

Transit Oriented Development (TOD) Development in Senen Area, Central Jakarta, Indonesia

Herika Muhamad Taki^{1*}, Aliah Amelia¹, Nathania Azarine¹, Muhammad Zainuddin Lubis²

^{1*} Urban and Regional Planning Department, Faculty of Architecture Landscape and Environmental Technology, Universitas Trisakti, Jakarta, Indonesia
² College of Oceanography and Ecological Science, Shanghai Ocean University, Shanghai, China

* Corresponding author : herika@trisakti.ac.id
Tel.: +6281288206699; fax: +81-72-867-1658
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Abstract

Senen area, Central Jakarta, is a strategic area that faces various problems, such as traffic congestion, lack of integration between modes of transportation, and minimal facilities for pedestrians and public transportation users. This study aims to evaluate the application of the TOD concept in the Senen area based on principles such as transportation integration, mixed land use, and pedestrian connectivity. This study uses a qualitative descriptive method approach, where the data used is secondary data obtained through literature studies. Literature studies are conducted by referring to previous studies and relevant institutional reports. The data collected includes spatial information, such as maps and geographic data, as well as non-spatial information, such as planning documents and policies. The results of the study indicate that the Senen area has great potential to be developed as a TOD area. Some steps that can be taken include improving connectivity between modes of transportation, improving public facilities, and adding green open spaces. In conclusion, the implementation of TOD in the Senen area can reduce the use of private vehicles, increase the efficiency of public transportation, and create a more comfortable and environmentally friendly city environment.

Keywords: Transit Oriented Development (TOD), Senen Area, Transportation, Spatial Planning.

1. Introduction

Transit Oriented Development (TOD) is a concept for developing an urban area that prioritizes the use of public transportation rather than private vehicles (Mohamad, Fahmy-Abdullah and Masrom, 2021). The TOD concept is intended as a solution for developing urban areas through development that is oriented towards the transit system so that it has the potential to reduce household transportation costs and improve the quality of life (Taki, Mahmoud and Maatouk, 2018). On the other hand, the development of areas with a mixed-use pattern is expected to increase regional accessibility and reduce travel needs which ultimately reduce environmental impacts and provide alternative solutions to avoid traffic congestion (Nigro, Bertolini and Moccia, 2019). According to the Regulation of the Minister of Agrarian Affairs and Spatial Planning/BPN Number 16 of 2017 concerning Guidelines for the Development of Transit-Oriented Areas, it is a concept for developing areas in and around transit nodes to provide added value that emphasizes integration between mass public transportation networks and non-motorized transportation networks, as well as reducing the use of motorized vehicles accompanied by the development of mixed and dense areas with medium to high intensity of space utilization (Singh et al., 2017).

DKI Jakarta as the nation's capital is also the center of activities for the surrounding area. As the largest city in Indonesia, DKI Jakarta also still faces challenges in urban problems such as severe congestion, one of which is. According to, in 2019 there were a total of 26.4 million daily

travel movements in DKI Jakarta. The high movement places Jakarta as the 10th most congested city in the world in 2019 (Taki, Maatouk and Lubis, 2018). The city of Jakarta is also one of the cities that has a lot of commuting behavior in it, including the study location, namely the Senen area which is designated as a secondary activity center with mixed activities (mix use) so that every day there is an increase in accessibility at transit points in the Senen area (Taki, Maatouk and Qurnfulah, 2017). Mixed activities at this location include trade and service activities, offices (Karina, Sumabrata and Berawi, 2025), TransJakarta transit mobility, terminals and train stations. In order for the handling of accessibility and integration between modes to be on target, it is necessary to develop integration between modes, one of which is the development of an area with the Transit Oriented Development (TOD) concept (Taki, Maatouk and Ahmadi, 2019).

