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The Influence of the Built Environment Design Quality of the Dukuh Atas TOD Pedestrian Area on Pedestrian's Comport Perception

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ABSTRACT

Jakarta faces a major challenge in creating sustainable urban mobility due to reliance on private vehicles that exacerbate congestion, air pollution, and degrade the quality of public spaces. The concept of Transit-Oriented Development (TOD) is present as a solution by prioritizing the development of areas around public transportation nodes to improve spatial efficiency and people's quality of life. This study focuses on the pedestrian area in Dukuh Atas, as part of the Jakarta TOD area, with the aim of identifying physical elements that affect walkability and comfort of pedestrian path users. The method used was exploratory sequential design, involving qualitative observation and distribution of questionnaires to 52 respondents of productive age (26–55 years). The findings show that physical elements such as trees and murals play a significant role in creating comfort and visual appeal, which are the main drivers of walkability. Regularly planted trees provide shade and a green ambiance, while the murals in the Kendal Tunnel enhance the aesthetics of the area through strong visual appeal. In addition, elements such as sidewalks, signage and street furniture also contribute to the user experience, although not as strong as green elements and murals. The results of this study support Rapoport and Speck's theory of the importance of fixed and semi-fixed physical elements in creating public spaces that are comfortable and attractive to pedestrians. With the integration of these elements, the TOD area has the potential to become a sustainable mobility solution, reduce dependence on private vehicles, and become a model for the development of inclusive and environmentally friendly public spaces for other major cities.

KEYWORDS

Built Environment, Design, Quality, Pedestrian, Perception

INTRODUCTION

Previous research has also shown that perceptions of safety and comfort affect the duration of a person's walk (Tilahun & Li, 2015). *Utilitarian walkers* have a tendency to choose shorter routes due to time constraints to reach their destinations (Agrawal et al., 2008). Afkara and Kusuma (2020) added that mileage, gender, and area function also affect walking comfort. In office areas, adequate facilities such as good sidewalks can increase comfort, while in residential areas, the lack of sidewalks and crossings tends to reduce comfort. The perception of distance is also an important aspect of the pedestrian path user experience, where environmental characteristics and travel destinations play a major role in influencing the perception (Horning et al., 2008).

According to Rapoport's theory, fixed physical elements such as buildings and sidewalks, as well as semi-fixed elements such as street furniture and directional signs, have a significant role in shaping the user experience of public spaces. This is in line with the results of a study from Alpat in 2021 that showed that although sidewalk amenities and safety aspects are not always optimal, visual

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appeal and environmental comfort are often the dominant factors driving walking activity. In the context of tourist areas, such as Fort Rotterdam, aesthetic and comfort elements have proven to be able to compensate for shortcomings in functional aspects, especially in locations that offer cultural value and attractive scenery.

Figure 1. Delineation Plan of the Dukuh Atas TOD Area (source: PT. MRT Jakarta)

Although various studies have examined the factors that affect the comfort and perception of walking, there is still a gap in understanding the influence of physical elements on walkability in the Dukuh Atas TOD area. Several studies show that elements such as sidewalks, street furniture, and signage have an important role in shaping the user experience of public spaces (Rapoport, 1982; Alpat, 2021), but there has been no research that specifically identifies and sequences these elements based on their impact on pedestrian comfort in TOD areas. In addition, previous research has also revealed that factors such as mileage, gender, and area function affect walking comfort (Afkara & Kusuma, 2020), while the study of Agrawal et al. (2008) shows that utilitarian hikers tend to choose the shortest route to reach their destinations. However, there has been no study that specifically examines how individuals' emotional attachment to the environment in the Dukuh Atas TOD area can affect their perception of comfort and walkability. By examining the relationship between physical elements and psychological factors in shaping the walking experience, this study is expected to provide new insights into more effective public space design and data-based recommendations to improve the quality of pedestrian facilities in the Dukuh Atas TOD area.

As one of the strategic areas in Jakarta, TOD Dukuh Atas is a clear example of the application of the Transit-Oriented Development (TOD) concept which focuses on increasing connectivity between modes of transportation while encouraging environmentally friendly mobility. With the majority of commuters coming from Greater Jakarta, this area has great potential to become a mobility hub that supports utilitarian walking activities and creates a comfortable walking experience. This study aims to identify the physical elements that affect walkability in this area, as well as provide recommendations for pedestrian facility improvements that can improve the comfort and sustainability of urban mobility. By integrating a walkability approach that prioritizes comfort, safety, connectivity, and visual appeal, the results of this study are expected to contribute to the development of more inclusive public spaces, reduce dependence on private vehicles, and become a reference for the development of other TOD areas in Jakarta.

