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Analysis of the Accessibility of Pedestrian Paths in Thamrin City Area Based on the Transit-Oriented Development (TOD) Concept

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Transit-oriented development (TOD) is a mixed residential and commercial area with high accessibility to mass public transportation. Tanah Abang area is included in the Dukuh Atas TOD area as one of the TOD projects in Jakarta, located in a strategic area dominated by houses, apartments, malls, and offices. In this study, the Thamrin City area was chosen. This area has the potential to integrate the movement of users of transportation modes and the development of space around the transit area. This study is aimed to determine and evaluate the availability of pedestrian paths in the Thamrin City area - Jl. Teluk Betung 1 to Transit Hub BNI City based on the TOD concept. This study uses a qualitative method with a case study approach. An analysis is carried out to identify the level of pedestrian path connectivity in the Thamrin City Jakarta area, which is seen in the distance and travel time, pedestrian dimensions, comfort, security, convenience, and pedestrian connectivity. Observations have been made by mapping the pedestrian paths in the study area to determine the level of connectivity from the BNI City station walk area based on 4 ITDP principles, namely walk, connect, transit, shift. From the observations, it can be concluded that several things need to be improved to support walkability in the Thamrin City area, and recommendations for the availability of pedestrian paths and facilities for pedestrians with special needs can be fulfilled.

Keywords: Accessibility, Pedestrian Path, TOD

1. INTRODUCTION

Transit-Oriented Development (TOD) means integrated urban places designed to bring people, activities, buildings, and public space together, with easy walking and cycling connection between them and near-excellent transit service to the rest of the city. It means inclusive access for all to local and city-wide opportunities and resources by the most efficient and healthy combination of mobility modes, at the lowest financial and environmental cost, and with the highest resilience to disruptive events. Inclusive TOD is a necessary foundation for long-term sustainability, equity, shared prosperity, and civil peace in cities.

Thamrin City area is included in the Dukuh Atas TOD area in urban development; intermodal transit facilities and transit areas have become important. The area around the transit point is a potential area for development. This is related to the ease of access offered by areas close to transit facilities and activities that transit activities in the area may generate.

This area has been purposely selected for two reasons. Firstly, this area is a case study for an urban commercial

center. Secondly, diversity combined with the trend of rapid urbanization reflects a need to investigate the transportation and the challenges being faced. Therefore, this study area presents an opportunity for the development and sustainable approaches towards the TOD Dukuh Atas development. Various theories and concepts regarding TOD, including those from the Institute for Transportation and Development Policy (ITDP), have been widely recognized as concepts that address the needs of the transit area [1].

This study aims to determine whether the current urban form and transport development on and around the corridor on Jl. Teluk Betung 1 can be characterized as a TOD type of development. However, free and excessive parking, poor pedestrian environments around transit, poor-quality transit service, incorrect mixes of land uses near transit, and lack of transit link between housing and jobs found in this area.

The research question of this study is how to decide whether the availability of pedestrian paths in an area with the TOD concept can accommodate the community in carrying out activities and reduce the use of a private vehicle due to the availability of integrating public transportation.

Research strategy in which researchers investigate an "event" (activity), the program, or more than one individual [2]. The qualitative method has been chosen to get a comprehensive picture of accessibility to the Dukuh Atas transit hub. The research strategy of this study is based on a case study about a variety of sources that has been used to obtain data for triangulation purposes. The main advantage of using triangulation is that it allows the evaluation of different sources of information to investigate concepts based on the result of the findings. In contrast, the qualitative method is based on group discussion and a structured interview. Findings from this study are used as reference and guidance to develop and improve design criteria for green pedestrian facilities.

2. LITERATURE REVIEW

Transit-Oriented Development (TOD) is a new trend in urban areas multiplying a central pedestrian design element is mixed with residential or commercial designed to maximize access to public transport. This makes it possible to live a higher quality of life without complete dependence on a car for mobility and survival [3]. There is no doubt that cities will continue to expand, and their population will explode. There is also no doubt that the automobile is not a sustainable transportation model, at least not in compact cities with high population densities where amenities, schools, hospitals, the central business district, etc., are located close to one another. Therefore, many cities have adopted TOD successfully, an integrated system with public transportation, BRT (busway), MRT or LRT, commuter line.

