

PERCEPTION FACTORS OF PEDESTRIAN TRANSIT ORIENTED DEVELOPMENT (TOD) DUKUH ATAS

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ABSTRACT

The concept of walkability is the right solution for increasing walking activities and solving various transportation problems. The function of TOD is to facilitate and accommodate public needs related to mobility which prioritizes pedestrian accessibility. This study aims to determine the factors influencing the pedestrians' perception in the TOD Dukuh Atas area. The quantitative analysis of perceptual data measured using a Likert scale will be compared with the walkability index value based on a qualitative assessment using the Global Walkability Index (GWI) framework. The results showed that there was a difference between the value of GWI and pedestrian perceptions value. It means that the GWI is not fully compatible with the Indonesian pedestrian culture.

Keywords: TOD, Walkability, Walkability Factor

INTRODUCTION

Pedestrian paths are provided as services to increase smoothness, safety, and ease the connectivity and quality of sidewalks, footpaths in cities through comprehensive assessments of pedestrians' available infrastructure and studies linking supply and demand (Leather et al., 2011). Further, Krambeck & Shah (2006) developed the walkability measurement method for the World Bank, known as the Global Walkability Index (GWI). This method aims to improve walkability in developing cities, namely:

1. Generating awareness that walkability is an essential issue in developing countries.

comfort for pedestrians (Departemen Pekerjaan Umum Direktorat Jenderal Bina Marga Direktorat Bina Teknik, 1995). Therefore, pedestrian paths should take the physical characteristics and supporting facilities into account, increasing people's movement to walk (Shirvani, 1985).

The concept of Transit Oriented Development (TOD) is one of the solutions for developing a transit system-oriented area coupled with the idea of urban design and environmentally-friendly factors for pedestrians (Calthorpe, 1993). In planning the policies related to pedestrians, especially in the TOD area, it is recommended to include pedestrians as the top priority. Currently, the concept of walkability is considered to increase walking activities and solving various transportation problems in Indonesia (Senjaya & Joewono, 2018) to m

2. Identifying specific pedestrian paths and providing recommendations for improving conditions for pedestrian paths.
3. Providing input and encouraging city governments to overcome walkability problems.

The Dukuh Atas TOD area needs to improve the pedestrian path's quality to accommodate pedestrian movement optimally (Ningrum et al., 2018). Christiana (2017) revealed that the walkability assessment level was 43.38%, which means pedestrians reach few facilities on foot. Meanwhile, the value of walkability

level on the pedestrian path was 64%, and this value showed that the community feels normal.

The fact is that in the Dukuh Atas TOD area, pedestrians feel normal when doing walking activities in the Dukuh Atas area. As an area based on TOD, it should facilitate and prioritize public provision and residents' accessibility to mass transportation modes by providing comfortable pedestrian paths. Currently, the walkability concept is the appropriate solution to increase walking activities and solve various transportation problems.

Christiana (2017) discussed pedestrian development's direction with a walkable city's concept by measuring walkability level based on pedestrian perceptions and providing pedestrian ways development direction. Agradiana (2020) revealed walkability level on pedestrian preferences in choosing a walking route and measured walkability influencing pedestrian preferences in choosing a pedestrian way. Further, Brouwer, B., & Tiara (2018) studied public access feasibility with a walking distance scale parameter.

This study measures the walkability index based on pedestrian theory and perception to obtain walkability values. The walkability assessment results can determine the factors that affect pedestrians' perception in the Dukuh Atas TOD Area. It concerns pedestrians' perceptions of various circles and aimed to find the factors influencing pedestrians' perception in the Dukuh Atas TOD Area based on previous research results.

THEORETICAL REVIEW

Walkability Index

The Walkability Index developed by Krambeck & Shah (2006) consists of 3 components, namely :

1. Safety and security (determining safety and security in the walking environment).

2. Comfort and attractiveness (reflecting the comfort and attractiveness of the pedestrian way).
3. Policy Support (reflecting the extent to which the city government supports the improvement of pedestrian facilities and related services).

