

MEASURING THE SUITABILITY INDEX OF TRANSIT ORIENTED  
DEVELOPMENT IN KL SENTRAL STATION AND BANDAR TASEK  
SELATAN STATION

NOOR FARRIS AQMAL BIN KAMARUNZAMAN

A thesis submitted in partial fulfilment of the  
requirements for the award of the degree of  
Master of Science (Transportation Planning)

Faculty of Built Environment and Surveying  
Universiti Teknologi Malaysia

JANUARY 2019

## DEDICATION

*Specially dedicated to my beloved family, To my father, Kamarunzaman Bin Abd Hamid, my mom Tengku Tun Nooraini bt Tengku Senawi, my loving wife, Nurazwani Binti Ahmad and my beloved son, Syawal Amsyar Bin Noor Faris Aqmal. Thanks for being the lovely people that surrounding my life. All of you are giving me inspiration to complete this master program. Thank you for your kindly support and please forgive me for being less in spending time with all of you. Thanks to whom that have direct and indirectly support me in dealing with myself through the hard days, through the hard night and telling me to keep on. To all my sibling, my lecture, my friend, may Allah bless you all.*

## **ACKNOWLEDGEMENT**

All praise and thanks belong to Allah, because giving me strength, willingness, idea, and patience in completing this research. Without His help, I would never finish this research entitled “Measuring the Suitability Index of Transit Orientated Development in KL Sentral Station and Bandar Tasek Selatan Station”.

I would like to dedicate a very special thanks to my supervisor Dr Gobi Krishna A/L Sinniah, for giving me guidance, suggestion and teach me so much in conducting this research from beginning and ending. I also like to express my gratitude to DBKL in helping me to access the research location and the as source of meaningful data for the research.

In the end, thanks to my beloved family, friends and to whom who has contribute their idea and time in completing this research. I dedicated my work in the improvement of transport planning in Malaysia. I hope the small step can lead to a bigger step for a better future.

## **ABSTRACT**

In current modernization, transportation is an important element in development of an area. In creating exciting and rapidly growing trend towards creating vibrant, sustainable communities, the term of Transit Oriented Development has been made. TOD has made the utilization of land and the integration of the transportation on high level. It is to ensure the compact, walkable, pedestrian - oriented, mixed-use communities based on high-quality train systems. This research is conducted to find out the TOD criteria in selected potential location area by using specific research method. Then researcher aim to analyse the suitability of the selected research location under Transit Planning Zone supervised under DBKL using based on the influence of 3D's (Diversity, Density and Design. There are problem in identifying the TOD criteria to measure and standardizing the TOD successfulness. Researcher use the several research methodology techniques in order to obtain data and data processing. The data is analyzed by using GIS mapping technique in analyzing the land use mix diversity characteristics, population density and walkability. Finally, this research aimed to propose future TOD improvement in Bandar Tasek Selatan station and KL Sentral station. Researcher has chosen the research area in Kuala Lumpur Sentral and Bandar Tasek Selatan Station as both stations is under the Kuala Lumpur 2020 Structure Plan that need both location is TOD friendly. TOD help human daily life running smoothly and effectively through the effective integration and cooperation from land use and transport planning. TOD mix together the land use element like, commercial area, resident area, and public structure to have well connection with the logistics. In this research, researcher has already identified the standard and criteria of TOD concept in both research area and determine its suitability. There are no specific guidelines in Kuala Lumpur as the application of TOD concept is still new in here. The present TOD index in KL Central Station and Bandar Tasek Selatan Station will be evaluated and measured in this study. The analysis result shows that Bandar Tasek Selatan achieve three criteria from five TOD criteria and KL Sentral only achieve two criteria from five TOD criteria. This research also necessary to determine which current locations fulfill the TOD concept

## ABSTRAK

Dalam pemodenan semasa, pengangkutan adalah elemen penting dalam pembangunan sesuatu kawasan. Dalam mewujudkan trend yang menarik dan pesat berkembang ke arah mewujudkan masyarakat yang mampan, berkekalan, istilah Pembangunan Berorientasikan Transit telah diperkenalkan. Ia adalah untuk menghasilkan orientasi di antara komuniti yang berorientasikan penggunaan tanah, penggunaan kemudahan pejalan kaki, dan hubungan sistem kereta api yang berkualiti tinggi. Kajian ini dijalankan untuk mengetahui kriteria Pembangunan Berorientasikan Transit di kawasan lokasi berpotensi terpilih dengan menggunakan kaedah penyelidikan tertentu. Kemudian, penyelidikan ini juga bertujuan untuk menganalisis kesesuaian lokasi penyelidikan yang dipilih di bawah Zon Perencanaan Transit yang diawasi di bawah DBKL dengan berdasarkan pengaruh 3D (Kepelbagaian, Kepadatan dan Reka Bentuk 3D). Terdapat juga masalah dalam mengenalipasti kriteria Pembangunan Berorientasikan Transit untuk mengukur dan menyeragamkan keberhasilan sistem tersebut menggunakan beberapa kaedah penyelidikan untuk mendapatkan data dan pemprosesan data. Data-data dari kajian akan dianalisa dengan menggunakan teknik pemetaan (GIS). Penyelidik telah memilih kawasan penyelidikan di Stesen Kuala Lumpur Sentral dan Bandar Tasek Selatan kerana kedua-dua stesen itu berada di bawah Pelan Struktur Kuala Lumpur 2020 dan ia memerlukan integrasi dan kerjasama dari penggunaan tanah dan perancangan pengangkutan. Sistem ini menggunakan elemen penggunaan tanah seperti, kawasan komersial, kawasan perumahan, dan kemudahan awam untuk berhubung baik dengan logistik. Dalam kajian ini, penyelidik telah mengenalipasti kriteria konsep Pembangunan Berorientasikan Transit di kedua-dua bidang penyelidikan dan menentukan kesesuaiannya. Tidak ada panduan khusus berkenaan konsep ini di kawasan kajian kerana ia masih konsep yang baru di sini. Indeks Pembangunan Berorientasikan Transit di Stesen Sentral KL dan Stesen Bandar Tasek Selatan akan dinilai dan diukur dalam kajian ini Hasil analisis menunjukkan Bandar Tasek Selatan mencapai tiga kriteria daripada lima kriteria TOD dan KL Sentral hanya mencapai dua kriteria daripada lima kriteria TOD. Kajian ini juga perlu untuk menentukan lokasi semasa yang memenuhi konsep TOD.

