

RESEARCH REPORT
INTERNATIONAL RESEARCH COLLABORATION



DETERMINATION OF THE IMPACT OF TRANSIT ORIENTED DEVELOPMENT (TOD) AT LIGHT RAIL TRANSIT (LRT) STATIONS IN PALEMBANG CITY

RESEARCH TEAM

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UNIVERSITASMERCUBUANA
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APPROVAL FORM OF INTERNATIONAL RESEARCH COLLABORATION REPORT

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PALEMBANG CITY OF ORIENTED TRANSIT DEVELOPMENT (TOD)

a. University Field of Excellence : Transportasi
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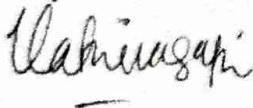
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PREFACE

This research is conducted because of good friendship bonding between Mercu Buana University, West Jakarta, Indonesia and Universiti Kebangsaan Malaysia, Selangor, Malaysia. This study applies the concept of Transit Oriented Development (TOD) to Light Rail Transit (LRT) stations in Palembang City from an environmental aspect. This research discusses the city of Palembang which already has several transit-based transportation such as Bus Rapid Transit (BRT) and Light Rail Transit (LRT) as a solution to overcome existing congestion. This research takes several areas that still have congestion and have not been able to be minimized, namely; (1) Bumi Sriwijaya, (2) Cinde Market, (3) 16 Ilir Market, and (4) Jakabaring. Principal researcher of this team, Nunung Widyaningsih. Dr. Ir. Pg. Dipl. Eng. IPM is a senior lecturer at the Master of Civil Engineering of Engineering Faculty in Mercu Buana University, Jakarta, Indonesia as corresponding and responsible for this research as well.

We are thank to head of Mercu Buana University research center, Director of Research and Technology Publication and Domestic Cooperation. Also to everyone in Universiti Kebangsaan Malaysia who support this research joint. This research is fully supported by University of Mercu Buana and University of Kebangsaan Malaysia as a Joint Research Collaboration overseas. I owe my gratitude to all those people who have made this work possible and because of whom my experience has been one that I will cherish forever.

Principal Researcher,
Dr. Ir. Nunung Widyaningsih, Pg.Dipl.Eng.IPM

ABSTRACT

This study applies the concept of Transit Oriented Development (TOD) to Light Rail Transit (LRT) stations in Palembang City from an environmental aspect. This research discusses the city of Palembang which already has several transit-based transportation such as Bus Rapid Transit (BRT) and Light Rail Transit (LRT) as a solution to overcome existing congestion. This research takes several areas that still have congestion and have not been able to be minimized, namely; (1) Bumi Sriwijaya, (2) Cinde Market, (3) 16 Ilir Market, and (4) Jakabaring. At that location there are several problem phenomena that are still being faced in the implementation of the existing TOD where the lack of utilization of an integrated transportation system by the community, then buildings that have not been integrated or still require distance and time to move.

This study uses the Process Hierarchy Analysis (AHP) method. This research is the preparation of evaluation and analysis of the determination of Transit Oriented Development (TOD) areas at Light Rail Transit (LRT) stations in Palembang City in a Review of Environmental Aspects. The research locations reviewed in this study are densely populated areas. In this study using a quantitative research approach. A quantitative approach is used to analyze the determination of Transit Oriented Development (TOD) areas in Palembang City in terms of environmental aspects using the AHP decision-making analysis technique in compiling research discussions.

The results of this research indicate that the area potential to become a Transit Oriented Development (TOD) area is the Pasar 16 Ilir area. This area has the highest potential of other areas after processing the AHP data on the three main criteria for the TOD area designation

Key word: Indonesia, Light Rail Transit (LRT) Stations, Transit Oriented Development (TOD), Proses Hierarchical Analysis (AHP), Environmental Aspects

IDENTITY AND GENERAL INFORMATION

1. Research Title : Determination at Light Rail Transit (LRT) Stations in Palembang City of Oriented Transit Development (TOD)

2. Researchers

No	Name	Position	Expertise	Institution	Allocated Time (hour/week)
1	Dr. Ir. Nunung W, Pg. Dipl.Eng	Principal	Transportation	Mercu Buana University	8
2	Dr. Wan Hanna WM	Partner 1	Structure	University Kebangsaan Malaysia	4

3. Research Object (type of materials):

Human and Vehicle (private car and public transport)

4. Time/Period

Starts : month: Januari year: 2022

Ends : month: June year: 2023

5. The Proposed Budget to Directorate General of Research and Development
x Year 1 : Rp 20.000.000;

6. Research Location (lab/studio/field) : Palembang.

7. Research Partner (if any, mention its contribution)-

8. The targeted findings (explanation, method, theory, or anticipation contributed to the field of study)

9. The basic contribution to the field of study (explain in not more than 50 words, focus on original and fundamental ideas supporting the development of science and technology)

This research takes several areas that still have congestion, namely; (1) Bumi Sriwijaya, (2) Cinde Market, (3) 16 Ilir Market, and (4) Jakabaring. At that location there are several problem phenomena that are still being faced in the implementation of the existing TOD.

10. The targeted journals (write the name of the international journal, accredited national journal, or non-accredited, and state the year of publication.

Publish International Journal on “Technical and Physical Problems of Engineering” (IJTPE) (Scopus Q3)

11. Plan for Intellectual Property Right, book, prototype or other targeted outcomes, the targeted year or the completion year. -

CHAPTER I

INTRODUCTION

1.1 Background

In Indonesia itself, the growth of urban areas to become centers of economy and trade is also inevitable. Almost all big cities in Indonesia are used as economic and trade centers, so that urbanization is inevitable, density is uncontrollable and increasingly threatens the economic, social and environmental impacts. One of them is Palembang City, which is the capital city of South Sumatra Province which has continued to grow in recent years. The city that has grown into a metropolitan city has a population density of up to 2 million people in 2020. The consequence of continuing migration of residents from areas outside the city of Palembang to work, do business and live in Palembang City has now presented various urban problems such as traffic jams, floods of settlements.

Palembang City is one of the most populous cities on the island of Sumatra. Along with the increasing human population in the city of Palembang, more and more transportation will be needed, causing an increasing need for transportation facilities and infrastructure that support human activities in the economic, educational, social, cultural and other fields. Therefore, this has an effect on the level of development of urban activities in Palembang City which has caused traffic conditions to worsen, mainly due to traffic jams by increasing traffic volume. This requires the need for an integrated urban planning pattern of development between one aspect and another.

In the discussion of urban mass transportation systems, the concept of the relationship between transit activities and development becomes an interesting discussion in the science of urban planning and design, including the Transit Oriented Development (TOD) or transit oriented development which has been realized in many cities in Indonesia. world. TOD has been widely recognized as a concept that answers the needs of transit areas.

Transit Oriented Development (TOD) is a strategy for developing dense areas with mixed land uses consisting of housing, offices, shopping, education, health and other social facilities with a focus on transit stations (buses or trains), Dunphy (2004). The benefits of TOD are reducing the use of private cars, increasing pedestrians and transit users, reviving downtown areas, increasing density and intensity, saving and developing for parking, as well as increasing property values and sharing activities

around transit locations, to improving environmental quality and community. On a regional scale, it is hoped that this concept can solve congestion problems in urban areas. Currently, the City of Palembang itself already has several transit-based transportation such as Bus Rapid Transit (BRT) and Light Rail Transit (LRT) as solutions to overcome existing congestion. However, in its implementation, until now it has not been able to function optimally in reducing the use of private vehicles.

1.2. Problems Identification

The problems identified and relevant are as follows:

1. Transportation problems in the form of congestion in the city of Palembang.
2. The presence of Bus Rapid Transit (BRT) and Light Rapid Transit (LRT) has not maximized the use of public transportation in Palembang City because the level of congestion on main roads is increasing.
3. There is a need for an evaluation of the current TOD concept determination so that recommendations for transit areas can be formulated that can maximize the role of BRT and LRT.

1.3 Research question

The formulation of the problem in this study is as follows:

1. What is the current evaluation of TOD's environmental aspects in Palembang City?
2. Environmental factors that influence the determination of the location of Transit Oriented Development (TOD)?
3. Where is the potential location as a Transit Oriented Development (TOD) Area based on Environmental and Planning aspects in Palembang City?

1.4 Research Objectives

In accordance with the background previously described, the objectives of this study are:

1. Knowing what factors are in choosing a location that can determine the Transit Oriented Development (TOD) area in terms of environmental and transport aspects in Palembang City.

2. Determine locations that have the potential to become Transit Oriented Development (TOD) areas in Palembang City.
3. Evaluating the current Transit Oriented Development (TOD) concept in Palembang City.

1.5 Problem Limitation and Scope

The limitations of this research include:

1. The research is only focused on environmental factors and aspects that are influential in determining and developing the current potential of TOD in Palembang City.
2. Research is only focused on areas including; (1) Bumi Sriwijaya, (2) Cinde Market, (3) 16 Ilir Market, and (4) Jakabaring.

Table 1 Outcome Target

No	Type of Outcome	Indicator	
1	Scientific Publication ¹⁾	International	Publish International Journal on "Technical and Physical Problems of Engineering" (IJTPE) – Q4
		National-Accredited	-
2	Invited speaker in scientific forum ²⁾	International	-
		National	-
3	Keynote speaker in scientific forum ³⁾	International	-
		National	-
4	Visiting Lecturer ⁴⁾	International	-
5	Intellectual Property Right ⁵⁾	Patent	-
		Simple Patent	-
		Copy Right	-
		Trade Mark	-
		Trade Secret	-
		Industrial Product Design	-
		Geographical Indication	-
		Plant Variety Conservation	-
6	Intermediate Technology ⁶⁾	Integrated Circuit	-
		Topography Conservation	-
7	Model/Prototype/Design/Art/ Social Engineering ⁷⁾	-	
8	Book (ISBN) ⁸⁾	-	
9	Technological Readiness Level (TRL) ⁹⁾	-	

¹⁾ Fill in with nothing, draft, submitted, reviewed, or *accepted/published*

^{2), 3), 4)} Fill in with nothing, draft, registered, or has been conducted

⁵⁾ Fill in with nothing, draft, registered /*granted*

^{6), 7)} Fill in with nothing, draft, product or application

⁸⁾ Fill in with nothing, draft, *editing process /published*

⁹⁾ Fill in with 1-9 scale refer to

CHAPTER II

LITERATUR REVIEW

2.1 Theory Study

2.1.1 Transit Oriented Development (TOD)

Transit Oriented Development first appeared in the 1990s pioneered by Peter Calthorpe. TOD appears due to the phenomenon of urban sprawl which results in high use of private vehicles and causes congestion (Yuniasih, 2007). According to Taolin (2008) The transit-based area development movement is based on the deteriorating quality of urban life which is characterized by congestion, sprawl, and non-integrated land use. TOD has the goal of creating a comfortable, safe, fine and adequate destination for pedestrians (walkable environment). By mixing the various functions of travel activities that need to be carried out, they can be combined to make it shorter and faster. These functions are the center of commercial areas, offices, retail, services, residential areas with medium to high density and also public open spaces.

