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Morphology of Neighborhood TOD in Jabodetabek

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ABSTRACT

Urbanization in Metropolitan Cities continues to increase, impacting the urban spatial structure. Furthermore, human transportation activities in an area are also impacted. Knowledge of urban spatial structure in the Transit-Oriented Development (TOD) Neighborhood is necessary for sustainable urban planning. The purpose of this study is to find the morphology of the Transit-Oriented Development (TOD) Neighborhood in Jabodetabek. This research uses a qualitative-inductive approach through interpretive spatial analysis of secondary data in the form of maps, regional images, and Morphology diagrams. The analysis was conducted comparatively between locations to identify regional Morphology patterns. The results achieved in this study are from 9 locations in Jabodetabek selected 3 locations were selected, including the Transit Oriented Development Neighborhood, namely Cawang, Cisauk, and Cicayur Electric Rail Stations, with different characteristics of the location area. In addition, the Morphology characteristics formed have similarities and differences in each TOD area. From the findings, it was found that each Morphology type is interrelated in terms of the development and planning of the Neighborhood TOD area. In addition, there is a combination of morphology in the Neighborhood TOD. The benefits of these findings can determine contextual urban planning and design in the future based on the findings of the Neighborhood TOD area form pattern.

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1. INTRODUCTION

The Jakarta Metropolitan Area (KJJ) continues to experience an increase in population and growth spread across suburban settlements (Taki, 2018). This can have an impact on changes in land use if there is no mature planning in an area. Not only that, but the transportation system also follows the development of the population in a residential area. Land use and transportation are key actors in city planning. An orderly city is characterized by good land use and transportation system conditions and indicates economic prosperity (Taki, 2017). In addition, the orderliness of a city can also be recognized by the typology formed in the city, so that in its planning, it can maximize land use (Taki, 2017).

Transit-oriented development (TOD) has been considered an efficient urban planning strategy to achieve city integration (Dou et al., 2021). The basic philosophy of Transit Oriented Development (TOD) is to advocate the geographic concentration and orderly development of cities around public transportation nodes, and can create communities with medium to high density, mixed land uses, and walkable street networks (Cervero and Kockelman, 1997; Rahman et al., 2022). According to Calthorpe (1993) thinks that TOD is a “neo-traditional guide to sustainable community design” that is a community design theory that promises to redefine the American Dream.

Practices in Transit Oriented Development summarize the main components of Transit Oriented Development (TOD) planning from Calthorpe's guidelines, namely to organize compact and transit-supportive growth at the regional level; locate retail, housing, offices, parks, and community uses within walking distance of transit stations; build pedestrian-friendly streets that directly connect to local destinations; design a mix of housing types, densities, and costs; preserve nature and sensitive habitat zones, and exclusive open spaces; and create public spaces with a focus on building orientation and neighborhood activities.

Although the basic philosophy of Transit Oriented Development (TOD) can be applied to all metro station areas, not all metro stations have the same characteristics in form, function, and impact (Lyu, 2016). Therefore, there is an urgent need to develop a context-based Transit Oriented Development (TOD) morphology in order to be able to describe it qualitatively better. TOD typology is limited to Regional, Urban, and Suburban TOD with the following explanation: Regional Transit Oriented Development (TOD) is a service center for the area, namely the center of economic and community activities in the area (Widyahari, 2015). This Transit Oriented Development (TOD) creates synergy between the community and the area, between jobs and settlements, between density and service levels, between individuals and society (T. Jaiswal, 2008).

While Neighborhood Transit Oriented Development (TOD) emphasizes its development more on medium-density housing, trade and services, entertainment, and other recreational functions, equipped with facilities to meet the needs of the population, so that it can reduce the use of private vehicles. Transit Oriented Development (TOD) is located on the local bus network or feeder by forming mixed land uses. Development is adjusted to the lower level of service of the transportation system, namely as a supporter of the main transportation network. This study specifically has a case study of the context of a Transit-Oriented Development (TOD) Neighborhood.

The implementation of TOD in the Jakarta metropolitan area is still in its early stages of development (Hasibuan, 2022). Transit-Oriented Development (TOD) is defined as a compact, mixed-use urban development approach around public transportation stations that encourages walking, cycling, and the use of public transportation (Elmarakby, 2024). Furthermore, the principles of TOD include density, diversity, design, accessibility, and distance to transit (Irsal, 2023). These considerations are key considerations in the

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implementation of TOD in regional, urban, and suburban contexts, each with its own distinct characteristics. Therefore, a deeper understanding of TOD typology, both in terms of morphology and characteristics, is necessary.