Leather et al. (2011) researched walkability in several Asian countries using modified parameters from the Global Walkability Index (GWI). GWI developed the measurement of walkability for Asian countries; however, it differs from Indonesian people who live in tropical countries. Thus, it is necessary to identify the variables of good walking in Indonesia, especially in Jakarta. There were nine parameters of the GWI used; namely, pedestrian path conflicts with vehicles, availability of pedestrian paths, availability of crossing facilities, driver behaviour, amenities, infrastructure for disabilities, security from crime, and obstacle.

The 2017-2022 DKI Jakarta Pedestrian Facility Design Guide (ITDP, 2019), provides information about pedestrian areas and the trend of increasing public transport users. In creating pedestrian space, it is necessary to consider four components: complete, safe, comfortable, and humane. Based on previous theories, the authors combine and conclude these theories by developing three aspects, namely (1) completeness, (2) safety and comfort, and (3) comfort and attractiveness.

Pedestrian Perception

According to Untermann K (1984), there were three criteria for a right pedestrian path, namely (1) Security, (2) Convenience, (3) Comfort, and (4) Attractiveness. While Speck (2012) stated that in order to realize the concept of a walkable environment in walking, it was necessary to pay attention to four aspects, namely (1) Benefits, (2) Safe, (3) Comfort, and (4) Attractive. The theory from Hakim

and Utomo (2003: 186) stated that the factors that affect comfort are (1) Circulation, (2) Climate, (3) Noise, (4) Scent, (5) Shape, (6) Safety, (7) Cleanliness, and (8) Beauty.

Pedestrian Facility Criteria

The 2017-2022 DKI Jakarta Pedestrian Facility Design Guidelines (ITDP, 2019) states that pedestrian space elements that are complete, safe, comfortable, and humane can support increased public transport use is sensitive to the creation of walkability. Pedestrian access that connects segments throughout the Jakarta area needs to be built and improved to increase the vitality of walking as a choice of mobility in urban areas. The complementary components of pedestrian facilities are (1) walking paths, (2) crossings, (3) transit access, (4) complimentary use/ land use, (5) access to food, and (6) access to public places. Safe means maintaining safety and security, minimizing crime and the potential for pedestrian accidents. Some of these safety factors are (1) Lightings, (2) Bollards, and (3) Curbs. Convenience is to provide

walking paths that are pleasant and make a distinctive impression on people. The walking space needs to provide for the needs of the five senses, including (1) Seating, (2) Trees / Plants / Landscape, and (3) Availability of trash bins.

Based on the conceptual framework (figure 1), the conducted research hypothesized that factors determining the perception of walkability follow the GWI factors.

MATERIAL AND METHOD

The TOD Dukuh Atas area was chosen as the research location because it is an interchange between several transportation modes. The observation radius is 500 meters, divided into two segments that have a significant local character. North Segment: Bundara HI - Ciliwung River and South Segment: Ciliwung River-Setiabudi MRT Station.