The definition of Transit Oriented Development according to Calthorpe in Yuniasih (2007) is: "A mixed-use community within an average 2,000-foot walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car"

Another definition of TOD, (Danbury, 2010):

"Transit-oriented development, or TOD, is a type of community development that includes a mixture of housing, office, retail and/or other commercial development and amenities integrated into a walkable neighborhood and located within a half-mile of quality public transportation"

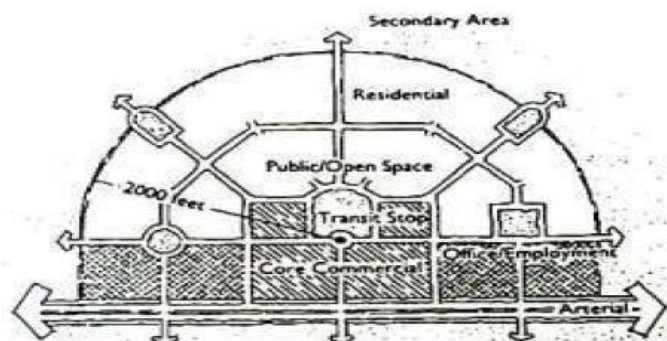


Figure 2.1 Transit-oriented development

The concept of Transit Oriented Development (TOD) offers an alternative towards development patterns by providing working, living, leisure functions in a diverse population, at low to high densities, with a configuration of pedestrian facilities and transit access.

The shape characteristics of this city are characterized by diversity and high density on a local/regional scale, and are connected to other parts of the city by a transit system. The concept of Transit Oriented Development (TOD) begins with the concept of human movement activities, both by mode and by walking. Movement as one of the activities most carried out by humans is accommodated by the placement of activity centers that are integrated with transit points, so that it is expected to encourage the use of public transportation. Activity centers are linked to one another within a comfortable and safe walking distance as an effort to reduce intermodal shifts (Wijaya, 2009).

The concept of Transit Oriented Development in the article Novie, et al (2021) The concept was popularized by Petrus Calthorpe in the 1980s. Transit Oriented Development is defined as a concept that uses a multi-purpose space pattern that encourages people to live close to transit services and reduces dependence on driving. The characteristics of the area built with the general TOD concept are as follows:

1. The development combines residential areas with various socio-economic categories, offices, shops, and commercial housing (apartments/hotels).
2. Ideally built on land owned or under the authority of the agency manage/operate mass transportation services.
3. There are incentives, promotions, encouragement, and even subsidies provided by the management of mass transportation agencies and the (regional) government.

2.1.2 Transit Oriented Oriented Development (TOD) Structure

According to Calthorpe in Yuniasih (2007) the structure of the TOD and the surrounding area is divided into the following areas:

4. Public functions (public uses). Public function areas are needed to provide services for the work environment and settlements within the TOD and the surrounding area. The location is at the closest distance to the transit point, a 5-minute walk.
5. Central commercial area (core commercial area). The existence of a central commercial area is very important in TOD, this area is located within a 5-minute walk. Size and location according to market conditions, proximity to transit points and development stages. Facilities that are generally in the form of retail, offices, supermarkets, restaurants, services and entertainment.

6. Residential area. Residential areas include settlements that are within walking distance of commercial centers and transit points. Residential area density must be in line with the variety of settlement types, including single-family housing, town houses, condominiums and apartments.
7. Secondary area. Each TOD has secondary areas adjacent to it, including areas across areas separated by arterial roads. This area is more than 1 mile from the center of the commercial area. The secondary area network should provide multiple roads/direct access and cycle paths to transit points and commercial areas with minimal disruption by arterial roads. This area has a lower density with the functions of single-family housing, public schools, large community parks, low-intensity office generator functions, and parking areas.
8. Other functions, i.e. functions that depend extensively on motorized vehicles, trucks or very low office intensity outside the TOD area and secondary area.

2.2 Past Research

Table 2.1 Review of Previous Research

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
1	Transit Area Development Priority Palembang Kertapati Station With Concept transit Oriented Development (TOD) (JOURNAL MADANI PLANO) Volume 9 Number 1 April 2020, 64-72)	(Fuady, 2020)	Quantitative : <ul style="list-style-type: none"> • Delphi analysis. • Spatial query analysis. 	This study aims to set development priorities in the transit Area of Kertapati Station with the TOD concept.	The research results obtained the concept of TOD in the transit area of Kertapati Station showing that there are twelve Variables. Development priorities include trade and service land use, office land use pedestrian lane availability public facility land use pedestrian lane connectivity, crossing facility availability, building floor coefficient, pedestrian path dimensions, building density; availability of bicycle lanes, residential land use; And the base coefficient of the building.

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
2	Analysis of Transit Oriented Development Potential on Light Rail Transit Palembang, Simpang Polda Station Area. (JOURNAL MATEC Web of Conferences / 259, 05003 – 2019)	(Fajri, 2019)	Quantitative	This study analyzes the TOD in the Simpang Polda Station area using the measurement of the 'TOD-ness' indicator according to previous research and the TOD standard according to ITDP	By using 8 indicators of new potential, the results of the assessment of the potential application of the TOD concept to the Palembang City LRT Simpang Polda show that this transit area has potential enough for the implementation of the TOD concept by implementing several supporting.
3	Development of Transit Oriented Development (TOD) at Transit Points Light Rail Transit (LRT) route for South Sumatra Province. (JOURNAL SPACE, Volume 4 Number 1, 75-84)	(Gumano & Yudi, 2018)	Quantitative : - AHP Analysis	Developing a TOD development concept based on the typology of the transit point area on the Provincial LRT route South Sumatra	The results showed 3 TOD typologies from 12 transit areas assessed, namely 1 area as City TOD, 6 transit areas as Sub-TOD TOD Cities, and 5 transit areas as Environmental TOD. Transit area which tends to be City TOD needs development and improvement on the principle of density, whereas in transit areas that are the trend as Sub-City TOD needs development and improvement on the principle of demand management.

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
4	Study of Directions and Development Strategies for Transit Oriented Development (Tod) Potential Areas Around the Palembang City LRT Transit Station. (KACAPURI JURNAL, Volume 3 Number 1 June 2020 Edition)	(Gumano, 2020)	Quantitative: - AHP Analysis	Determine the directions for the development of the TOD area and the strategy for realizing the TOD area at 12 Palembang City LRT transit stations	The results of the assessment are the typology of potential City TOD areas (1 area), Sub-City TOD (6 areas) and Environmental TOD (5 areas). The development strategy in realizing the TOD area is: <ol style="list-style-type: none"> 1. Infill Development Site for the TOD ST area. Hajj hostel and ST. Telkom, 2. Redevelopment Site & Infill Development Site for the TOD ST area. Provincial Hospital, ST. Save. Polda, ST. Fever, ST. Palembang Icon, ST. Diskhubkominfo, ST. Cinde Market, ST. Ampera Bridge, ST. Polrestabes. 3. New Growth Area for the TOD ST area. Jakabaaring, ST. OPI Mall.

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
5	Development Strategy for the Transit Oriented Development (TOD) Area in Bekasi City. (JOURNAL 2019, 1 – 15)	(Muwahidin, 2019)	Quantitative : - SPPS.	Road maintenance requires road construction activities that can endanger the safety and comfort of road users.	The results of this analysis indicate that the factor that most influences the safety of road users is the completeness of traffic signs around the road repair area
6	Spatial Model of DKI Jakarta Transit-Oriented Development (TOD) Built Environment. Case Study of the Dukuh Atas DKI Jakarta TOD Area. (Journal Globë Volume 22 No.1 April 2020: 41-50)	(Sodri, 2019)	Qualitative descriptive: - Spatial Analysis	Identify indicators of success of the TOD concept for developing countries and evaluate existing TOD development plans	The results of this study indicate that the Dukuh Atas TOD area has planned pedestrian paths, bicycle paths, mixed land use, and green open spaces. However, the actual condition of the Dukuh Atas TOD area shows that pedestrian paths, bicycle lanes, mixed land use, and green open spaces do not meet the eligibility criteria for the TOD area because they are not as planned.
7	Zero Point Area Arrangement in Manado City Based on Transit Oriented Development (TOD) (Jurnal Sipil Statik Vol.8 No.2 February 2020 (155-166) ISSN: 2337-6732)	(Sodri, 2019)	Quantitative : - Spatial query analysis. - Delphi analysis - AHP analysis	Formulate the criteria for structuring the Zero Point area of Manado city based on TOD and Determine the priority for the development of the Zero Point area of Manado City with the TOD concept.	The results of the AHP analysis of the 3 research indicators, namely Land Use Density (Density), Mixed Land Use (Diversity) and Friendly to Pedestrians (Design). The design indicator (Pedestrian Friendly) gets the first priority value. The results of the analysis of the Design variable are 4 variables that are processed, namely: the first priority is the Transit Station variable with an interest percentage of 50.2%, the second is the disable facility variable with an interest percentage of 22.5%, the third is the shade and shelter variable with a

