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# Examining Existing Land Use of TOD MRT Jakarta Sites

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***Abstract*—Since the operation of MRT Jakarta, the government establish the plan to build TOD around several MRT Jakarta's station. However, many so-called TODs have failed to deliver a transit oriented outcome. TOD become another buzzword in marketing campaign of property development nearby the station. To overcome this problem, we need to truly look inside the roots of the land use planning, which is the zoning regulations. This research aim to examine whether the current land use plan is comply with the ideal land use plan for TOD, which will be obtain by performing literature study/benchmarking from previously successful TOD projects. By employing spatial analysis with GIS software, this research carefully mapping and analyze the land use characteristics of selected TOD site. A comparison analysis is perform to comparing the existing land use plan versus the ideal land use plan and see how much the differences. The result found that the current zoning regulations of land use plan has failed in terms of diversity of land use, and also a relatively low BCR and FAR values.**

***Keywords—TOD, land use, mass rapid transit, planning, mapping***

## I. INTRODUCTION

Transit oriented development (TOD) as a promising planning concept tries to ensure a more sustainable development through integrating land use and transport systems [1]. Since March 2019 the MRT Jakarta has fully operated, serving nearly 65,000 passenger per day [2]. Following the success of MRT Jakarta launch, the government planned to built TOD around several station of MRT Jakarta. They expect this development will improving the quality of life for the citizen, not only for them who lives nearby around the station, by providing excellent transit services, accessible walkway network, and public spaces.

However, many so-called TODs have failed to deliver a transit-oriented outcome [3] and therefore labelled as TAD 'transit adjacent development' for less successful TOD efforts [5]. TOD should provide a livable neighbourhood where transit and amenities are within walking distance and thus minimize the necessity of automotive use [3]. A sustainable TOD development needs commercial development of the core area, sufficient public service facilities, a certain proportion of park and open space, and white site [10].

According to [6] three aspects of urban development in particular influence travel behavior are density, diversity, and design. Reference [7] use FAR 'floor area ratio' to measure density, which is the ratio of a building's total floor area to the overall size of the land upon which the building stands [3], a high FAR value means a taller building. Diversity is a characteristic suggested by some activities or uses that are accommodated in a given area. A more and various activities can be accommodated, the better the ability of one development to meet the needs of its residents [3]. Diversity is measure by the proportion of land use in the catchment area. While design is measured by the quality of a network grid, including block size and number of intersections according to [8]. Reference [9] who divided TOD into neighborhood TOD and urban TOD, has given recommendation for land use proportion of both sites.

Therefore, this research aim to examine whether the current land use plan of TOD MRT Jakarta is comply with the ideal land use plan for TOD, to prevent failure in development of TOD by the government and become a truly TOD--not just a TAD.

In this research, the author select Fatmawati MRT Station for the empirical study on the land use characteristic. The catchment area of research is radius 800 m from the center point of station. Which is suitable, according to [4] TOD planning commonly addresses a distance from 400 m to 800 m as an acceptable walking distance standard.

## II. METHODOLOGY

To answer the research question, what are the land use characteristics of Fatmawati MRT station TOD site? The methodology which has conducted in this research is consisting of data collection, literature review, data processing, and comparative analysis. Secondary data such as existing land use maps and zoning regulation are obtain from the government of DKI Jakarta through their website jakartasatu.jakarta.go.id, while the aerial imagery derived from ESRI ArcGIS. These data were processed with ESRI ArcGIS for land use digitization and further spatial analysis of the area. Land uses like residential, commercial, office, and public facilites were digitized to determine the land size area, and measure existing radius, all the features must be located within 800 m from the Fatmawati MRT station.

In the literature review, some key publications such as journal, books, from previous research have been reviewed and use to create a conceptual ideal land use plan of TOD. Research from [10] examine land use characteristics of urban TOD stations in Singapore, while [3] examine three TOD properties in Hong Kong, Osaka, and Seoul. The land use characteristics (density and diversity) derived from these research preserved as an ideal land use plan of TOD. The existing land use plan then compared to the ideal land use plan, to determine how much the difference between these two plan. And conclude whether the current land use plan is already comply with a genuine TOD theory or not.