METHOD

This study uses the exploratory sequential design method in accordance with the concept of Sugiyono (2019), which combines qualitative and quantitative data collection. The research stage starts from the qualitative stage through observation of the pedestrian area in the TOD area of Dukuh Atas Station. The area that became the focus of attention from this observation was the former Blora Road and the Kendal Tunnel, where this strategic route was found to make it easier for pedestrians to connect with various modes of public transportation, such as KRL, MRT, LRT, and TransJakarta. This observation stage was carried out in the period from March to April 2024. This observation stage was carried out to understand the use of TOD Area facilities such as street furniture, shade

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trees, and garbage cans.

Figure 2. Dukuh Atas TOD Pedestrian Path Area (source: Google Maps, Researcher)

The results of this observation were then used to compile a questionnaire which was then applied at the quantitative stage of this study. The questionnaire was designed based on the walkability theory described by Jeff Speck, as well as the physical element theory from Rapoport, which was then adjusted to the results of field observations. The questionnaire questions and their systematization are presented in Table 1.

The questionnaire was distributed to 52 respondents of productive age (26-55 years), who are a group of pedestrians who routinely use pedestrian facilities in the Dukuh Atas TOD area for daily mobility purposes, such as trips to work, school, or other activities. The selection of subjects with this age range is based on the tendency of routines that have the potential to cause saturation of pedestrian facilities that are used repeatedly.

Table 1. Questionnaire Questions

Question Types	Variabel	Number of Questions	Measurement Scale
Profil responden	Gender, age, domicile, profession	4	X
Kunjungan	Frequency	1	X
	Purpose	1	X
	Reasons for Use	1	X
Walkability and Sence of place	Pedestrian Quality	40	Likert
Elemen fix dan non fix	Perception is far closer	8	Likert
Kepuasan	User satisfaction level	1	Likert
Total		56	

The data obtained from observations and questionnaires were then analyzed descriptively to identify significant elements of facilities in influencing pedestrians' perception of comfort. The purpose of this analysis is to find out the physical elements that affect pedestrian walkability in the Dukuh Atas TOD area and produce recommendations for improving pedestrian facilities to support comfortable and sustainable mobility.

RESULT AND DISCUSSION

This section presents a comprehensive analysis of the quality of pedestrian facilities in the *Transit-Oriented Development* (TOD) area of Dukuh Atas, based on field observations and user perceptions. The main focus of this analysis lies in *fixed* and *semi-fixed elements*, such as sidewalks, building structures, street patterns, and *street furniture*, which according to Amos Rapoport's theory have an important role in shaping the long-term perception of the quality of public spaces. These elements not only determine the basic function of a space, but also affect the comfort, security, and overall attractiveness of the area.

A total of 52 respondents in the productive age range (26–55 years) were involved in this survey. Around 41% of them are regular users of the Dukuh Atas TOD pedestrian area, while the

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rest (59%) only use it occasionally. The motives for using this area are quite diverse. The majority of respondents used this area for office activities (51%), followed by visits to shopping centers (22%), transit (4%), business premises (4%), and various other purposes (19%). In terms of employment, the majority are employees (67%), followed by entrepreneurs (10%), state civil servants (6%), and freelancers (2%).

The overall level of consumer satisfaction with the Dukuh Atas TOD area shows a fairly positive trend. As many as 48% of respondents stated that they were satisfied, while the other 19% stated that they were very satisfied. On the other hand, only 6% felt dissatisfied and no respondents felt very dissatisfied, while 27% stated neutrality. These findings show that while the overall quality of the area has been appreciated, there are still some spatial elements that have not fully supported the optimal walking experience.

The assessment of the quality of pedestrian facilities was carried out through a five-point Likert scale, covering aspects of functionality, safety, comfort, visual attractiveness, and emotional proximity to the space. A neutral answer on this scale indicates that an element is not considered to have a significant impact on the user experience—either positively or negatively. To understand more deeply the contribution of each element to user perception, the following section will describe the results of the respondents' observations and responses to *fixed elements* such as sidewalks, vegetation, and building facades, as well as *semi-fixed elements* such as *street furniture* and the presence of carts in the pedestrian corridor of TOD Dukuh Atas.

