

THE KUALA LUMPUR EFFECT OF SPATIAL HETEROGENEITY ON  
PASSENGER RIDERSHIP OF URBAN RAIL SYSTEM

LI XIANGYU

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## **DEDICATION**

This project report is dedicated to my parents. Although there are many difficulties in the process of writing the proposal, my parents have always supported me and encouraged me.

## **ACKNOWLEDGEMENT**

This project report was completed based on reading a large number of documents, and I would also like to thank relevant scholars for their help in this project report.

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## ABSTRACT

The urban rail system is most significant for urban transport due to its faster, dedicated lane and mass capacity feature etc. Many countries or cities devout build it to relieve urban transport pressure. Whereas it is not every city could gain the expected outcome as they want after completing because of complication impacting factors. Furthermore, the gran investing could not be ignored. As well as the box-revenue also should be mentioned due to it is one of significant matter for this system which will guarantee urban rail system operating normally, meanwhile, it will represent the effectiveness in term of the urban traffic solution. As to it, the passenger flow is important for this system whether for which purpose. However, because of coupling effect which spatial heterogeneity and uneven ridership, it is worthy identify this inner correlation to acknowledge the impacting degree which generate more people using it. Thereby, this project report selects five variables to measure the impacting the passenger ridership for the MRT line located in the case city -Kuala Lumpur. Under this foundation, also attempts to reflect the Kuala Lumpur's spatial heterogeneity by the uneven distribution ridership of the MRT line. The result indicates there is significant spatial heterogeneity due to the impacting degree is different in various station catchment area under the same measuring variable. For instance, the population variable has a higher impacting degree in the suburb area compared the core area, and the whole interval value is  $[-4.57, -0.42]$  that the discrepancy is around ten times from the highest to the lowest impacting coefficient. Besides, the commercial area and workplace which constitute Density variable positive correlate with MRT ridership that is opposite with population variable and the rest variables. Therefore, we could increase commercial and workplace around the station area to attract more people using MRT in order to generate more ridership as well as relieve the urban traffic stress.

## ABSTRAK

Sistem kereta api bandar paling penting untuk pengangkutan bandar kerana ciri lorong khas dan kapasiti jisimnya yang lebih pantas, dll. Banyak negara atau bandar yang taat membangunnya untuk membebaskan tekanan pengangkutan bandar. Manakala tidak setiap kota dapat memperoleh hasil yang diharapkan setelah selesai kerana faktor komplikasi yang mempengaruhi. Sementara itu, pendapatan kotak juga harus disebutkan kerana ini adalah salah satu perkara penting bagi sistem ini, yang menjamin sistem kereta api bandar beroperasi dengan normal. Ini mewakili keberkesanan dari segi penyelesaian lalu lintas bandar kerana pelaburan gran. Aliran penumpang sangat penting untuk sistem ini sama ada untuk apa-apa tujuan. Walau bagaimanapun, terdapat kesan gandingan antara pengedaran penumpang dan persekitaran binaan. Adalah wajar untuk mengenal pasti korelasi dalamannya untuk mengetahui tahap pengaruhnya untuk mengenal pasti sama ada terdapat heterogenitas spatial dari aspek penumpang sistem rial bandar. Oleh itu, laporan projek ini memilih lima pemboleh ubah dari visi persekitaran binaan untuk mengukur korelasi penunggang jalur MRT, yang terletak di bandar raya -Kuala Lumpur. Hasilnya menunjukkan heterogenitas spasial yang signifikan kerana tahap pengaruhnya berbeza di pelbagai kawasan tadahan stesen di bawah pemboleh ubah pengukuran yang sama. Sebagai contoh, pemboleh ubah penduduk mempunyai tahap pengaruh yang lebih tinggi di kawasan pinggir bandar berbanding kawasan teras. Nilai selang keseluruhan adalah  $[-4.57, -0.42]$ , bahawa perbezaannya sekitar sepuluh kali dari pekali hentaman tertinggi hingga terendah. Selain itu, kawasan komersial dan tempat kerja yang merupakan pemboleh ubah ketumpatan berkorelasi positif dengan penumpang MRT, yang merupakan kebalikan dari populasi dan pemboleh ubah selebihnya. Oleh itu, kami dapat meningkatkan kawasan komersial dan tempat kerja di sekitar kawasan tadahan stesen untuk menarik lebih banyak orang yang menggunakan MRT untuk menjana lebih banyak penumpang dan menghilangkan tekanan lalu lintas bandar.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

In "Athens Charter" (1933), the urban function has been constituted for "living, working, recreation and circulation," obviously the transport is vital for urban development, whatever the past or current, even if the future. Moreover, suppose we review the urban planning principle, such as Garden City, new urbanism and smart growth, Etc. In that case, it is also relevant to urban transport, even though Von Thunen's Isolated Stated Theory also considers transport cost.

