

# Determinants of the Passengers' Light Rail Transit Usage in the Klang Valley Malaysia

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**Abstract-** The study aims to examine the determinants that motivate passengers to use the Light Rail Transit in The Klang Valley, Malaysia. The factors identified in the study were traffic reduction, advantage of LRT, and attitude. This study used a questionnaire to gather the survey data. The convenience sampling technique was utilised in the study. SmartPLS Version 3 was used to test the hypotheses. The results of the study showed that traffic reduction, advantages of LRT and attitude have a positive influence towards the LRT usage. These significant variables can be used as a guide for the LRT operators to increase the LRT usage. Future research is suggested to include other potential factors that could stimulate more LRT usage and for it to become the preferred mode choice for travelling amongst the users.

**Keywords-** Light Rail Transit, Traffic reduction, Advantage of LRT, Attitude, Usage

## 1. Introduction

Nowadays, as the number of people is growing in each country, the need for public transportation is very high to cater to all of the human beings going from one place to another. The number of vehicles in the country has increased, extremely, in the past two decades. Definitely, motor vehicles are the most favoured mode used by a lot of people. They undoubtedly enable the people to gain services and to maintain social relationships faster than other modes. Nevertheless, this type of transport cannot bring a lot of people at one time as the capacity of the car is limited. These days, the major roads surrounding the city centre are nearing their usage capacity and the matter of land scarcity in the Klang Valley obstructs the development of more roads and more parking amenities. This can be seen

where a lot of roads are fully crowded by cars parked even to the point of double- and triple-parking which causes even more congestion on the road. Clearly, traffic congestion in the city is increasing and this makes it take even longer to get to one's destination [16]. According to [5], traffic congestion, limited parking space, and environmental pollution have become important concerns in the Klang Valley, especially with the huge growth of motorisation in that region. Furthermore, the productive time lost caused by the road congestion will then eventually cost the nation its competitiveness, specifically in its key economic corridor. Moreover, the situation in the Klang Valley is especially worrying when comparing the higher usage of public transport in cities such as Singapore, Hong Kong, and London, where the public travelling with public transport were above 60% and nearly reached to 90% [16].

For this reason, public transportation is crucial as one of the major elements for the country growth, especially at the city centre where the area is populated by a high density of people. In the Malaysian context, this service has been a major system of transportation in the Klang Valley as the quick development of the socio-economy is taking place in this area. It is imperative to manage the urban areas in such a way that can reduce the number of motor vehicles [1]. In this case, [51] found the decline in the usage of the car when the transit system, including the light rail transit (LRT) system, has been implemented.

However, [67], the chairman of the Commission of Public and Land Transport insisted that, in reality, the Malaysian use of public transportation countrywide was only 5%. Fewer people are using public transport as compared to private vehicles

[62]; [37] and [58]. Any discussions on people's confidence towards public transport services are not quite that easy because public transport services are always implicated by technical incidents due to the misconduct by the service provider.

Besides that, the past study has consistently shown that the high reliance on private vehicles in Malaysia is attributed to the growth of the economy, rising household income, establishment of the Malaysian national car project, and deficiencies and bad management of the public transport system [43]; [45]; and [55]. As the dependency on private vehicles has been rising, both the economic growth and household income have also been increasing. Nevertheless, the insufficiency and the poor management of the public transport system in Malaysia has somehow been affected by the high dependency on the private vehicles. The high rate of car ownership and high incomes have reduced the light rail ridership [50].

As such, it is important to examine the determinants of LRT usage in the Klang Valley to identify what actually motivates the people to use the LRT service. The paper is organised with a literature review on the LRT usage, traffic reduction, advantage of LRT, and attitude which are discussed after the introduction section. Next, a conceptual model is proposed to identify the influence of the determinants on the LRT usage. An empirical study using a survey is explained to verify the proposed theoretical framework. Finally, the conclusion and recommendations are discussed in the last section of the paper.