In this case, the Senen area still has problematic issues, including congestion due to high accessibility and mobility in the area (Taki, Pamungkas, et al., 2024). This area has a central terminal and commuter and long-distance train stations, so there needs to be a re-arrangement for the integration of mass transportation, in addition, the high volume of traffic due to private vehicles that is not balanced with even road construction also causes congestion in this area (Taki, Rani, et al., 2024). Presidential Regulation Number 60 of 2020 concerning the Spatial Planning for the Urban Areas of Jakarta, Bogor, Depok, Tangerang, Bekasi, Puncak and Cianjur has mentioned several transit-oriented area development programs with the type of transit-oriented city development area, one of which is at Pasar

Senen Station in Senen District. Through the DKI Jakarta Government in the 2010-2030 Jakarta City Spatial Planning Plan (RTRW) the results of the revision in 2019 began using the TOD concept planning to develop transit points spread across the Jakarta City area. This point is in the form of intermodal terminals/stations at activity centers, rail transportation stations, highway mass transportation shelters (stops) and public transportation terminals, TOD concept planning in Jakarta City will not be achieved if its implementation has not or does not comply with the TOD Area development criteria. Based on existing conditions, the Senen area is currently in the development stage of markets, housing, transit stations and infrastructure, there is a need for a comparison between the TOD guideline criteria and the existing conditions of the area (Guthrie and Fan, 2016).

2. Research Methodology

This study uses a descriptive qualitative method approach, where the data used is secondary data obtained through literature studies (Sun et al., 2022). Literature studies are conducted by referring to previous studies and relevant institutional reports. The data collected includes

Table 1. 8 Principles of TOD

INDICATOR	VARIABLES	PROVISION
ACCESSIBILITY	Distance to public transportation	Measures how close a location is to a train station or bus stop.
	Availability of alternative modes of transportation	Assess the presence of bicycle lanes, pedestrian lanes, and public transportation.
DENSITY	Number of housing units per hectare	Measuring population density in TOD areas to support public transportation.
	Land use level	The percentage of land used for housing, commercial, and public facilities.
MIXED USAGE	Proportion of land use	Assess land use diversity (residential, commercial, public space).
	Availability of services and facilities	The presence of schools, parks, health centers within reach.
PEDESTRIAN ORIENTED DESIGN	Quality of sidewalks and pedestrian paths	Measuring the width, comfort and safety of pedestrian paths.
	Crossing facilities	Number and quality of zebra crossings or pedestrian bridges
	Green open space area	Measuring the amount of green open space available to the community
PUBLIC SPACE	Quality of public facilities	Assessment of parks, plazas, and other gathering areas
	Connectivity between modes of transportation	How well is the public transport system integrated with other modes?
INTEGRATION WITH PUBLIC TRANSPORTATION	Frequency of transportation services	Number of public transportation services in a certain time period
	Rental price or house price	Measuring housing affordability for low-income communities
LEVEL AFFORDABILITY	Percentage of income spent on housing	The ratio between housing expenses and household income.
	Carbon emission reduction	Measuring the environmental impact of using public transport compared to private vehicles.
ENVIRONMENTAL SUSTAINABILITY	Use of renewable energy	Percentage of renewable energy use in TOD development

3.2 The Purpose of Spatial Planning for the detailed Spatial Planning of Senen District

The objectives of spatial planning for Senen District are outlined in the Regional Regulation of the Special Capital Region of Jakarta Province Number 1 of 2014 concerning Detailed Spatial Planning and Zoning Regulations, as follows :

spatial information, such as maps and geographic data, as well as non-spatial information, such as planning and policy documents (Chaniago and Taki, 2022). The analysis process is carried out using overlay techniques and manual digitization to process spatial data and integrate non-spatial information. In addition, deductive methods are applied to examine the theory and criteria of Transit Oriented Development (TOD) guidelines (Taki and Maatouk, 2018). This analysis begins using a literature review to identify TOD theories and concepts, which are then used as the basis for formulating research variables (Zhang et al., 2019).

3. Results and Discussion

3.1 TOD Area Development Requirements According to ITDP

ITDP uses eight key principles known as the "8 Principles of TOD," which help create transit-friendly, sustainable, and inclusive areas (Bai et al., 2023). Here are the key criteria according to ITDP :

1. Realization of the arrangement of national scale office, trade and service centers integrated with mass public transportation in the Senen area.
2. Implementation of integrated transportation infrastructure development with pedestrian paths, mass public transportation, and other public transportation to support TOD (Taki, Anita Sitawati Wartaman, et al., 2024).
3. Implementation of development and/or improvement of trade and service infrastructure

environment by providing space for micro businesses and arranging passenger terminals in an integrated manner with railway transportation at Senen Station (Barus, Djaja and Transoptasi, 2023).