The Institute for Transportation and Development Policy or ITDP mentions eight principles in urban transportation that align with the objectives of the application of the TOD concept: walk, cycle, connect, transit, mix, density, compact, and shift.



Figure 1 8-principles from ITDP [3]

Source: TOD standard [3]

1. Walk - develop an area within the city that encourages residents to walk more.
2. Cycling - encourage more sustainable alternatives to motorized vehicles such as bicycles for short trips.
3. Connect - create a unified network of roads and trails

4. Transit - develop key areas near public transport
5. Mix - a plan for utilizing a combination of uses.
6. Density - optimizes density by dampening urban growth through the construction of vertical houses.
7. Compact - creates areas within the city that allow short trips.
8. Shift - adjust the parking area and road use to increase mobility.

This research study is the accessibility of pedestrian paths in the corridor of Jl. Teluk Betung 1, starting from Thamrin City to BNI City station, focused only on the four principles of this ITDP, namely walk, connect, transit, shift.



Figure 2 Four principles from ITDP

Source: [3]

TOD has been widely accepted as an important plan to create attractive, liveable, and sustainable urban environments. The purpose of TOD is to concentrate on housing and commercial development close to an existing transit hub. TOD development radius is roughly a half-mile or less than 10-minute walking distance from its station. In most cities worldwide, potential sites for TOD are plentiful and can be developed. Existing rail or bus stations can be integrated with the MRT system, automobile parking system, bicycle lanes, commuter lines, walking paths, etc. TOD can be implemented by integrating existing commuter lines in the TOD area.

With TOD, cities will significantly reduce automobile ownership. The benefit of TOD concept for citizens:

1. Numbers of cars on the roads decrease,
2. Less air pollution and carbon emissions,
3. Fewer traffic jams,
4. Less lost person-hours,
5. More productive hours spent at work,
6. Quicker access to amenities, and more convenience as amenities, shops, and recreation spots are all located nearby.

These eventually make the city sustainable. TOD is relevant to Asian cities where the development density is already high, and land use mixture is a common practice and the share of transit use.

Accessibility is the convenience or ease of a location to interact with one another. The ease or difficulty of the location being reached through the transportation network system is referred to as accessibility. Accessibility is also focused on making it easy for pedestrians with special needs, such as wheelchair users, to use the facilities to walk on sidewalks and ride public transportation. Accessibility includes the factor of time, cost, and effort in moving places. Accessibility can also be expressed by distance. If one place is close to another, it is said that the accessibility between the two places is high. If the two places are very far apart, the accessibility is low [5]. Walking is the most enjoyable and effective if the available walking path has supported activities, social media, and other supporting elements. Therefore, the element of the walkability of the pedestrian path in the corridor along Jl. Teluk Betung 1, starting from Thamrin City to BNI City station, needs attention.

Walkability is the interaction between facilities for walking and the overall support for the pedestrian environment [6]. As a TOD area, the development of Dukuh Atas is directed at realizing regional integration between transit nodes and the surrounding area by creating a pedestrian-friendly environment [7].

Pedestrian networks in urban areas that are safe, comfortable, and humane must be realized to encourage people to walk and use public transportation [8]. The existence of the transit process causes the need for an increase in the volume of pedestrian paths in the transit area.

Things to watch out for are:

- The function of the pedestrian path itself.
- Pedestrian condition.
- Mileage (walking distance), relation to walkability
- Side activities activity support.

Pedestrian Path Typology

- a. Pedestrian Space on the Side of the Road (Sidewalk)
Pedestrian space on the side of the road (sidewalk) is part of the pedestrian path system from the edge of the highway to the outer edge of the building's land. Segments 3 to 3 in this case study consist of the concept of pedestrian space on the side of the road.



Figure 3 Sidewalk

Source: doc.private, April 2021

- b. **Pedestrian Space on the Water Side (Promenade)**
Pedestrian Space which is adjacent to a body of water on one side.



Figure 4 Riverbank

Source: Sabandar,2020[9]

- c. **3 Pedestrian Space in Commercial/Office Areas (Arcade).** Pedestrian Space adjacent to the building in one or more both sides.