## 2. Literature Review

### 2.1 LRT Usage

Light rail transit (LRT) consists of modern light weight urban rail vehicles operating predominantly on private rights-of-way, at the surface level or fully grade separated [72]. The LRT promotes high collection-distribution capability with outstanding service from the automation and technology enhancement in rapid transit mode [20]. The LRT is one of the vital public transports to ease the people's daily lives in many countries around the world. Improving the public transport ridership is a well-established goal of the transport policy and not because of its discerned contribution to the growth of sustainable transport ideas [63]; [59]. According to [46], service improvement of public transport can attract the potential riders. Owing to

multiple environmental, economic, and social advantages [31]; [47] and [48] public transport (PT) is marketed as possible car replacement. As eloquently stated by [20], public transport is considered as an extra tourism product, which adds to the total experience of the tourist and may also influence satisfaction of the tourist together with the destination [70].

### 2.2 Traffic Reduction

The road congestion avoidance is a strong effect for train usage [22]. He also indicated, in his study of tourists to St Ives in the UK, that those who used the rail system to reach their desired places were driven by congestion avoidance, suggestions from family or friends, relaxation and enjoyment of the train, and also environmental contribution. Based on the research study conducted by [46], it showed that the respondents also stated the traffic reduction as their motivation to use LRT as that would make them avoid traffic jams, and because they wanted to contribute less to the traffic congestion by not using private cars.

According to [73], the LRT project would cause transport efficiency, assist programmes of multimodal expansion, and supply a swift, safe, and reliable service for passenger transit, which then would alleviate the congestion, and overfull and parking difficulties that were being experienced in Lagos. [20] and [18] indicated that amongst the diverse land transport modes, the most often used for travel and leisure reasons was the car in many nations. In spite of that, emerging population and growing demand for tourism and leisure time activities have caused more pollution, congestion, and also traffic issues in a lot of cities worldwide [46].

### 2.3 Advantage of LRT

Accessibility to bus stops and train stations is vital to enhance public transportation ridership [10]. The accessible and convenient system of the LRT service have arisen to become two of the factors for the people to feel encouraged to use the LRT in the Klang Valley. According to [46], the accessible and suitable system has thus become a pull determinant which has motivated visitors to use public transportation in Munich. [30] stated in their study that, shorter headways contribute to fewer passengers waiting. [39] mentioned that, real-time transit information lessens the unpredictability of accessing the transportation services so riders reduce their time wasted on waiting and the

productivity lost to delayed, missed or unavailable transportation services. According to [61], a conjoint analysis by him found that real-time information was anticipated to minimise the burden of waiting as the degree of certainty increased. Therefore, access to real-time information stimulates feelings of reliability and convenience [74]. This is in accordance with the schedule of the LRT in this country which plays one of the vital roles in motivating the people to use the service.

#### 2.4 Attitudinal Factor

Based on the study by [57] and [23], personal attitudes have been recognised as affecting the mode choice resolution process. According to [24], comfort during the trip is crucial for transit riders for both the physical comfort of the vehicles and the comfort concerning ambient states at transit points or on board. The single most vital comfort determinant for the passengers is according to [72], seat availability. [44] described that the trip time is discerned to be longer when the passengers have to stand during the journey compared to when seated. As mentioned by [60], attitude can be referred to as a relatively firm and consistent behavioural inclination of individuals based on their acknowledgement and based on the likes and dislikes of event objects, people, and the environment. Attitudes are based on the anticipation beliefs about the probability that behaviour will result in certain consequences and on the evaluations of the desirability of those consequences [3].

### 3. Development of the Theoretical Framework and Hypotheses of the Study

#### 3.1 Theory of Reasoned Action

In this study, the underpinning principles of Theory of Reasoned Action (TRA) has been applied to explain the relationship between attitudes and behaviours within human actions [11]. The TRA is appropriate to anticipate the LRT users behaviour based on their pre-existing attitudes and behavioural intentions [11]. The user's decision to use the LRT services depends upon the outcome that they expect will benefit them [52], such as traffic reduction, the advantage of LRT and attitude towards the LRT usage. The TRA encompasses the characteristics of the theoretical foundation to describe and anticipate moral behaviour. In fact, the attitudinal and normative elements of the theory

signify the personal and social variables, which equally related to the moral behaviour [71].

Based on the problem identified for this study, there are a few factors that motivate the people in the Klang Valley to become the ridership of the LRT, which can be seen as the motivation to use the LRT services. The success indicator in this case is related to several motivations to use the LRT in the Klang Valley, which are traffic reduction, advantage of LRT, and attitude. Based on this argument, the following theoretical framework of the study has been proposed.