4. Realization of urban tourism
5. Realization of residential area development through environmental improvement and/or rejuvenation equipped with infrastructure integrated with mass public transportation.
6. Construction of public flats equipped with infrastructure integrated with mass public transportation.

3.3 Spatial Structure Plan for Senen District

The following is a map of the spatial pattern of the Senen District area, Central Jakarta.

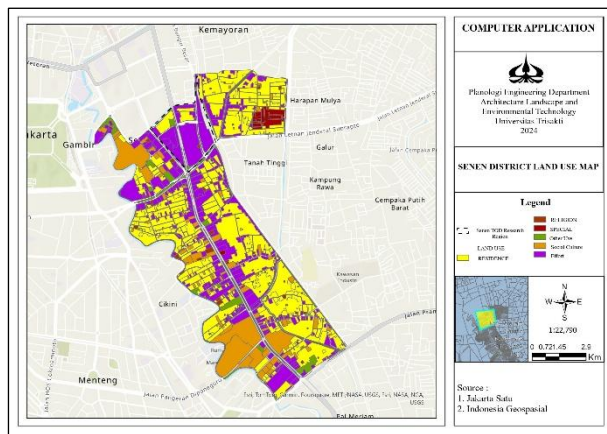


Fig 1. Land Use Map of Senen District

There is a Spatial and Regional Structure Plan for Senen District which is explained in DKI Jakarta Regional Regulation Number 1 of 2014 concerning RDTR and Zoning Regulations as follows :

1. The land transportation plan functions to smooth the flow of transportation and overcome traffic congestion by :
 - a) Development of mass public transportation infrastructure on special routes in the Harmoni-Pulo Gadung corridor, the Dukuh Atas-Pulo Gadung corridor, and the Kampung Melayu-Ancol corridor
 - b) Improvement of primary arterial roads throughout
 - c) Improvement of secondary arterial roads in each sub-district
 - d) Improvement of secondary collector roads in the sub-districts of Paseban, Kenari, Kramat, Senen, and Bungur sub-districts
 - e) Development of local roads in each sub-district
 - f) Implementation of phase II traffic restrictions in Kramat, Senen, and Paseban Sub-districts
 - g) Development of parking infrastructure in each sub-district
 - h) Development of pedestrian paths and bicycle paths on arterial, collector and local roads in each sub-district

2. The plan for evacuation routes and space infrastructure in Senen District is as follows :

- a) Disaster evacuation route on the section
- b) The intersection of the intersection and Kwitang Road in Senen Village and Kwitang Village
- c) Kramat Roundabout Road in Senen Subdistrict and Kramat Subdistrict
- d) Jalan Letjend Suprato in Bungur Village
- e) Pejambon Street, Abdul Rahman Saleh Street, Senen Raya Street, and Kwini 2 Street in Senen Subdistrict
- f) Matraman Street in Kenari Subdistrict
- g) Scout Street in Paseban Subdistrict
- h) Senen Market Street in Senen Subdistrict
- i) Kramat Raya Street in Kramat Subdistrict
- j) Kwitang Street and Kenari Subdistrict
- k) Salemba Raya Street in Paseban Subdistrict

3. Transportation infrastructure plan

- a) Bus Stop Infrastructure
 - 1) Senen Central Bus Stop
 - 2) Atrium Stop
 - 3) RSPAD bus stop
 - 4) Ministry of Foreign Affairs bus stop
- b) Parking Provision
 - 1) provision of parking facilities for changing modes (park and ride) is available in the Senen area in Senen sub-district
 - 2) Parking on the road (on street parking) is carried out based on statutory regulations
- c) Railway Transportation Infrastructure
 - 1) Plans to develop an inner-city ring train via Senen Station in Senen Subdistrict and Kramat Station in Rawasari Subdistrict
 - 2) The Jabodetabek commuter train development plan is at Pasar Senen Station in Bungur, Kramat, Paseban and Senen Sub-districts
 - 3) The planned non-level crossing is located at the Fly Over/Underpass on Jalan Kramat Lontar in Kramat Subdistrict and on Jalan Diponegoro in Kenari Subdistrict
- d) Land Transportation Infrastructure Plan
 - 1) Development of mass public transportation infrastructure on special routes in the Harmoni-Pulo Gadung corridor, the Dukuh Atas-Pulo Gadung corridor, and the Kampung Melayu-Ancol corridor
 - 2) Improvement of secondary arterial roads in each sub-district
 - 3) Improvement of secondary collector roads in the sub-districts of Paseban, Kenari, Kramat, Senen, and Bungur
 - 4) Development of local roads in each sub-district
 - 5) Implementation of phase II traffic restrictions in Kramat, Senen, and Paseban Sub-districts
 - 6) Development of parking infrastructure in each sub-district