## TABLE OF CONTENTS

	TITLE	PAGE
	<b>DECLARATION</b>	<b>ii</b>
	<b>DEDICATION</b>	<b>iii</b>
	<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
	<b>ABSTRACT</b>	<b>v</b>
	<b>ABSTRAK</b>	<b>vi</b>
	<b>TABLE OF CONTENTS</b>	<b>vii</b>
	<b>LIST OF TABLES</b>	<b>x</b>
	<b>LIST OF FIGURES</b>	<b>xii</b>
	<b>LIST OF ABBREVIATIONS</b>	<b>xiv</b>
	<b>LIST OF SYMBOLS</b>	<b>xv</b>
	<b>LIST OF APPENDICES</b>	<b>xvi</b>
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Background of Study	1
	1.2 Problem Statement	5
	1.3 Study Areas	6
	1.4 Research Aim	10
	1.5 Research Objectives	10
	1.6 Research Question	11
	1.7 Scope of Study	11
	1.8 Significant of Study	11
	1.9 Research Design	12
	1.10 Research Outline	13
	1.11 Summary	13
<b>CHAPTER 2</b>	<b>LITERATURE REVIEW</b>	<b>15</b>
	2.1 Introduction	15
	2.2 Transit Oriented Development in the Context of Sustainable Development	15

2.3	Defining Transit Oriented Development (TOD)	18
2.4	The Concept of Transport Planning and Land Utilization	20
2.5	Element of Transit Orientated Development	22
2.6	TOD Criteria and Characteristic	23
2.7	Fundamental of Transit Orientated Development	26
2.8	The Utilization of Transit Oriented Development	31
2.9	The Assessment of TOD	33
2.10	The Advantages of Transit Orientated Development	35
2.11	KL Sentral and Bandar Tasek Selatan Station Population Density	36
2.12	Summary	38
 <b>CHAPTER 3 RESEARCH METHODOLOGY</b>		<b>39</b>
3.1	Research Design and Procedure	39
3.1.1	Preliminary Study	41
3.1.2	Literature Review	41
3.1.3	Data Collection and Sources	41
3.1.4	GIS Mapping Tools	42
3.1.5	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 400 meters	45
3.1.6	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 800 meters	47
3.1.7	Land Use Analysis of KL Sentral	49
3.1.8	Data Analysis	52
3.2	Summary	56
 <b>CHAPTER 4 RESULT AND FINDING</b>		<b>57</b>
4.1	Introduction	57
4.2	Calculation TOD Index	58
4.2.1	Simpson Diversity Index Analysis	58
4.2.2	Walkability Analysis	61
4.2.3	Population and Housing Density	65
4.2.3.1	KL Sentral Station Population Density	65
4.2.3.2	Bandar Tasek Selatan Station Housing and Population Density	66

4.2.4	Summary of the Analysis Criteria	68
4.3	Summary of Finding	69
<b>CHAPTER 5</b>	<b>RECOMMENDATIONS AND CONCLUSION</b>	<b>73</b>
5.1	Introduction	73
5.2	Objective Achievement	73
5.2.1	Objective 1: To identify criteria TOD in selected potential location	73
5.2.2	Objective 2: To analyze the suitability of the proposed potential location using based on influence of 3D's (Diversity, Density and Design).	74
5.2.3	Objective 3: To propose future TOD improvement in Bandar Tasek Selatan station and KL Sentral station	74
5.3	Recommendation Improvement for KL Sentral Station and Bandar Tasek Selatan Station Based on Transit Oriented Development.	75
5.4	Limitations of Research	80
5.5	Conclusion	81
<b>REFERENCES</b>		<b>83</b>
Appendices A-C		85-92