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
					percentage of interest 19.4%, and the last variable is the availability of bicycle lanes with an interest percentage of 7.9%.
8	Transit Oriented Development (TOD) Based Terminal Sustainability Evaluation, Case Study at Terminal Pal Enam, Banjarmasin City (JOURNAL Indonesian Green Technology, 2016. E-ISSN. 2338-1787.)	(Ridhoni, 2016)	Qualitative : - Multi Criteria Evaluation (MCE)	Conducted an assessment of the application of the TOD concept in the Pal Enam Terminal Area, Banjarmasin City using 8 work variables namely Walk, Cycle, Connect, Transit, Mix, Density, Compact, and Shift.	The results of the assessment show that the Pal Enam Terminal Area of Banjarmasin City has met the TOD standard with the Bronze category. The location of Pal Enam Terminal in Banjarmasin City not only acts as a Strategic Economic Area to accommodate transit needs and intermodal integration but also fulfills expectations as one of the pioneers of implementing the TOD concept.
9	Readiness of Pedestrian Path Accessibility in the Transit Area of Tirtonadi Terminal, Surakarta City Based on the Transit Oriented Development (TOD) Concept. (Village-City JOURNAL Volume 2, Number 1, 2020, 31 - 44)	(Dewi, 2020)	Quantitative : - Scoring and descriptive analysis.	Knowing the accessibility readiness of pedestrian paths in the transit area of Surakarta City based on the TOD Concept.	The results of the scoring calculation show that the level of readiness for each criterion is different and shows that the accessibility of the pedestrian path in the transit area of Tirtonadi Terminal based on the TOD concept is classified as not ready, of the eight readiness criteria, three criteria are classified as not ready, three other criteria are classified as not ready and two criteria are quite ready. Several factors influencing readiness come from the stakeholder and plan aspects.
10	Risk Analysis of Licensing and Land Acquisition on Project Performance of	Novie, Nunung, Bambang	- TOD, Structural Equation Modeling (SEM).	- TOD, Licensing Risk, Land Acquisition Risk, Project Performance,	The Tanjung Barat TOD project is a development that combines residential areas with transportation facilities. traffic jams and Transportation problems

No.	TITLE (JOURNAL / THESIS)	Name of Researcher / Year	METODE	THEME	RESULT
	Transit Oriented Development/ TOD Tanjung Barat (International Journal of Research and Review-Vol.7; Issue:11; November 2020)			Structural Equation Modeling (SEM).	occur because of the high level of community activity from land use that is not accompanied by good access. The research was conducted using Partial Least Square (PLS) which is a variant-based choice of the Structural Equation Modeling (SEM) method. The results of this study are Licensing Risk and Land Acquisition Risk Impacting the Performance Project.

2.3 Research Gap

Based on previous research that has been discussed in the previous sub-chapter, the position of this research will be shown in Table 2.2.

Table 2.2 Research Gap

Peneliti*	Teori							Objek				Analisis Data		
	TPB	HBM	AIDA	T-LOC	Stakeholder	TAM	RDT	Other Variables	Motor cycle	Truk	Passengers'	Cruise	SEM	Multiple Regression
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
This research														

* Information : (1) Wang et al., (2) Ozkan et al., (3) Yuen et al., (4) Brijs et al., (5) Chorlton et al., (6) Payani & Law, (7) Aghamolaei et al., (8) Aghamolaei et al., (9) Rosset al., (10) Ali et al.,

CHAPTER III

RESEARCH GOAL AND BENEFIT

3.1 Research Goal

The objectives of this study are:

1. Knowing what factors are in choosing a location that can determine the Transit Oriented Development (TOD) area in terms of environmental aspects in Palembang City.
2. Determine locations that have the potential to become Transit Oriented Development (TOD) areas in Palembang City.

3.2 BENEFITS

This research is expected to provide benefits for several scopes, including:

1. For the Government
Can assist local governments to make policy decisions in determining Transit Oriented Development (TOD) areas
2. For Academics
Can be a complement to previous studies that have discussed the development of existing transportation in the city of Palembang

3.3 Partner Selection Considerations

As mentioned earlier in Chapter 1 the consideration to choose Dr. Wan Hanna Melini Binti Wan Mohtar as a research partner is because her experts in their fields. She is an expert in sediment transport, environmental hydraulics. She is currently a Senior Lecturer, Department of Civil & Structural Engineering, UKM from 2012 – current. and power electronics. She has authored or coauthored of several papers (over to 100) in journals (ISI/INSPEC or indexed) and international conference proceedings. She is member of several organization. She is H-Index (Google Scholar): 10 Citations (Google Scholar): 552 Citations (SCOPUS): 352.

CHAPTER IV
RESEARCH METOD

4.1 Research Framework

The research flowchart used as a flow chart in this research process can be seen in Figure 4.1 below:

4.1. Flowchart

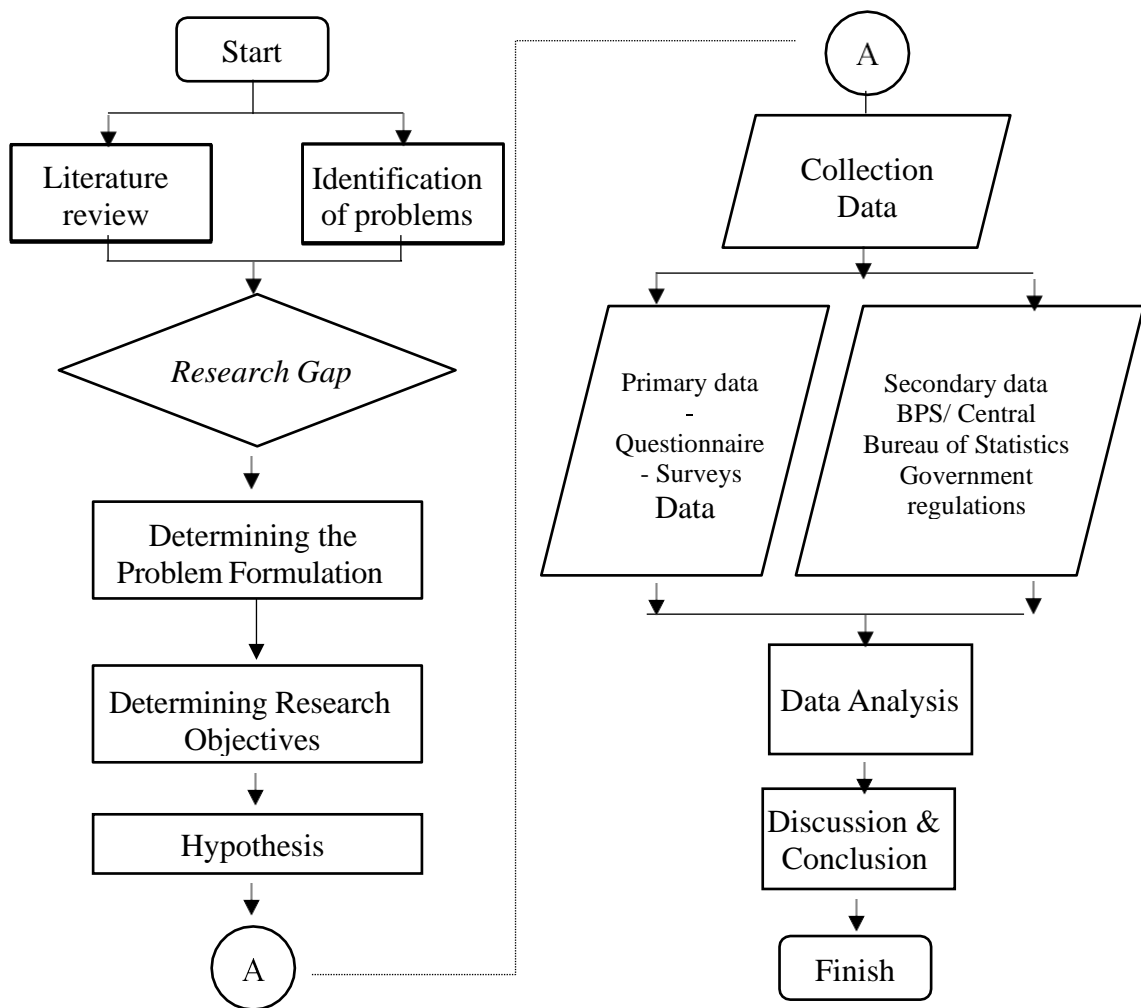


Figure 4.1 Research Flowchart

4.2. Research design

To answer the research questions, a research design was developed that explained the research approach and the stages in the research. In this study using a quantitative research approach. A quantitative approach is used to analyze the determination of Transit Oriented Development (TOD) areas at Light Rail Transit (LRT) stations in Palembang City in terms of environmental aspects using the Analytical Hierarchy Process (AHP) decision-making analysis technique in compiling research discussions.

4.3. Research variable

4.3.1. Variable

The variables used in this research are independent variables and dependent variables. These variables are as follows:

4.3.2. Variable Operational Definitions

The operational definition of a variable is a research element that provides an overview of how to measure a variable (Adi, 2019). The operational definitions of the variables in this study are presented in table 4.1 below.

Table 4.1 Operasional Variabel

Variable	Dimension	Type
Mixed land use (Diversity)	<ul style="list-style-type: none">• Residential land use• Use of office land• Commercial land use• Use of land for public facilities	Primary & Secondary
Density	<ul style="list-style-type: none">• Building Base Coefficient• Building Floor Coefficient• Population• High density of residential buildings	Primary & Secondary
Supporting facilities (Design)	<ul style="list-style-type: none">• Availability of pedestrian paths• Adequate pedestrian width• Comfortable walking distance. Pedestrian yang terkoneksi dengan jalan serta pusat aktivitas local kawasan.• Ketersediaan fasilitas parkir• Kemudahan akses ke angkutan umum	Primary & Secondary

Variable	Dimension	Type
Environment	<ul style="list-style-type: none"> • Physical environment (availability and quality of water, and air quality) • • Biological environment (Vegetation or trees and plants around the area) • • Social environment (Economic conditions or economic characteristics of the surrounding area) 	Primary & Secondary

Source: processed from various sources, 2021

4.4. Data analysis technique

In this study, there are several analytical techniques used and have a relationship between one and another. The selection of analytical techniques in this study was based on the formulation of the problem and the results of the literature review. The analysis technique used in this study is descriptive analysis to evaluate the current application of existing areas in Palembang City. the second analysis technique is the Analytical Hierarchy Process (AHP) to determine what factors are for choosing a location that can determine the Transit Oriented Development (TOD) area at the Light Rail Transit (LRT) Station in terms of environmental aspects in Palembang City.

