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# Development Strategy of Malang Kota Baru Station Area Using Transit-Oriented Development (TOD) Principle Approach

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# Development Strategy of Malang Kota Baru Station Area Using Transit-Oriented Development (TOD) Principle Approach

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**Abstract**. Malang Kota Baru Station is located in the center of Malang City with a variety of land uses occurring around the area. The concept of an area supports aspects of building density, diversity of land use, and the proximity of the area to transit points, one of which is Transit-Oriented Development (TOD). The purpose of this research is to obtain a development strategy that can be carried out in the area. The TOD principle approach is used in the Area of suitability analysis. The AHP method and SWOT analysis are used to obtain a regional development strategy. The results of the suitability analysis show that almost all of the existing condition variables are not under the TOD principle parameters. Furthermore, all parameters are used in the AHP analysis, and the order of priority for regional development is obtained, namely: diversity, design, and density. Determination of the grand strategy for regional development based on IFAS and EFAS obtained recommendations for aggressive maintenance strategy. This strategy needs to be carried out in regional development by maximizing various opportunities, to resolve or minimize internal weaknesses that occur.
**Keywords.** Transit-Oriented Development, Analytical Hierarchy Process, SWOT, IFAS, EFAS

## 1. Introduction

According to [1] transportation has two main roles, namely as a tool to direct development in urban areas, and as a means for the movement of people and goods arising from activities in urban areas. Urban areas are areas that have a significant movement of goods and services. A common problem related to transportation that is often encountered in urban areas is congestion due to the high use of private vehicles as the main mode of transportation.

One of the efforts that can be done to overcome the problems that arise due to the high mobility of people using private vehicles, is necessary to have an integrated public transportation mode that can accommodate the needs of the community [2]. One of the urban planning concepts that prioritize the function of public transportation is Transit-Oriented Development (TOD). The concept of regional development using the TOD principle has been carried out in several big cities in developed countries.

Malang City is the second-largest city in East Java Province and is known as an education city with many universities. Malang City Government data recorded that there were 59 universities [3]. So that the increase in population that occurs can be caused by the addition of students who come from outside the city. One of the congestion problems caused by the high use of private vehicles can be overcome by using public transportation. Until now, Malang City has several modes of public transportation that can be used by the community, including trains, planes, city transportation, and inter-city buses. One of the transit stations located in East Java is Malang Kota Baru Station, which is located in the center of Malang City.

The location of the station in the city center causes the surrounding area to be filled with various activities, ranging from trade and services, settlements, educational facilities, public facilities, defense and security, health facilities, offices, to tourism activities. The diversity of land uses makes the area around the station the center of community activities.

The characteristics of the area around Malang Kota Baru Station are related to the characteristics of the transit area, with the potential to be developed using a transit-based approach. The purpose of this research is to find out what the suitability of the characteristics of the area is to the concept or principle of TOD, then the priority of regional development is arranged based on the principle of TOD. The ultimate goal of the research is to obtain a viable regional development strategy.

## 2. Method

### *2.1. Research sites*

One area concept that supports aspects of building density, diversity of land use, and proximity of the area to transit points is TOD [3]. In Indonesia, the TOD concept is better known as the Transit Oriented Area which is regulated in the Regulation of the Minister of Agrarian Affairs and Spatial Planning Number 16 of 2017 concerning Guidelines for the Development of Transit-Oriented Areas [4]. In the Ministerial Regulation, it is stated that transit-oriented areas are areas within a radius of 400 to 800 meters from the transit point. In the guidelines published by the Florida TOD Guidebook [5], it is stated that the TOD principle is divided into three parts: density, diversity, and design.

This research was conducted in the Malang Kota Baru Station Area, which is located in Klojen District, Malang City, East Java. In general, the area around Malang Kota Baru Station complies with the above criteria, namely the high density of buildings, the diversity of land uses, and the availability of pedestrian facilities, as well as public spaces. The area as the study area in the research is an area with a radius of 800 meters from Malang Kota Baru Station.