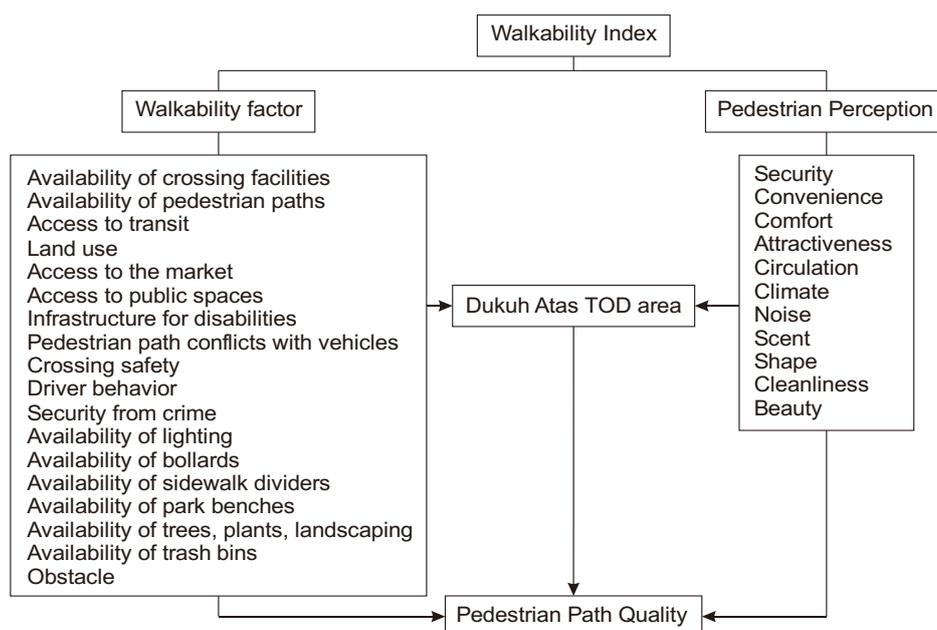


Figure 1. Conceptual framework (Muhammad Zaidanur Rizqi, 2020)



Figure 2. Research Location

Research Stages

This study focuses on pedestrian perceptions of the TOD area's walkability, which will be compared with the walkability Index value based on theory. The research stages were as follows:

1. Preparation stage. Problem identification, problem formulation, literature review, determining variables, and determining the study's scope.
2. Data collection stage. A survey using a questionnaire in Likert Scale to capture the perceptions of pedestrians. Field observations and interviews with resource persons and secondary data from documents and literature studies are used as data confirmation and to strengthen the discussion.
3. Analysis stage. Analyses pedestrians' perception of walkability, calculates walkability level based on GWI and analyses walkability factors that affect walkability perceptions.

In this study, 100 respondents were randomly chosen from the pedestrians using the Dukuh Atas TOD at the time of observations. They were selected from MRT, KRL, Busway, Airport Stations users in the Dukuh Atas TOD area. The questionnaire's scores were a range of values/ratings from 0-100. The analysis used the approach of Lether, J., Herbert

Fabian, Sudhir Gota (2011) to interpret the scores' values by classifying walkability rankings into three categories as follows (Tanan et al., n.d.) :

1. Green Category, score > 70, declared highly walkable (very good for walking);
2. Yellow category, score 50 - 70, stated waiting to walk (good enough for walking).
3. Red Category, score < 50, stated not walkable (not suitable for walking).

The research used a qualitative assessment supported by observation and document study to determine the walkability index. The assessment score used a scale of '1' to '5', where '1' was very low and '5' was very high, then the walkability index value for each score was multiplied by its weight. These scores were assumed to have the same level of importance so that the weight value used was '1'. The weighting for the score of each segment used the following formula:

$$segment\ score = \sum_{j=1}^n (value \times weights)$$

Then, the segment's score value was multiplied by the length of the walking path.

$$distance\ score = segment\ score\ i \times segment\ length\ i$$

The index obtained for each area using the following formula:

$$regional\ walkability\ index = \frac{\sum distance\ score}{\sum i}$$

n = number of parameters

i = segment

j = parameter

The index explained the condition of pedestrian facilities.

The average index of each location was the final calculation of WI per area. Proposed improvements can be seen based on the lowest WI acquisition in certain parameters. This walkability assessment was an assessment of pedestrian perceptions whose information

was obtained through Likert scale questionnaires filled out by the Dukuh Atas TOD's visitors.

Quantitative analysis was used to see the distribution of variables that score high or low. The weight of the positive question score (+) on the Likert scale included the choices: Strongly Agree (SS) score weight was 5, Agree (S) 4, Doubt (R) 3, Disagree (TS) 2, and Strongly Disagree (1). A scale of 1 was for very low scores, and 5 was for very high. To compare pedestrians' theoretical results and perceptions, the researcher used a qualitative analysis by paying attention to incorrect or different numbers so that these values determined the perception of walkability.

The research variables referred to Krambeck (2006) and ITDP (2019), as follow:

1. Completeness
 - a. Availability of crossing facilities
 - b. Availability of pedestrian paths
 - c. Access to transit
 - d. Land use
 - e. Access to the market
 - f. Access to public spaces
 - g. Infrastructure for disabilities
2. Safety and Security
 - a. Pedestrian conflicts with vehicles
 - b. Crossing safety
 - c. Security from crime
 - d. Availability of lighting
 - e. Availability of bollards
 - f. Availability of sidewalk dividers
3. Comfort and Attractiveness
 - a. Availability of park benches
 - b. Availability of trees, plants, landscaping
 - c. Availability of trash bins
 - d. Obstacle

DISCUSSION

The walkability analysis was divided into two segments consisting of 18 variables

from 3 aspects of walkability. Based on the perspective of researchers and pedestrians, the assessment was carried out so that the results obtained were more objective.