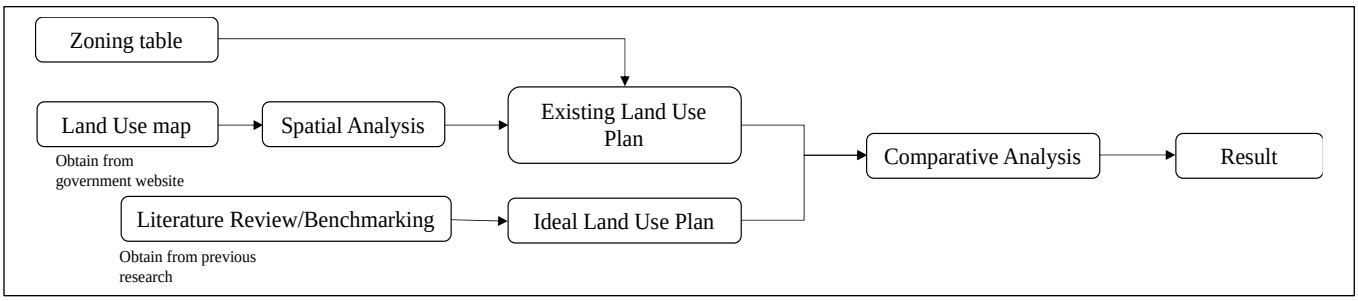


Fig. 1. Research workflow.

Fig. 2. Aerial image of Fatmawati TOD with 800 m catchment area..

## III. RESULTS

The section below show the result for existing and ideal land use plan, and comparison between them.

### *A. Existing Land Use*

The Fatmawati MRT station located in Cilandak district, South Jakarta, it is an elevated station with two entrances, nearby MRT station are Cipete and Lebak Bulus. Spatial analysis with GIS software was employed to filter the land use features within 800 m from the station, shown in Fig. 3. According to the existing land use of the site, most of the area were covered by residential (54.83%), followed by office function (18.98%), public facilities (14.50%), green space (6.14%), mixed zone (2.88%), and commercial area (2.67%).

TABLE I. EXISTING LAND USE ALLOCATION OF FATMAWATI TOD

| No | Land Use | Area (M2) | Proportion (%) |
|---|---|---|---|
| 1 | Residential | 868.487,17 | 54.83 |
| 2 | Office | 300.661,11 | 18.98 |
| 3 | Commercial | 42.270,53 | 2.67 |
| 4 | Mixed-use zone | 45.566,73 | 2.88 |
| 5 | Public facilities | 229.735.64 | 14.50 |
| 6 | Green space | 97.287,89 | 6.14 |

Residentials are including apartment and landed houses. Public facilities are hospital, school and university, and government office, while parks categorized as green space. Mixed zone is combination between residence and commercial business in one building lot, such as shophouses. The analysis which was done showed a low proportion of commercial/mixed use zone.