CHAPTER V

RESEARCH COLLABORATION IMPLEMENTATION

5.1 Research Purpose

Referring to the formulation of the problem, the objectives of this research are;

1. Knowing what factors are in choosing a location that can determine the Transit Oriented Development (TOD) area in terms of environmental aspects in Palembang City.
2. Determine locations that have the potential to become Transit Oriented Development (TOD) areas in Palembang City.
3. Evaluating the current Transit Oriented Development (TOD) concept in Palembang City

5.2 Contribution

This research is expected to provide benefits for several scopes, including:

1. Can assist local governments to make policy decisions in determining Transit Oriented Development (TOD) areas
2. Can be a complement to previous studies that have discussed the development of existing transportation in the city of Palembang
3. Can provide knowledge development and updated information regarding Transit Oriented Development (TOD)

5.3 Partner Selection Collaborations

As mentioned earlier in Chapter 1 the consideration to choose Dr. Wan Hanna Melini Binti Wan Mohtar as a research partner is because her experts in their fields. She is an expert in sediment transport, environmental hydraulics. She is currently a Senior Lecturer, Department of Civil & Structural Engineering, UKM from 2012 – current. and power electronics. She has authored or coauthored of several papers (over to 100) in journals (ISI/INSPEC or indexed) and international conference proceedings. She is member of several organization. She is H-Index (Google Scholar): 10 Citations (Google Scholar): 552 Citations (SCOPUS): 352.

5.4. Implementation

5.4.1. Rights and Responsibilities of Mercu Buana Researcher

Rights:

- a. Mentioned as author in any publication
- b. Use partner's laboratory (ies) by submitting a laboratory usage schedule in advance
- c. Entitled to appoint 50% of the number of freelance workers (research assistant) employed in this study
- d. Get consultation times, requests for approval and briefings related to research
- e. Do calculation needed in the research

Responsibilities:

- a. Coordinate, supervise and provide counseling to all freelance workers (research assistant) who are employed in this study
- b. Arrange research report to Mercu Buana University

5.4.2. Rights and Responsibilities of Universiti Kebangsaan Malaysia Researcher

Rights:

- a. Mentioned as author in any publication
- b. To use partner's laboratory (ies) by submitting a laboratory usage schedule in advance
- c. Entitled to appoint 50% of the number of freelance workers (research assistant) employed in this study
- d. To get consultation times, requests for approval and briefings related to research

Responsibilities:

- a. Coordinate, supervise and provide counseling to all freelance workers (research assistant) who are employed in this study
- b. Make a draft manuscript for publication

After this research, the next research that will be conducted is still in the track of behavior fields. The research that we want is to be learning of the behavior of motorise in Malaysia specialy in Kuala lumpur as well. And we wish to work together in research and teaching in which to expand teaching materials and experience in as advancing as the Magiter of Civil Engineering in particular and advancing science in general.

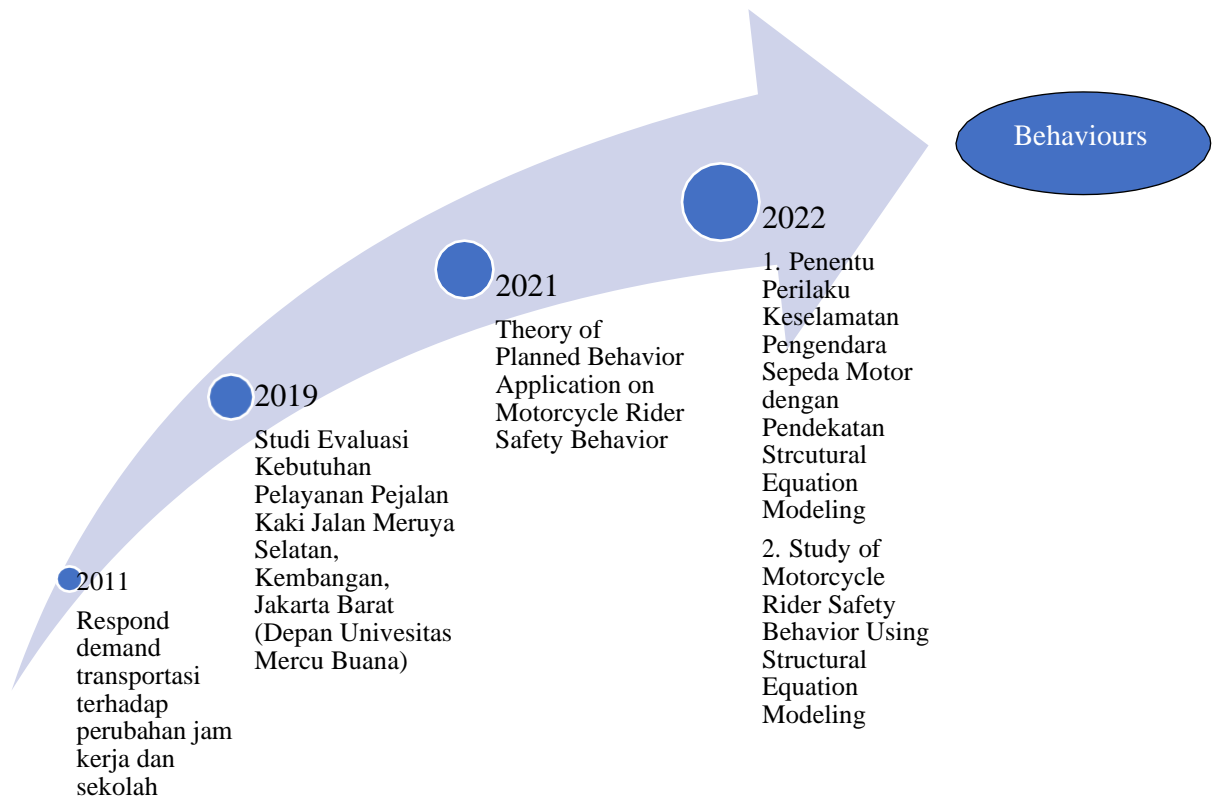
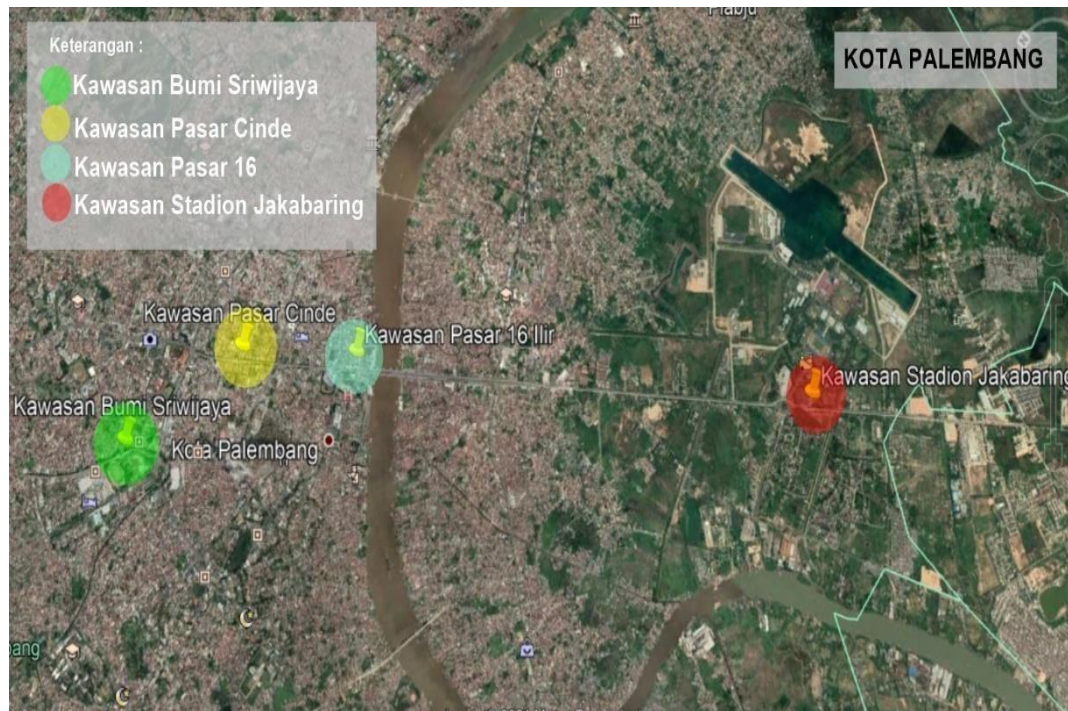


Figure 5.1 Research roadmap of researchers

CHAPTER VI RESULT AND DISCUSSION

6.1. Research sites

The research locations reviewed in this study are the areas marked in the figure below, where the research location points are densely populated areas in the city of Palembang.



Description:

Kota Palembang : Palembang City

Kawasan Pasar Cinde : Pasar Cinde area

Kawasan Bumi Sriwijaya: Bumi Sriwijaya area

Kawasan Pasar 16 Ilir : Pasar 16 Ilir area

Kawasan Stadion Jakabening : Jakabening Stadium area

Figure 6.1 Map of Palembang City

6.2 Regional Data Analysis of TOD Areas in Palembang City

6.2.1. Classic assumption test

6.2.1.1. Normality test

In determining the Transit Oriented Development (TOD) area, there are 8 variables that will greatly determine the determination of the TOD area. Before the test is carried out to answer the hypothesis, a normality test is carried out on each variable, with the following results:

Table 6.1. Normality test

Variable	Sig Value	Sig Limit	Description
Density	0,00	0,05	Linear
Diversity	0,00	0,05	Linear
Design	0,00	0,05	Linear
High Density	0,00	0,05	Linear
Walkable	0,00	0,05	Linear
Parking	0,00	0,05	Linear
Transit	0,00	0,05	Linear

Source: Test Results

Based on table 6.1 above, the results of the linearity test for each variable were obtained with a sig value <0.05 , which means that the data is linear.