## LIST OF TABLES

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
Table 1.1	Data Population of Kuala Lumpur 2014-2018	2
Table 1.2	Data Population Labour Force in Kuala Lumpur 2014-2018	3
Table 1.3	Kuala Lumpur Projection Land Use	4
Table 2.1	Gross Land Use Area within the TOD with a Minimum and Maximum Percentage of the Land Use Proponents	28
Table 3.1	Data collection for MapInfo File	43
Table 3.2	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 400 meters	46
Table 3.3	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 400 meters based on TOD criteria	46
Table 3.4	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 800 meter	48
Table 3.5	Bandar Tasek Selatan Land Use Distribution Percentage within 800 Meters Based on TOD Criteria	48
Table 3.6	Land Use Inventory Analysis of Kuala Lumpur Sentral in Radius 400 meter	50
Table 3.7	Land Use Inventory Analysis of Kuala Lumpur Sentral Station in Radius 400 meter Based on TOD criteria	51
Table 3.8	Land Use Inventory Analysis of KL Sentral 800 Meters	51
Table 3.9	Land Use Inventory Analysis of Kuala Lumpur Sentral in Radius 800 meter Based on TOD criteria	52
Table 4.1	Diversity Index Calculation for Bandar Tasek Selatan	59
Table 4.2	Diversity Index for KL Sentral 800 Meters	60
Table 4.3	Comparison walkability analysis between Bandar Tasek Selatan and Kuala Lumpur Sentral	64
Table 4.4	Population and Resident Density (acre) in KL Sentral Statio	66
Table 4.5	The Housing Density and Florida Department of Transportation	66
Table 4.6	The Population Density Suggested by Florida Department of Transportation	66
Table 4.7	The Population Density and Housing Density of Bandar Tasek Selatan	67

Table 4.8	The Housing Density and Florida Department of Transportation.	67
Table 4.9	The Population Density Suggested by Florida Department of Transportation	68
Table 4.10	Summary of the analysis criteria	68
Table 5.1	TOD's Criteria based on 3D	74
Table 5.2	Comparison between Bandar Tasek Selatan between KL Sentral	76

## LIST OF FIGURES

<b>FIGURE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 1.1	Statistics of accident in Malaysia from 2008 to 2017	3
Figure 1.2	Land use of KL Sentral Station area	7
Figure 1.3	Bandar Tasik Selatan Station	8
Figure 1.4	Land use at LRT stations along Kelana Jaya and Ampang Line	9
Figure 2.1	Theoretical Model of Sustainable Development	17
Figure 2.2	Shows the example of transit city	19
Figure 2.3	Illustration of TOD concept	21
Figure 2.4	Mix of Land Use in TOD	27
Figure 2.5	Core Commercial Area and Location	29
Figure 2.6	Housing Combinations an Average Net Density of 18 Dwelling Units per Acre.	30
Figure 2.7	Influence of 3Ds on Travel Behaviour	35
Figure 2.8	KL Sentral Population Density	37
Figure 2.9	Bandar Tasek Selatan Station Residential Density	38
Figure 3.1	Research Operational Framework	40
Figure 3.2	Simpson Diversity Index Formula	44
Figure 3.3	Bandar Tasek Selatan station Radius within 400 meters area	45
Figure 3.4	Land Use Inventory Analysis of Bandar Tasek Selatan in Radius 400 meters	47
Figure 3.5	Land Use Analysis of KL Sentral Station 400 Meters	50
Figure 3.6	The Calculation Formula Walkability Analysis	54
Figure 3.7	Actual Mapped and theoretical area of KL Sentral in Walkability Analysis	55
Figure 3.8	Actual Mapped and theoretical area of Bandar Tasek Selatan in Walkability Analysis	56
Figure 4.1	The Calculation Formula Walkability Analysis	62
Figure 4.2	Walkability Analysis for Bandar Tasek Selatan Terminal	62
Figure 4.3	Walkability Analysis for Kuala Lumpur Terminal	63
Figure 5.1	Walking accessibility	76

Figure 5.2	Walking accessibility for KL Sentral Station	77
Figure 5.3	Land Use Distribution at Bandar Tasek Selatan Station	79

## LIST OF ABBREVIATIONS

TOD	-	Transit Orientated Development
KL	-	Kuala Lumpur
TBS	-	Terminal Bersepadu Selatan
DBKL	-	Dewan Bandaraya Kuala Lumpur
3D	-	Density, Diversity, and Design
PUKL	-	Pengkalan Udara Kuala Lumpur
IUCN	-	International Union for Conservation of Nature
GIS	-	Geographic Information System
KL Sentral	-	Kuala Lumpur Sentral
FDOT	-	Florida Department of Transportation
TPZ	-	Transit Planning Zone
KLIA	-	Kuala Lumpur International Airport
KTM	-	Keretapi Tanah Melayu
LRT	-	Light Rail Transport
MRR2	-	Kuala Lumpur Middle Ring Road Two
LD	-	Land Diversity

## LIST OF SYMBOLS

D	-	Diversity
N	-	The total number of individuals of all land uses
n	-	The number of individuals of all the land uses
Ha	-	Hectare
%	-	Percentage
m	-	Meter
M <sup>2</sup>	-	Meter square
Km	-	Kilometre

## **LIST OF APPENDICES**

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
Appendix A	Academic Interview Application Letter With DBKL	85
Appendix B	Observation in KL Sentral Station	86
Appendix C	Observation in Bandar Tasek Selatan Station	90

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

Living in a hustle and bustle life in the centre of the city is becoming epidemic in the current modern society. Transport planner and town planner cooperate with each other in finding the suitable method in overcome congestion, pollution, and land use utilization. Transit Oriented Development or TOD is the creation of compact, walkable, pedestrian-oriented, mixed-use communities centred on high-quality train systems (Transit Oriented Development Institute USA, 2018). TOD can become a solution to improve all the hectic lifestyle in city and become livelier, healthier lifestyle and enhancing the green environment.

TOD is the best perfect idea to improve the life everyday especially in urban city where development is uncontrollable causing people to solely depend on private vehicles, because of the inefficiency of public transportation. In achieving a develop country, the number of dependency in private vehicle need to be reduce. A system that integrate all connection is being clearly determined by TOD. Moreover with TOD, vibrant, live able and sustainable communities can be created.