The core of the TOD typology is to classify station areas with the same Morphology and functional characteristics (Lyu et al., 2016). Various studies have attempted to develop TOD typologies based on various features of the station and its surroundings, while the node-place model is the most well-known and frequently applied approach (Ibraeva et al., 2020). What are the morphological characteristics of a Transit-Oriented Development (TOD) Neighborhood? This study will focus on this topic. The station area is a place where population and logistics are concentrated, and transit-oriented development (TOD) planning is applied in many cities as a strategic tool for sustainable urban planning and management. (Bertolini, 1999 & Li, 2010) This study took place in the station area in the Jabodetabek area. This is one of the steps to support sustainable city planning.

2. LITERATURE REVIEW

Calthorpe (1993) divides TOD types into two groups based on land use type or area service scale, namely Urban TOD and Neighborhood TOD. The difference between the two lies in the variation of land use mix, the area's relationship to transit, and the density of the area. Each type of TOD can have different characteristics and land use mix, depending on its location in the region, market demand, and surrounding land use (Natalivan, 2019)

1. Urban TOD. In this TOD, land use has high intensity, such as offices (30-70%), trade centers (30-70%), public areas (5-15%), and medium to high-density housing (20-60%) according to the size of the job market. There is direct access to the transportation network, without changing modes. Urban TOD locations are generally located on major transportation networks, such as light rail lines, express buses, or trains. This TOD is usually placed at a distance of ½ mile to 1 mile from the next TOD.
2. NeighborhoodTOD. This TOD focuses more on medium-density housing (50-80%), trade and services (10-40%), entertainment, and other recreational functions, equipped with facilities to meet the needs of the population (10-15%), so that it can reduce the use of private vehicles. This TOD is located on a local bus network or feeder with a distance of no more than 10 minutes to the main transportation network stop. Its location can be along the feeder corridor by forming a mixed land use. Development is adjusted to the lower level of transportation system service, namely as a supporter of the main transportation network.

Duanny Plater Zyberk and Company (1999) wrote a book on urban planning and design entitled The Lexicon and New Urbanism. The Lexicon is a book that explains the model of urban spatial structure that is formed in an environment, both in terms of characteristics, layout, and relationship to blocks, roads, and land boundaries. One explanation of urban spatial structure is the types of blocks in a city, namely:

1. Square Block: “The square block was an early model for planned settlements in America. It was sometimes associated with agricultural communities with four large lots per block, each with a house at its center”. (Figure 1-i).
2. Elongated Block: “The elongated block can bend somewhat along its length, giving a limited ability to shape space and to negotiate slopes (Figure 1-ii). Unlike the square block, it provides two distinct types of frontage”.

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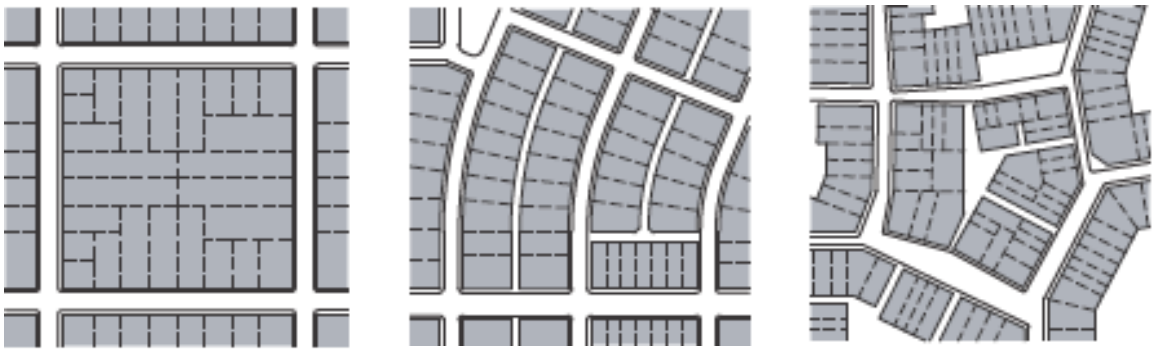
3. Irregular Block: "The irregular block is characterized by its unlimited variations. The original organic block was created by the subdivision of land remaining between well-worn paths. An important technique in the layout of irregular blocks is that the frontages of adjacent blocks need not be parallel" (Figure 1-iii).