1. Elemen Fix

a. Trotoar

The sidewalk in the Dukuh Atas area, Jakarta, is an extension of the sidewalk of Jalan Blora. Blora Street, which was previously used as a motorized vehicle route, has now been converted into a pedestrian area along with the implementation of the Dukuh Atas TOD area. Because this pedestrian area used to be a highway where there was a height difference of 15 cm. However, this difference does not interfere with pedestrian activities, because the area is equipped with *a road barrier* (road guardrail) and benches that highlight the difference in level, so that pedestrians are more vigilant. Ramp facilities are also provided at several points to facilitate access for people with disabilities as well as pedestrians carrying wheeled luggage or trolleys.

Figure 3. Sidewalk of the TOD Dukuh Atas Pedestrian Path (Source : Researcher Documentation)

The results of the questionnaire showed that most of the respondents assessed that the sidewalks in the Dukuh Atas area were of good quality. The majority of respondents strongly agree that sidewalks are functional (37%), safe (41%), comfortable (45%), and attractive (43%). In addition, 14% of respondents felt that the sidewalk made the distance feel very close and 35% felt that the distance felt close. Overall, respondents gave a positive rating of the sidewalks in this area.

b. Building Facades

The façade of the building along the pedestrian area of Dukuh Atas reflects the diversity of architecture that creates a dynamic urban atmosphere. Restaurants and cafes are designed with an aesthetic design aimed at attracting visitors, while some buildings still retain the original façade of the building from before the implementation of TOD in this area. Mini markets with transparent glass façades are also an important element, providing convenience for pedestrians to meet their daily needs. Overall, the region presents a rich and diverse urban experience.

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Figure 4. Building Facades on the Dukuh Atas TOD Pedestrian Path (Source: Researcher's Documentation)

The results of the questionnaire showed that most of the respondents rated the building façade in the Dukuh Atas area positive. Specifically, the majority of respondents strongly agree that building facades are functional (37%), safe (31%), comfortable (39%), and attractive (35%). In addition, 12% of respondents felt that building facades made the distance feel very close, and 29% felt that the distance felt close.

c. Street Furniture

Street furniture along the Dukuh Atas pedestrian path is designed with comfort and function in mind for pedestrians. In addition to being a resting place, several benches are integrated with *planter boxes* that add green and aesthetic elements to the area. This design allows users to feel a fresher atmosphere in the midst of city density. In the afternoon until evening, these benches are often used by restaurant visitors around the area to sit while enjoying their food. This shows that street furniture not only serves as a place to rest, but also supports social interaction and communal activities in public spaces. From a blend of natural elements and infrastructure, these seating facilities contribute to environmental sustainability while enriching the experience of public spaces, making them more comfortable, eco-friendly, and aesthetically pleasing.

Figure 5. Street *Furniture Facilities* on the Dukuh Atas TOD Pedestrian Path (Source : Researcher Documentation)

The results of the questionnaire showed that most respondents rated *street furniture* in the Dukuh Atas area positively. The majority of respondents strongly agree that *street furniture* is functional (35%), safe (41%), comfortable (39%), and attractive (45%). In addition, 24% of respondents felt *that street furniture* made the distance feel very close, and 37% felt that the distance felt close.

d. Mural / Street Art

Figure 6. Kendal Tunnel Mural on the Dukuh Atas TOD Pedestrian Path (Source: Researcher's)

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The Kendal Tunnel in the pedestrian area of Dukuh Atas is now a large canvas for colorful and dynamic murals, street art, and graffiti. A variety of artworks adorn the walls of the tunnel with themes ranging from abstract to local culture, reflecting the creativity of the artists. The materials used, such as spray paint and high-quality wall paint, ensure these murals are resistant to weather and pollution. With an urban and social theme, this street art not only beautifies the tunnel but also conveys relevant social messages, making the Kendal Tunnel a public art gallery that can be enjoyed by the wider community.

The results of the questionnaire showed that most of the respondents rated murals and *street art* in the Dukuh Atas area positively. Specifically, 20% of respondents felt that murals and *street art* made distance feel very close, 45% felt that distance felt close, and 29% felt that distance was neutral.

