Vertical residential on Transit Oriented Development principles: Jakarta case study

A S Y Ibung, V Soebiyan, W Wizaka

Architecture Department, Faculty of Engineering, Bina Nusantara University, Jakarta, Indonesia 11480

Vivien.soe@binus.ac.id

Abstract. Vertical residential have not integrated with public transportation modes, so that dwellers use their private vehicles as daily transportation, which is has a negative impact to the level of traffic congestion and air pollution. According to UN Habitat related to Sustainable Transportation and Communication Systems, the transportation sector is major consumer of non-renewable energy of land and is a major contributor pollution, congestion and accident. The application of the concept of Transit Oriented Development is needed to control the level of congestion and air pollution.

Keywords: Vertical Residential, Transit Oriented Development

1. Introduction

The capital city of Jakarta is one of the most populous cities in the world with a population in 2017 of 10,177,924 people [1] and continues to increase along with population growth in Jakarta. City of Jakarta then together with the cities of Bogor, Depok, Tangerang and Bekasi become a metropolitan city called Jabodetabek.

|        | Total Population | Annual population growth rate |
|--------|------------------|-----------------------------|
|        | 2010             | 2014 | 2015 | 2010-2015 | 2014-2015 |
| Kepulauan seribu | 21.414 | 23.011 | 23.340 | 1.74 | 1.43 |
| Jakarta Selatan | 2.071.628 | 2.164.070 | 2.185.711 | 1.08 | 1.00 |
| Jakarta Timur | 2.705.818 | 2.817.994 | 2.843.816 | 1.00 | 0.92 |
| Jakarta Pusat | 895.371 | 910.381 | 914.182 | 0.42 | 0.42 |
| Jakarta Barat | 2.292.997 | 2.430.410 | 2.463.560 | 1.45 | 1.36 |
| Jakarta Utara | 1.653.178 | 1.729.444 | 1.747.315 | 1.11 | 1.03 |

Source: Badan Pusat Statistik DKI Jakarta, 2010-2015

The increase number of apartment buildings built in Jakarta recently planned in TOD, an integrated area with public transportation. The community will shift to public transportation for their activities avoiding congestion and also reducing air pollution levels. The transportation sector is the main consumer of non-renewable energy and the main contribution increasing rate of pollution, congestion and accidents. This mean to prevent the increase in the growth of private motorized traffic and reduce...
congestion, which damages the environment, economy and society, to human health and safety, through especially to the most densely populated areas [2]. TOD provides benefits as congestion relief, land conservation, reduced outlays for roads, and improved safety for pedestrians and cyclist [3]. The TOD strategy can reduce the traffic congestion and air pollution. Regard to planning and design concepts for vertical residential, case studies are reviewed based on the assessment of indicators for the Transit Oriented Development area [4].

The concept of Transit Oriented Development has several principles as Walk, Cycle, Connect, Transit, Mix, Densify, Compact and Shift. According to the problem of vertical residential areas, the principles focuses on Walk, Cycle, Transit, Mix and Shift. Object studies took at three locations represent as typical residential areas of the city center, peri-urban and sub urban (commuter). The location is in Fatmawati city center, Jatibening area represent peri urban residential area and Serpong represents the vertical residential on a sub urban Jakarta.

The 5 selected principles, each of principles has an indicator, details assessment and the score that formulated by ITDP on the Journal TOD Standard 3.0. Which can be used as a reference in the assement process. The TOD assessment shown in Table 2. Each principle assessment will be complemented by a table containing the indicators for assessing the TOD area and actual conditions in the study.

| No | Principles | Indicator | Details | Score |
|----|------------|-----------|---------|-------|
| 1  | Walk       | Pedestrian infrastructure is safe, complete and accessible to everyone | Designed for pedestrian easy access to all buildings. | 1 0 |
|    |            |           | - Unbstructed and barrier-free for persons with disabilities. | 1 0 |
|    |            |           | - Receive sufficient street lighting at night for pedestrian safety | 1 0 |
|    |            | Pedestrian infrastructure is comfortable and temperature maintained | Count the number of pedestrian paths that provide adequate shading or protective elements | 1 0 |
| 2  | Cycle      | Cycling infrastructure is available and safe for everyone | Section of roads with speeds above 30 km/h (20 mph) provided exclusive lanes that colored lane and separate from motorized vehicle lanes. | 1 0 |
|    |            |           | - Section of roads with a vehicle speed of 30 km/h (20 mph) or slower (bicycle lane exclusive or protected is not required). | 1 0 |
|    |            | Available bike parking and storage for everyone | Provide bicycle racks or other secure facilities and located free from pedestrian paths or vehicle circulation | 1 0 |
| 3  | Transit    | High quality public transport is accessible by foot | The furthest walking distance to the public transport station as far as 1000 m or less. | 1 0 |
| 4  | Mix        | Providing mix area for settlement, public space and local services that can be reached by walking | Land use for settlement not less than 15% and not more than 85% of the total area. | 8 0 |
|    |            |           | - Percentage of building that within walking distance from schools, health facilities or pharmacies and fresh food sources | 3 0 |
| 5  | Shift      | Reduction of land used for private motorized vehicle | Requirement for parking space used is 10% from the total land area. | 8 0 |