(i) (ii) (iii)

Figure 1. Urban Structure: Block Types.
(Source: Plater-Zyberk, 1999)

Apart from the types of blocks in a city, Duanny Plater Zyberk and Company (1999) also formulated the urban spatial structure that occurs in street space in relation to regional blocks, namely as follows:

(a) Savannah-Pattern:
Advantages: (a) Excellent directional orientation; (b) Controllable lot depth; (c)Provides end grain of blocks for fast traffic; (d) Even dispersal of traffic through the web; (e) Straight lines enhance rolling terrain; (f) Efficient double-loading of alleys and utilities.
Disadvantages: (a) Monotonous unless periodically interrupted; (b) does not easily absorb environmental interruptions; (c) Unresponsive to steep terrain. (Figure 2-a).

(b) Mariemont-Pattern:
Advantages: (a) Hierarchy with diagonals for through traffic; (b) Even dispersal of traffic through the grid; (c) Monotony interrupted by deflected vistas; (d) Diagonal intersections spatially well-defined
Disadvantages: Tends to be disorienting (Figure 2-b).

(c) Washington-Pattern:
Advantages: (a) Hierarchy with diagonals for through traffic; (b) Even dispersal of traffic through the grid; (c) Diagonals focus on terrain features; (d) Diagonals interrupt monotony of the grid
Disadvantages: (a) Uncontrollable variety of lots; (b) High number of awkward lot shapes; Diagonal intersections are spatially ill-defined. (Figure 2-c).

(d) Nantucket-Pattern:
Advantages: (a) Hierarchy with diagonals for through traffic; (b) Even dispersal of traffic through the grid; (c) Monotony interrupted by deflected vistas; (d) Diagonal intersections spatially well-defined
Disadvantages: Tends to be disorienting (Figure 2-d).

(e) Radburn-Pattern:
Advantages: (a) Good street hierarchy for locals and collectors; (b) Controllable variety of blocks and lots; (c) Easily absorbs environmental interruptions; (d) Responsive to terrain
Disadvantages: Congestion of traffic due to the absence of a web. (Figure 2-e).

(f) Riverside-Pattern:
Advantages: (a) Monotony interrupted by deflected vistas; (b) Easily absorbs

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environmental interruptions; (c) Highly responsive to terrain; (d) Even dispersal of traffic through the web

Disadvantages: (a) Highly disorienting; (b) Uncontrollable variety of lots; (c) No intrinsic hierarchy interruptions; (c) Unresponsive to steep terrain. (Figure 2-f).