2. Elemen Semi-Fix

a. *Signage*

Figure 7. Signage on the TOD Dukuh Atas Pedestrian Path (Source : Researcher Documentation)

Signage or signage along the Dukuh Atas pedestrian path is designed to make it easier for pedestrians to navigate the area clearly and efficiently. This signage is placed in strategic locations and provides important information such as directions to stations, bus stops, shopping centers, and other public facilities. Some *signage* also comes with an area map to help pedestrians understand the layout of the area. The signage design takes visibility into account, with a location that is easily visible to pedestrians of all ages and equipped with adequate lighting to make it easier for pedestrians at night. In addition to being a navigation tool, this signboard also improves the quality of public facilities and the comfort of pedestrian path users.

The results of the questionnaire showed that most respondents rated *the signage* in the Dukuh Atas area positive. The majority of respondents strongly agree that *signage* is functional (43%), safe (41%), comfortable (43%), and attractive (43%). In addition, 14% of respondents felt that *signage* made the distance feel very close, and 41% felt that the distance felt close.

b. Lighting Description

Figure 8. Lighting Lights for the TOD Dukuh Atas Pedestrian Path (Source : Researcher Documentation)

The lighting in the Dukuh Atas pedestrian area is designed with a focus on pedestrian safety and comfort, especially at night. The lights along the pedestrian path provide adequate lighting, ensuring optimal visibility and increasing a sense of safety for road users. Additionally, the additional lighting of the commercial buildings around the area adds to the dynamic and lively atmosphere, making the area bright and cozy. The synergy between street lighting and buildings creates a modern and pedestrian-friendly environment.

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The results of the questionnaire showed that most of the respondents rated the lighting in the Dukuh Atas area positive. Specifically, the majority of respondents strongly agree that lighting is functional (37%), safe (43%), comfortable (45%), and attractive (37%). In addition, 12% of respondents felt that lighting made the distance feel very close, and 29% felt that the distance felt close.

c. Shade Trees

Figure 9.. Shade Trees on the Dukuh Atas TOD Pedestrian Path (Source : Researcher Documentation)

In this area, several kinds of green elements are found such as shade trees and planter boxes, shade trees and *planter boxes* along the Dukuh Atas pedestrian path play an important role in creating a comfortable and beautiful environment for pedestrians. In the pedestrian area of Dukuh Atas, there are various green elements, such as shade trees and *planter boxes*, which play an important role in creating a comfortable and beautiful environment for pedestrians. Shade trees in the pedestrian area of Dukuh Atas have an important role in creating a more comfortable and shady environment for pedestrians. These trees are planted regularly along the sidewalks, providing shade as well as shade in the midst of a busy city atmosphere. Maintenance of this tree is carried out periodically by the local government, including pruning to maintain the shape and quality of the tree. Although some large trees show potential damage to the sidewalk, the impact is still minimal and does not interfere with pedestrian safety. These trees not only provide shade but also help filter air pollution and absorb rainwater, which contributes to maintaining ecological balance in dense urban areas. At some point, benches are placed under trees, creating an ideal area for resting.

The results of the questionnaire showed that the majority of respondents strongly agreed that shade trees are functional (43%), safe (37%), comfortable (39%), and attractive (41%). The perception of distance generated by trees also tended to be "very close" (16%) to "close" (45%), suggesting that trees contribute to influencing the perception of distance from users.

d. Planter Box

Figure 10. Shade Trees on the Dukuh Atas TOD Pedestrian Path (Source : Researcher Documentation)

In addition to trees, *planter boxes* placed along this area add a green element while beautifying the area. *This planter box* contains ornamental plants and ketapang trees which are expected to bring coolness to pedestrians. However, some of the plants in the *planter box* currently seem to be poorly maintained, with yellowing leaves and ketapang trees that have not grown optimally. This condition can be caused by inadequate care, such as irregular watering and fertilization. To maintain aesthetic

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and shade functions, more intensive maintenance efforts are needed so that plants grow properly and optimally. The existence of shade trees and *planter boxes* not only beautify the area, but also create public spaces that are more environmentally friendly and ecological, improving the quality of life and comfort of pedestrians.