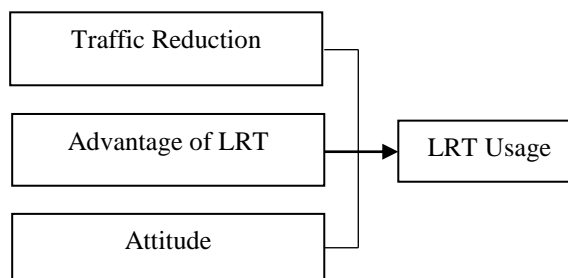


Figure 1: Theoretical Framework of the Study

By referring to Figure 1, the theoretical framework illustrates that the independent variables (Traffic reduction, Advantage of LRT, and Attitude) can positively influence the LRT usage. Hence, the study has proposed the model in that, traffic reduction, advantage of LRT, and attitude influence the LRT usage amongst the people in the Klang Valley.

As mentioned by [22], he believed that avoidance of road congestion is a strong influence for using the train. This then leads the people to use the train because of the traffic reduction. Simply put, they want to avoid traffic jams and to contribute to less traffic congestion. Therefore, the following hypothesis has been formulated:

**H1: There is a positive influence of traffic reduction towards LRT usage.**

As the country which is recognised for having one of the most developed and efficient public transport systems in Europe, Munich has an accessible and convenient system [46]. This appears to be a pull factor to encourage people to use public transport in Munich. In other words, if the public transport system is good enough, people will use it. This factor has been looked as one of the important indicators to know whether the same advantages

influence the LRT usage in the Klang Valley, Malaysia. Therefore, the following hypothesis has been formulated:

**H2: There is a positive influence of the advantage of the LRT towards LRT usage.**

According to [17], attitudes towards different transport modes were surveyed and the results indicated that a fast, convenient, and low-priced trip are the common users' perceptions towards the LRT services. These also include comfort and speed, which are influences towards the public transport usage. Therefore, the following hypothesis has been formulated:

**H3: There is a positive influence of attitude towards LRT usage.**

#### 4. Research Methodology

This study was a quantitative research in nature. The primary data was obtained through personally administered questionnaires, also known as the self-administered questionnaires. The questionnaires were distributed randomly to the LRT users in the Klang Valley. In this case, three of the most crowded LRT stations had been selected as the sample population of the study. This was due to the large number of the population for the overall LRT stations. By choosing the Masjid Jamek station, Kinrara BK5 station, and Ampang station, the total population was estimated at 30000 people. From the total population, 379 people had been selected to be the sample size. They were selected randomly regardless of their gender, age or ethnicity. The convenience sampling technique has been used as the sampling technique for this study. The convenience technique also meant that the questionnaires were for those who were available to answer the questionnaires [65].

Nevertheless, out of the 379 questionnaires distributed, only 285 usable questionnaires were received (75.2%) for further evaluations. This was because 94 respondents were found not to be the LRT users and thus, they were not eligible to represent the population of the study. The descriptive analysis showed that the majority of the respondents were female (57.5%), at the age bracket between 19 to 29 years old (70.2%), Malay race (81.8%), students (54.9%), and used the LRT everyday (42.5%).

#### 5. Data Analysis and Findings

In this study, there were two stages of analysis that had been adopted - the measurement and the structural models. In the first stage, the measurement model needed to be established first, before analysing the structural model. The purpose of constructing the measurement model was to analyse the convergent validity which measures the individual loading of each item, the composite reliability (CR), and the average variance extracted (AVE). As for the discriminant validity, the square root of the AVE should be higher than the other correlation values between the latent variables.

According to [35], they suggested that the factor loadings be above 0.7. For the composite reliability (CR), the recommended value was above 0.7 for the present study and 0.6 for the exploratory study [6]. Next, the acceptable value for the average variance extracted (AVE) is from a value of 0.5 or higher [34]. Next was the discriminant validity that measures the square root of the AVE for each latent variable. The square root of the AVE for each construct had to be greater than the inter-correlations between each construct to indicate the model's discriminant validity for the study [28].

The second stage was the assessment of the structural model in order to test the hypotheses of the study. The bootstrapping method has been applied to determine the significant level of weights, path coefficients, and loadings. Moreover, the blindfolding method has been used to assess the model fit. [66] and [29] suggested method was used to calculate the Stone-Geisser  $Q^2$  in the context-validated redundancy value. As stated by [15], the model is considered fit when the value of  $Q^2$  is above 0.00.

