

# Future Parking Demand at Rail Stations in Klang Valley

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**Abstract.** Klang Valley, Malaysia is currently undergoing a massive development of rail transportation system expansion where the current integrated rail transit system will see new extensions of two MRT lines and an LRT line by year 2020. By year 2017, the first MRT line will be ready to run with 31 new rail stations connected to the current passenger rail network. The existing Park and Ride facilities in Klang Valley are commonly known as being unable to sufficiently cater for the current parking space demand. Therefore, with the expansion of many additional rail stations which are rapidly under construction, there are doubts that the future parking space at rail stations will be able to accommodate the sudden rise of rail passengers. Although the authorities are increasing parking bays at various locations, will the future parking demand at rail stations be sufficient? This paper studies the factors influencing parking demand in terms of population, car ownership, new car registrations and passenger rail ridership and estimating the future parking demand using Linear Regression method. Result shows that the forecasted parking demand at rail stations after the implementation of the first new MRT system in 2017 is 2.7 times more than in 2014.

## 1 Introduction

Klang Valley, consists of cities and towns in Kuala Lumpur, the Selangor state and Putrajaya and is home to 7.8 million population and growing [1]. With the addition of around 500,000 new vehicle registrations every year, this contributes to the enormous traffic congestion in Klang Valley [2].

Public transportation such as rail, buses and taxis play an important role to reduce traffic congestion in Klang Valley. The Malaysia Land Public Transport Commission (SPAD) has set out an integrated 20 year plan to transform land public transportation in the region to respond to local needs and aspirations [3]. This includes the massive development of rail transportation system expansion where the current integrated rail transit system will see new extensions of two Mass Rapid Transit (MRT) lines and an Light Rapid Transit (LRT) line, with a total of 91 new rail stations by year 2020 [4], [5]. This is indeed in line with Malaysia's aim to increase public transportation modal share from 18.1% in 2014 to 40%

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by year 2030 [6] and to achieve transportation sustainability and a high income and developed nation by year 2020, with a world class rail transit system [2].

## 2 Park and ride facilities in Klang Valley

Park and Ride (P&R) facilities in Klang Valley allow rail passengers to drive and park their cars to get on the passenger trains such as the LRT and MRT. It is crucial for P&R facilities to facilitate the first mile travel to enable the transfer of rail passengers to the trains along the rail network in order to increase rail ridership, thus the public transportation modal share. The existing P&R facilities in Klang Valley are commonly known for having parking space constraint problem and is unable to sufficiently cater for the current parking space demand.

### 2.1 Parking space constraint at park and ride facilities

Illegal and indiscriminate parking at P&R facilities indicates the lack of parking space at rail stations. These scenarios of parking space constraint can be further analyzed and confirmed with a parking utilization survey, where in such surveys, the parking occupancy rate represents the parking demand of the facility [7].

Parking space constraint at P&R facilities in Klang Valley can be traced from as far back as year 2008 where many vehicle double parking cases were seen at the Rawang P&R facility, in which 94% of the facility's regular users suggested that more parking spaces should be provided [8].

In 2009, cars were noticed parking illegally by the road side in the residential area causing traffic congestion and on plots of land where high tension pylons were located near the Kelana Jaya LRT station. Similar cases were also noticed at the Taman Bahagia and Taman Paramount LRT stations [9]. A survey conducted in 2014 to examine the parking usage at the Kelana Jaya LRT station showed a high 92% parking occupancy rate [10].

The concern of parking space constraint at LRT stations was highlighted again in 2013 where hundreds of rail passengers daily parked at undesignated areas near LRT stations, causing inconvenience and risking damage to their own vehicles. Stretches of cars were found parked at every nook and corner that fits and on grassy roads between houses in residential areas. At the Sentul LRT station, vehicles were parked at the parking area at almost double its capacity. Few parking bays at the Bangsar LRT station, which are on a first-come, first-served basis, were often taken up by those working nearby [11].

At the Putrajaya P&R facility, vehicles were noticed to have parked illegally at the surface parking with 95% parking occupancy rate [12]. Similarly, the multi-storey parking recorded an average 90% occupancy and can go up to 100% during weekends [13]. The Gombak P&R facility had reached 100% occupancy rate in 2013, a month after its official opening [14].

Note that some of the above data were taken in 2008, 2009 and 2013 which means that the most recent parking occupancy rates may be more than what were founded before. In actual fact, there could be many more rail stations facing the same problem. This problem has been a deterrent factor for many urbanites in the Klang Valley who cite it as a reason they are reluctant to travel by train to their destinations [6], [11]. Closer to the completion of the new MRT, there were parties who raised concerns about the possible illegal parking after the opening of the MRT station, due to the lack of parking space [15].