6. 2.1.2 Multicollinearity Test

Table 6.2. Multicollinearity Test

Variable	Tolerance	VIF	Description
Density	0,32	3,07	No Indication
Diversity	0,65	1,53	No Indication
Design	0,13	6,74	No Indication
High Density	0,36	2,81	No Indication
Walkable	0,12	8,66	No Indication
Parking	0,27	3,74	No Indication
Transit	0,21	4,78	No Indication
	0,19	5,26	No Indication

Source: Test Results

Description:

VIF : Variance Inflation Factor

Based on table 6.2 above, the results of the multicollinearity test for each variable have a VIF value <10 , meaning that there are no symptoms of multicollinearity.

6.2.1.3. Heteroscedasticity Test

The heteroscedasticity test aims to test whether in the regression model there is an inequality of variance from one residual observation to another. If the variance from the residual from one observation to another observation remains, it is called homoscedasticity and if it is different it is called heteroscedasticity.

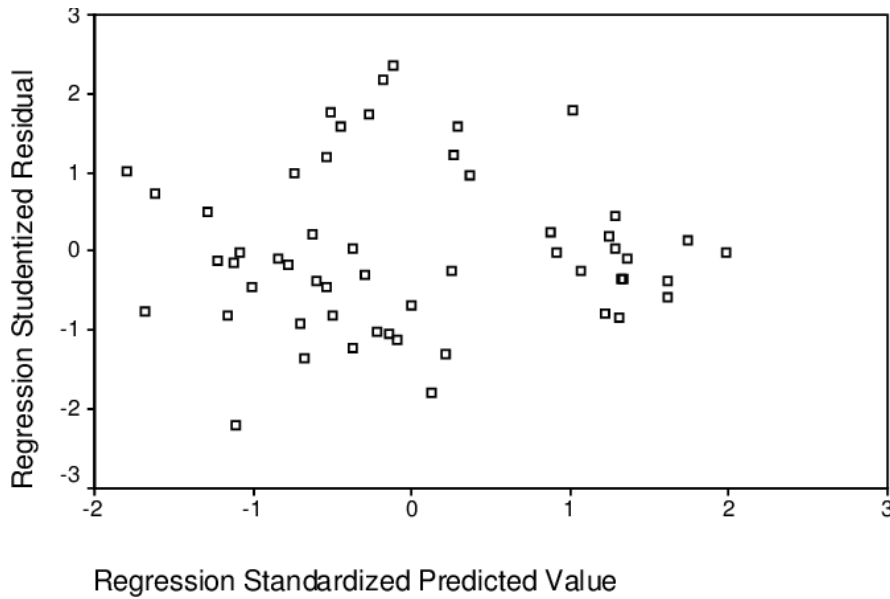


Figure 6.2 Heteroscedasticity Test Using a Scatterplot Dependent Variable

Source: John (2010)

Table 6.3. Heteroscedasticity Test

Variable	Sig Value	Sig Limit	Description
Density	0,60	0,05	No Indication
Diversity	0,05	0,05	No Indication
Design	0,34	0,05	No Indication
High Density	0,08	0,05	No Indication
Walkable	0,59	0,05	No Indication
Parking	0,50	0,05	No Indication
Pedestrian	0,75	0,05	No Indication
Transit	0,32	0,05	No Indication

Based on table 6.3 above, the results of the heteroscedasticity test were obtained for each variable with a sig value > 0.05 , meaning that there were no symptoms of heteroscedasticity.

6.2.1.4. Autocorrelation Test

Table 6.4. Autocorrelation Test

Model Summary ^b		
R	R Square	
0,58 ^a	0,34	
a. Predictors: (Constant), Transit, High Density, Pedestrian, Diversity, Parking, Walkable, Density, Design		
b. Dependent Variable: Surroundings		

Based on table 6.4 above, the Durbin-Watson value is 1,95. Making a decision on this assumption requires two auxiliary values obtained from the Durbin-Watson table, namely dL and dU values, with k=8 and n=113.

Based on the results of the analysis, it can be seen that the DW value of 1,95 is greater than the upper limit (dU) of 1,85 while it is lower than (4-dU) 2,15. Based on the results above it can be seen that $dU < DW < 4 - dU$

6.2.2. Multiple Linear Regression Test

Rever what factors influence choosing a location that can determine Transit Oriented Development (TOD) in terms of environmental aspects in Palembang City, multiple linear regression analysis is used. Based on the results of data processing with the help of the IBM 25.0 program, a summary of the empirical research results can be seen as follows:

Table 6.5 Multiple Linear Regression Test

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant)	6,72	2,80		2,40	0,02
	Density	0,25	0,07	0,31	3,42	0,00
	Diversity	0,23	0,07	0,32	3,50	0,00
	Design	0,25	0,04	0,53	6,60	0,00
	High Density	0,38	0,22	0,16	2,71	0,01
	Walkable	1,00	0,19	0,45	5,26	0,00
	Parking	0,90	0,19	0,41	4,79	0,00
	Pedestrian	1,27	0,22	0,47	5,68	0,00
	Transit	0,78	0,20	0,33	3,72	0,00
a. Dependent Variable: Surroundings						

6.2.1.5. Regression Analysis Results

From table 6.5 above a multiple regression equation can be made as follows:

$$Y = 6.72 + 0.25 X_1 + 0.23 X_2 + 0.25 X_3 + 0.38 X_4 + 1.00 X_5 + 0.90 X_6 + 1.27 X_7 + 0.78 X_8 + e$$

From these equations it can be concluded that:

6.2.2.1 From the multiple linear regression equation model above, it can be seen that the constant value is 6.72, which means that without the influence of the variable density (density), mixed land use (diversity), supporting facilities (design), high area density (high density), pedestrian friendly (walkable), parking (parking), pedestrian (pedestrian), and moving (transit) then the environment has reached 6.72.

6.2.2.2 The regression coefficient of the density variable is 0.25. This means that if the environmental value increases by one unit, the density will increase by 0.25 in each unit. Assuming other variables do not change or are constant.

6.2.2.3 The regression coefficient of mixed land use variable (diversity) is 0.23. This means that if the environmental value increases by one unit, mixed land use (diversity) will increase by 0.23 in each unit. Assuming other variables do not change or are constant.

6.2.2.4 The regression coefficient of the supporting facility (design) variable is 0.25. This means that if the environmental value increases by one unit, the supporting facilities (design) will increase by 0.25 in each unit. Assuming other variables do not change or are constant.

6.2.2.5 The regression coefficient of the high density variable is 0.38. This means that if the environmental value increases by one unit, then the high density area will increase by 0.38 in each unit. Assuming other variables do not change or are constant.

6.2.2.6 The regression coefficient of the walkable variable is 1.00. This means that if the environmental value increases by one unit then walkable will increase by 1.00 in each unit. Assuming other variables do not change or are constant.

6.2.2.7 The regression coefficient of the parking variable is 0.90. This means that if the environmental value increases by one unit then parking will increase by 0.90 in each unit. Assuming other variables do not change or are constant.

6.2.2.8 Pedestrian variable regression coefficient of 1.27. This means that if the environmental value increases by one unit, pedestrians will increase by 1.27 in each unit. Assuming other variables do not change or are constant.

6.2.2.9 The regression coefficient of the transit variable is 0.78. This means that if the

environmental value increases by one unit then transit will increase by 0.78 in each unit. Assuming other variables do not change or are constant.

In testing multiple linear regression is a regression model that involves more than one independent variable. Multiple linear regression analysis was carried out to find out the direction and how much influence the independent variables have on the dependent variable (Ghozali, 2018). The purpose of multiple linear regression analysis is to find out how much influence some of the independent variables have on the dependent variables and can also predict the value of the dependent variable if all the independent variables have known values. In multiple linear regression analysis with many independent variables, problems often arise because of the relationship between two or more independent variables. Independent variables that are correlated with each other are called multicollinearity.

6.2.3. Hypothesis test

6.2.3.1 Test of the Coefficient of Determination (R²)

The coefficient of determination is used to see how much influence the proportion of changes in the overall independent variable (independent variable) has on the dependent variable (dependent variable) in table 7 as follows:

Table 6.6 R² Test

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,58 ^a	0,34	0,29	3,52
a. Predictors: (Constant), Transit, High Density, Pedestrian, Diversity, Parking, Walkable, Density, Design				

From table 6.6 above, it is obtained that R square 0,34 means 34,0% variable density (density), mixed land use (diversity), supporting facilities (design), high area density (high density), pedestrian friendly (walkable) , parking (parking), pedestrians (Pedestrian), and moving (transit) affect the environment and the remaining 66,0% is influenced by other variables outside the research variables.

6.2.3.2. t test

The t statistical test is basically used to see the effect of the independent variables on the dependent variable partially. Where in this study to see the effect of density (density), mixed land use (diversity), supporting facilities (design), high density (high density), pedestrian friendly (walkable), parking (parking), pedestrians (Pedestrian) , and move (transit) with the environment.

Table 6.7 T-Test

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6,72	2,80		2,40	0,02
	Density	0,25	0,07	0,31	3,42	0,00
	Diversity	0,23	0,07	0,32	3,50	0,00
	Design	0,25	0,04	0,53	6,60	0,00
	High Density	0,38	0,22	0,16	2,71	0,01
	Walkable	1,00	0,19	0,45	5,26	0,00
	Parking	0,90	0,19	0,41	4,79	0,00
	Pedestrian	1,27	0,22	0,47	5,68	0,00
	Transit	0,78	0,20	0,33	3,72	0,00
a. Dependent Variable: Surrounding						

From table 6.7 above, it can be seen that the influence of the independent variables that influence the Determination of Transit Oriented Development (TOD) Areas in Palembang City are:

6.2.3.3 Hypothesis 1, there is an influence between density (density) on the environment. Density is obtained with a tcount of 3,42 > ttable of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is an influence between density (density) on the environment.

6.2.3.4 Hypothesis 2, there is an influence between mixed land use (diversity) on the environment. Mixed land use (diversity) was obtained with a tcount of 3,50 > ttable 1,98, meaning that Ha was accepted and H0 was rejected, thus it can be said that there is an influence between mixed land use (diversity) on the environment.

6.2.3.5 Hypothesis 3, there is influence between supporting facilities (design) on the environment. Obtained supporting facilities (design) with a value of tcount 6,60 > t table 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is influence between supporting facilities (design) on the environment.

6.2.3.6 Hypothesis 4, there is an influence between high density areas on the environment. A high density area is obtained with a tcount of 2,71 > ttable of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is an influence between high density areas on the environment.