The benefits of TOD are as follows:

- i. Improve the accessibility of public service vehicles.
- ii. Encourage the people in community more healthy such as walking or biking.
- iii. Reduce the use of private vehicles and beyond reduce traffic congestion and air pollution
- iv. Improve the economy of the country through more organized business activities and wider job opportunities



- v. Improve the quality of life of the community in planning early on for daily activities.(ITDP, 2017)

By following KL structure plan 2020, DBKL already consider TOD as the solution of the current traffic and population density. TOD can minimize people depending on private vehicle because TOD planning is one tool model design more friendly in urban development. Less dependencies on private vehicle can reduce the numbers of vehicle on the road, and reduce the carbon dioxide emission. This action will promote the Green concept of a lifestyle.

Not only that, Kuala Lumpur also needed the TOD because of the rapid population and labour force growth. Based on (DOSM, 2018) there has been an increase in the population of the Kuala Lumpur from 1.74 million in 2014 to 1.80 million in 2018. The data population in Kuala Lumpur is also increase from 2014 to 2018. The increasing of population around Kuala Lumpur also lead to the increasing the number of private vehicle, increase accident rate and contribute to air pollution. For more information can refer to table 1.1 shows the data population in Kuala Lumpur.

Table 1.1 Data Population of Kuala Lumpur 2014-2018 (DOSM, 2018)

Year	2014	2015	2016	2017	2018
Population(million)	1.74	1.78	1.79	1.79	1.80

All the development in Kuala Lumpur contributed to this rapid population and labour force growth. For example, the Bandar Malaysia Project in Sungai Besi will encourage population growth of workers from local and also foreigner. In addition, Bandar Malaysia is a 197-hectare development project in Kuala Lumpur, to be developed at the Pengkalan Udara Kuala Lumpur (PUKL) at Sungai Besi, 7km from the city centre. Moreover, these project which is expected to finish between 15 and 25 years will open up 220,000 jobs (Adam, 2017). Table 1.2 show the data population labour force from years 2014 to 2018.

Table 1.2 Data Population Labour Force in Kuala Lumpur 2014-2018 (DOSM, 2018)

Employment	2014	2015	2016	2017
Labour Force (000)	877.0	882.6	855.4	8.67.9
Employed ('000)	852.0	853.4	827.2	840.9
Unemployment ('000)	25.0	29.1	28.1	27.0

Based on this whole population and labour growth, car ownership and congestion have a chain effect due to the multiplication of the number of vehicles in Kuala Lumpur. Private vehicle ownership is estimated to grow by an average of three million vehicles in and out of the capital, with 58 percent cars and 27 percent motorcycles (Hamid, 2016). This research only selected a station terminal in Kuala Lumpur, for more information can refer figure 1.1 that show Kuala Lumpur maps boundary.

NEGERI State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PERLIS	1,417	1,633	1,548	1,791	1,881	1,895	1,888	1,861	2,062	1,925
KEDAH	16,520	17,701	17,966	19,639	19,935	20,228	20,159	22,016	23,200	23,262
PULAU PINANG	94,049	93,718	94,306	97,158	97,851	99,361	98,747	99,956	102,244	103,007
PERAK	90,539	92,327	92,072	93,506	94,714	95,408	95,131	96,736	98,531	98,587
SELANGOR	100,380	107,429	115,565	128,876	129,106	135,024	137,809	140,957	151,253	154,958
W.P. KUALA LUMPUR	48,671	51,942	53,493	58,785	61,872	64,527	63,535	64,664	68,866	72,940
NEGERI SEMBILAN	17,362	18,368	19,407	21,157	22,146	23,066	23,748	22,939	24,428	24,941
MELAKA	12,106	13,275	14,110	14,720	15,195	16,083	16,375	17,069	18,601	18,771
JOHOR	48,667	51,747	55,381	59,501	62,316	64,600	64,473	67,112	73,116	76,121
PAHANG	15,629	17,068	17,315	18,001	20,554	20,130	19,071	19,535	20,485	20,813
KELANTAN	8,942	9,549	9,707	9,603	9,958	9,748	10,326	9,960	10,544	10,786
TERENGGANU	8,914	10,118	10,106	10,684	10,861	10,996	9,383	10,381	10,793	10,713
SABAH	14,588	15,798	16,192	16,585	17,446	17,438	17,858	17,290	17,298	17,244
SARAWAK	15,468	16,655	17,253	17,964	18,578	18,700	17,693	19,130	20,065	19,807
<b>JUMLAH Total</b>	<b>373,071</b>	<b>397,330</b>	<b>414,421</b>	<b>449,040</b>	<b>462,423</b>	<b>477,204</b>	<b>476,186</b>	<b>489,606</b>	<b>521,466</b>	<b>533,875</b>

Figure 1.1 Statistics of accident in Malaysia from 2008 to 2017 (Ministry of Transport Malaysia, 2017)

According to Ministry of Transport Malaysia, the number of accident's case that occur in Kuala Lumpur increase from 2008 which the case is 48,671 to 72,941 in 2017. In this situation, the rising number of accidents is due the increasing number of vehicle in Kuala Lumpur.(Ministry of Transport Malaysia, 2017). Figure 1.2 show the statistics of accident in Malaysia from year 2008 to 2017

Since the number of vehicle keep increase, this will force the government to allocate more land for road network built areas. According to Kuala Lumpur structure plan 2020, in 2000, the government has use 20% of land for road network. In this, it takes 4789 hectare of built up areas which bearing the cost of RM 240 billion. However, this cost did not covered the road development. Table 1.3 Show the Kuala Lumpur projection land use for transportation.