### *2.2. Data collecting*

Data collection is an activity carried out to compile a systematic analysis based on the required input. Data collection methods in this study are divided into two, namely primary data and secondary data. The primary data in this study were obtained through observation, interviews, and questionnaires. While for secondary data, it is done by collecting data from related parties, including Spatial Plans (RTRW) of Malang City, Medium Term Development Plan (RPJM) and Long Term Development Plan (RPJP) of Malang City, Detailed Spattials Plans (RDTR) of Malang Tengah, Malang City public transportation documents, and theories related to the development of TOD-based areas.

### 2.3. Research variable

The indicators and variables used in this study were compiled based on the results of research related to TOD and transit area development. The indicators, variables, and parameters used in the study are shown in table 1.

**Table 1.** Research variable

| Indicator | Variable | Parameter |
|---|---|---|
| Density | Building density | 100-1000 building/Ha, with residential functions > 20 unit/ Ha. |
| | Building Base Coefficient (KDB) | Minimum 70%. |
| | Building Floor Coefficient (KLB) | Minimum 2.0. |
| Diversity | Residential | The calculation of the percentage of land use is as follows:<br>5% - 15% Public Space.<br>30% - 70% Commercial and Office Area.<br>20% - 60% Residential Area. |
| | Non-residential | |
| Design | Availability of pedestrians | 100% available in the area.<br>Pedestrian width 2-3 meters.<br>100% disabled facilities, with bollards or tactile paving. |
| | Availability of crossing facilities | The crossing facilities can be in the form of:<br>Zebra Cross.<br>Pelican Crossing. |
| | Availability of bike paths | Minimum width 1.5 meters. |
| | Node of transit | Active transit node between public transport with high accessibility.<br>Travel time 5-10 minutes on foot from the activity center or vice versa. |

*2.4. Approach method*

The approach used in this research is mixed methods research. Researchers combine two forms of approach in qualitative and quantitative research. Conformity analysis is carried out to obtain a portrait of the suitability of the existing condition of the area to the indicators and components in the TOD principle. The results of the analysis are then used as the basis for obtaining the priority order which is analyzed using the Analytical Hierarchy Process (AHP) method [6]. The respondents that are involved in this method are from various agencies related to the urban planning field. The results of the priority order of indicators and components in the TOD principle are then used as one of the inputs for analysis to obtain an Area development strategy. SWOT analysis by conducting an assessment using IFAS and EFAS matrices is carried out to obtain a recommended strategy according to existing conditions.

## 3. Results and Discussion

*3.1. Suitability analysis of TOD components.*

The components that will be used at the study site consist of three TOD criteria, namely Density, Diversity, and Design. To be able to know the components of Transit-Oriented Development at the research location, it is necessary to collect data according to the variables and indicators of the research. The data collection technique used to determine the TOD component in the existing condition of the study area is observation. Observation activities are carried out to observe directly the conditions in the field. The research instrument used in the observation technique is a block map, where the study area is divided into 8 blocks.

*3.1.1. Density.* Calculation of building density is carried out based on predetermined blocks with the results as shown in table 2.

**Table 2.** The density of buildings and residential buildings per-block

| Block | Building Density per-Block (building/Ha) | Residential Buildings per-block (unit/Ha) |
|---|---|---|
| 1 | 48 | 7 |
| 2 | 34 | 3 |
| 3 | 27 | 2 |
| 4 | 30 | 11 |
| 5 | 67 | 57 |
| 6 | 26 | 26 |
| 7 | 10 | 1 |
| 8 | 31 | 29 |

The average building density is 35 buildings/ha where the largest density is seen in block 5 of 67 buildings/ha. The parameter states that the building density is at a value of 100-1000 buildings/ha. Meanwhile, the density of residential buildings obtained an average of only 17 units/ha, where the parameters for residential functions are > 20 units/ha. However, in block 5, block 6, and block 8 the density of residential buildings has reached > 20 units/ha. The building density at the research site as a whole does not meet the parameter requirements.

The Basic Building Coefficient Interpretation (KDB) is calculated based on the block division that has been done. Based on Figure 1, the KDB condition can be interpreted. KDB at research sites has various ranges, namely 60% to 100%, while the parameters require a minimum of 70%. So that in the review of the KDB variables, it can be said that only some of them meet the parameter criteria.