- 7) Development of pedestrian paths and bicycle paths on arterial, collector and local roads in each sub-district

3.4 Existing Conditions of the Area

The existing condition of Senen District including our case study area, namely Pasar Senen Station, has activities and activities that are close to each other, including Malls, Markets, Terminals, Sports Arenas, Police Stations and Train Stations as in the picture below which are in accordance with the color of the land use of the area (Taki et al., 2018), namely as follows :

1. Green, an area designated as a protected function
2. Pink, the area designated for the function of the national capital
3. Yellow, residential area
4. Ungi, area designated for offices, trade and services
5. Abu, industrial area
6. Blue, designated area for non-green open space
7. Light brown, area designated for public and social services

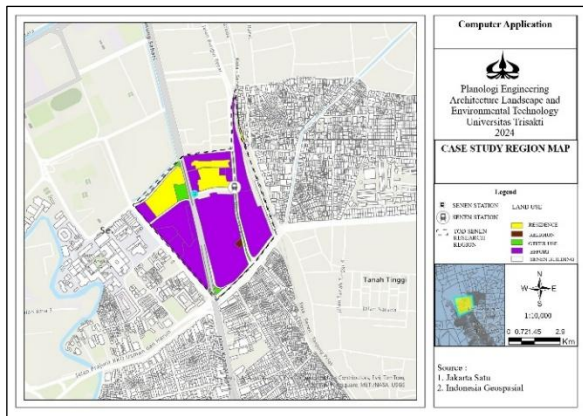


Fig 2. Map of the Case Study Area of Pasar Senen Station

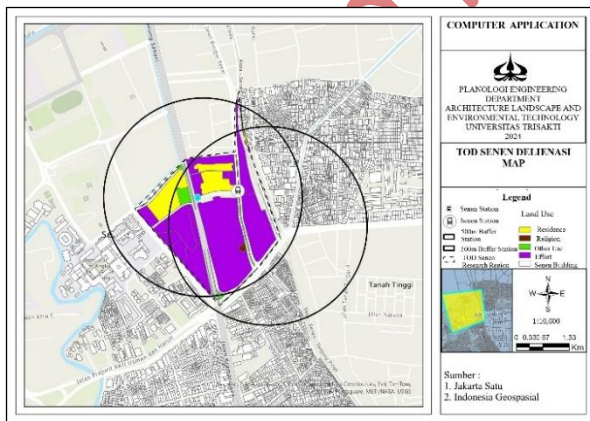


Fig 3. Map of 500 m TOD Buffer Area

There is a buffer map of the Pasar Senen Station area with a distance of 500 meters, which is in accordance with the criteria of the Regulation of the Minister of Agrarian Affairs and Spatial Planning/BPN Number 16 of 17 concerning Guidelines for the Development of Transit-Oriented Areas (TOD), namely there are 3 zones based on the distance from the transportation center (Berawi et al., 2020) :

1. 300 meters: Core zone (land use intensity)
2. 800 meters: Development Zone (zone that is still effectively reachable by foot or bicycle)

3.5 Evaluation of TOD Criteria against Existing Conditions

Based on the existing conditions and characteristics above, it can be said that the Senen area is included in the urban TOD typology based on the criteria of the Ministry of ATR/BPN. The form and delineation of the area are with the character of TOD development of the City-sub City Service Center because the Senen area has the criteria of an economic center, especially for secondary functions and regional culture (Bolleter and Ramalho, 2020). In addition, the Senen area was designated as a secondary activity center in the 2030 DKI Jakarta RTRW which has been described above, but the results of a survey conducted stated that there are still several criteria that have not been met in the development of the TOD area in Senen (Renne and Appleyard, 2019), Central Jakarta, as in the table below :