From the results of the questionnaire, respondents gave a positive assessment of *the planter box*, with a percentage strongly agreeing for functionality (29%), safety (29%), comfort (31%), and attractiveness (37%).

e. Coffee Booth

Figure 11. Coffee Booth Facility on the Pedestrian Path of TOD Dukuh Atas (Source : Researcher Documentation)

The Dukuh Atas pedestrian area is equipped with elements to support trade activities, including a coffee booth in collaboration with the Difabis community, Difabel Bazis Jakarta. This booth has a clean and professional appearance, with consistent and prominent branding, and is equipped with adequate facilities to serve customers. The neat and orderly arrangement of the booth creates a pleasant impression, while also supporting a comfortable walking experience in the area. With a strategic position and an integrated design, this coffee booth not only provides convenience for visitors who want to enjoy coffee, but also adds aesthetic value and attractiveness to the Dukuh Atas pedestrian area.

Overall, respondents gave a positive assessment of the existence of street vendor booths in this area. The majority of respondents strongly agreed that street vendor booths are functional (22%), safe (25%), comfortable (27%), and attractive (27%). In addition, 16% of respondents felt that street vendor booths made the distance feel very close, and 33% felt that the distance felt close.

The results of observations and questionnaires regarding user perception of physical elements in the Dukuh Atas pedestrian area show significant variations in five main aspects: proximity, functionality, safety, comfort, and attractiveness. This analysis can show the identification of elements that make a positive contribution to the user experience and walkability of the TOD Area, as well as elements that still need to be improved.

1) Functionality

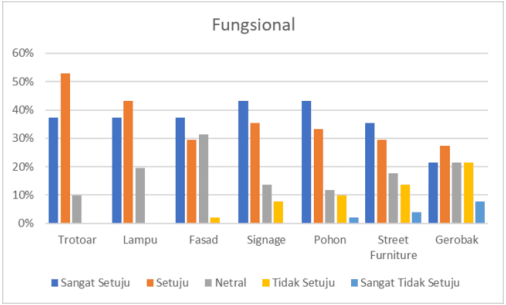

Figure 12. Functional Assessment Chart of Spatial Elements (Source: Researcher Data)

Tree and *signage* elements received the highest functionality ratings, with more than 75% of respondents agreeing or strongly agreeing that both elements function optimally. In addition, the existence of shade trees not only provides aesthetic value, but also acts as a source of shade and space barrier that facilitates orientation. Meanwhile, *signage* functions as a navigation tool that facilitates

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the movement of users in the area. In contrast, carts received the lowest response with around 30% of respondents stating that they disagreed or strongly disagreed with their functionality, indicating a potential disruption to the smooth running of the pedestrian space.

2) Security

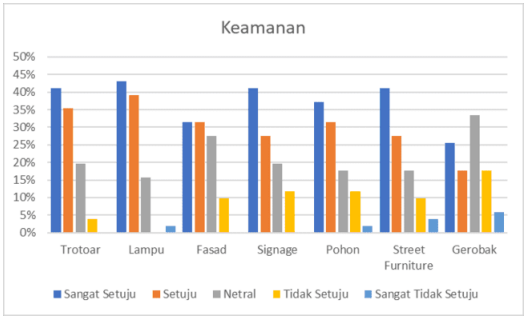

Figure 13. Security Assessment Chart of Space Elements (Source: Researcher Data)

In terms of safety aspects, it shows that the elements of the sidewalk and lighting space received the highest positive response, with around 76-82% of respondents stating that they agreed or strongly agreed. Adequate sidewalks and adequate lighting are considered essential in creating a safe and comfortable space. On the other hand, carts are again the element with the highest negative perceptions, with 24% of respondents disagreeing or strongly disagreeing regarding their contribution to security, signaling the potential risks posed by their existence.

3) Convenience

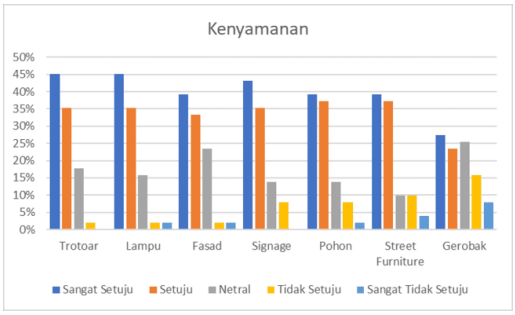

Figure 14. Comfort Rating Chart of Space Elements (Source: Researcher Data)

Trees and sidewalks also excel in terms of comfort, with more than 75% of respondents saying they agree or strongly agree that both elements provide a sense of comfort when walking. The presence of green elements including shade trees and planter boxes provides a refreshing atmosphere, while good pavements provide optimal walking space. Street furniture and murals also make a positive contribution albeit with a slightly lower approval rate. The cart again occupies the lowest position with a significant level of disapproval.