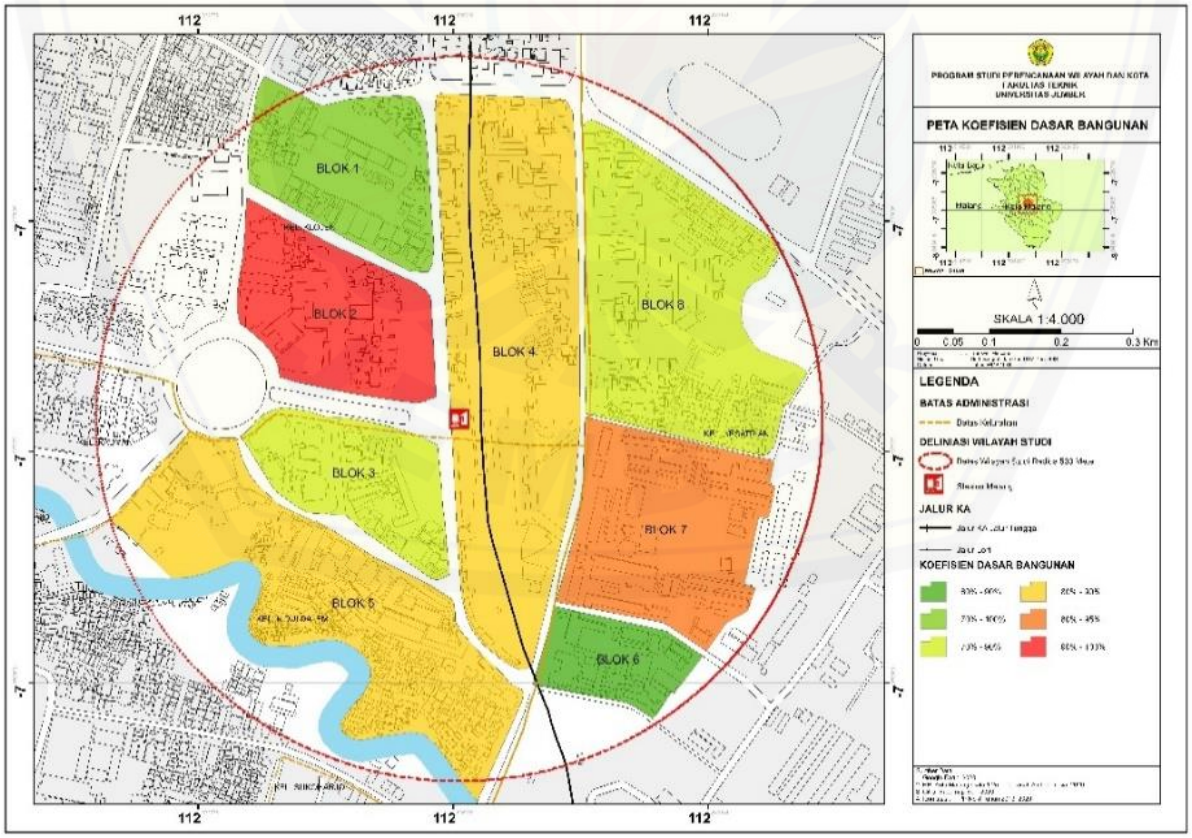


**Figure 1.** Interpretation of Building Basic Coefficients (KDB) map

The results of the calculation of the Building Floor Coefficient (KLB) show the lowest value of 1 and the highest of 5. The area with the highest KLB average value is in block 1, which is dominated by trade and service land uses and settlements. The lowest KLB average values are in blocks 4, 6, 7, and 8 which are dominated by land use functions for transportation, defense and security, trade and services, and settlement infrastructure.

*3.1.2. Diversity.* There are several types of land use with a total of 1,920 buildings. The land use in question consists of residential land use, health facilities, defense and security, and other land use. The interpretation of diversity at the research site is shown in Figure 2.