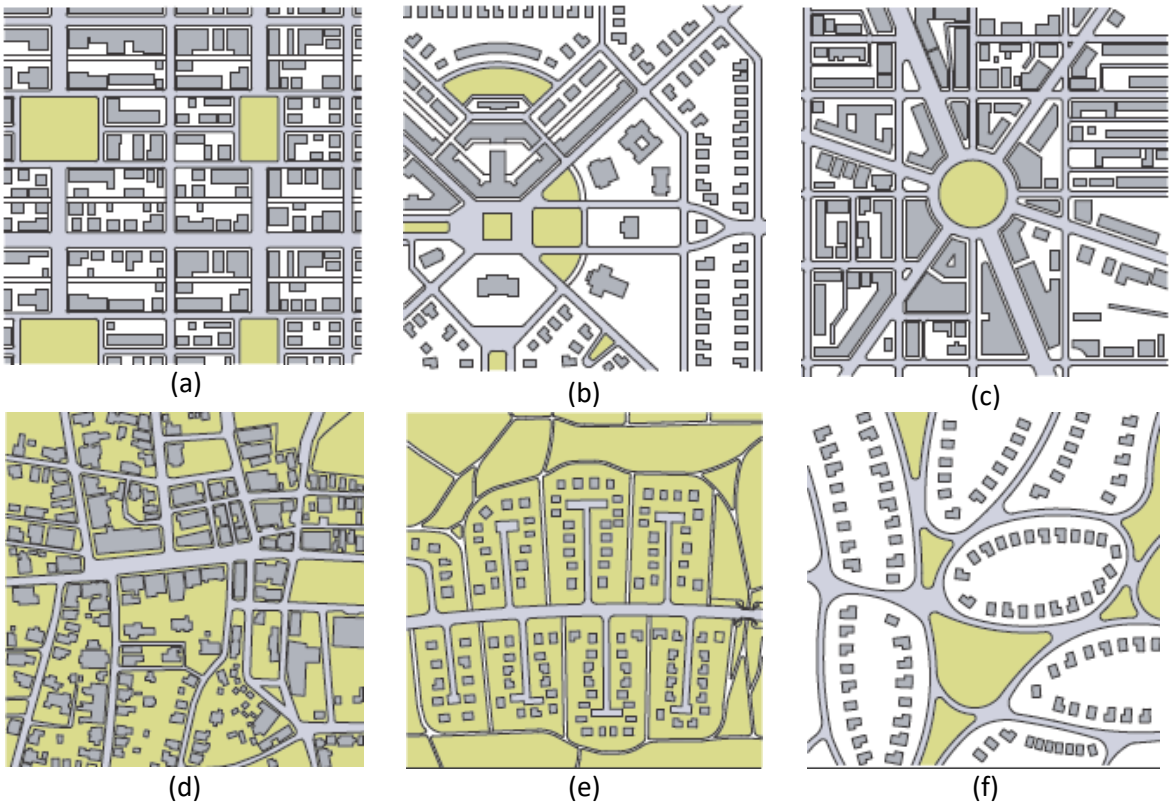

Figure 2. Urban Structure: Network Types.
(Source: Plater-Zyberk, 1999)

3. RESEARCH METHODS

This research employed a Qualitative Exploratory methodology. This method was employed through several steps to answer the research questions. The researchers conducted an in-depth analysis of secondary data in the form of maps, aerial images, and Morphology diagrams using interpretive spatial analysis. Urban morphology is concerned with the town plan, building fabric, and land utilization pattern (Conzen, 1960). The Jabodetabek Land Use Map was used in the initial data collection process. The expected initial result was to identify the TOD types found in the case study locations.

The qualitative researcher uses inductive logic, studies the topic within its context, and addresses the meaning people bring to it (Creswell, 2018). Next, an Inductive Analysis was conducted in this research. This analysis was used to examine the block patterns formed in the case study locations and to determine the Neighborhood TOD morphology. After the in-depth data analysis, the Morphology types found in the research locations were determined based on available literature.

The final step in this research was an Interpretive Visual Analysis. This analysis was conducted by creating a Morphology diagram of the selected Neighborhood TODs and formulating a Morphology concept for the locations. The researchers conducted a comparative analysis to differentiate between morphologies, resulting in key findings in this study.

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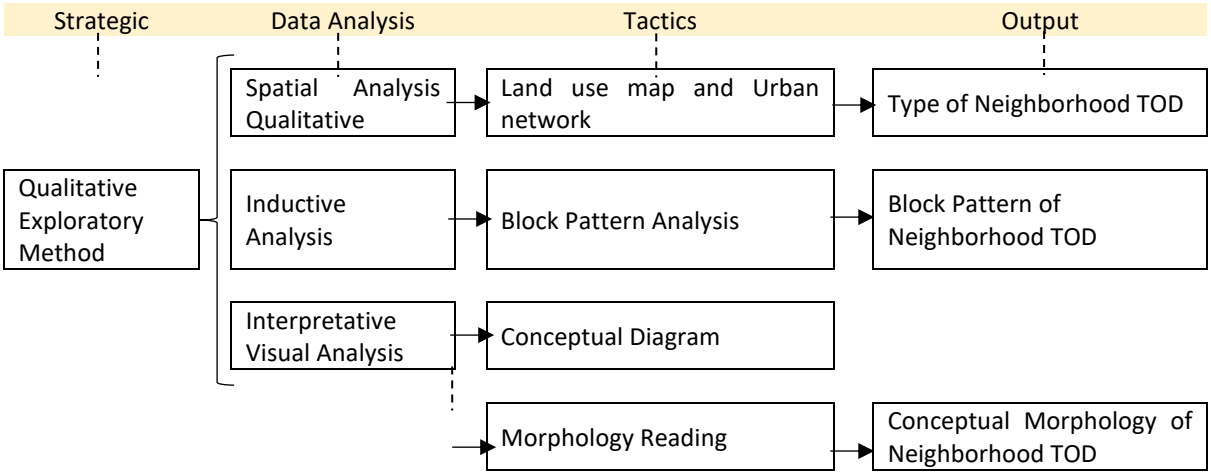

Figure 2. Research Methodology Flowchart
(Source: personal construction, 2026)

Stations can be both nodes in transport networks and places in urban systems (Bertolini, 1999). The Jakarta Metropolitan Area railway system serves the areas of Jakarta, Bogor, Depok, Tangerang, and Bekasi. This railway system uses high-speed rail standards and operates at high frequencies with minimum travel distances. Although the basic philosophy of TOD can be applied to all metro station areas, not all metro stations have the same characteristics in terms of form, function, and impact. This study specifically examines the Case Study of the Electric Train Station (KRL) area in Jabodetabek. The map of the Electric Train network in the Jabodetabek area is shown in Figure 3.