Meanwhile, urban development had experiences changes; firstly, people migrate from the country to urban areas to earn more money because of the Industry Revolution. After several decades, a heap of high-level or middle-class indicators departs from urban areas to suburbs or distant areas away from the terrible urban environment. However, the consequence of decentralized spatial structure is automobile-oriented cities leading to more traffic demand, commute itinerary increasing and environmental pollution.

After this, some people recognized the dispersed development mode is not very well; therefore, the compact city principle formed and created TOD (transit-oriented

development) mode to relieve the conflict between expectation and realistic situation. According to the new urbanism, the mixed model living style gradually gets attention; however, traffic jams again and almost worse than in the past. Thus, people created Mass Rapid Transport.

## **1.2 Problem Background**

Before the 19th century, public transport had been created so that residents could go to another place by stagecoach. The horse is the primary traction power, and the function almost the same as the bus in current to transport passengers or cargo. Due to the grain and plant industry factors, feeding horses' cost is too high to afford, and the authority raised the tax. Thereby the people wanted to innovate a new pattern to replace the horse as Adam Smith said the grain of feeding one horse could enough eight laborers. The steam locomotive had been created due to willingness to reduce product cost.

After this, the first subway was built in London in 1863, and the first line in America and Asia in 1870 (United States) and 1919 (Japan), respectively (wikipedia, 2021). Currently, there are around 201 cities in 60 countries that have built the urban railway system. The rail system significantly enhances resident trip convenience and accessibility and reconstructs or reshapes the urban area pattern. As Japan obtains an important achievement in terms of the urban rail system in Asia, the habitant intensely relies on this system, especially those who live around the Tokyo economic circle, consequently establishing a rail-oriented city.

In Tokyo, the number of people using urban rail as a travel model obtained 30 percentage, followed by cars (29%), found in the 2008 Personal Trip (Abe & Kato, 2017). While, in Malaysia, the first line was operated in December 1996 in Kuala Lumpur, which the length is about 12.1 kilometers, and now there are 12 lines (159.2 kilometers), includes MRT (Mass Rapid Transit)/ LRT (light rapid Transit) and Monorail. Besides, the quantity of passenger ridership for KJL (Kelana Jaya Line), one of the Kuala Lumpur LRT lines, was about 78.8 million in 2013 from 57.7 million in 2004 (Mohamad Zulkifli et al., 2017).

Improved by the urban rail system, the whole urban transportation network could form a significant model shift from automobile to transit; it would create TOD (transit-oriented development) (Tu et al., 2018). For instance, in Japan, the Tokyu Tamagawa Line created a Tama community with about 4.08 million and the areas around 1,159 kilometers square. This community provides high-quality living neighborhoods to the people who work in Tokyo because the property value is too high to afford the large house in Tokyo. This neighborhood guaranteed the ridership quantity of rail, vice versa, that gained the maximization profit of real-estate. After that, to optimize the urban area structure to obtain more revenue, this corporation provided some land to the university and built the leisure place to gain reverse passenger flow, an opponent with the commuting flow during the rush hour. It forms the balance of passenger flow in the two directions, maximizing the ridership during working or weekend day that weakens the spatial heterogeneity in its coverage area.

However, not every country or region could obtain success like Tokyo, Japan, due to the different city background. The resident trip habits or governing awareness also is a discrepancy. Such as in Kuala Lumpur, Malaysia, completion several urban rail lines constructing in the past years. While consequent to its development, the new

issue has emerged that the passenger ridership of its uneven leads to new congestion called traveler jam. In some stations, passenger queuing is a terrible matter to embark on the subway due to overmuch passenger, especially during peak hour. Figure 1.1 shows that the highest passenger of ridership was about five times the lower one in the LRT line, Kuala Lumpur.