6.2.3.7 Hypothesis 5, there is an influence between pedestrian-friendliness (walkable) on the

environment. It is obtained that it is walkable with a tcount of 5,26 > t table of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is an influence between walkability on the environment.

6.2.3.8 Hypothesis 6, there is an influence between parking (parking) on the environment. Parking (parking) is obtained with a tcount of 4,79 > ttable of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is an influence between parking (parking) on the environment.

6.2.3.9 Hypothesis 7, there is influence between pedestrians (pedestrians) on the environment. Pedestrians are obtained with a tcount of 5,68 > t table of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is influence between pedestrians (pedestrians) on the environment.

6.2.3.10 Hypothesis 8, there is an influence between moving (transit) to the environment. Transit is obtained with a tcount of 3,72 > t table of 1,98, meaning that Ha is accepted and H0 is rejected, thus it can be said that there is an influence between moving (transit) on the environment.

6.2.3.11 Test F

To see simultaneously the effect of density (density), mixed land use (diversity), supporting facilities (design), high density (high density), pedestrian friendly (walkable), parking (parking), pedestrians (Pedestrian), and moving (transit) to the environment obtained results on the F test by comparing Fcount with Ftable description below;

Table 6.8 F Test Results

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	658,43	8	82,30	6,64	0,00 ^b
	Residual	1288,30	104	12,39		
	Total	1946,73	112			
a. Dependent Variable: Surrounding						
b. Predictors: (Constant), Transit, High Density, Pedestrian, Diversity, Parking, Walkable, Density, Design						

From the results of data processing, it can be seen in table 6.8 above that the value of Fcount > Ftable is 6,64 > 2,10. This means that H₀ is rejected and H_a is accepted. Thus it can be said that density, mixed land use (diversity), supporting facilities (design), high density, pedestrian friendly (walkable), parking), pedestrians (Pedestrian), and moving (transit) together affect the environment.

6.3 Create a Hierarchical

6.3.1 Create a Hierarchical Arrangement

In the hierarchical arrangement for determining Transit Oriented Development (TOD) friends in Palembang City, there are 3 main criteria elements for determining TOD areas in Palembang City. These three criteria are used as elements to determine the TOD area in Palembang City. The areas taken as TOD zoning areas in Palembang City are Bumi Sriwijaya Stadium, Cinde Market, 16 Ilir Market and Jakabaring Stadium

6.3.1 Priority Element Main Criteria

After compiling the hierarchy, determine the priority of the elements by doing pairwise comparisons on the main criteria

Table 6.9 Main criterion Pairwise Comparison Matrix

Criteria	Density	Diversity	Design
Density	1	3	5
Diversity	0,33	1	3
Design	0,2	0,33	1
Total	1,53	4,33	9

(Source: Field survey)

The criteria matrix is obtained from the row item value (a) / the number of each column item.

$$\text{Formula} = (1/1.53) + (0.33/1.53) + (0.2/1.53)$$

$$= 0.65 + 0.21 + 0.13$$

$$= 1$$

This step is continued for rows and columns on the diversity and design criteria.

Table 6. 9 Pairwise Comparison Matrix of Main criteria

6.4 Summary of Results and Discussion

1. In conducting this research to determine areas that have the potential to become Transit Oriented Development (TOD) areas, regression tests and analysis tests of the AHP method have been carried out. The areas to be tested are the Bumi Sriwijaya Stadium, Cinde Market, 16 Ilir Market and Jaka Baring Stadium. Regression tests and the AHP method are used to determine which areas will potentially become Transit Oriented Development (TOD) areas.
2. The normality test is used to see whether the data obtained is normally or not normally distributed. The normality test used in this study is the Kolmogorov-Smirnov test. The minimum significant limit for the normality test is 0.05, so if the significance value is less

than 0.05 then the data is not normal, but if the significant value is large equal to 0.05 then the data is normal. The significant value is taken from the normality test table in the asymp data processing results. Sig (2-tailed).

3. After the normality test was carried out, the researcher conducted a linearity test. The linearity test is used to find out whether the regression model that the researcher uses is correct or not. For decision making from the sig value of the linearity line in the results of data processing. Contrary to the normality test, the maximum significant limit for the linearity test is 0.05. So if the significant value is less than 0.05 then the data is linear, if the significant value is large equal to 0.05 then the data is not linear. In the next test, the multicollinearity test is used to test whether there is a correlation between the independent variables in the regression model. Multicollinearity means that there is a perfect linear relationship between some or all of the variables that describe the regression model. Multicollinearity should not occur in the regression because it will affect the regression results. First, the significance value will be invalid or decreased. Second, the value of the coefficient is contrary to the theory. To make a decision based on the tolerance and VIF values, the conditions are that the tolerance value must be less than 1 and the VIF value must be less than 10.
4. The heteroscedasticity test aims to test whether in the regression model there is an inequality of variance from one residual observation to another. If the variance from the residual from one observation to another observation remains, it is called homoscedasticity and if it is different it is called heteroscedasticity. The heteroscedasticity test used is called the Glejser test. It is hoped that there will be no heteroscedasticity. The decision is made from a significant value that must be equal to 0.05, then there are no symptoms of heteroscedasticity. However, if the significance is less than 0.05, heteroscedasticity occurs.
5. The autocorrelation test is used to find out whether or not there is a correlation or relationship between samples, for example the 1st sample's value is affected by the 2nd sample then the 2nd sample's value is affected by the 3rd sample, that shouldn't happen so our target must be that autocorrelation doesn't occur. It is proven that there is no autocorrelation if the dU value $< DW < 4-dU$, the DW value is in the data processing results in the Durbin Watson column, now while the dU value is obtained from the DW table, there is a separate file there, we can take the value according to the number of variables X (k) and the number of samples (n), with $k=8$ and $n=113$ the value of dU is 1.8468, then calculate the value of $4-dU = 4-1.8468 = 2.1532$, then compare the value of dU , DW , and $4-dU$ it turns out that the value is 1.8468

$<1.952 < 2.1532$, which means that there is no autocorrelation because $dU < DW < 4-dU$ is fulfilled. So the five tests are conditions that must be met before carrying out the multiple linear regression test but if the five tests are fulfilled then the regression test can be continued, but if something is not fulfilled then the regression test cannot be carried out or continued.

6. The regression test aims to see whether or not the influence of the independent variable (independent or also X) on the dependent variable (dependent or also Y), if only 1 is free it is called simple linear regression, if more than 1 is free it is called multiple linear regression. Here the determination of the X and Y variables follows the hypothesis in Chapter III. Variable X is said to have a positive and significant effect if these three conditions are met, 1) the unstandardized coefficients value of variable X is positive (no negative sign), 2) the calculated t value is greater than t table, 3) the significant value is less than 0,05. There are 2 types of influence, namely positive influence and negative influence, if it is negative, the unstandardized coefficients value of variable X has a negative sign, for example -.606 is negative, meaning that .606 means positive. In the attachment to the processed data, the point is read as a comma, if there is no number in front of the point, it is read as 0. The positive effect means that if X increases, Y will also increase, and if X decreases, Y will also decrease, so they are the same. However, if the effect is negative, if X increases, Y will decrease, and if X decreases, Y will increase, so they are opposite.
7. The results of the focused regression analysis present only the coefficient values, while the results of the focused t test present the calculated t values and significant values. The t table value is obtained from a separate table such as the dU table. The t value in the table of results of research data processing is called t arithmetic, the reference or limit is the t table value. The way to find the numbers in the t table is the formula $n-k-1$, n = number of samples, k = only the number of X variables, so look for the value of t table section 104 column 0.025-0.05 so that the t table value is 1.983.
8. The coefficient of determination is used to see what percentage of the influence of all X variables that are examined jointly on Y (environmental) variables, you do this by taking the value of r square multiplied by 100, the result obtained is the percent effect, then the remainder is 100% minus the percent that is the number above and the results obtained are the rest that affect Y, the remainder that is obtained is a variable that is outside of this study
9. the regression test which is carried out lastly is the F test. The F test is known as the Simultaneous Test or Model test/Anova Test, which is a test to see how the influence of all

independent variables together on the dependent variable or to test whether the regression model that we make good/significant or not good/non-significant. This determines where the sig value must be less than 0.05 and the calculated F value must be greater than the F table. (dU values, t table values and table F values have separate tables).

10. 10. After all tests have been fulfilled, only after that can proceed to AHP data processing to be able to get results on area estimates that have the potential to become Transit Oriented Development (TOD) areas. The AHP method is a decision support model developed by Thomas L. Saaty. This decision support model will describe complex multi-factor or multi-criteria problems into a hierarchy, according to Saaty (1993), a hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the objective, followed by the factor level. , criteria, sub criteria, and so on down to the last level of the alternative. With a hierarchy, a complex problem can be broken down into groups which are then arranged into a hierarchical form so that the problem will appear more structured and systematic (Syaifullah, 2010). AHP is often used as a problem solving method compared to other methods for the following reasons:
 - a) Hierarchical structure, as a consequence of the selected criteria, up to the deepest sub-criteria.
 - b) Take into account the validity up to the tolerance limit for inconsistency of various criteria and alternatives chosen by the decision maker.

Taking into account the durability of the sensitivity analysis output decision making.

So from this AHP method it can be concluded that the area that has the potential to become a Transit Oriented Development (TOD) area in Palembang City is Pasar 16 Ilir. Because the area meets the requirements and supporting factors for the TOD area.

11. In making decisions, multiple linear regression analysis was carried out to test which variables influence the determination of Transit Oriented Development (TOD) areas in Palembang City. The use of the AHP analysis method is used to see which factors most influence the determination of the Transit Oriented Development (TOD) area in Palembang City. Thus, the regression test and AHP greatly determine the success of the data taken in the field and based on a Google form survey. When carrying out the regression test whether the existing data is feasible to proceed to the analysis of the AHP test process to make the best decision in determining the Transit Oriented Development (TOD) area in Palembang City.

