audit of Yogyakarta train station platforms

Aspect	Sub-aspect Audited	Compliance Indicators		
		Accessible	Less Accessible	Not Accessible
Platform	Passenger path on the platform leading to the train.	Provide priority lane lines for PRMs	Passenger lines are undifferentiated, for all walks of life	Potholes make it difficult for all passengers to pass
	The difference in the height of the building floor against the platform.	Has a spacious Ram with no steps	Has a Ram but adjoins the stairs without a safety boundary	No Ram, only steps
	Ram access dimensions	Ram width \geq 120 cm and slope $<5^\circ$	The ram is 95-120 cm wide and slopes 5-8 $^\circ$.	Ram has width $<$ 95cm and slope $>8^\circ$
	Handrail and curbs on the access ram	Ram has Handrail and also high curbs \geq 10 cm	Ram has Handrail or curbs	Ram does not have Handrails and curbs
	Gap between platform edge and train body - train door	Has an automatic or portable slit cover	No ram cover, but gap <20 cm in size	No cover and gaps $>$ 20cm
	Difference in the height of the station platform floor to the train platform floor	Has an automatic or portable Ram as gap cover, height difference $<$ 10 cm	No Ram cover, with height difference $<$ 5cm	No Ram cover, with height difference $>$ 5cm
	Safety line from the platform edge or PSD (platform screen door) on the platform edge is available.	Safety line is \geq 35 cm from the edge of the platform	Safety lines are 10-35cm from the edge of the platform	Safety line is $<$ 10cm from the platform edge
	Additional aids for boarding/disembarking from and to means of transportation	Provide an automatic ram or portable stair lift	Provide manual ram assisted by staff	Does not provide special aids for PRMs

3. METHODOLOGY

The use of qualitative methods by direct observation and conducting an assessment or audit of accessibility at Yogyakarta Station. The evaluation is carried out on the main infrastructure, namely the platform. An accessibility audit can establish how well the facility functions properly and provides convenience for potential users especially for PRMs. This study covers all categories of PRMs or passengers with mobility impairments (see section 2: literature review). Furthermore, the assessment data will be analyzed for accessibility and those that have obtained an accessibility index will be given proposals for new design improvements. The proposed improvements to increase the level of accessibility also consider the current condition of the station, if the project is implemented which will propose improvements to station facilities (Aji, Suhardi, 2022).

The access audit is the main tool to check the conformity of platforms to access and facilities for PRMs. The data processing stage is carried out by calculating the mosque accessibility index value based on the assessment tabulation according to the evaluation list in the assessment rubric (table 1) with the following provisions:

- a Each answer choice from the indicator of compliance with the rules is given a weight. If it is included in the accessible category, it is given a number two, if it is less accessible, it is given a number one, and if it is inaccessible, it is given a number zero.
- b Audit results are calculated based on the following formula

$$PA = \frac{(A * 2 + LA * 1 + NA * 0)}{(Sub - aspect * 2)} * 3 \quad (1)$$

Where *PA* is the value of accessibility index Platform Area, *A* is accessible category, *LA* is less accessible category, and *NA* is not accessible category in assessment score.

- c Modified from the rank weighting method as the basic method. The weighting of variables in an index is a complex task (Mehta, 2021). The index applied to the Platform Area will be given an accessibility scale ranging from 0.00 - 3.00. There are observation criteria for the rating scale that are normative:

Table 2. Index accessibility score category

Score Category	
Inaccessible	: 0,00 - 1,00
Less Accessible	: 1,00 - 2,00
Accessible	: 2,00 - 3,00

4. RESULT AND DISCUSSION

The platform is an interface between the train and the station floor, a place where passengers will pass when they want to get on or off rail transportation. The circulation path on the platform is said to be sufficiently good. There are special specifications that can make it easier for all passengers to pass through. Currently the platform is difficult to access and passengers experience problems when getting on or off the train on Fig. 2.





Figure 2. Currently situation in the platforms area

The index value obtained is 1.50 which is included in the less accessible category. Only 2 sub-aspects are well met, namely having a ramp for easier access due to the height difference between the ground floor and the platform height and having a qualified safety line with a good safety distance. The rest are rated as less accessible and inaccessible. Seen from the picture above, the width of the available ramp is still small. If indeed the ramp is provided specifically for passengers with reduced mobility, then there is no signage to explain this. The access ramp on the platform looks steep which makes it difficult for users to pass through. Significant gaps in the platform, whether it is a hole or a height difference, will make it difficult for users and can result in passenger injury. To improve this, the development design to improve accessibility is made as follows on Fig. 18.