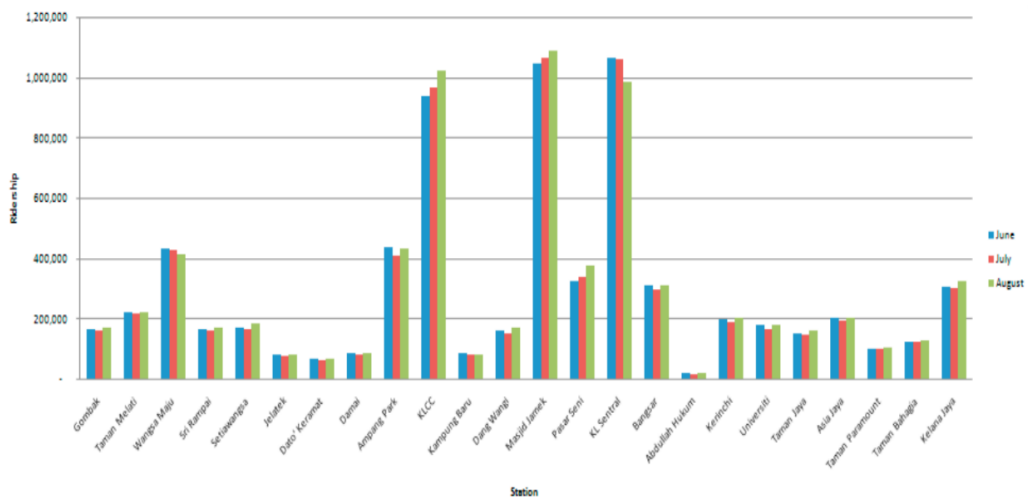


Figure 1.1 Ridership of KJL (Kelana Jaya Line) from June to August 2015

Source: (Mohamad Zulkifli et al., 2017)

This phenomenon also becomes an ordinary matter in China, specifically the metropolis city such as Beijing, Shanghai, Etc. Many experts used different methods and different aspects to identify the real reason that leads to passenger ridership for urban rail transit uneven, thereby attempting to determine the direct or indirect factor that would affect it (An et al., 2019; Chakraborty & Mishra, 2013; Karimi et al., 2019; Lanza et al., 2020; Q. Li et al., 2020; Soares Machado & Quintanilha, 2019; Vergel-Tovar & Rodriguez, 2018; Zeng et al., 2017).

As to the case in Nanjing China, Gan et al. (2020)" the author used Geographic Information System (GIS) and multiple regression analysis to identify the correlation between built environment and urban rail system ridership. Furthermore, they found the population, business/office area floor area, CBD dummy variable, number of education buildings, entertainment venues, and shop centers positively correlate for urban rail's passenger ridership Gan et al. (2020). "Land use and transit ridership connections: Implications for state-level planning agencies" estimated multiple models of transit ridership – using ordinary least squares and spatial error modelling approaches to appraise the correlation among the transit ridership, land use and social-economic variables that land-use type, transit accessibility, income, and density are enormously significant and robust predictors of transit ridership for the statewide and urban areas datasets (Tu et al., 2018).

As the successful case in Tokyo mentioned above, ridership is vital for the rail system, and it complements each other with the built environment. Whereby this inner correlation all the time is the researching focus field in terms of the urban realm. Calthorpe (1993), Schlossberg and Brown (2004), Boarnet and Crane (1997), Parker et al. (2002), Cervero (2004), Dittmar and Poticha (2004) said the TOD (transit-oriented development) provides high-effective public transportation, friendly walking surrounding, high-density developing, and land-use diversity (Singh et al., 2017).

Moreover Calthorpe (1993) identified three TOD characteristics: Density with a high density of dwelling units, population, jobs and activity sites; Diversity with multiple forms of land use; and Design with dense urban grids and pedestrian-friendly environments, while Cervero and Kockleman (1997), Curtis, Renne, and Bertolini (2009) and Ewing and Cervero (2010) following developed Calthorpe's definition by adding three more characteristics: Distance to access transit; Destination Accessibility;



and Demand Management of urban car traffic (Knowles et al., 2020). Hence, we could recognize that the passenger ridership of urban rail transit would be affected by the built environment under these research results.