Source: TOD Standard 3.0

2. Result and Discussion

2.1. Fatmawati, Jakarta
This area is a premium apartment complex developed with an area approx. 220,000 m² located on Jalan TB Simatupang, South Jakarta. This area developed with a smart city concept and the Transit Oriented Development concept, by presenting an integrated urban residential complex with various conveniences and certain facilities. Such as the availability of MRT transportation access, resort facilities, retail areas and entertainment areas.

### Table 3. Assessment of TOD principles at Fatmawati city center area

| Principles | Indicator | Conditions | Images | Score |
|------------|-----------|------------|--------|-------|
| Walk       | Pedestrian infrastructure is safe, complete and accessible to everyone. | An outdoor pedestrian path is available to connect between buildings. The pedestrian path doesn’t have a barrier and availability of street lights which can help everyone to access it. | ![Image](image1.jpg) | 3     |
|            | The pedestrian infrastructure is comfortable and temperature maintained. | The outdoor pedestrian path planted with vegetation so that pedestrian users are comfortable and maintain the temperature. | ![Image](image2.jpg) | 1     |
| Cycle      | Cycling Infrastructure is available and safe for everyone. | The Fatmawati City Center area does not have a special lane for cyclists. | - | 0     |
|            | Available bike parking and storage with enough slots for everyone. | The Fatmawati City Center area also does not have a special place as a bicycle parking area | - | 0     |
| Transit    | High quality public transport is accessible by foot. | Fatmawati City Center has an MRT Hub that connects the area to Fatmawati MRT Station, within ± 500 m | ![Image](image3.jpg) | 1     |
| Mix        | Providing mix area for settlement, public space and local services that can be reached by walking. | Fatmawati City Center is mixed area with apartment, office towers and commercial area. The area for settlement is ±108,950 m², which is almost 50%. And all of those facilities can be reached by comfy walking. | ![Image](image4.jpg) | 11    |
| Shift      | Reduction of land used for private vehicle. | Fatmawati City Center does not use land restrictions as a parking area for private vehicles. | - | 0     |

Total 16

### 2.2. Serpong, Tangerang
Located on Jalan Raya Cisauk Lapan, Tangerang with an area of 27,000 m² this developed area carries the concept of Transit Oriented Living. The concept of Transit Oriented Living is to reduce human dependence on private vehicles, improve walking, cycling and public transportation facilities.

Table 4. Assessment of TOD principles at Serpong

| Principles | Indicator | Conditions | Images | Score |
|------------|-----------|------------|--------|-------|
| Walk       | Pedestrian infrastructure is safe, complete and accessible to everyone. | Non direct pedestrian path from roadway, but have a pedestrian path free barriers and availability of street lights for access between towers which can be used for everyone. | ![Image](image1.png) | 3     |
|            |           | The pedestrian infrastructure is comfortable and temperature maintained. | Serpong Garden Apartment have a pedestrian path on around artificial lake planted with a lot vegetation which can maintain the temperature. | ![Image](image2.png) | 1     |
| Cycle      | Cycling Infrastructure is available and safe for everyone. | On area of apartment has a vehicle lane fall into category of 30 km/h (20 mph) which is still can be used by bicycle users without exclusive lane. | ![Image](image3.png) | 1     |
| Transit    | High quality public transport is accessible by foot. | The Serpong Garden Apartment has a 25-meter long Sky bridge as a connection between the Apartment area and Cisauk Station. | ![Image](image4.png) | 1     |
| Mix        | Providing mix area for settlement, public space and local services that can be reached by walking | The Serpong Garden have any mix functions with percentage that fit with TOD standard on there such as parking area on basement with 9.5% from total floor area, arcade shopping mall on 1st floor and 2nd floor which is 12%, facilities area on 3rd floor 3% and settlement 68% and 7.5% services. | ![Image](image5.png) | 11    |
| Shift      | Reduction of land used for private vehicle. | The Serpong Garden Apartment limits the parking area for the resident’s private vehicles that only 9.5% that available. | ![Image](image6.png) | -     |

Total 25

2.3. Jatibening, Bekasi
This residential area developed on designated an urban TOD area with area of 52,714 m² located in Jatibening, Bekasi. This residential area equipped several facilities such as private residents, commercial area and transit areas.