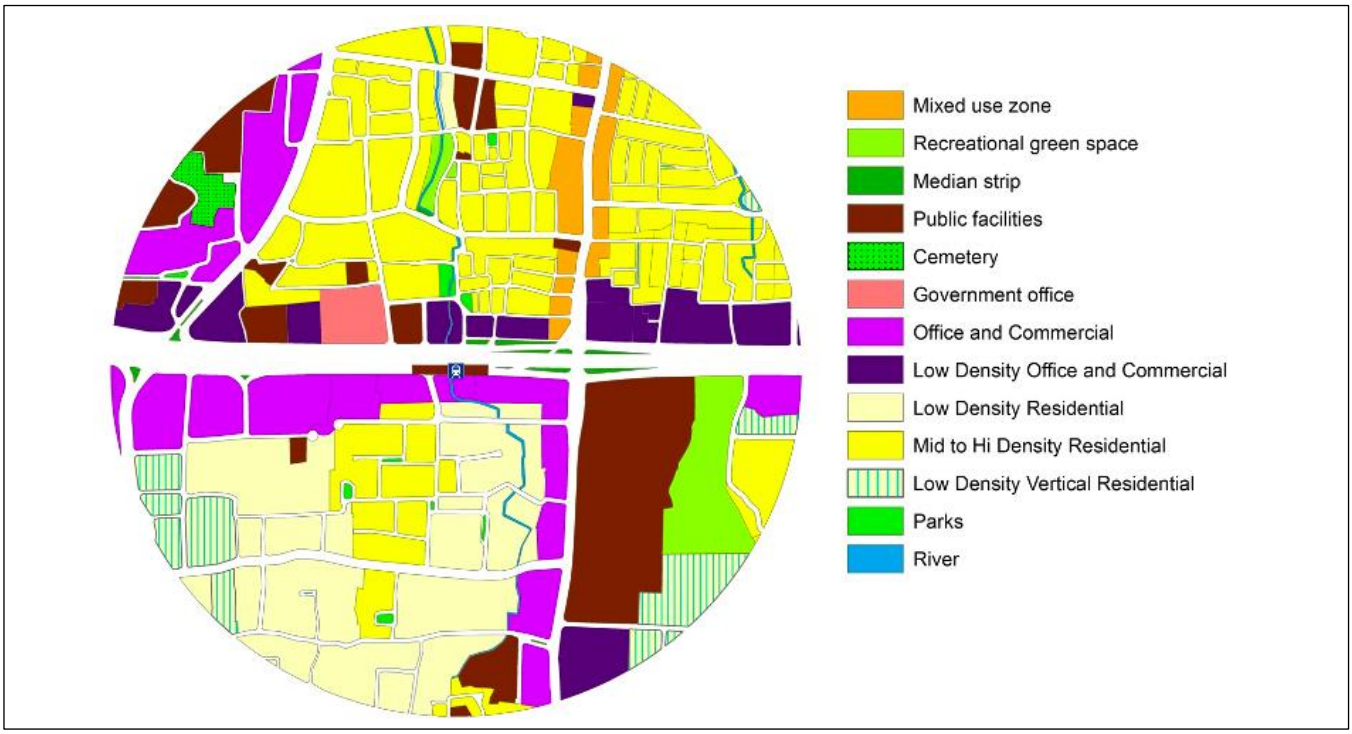

Fig. 3. Existing land use map of Fatmawati TOD within 800 m radius.

From the zoning regulation table we can obtain data for BCR 'building coverage ratio' and FAR 'floor area ratio' calculation. As shown in Table II this existing land use area has a relatively low BCR and FAR values. Average BCR value for residential, office, commercial and mixed use zone is 42.5% (not including public facilities), with highest BCR value 60% for high rise residential. Average FAR value for those zone is 2.32, with highest FAR value 4.5 for high rise office building.

TABLE II. BCR AND FAR VALUES OF FATMAWATI TOD

| No | Land Use | BCR | | FAR | |
|---|---|---|---|---|---|
| | | Avg | Range | Avg | Range |
| 1 | Residential | 40% | 30 - 60% | 1.76 | 0.9 – 3.2 |
| 2 | Office | 37% | 30 – 55% | 2.72 | 3 – 4.5 |
| 3 | Commercial | 43% | 40 – 50% | 2.8 | 2 – 3 |
| 4 | Mixed-use zone | 50% | 50% | 2 | 2 |
| 5 | Public facilities | 37% | 30 – 40% | 1.1 | 0.8 – 4.5 |
| 6 | Green space | 1% | 0 – 5% | 0.02 | 0 – 0.1 |

## B. *Ideal Land Use*

A literature review was employed to obtain data from previous research related to land use characteristics of TOD area. Five different TOD sites were selected to create ideal land use model, three TOD sites properties from research [3] in Hong Kong, Osaka, and Seoul, two TOD sites form research [10] in Singapore. The summarize land use characteristics from those TOD sites shown in Tabel IV.

Two TOD sites in Singapore, Toa Payoh and Tampines station has a similar land use characteristics. Which is expected because these two station designated as Urban TOD site. According to the existing land use of the sites, average proportion of commercial area are 43.07% followed by residential area 36.73%, public facilities 10.85%, green space 7.69%, and reserved site 1.66%. Commercial area including office and mixed use zone. BCR and FAR data is not available, however research [10] mention about commercial compactness that calculated by the ratio of the commercial land density in the area within 500 m of the station site to the commercial land density in the entire town. Average commercial compactness for Toa Payoh and Tampines station are 5.67.

From research [3] there are three TOD sites that uses as benchmark study which are Union Square in Hong Kong, a 13.54 Ha mixed use development with an integrated transit station, Namba Parks in Osaka, a 3.37 Ha shopping arcades adjacent to Sekai station, and D-Cube City in Seoul, a 6.36 ha complex amenities with direct access to Shindorim Station. According to [3] the average proportion of residential area are 44% followed by office function 18%, commercial/retail 16%, hotel 10%, and others 12%. Average BCR values for those TOD sites are 92% with FAR values of 7.29.