Walkability Assessment Based on GWI

Based on observations of the condition of the pedestrian path, it can be concluded that the results of the assessment are as shown in Figure 3. The walkability assessment segment 1 produces an average value of 73.05, segment 2 an average of 81.39, and the value of the walkability index in the TOD Dukuh Atas area is 65.837 which is categorized as the yellow zone which means good enough.

Pedestrians' Perceptions of Walkability

Figure 4 shows the results of the assessment of the pedestrian path conditions. The average value of walkability according to the perception of pedestrians in the TOD Transit Dukuh Atas area is 3.59. The mean score for segment 1 is 3.56, and 3.62 for the average walkability in segment 2. Comparison of low and high scores on variables, through walkability factor analysis, is used to determine the difference between theory and perception.

Analysis of Walkability Factors

The factors that affect the value of walkability in segment 1 are the availability of pedestrian paths, transit access, land use, market access, access to public spaces, infrastructure for disabilities, driver behaviour, security from crime, availability of lighting, availability of sidewalk barriers, availability of benches, garden, availability of trees, plants or landscape, availability of bins, and barriers.

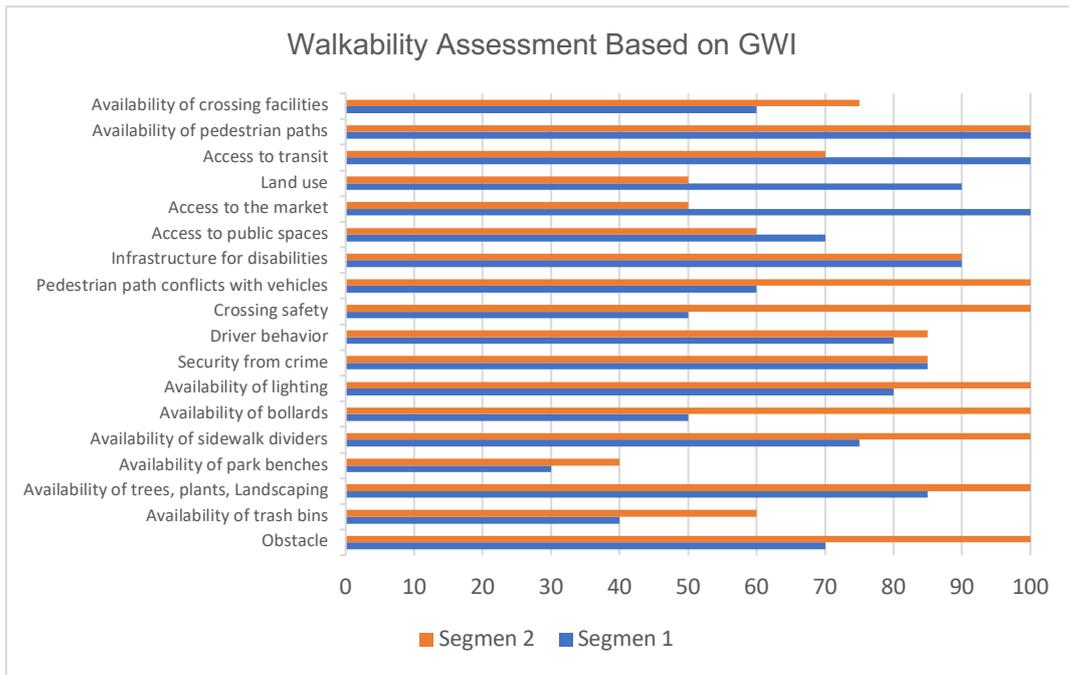


Figure 3. Walkability index value by qualitative assessment

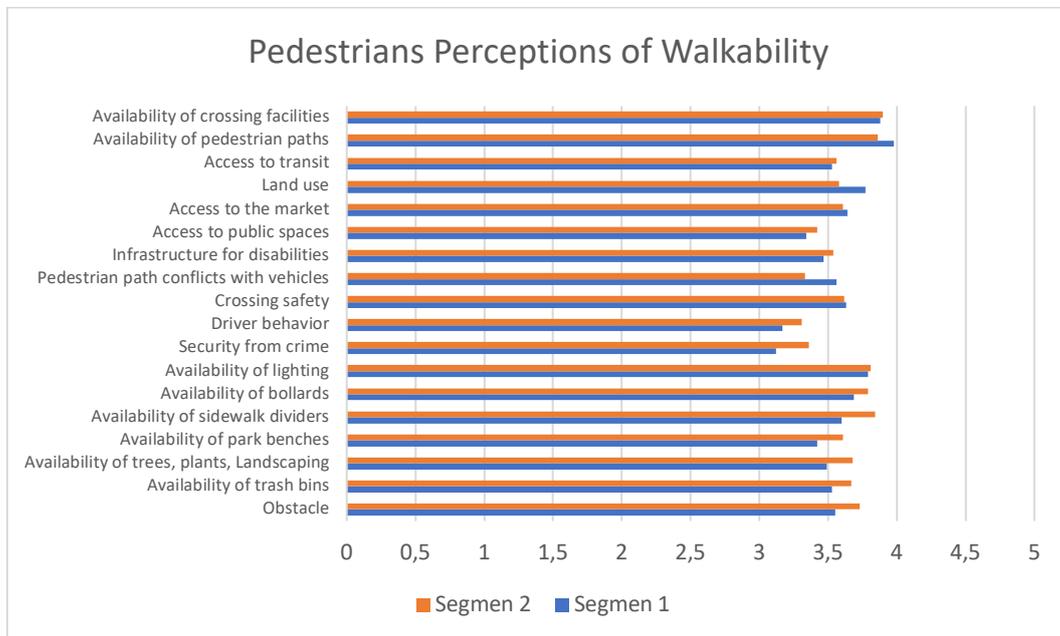


Figure 4. Walkability index value by pedestrians perceptions

Table 1. Comparison of Walkability Factors

No.	Walkability Factors	Segment 1		Segment 2	
		GWV value	Perception	GWV value	Perception
1	Availability of crossing facilities	Medium	Medium	High	Medium
2	Availability of pedestrian paths	Highest	Medium	Highest	Medium
3	Access to transit	Highest	Medium	High	Medium
