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Passenger Rail Service Comfortability in Kuala Lumpur Urban Transit System

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Abstract. Rail transit transportation system is among the public transportation network in Kuala Lumpur City. Some important elements in establishing this system are ticket price, operation cost, maintenance implications, service quality and passenger's comfortability. The level of passenger's comfortability in the coach is important to be considered by the relevant authorities and system operators in order to provide comfort and safety to passengers. The objective this research is to study some parameters that impact the comfortability of passengers and to obtain feedbacks from passengers for different rail transit system. Site observations were conducted to obtain data such as noise, vibration, speed and coach layouts which will be verified by using the passenger feedback outcomes. The research will be focused in and around the Kuala Lumpur City for the duration of 10 months. Four rail transit systems were being considered, i.e. Train Type A (LRA), Train Type B (LRB), Train Type C (MRL) and Train Type D (CTR). Data parameters obtained from field observations were conducted in the rail coaches during actual operation using apparatus among others the sound level meter (SLM), vibration analyzer (VA) and the global positioning system (GPS). Questionnaires were prepared as passenger feedback instrument, focusing on the level of comfortability in rail coaches. The outcomes of these analyses showed that CTR was the best and most comfortable coach, followed by LRA, LRB and MRL. Using the passenger feedbacks (MBP) it was also found that the ranking values for the railway transit system using Rail Coach Comfortability (RCC) is RCC (MBP) were the same as the outcomes using the RCC (parameters). In conclusion, it was found that this research has successfully determined the level of comfortability as determined in its aim and objectives. From this research, it is hoped that the relevant authorities will continue to find ways to enhance the comfortability and safety of its train coaches especially its passengers and the community at large.

1 Introduction

Rail transportation service becomes the first choice mode of public transportation in city area. Rail service giving a better solution for traffic congestion and served passengers the quality of service and comfort [3]. It also provides a better quality of environment and reduces the air pollution cause by transportation used diesel as power of supply. Rail service use own rail tracks for transport passengers and freight, and its contrast to other public transportation where vehicle run on the road. Basic infrastructure requirements for developing railway system usually consists rail, track, rolling stock,

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stations and signaling system [2]. A rail services is expected to connect effectively and efficiently the population in conducting their business and daily activities. It may be classified into different categories depending on its demographic nature or its types of service [5]. Demographically, it can be categories as urban and urban services whereas typically, it can be categories as cargo, high speed, light rail transit, mass rapid transit, monorail, passenger train aero-train, depending on its purpose and designation. In this paper, the focus will be mainly on the urban transit systems that exist in Kuala Lumpur city [1].

A rail transit system will require specific infrastructures to be conducted. It needs rail system with signaling and control systems, the stations as terminal stops with platforms and information system, and it also needs several sets of strains which will commute at designated frequencies to deliver its services effectively and efficiently [5, 6]. Thus, a rail transit system differs totally on its operation nature when compared with other transportation system. The most pertinent difference between train system and others are train will need a right of way system as it only operates on rails which does not same with other transportation system [7].

2 Urban Rail Transit Systems

Urban rail transit systems are mentioned earlies is getting more popular as it seems to be an effective alternative for urban transportation to reduce congestion. Many cities such as London, Paris, Seoul, Kuala Lumpur and China were successful in managing their traffic flow to reduce the travelling time of motorist on the roads [2]. It seems to successfully the numbers of vehicles on the roads. The needs of an effective and efficient urban transit system is more pertinent as the growth of population is getting more rapid due to the current economic needs of more human resources. Migration of the people from rural to urban areas due to availability of employment in the cities has increased the needs for an alternative transportation system [3].

As mentioned earlier, there are categories of urban transit systems and one of them is the rail transit system. In Malaysia, the most popular urban transit system are the bus and taxis, whereas rail transit system is only for long distance travel, even though currently in Kuala Lumpur it is popular as an urban transit system due to its punctuality and less hassle during peak hours. However, the Malaysian government is currently contemplating to encourage other cities to plan and built rail transit system into their urban transportation network [1]. This is again important to reduce congestion during peak hours, and to coupe with future population growth, to enhance and create the image and landscape of a modern city and to reduce air pollution due to vehicular carbon emission [5].

3 Impact of Passenger Comfortability on Rail Transit Service

Better riding quality, especially for passengers travelling long distance needs the high level of comfort. The key for sustainable of passengers using one of public transportation is when the riding comfort parameters such as noise, vibration, design layout and speed are acceptable to them. These parameters were studied by various parties such as rail operators, engineers, scientist and researchers [1, 11]. Most of them were concerned about punctuality, vibration and noise. Others are more concern on ways to attract passengers using the rail transit system [9]. The economics of establishing a rail transit system is always a concern, thus many authorities usually will give or stress more on ensuring that the ROI (Return of Investment) period will be considered thoroughly which depends on the population growth as the main demand indicator.