Figure 5 Arcade

Source: doc.private, April 2021

- d. Pedestrian Space in RTH (Green open space) or Green Pathway. It is a pedestrian space located between green open spaces. This space is a barrier between green space and pedestrian circulation space. This area allows to be equipped with space elements such as hydrants, street furniture (benches, and so on).



Figure 6 Pathway in green open space. Source:

Landscape Presentation - Aedas for BSD, Oct 2010

- e. This figure is an underground pedestrian space that is part of the building above it. Alternatively, a particular pedestrian path is below ground level. This

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underground pedestrian space must be connected to the underground pedestrian crossing. At night, crossings under the road must be provided with adequate lighting.



Figure 7 Underpass

Source: Kumparan, Maret 2019

- f. This figure is pedestrian space above the ground (elevated). TOD includes a skywalk network plan. Stations need to be connected to the skywalk network to activity centers along roads or vacant land to streamline land use by utilizing airspace [10].



Figure 8 Skybridge. Source:

StasiunCisaukjadipeluangemaspengembang, Dwytia Putra, 2019

According to Hamid Shirvani (1985), it is necessary to consider the following [11].

- a. The balance of interaction between pedestrians and vehicles.
- b. Safety factor, enough space for pedestrians.
- c. Facilities that offer pleasure along the pedestrian area and the availability of public facilities as a supporting element

3. ANALYSIS

Transit-Oriented Development (TOD) means integrated urban places designed to bring people, activities, buildings, and public space together, with easy walking and cycling connection between them and near-excellent transit service to the rest of the city. It means inclusive

access for all to local and city-wide opportunities and resources by the most efficient and healthy combination of mobility modes, at the lowest financial and environmental cost, and with the highest resilience to disruptive events. Inclusive TOD is a necessary foundation for long-term sustainability, equity, shared prosperity, and civil peace in cities.

3.1. Identifying the Characteristics of Pedestrian Paths in Thamrin City Area

The research location is taken from Thamrin City Jl. The Thamrin City area is located in the Kebon Melati village, Tanah Abang district. Teluk Betung 1 arrives at BNI City station as a Transit hub that accommodates five modes of transportation.

TOD is developed by referring to the transportation base as a primary reference for developing an area or area. The analytical method used is related to the theory used from ITDP, which mentions eight principles in urban transportation that are in line with the objectives of the application of the TOD concept, namely walk, cycle, connect, transit, mix, densify, compact, and shift, taken four principles for this research, namely: analyzing walk (walk), connect (connect), transit (stopover), shift (transport switch). This research does not discuss mixed-use development, known as integrated area development (mix, densify, compact). At the same time, mixed-use is built to unite needs such as offices, shopping centers, and residential areas. To make it easier to identify and analyze the study location, the Study Area will be divided into five segments based on the dominance of the building function in each segment. The pedestrian path segments to be surveyed are not continuous and are limited by a 200-400 meters pedestrian catchment area. The pedestrian paths are taken according to the function of the building in each segment. This is done to obtain the level of diversity of pedestrian path conditions in the studied area.

Study Area Segment Division

- a. Segment 1: Thamrin Terrace to Office Park Ruko (dominated function: trade, commercial, office)
- b. Segment 2: Office Park shophouses up to Thamrin Residence (function dominance: community service)
- c. Segment 3: Thamrin Terrace up to the corner of Jl. Teluk Betung 1 (dominant function: commercial and community service)
- d. Segment 4: along the Melati Reservoir to the UPK of the Water Agency (dominant function: vacant land, residential houses)
- e. Segment 5: UPK Water Agency to BNI City Station (North Lobby)



Figure 9 Segment Division

Source: jakartasatu.go.id

3.2. Findings

The investigation on five segments describes several conditions or problems worth addressing in TOD planning. These findings, of course, are completed with some characteristics that are not represented in the four principles from ITDP. The summary of the pedestrian problem on five segments is summarized in table 1.