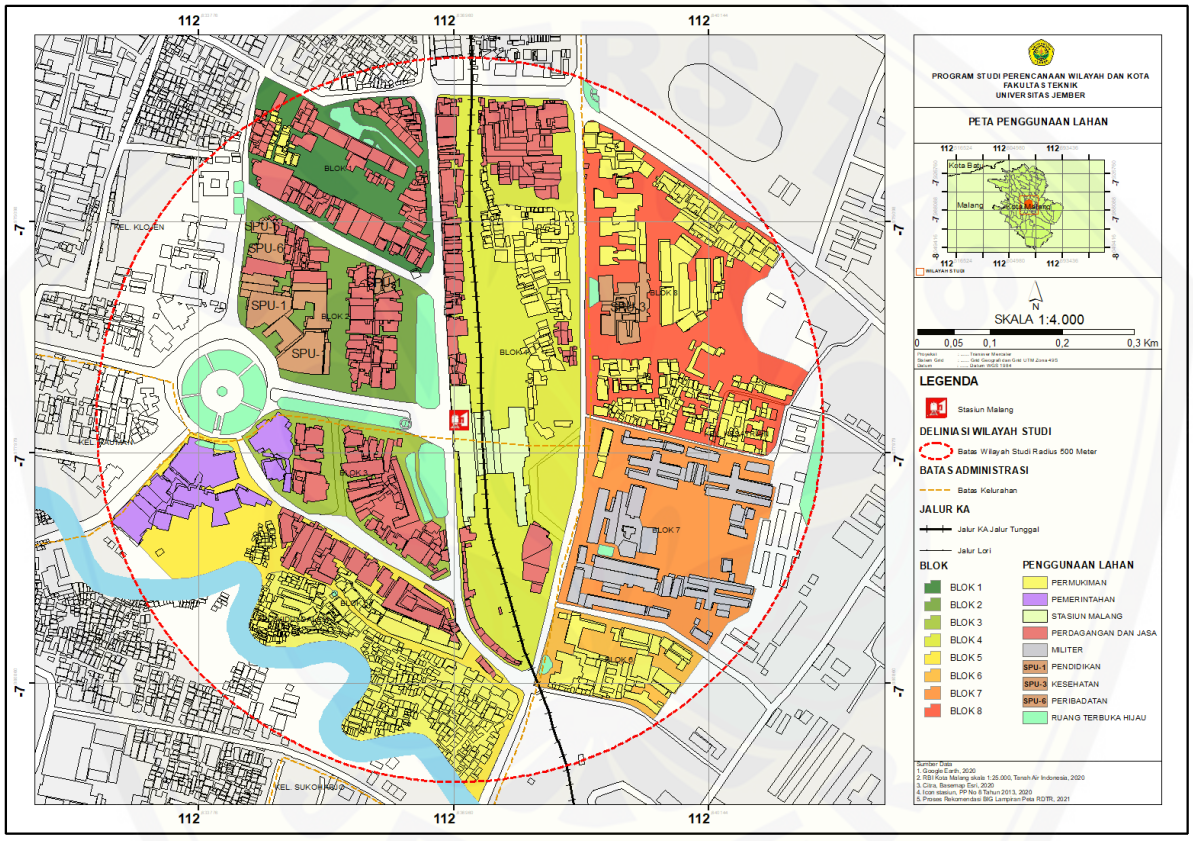


Figure 2. Interpretation of diversity map

The results of the analysis of land-use diversity in the research area show that half of the research area is functioned as residential buildings, with a proportion of 55%. Parameters of commercial buildings and offices with a proportion of 43% meet the specified parameters, which are 30%-70%. The only type of land use that does not match the parameters is Green Open Space, with a proportion of only 2% of the parameters of 5%-15%.

*3.1.3. Design.* There are four variables in the design indicator, namely: pedestrians, crossing facilities, bicycle lanes, and transit points. Pedestrians in the research location area are located on the main road, and have completeness in the form of tactile paving for people with disabilities. The pedestrian dimensions have met the parameters, which have a width of 2 to 3 meters. Although the main route in the research location area has pedestrians that meet the standards, several areas do not meet the

standards, such as the width of fewer than 2 meters and the unavailability of facilities for persons with disabilities.