TABLE III. BCR AND FAR VALUES OF BENCHMARK TOD

| No | TOD Site | BCR | FAR |
|---|---|---|---|
| 1 | Toa Payoh | - | - |
| 2 | Tampines | - | - |
| 3 | Union Square | 100% | 8.05 |
| 4 | Namba Parks | 76% | 7.23 |
| 5 | D-Cube City | 100% | 6.57 |

TABLE IV. SUMMARY LAND USE CHARACTERISTICS OF BENCHMARK TOD

| No | Land Use | Toa Payoh | Tampines | Union Square | Namba Parks | D-Cube City |
|---|---|---|---|---|---|---|

| | | M2 | % | M2 | % | M2 | % | M2 | % | M2 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Residential | - | 40.53% | - | 32.93% | 608,026 | 56% | 60,000 | 24% | 110,300 | 26% |
| 2 | Office | - | - | - | - | 231,778 | 21% | 60,000 | 24% | 24,480 | 6% |
| 3 | Commercial | - | 39.46% | - | 46.55% | 82,750 | 8% | 86,000 | 34% | 107,800 | 25% |
| 4 | Mixed-use zone | - | - | - | - | - | - | - | - | - | - |
| 5 | Public facilities | - | 10.63% | - | 11.08% | - | - | - | - | - | - |
| 6 | Green space | - | 7.94% | - | 7.45% | - | - | - | - | - | - |
| 7 | Hotel | - | - | - | - | 167,472 | 15% | - | - | 18,360 | 4% |
| 8 | Reserved site | - | 1.44% | - | 1.88% | - | - | - | - | - | - |
| 9 | Others | - | - | - | - | - | - | 44,700 | 18% | 171,000 | 39% |

### *C. Comparison*

Tabel V show comparison of existing and ideal land use data. Which presented by category of land use allocation, area proportion of each land use, BCR and FAR value. The ideal model is built from synthesize of five benchmark TOD projects. Note that the land use category has been simplified and differ than presented in previous section. The mixed use zone and hotel function merge into 'Commercial' function, while the public facilities, green space, and reserved site merge into 'Others' category. This is done to ease the calculation, value shown in the table are average of all five TOD benchmark sites.

TABLE V. COMPARISON OF EXISTING AND IDEAL LAND USE CONDITION

| No | Land Use | % Proportion | |
|---|---|---|---|
| | | Existing Condition | Ideal Condition |
| 1 | Residential | 54.83% | 35% |
| 2 | Office | 18.98% | 17% |
| 3 | Commercial | 5.55% | 29% |
| 4 | Others | 20.64% | 19% |

Tabel VI comparing average BCR and FAR value of existing and ideal TOD site. Since two benchmark TOD in Singapore (Toa Payoh and Tampines) has no BCR nor FAR data, then it is not taken into account in determining average BCR and FAR value of ideal TOD site. For the existing condition of TOD site, BCR and FAR value shown are derived from average value of residential, commercial, office, and mixed use zone combine together, it does not include the BCR and FAR value of public facilities (school, hospital, government office).

TABLE VI. COMPARISON OF EXISTING AND IDEAL BCR AND FAR VALUE

| | Existing TOD site | Ideal Benchmark TOD |
|---|---|---|
| **BCR** | 42.5% | 92% |
| **FAR** | 2.32 | 7.29 |

## IV. DISCUSSION

There are two aspects of land use characteristics being examined in this research, density and diversity. Density is measured with floor area ratio/FAR, while diversity measure with numbers of land use allowed and area proportion of each land use allocation in the site.

In comparison to ideal condition, the existing land use of Fatmawati TOD has more residential area, almost 20% higher. Meanwhile the existing lack of commercial area, only a quarater of what the ideal condition have. These things need to be point out and resolved by rearranging land use allocation.

BCR value of ideal benchmark TOD almost two times higher than the existing condition, it means Fatmawati TOD has a smaller building plot. Similar pattern happens to FAR value, where ideal benchmark TOD has three times higher than the Fatmawati TOD, it means the building will be much shorter. Amendment in zoning regulation needs to change this relatively low BCR and FAR value.

The current land use map and zoning regulation of Fatmawati area issued in 2014, while the governor regulation of TOD in MRT Jakarta station first issued in 2017, it is possible that there is a gap between these two government policy.

## V. CONCLUSION

The finding from this research highlight that the existing land use plan of Fatmawati TOD is not fully meet the ideal condition of benchmark TOD in terms of diversity and density. An unequal proportion of land use allocation where most of land is planned to become residential zone and a relatively low BCR and FAR values. The diversifying land uses of TOD sites will generate maximum ridership [11] and helping to achieve the goal of true TOD. A higher BCR and FAR values reflects more floor area that allowed to built, it means more saleable area either apartment, office, or commercial/retail. Additional saleable floor area can attract investor to provide financing for development of TOD.

To avoid Fatmawati TOD become failed, an improvement needs to be done. The government should revised the current zoning regulation, inducing more diversifying land use allocation accompany with higher BCR and FAR value.

Further research should be performed to explore how this current land use plan of TOD MRT Jakarta could fulfill the ideal land use plan of successful TOD project, this include simulation of rearrangement land use allocation and adjustment of FAR and BCR values.

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