Table 1.3 Kuala Lumpur Projection Land Use

<b>Land Use Categories</b>	<b>Hectares</b>	<b>%</b>
Infrastructure	5,029.62	20.77
Road Reserve	4,798.80	19.81
Rail Reserve	104.79	4.33
Terminal	126.03	0.52
Utility	1,146.94	4.73

However, the increasing number of vehicles will cause more urban sprawl. If there is no action taken, the number of accident's case that occur in Kuala Lumpur increase from 2008 which the case is 48,671 to 72,941 in year 2017. In this situation, the rising number of accidents is due the increasing number of vehicle in Kuala Lumpur.(Ministry of Transport Malaysia, 2017)

Not only greenhouse gas emissions, with the escalating number of cars, it means decreasing in fossil fuels reserve, so not only subsidy and fuel prices will be the issue in the future, but also an economic downturn.

In order to achieve sustainable and international city by 2020, some actions must be taken, TOD is a perfect measure to apply in big cities like Kuala Lumpur.

## 1.2 Problem Statement

Kuala Lumpur is one of the fast developing cities in Malaysia. The fast pace of KL development has create problem for current traffic and high population density. TOD is a concept that seems to overcome the traffic problem that arises. KL indeed, should implement the TOD due of the rapid population and labour force growth. Based on Department of Statistics Malaysia there has been an increase in the population of the Kuala Lumpur from 1.74 million in 2014 to 1.80 million in 2018. (DOSM, 2018). The increment of population in the area lead to urban sprawl and some action need to be taken in order to be the modern and sustainable city.

According to DBKL Town Planning, another problem that arise is that even though the areas has been develop by TOD system, there still challenges occur in meeting all of the TOD criteria. However, the DBKL planning authority still lacks standard and measurement for its success. According to DBKL Town Planning Department, Transit Planning Zone (TPZ) regarding the KL Structure plan is improve the land utilization by applying TOD in high density area. In spite of this, the planning for TOD in Malaysia is still not clear and causing the unprogressively achievement. DBKL has problem to measure criteria TOD for public transit in Kuala Lumpur. Moreover, DBKL still find solution to attract more people to use the transit station,. The impact of people do not use the public transport will cause another problem in the future. The TOD concept in context of Malaysia is still new and there is no specific guideline for it.

TOD criteria in research area is still not clear. It is important to determine those criteria in order to make the improvement for TOD implementation in designated area. This study will evaluate and measure the current TOD index in KL Sentral Station and Bandar Tasek Selatan Station. It is also to determine which current locations lands are comply with TOD concept. This research will enlighten which area that had a low TOD and need policy for improvement and areas that have high TOD should pursue the development. If the TOD index is planned efficiently, a city can achieve the sustainable development in term of urban vehicle mobility. The concept of TOD is a concept that has a safe city leads to a high quality living environment.

### 1.3 Study Areas

In conducting a study about TOD, researcher need to choose the right place which have a suitable criteria for TOD application. The area should have a proper mixture of land use, transportation linkage, commercial value, and residential area. The study areas for this research are KL Sentral station and Bandar Tasik Selatan station. KL Sentral development in Brickfields, Kuala Lumpur is one of the promising developing areas in Kuala Lumpur (Kaur, 2018)

Kuala Lumpur Sentral Station is located in brickfield area (DBKL, 2018). Brickfields is one of major access points into and out of the city and can be accessed by Rapid KL buses, KL Monorail, KTM Commuter, and Express Rail Link via KL Sentral. KL Sentral is an exclusive urban centre built in Malaysia as the largest transit hub. Moreover, KL Sentral consist of residence, office blocks, hotels, shopping malls, international exhibition and also entertainment outlets.

KL Sentral station being the integrated of road ways for cities in Kuala Lumpur, such as Bangsar, Ampang, Petaling Jaya and Kuala Lumpur city centre. According to KL structure plan 2020, KL Sentral is a place that include in the transport planning in the current city program project. Transport planning and town planner need to have proper working integration in finding the best connection between the two parties.

Moreover, KL Sentral station in Brickfields, Kuala Lumpur today has become exclusive urban centre built in Malaysia as the largest transit hub and highly developing residential area. The rapid development of commercial areas in brickfields such as Pos Malaysia Brickfields, Nu Sentral, Menara Vista and other than that are projected the importance of having TOD. The population growth in brickfields is also increase where not only local resident lives in brickfields, but also migrant due to blooming job opportunities.

In Malaysia, KL Sentral Station is the largest transit hub, the integrated Kuala Lumpur rail transport centre, offering global connectivity and connecting all residential, commercial and industrial areas of the city and intercity.

This station integrates the International Airport of Kuala Lumpur, the city of Malaysia (Putrajaya) and Cyberjaya. KL Sentral also has public transport links that make the transportation there more effective, such as taxis, buses and trains. For more information can refer to figure 1.3 that show the land use of KL Sentral Station in Kuala Lumpur area.