Besides, the urban rail system is expensive Gendron-Carrier et al. (2018) said, the construction investment is enormous, and the operating cost after building. The operating line's revenue and expenditure ratio is only 54% in China (Haoran Zhang, 2020), which means the government has to provide vast subsidy in the urban rail system to guarantee normal operating. Because of the connectivity counts that the infrastructure would produce economic performance and improve people well-being.

In Malaysia, the Federal Government invested billions in the Mass Rapid Transit (MRT) project as part of its Greater KL plan. For instance, the Sungai Buloh-Kajang (SBK) line (MRT 1) and Sungai Buloh-Serdang-Putrajaya line (MRT 2) cost RM21 billion and RM32 billion, respectively, MRT 3 is estimated to cost between RM35 billion and RM40 billion. However, after building, the government has met a barrage of criticisms from various parties. These critical voices display the realistic situation perhaps is conversely with the expectation, and the ridership is one of the most significant factors when building an urban rail system aspect.

The spatial heterogeneity always companions with the urban rail system operating means there is the discrepancy of demand in the same line or nearly station because of the different built environment or resident's habits. Furthermore, this phenome could lead to unbalance trip demand in these areas and potentially enhance the traffic conflict.

Mohamad Zulkifli et al. (2017) measured the urban rail transit in Klang Valley (KV) measured the urban rail transit in Klang Valley (KV), an urban conglomeration centered in Kuala Lumpur and involves its adjoining cities and towns in the state of Selangor. He found the urban rail transit station has different characteristics by identified the land use density, diversity. Meanwhile, he classified the urban rail station under passenger ridership. For instance, the Kelana Jaya line is the light rapid transit (LRT) from Kelana Jaya to Gombak with about 29km. The Sri Rampai station has a higher density, higher diversity, medium ridership, and the KLCC, Taman Melati station has a medium density, medium diversity, higher ridership, as Table 1.1 shows. Finally, he concludes the transit ridership would increase if the land-use diversity or land-use mix rise. They complement each other.

Table 1.1 Comparison the built environment for Kelana Jaya Line

<b>LRT Line</b>	<b>Length</b>	<b>Station</b>	<b>Condition</b>
Kelana Jaya line	29km	Sri Rampai	higher density, higher diversity, medium ridership
		KLCC, Taman Melati	medium density, medium diversity, higher ridership

As a passenger transportation system, the subway adopts an exclusivity traffic model to decline transportation costs for people while relieving travelers' interfering from other social movements such as goods' transportation and commercial trade. It is more suitable to reflect the spatial equilibrium theory of urban economics compare with the highway for mixed transportation (Haoran Zhang, 2020). The current research primarily focuses on typology to explore the metro station classification and measure it in the pedestrian catchment area (Antipova et al., 2011; Belzer & Autler, 2002; Stojanovski, 2018) shows. Exploring the station type, we can yet dig out the feature that forms the disparity in transit ridership in a different station, optimize the station

built environment, or improve the station to increase the passenger's use of public transport and away from the car.

Distinguish the correlation between urban spatial and metro systems and measure the inner relationship to identify the metro type and pedestrian catchment area built environment, reflecting its connection that creates a high number of passenger ridership. It is an effective method to improve the urban transport system and urban spatial distribution as an improvement standard to implement in other places.

Nevertheless, we could not optimize somewhere by merely copying the method from other places due to the heterogeneity, just like Tobler's first law of geography said "everything is related to everything else, but near things are more related than distant things". Moreover, the spatial information has yet to be fully utilized in urban land-use intensity assessment, where spatial correlations and spatial heterogeneity attributes are often neglected (Zeng et al., 2017).

Indeed, there probably is a discrepancy between the overall conclusion and specific point result. For instance, a metro line has been called the Kelana Jaya line in Kuala Lumpur. There is an interesting phenomenon in which the higher density, higher diversity area creates medium ridership, else medium density, medium diversity area has high ridership (Mohamad Zulkifli et al., 2017). Moreover, although this article said the transit ridership increase as land-use diversity or land use mix increases generally, there is still some discrepancy in some station. Therefore, we perhaps need to identify it from the micro level to obtain a precarious result as possible as we can. Due to the holistic conclusion, perhaps hide some discrepancy occasionally without awareness.