Figure 3. Transportation Maps of KRL Station in Jabodetabek
(Source: KAI Commuter, 2026)

As seen in the picture, there are several location points taken for the needs of this research. The taking of the location points is based on the representative areas of Jakarta, Bogor, Depok, Tangerang, and Bekasi. The research locations to be discussed further in this research are as follows:

1. Jakarta: (1) Mangga Besar Station; (2) Sawah Besar Station; (3) Kampung Bandan Station;
2. Bogor: (4) Sudimara Station; (5) Cisauk Station; (6) Cicayur Station
3. Depok: (7) Cawang Station;
4. Tangerang: (10) Tangerang Station
5. Bekasi: (8) Kemayoran Station; (9) Rajawali Station

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4. RESULTS AND DISCUSSION

4.1 Type of Neighborhood TOD

This study used 9 Case Studies in the Jabodetabek KRL Station area, which became the forerunner of the TOD area in the future. Data collection used secondary data obtained from the Satu Jakarta data. Each location point uses a radius of less than 500 meters and 1000 meters, based on the requirements of TOD Urban and Neighborhood TOD. After that, the researcher identified each location, whether it was included in the TOD Urban or the Neighborhood TOD. This needs to be done to determine the locations included in the Neighborhood TOD. The identification results of each location point are attached in Figure 4 below.

1. Kampung Bandan Station: Urban TOD ; Public: - ; Commercial/Office: 80% ; Settlement: 20%
2. Cawang Station: Neighborhood TOD; Public: 10%; Commercial/Office: 30%; Settlement: 60%
3. Sawah Besar Station: Urban TOD ; Public: - ; Commercial/Office: 80% ; Settlement: 20%
4. Kemayoran Station: Urban TOD; Public: 10%; Commercial/Office: 50%; Settlement: 40%
5. Rajawali Station: Urban TOD ; Public: - ; Commercial/Office: 60% ; Settlement: 40%
6. Mangga Besar Station: Urban TOD; Public: 10%; Commercial/Office: 50%; Settlement 40%
7. Sudimara Station: Neighborhood TOD ; Public: - ; Commercial/Office: 10% ; Settlement: 90%
8. Cisauk Station: Neighborhood TOD ; Public: - ; Commercial/Office: 10% ; Settlement: 90%
9. Cicayur Station: Neighborhood TOD ; Public: - ; Commercial/Office: 10% ; Settlement: 90%



(1) Kampung Bandan Station



(2) Cawang Station



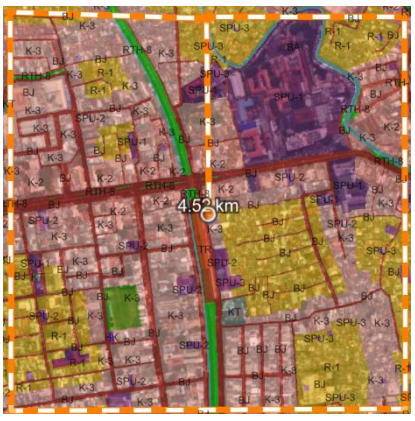
(3) Sawah Besar Station



(4) Kemayoran Station



(5) Rajawali Station



(6) Mangga Besar Station

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(7) Sudimara Station



(8) Cisauk Station



(9) Cicayur Station

Figure 4. TOD Types in Jabodetabek
(Source: Author, 2026)

Based on the table above, there are several locations included in the Urban TOD category, namely (1) Kampung Bandan Station, (2) Mangga Besar Station, (3) Sawah Besar Station, (4) Kemayoran Station, and (5) Rajawali Station. The locations included in the Neighborhood TOD category are (6) Cawang Station, (7) Sudimara Station, (8) Cisauk Station, and (9) Cicayur Station. This is based on the results of the percentage of Urban TODs in general having a commercial area that dominates at the location point, with an average range of 50% -80%. In contrast to Neighborhood TODs, which are generally dominated by residential areas with an average range of 50% -80%. Therefore, in this study, in-depth data were taken at the Neighborhood TOD location point.