4	Land use	Highest	Medium	Medium	Medium
5	Access to the market	Highest	Medium	Medium	Medium
6	Access to public spaces	High	Medium	Medium	Medium
7	Infrastructure for disabilities	Highest	Medium	Highest	Medium
8	Pedestrian conflicts with vehicles	Medium	Medium	Highest	Medium
9	Crossing safety	Medium	Medium	High	Medium
10	Driver behavior	High	Medium	Highest	Medium
11	Security from crime	Highest	Medium	Highest	Medium
12	Availability of lighting	High	Medium	Highest	Medium
13	Availability of bollards	Medium	Medium	Highest	Medium
14	Availability of sidewalk dividers	High	Medium	Highest	Medium
15	Availability of trees, plants, landscaping	Low	Medium	Low	Medium
16	Availability of park benches	Highest	Medium	Highest	Medium
17	Availability of trash bins	Low	Medium	Medium	Medium
18	Obstacles	High	Medium	Highest	Medium

Table 1 shows that there are differences between the walkability index value according to GWI criteria, and walkability value according to pedestrian perceptions. In segment 1, the significant differences involve 14 factors, namely, availability of pedestrian paths, access to transit, landuse, access to market, access to public spaces, infrastructure for disabilities, driver behavior, security from crime, availability of lighting, availability of sidewalk dividers, availability of park benches, availability of trees, plants, or landscaping, availability of trash bins, and obstacle.

Whereas in segment 2 the significant differences involve 14 factors, namely, the availability of crossing facilities, availability of pedestrian paths, access to transit, infrastructure for disabilities, pedestrian path conflicts with vehicles, crossing safety, driver behaviour, security from crime, availability of lighting, availability of bollards, availability of sidewalk dividers, availability of park benches, availability of trees, plants, or landscaping, and obstacle.