Table 1 Problem Segment

Segment	Problem Segment
1	Crossing with vehicle entrance to the building. There are no slopes at all crossing points
2	The width of the lane is less and the use of materials is not optimal, the ramps are not yet available, so it is difficult for people with disabilities to cross
3	The floor pattern has not been equipped with facilities for the disabled. Pedestrian connection to BNI station. The distance to the rubber station is still far
4	The pedestrian path to BNI City station is not yet available. The existing condition is still vacant land and some houses of residents, at the end of the jasmine reservoir there is a disconnection to BNI Station.
5	Lines from Jl. Waduk Melati - Jl. Talang Betutu from the end to BNI Station is not yet available.

3.3. Analysis Using Four TOD Principles

A complete infrastructure network is needed so that areas with the TOD concept can be prosperous. This analysis aims to assess the feasibility of the infrastructure on the site.

The principles include:

1. Walk. Pedestrian paths must meet the following criteria:
 - a. Special sidewalks for pedestrians that are protected by motorized vehicles.

- b. Distribution of roads that are friendly and safe for pedestrians, separated from other vehicles with a maximum speed limit of 20 km/hour.
- c. A particular pedestrian-friendly road for persons with disabilities is free from obstacles both vertically and horizontally by applicable regulations or standards.

In the study area, some crossings are not by the principles of ITDP (2014), such as:

- a. The width of the pedestrian path is less than two meters.
 - b. Not all pedestrian paths have slopes for wheelchairs to pass.
 - c. The use of inadequate materials is also not equipped with guidelines.
2. Connect. The length of the buildings within the study area ranges from 150-200 meters. This short distance provides a wider choice of routes and shorter travel times.
 3. Public Transportation (Transit) ¹⁸ Standard TOD compiled by ITDP (2014) The maximum recommended distance to the nearest mass transit station is 1 kilometer or 15 to 20 minutes on foot to maximize the number of users who can easily access public transport services. Long distances between centers activities with transit stations cause public transportation modes to be less than optimal.
 4. Switch (Shift) Problems found in the study area that are not by ITDP (2014) include:
 - a. The street structure is mainly dominated by traffic.
 - b. The parking lot is not well organized.
 - c. Entrance for areas or vehicle exits from buildings that interfere with pedestrians. The existing road conditions are not maximized to provide comfort for pedestrians. The design must be prioritized for pedestrian comfort and reduce the area for motorized vehicles.

Driveway or motorized vehicle access into the building, which cuts the pedestrian walkway, can be overcome by relocating the driveway in one building to reduce the driveway and the use of private vehicles.

To collect information on pedestrian perceptions and preferences, pedestrian characteristics, and travel characteristics ²⁰ several pedestrians, have been interviewed to get the information about the condition of pedestrian facilities from respondents with different purpose.

3.4. Result and Discussion

From the results of field observations, the condition of the pedestrian path in Segment 1 to Segment 5 is as follows: SEGMENT 1, Thamrin Terrace section, which is 200 meters long to Office Park Thamrin City, is not yet free from obstructions, so wheelchair users cannot pass easily. The condition of the pedestrian path on this segment occurs "crossing" with the exit of vehicles from the

building so that wheelchair users cannot pass. In other words, there are still many pedestrian paths and barriers, so there are only a few pedestrian paths that are barrier-free and free of barriers so that wheelchairs can pass easily.

SEGMENT 2, the section between Thamrin Terrace and Thamrin Residence, the pedestrian path is 150 meters long, crossing with vehicles to Office Park is not yet equipped with Zebra Cross, and there is no ramp, the width of the 130 cm lane is not wide enough to pass. Also, the material used is not adequate for disabled people because of the rough and bumpy surface (paving block), and there is no guiding block. However, there is an ojek shelter that serves people who want to change transportation on this route.

SEGMENT 3 different conditions are found on the pedestrian path along the section along with Thamrin Residence. Pedestrian paths in trade areas require wider free space and more rest or stopover areas because walking activities in these areas are usually dominated by those who move while carrying large amounts of goods over long distances. However, even though the pedestrian path is very wide in this segment, it is not equipped with a guide path. Walkability is a term used to describe and measure the connectivity and quality of sidewalks, walkways, or sidewalks in cities. This can be measured based on the average walking time for each block.

SEGMENT 4 pedestrian path beside Melati Reservoir, the existing condition is still inadequate to access BNI City Station because there is still no pedestrian path available in this 300-meter long area. Access to BNI City Station can be passed through the Water Agency (UPK) building to the North Lobby of BNI City station (North Lobby) along 300 meters. Then pedestrians can continue their destination to reach Dukuh Atas station for KRL (Commuter Line) mode.