From the results of the identification of the Neighborhood TOD location point data, a discussion was carried out regarding the Morphology conditions at the location. In addition, there are important things regarding the data results at the 4 Neighborhood TOD locations, namely:

1. Cawang Station is a location in the Urban area, not a Neighborhood. However, because the presentation of residential areas is more dominant than commercial, Cawang Station is declared a Neighborhood TOD located in the Urban area.
2. Different from other locations, namely Sudimara, Cisauk, and Cicayur Stations. These three locations are in the Sub-Urban area (city outskirts), so, naturally, they are included in the Neighborhood TOD category, surrounded by residential areas.
3. Based on the in-depth study of the two previous things, the Neighborhood TOD has 2 different location points, namely in the Urban area and the Sub-Urban area.

According to Guowei Lyu and colleagues (2016), based on the basic philosophy of TOD, there should be diverse land use. This can be seen from each area that occurs in the Neighborhood TOD, based on the previous explanation. This shows that each Neighborhood TOD area has a different context from the others, so further study is needed in the next study to find the characteristics of Neighborhood TOD as a basis for contextual design.

4.2 Block Pattern of Neighborhood TOD

After finding the initial identification results at each location point, the next discussion is a description of the Morphology conditions at each location point, both in the TOD Urban and the Neighborhood TOD. The results of data processing related to the morphology of each location point are shown in Fig.5.

(a) Cawang Station: Blocks generally have an elongated shape, and the streets tend to be parallel to each other. Some more irregular block shapes cannot be said to be irregular blocks because there are still streets that are parallel to each other. A fairly neat collection of blocks with quite varied elongated shapes connected by interconnected roads.

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(b) Cisauk Station: A fairly neat collection of blocks with quite varied elongated shapes connected by interconnected roads. A collection of blocks of varying shapes connected by interconnecting roads, there are still some cul-de-sacs, but they are not too dominant.

(c) Cicayur Station: The block shape is not very defined with definite geometry, and many empty lots are green areas. The blocks are separated or sparsely spaced enough that the roads connecting one block to another are also sparse (creating cul-de-sacs).