4) Atraktivitas

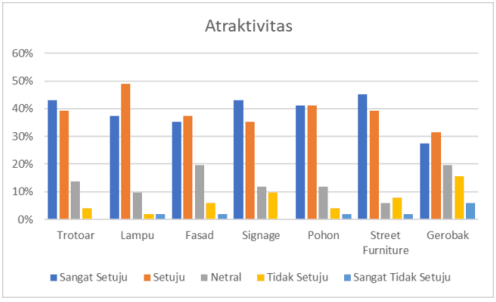

Figure 15. Attractiveness Assessment Chart of Spatial Elements (Source: Researcher Data)

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Elemen ruang pohon peneduh menjadi elemen paling menonjol dari segi atraktivitas, dengan persentase responden yang menyatakan setuju atau sangat setuju di atas 70%. Elemen seperti trotoar, lampu, dan *street furniture* berperan sebagai pendukung atraktivitas meskipun dengan nilai yang sedikit lebih rendah. Gerobak tetap menjadi elemen dengan persepsi atraktivitas terendah, mencerminkan kurangnya daya tarik visual dan potensi gangguan terhadap estetika kawasan.

5) Proximity

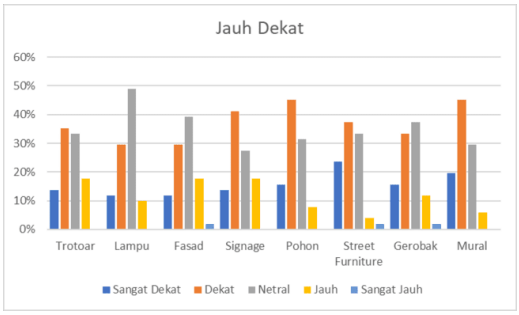

Figure 16. Assessment Chart of the Influence of Spatial Elements in Influencing Distance Perception

(Source: Researcher Data)

In terms of spatial and emotional proximity, trees and *signage* scored the highest, with 61% and 55% of respondents feeling that this element of space provides a perception of very close or close distance, respectively. This suggests that these elements are perceived as an integral part of the public space experience. The mural which is strategically located in the Kendal Tunnel also received a positive rating. Sidewalks and street furniture have moderate perceptions of proximity, while carts occupy the lowest position with 51% of respondents feeling distant or neutral towards these elements.

CONCLUSION

Jakarta faces a major challenge in creating sustainable urban mobility amid increasing population and land crisis. Reliance on private vehicles exacerbates congestion, air pollution, and degrades the quality of public spaces. In this context, Transit-Oriented Development (TOD) is a strategic solution, by focusing on development in the area around the public transportation transit node. TOD areas, such as Dukuh Atas, function as mobility centers that support connectivity between modes of transportation, thus providing a great opportunity to improve the quality of public space and encourage more pedestrian-friendly mobility patterns.

From the findings of this study, several physical elements such as trees, murals, sidewalks, and street lights make a significant contribution to improving *walkability* in the pedestrian area of TOD Dukuh Atas. The rhythmically embedded trees create shade and thermal comfort, while the murals in the Kendal Tunnel add a visual dimension that reinforces the appeal of the area. This is in line with Speck's 2019 view that emphasizes the importance of visual and atmospheric elements in shaping the walking experience. In addition, these findings also support the results of Alpat's 2021 research which highlights that the visual power of a space can overcome the limitations of physical infrastructure in encouraging walking activities.

In addition to dominant elements such as trees and murals, fixed and semi-fixed elements such as sidewalks, signage and street furniture also play an important role in creating a sense of comfort and connectedness in public spaces. This is in line with Rapoport's thinking which emphasizes the importance of order and integration in the elements of the built space. When these elements are properly integrated into the design of the TOD area, the built space is not only able to support the utilitarian walking pattern, but also contributes to the creation of a more sustainable mobility system. These findings underline that the quality of public spaces, both in terms of functionality and aesthetics, plays an important role in driving a shift in mobility behavior towards healthier, more efficient, and environmentally friendly patterns. Thus, a walkability-based approach needs to be mainstreamed in the development of the TOD area as a strategy to build a more inclusive and humane

city in the future.

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