##### 5.1 Assessment of the Measurement Model

In the assessment of the measurement model, the reflective constructs were evaluated to determine the acceptance of the reliability and validity of the constructs. Table 1 shows that the composite reliability of all of the constructs in the study exceeded the 0.7 threshold as suggested by [35].

The outer loading above 0.6 (with the details shown in Figure 1) also clearly indicated that the reliability of each individual item was greatly achieved [32]. Subsequently the convergent validity was assessed, with the results of the AVE of all of the constructs being above 0.5, this

indicated that the convergent validity had reached a satisfactory level [28].

**Table 1:** Result summary reflective for outer model

Latent Variable	Item	Outer Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Traffic Reduction	TR1	0.858	0.893	0.736
	TR2	0.854		
	TR3	0.861		
Advantage of LRT	AD1	0.791	0.891	0.671
	AD2	0.797		
	AD3	0.839		
	AD5	0.848		
Attitude	AT1	0.756	0.874	0.634
	AT2	0.797		
	AT4	0.823		
	AT5	0.808		
LRT Usage	USG1	0.719	0.884	0.604
	USG2	0.814		
	USG3	0.786		
	USG4	0.785		
	USG5	0.780		

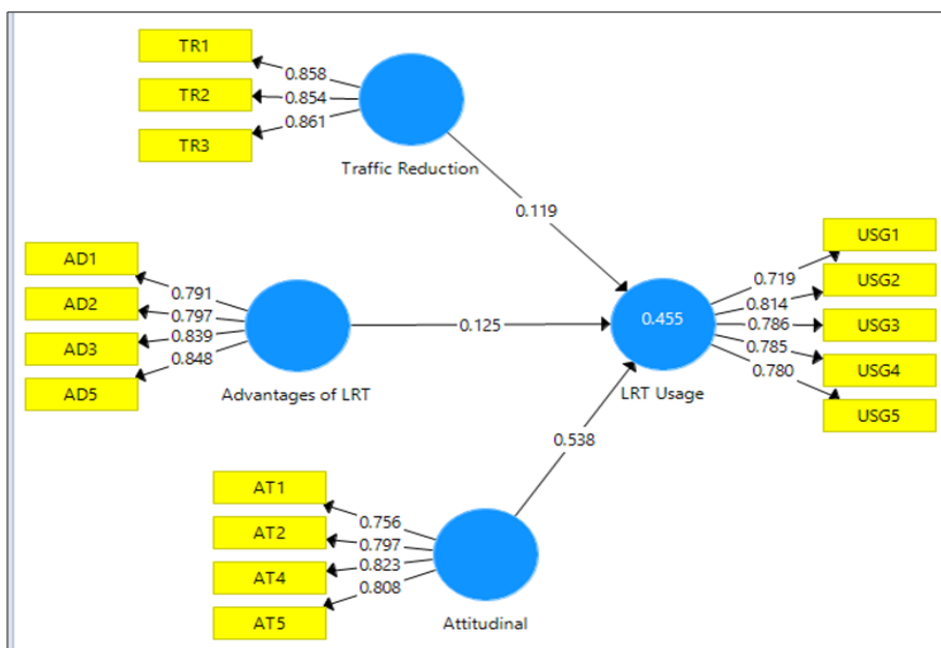


Figure 1: Measurement Model

Figure 1 shows that the coefficient of determination,  $R^2$ , for the LRT Usage's endogenous latent variable was 0.455. This coefficient of determination,  $R^2$ , of the endogenous variable suggests that 45.5% of the variance in the LRT Usage can be explained by the three types of

exogenous variables of this study, which were traffic reduction, advantage of LRT, and attitude. Another 54.5% can be explained by other variables which were not included in this research study. As for the inner model, it suggests that traffic reduction had a strong effect on the LRT Usage

(0.119) followed by the advantage of the LRT towards LRT Usage (0.125), and the last one was attitude towards LRT Usage (0.538). These outer loadings of each indicator also changed slightly compared to the first established measurement model.