Moreover, other experts have considered several indicators (Kim et al., 2016; Lanza et al., 2020; S. Li, Lyu, et al., 2020; Zeng et al., 2017), which includes but are not limited to land-use density, community diversity, population density, office floor area, Etc. Consequent to researching development, people gradually identify more direct or indirect factors that would affect transit ridership.

As the TOD realm reaching, the initial variable rarely is density, diversity, design; after becoming to five elements that add distance and accessibility, currently, these authors deemed the number of variables that should be considered is nine (Huang et al., 2018; Ibraeva et al., 2020). However, the urban transportation exploring should be related to local characteristics due to spatial heterogeneity, which mostly belongs to different cultural backgrounds.

Stojanovski (2018) shows the diversity, quantitative entropy and qualitative categories are no significant effect on bus mobility in the Swedish city of Karlstad, while the D-variable is significant for Kuala Lumpur LRT transit ridership (Mohamad Zulkifli et al., 2017). Thereby, if we want to measure the correlation between the built environment and transit ridership, the tangible built environment should not be ignored.

Finding the direct or indirect impacting variable is significant for creating a good and suitable urban rail system. Besides, mention real performance, whether for economic or social resource allocation, when creating an urban rail system is necessary. Tu et al. (2018) measured the passenger ridership impacting degree among bus/ metro and taxi based on the built environment variable. While they found the employment factor coefficient is positive in most traffic analysis zones located in Shen Zheng, China, the mean coefficient is 0.4113, which the interval value is from -0.12 to 0.65.

The land use mix and the road density, which the coefficient mean value is 1.2331 what interval value is from -0.4 to 0.8, and 0.049 what range is from -0.01 to 0.1, respectively. According to this finding, the city governing or urban rail system agency could adopt useful means to improve the operating efficiency to raise the ridership to attract people away from the automobile. Moreover, using different methods in the different areas to maximize the effect.

In Kuala Lumpur, Dziauddin (2019) identified the land value uplift/down lift around the light rail transit station. He found that most properties located at the rail station catchment area raised 8% value located the lower-middle and upper-middle incoming neighborhoods, conversely, non-significant in the high-income neighborhood. However, there no people This paper will attempt to identify the inner impacting degree among the population/ land use/ density/ design/ connectivity and the ridership of the urban rail system. While it should not be ignored if we want to optimize the urban traffic.

### **1.3 Problem Statement**

#### **1.3.1 Urban Rail System Ridership**

The urban rail system revenue and expenditure ratio uneven is customary around the world, a heap of the city's subway around the world has to gain subsidy from the government. It currently seems only in Hong Kong the metro system could earn money, while the precondition is it has the property around the station and gets the profit (Loo et al., 2010; Lu et al., 2018). Thus, the transit ridership could not be ignored

in an urban rail system; meanwhile, it also conduces to assess the urban rail transit system because it could generate income and reflect the resident's travel habits.

Besides, Abdullah & Mazlan (2016) found 83 percentage of respondents used public transportation for work and leisure, although around 91.3% respondents considered the station is far. He explored the characteristic and quality life in TOD community in Kuala Lumpur, this case area located at Bandar Sri Permaisuri and LRT Sir Petaling line across it and has a station called Bandar Tun Razak. It indicated the good built environment will encourage people using the urban rail system even the first-last mile is difficult.

In the “Kuala Lumpur Structure plan 2020 (Transportation)” indicated the model share of public transportation decreased from 34.4 percentage to 19.7 percentage between 1985 and 1997. While in the “National Land Public Transport Master Plan” supports Malaysia’s efforts to become a high-income nation by delivering a high impact public transport transformation, meanwhile “Greater KL/Klang valley Land Public Transport Master Plan” expect the public transport model share reach 40% by 2030. However, as previous mention the Tokyo, the number of people using urban rail as a travel model obtained 30 percentage. Hence, to achieve this purpose as Master Plan said it is not easy.

While the passenger ridership is a primary element in urban transportation when planning to build a new project or during the operating period, even if there are a figure of factors that would affect it. The urban rail system could relieve the transport stress in the urban areas due to its feature of mass capacity transport and exclusive lane. Many

cities want to develop it because of its advantage, while the cost usually could not be ignored, whatever initial or after building.