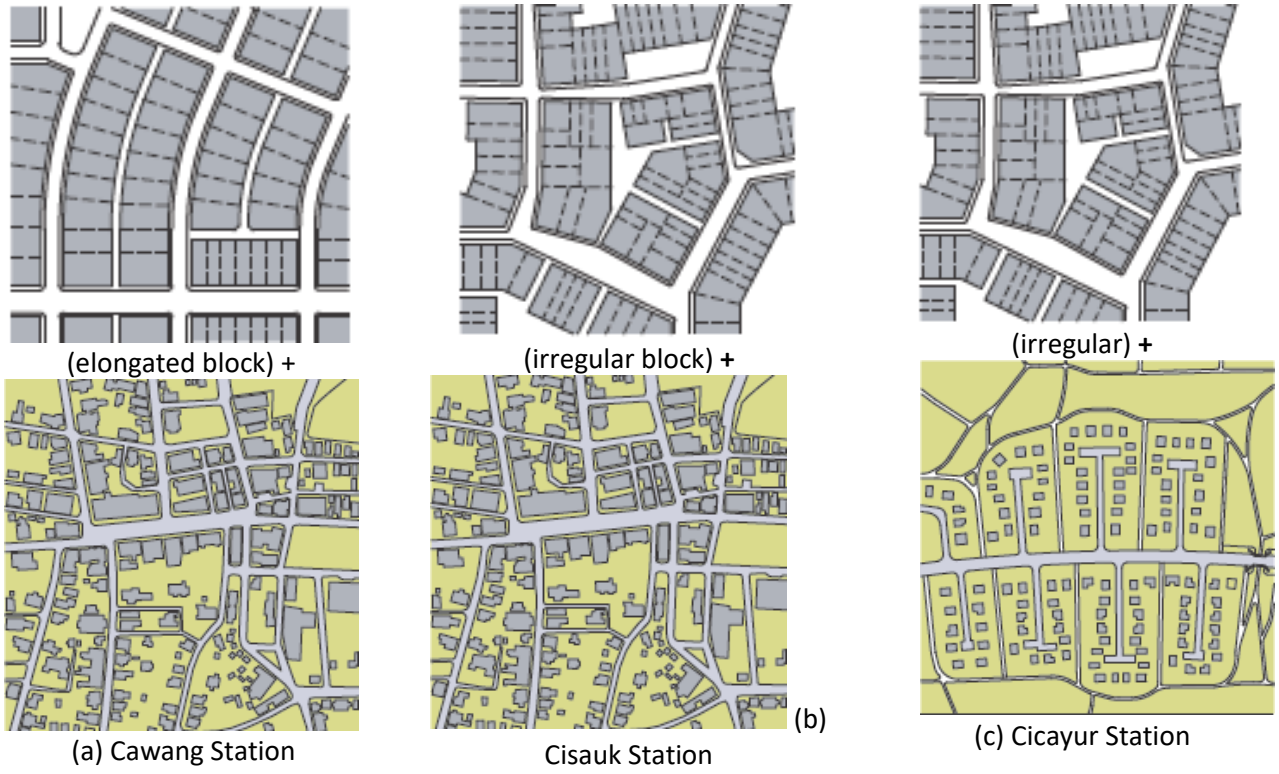

Figure 5. Inductive Analysis Neighborhood TOD Block Pattern in Jabodetabek
(Source: Author, 2026)

Based on the explanation of the table, almost all location points have a Nantucket shape pattern, namely a collection of blocks with quite varied elongated shapes, connected by interconnected roads. This Nantucket shape pattern is found in every location except Cicayur Station. Cicayur Station is a station included in the Neighborhood TOD located in a suburban area. Cicayur Station has a Radburn shape pattern, namely a collection of blocks that are quite separate or rare from the road connecting the collection of blocks to each other and also separate (causing a cul-de-sac). Therefore, only Cisauk Station is not included in the Nantucket shape pattern from other Neighborhood TOD location points.

In addition to the explanation of the existing shape pattern of the location point, the next explanation is related to the Morphology type, which consists of 3 types, namely the irregular block type, the mixed block type (elongated block), and the regular block type (regular block). Based on the identification results, the location point of the Jabodetabek station is not included in the regular block type. The location points of Jabodetabek stations are included in 2 types of blocks, namely mixed block types (elongated block) and irregular block types (irregular block). The irregular type explains that the block shape is not too defined with definite geometry, while the mixed block shape is a block shape that is generally elongated, and there are parallel roads. The identification results are contained in Fig.5.

According to Guowei Lyu et al. (2016), the core of TOD typology is to be able to classify station areas based on their Morphology and functional characteristics. Morphology characteristics can provide an overview of urban development patterns in a region. With the

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findings made previously, it can be useful for knowledge related to the urban structure formed in the Neighborhood TOD area in the Jabodetabek area, specifically the three previously determined locations.

4.3 Morphology of Neighborhood TOD

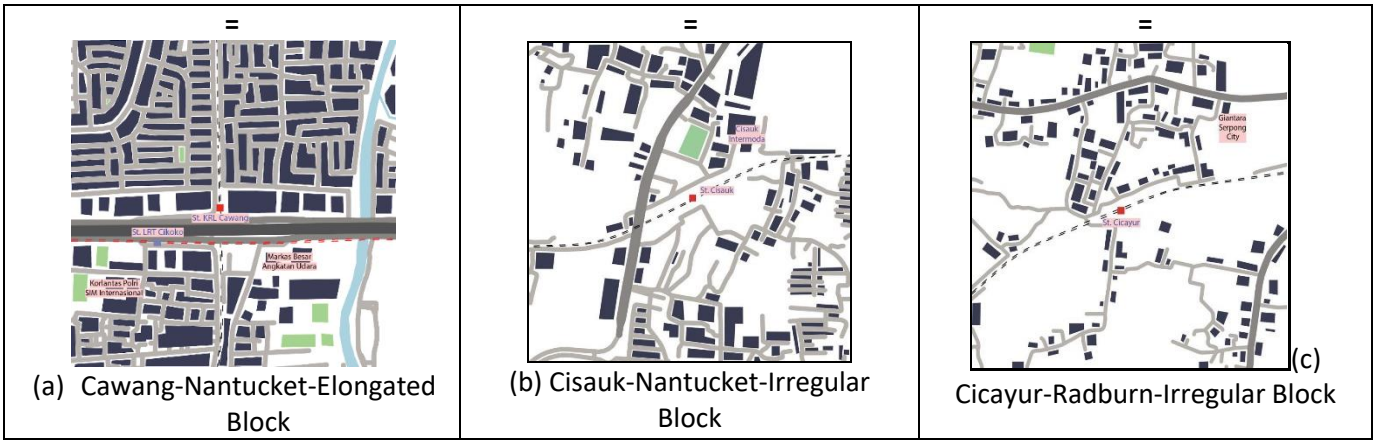
Based on the previous results and discussions, several things have been formulated related to the completeness needed to achieve the Neighborhood TOD typology, namely the type of area, type of TOD, type of block, and block pattern of the area in each case study location of the research. So, in the discussion of this section, the researcher tries to combine the results of the formulations that have been obtained previously and make a summary to determine the Neighborhood TOD Typology in the Jabodetabek context.