## 2.2 Parking concern after the implementation of new MRT line

In the near future, by year 2017, the first MRT line will be ready to run with 31 brand new rail stations connected to the current passenger rail network. Considering that the current parking space capacity is already an existing problem, with the expansion of the new MRT which are rapidly under construction, there are doubts whether the future parking space at P&R facilities will be able to accommodate the sudden rise of rail passengers. The lack of parking space at P&R facilities after the implementation of the new rail lines, may cause massive traffic congestion [16], [17], thus air pollution [18], [19] and the limitation of rail transit system ridership [20]–[23] for the Klang Valley integrated rail transit system.

The success of P&R facilities are confirmed in attracting rail passengers with users reported high levels of satisfaction [24]. Therefore, it is necessary to provide more parking space to encourage the usage of rail transportation. However, although the authorities are looking at finding a solution, they are challenged with the lack of land to provide more parking bays [11]. How many parking bays at P&R facilities are enough to cater for the future in 2017, after the implementation of the first new MRT line in Klang Valley? This depends on the future parking demand.

## 2.3 Factors influencing parking demand at rail stations in Klang Valley

Parking demand refers to the amount of parking that would be used at a particular time, place and price. It is a critical factor in evaluating parking problems and solutions. Parking demand is affected by vehicle ownership, among all other behavioral factors such as trip rates, mode split, parking duration and type of trip, and factors of other travel modes such as the quality of alternative travel, fuel and road pricing [25].

In Klang Valley, vehicle ownership is an exceptional factor and plays a significant role in influencing parking demand as there are around 500,000 new vehicle registrations added to the region every year [2]. Malaysia also tops the list as the country with third highest car ownership in 2014. 88% of Malaysian car owners also intend to upgrade their vehicle when they are financially able [26]. With car ownership in the growing trend, the parking demand in Klang Valley, especially at rail stations, is expected to increase.

Besides car ownership, the growth of rail passenger ridership due to the massive rail development in Klang Valley is expected to increase parking demand at rail stations. At the same time, population growth in Klang Valley is also expected to increase rail passenger ridership, thus parking demand at rail stations [23], [27]–[29]. It is projected that Malaysia's population will grow from around 30.6 million to 38.6 million in 2040 [1], [30].

## 2.4 Estimating parking demand at rail stations in Klang Valley

It is important to estimate the parking demand in 2017 to gauge the parking bays needed as there will be a sudden rise of rail passengers after the 31 new rail stations are in operations. This is to prepare for the future parking space needs and to ensure the success of the integrated rail transit system in Klang Valley.

## 3 Methodology

This study estimates parking demand in 2017 at rail stations in Klang Valley by forecasting using the Least Squares Regression method or popularly known as Linear Regression method. Factors influencing parking demand specifically population, car ownership and rail passenger ridership are forecasted in 2017 to estimate the parking demand in 2017.

## 4 Results and discussion

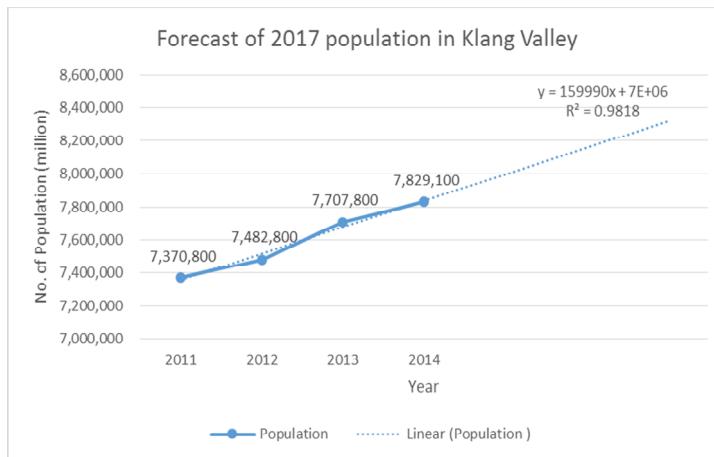
### 4.1 Population in Malaysia and Klang Valley

Historical data shows that the population in Malaysia and Klang Valley have been increasing with a similar upward trend since 2011 until 2014 as shown in Table 1. The total population increases with an average growth rate of 1.7% and 2.0% annually in Malaysia and Klang Valley respectively during these period. The average increase in Klang Valley is higher Malaysia which shows that Klang Valley is one of the preferred location to live in Malaysia.