### **1.3.2 Spatial Heterogeneity**

To make informed decisions when build great urban rail system, it is significant to understand the affecting of the built environment and station attributes on transit ridership. As well, the built environment around the station belongs the spatial characteristics which discrepant built environment will create uneven distribution of many ridership-related factors across space in term of urban rail system (Gan et al., 2019).

As the Chapter 1 showed, in Kuala Lumpur Kelana Jaya line (LRT), the Sri Rampai station has higher density, higher diversity, medium ridership, and the KLCC, Taman Melati station has a medium density, medium diversity, higher ridership. It remarkable indicates the discrepancy from the built environment aspect because the same condition leads to a different result. Moreover, this reference paper did not continue to explicate the inner correlation, which merely classified the type of per station.

Indeed, the urban spatial environment is near relative with this system operating specialize after building due to building it to solve the urban transport at an overweight area, whereas if no people are using it or there is a considerable lag compare with expectancy that the efficiency would not be expressed, means the investment cost can not be recovered, and the problematic traffic congestion situation also can not be

relieved. Thus, every urban rail system project would do the surveying before building to recognize the realistic passenger ridership.

However, numerous factors would affect the urban rail system operating, such as society demographic, society economic, pedestrian condition, etc. Moreover, which one or several factors would impact the transit ridership in Kuala Lumpur should be measured to form more efficient and effective urban rail systems that gain a solution in urban transport.

#### **1.4 Research Questions**

To recognize the reason what would create passenger ridership in Kuala Lumpur, this report will attempt to measure the urban rail system from the built environment and transit ridership perspective, and then determine the direct or potential factor influencing the transit ridership factor. Thereby the research question as below shows:

1. What are the factors that affect transit ridership in urban rail system?
2. What are the indicators that would impact the transit ridership in Kuala Lumpur?
3. How will these selected indicators affect the ridership in Kuala Lumpur?



## **1.5 Research Objectives**

Based on this research, the affecting variable would be identified, and the realistic situation could be measured from the micro-scale, which means under the specific built environment in Kuala Lumpur.

### **1 To recognize factors which affect the urban rail system ridership in the Kuala Lumpur**

As previously mentioned, there are a heap of factors would affect the urban rail system passenger flow, including but not limited land use mix/ connectivity/ accessibility etc. While people would match suitable and reasonable factors based on his/her researching purpose. Thereby there is no fixed framework to apply in every place, however, the overlapping variable is not less due to most of the factor what has been chosen is the same. Moreover, based on this background, this paper initial will try to recognize which factor would affect the ridership based on already mentioned to clearly identify the independent variable for impacting urban rail system ridership.

Based on the spatial heterogeneity conception, there is discrepancy following the location changing. Thereby this different would be huge if the researching goal or place differs. As this background, due to this paper selects Kuala Lumpur as case study, hence, this paper would sift factors as the independent variable to use under the Kuala Lumpur situation. Furthermore, build an assessment framework to identify the correlation between ridership and the impacting factors.

## **2 To evaluate its impacting degree in term of urban rail system ridership based on the selecting measuring variable in Kuala Lumpur**

After this step, there is a reasonable and clear assessment framework that could measure the impacting degree for urban rail system ridership by the reliable independent variable. To identify the exact impacting degree in traffic analysis zone by the independent variable. To recognize which indicator would affect the ridership in the urban rail station and how to impact. Moreover, could understand how to optimize the urban structure in the traffic analysis zone when need to do that in the future.

## **3 To acknowledge the spatial heterogeneity characteristic by the urban rail system ridership**

Under the ridership-related factor across space has been recognized, this report will continue study the inner correlation from the spatial heterogeneity vision. Attempt to identify the potential correlation between the built environment and urban rail ridership. Thereby, based on the finding, this report tries to give some tangible optimizing idea in the specific station catchment area.

### **1.6 Research Scope**

For this research, the transit ridership at the urban rail system aspect in Kuala Lumpur is measured by Malaysia's capital. The population is about 1.79 million as of

2018. In Greater Kuala Lumpur, known as an urban agglomeration called Klang Valley, the population is around 7.564 million as of 2018 (Department of Statistic Malaysia Office Portal). Malaysia's financial/ culture and economic center is the fastest-growing metropolitan area in Southeast Asia. No doubt, this city, like other world metropolitans, meet severe urban issues such as demographic continuing growth, land demand raising and bombastic traffic demand, Etc.