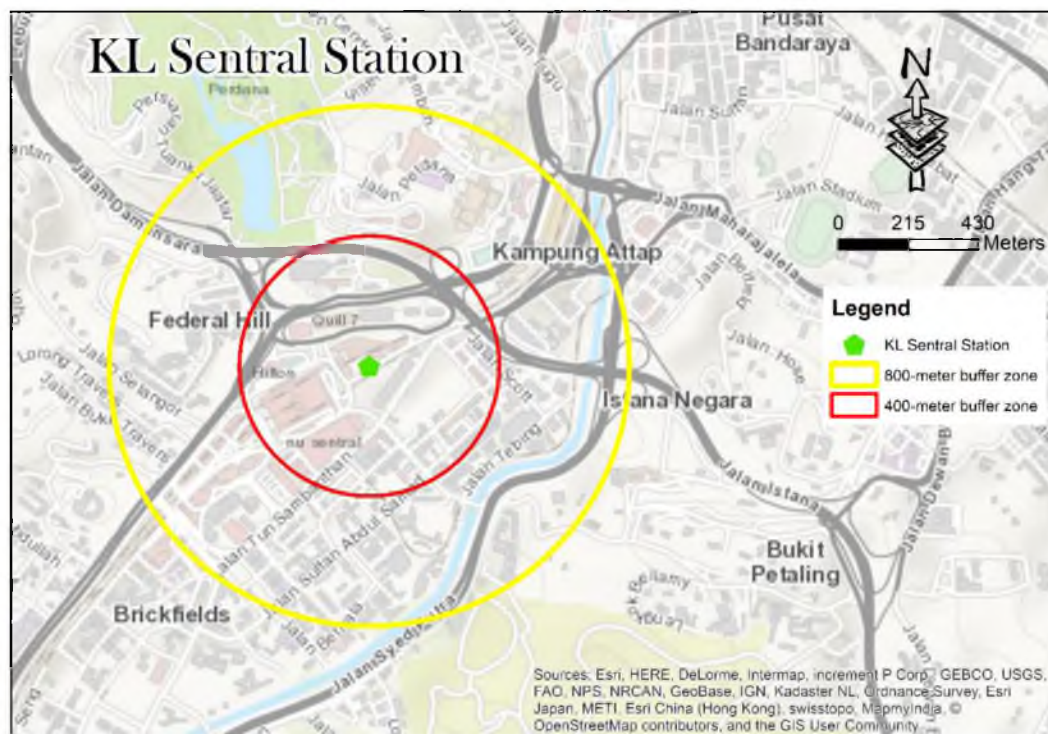


Figure 1.2 Land use of KL Sentral Station area (Source: Esri,Here Maps, 2018)

The second areas are Bandar Tasik Selatan is a suburb of DBKL. Due to the growth of Kuala Lumpur economic development, this area had emerged as a part of the new growth corridor of Kuala Lumpur. Moreover, Bandar Tasik Selatan is the headquarters of the Malaysia Tekun National Office and a home to the Mentari College university campus.

According to KL Structure Plan (KL Structure Plan, 2018), the key economic of Bandar Tasik Selatan is concentrated on its commercial sector. Now, Bandar Tasik Selatan terminal station of Kuala Lumpur is the landmark of Bandar Tasik Selatan. It becomes a public transport terminal received millions of visitor from all states of Malaysia and also from international tourist.

In addition, Bandar Tasik Selatan station is an interchange station located on the outskirts of the capital, Kuala Lumpur. The station serves as both a stop and interchange for KLIA Transit, KTM Commuter, Ampang Line LRT and Rapid KL buses. The station is accessible via the Kuala Lumpur Middle Ring Road (MRR2) from the southeast and indirectly, the Sungai Besi Expressway from the west peninsular Malaysia (DBKL, 2018).



Figure 1.3 Bandar Tasik Selatan Station (Source: Esri,Here Maps, 2018)

Bandar Tasik Selatan resident area condition is surrounded by quite numbers of residential areas such as Tasik height apartment, Bandar Tasik Selatan low cost apartment and also Lake Village for Malaysian Royal Police resident, making it one of the many places in Bandar Tasik Selatan that comes to mind when planning TOD.

This station actually provide the problem that is suitable to be fixed by TOD implementation. Figure 1.3 shows the land use of Bandar Tasik Selatan Station area, while land use at LRT stations along Kelana Jaya and Ampang line is shown in figure 1.4.