No.	TOD Principle	TOD Criteria	Existing Condition	Conformity Result
1.	Building Density	KLB 3-5 KDB Max 70%	KLB 3-5 40%-50%	In Accordance
2.	Residential Density	High Density Average Residential Density 12-38 units/1000 m ²	High Density Average 15-35 units/ 1000 m ²	In Accordance
3.	Land Use Diversity	% Housing area : % Non Housing 30%-60% : 40%-70%	% Housing area : % Non Housing 26 : 74% Too much low housing number	Not yet Suitable
4.	Road Network Convenience	Integrated Transit System Network Bike Path	Difficult Integration and Feeder	Not Yet Suitable
5.	Distance Between Blocks	Block Size corresponds to a 5 minute walk, 70-200 meters	There are No bike lanes yet Average block size with a walking distance of 100-200 meters between blocks 5-6	In accordance
6.	Pedestrian Condition	Length of block face with path safe and accessible pedestrian for wheelchair users	The front of the block is in accessible due to fences and minimal wheelchair access	Not yet suitable
7.	Pedestrian comfort	Safe pedestrian and support for diffable infrastructure	Most pedestrians are safe and the infrastructure is disable	In accordance

8.	Pedestrian Design	Sidewalk available, park, plazas and other amenities Direction	There is No. sidewalk yet Still drinking direction	Not yet Suitable
9.	Parking availability Bicycle parking	Park and Ride Bicycle Parking	There is No. park yet not yet suitable for bicycle parking There is No. bicycle parking yet	Not yet suitable
10.	Parking lot conditions	Shared and restricted parking	Shared parking spaces are not restricted and some are not yet appropriate using on street	Not yet suitable
11.	Availability of Mode Types	Availability of short distance commuter (inside the city) micro bus, city bus, BRT, LRT, MRT Long distance commuter (intercity, inter provincial), LRT, MRT, Fast Train, Train, Commuterline, Intercity Bus	Availability of Metro Trans, Transjakarta, Mikrotrans, mini trans, but there is no LRT or MRT Yet Availability, Transjabodetabek, Train	In Accordance
12.	Frequency and headway	High frequency and headway	Average frequency and headway 7-15 minutes	In accordance
13.	Open Space Typology	Community scale (Community Scaled Park), environmental park (Small Park) according to standards service.	There are parks on a community scale, namely the struggle monument park, the station plaza Park, and the senen Jaya Market Park.	In accordance
14.	Open Space Capacity	RTH within a 5 minute walking radius, 10-15% of TOD is a park, easy accessed from transit location	There is park within a 5-7 minute walking radius and with a capacity of 10-20% of the TOD.	In Accordance
15.	Open Space Conditions	Open Spaces should be easily accessible, comfortable, have features the	The open space is just a garden with chairs and plants.	Not Yet Suitable

attractive on	Retail availability modern and coffee shop in the graden area
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From the table above, it can be stated that of the 15 TOD development criteria tables, only 8 are appropriate and meet the existing conditions of TOD development in the Senen area (Taki, Wicaksono and Badawi, 2023).

4 Conclusion

Based on the analysis of the existing conditions and characteristics of the Senen Area, in principle the development of Transit Oriented Development (TOD) has met several main elements, such as population density and a maximum distance of 500 meters which are part of the TOD principle (Suryani, Harun and Astuti, 2020). However, in terms of design and accessibility, this area is still not fully in accordance with the criteria and guidelines for TOD development. The greatest inconsistency was found in the infrastructure aspect, especially in the road network pattern, which still needs adjustment to be in line with the TOD principle (Khaderi, Bakeri and Shukor, 2021).

This is due to various constraints, including suboptimal parking area management, limited green open space, and inadequate facilities for pedestrians (Stojanovski, 2020). Although several other aspects have been in accordance with the characteristics of TOD, there are still variables that need to be improved to support the development of the area as a whole (Tong et al., 2018).

As a recommendation, the DKI Jakarta Provincial Government is advised to establish strategic cooperation with relevant stakeholders, including PT KAI, to develop the area around the station (Taki et al., 2017). Development priorities include improving pedestrian path facilities, building integrated pedestrian bridges, and providing adequate park and ride facilities (Jamme et al., 2019). This step is expected to accelerate the transformation of the Senen Area into a TOD area that is more inclusive, sustainable, and in accordance with applicable guidelines (Zaręba et al., 2019).

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