**5.2 Discriminant Validity**

To determine the discriminant validity, the Fornell-Larcker criterion analysis was used by comparing the intercorrelations between the constructs and the square root of the AVE. Based on the results in Table 2, the values of the square root of the AVE were higher than the correlation values between the latent variables. This clearly indicated that the discriminant validity had been adequately achieved.

Table 2: Discriminant Validity

	[1]	[2]	[3]	[4]
<b>Advantage of LRT</b>	<b>0.819</b>			
<b>Attitude</b>	0.569	<b>0.796</b>		
<b>LRT Usage</b>	0.475	0.654	<b>0.777</b>	
<b>Traffic Reduction</b>	0.365	0.379	0.369	<b>0.858</b>

**5.3 Assessment of the Structural Model**

In this research, the relationship between the latent variables has been described by the establishment of a structural model. Plus, this relationship in the structural model was called the path coefficients. Figure 2.0 shows the final research model's PLS-SEM outcome. To test the significance of both of the inner and outer models, bootstrapping has been

used to generate the statistics values. The bootstrapping of 5000 subsamples was applied to obtain the required results. The path coefficient's significant level was decided based on the T-statistics value exceeding 1.645 for a one-tailed t-test. Table 3 below shows the results of the structural model.

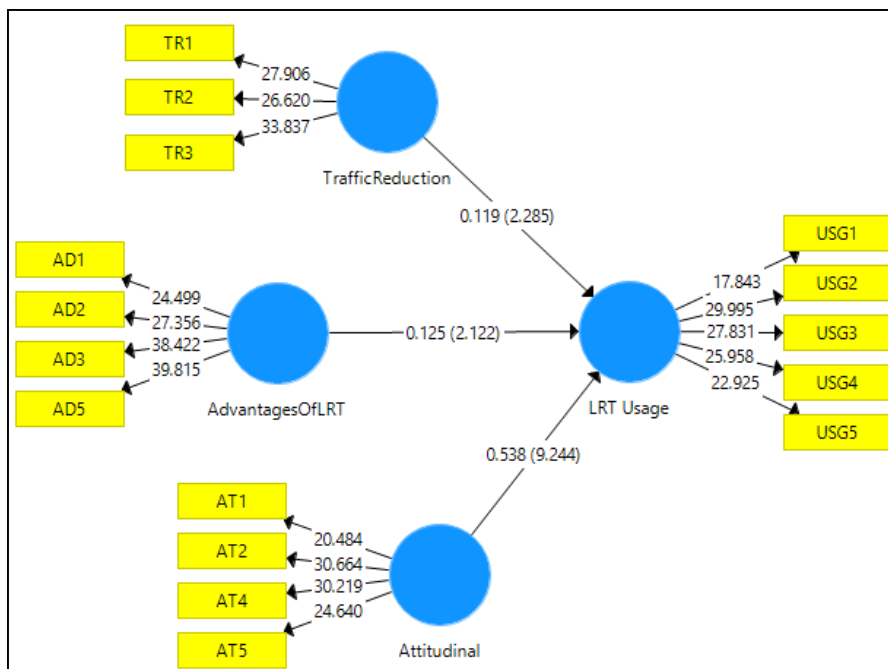


Figure 2: Structural Model

**Table 3: Path Analysis Results**

Hypothesis	Path	Beta	T-statistics	Decision
H1	Traffic Reduction -> LRT Usage	0.119	2.285	Supported
H2	Advantage of LRT -> LRT Usage	0.125	2.122	Supported
H3	Attitude -> LRT Usage	0.538	9.244	Supported

The above table shows that the path of traffic reduction towards LRT usage was 2.285 (t-Stat = 2.285 > 1.645), advantage of LRT towards LRT usage was 2.122 (t-Stat = 2.122 > 1.645), and attitude towards LRT usage was 9.244 (t-Stat = 9.244 > 1.645). All of these path values of the inner model exceeded the acceptable values. Hence, H1, H2, and H3 have been supported.

## 6. Discussions

This study has examined the influential determinants which impact the LRT usage. This study has utilised the Theory of Reasoned Action to explain and predict that the behaviour of an individual's decision to use the LRT is based on the outcomes the individual expects from the traffic reduction, advantage of LRT, and attitudinal reasons.