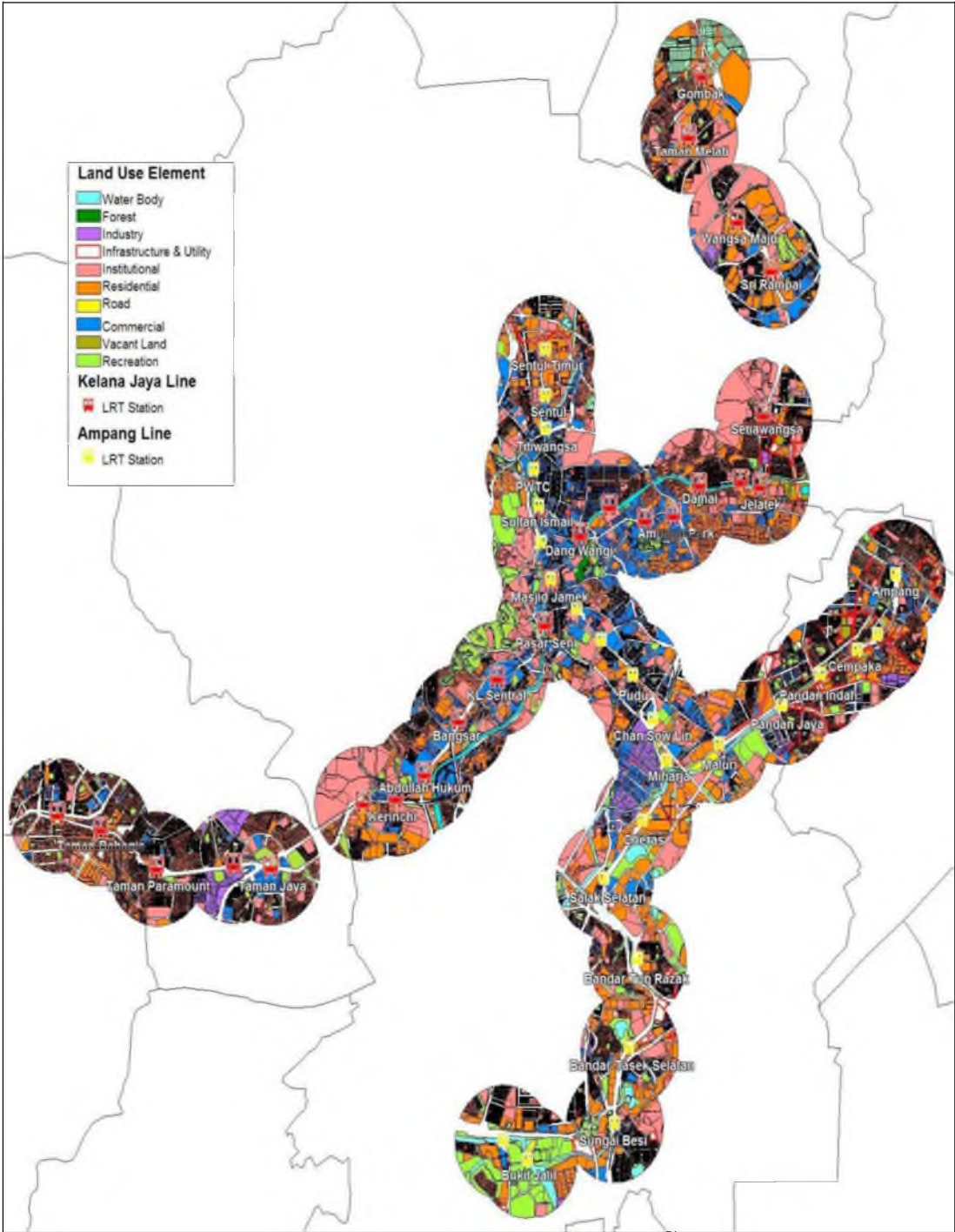


Figure 1.4 Land use at LRT stations along Kelana Jaya and Ampang Line (Source: Zulkifli, 2016)



Both research area is selected as it characteristic that is suitable in conducting research about TOD. Both areas also under the implementation of TOD by the authorities. The land complexity of land use, transportation and population are the critical selection criteria in TOD application in both research area. Both areas have congestion problem, high density of human population, and high accessibility of public transport.

Major factor that contribute researcher to study TOD criteria in both research location is site observation. Observations on site are some of the most effective ways for the analyst to personally visit the site and learn the system's functioning. Researcher has undergone site observation in determine the density and the commercial value of research area. This data is very valuable because it is not prejudiced and was taken straight by the researcher. Researcher found in KL Structure Plan 2020, that KL Sentral and Bandar Tasek Selatan Station is the only urban area that applying the concept of TOD. In this research, the study is focus more on urban TOD.

#### **1.4 Research Aim**

The aim of this studies is to raise people awareness about something previously unknown by utilizing the information that outcome from this research for better planning in the future and provide the measurement to assess the TOD area in Kuala Lumpur by use the current land use distribution of selected area in Kuala Lumpur by refer to land use characteristics, density, and design will be tested based on criteria while, the finding on result will shows in the end of research.

#### **1.5 Research Objectives**

To achieve the objective, there are three (3) main objectives have been outlined in this study. Some of the input and findings can be discovered from the study.

- i. To identify criteria TOD in selected potential location area
- ii. To analyse the suitability of the propose potential location using based on influence of 3D's (Diversity, Density and Design)
- iii. To propose future TOD improvement in Bandar Tasek Selatan station and KL Sentral station

## **1.6 Research Question**

There are three questions identified to achieve the objectives outlined

- i. What is the standard and criteria of TOD?
- ii. Which location is suitable for TOD Concept 3D's (Diversity, Density and Design) between the TOD area
- iii. What are improvements needed in TOD selected area.

## **1.7 Scope of Study**

The study will focus on the following aspect:

- i. The study area only in Kuala Lumpur area.
- ii. The study will be based on secondary data on the existing land use plan of Kuala Lumpur
- iii. The study will assess on current land use selected area based on TOD standard and criteria

## **1.8 Significant of Study**

The study is aimed to determine the Transit Oriented Development in KL Sentral and Bandar Tasek Selatan. TOD in particular area will be study and analyse to provide useful data. Researcher find out the standard and criteria of TOD applied in

both designated areas. The significant of the study are, this research provide the information for TOD concept that applied by KL Sentral and Bandar Tasek Selatan Station. This information may be a useful source of future transport and urban planning in both particular areas. Local government can plan to do the improvement to ensure the TOD in the area achieve global standard and also applying the environmentally friendly measure. User also get the benefit if the transport planning integrates well with land use as people get the efficient transport service, well develop settlement and pollution reduction.

## **1.9 Research Design**

There are four steps in conducting this research,

### **a. Determining the issue of the research**

Researcher need to formulate the research issues, objective and research hypothesis in order to develop the research guideline.