The proposed improvements to the platform are the widening of the access ramp where the stairs are removed to become a full ramp. Then there is a wheelchair priority access lane line so that there is a priority area for getting on or off wheelchair passengers. The existing ramp is modified by reducing the steepness so as to facilitate everyone's access. Then the existing gap and the difference in floor height on the platform must be given a gap cover. Gap covers can have a major effect on accessibility by all passengers, especially wheelchair users. They can independently enter the train without assistance if the gap is removed (Hartblay 2017; Matsika and Li 2020; Matsika and Guo 2022). The following is an image of a model used as a proposed improvement.

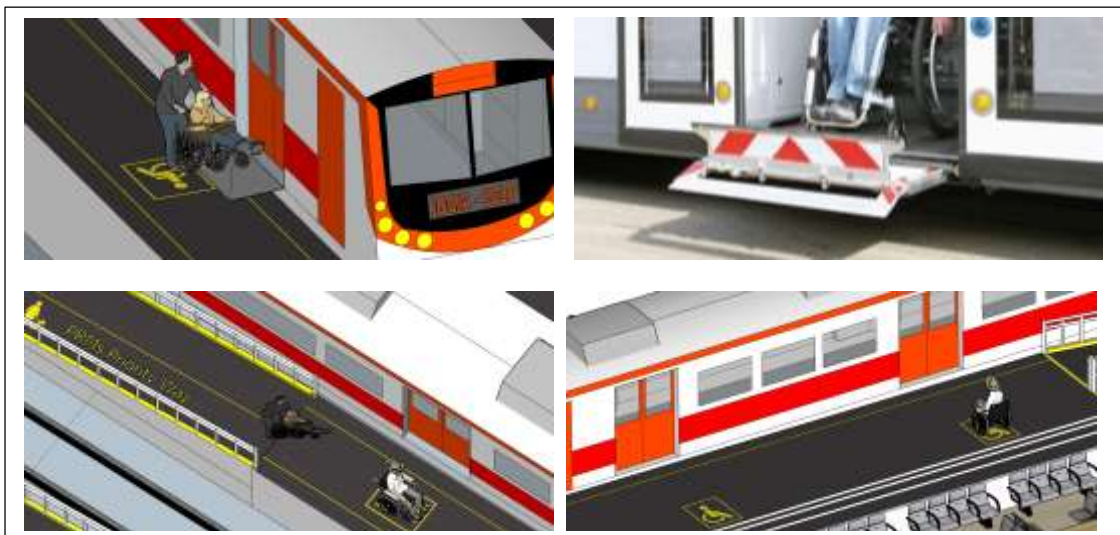


Figure 3. Improvement plan of the platforms (Source: Authors and Palfinger)

When accessible design elements are then installed to meet minimum standards, it is only for some and often does not work well. A pathway with minimum parameters of wheelchair-specific standards will be of great benefit to all. Because eventually everyone will be able to use it properly and easily. Design that fails to be accessible draws attention to the moral field that governs the responsibility of actors to produce a "good" built

environment, which is impregnated in the teleology of progress (Hartblay 2017). All proposed improvements related to dimensions are in accordance with the provisions of the government of the Republic of Indonesia.

5. CONCLUSION

Based on the case study, it can be concluded that the platform area at Yogyakarta Station has not provided accessible facilities for passengers with limited mobility. The results show that the level of accessibility at Yogyakarta Station is still inaccessible. This condition makes stakeholders have to improve accessibility in the platform area. In addition, there will be a sense of comfort and safety for PRMs when doing activities using trains. When improving the infrastructure so that it becomes accessible, it can be easily accessed by everyone, especially PRMs. Special attention starts from providing priority or special lanes for PRMs marked by symbols or paint lines. Make a sloping access ramp with good safety. Then make a gap cover in the form of a ramp either manual or automatic, this immediately reduces the impact of the risk of injury for passengers so that the platform towards an inclusive design. By following the recommendations contained in government regulations, Yogyakarta Station will become more accessible. PRMs are seen to have difficulties in accessing the station platform for accommodation on their journey. The station management or stakeholders should make special policies for PRMs to improve the less accessible facilities at the station.

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How to cite this article: **Bambang Suhardi, Muhammad Rizki, Pringgo Widyo Laksono, Evaluation and Improvement of Platform Area Accessibility at Yogyakarta Station: Towards Inclusive Design. *Asian. Jour. Social. Scie. Mgmt. Tech.* 2024; 6(1): 178-186.**