CONCLUSION

The results showed that the GWI criteria had not fully met the local pedestrian culture. It seems that pedestrians in both segments have an assessment that the walkability of the pedestrian paths in the TOD Dukuh Atas area is relatively moderate. They don't pay attention to the availability of park benches, trash bins in segment 1 and segment 2. However, the community is very concerned about the availability of crossing facilities, pedestrian paths, access to transit, infrastructure for people with disabilities, pedestrian path conflicts with vehicles, crossing safety, driver behaviour, security from crime, availability of lighting, bollards sidewalk dividers, and landscaping. Therefore, in planning walkability, it is necessary to consider local perceptions and culture. This shows that the GWI which should be able

to be used globally or universally is not fully compatible with the culture of the Indonesian people.

REFERENCES

- Agradiana, P. (2020). Tingkat Preferensi Pedestrian dan Walkability Koridor Jalan di Kota Tua Jakarta. *MARKA (Media Arsitektur Dan Kota): Jurnal Ilmiah Penelitian*. <https://doi.org/10.33510/marka.2020.3.2.68-82>
- Brouwer, B., & Tiara, E. (2018). Kualitas Walkability Berdasarkan Persepsi Pedestrian (Studi Kasus pada Koridor Jalan Kawi Atas, Kota Malang). *Jurnal Mahasiswa Jurusan Arsitektur*, 6, 1.
- Calthorpe, P. (1993). *The Next American Metropolis*. Princeton Architectural Publisher.
- Christiana, N. E. (2017). Pengembangan Jalur Pejalan Kaki dengan Konsep Walkable City Koridor Dukuh Atas Jakarta Berdasarkan Preferensi Pengguna. *Skripsi, Institut Teknologi Sepuluh Nopember*.
- Departemen Pekerjaan Umum Direktorat Jenderal Bina Marga Direktorat Bina Teknik. (1995). *Tata Cara Perencanaan Fasilitas Pejalan Kaki Di Kawasan Perkotaan*.
- ITDP. (2019). *Panduan Desain Fasilitas Pejalan Kaki: DKI Jakarta 2017-2022*. 2019(September).
- Krambeck, H., & Shah, J. J. (2006). *The Global Walkability Index*.
- Leather, J., Fabian, H., Gota, S., & Mejia, A. (2011). Walkability and Pedestrian Facilities in Asian Cities State and Issues. *Asian Development Bank Sustainable Development Working Paper Series*, 17, 69.
- Lether, J., Herbert Fabian, Sudhir Gota, and A. M. (2011). *Walkability and Pedestrian Facilities in Asian Cities*. ADB Sustainable Development Working Paper Series.
- Ningrum, A. S., Astuti, W., & Mukaromah, H. (2018). *Kesesuaian Akomodasi Pergerakan Pejalan Kaki terhadap Konsep Transit Oriented Development di Kawasan Dukuh Atas Suitability of Pedestrian Movement*

Accommodation Towards Transit Oriented Development Concept in Dukuh Atas. XX.

- Senjaya, S., & Joewono, T. B. (2018). Penilaian Walkability Untuk Wilayah Perkotaan di Indonesia. *Prosiding Forum Studi Transportasi Antar Perguruan Tinggi, July.*
- Shirvani, H. (1985). *The Urban Design Process.* Van Nostrand Reinhold.
- Speck, J. (2012). *Walkable City: How Downtown Can Save America, One Step at a Time.* Farrar, Strauss, and Giroux.
- Tanan, N., Wibowo, S. S., Tinumbia, N., Jalan dan Jembatan, P., Teknologi Bandung, I., Pancasila, U., Nasution No, J. A., Ganesha No, J., & Srengseng Sawah Jakarta Selatan, J. (n.d.). *Pengukuran Walkability Index Pada Ruas Jalan Di Kawasan Perkotaan (Walkability Index Measurement On Road Links In Urban Area).*
- Untermann K, R. (1984). *Accommodating the Pedestrian: Adapting Towns and Neighborhoods for Walking and Biking.* Van Nostrand Reinhold International.