SEGMENT 5. Jl. Talang Betutu Ujung, the pedestrian path to BNI City Station, still has to go through the vehicle road. In segment 5, the integration of the pedestrian path with the transportation system has not yet been realized. In Segment 4 and Segment 5, it is necessary to plan a pedestrian path to reach the BNI City Station transit hub.



Figure 10 Map of segment 1-5
Source: doc.private, April 2021



Figure 11 Aerial view segment 1 - Thamrin Terrace up to Segment 4 - Waduk Melati Source: Drone Thamrin City doc.Property Management

3.5. Design Proposal Simulation

This study has found differences in the characteristics of each segment studied. Between segment four and segment 5, there is no pedestrian network available to reach the transit hub of BNI City Station. Pedestrians are needed for people to walk from Thamrin City to BNI City and Dukuh Atas Stations. It is necessary to find appropriate solutions and alternatives so that pedestrian facilities can be met. The needs are to be done considering that the condition of the pedestrian path along the Melati Reservoir is not yet available.

Through the results of interviews with users of transportation modes in the Thamrin City area, it can be concluded that transportation users in the area are office employees aged around 23-40 years. From the interview transcripts, it can be concluded that, on average, the respondents support the availability of pedestrian paths to overcome the disconnectivity between Thamrin Residence and BNI City Station. With the development of the intensity of the Melati Reservoir area, it is possible to develop:

1. City space on the ground
2. City space in the air
3. City space underground

The proposed design that can be applied to provide a pedestrian path that does not yet exist along the Melati Reservoir to the BNI City station must be adapted to existing conditions. The concept applied must also be able to maximize the circulation of public transportation users to increase the accessibility and mobility of the area and the transit movement process. For Segment 4 along the Melati Reservoir to the BNI City station, the design strategy can be applied so that pedestrian circulation in this area can be connected to transportation modes connected to bridge infrastructure, namely the "sky-bridge." This sky bridge alternative was chosen because of the area's physical condition, which is still vacant land, and the Melati Reservoir on the south side, where there is a UPK Water Management Unit building.



Figure 12 Design simulation. Source: doc.private, April 2021



Figure 13 Plan of proposed skybridge along Waduk Melati. Source: doc.private, April 2021

3.6. Skywalk Concept

It creates a network of pedestrian paths to fly (skywalk) down the street and through the existing buildings. Streamline land use by constructing "floating" buildings to take advantage of the space in the air.

4. CONCLUSION

Based on the results of the analysis of Pedestrian Paths in the TOD Area with four indicators from ITDP: walk, connect, transit and shift which includes distance and travel time; pedestrian-friendly, pedestrian dimensions, comfort, security, and convenience; public space with the origin and destination points and pedestrian connectivity and accessibility based on observations, in segment one along Thamrin Terrace is pretty good, only crossing occurs with vehicle exits. Segment 2 is quite good. It only needs widening of the pedestrian path and the floor material used to make it more suitable for people with disabilities. At the same time, in Segment 3, the accessibility is excellent in the area along with Thamrin Residence, which only needs improvements to lighting and guidelines. In Segment 4, the route from Thamrin Residence to Jl. Talang Betutu Ujung along Waduk Melati is still not available for pedestrian paths. Segment 5 is from Jl. The Talang Betutu

Ujung to the BNI City station transit hub is also not sufficient. Repair and improvement of pedestrian paths in the area so that it is friendly to pedestrians and existing connectivity in the Thamrin City area needs to be further improved by maintaining existing routes by adding pedestrian facilities to improve pedestrian path connectivity. These things significantly affect the pedestrian path for pedestrians in the Thamrin City area to the Dukuh Atas transit hub.

Transit-Oriented Development (TOD) area at areas of Dukuh Atas is planned with adequate facilities and infrastructure with TOD (Transit Oriented Development) concept to feel comfortable and public transportation users easy in carrying out their daily activities.

For the conclusion, the unbuilt area, passive green open space located along the Waduk Melati based on the TOD regulation must be created to meet pedestrians needs.

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