There are only two zebra crossings complete at the research site. Both locations are in front of Malang Kota Baru Station. Pedestrian-prone points such as schools, offices, government centers, and shopping areas are still not found in the study location area.

Bicycle lanes are one of the necessary instruments in the development of transit-based areas. This is under one of the objectives of implementing the TOD concept, namely to reduce the use of motorized vehicles, as well as to create a comfortable area for pedestrians and cyclists. In the research area, there were no bicycle lanes along the road, so there was no separation between bicycle users and other motor vehicle users.

There are three transit points at the research location, one of which is Malang Kota Baru Station. This train station serves road trips with local routes as well as medium and long-distance routes. While the other transit points are bus stops. The primary survey was carried out on the parties around the bus stop. The results of the interpretation obtained information for the bus stop that was actively used only the Sriwijaya Bus Stop. This bus stop is located in front of Malang Kota Baru Station.

### *3.2. Priority of development.*

The priority of developing the transit area of Malang Kota Baru Station is determined from the results of the AHP analysis. Respondents who become objects are all relevant stakeholders, in this case, the respondents involved are parties who have a background in urban development and transportation. Seven respondents participated, they came from various agencies such as government officials, lecturers, and DAOP 8 employees. The survey results were processed using the AHP method based on the criteria for the predetermined variables. The results of the AHP analysis output obtained an AHP output diagram based on the TOD principle approach as shown in Figure 3.

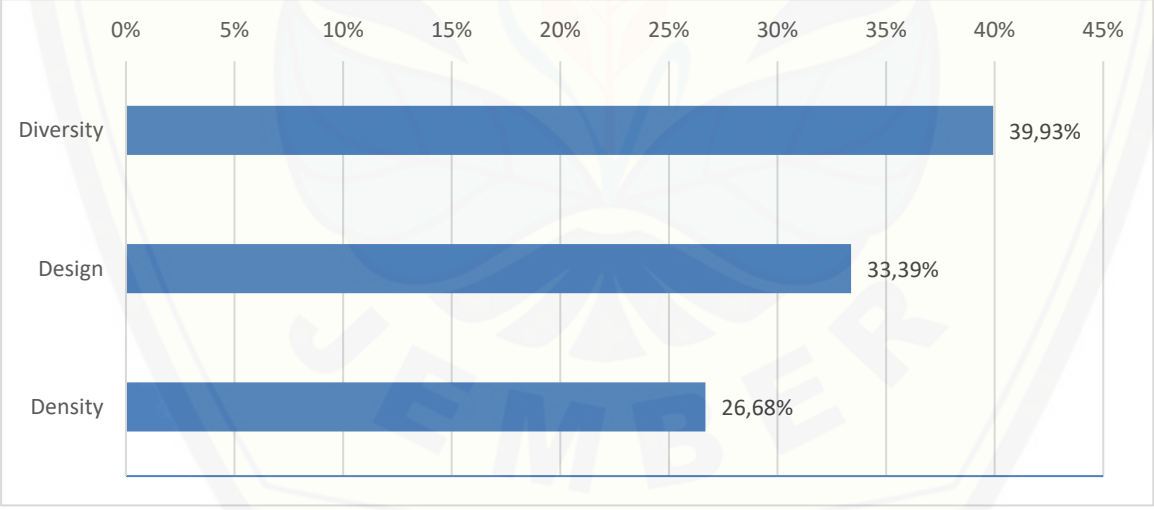


Figure 3. AHP analysis output diagram based on the TOD principle approach

The development priorities on indicators and research variables based on the results of the AHP analysis are obtained:

1. Diversity, with an assessment result of 39.93%. The order of priority of the components is as follows:
   a. Availability of pedestrian paths (22.11%);
   b. Pedestrian connectivity (21.13%);
   c. Availability of road crossing facilities (19.18%);
   d. Availability of bicycle lane facilities (18.82%); and

e. Dimensions of the pedestrian path (18.76%).