| Table 5 Assessment of TOD principles at gateway park apartment |
|---------------------------------------------------------------|
| Principles          | Indicator                                      | Conditions                                                                 | Images | Score |
|---------------------|-----------------------------------------------|----------------------------------------------------------------------------|--------|-------|
| Walk                | Pedestrian infrastructure is safe, complete and accessible to everyone. | An outdoor pedestrian path is available to connect between buildings, the pedestrian path doesn’t have a barrier and availability of street lights which can help everyone to access it. | ![Image](image1.png) | 3     |
|                     |                                               | The pedestrian infrastructure is comfortable and temperature maintained.     | ![Image](image2.png) |       |
| Cycle               | Cycling Infrastructure is available and safe for everyone. | On area of apartment has a vehicle lane fall into category of 30 km/h (20 mph) which is still can be used by bicycle users without exclusive lane. | ![Image](image3.png) | 1     |
|                     |                                               | Available bike parking and storage with enough slots for everyone.          | ![Image](image4.png) |       |
|                     |                                               | The Gateway Park Apartment area does not have a special place as a bicycle parking area. | ![Image](image5.png) | 0     |
| Transit             | High quality public transport is accessible by foot. | The apartments have access that less than 1000 m to Jati Bening LRT Station. | ![Image](image6.png) | 1     |
| Mix                 | Providing mix area for settlement, public space and local services that can be reached by walking | The area has a several facilities such as mall, commercial area and apartment. Every facilities has their own portion of percentage like a mall with 11% from total floor area, then for settlement is 67% and the rest is for commercial area and parking. | ![Image](image7.png) | 11    |
| Shift               | Reduction of land used for private vehicle.    | The Gateway Park Apartment has 1389 parking lots or 19% from total floor area, which is not compatible with theory TOD Standard 3.0 | ![Image](image8.png) | 0     |
|                     |                                               |                                                                           |        |       |
|                     |                                               |                                                                           |        | **Total** 17 |

The results of the suitability assessment of each variable were carried out by comparing the existing conditions of each precedent and will result a score in accordance with the concept Transit Oriented Development. From the three precedents that using Transit Oriented Development, each of the precedents have deficiencies from the TOD Standard 3.0 but still have conformity from the theory. The following is an explanation of the results of each variable adjusted to the indicators and the details of the assessment. After the explanation the result of each variable below, there will be a table assessment including the score of each variable.

Regarding to the assessment, table 6 provides a summary assessment based on the TOD principle. Assessment on several TOD indicators indicates that Fatmawati area in city center has several values in accordance with the indicators. This area meets the TOD principle criteria such as Walk, Transit and Mix.
Vertical residential at Serpong is located in the sub-urban area of Jakarta. Located on the TOD development area which is connected to Cisauk commuter station. This area is approximately 37 km from downtown Jakarta, which can be reached via toll roads and commuter trains. The commuter’s trains relation is Cisauk trains station to Tanah Abang train station served every 10 minutes with travel time 40 minutes. This area has just been developed by maximizing the potential of the commuter’s lane. This newly development sub urban area has met the TOD principle of Walk, Transit, Mix, Cycle and Shift. This area supported by a vehicle lane specify into slow lane category of 30 km/h (20 mph) which can be used by bicycle. While for principle of Shift, Serpong Garden Apartment The Serpong Garden Apartment limits the parking area for the residents private vehicles with a ratio of 1:10 which is related with principle of shift.

Vertical residential at Jatibening peri urban TOD assessment give an overview as similar result as Serpong sub urban area on principles of Walk, Cycle, Transit and Mix and the difference is on principle of Shift. This peri urban residential limit the parking area with ratio 1:4.

| No | Building | Assessment Standard | Total |
|----|----------|---------------------|-------|
|    |          | Walk    | Cycle  | Transit | Mix | Shift |
| 1  | Fatmawati | 4       | 0      | 1       | 11  | 0     | 16   |
| 2  | Serpong  | 4       | 1      | 1       | 11  | 8     | 25   |
| 3  | Jatibening | 4      | 1      | 1       | 11  | 0     | 17   |

3. Conclusion
Concerning on the problems of population density, traffics and air pollution, vertical residential concept evolved to integrate with the TOD principles. In this study three vertical residential area of Jakarta metropolitan were taken to case study, implementing the concept of Transit Oriented Development and conduct conformity assessments with indicators of the Transit Oriented Development concept such as Walk, Cycle, Transit, Mix and Shift. From the study, Vertical residential at Serpong mostly meet the TOD concept.

4. References
[1] Jakarta.bps.go.id, accessed 23 August 2019
[2] UN 1996 UN Habitat agenda p 17
[3] Treasure Coast Regional Planning Council 2012 Florida Tod Guidebook (Tallahassee: Florida Department of Transportation)
[4] Institute for Transportation Development and Development Policy 2017 TOD Standard 3.0. (Jakarta: ITDP)