CHAPTER 7

CONCLUSION AND SUGGESTION

7.1 Conclusion

Based on the results of research on "Analysis of Determination of Transit Oriented Development (TOD) Areas in Palembang City in View of Environmental Aspects", it can be concluded that:

1. Factors that have a positive and significant impact on environmental aspects for choosing a Transit Oriented Development (TOD) location based on the results of Google Form data are density, shared land use (diversity), supporting facilities (design), high area density (high density), pedestrian friendly (walkable), parking (parking), pedestrian (Pedestrian), and moving (transit).
2. The location that has the potential to become a Transit Oriented Development (TOD) area in Palembang City is the Pasar 16 Ilir area (location 3). This area has the highest potential of other areas after processing AHP data on the three main criteria for determining the TOD area in the Bumi Sriwijaya Station area, Cinde Market, Pasar 16 Ilir, Jakabaring Stadium. So that the determination of the area that has the potential to become a Transit Oriented Development (TOD) area in Palembang City is the Pasar 16 Ilir area. This is because Pasar 16 Ilir has the highest presentation obtained after AHP data processing.
3. For the evaluation of the determination of the TOD area in Palembang City, it focuses on three main criteria, namely density, diversity and design. These three main criteria really need realignment in the Pasar 16 Ilir area to be able to make the area a Transit Oriented Development (TOD) partner.

6.2 Suggestions

Based on the implementation process and analysis of this research, the authors have great hopes for future researchers so that this research can greatly assist other researchers in studying the same thing. In the sustainability and implementation of the results of this research the researcher hopes for a number of things including:

1. Evaluation, factors and determination of the area of the TOD area can be used to determine the success of the regional and spatial development of Palembang City as a Transit Oriented Development (TOD) area.

2. This research can be developed using a similar method but with more complex variables for new areas with a more micro-context (importance of urban design) so that future researchers can find things that researchers missed before.
3. With the results of this study, the researcher hopes that the operators and city planners of Palembang City can make this research an evaluation and determine the factors to realize the Transit Oriented Development (TOD) area.

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Nama Dosen : Dr.Ir. Nunung Widyaningsih Pg. Dipl.Eng.,IPM

NIDN 0304015902

Judul Penelitian : Analysis of Determination of Transit Oriented Development (TOD) Area At Light Rail Transit (LRT) Stations In Palembang City

Skema : KLN

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Link Jurnal : <http://www.iotpe.com/ijtpe.html>
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Determination of Oriented Transit Development at Light Rail Transit Stations by The Process Hierarchy Analysis

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Abstract- All big cities in Indonesia are used as economic and trade centers, so that urbanization is inevitable, density is uncontrollable and increasingly threatens the economic, social and environmental impacts. One of them is Palembang City, which is the capital city of South Sumatra. This research discusses the city of Palembang which already has several transit-based transportations such as Bus Rapid Transit (BRT) and Light Rail Transit (LRT) as a solution to overcome existing congestion, the lack of utilization of an integrated transportation system by the community, then buildings that have not been integrated or still require distance and time to move to applies the concept of Transit Oriented Development (TOD).

Method of the Process Hierarchy Analysis (AHP) uses to evaluate and analyze of the determination of Transit Oriented Development (TOD) as areas at Light Rail Transit (LRT) Stations in Palembang City in a Review of Environmental Aspects (4,19).

The results of this research indicate that the area potential to become a Transit Oriented Development (TOD) area is the Pasar 16 Ilir area. This area has the highest potential of other areas after processing the AHP data on the three main criteria for the TOD area designation (19).

Keywords: Indonesia, Light Rail Transit (LRT) Stations, Transit Oriented Development (TOD), Proses Hierarchical Analysis (AHP), Environmental Aspects,

1. INTRODUCTION

Palembang City, which is the capital city of South Sumatra Province, has continued to grow in recent years. The city that has grown into a metropolitan city has a population density of up to 2 million people in 2020. The consequence of continuing migration of residents from areas outside the city of Palembang to work, do business and live in Palembang City has now presented various urban problems such as traffic jams, floods to settlements, seedy (28). By increasing population in the city of Palembang, transportation will be needed, causing an increasing need for transportation facilities and

infrastructure that support human activities in the economic, educational, social, cultural and other fields. As effect on the level of development of urban activities in Palembang City which has caused traffic conditions and requires the need for an integrated urban planning pattern of development between one aspect and another. Currently, the City of Palembang itself already has several transit-based transportations such as Bus Rapid Transit(BRT) and Light Rail Transit (LRT) as solutions to overcome existing congestion. However, in its implementation, until now it has not been able to function optimally in reducing the use of private vehicles (7,5).

Transit Oriented Development (TOD) is a strategy for developing dense areas with mixed land uses consisting of housing, offices, shopping, education, health and other social facilities with a focus on transit stations (bus or trains), (25, 26). The benefits of TOD are reducing the use of private cars, increasing pedestrians and transit users, reviving downtown areas, increasing density and intensity, saving and developing for parking, as well as increasing property values and sharing activities around transit locations, to improve environmental quality and community. On a regional scale, it is hoped that this concept can solve congestion problems in urban areas (7,5,14, 15).

In the discussion of urban mass transportation systems, the concept of the relationship between transit activities and development becomes an interesting discussion in the science of urban planning and design, including the Transit Oriented Development (TOD) or transit-oriented development which has been realized in many cities in Indonesia. world. TOD has been widely recognized as a concept that answers the needs of transit areas (11).

2. STUDY AREA

The City of Palembang already has public transport such a several transit-based transportations as Bus Rapid Transit (BRT) and Light Rail Transit (LRT), however, it has not been able in reducing the use of private vehicles some areas still have congestion.

Some areas still have congestion and have not been able to be minimized. at these locations there are several problem

that are still being faced in the implementation of TOD where the lack of utilization transportation systems that are integrated by the community, then buildings that have not been integrated or still require distance and time to move. These research locations as (1) Bumi Sriwijaya area, (2) Cinde Market area, (3) 16 Ilir Market area, and (4) Jakabaring stadium area. For example, In the Cinde Market area, their daily lives, people not to use mass transportation and still use of private cars, taxis, both regular taxis or online taxis, base ojek or online ojek.

People complain about the distance from the pedestrian bridge to LRT is one of the reasons (5).

The research locations reviewed in this study are the areas marked in the figure below, where the research location points are densely populated areas in the city of Palembang.

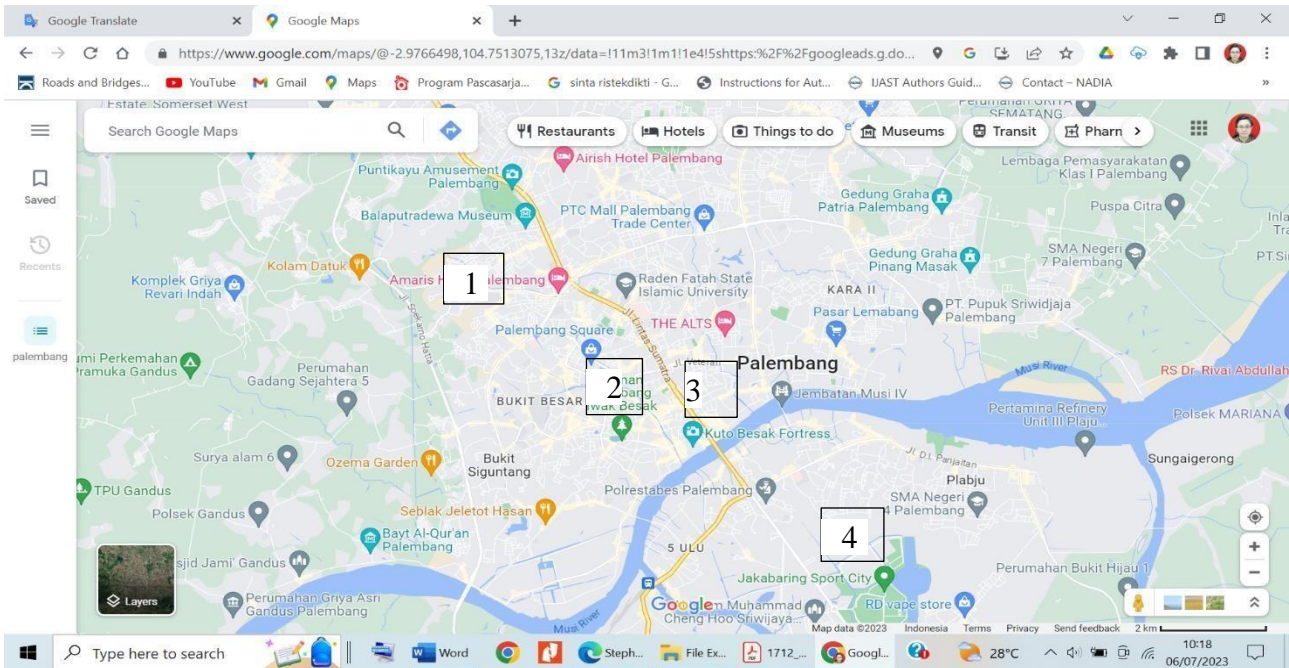


Figure 1. Map of Palembang City (19)

Description:

- Kota Palembang : Palembang City
- Kawasan Pasar Cinde : Cinde Market area (2)
- Kawasan Bumi Sriwijaya: Bumi Sriwijaya area (1)
- Kawasan Pasar 16 Ilir : 16 Ilir Market area (3)
- Kawasan Stadion Jakabaring : Jakabaring Stadium area (4)

3. METHODS

3.1 Research design

In this reseach use a quantitative approach. A quantitative approach is used the AHP decision-making analysis technique by compiling research discussions and to analyze the determination of Transit Oriented Development (TOD) areas at Light Rail Transit (LRT) stations in Palembang City in terms of environmental aspects (7,5)

3.2. Research variable

3.2.1. Variable

The variables of research are independent variables and dependent variables as follows:

Table 1 Operasional Variabel

Variable	Dimension	Type
Mixed land use (Diversity)	<ul style="list-style-type: none"> • Residential land use • Use of office land • Commercial land use • Land use for public facilities 	Primary & Secondary
Density	<ul style="list-style-type: none"> • Koefisien Building Base Coefficient • Building Floor Coefficient • Population • High density of residential buildings 	Primary & Secondary
Supporting facilities (Design)	<ul style="list-style-type: none"> • Availability of pedestrian paths • Adequate pedestrian width • Comfortable walking distance. 	Primary & Secondary

Variable	Dimension	Type
	<ul style="list-style-type: none"> • Pedestrians connected to roads and local activity centers in the area. • Availability of parking facilities • Easy access to public transportation 	
Environment	<ul style="list-style-type: none"> • Physical environment (availability and quality of water, and air quality) • Biological environment (Vegetation or trees and plants around the area) • Social environment (Economic conditions or economic characteristics of the surrounding area) 	Primary & Secondary

Source; processed from various sources, 2021 (19, 13)

3.2.2. Operational Variable Definitions

Operational Definition is a definition given to a variable to give an indicator or specifications about the activities in measuring the variable (Ferdinand, A, 2006).