**Table 1.** Population in Malaysia and Klang Valley [31-34].

Region/Year	2011	2012	2013	2014
<b>Malaysia</b>	29,062,000	29,510,000	30,213,700	30,597,900
<i>Annual Growth Rate</i>	1.5%	2.4%	1.3%	
<b>Klang Valley</b>	7,370,800	7,482,800	7,707,800	7,829,100
<i>Annual Growth Rate</i>	1.5%	3.0%	1.6%	

By 2017, the forecast of the total population in Klang Valley is 8.3 million people as shown in Fig. 1. This is approximately 6.2% increase from the population in Klang Valley from 2014. With the future population increase, parking demand at rail stations is also expected to increase.



**Fig. 1.** Forecast of 2017 population in Klang Valley [31-34]

### 4.2 Car ownership in Malaysia and Klang Valley

Registered cars in Table 2 shows the number of new and old cars registered in Malaysia and Klang Valley, which also represents car ownership. 43% of the total registered cars in Malaysia, almost half is located in Klang Valley. Therefore, parking demand will be exceptionally high in this region, especially after the implementation of the new MRT line.

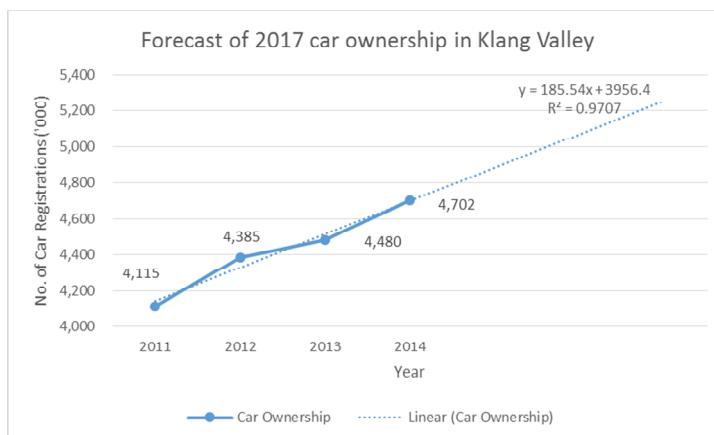
Historical data shows an upward trend for car ownership in Malaysia and Klang Valley from 2011 until 2014. The gradual increase of the number of cars is at an average annual rate of 5.8% and 4.6% respectively in Malaysia and Klang Valley. For the same period, the

car registrations growth rate is higher than the population growth rate in Malaysia and Klang Valley. This shows that the transportation in Malaysia is currently unsustainable.

**Table 2.** Registered cars in Malaysia and Klang Valley [31]–[34].

Region/Year	2011	2012	2013	2014
<b>Malaysia</b>	9,324,276	9,952,515	10,535,575	11,028,296
<i>Annual Growth Rate</i>	6.7%	5.9%	4.7%	
<b>Klang Valley</b>	4,114,759	4,385,120	4,479,562	4,701,751
<i>Annual Growth Rate</i>	6.6%	2.2%	5.0%	

By 2017, the forecast of the car ownership in Klang Valley is 5,255 thousand of cars as shown in Fig. 2. This is approximately an 11.8% increase from 2014. With the increase of car ownership in Klang Valley, parking demand at rail stations is also expected to increase.



**Fig. 2.** Forecast of 2017 car ownership in Klang Valley [31-34]

### 4.3 New car registrations in Malaysia and Klang Valley

The new car registrations represents only the new cars registered in Malaysia and Klang Valley, with a similar trend as shown in Table 3. The numbers picked up from 2011 until 2012, thereafter have dropped in 2013 and reduced further in 2014.

**Table 3.** New car registrations in Malaysia and Klang Valley [31-34]

Region/Year	2011	2012	2013	2014
<b>Malaysia</b>	594,610	628,239	583,060	492,721
<b>Klang Valley</b>	255,460	267,689	262,818	222,189

Although new car registrations in Malaysia and Klang Valley have dropped from 2012 until 2014, the total number of car ownership were gradually increasing. This only shows that Malaysians were not purchasing as many new cars as before, but they still rely on their cars as a mode of transport by purchasing second hand cars or retaining their existing cars.