The summary of the description of the types of typologies available is in Fig.6. Based on the results of Fig.6, 3 types of Neighborhood TOD typologies were found, namely.

(a) Cawang Station: In the image below, it can be seen that the typology character of Neighborhood TOD 1 has a mixed block type morphology (elongated block), with both regular blocks at the top and irregular blocks at the bottom. In addition, the Nantucket shape pattern is clearly visible in the image, a collection of blocks with quite varied elongated shapes, connected by interconnected roads.

(b) Cisauk Station: In the image below, it can be seen that the typology character of Neighborhood TOD 2 is that it has an irregular block type morphology. In addition, the Nantucket shape pattern is clearly visible in the image, a collection of blocks with quite varied elongated shapes, connected by interconnected roads.

(c) Cicayur Station: In the image below, it can be seen that the typology character of Neighborhood TOD 1 is that it has an irregular block type morphology. In addition, the Radburn shape pattern is clearly visible in the image; the blocks are quite separate or rare from the road.



(a) Cawang-Nantucket-Elongated Block

(b) Cisauk-Nantucket-Irregular Block

(c) Cicayur-Radburn-Irregular Block

Figure 6. Neighborhood TOD Block Pattern in Jabodetabek
(Source: Author, 2026)

Based on Fig.6, there are similarities and differences in the variations of the Neighborhood TOD morphology formed in Jabodetabek. The similarities formed from these variations are the Nantucket shape pattern owned by Cawang and Cisauk Stations, the irregular Morphology form owned by Cisauk and Cicayur Stations, and the type of Neighborhood TOD owned by all three. The type of Neighborhood TOD can be seen from the percentage of residential areas that are more dominant than public & commercial spaces.

The morphology of irregular blocks in suburban areas is a collection of irregular blocks, with roads that are quite connected to the edge of the city. This definition can be known as the Nantucket Sub-Urban Pattern. This is one of the findings in this study, found in the

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Neighborhood TOD, precisely in the Cicayur Station area. Furthermore, the irregular block morphology of the general-urban area is a collection of irregular blocks, with roads that are quite connected to the general urban area. This definition can be known as the Nantucket General-Urban Pattern. This is one of the findings in this study, found in the Neighborhood TOD, precisely in the Cisauk Station area. Finally, the morphology of the mixed block (elongated block) of the central-urban area is a collection of blocks with quite varied elongated shapes, connected by interconnected roads in the city center area. This definition can be known as the Nantucket Center-Urban Pattern. This is one of the findings in this study, found in the Neighborhood TOD, precisely in the Cawang Station area.

5. CONCLUSION

Neighborhood TOD Morphology is very necessary for further recognition of the characteristics, types, and concepts of morphology formed in a particular area in Jabodetabek. In this study, there are several important findings that can be continued in the development of future research. Directly, there are 3 Neighborhood TOD Morphologies that occur in Jabodetabek, namely (1) irregular blocks in suburban areas, (2) irregular blocks in general-urban areas, and (3) mixed blocks (elongated blocks) in the central urban area, with the same pattern concept, Nantucket Pattern. The findings of these three Morphology models are based on the Greater Jakarta context. Therefore, future urban planning and design require consideration of the morphology of the location's context.

In addition, the differences formed from these variations are that the shape pattern of Cicayur Station is different from the others, the Morphology form of Cawang Station is different from the others, and the area categories are different between the three. The area categories are sequentially divided into City Center at Cawang Station, General Urban at Cisauk Station, and City Edge at Cisauk Station. Based on the area categories above, it is possible that these three locations can be the sequence in the development of a Neighborhood TOD area, starting from the suburbs, then the general urban area, and becoming the city center. In addition to the development of area categories, the development of spatial patterns also occurred, from the initial Irregular Block to the Elongated Block. Regular Blocks are self-contained unless combined with other spatial patterns. This development also determines an area in previous planning, and vice versa. This research can be continued with a Neighborhood TOD Typology Study.

The benefit of this finding is that it allows us to see the patterns of form that occur in a city related to the context of the urban structure that is formed within it. The three Morphology findings need to be studied further in relation to the issue of sustainable cities and settlements, and quantitative data. This is important because morphology without significant integration in people's lives is useless. However, the three findings can be the forerunners for the development of knowledge in the context of the Neighborhood TOD.

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