3.3. Data analysis technique

The analysis technique used in this research is descriptive analysis which is to evaluate the current use of existing areas in Palembang City. The second analysis technique is the Analytical Hierarchy Process (AHP) to determine what factors are for choosing a location at the Light Rail Transit (LRT) Station that can specify the Transit Oriented Development (TOD) area in terms of environmental aspects in Palembang City (4,11,19).

3.3.1. Identify Area Characteristics

In identifying the characteristics of the Palembang City area, descriptive statistical analysis is used. Descriptive statistics only relate to describing or providing information about data or situation. In words, descriptive statistics function to explain conditions, symptoms, or problems. Drawing conclusions on descriptive statistics (if any) is only aimed at the existing data set.

The objects examined for this target are area characteristics which include indicators of mixed land use patterns, density of land use in transit areas and pedestrian friendliness in the Palembang City area (4, 11).

3.3.2. Analyzing the Conformity of Area Characteristics with TOD-Based Area Criteria

To find out which areas are potential TOD that are not suitable and are appropriate in the Palembang City area based on TOD criteria, this Descriptive Statistical analysis technique was chosen to answer target 3 (three) in this study. The process of determining the suitability of the transit area is carried out by tabulating the ideal TOD criteria and existing characteristics that have been obtained in the previous process. From the criteria and characteristics of the transit areas that have been tabulated, then one by one the variables on the existing characteristics are compared with the parameters of the ideal criteria from the TOD concept (4,11).

After obtaining data on the congruence of the being characteristics of the area with the TOD criteria, the next step is to implement an all evaluation of each variable into indicator evaluation (1, 2, 3, 6, 11, 13, 24).

3.3.3. Formulated Directions for Improved Development of Transit Areas Based on the TOD Concept

After answering the three (3) objectives in this study, the results of the analysis of the third objective (3) will be used as input for this objective to formulate directions for increasing the application of the TOD concept in Palembang City by using a descriptive analysis tool. Palembang City based on environmental aspects using the TOD concept approach with research results that have been obtained based on regional suitability and development priorities that should be applied to Palembang City (7, 5).

3.4. Research variable

3.4.1. Variable

The variables used in this research are independent variables and dependent variables.

3.4.2. Variable Operational Definitions

The operational definition of a variable is a research element that provides an overview of how to measure a variable (4,5,7).

4. RESULTS AND DISCUSSIONS

4.1 Result

1. In conducting this research to determine areas that have the potential to become Transit Oriented Development (TOD) areas, regression tests and AHP method analysis tests have been carried out. The areas to be tested are the Bumi Sriwijaya Stadium, Cinde Market, 16 Ilir Market and Jaka Baring Stadium. Regression tests and the AHP method are used to determine which areas will potentially become Transit Oriented Development (TOD) areas. Multiple regression equations are as follows:

$$Y = 6,72 + 0,25 X_1 + 0,23 X_2 + 0,25 X_3 + 0,38 X_4 + 1,00 X_5 + 0,90 X_6 + 1,27 X_7 + 0,78 X_8 + e$$

Where X1 is density, X2 is diversity, X3 is design, X4 is high density, X5 is walkable, X6 is parking, X7 is pedestrian, X8 is transit.

2. The normality test is used to see whether the data obtained is normally distributed or not. The normality test used in this study is the Kolmogorov-Smirnov test. Significant values are taken from the normality test table on the results of asymp data processing with Sig (2-tailed). For each variable it produces a sig value > 0.05, It means that the data distribution is normally distributed.

3. There is no heteroscedasticity. The decision is based on a significant value which must be greater than or equal to 0.05 so that symptoms of heteroscedasticity do not occur (19).

4.2. Discussions

1. The autocorrelation test that It is proven that there is no autocorrelation if the dU value $< DW < 4-dU$, the DW value is in the data processing results in the Durbin Watson column, now while the dU value is obtained from the DW table, there is a separate file there, we can take the value according to the number of variables X (k) and the number of samples (n), with $k=8$ and $n=113$ the value of dU is 1.8468, then calculate the value of $4-dU = 4-1.8468 = 2.1532$, then compare the value of dU , DW , and $4-dU$ it turns out that the value is $1.8468 < 1.952 < 2.1532$, which means that there is no autocorrelation because $dU < DW < 4-dU$ is fulfilled.
2. From the regression test, Variable X is said to have a positive and significant effect if these three conditions are met, 1) the unstandardized coefficients value of variable X is positive (no negative sign), 2) the calculated t value is greater than t table, 3) the significant value is less than 0.05.
3. The results of the regression analysis present only the coefficient values. The t table value is obtained from a separate table such as the dU table. The t value in the table of results of research data processing is called t arithmetic, the reference or limit is the t table value. The way to find the numbers in the t table is the formula $n-k-1$, n = number of samples, k = only the number of X variables, so the t table value is 1.983.
4. The coefficient of determination (R^2) that R square 0.34 or 34.0% variable density, diversity) supporting facilities (design), high density, walkable, parking, pedestrian, and transit affect the environment and the remaining 66.0% is influenced by other variables outside the research variables.
5. The value of $F_{count} > F_{table}$ is $6.64 > 2.10$. This means that H_0 is rejected and H_a is accepted. Thus it can be said that density, diversity, design, high density, walkable, parking, pedestrians and transit together affect the environment.
6. The result of AHP test that it can be evident that the area has the potential to become a Transit Oriented Development (TOD) area in Palembang City is 16 Ilir Market area.

5. CONCLUSIONS

Based on the results of research, it can be concluded that:(19)

1. Factors for choosing a Transit Oriented Development (TOD) location based on the results of Google Form data that impact on environmental aspects are density, diversity, design, high density, walkable, parking, pedestrian, and transit.
2. The possibility of a Transit Oriented Development (TOD) area in Palembang City is the 16 Ilir Market area (location 3).
3. It is three main criteria that is needed realignment in the 16 Ilir Market area to be able to make the area a Transit Oriented Development (TOD), it focuses on density, diversity, and design.

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BIOGRAPHIES



Nunung Widyaningsih was born in 04 January 1959. She received a degree in Civil Engineering from the University of Gadjah Mada in 1987, Postgraduate Diploma Engineering in Institute for Transport Studies in 1995 and the Ph.D degree in Tarumanagara University in

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IMPLEMENTATION ARRANGEMENT

BETWEEN

MASTER OF CIVIL
ENGINEERING OF
UNIVERSITAS MERCU BUANA



AND

FAKULTI TEKNOLOGI KEJURUTERAAN OF
TEKNOLOGI KEJURUTERAAN PENGANGKUTAN

REGARDING

INTERNATIONAL JOINT RESEARCH

Number (First Party) : 01-1-4/IA/RISET/KLN/101/II/2023
Number (Second Party) : 07/123e/MoA/a/2018

I. BACKGROUND

- a. *Memorandum of Understanding (MoU)* between Universitas Mercu Buana (UMB) and - date: -;*
- b. *Memorandum of Agreement (MoA)* between Faculty of Engineering of Universitas Mercu Buana and *Universiti Kebangsaan Malaysia*, No. 07/123e/MoA/a/2018 date: - ;*

**Choose one or both*

II. PURPOSE

- a. Knowing the factors that most influence the safety behavior of motorcyclists
- b. Knowing the structural equation modeling safety behavior on motorcycle riders in

III. SCOPE OF ACTIVITY

Research title : DETERMINATION AT LIGHT RAIL TRANSIT (LRT) STATIONS IN PALEMBANG CITY OF ORIENTED TRANSIT DEVELOPMENT (TOD)

Research Partner (*Institution name*)

**: Universiti
Kebangsaan
Malaysia**

UMB's Principal researcher : **Dr. Ir. Nunung Widyaningsih, Pg. Dipl. Eng**
National ID number : **190590030**

**Member of researcher (min 1
max 2) from UMB** :
National ID number :
Partner's Principal researcher : **Dr. Wan Hanna WM**
National ID number : **K14453**
**Member of researcher (min 1
max 2) from Partnering
institution** :-
National ID number :-
Research Summary
(Maximum 500 words)

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Role of researchers and partner

Journal title that is intended for publication, with authors from UMB and partner

**: Collaborate in research and journals
: IJTPE (Scopus Q3)**

IV. ACTIVITY LOCATION

Location of research : Palembang

V. ACTIVITY TIMELINE

Research duration : 6 months

(not more than 12 months,
please attach the schedule of
the research)

VI. EQUIPMENTS/FACILITIES

Use of facilities:	UMB	Partner
i. Existing facilities	- Lecturer working space - Material of survey	- Lecturer Note
ii. Supplementary facilities	- Laptop - Printer - Wifi connection	

VII. BUDGETING

Planned Total Research Cost :
from UMB and Partners

COST SPECIFICATIONS	TOTAL (RP)	
	UMB	PARTNER
1. Salary and wages (Max. 30%) :	Rp. 4.000.000	
2. Non-durable goods and equipments (30–40%) :	Rp. 4.000.000	
3. Travel (15–25%) :	Rp. 4.000.000	
4. Publications, seminars, reports, others (specify) (Max. 15%) :	Rp. 3.000.000	
5. Others : laboratorium, meeting room, etc (specify) :	Rp.5.000.000	

From UKM Malaysia (Data analysis, discussion, conclusions and recommendations)		Rp. 5.000.000
Sub Total	Rp.20.000.000;	Rp. 5.000.000
GRAND TOTAL (UMB's sub total + Partner's sub total)	Rp.25.000.000;	

VIII. CLOSING

Thus, the implementation of this partnership arrangement was made and will be effective immediately once it is signed.

Jakarta, 3 - August-2023

**Head of Civil Department
Engineering Master
Universitas Mercu Buana**

**Chief/Head of
Departement/Unit
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