The rapid economic development of Malaysia since the 1980s has increased the number of vehicles and road traffic in the capital Kuala Lumpur. The government has also adopted policies to support the domestic automobile industry to make Malaysia reach the highest car ownership rate among other Southeast Asia counties. Therefore, the various policies and historical backdrops create a hidden danger in this city.

After that, the government recognized this hiding issue to develop public transportation to eliminate the growing traffic congestion. The government decided to form urban rail transit and supplement by bus in Kuala Lumpur, which has been called “Bus plus Light Rail Transit System” (Bte Mohamad, 1992). In 1996, the first line of rail had been built, connect center and southeast regional. Moreover, it gradually built more rail lines here; currently, there are 11 lines (493.1 kilometers) operated and several lines under construction.

In Kuala Lumpur, the urban rail system has been formed by four categories type which is LRT (Light Rapid Transit)/ MRT (Mass Rapid Transit)/ monorail and KTM (Komuter Train). The LRT involves Kelana Jaya Line, Sri Petaling Line & Ampang Line that the length is 46.4 kilometers (37 stations), 45.1 kilometers (36 stations), respectively. Besides, the Sri Petaling Line & Ampang Line runs on a common route

between Sentul Timur station and Chan Sow Lin station, then dividing two directions. The building MRT line is SBK (Sungai Buloh - Kajang Line), which has 41.5 kilometers (35 stations). The KTM (in the Klang Valley) is the electric train line, which includes the Seremban Line, the Port Klang Line, and the Skypark line covering more than 300 kilometers of a train track with 61 stations.

The current daily ridership on the urban rail network is over 464,000 passengers. The Kelana Jaya and Ampang LRT services have the highest passenger loads as Mohamad Zulkifli et al. (2017) found, because the LRT line is older and started operating in 1999. Meanwhile, the Monorail operated in 2003, and MRT was in 2017 (phase 1 commenced service in 2016). Moreover, the MRT line reduces the overcrowding on other operated lines such as Monorail, meanwhile alleviating traffic congestion in the Klang Valley (the Great Kuala Lumpur).

The MRT line has been selected because it is currently the newest line, and it would reflect recent characteristics of the urban rail system ridership. As well, few people study it. The finding would also benefit from the traffic analysis zone optimization if needed or borrowed in the future new line planning because of a more similar social background compared with the past.

## **1.7 Research Contribution**

According to this research, the factor affecting transit ridership in terms of the urban rail system would be acknowledged. It contributes to self or others recognize the essential influencing factor in the passenger ridership aspect. Moreover, Kuala Lumpur,

as the main metropolis worldwide, is worthy of research because it could represent the developing country city's situation in extent.

Many cities are currently devoted to developing urban rail systems to relieve urban traffic predicament, especially in Southeast Asia. Moreover, due to the culture backdrop discrepancy, some participate experiment obtained from other countries or cities is perhaps not suitable. For instance, some research shows that population density would positively affect transit ridership in the metro system in China; nevertheless, this phenomenon seems not the same with Kuala Lumpur.

This report speculates: (1) in China, people prefer using public transportation as a daily travel model due to the higher cost if they use the automobile. The petrol price is lower in Malaysia than in China, which the price of RON95/liter is on average 0.47 dollars and 0.94 dollars respectively (25/Jan/2021). (2) Chinese city buildings follow the compact city model, whereas lower height buildings and decentralized spatial structures more prevalent in Kuala Lumpur.

Meanwhile, many cities are more similar to Kuala Lumpur because their population is around 1.8 million (Department of Statistic Malaysia Office Portal, 2019). Manila had around 1.78 million in 2015, Hamburg has around 1.84 million in 2019, Etc. In comparison, Beijing had 19 million in 2010 (2010 Census, National Bureau of Statistic, China). Thereby, this outcome probably benefits them when they want to create a new urban rail system or improve it from the ridership aspect. Furthermore, the correlation between urban spatial dimension and transit ridership would be analyzed by the built environment status around the station coverage area that differentiates what factor causes different passenger ridership amounts at the various station in the same

metro line. That would promote the urban rail system developing forward a good direction after acknowledging these.

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