### 4.4 Ridership for integrated rail transit system in Klang Valley

Table 4 shows the annual ridership for all passenger rail services in Klang Valley where the new MRT will be built and integrated into. The total ridership for these rail services shows

a strong upward trend from 2011 until 2014 with an average growth rate of 6.2% annually. By 2017, the forecast of annual passenger rail ridership is 257 million based on the current existing number of rail stations. However, the number of rail passengers will definitely surpass this figure when the new MRT line commences in 2017.

**Table 4.** Annual ridership for passenger rail services [1, 35]

Passenger Rail Services/Year	2011	2012	2013	2014
<b>Putra LRT</b>	68,398,561	71,574,675	78,702,931	81,971,322
<b>Star LRT</b>	53,568,672	56,809,978	60,207,397	63,270,431
<b>KL Monorail</b>	24,200,299	24,113,242	25,437,623	24,303,466
<b>KLIA Express</b>	1,581,476	1,649,410	2,062,223	2,928,302
<b>KTM Commuter</b>	35,598,901	34,847,254	43,941,777	46,956,723
<b>Total Passengers</b>	<b>183,347,909</b>	<b>188,994,559</b>	<b>210,351,951</b>	<b>219,430,244</b>
<i>Annual Growth Rate</i>		3.1%	11.3%	4.3%

According to SPAD, the expected ridership of the new MRT line is 445,000 passengers per day [3]. Table 5 shows the projected rail ridership in 2017 including the new MRT line. There will be a total of 555 million of annual passenger rail ridership with an approximate 153% increase from 2014. With the tremendous increase of rail passengers in 2017, parking demand will certainly shift up to a new level.

**Table 5.** Forecast of 2017 annual passenger rail ridership [3]

Passenger Rail Services	Daily Ridership	Annual Ridership
<b>LRT Kelana Jaya</b>	496,000	181,040,000
<b>LRT Ampang</b>	352,000	128,480,000
<b>KL Monorail</b>	115,000	41,975,000
<b>KLIA Express</b>	16,500	6,022,500
<b>KTM Commuter</b>	95,000	34,675,000
<b>MRT Line 1</b>	445,000	162,425,000
<b>Total Passengers</b>	<b>1,519,500</b>	<b>554,617,500</b>

#### 4.5 Car parking bays demand in Klang Valley for year 2017

To project the car parking demand at rail stations in Klang Valley for 2017, the car ownership for rail passengers, which directly influences the car parking demand is estimated for 2017 and 2014. The rail passengers' car ownership per total rail passengers (cars per person) is equal to the total car ownership per total population (cars per person) in Klang Valley, with the estimation that the average car ownership in Klang Valley is the same for all population as per Equation (1).

$$\frac{Q}{R} = \frac{O}{P} \quad (1)$$

where  $O$  = Car ownership in Klang Valley,  $P$  = Population in Klang Valley,  $Q$  = Rail passengers' car ownership,  $R$  = Daily rail ridership .

The Rail Passengers' Car Ownership (RPCO) can be derived as per Equation (2).

$$Q = \frac{O}{P} \times R \quad (2)$$

Based on Equation (2), the forecasted RPCO for Klang Valley is 960,055 and 361,037 in total for 2017 and 2014 respectively. With this, the ratio of RPCO in Klang Valley for 2017 to 2014 is as per Equation (3).

$$\frac{Q_{KV-2017}}{Q_{KV-2014}} = 2.7 \quad (3)$$

Referring to the result of Equation (3), the RPCO for 2017 has increased tremendously by 2.7 times compared to 2014. Therefore, based on all other factors affecting the use of cars for rail passengers remain unchanged, the car parking bays demand in Klang Valley for 2017 is 2.7 times more than the number of car parking bays provided in Klang Valley for 2014.

## 5 Conclusion

Based on the above forecast, the future parking demand at rail stations after the implementation of the first new MRT line is 2.7 times more than in 2014. The fact that Klang Valley is currently facing parking space constraint at rail stations should be seriously looked into. Measures should be engaged to ensure that there will be sufficient parking bays available to those planning to commute the train in the near future. It is crucial especially for passengers who will be commuting the train for the first time and are planning to change their travel mode to train for long term. If the authorities are unable to react to the situation promptly, the unpleasant experiences such as time and resources wastage and traffic congestion, will be part of normalization, which will further result to underutilize of rail transit system. Whereas, sufficient parking bays will encourage rail ridership, increase public transportation modal share thus achieving transportation sustainability.

This study was funded by the Malaysian Ministry of Higher Education through the MyBrain15 MyPhD scholarship award. Authors are indebted to the anonymous reviewers for their valuable comments and suggestions.

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