2. Design, with 33.39% assessment results. The order of priority of the components is as follows:
   a. Trade and services (27.27%);
   b. Offices (26.05%);
   c. Public Space (23.94%); and
   d. Residential (22.74%).
3. Density, with a calculation result of 26.68%. The order of priority of the components is as follows:
   a. Building Density (48.1%);
   b. Basic Building Coefficient (KDB) (25.95%); and
   c. Building Floor Coefficient (KLB) (25.94%).

### *3.3. Area development strategy*

The strategy for developing the Malang Kota Baru Station area using the transit principle approach (TOD) is obtained through a series of SWOT analysis stages. Internal and external factors were identified based on the results of the conformity analysis and AHP analysis that had been carried out previously. Subsequently, the Internal Factors Analysis Strategic (IFAS) Matrix and the External Factors Analysis Strategic (EFAS) Matrix were prepared. Weights and ratings are determined based on development priorities based on the results of AHP analysis for each component of internal and external factors. IFAS matrix analysis results are shown in Table 3.

**Table 3.** Matrix of Internal Factors Analysis Strategic (IFAS)

| No. | Internal Factor | Weight | Rating | Score | Remark |
|---|---|---|---|---|---|
| A. | Strengths | | | | Rating Scale 1-4.<br>Score = Weight*Rating<br>Value meaning:<br>• A positive sign is a strength.<br>• A negative sign is a weakness. |
| 1. | There are various land uses in the research area. | 9.5% | 3 | 0.285 | |
| 2. | Has a commercial activity center. | 9.5% | 4 | 0.380 | |
| 3. | It is the location of one of the tourist attractions of Malang City, namely Jodipan Village. | 9.5% | 2 | 0.190 | |
| 4. | It is the central government area. | 9.5% | 4 | 0.380 | |
| 5. | It has complete public facilities. | 7.0% | 2 | 0.140 | |
| | Amount: | 45% | | 1.375 | |
| B. | Weaknesses | | | | |
| 1. | The need for public space is not fulfilled according to the rules. | 7.0% | 2 | -0.140 | |
| 2. | Has a poor level of pedestrian service. | 9.5% | 4 | -0.380 | |
| 3. | The small dimensions of the pedestrian path in some areas. | 9.5% | 3 | -0.285 | |
| 4. | The lack of pedestrian path facilities is under standards. | 9.5% | 3 | -0.285 | |
| 5. | Does not have a bike path. | 9.5% | 4 | -0.380 | |
| 6. | Has a low level of accessibility for non-motorized vehicle users. | 10.0% | 4 | -0.400 | |
| | Amount: | 55.0% | | -1.870 | |
| | Total | 100.0% | | -0.495 | |

Based on table 3, the Strength score is +1.375 on the internal factor. Meanwhile, the Weakness score is -1.87. The total score on the internal factor is -0.495, where the SWOT analysis quadrant is more directed at Weakness. Meanwhile, the results of the EFAS matrix are shown in table 4.

**Table 4.** Matrix of Eksternal Factors Analysis Strategic (EFAS)

| No. | External Factor | Weight | Rating | Score | Remark |
|---|---|---|---|---|---|
| A. | Opportunities | | | | Rating Scale 1-4. Score = Weight*Rating Value meaning: • A positive sign is an opportunity. • A negative sign is a threat. |
| 1. | RTRW Malang City and RDTR Centre Malang have development plans that are in line with the TOD concept. | 40,0% | 3 | 1,2 | |
| 2. | The research area has a generation in the form of commercial, educational, office, government, and tourism areas which are one of the goals of the community in their activities. | 20,0% | 2 | 0,4 | |
| | Amount: | 60% | | 1,6 | |
| B. | Threats | | | | |
| 1. | The level of discipline of traders in the research area is still low, so many of them sell in the pedestrian area. | 20,0% | 2 | -0,4 | |
| 2. | There are many city public transportations and online taxis that park inappropriately, especially around public facilities while waiting for passengers. | 20,0% | 1 | -0,2 | |
| | Amount: | 40% | | -0,6 | |
| | Total | 100% | | 1 | |