### **b. Literature review**

Researcher has gained most of research information from reading material that made the research literature review. By reviewing and analysing reading materials such as, past research, journal, thesis, report and books will lead to research data collection. Researcher has found the literature review regarding the TOD.

### **c. Collecting data and analysis**

There are two sources of data. There are primary data and secondary data. Primary data come from observation on the research site and through interview. For secondary data, the sources are come through reading material. Researcher will study the land proposition that use by developer align with the transportation planning.

#### **d. Research findings**

Research finding will be explained at the end of the study. The finding and conclusion will be formulated regarding the analysis of the data to achieve the research objective. Researcher also determines the recommendation for improvement of transport planning and land utilization in future.

### **1.10 Research Outline**

There are five chapters in completing the research. First is Chapter 1, the Introduction. In chapter 1, research will explain the underlying background of the research, problem statement, scope of study and clarify the research objective. Second chapter, Chapter 2, Literature Review. Report, journal, article will be reviewed in this chapter. The reading material is related to the research background, the TOD and the land utilization. While in Chapter 3, the Research Methodology, researcher explained about the method that research use in order to collect data, data processing and displaying the finding. Next is Chapter 4 which is Analysis and Finding. In Chapter 4, it provided the research finding and analysis. The result of the data analysis is show by mapping, sketches, graphics, and table. Researcher has test the data by appropriate research tool. Last chapter is Chapter 5, Recommendation. Recommendation from this chapter is made through the analysis that already done from previous chapter. Researcher suggests the recommendation for future improvement. In this chapter, researcher stated the objectives that have been achieved.

### **1.11 Summary**

For this chapters, researcher has provided clear understanding about the background of the study, set on problems statement, purposing of the study, identifying objectives of the study, questioning of the research, determining significance of the study and also explain scope of the research study. All relevant information regarding this research has been clearly explained.

## REFERENCES

- Adams, W. (2006). The Future of Sustainability Re-thinking Environment and Development in the Twenty-first Century. *Report of the IUCN Renowned Thinkers Meeting*.
- Calthorpe, P. (1993). *The Next American Metropolis: Ecology, Community, and the American Dream*. New York: Princeton Architectural Press.
- Cervero, R. (1989). *America's Suburban Centers: The Land Use-transportation Link*. Unwin-Hyman: Boston.
- Cervero, R. a. (1996). Travel Choices in Pedestrian Versus Automobile Oriented Neighborhoods . *Transport Policy*.
- Cervero, R. a. (1997). Travel Demand and The 3Ds: Density, Diversity, and Design. *Transportation Research Part D: Transport and Environment*.
- Chris Hale, P. C. (2007). A Step-by-Step Approach to Transit Oriented Development Project Delivery. *The 11th World Conference on Transport Research University of California, Berkeley*. Berkeley.
- Ditmar, H. a. (2003). *The New Transit Town: Best Practices in Transit-Oriented development: 1st (First) Edition*. Island Press.
- Ditmar, H. O. (2004). *The New Transit Town: Best Practices in Transit-Oriented Development*. Washington: Island Press.
- Handy, S. (1993). *Regional Versus Local Accessibility: Implication for Nonwork Travel*. California: University of California Transportation Centre.
- John Niles, D. N. (1999). Measuring the Success of Transit-Oriented Development Retail Market Dynamics and Other Key Determinants. *National Planning Conference*. Seattle, Washington.
- Kenworthy, P. W. (1996). The land use-transport connection . *Land Use Policy*.
- PLANMalaysia. (2018). *Perancangan Pembangunan Berorientasikan Transit*.
- Seoul Development Institute. (2005). *Toward Better Public Transport*. Seoul: Seoul Metropolitan Government
- Todd, W. R. (2006). *PATCO Transit-Oriented Development Master Plans Study*. The Delaware River Port Authority and The Port Authority Transit Corporation.

- Wells, J. S. (2003). *Transit Villages in New Jersey: Recommendations for Assessment and Accountability*. New Brunswick, New Jersey, Rutgers University: Alan M. Voorhees Transportation Center,.
- Calthorpe. (1993). City of San Diego Land Guidance System: Transit-Oriented Development Design Guidelines. *Planning Department Office of The City Architect, San Diego, California, No.R-28048*.
- DBKL. (2018). KL Development Control plan ,Volume 2 part 1. *Kuala Lumpur : Dewan Bandaraya Kuala Lumpur,.*
- Fard, P. (2013). Measuring Transit Oriented Development: Implementing a GIS-based analytical tool for measuring existing TOD levels. *University of Twente Faculty of Geo-Information and Earth Observation, 62*.
- Ministry of Transport Malaysia. (2017). Statistik pengangkutan Malaysia 2012. *Kementerian Pengangkutan Malaysia, 1–117*.
- Mohamad Zulkifli, S. N. A., Kadar Hamsa, A. A., Noor, N. M., & Ibrahim, M. (2016). Evaluation of land use density, diversity and ridership of Rail Based Public Transportation System. *Transportation Research Procedia, 25(2016), 5266–5281*. <https://doi.org/10.1016/j.trpro.2018.02.053>
- Newman. (1996). The land use-transport connection: An overview. *Land Use Policy, 13(1), 1–22*.
- Peter Calthorpe. (1993). The Next American Metropolis: Ecology, Community, and the American Dream. *Princeton Architectural Press, 175*. [https://doi.org/loc?not in merlin](https://doi.org/loc?not_in_merlin)
- Stevens, R. D. (2005). Walkability Around Neighborhood Parks: An Assessment Of Four Parks In Springfield, Oregon, (June), 70.