The results unveiled that traffic reduction, advantage of LRT, and attitude had positive influences towards the LRT usage. Clearly, traffic reduction has become a factor to motivate the people to use the LRT in the Klang Valley. It can solve the road congestion problems faced by road users, especially in the Klang Valley. Busy areas such as Kelana Jaya and Ampang heading to the Kuala Lumpur City Centre are causing the worst traffic congestion and inconvenience to the road users. The LRT can overcome the traffic jams due to its independent rail system network. The LRT's existence in Malaysia indicates that it can solve one of the main problems faced by road users, especially in urban areas. The LRT eases their burdens by providing a smooth journey to work, school, and other desired destinations. Moreover, the difficulty in finding parking lots, especially in the city centre, has somehow affected the traffic jams. Double-parking usually causes this problem as road users prefer to just park wrongly without thinking about other people. Hence, it is very important to reduce traffic jams, pollution, accidents, and undesired fuel usage by having effective parking management and strategies [5].

Furthermore, the results revealed the positive influence of the advantage of the LRT towards the

LRT usage. Enhanced active accessibility of a particular place will make the population adjoining it gain more 'opportunities' with, for instance, schools, malls, and jobs. This active accessibility will then make the location more appealing for the development of residential areas since people would possibly desire to stay there because they could reach activities and services in an acceptable timeframe. Undeniably, LRT usage benefits the rider by having high accessibility in many good ways as it soothes their daily lives. It allows for fast connection to the residential area and offices within a single city [68].

LRT accessibility also directly encourages the people to use this public transport as many other complementary services provided by government like feeder buses have definitely assisted the people's movement. Besides that, travelling in the city has also become much easier for the LRT users. There is no need for them to go far as there are also many residential areas, schools, and supermarkets which are conveniently close to the LRT stations. This definitely has proved that the LRT is convenient to use, not only for the normal passenger, but also for disabled persons. A study by [46] has confirmed that accessible and conveniently located train stations and bus stops are also essential besides other factors to motivate the usage of public transport.

Lastly, the results revealed the positive influence of attitude towards the LRT usage. As a result, the outcome of the findings shows that there is a significant relationship between attitude and LRT usage. As stated by [49] and [69], the effect of crowding is not only on physical comfort but also on psychological problems like stress, anxiety, and feelings of a person's privacy being conquered; as a matter of fact, the varied level of crowding between both unstable vehicle loads and competing routes is found to have an effect on the choice of route and vehicle by passengers. Definitely, comfort in riding public transport plays an essential role for the LRT users in the Klang Valley as they are concerned with their own space and privacy. Comfort is a crucial deliberation when travelling [26]. This shows that comfort in public transport undoubtedly

influences the perceptions of the people in order for them to use the service.

Furthermore, [17] stated that people who consider travelling fast as the most important factor when using public transportation are more likely to use the light rail transit than to use buses. This was confirmed by [64] who said that the travellers are less attracted to the bus transit compared to the light rail transit even though both services are offering similar levels of service. He also explained the contrast in ridership by recommending that the light rail transit is viewed as being faster than the bus service as it moves on its own right-of-way. This then proved that people do use the light rail transit because it is considered as a faster service than other public transport modes to go to their wanted places.

## 7. Conclusion

As a conclusion, we can say that the LRT users in the Klang Valley have chosen the LRT due to the factors of traffic reduction, advantage of LRT, and attitudinal reasons. The selection of the LRT amongst the users has been mainly to avoid the congestion and parking hassles during the peak hours. Several advantages of the LRT, such as enhancing the active accessibility to and convenience for the users have also motivated the users to use the LRT as the mode choice amongst the available public transportation systems. Finally, personal attitudes have significantly influenced the usage of the LRT. Comfort and fast travelling were amongst the users perceptions of the LRT services which can reduce the crowding and provide speedier travelling to reach the destination in a shorter period of time. The results of the study have validated the underpinning Theory of Reasoned Action in explaining and predicting the LRT usage by the users which were simply based on the influence of the traffic reduction, advantage of LRT, and attitudinal reasons.

This study is expected to benefit the LRT operators in the Klang Valley by helping them to recognise the significant factors that influence the LRT usage so that they will have the opportunity to improve their services. This could eventually lead to an increasing number of LRT users and, ultimately, maximise the profits in the long run. Future research is suggested to include other potential factors which could influence higher LRT usage amongst the users.

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