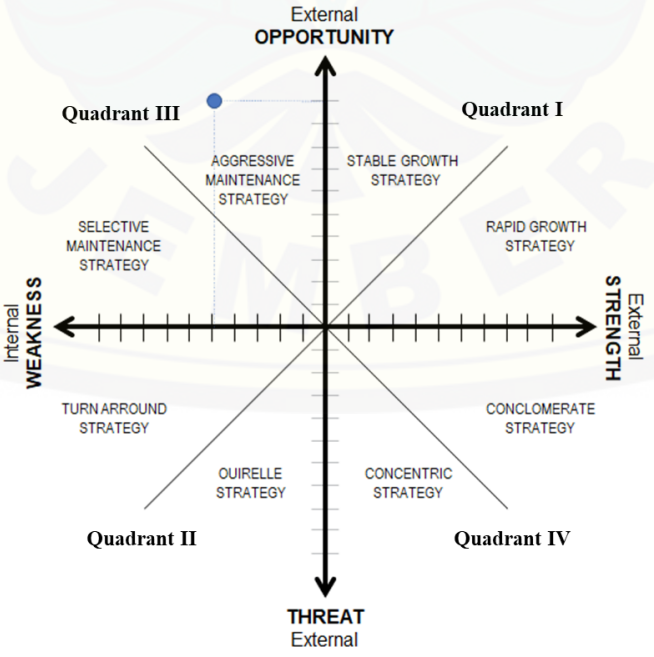


Figure 4. Matriks of analysis strategy quadrant of IFAS-EFAS

Based on table 4, the Opportunity score is +1.60 on the external factor. Meanwhile, the Threat score is -0.60. The total score on the external factor is +1.00, where the SWOT analysis quadrant is more directed to Opportunity. Based on the analysis of the IFAS Matrix and the EFAS Matrix in table 3 and table 4, the recommended strategy can be obtained, namely the aggressive maintenance strategy, where the analysis results show that it is in quadrant III (see Figure 4).

Aggressive maintenance strategy on the development of the Malang Kota Baru Station Area is carried out by prioritizing implementing the Weakness-Opportunity Strategy (W-O Strategy). Strategies that can be done are:

1. Enforcement of building intensity can be adjusted to the rules of the Malang City spatial policy and the provision of incentives and disincentives to the intensity of buildings that are not appropriate.
2. In line with the enforcement of building intensity, enforcement of regulations related to Green Open Space can also be carried out by implementing incentives and disincentives.
3. The construction of pedestrian and cyclist facilities is needed to facilitate the use of non-motorized vehicles and public transportation. In the concept of a transit-based area, the availability of pedestrian and bicycle facilities is required 100% within the area.

## 4. Conclusions

The suitability analysis in the Malang Kota Baru Station area shows that the existing conditions are not suitable. Of the nine variables used (building density, Basic Building Coefficient (KDB), Building Floor Coefficient (KLB), residential, non-residential, pedestrian availability [7], crossing facilities availability, bicycle lane availability, and transit points), there is no match between the conditions existing with predefined parameters.

Nine variables are used in the AHP analysis, and the order of priority and the results of the assessment of the TOD indicators are:

- First, diversity of 39.93% with the priority order of components: (i) availability of pedestrian paths, (ii) connectivity of pedestrian paths, (iii) availability of road crossing facilities, (iv) availability of bicycle lanes, and (v) dimensions of lanes. pedestrian.
- Second, the design is 33.39% with the components in order of priority: (i) trade and services, (ii) offices, (iii) public spaces, and (iv) settlements.
- Third, density is 26.68% in order of priority of components: (i) building density, (ii) Building Base Coefficient (KDB), and (iii) Building Floor Coefficient (KLB).

The regional development strategy at Malang Kota Baru Station with the TOD principle approach can be carried out with an aggressive maintenance strategy. The results of the SWOT analysis give the results being in quadrant three with negative IFAS and positive EFAS values. The W-O strategy must be carried out in the development area by maximizing various opportunities, to resolve or minimize internal weaknesses that occur.

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