Comfortability in rail service depends on the perception of passengers whereas efficiencies and effectiveness will depend on the operation and delivery of the service [5, 11, 12]. If the service frequency in punctual and as expected, then the rating will be high while if it is not, then it will be considered as poor and not trustworthy. Comfortability of rail transit service will determine the numbers of commuters as the more popular it is. The more passengers it will be attracting. Thus, the ROI of a train system or operation will depend not only on its technical delivery but also on its

marketing and ability to attract new passengers from time to time, while reducing the technical problems such as vibration and noise disturbances to passengers.

4 Results and Analysis

This is a research conducted in collaboration with Prasarana Negara Bhd. and Keretapi Tanah Melayu Berhad, two main railway operations in Malaysia. This study was carried out on rail transport system in the city of Kuala Lumpur. The results of the research conducted in the field, the data for the specified parameters have been obtained. The focus of the research is mainly on vibration and noise with another parameter is also discussed i.e. design layout which affects comfortability of passengers in railway coaches. All these parameters are analyzed to determine the level of passengers comfort and data from passenger feedback are used as the verification process. All of this data observation was carried out on four (4) types of selected rail transport system. The data obtained were used to determine the level of passenger comfort in coaches for every type of rail system under study. Selected routes with pre-determined number of stations were observed as samples of the research work. The data observed were based on field and passenger feedbacks.

Vibration parameters were analyzed for this study is the vibration displacement and velocity. It is considered important due to the potential cause discomfort while operating the passenger coaches. According to Table 1, it was found that the LRA system producing the least vibration and very similar to LRB system. This shows that light rail transport system, LRT, producing the least vibration level compared to other rail transport system. Whereas MRL system is the rail system with the highest income level of vibration. This may be due to system or a mono track has created a situation less stable over time. Therefore, the study of the real causes vibration viewed more than 5 times of that produced by the LRT system to be done to improve the rail transportation system based on vibration impact on passengers. CTR system, which is categories as sub-urban rail system, also viewed produce high vibration compared to the LRT system. But it's still an acceptable level of around 0.1μm for displacement and 0.1mm/s based on the specification operators and authorities rail transport system.

Table 1. Ranking of vibration parameter.

No.	Types of rail system	Displacement (μm)	Vibration Velocity (mm/s)	Ranking
1.	LRA	0.33553	0.03234	1
2.	LRB	0.14408	0.03400	2
3.	MRL	1.67692	0.42292	4
4.	CTR	0.85608	0.08517	3

*Ranking is based on displacement and vibration velocity

The data tabulated were obtained from concurrent observations with the vibration observations. According to collected data, Table 2 was produced and the comparability of the rail system is showed. The lowest average noise level for this study was developed by CTR system while the highest is MRL system. The range of sound, is the sound level of the highest and lowest is the biggest LRB rail systems while the smallest is MRL system. However, the observed range was almost in each other, a difference of 2 to 3 dBA only and is considered a small value. However, the level of sound emitted by the rail system being studied, it is still within the sound level required by the specifications of the original operator and the authorities are around 75dBA.

The layout was obtained from the operators which were approved for construction. In Table 3, the best rail transit system in terms of layout and the number of passengers is the CTR system. It's because this rail transit categories as sub-urban system, the better facilities provided to passengers because of long distance and travel of time. This resulted in CTR provides excellent facilities to give passengers the high level of comfort. While the lowest rail system is MRL system. However, this occurs because MRL system has limitations in terms of control and balance during operation. Its size

is only built for 2 cars with the maximum number of passengers a total of 158 people led to poor levels of passenger comfort, especially at peak hours.

Table 2. Ranking for noise parameter.

No.	Types of Rail System	Standard (dBA)	Average Noise Level (dBA)	Difference Range in Noise Level (dBA)	Average Noise Level (dBA)	Ranking
1.	LRA	75	73.8 – 78.3	4.5	76.0	3
2.	LRB	75	69.0 – 75.9	6.9	72.0	2
3.	MRL	75	74.8 – 78.9	4.1	77.0	4
4.	CTR	75	68.2 – 74.0	5.8	71.2	1

*Ranking is based on average noise level generated

Table 3. Ranking for coach design layout.

No.	Types of Rail System	Number of Passengers (Specification)	Number of Passengers (Observation)	Floor Area Coaches (m^2)	Number of Doors	Number of OKU Seats	Ranking
1.	LRA	166	137	44.255	6	1	2
2.	LRB	156	192	40.152	6	-	3
3.	MRL	92	112	25.836	4	-	4
4.	CTR	259	171	62.700	6	2	1

*OKU – Disable person

Summary of field observation results based on all parameters that were observed, Table 4 showed the summary of the four types of rail systems in City of Kuala Lumpur. From the field data analysis, it shows that the level of comfort in the CTR system coach is the best, followed by LRB, LRA and MRL systems.

Table 4. Summary of field data analysis.

No.	Types of Rail System	Types of Parameter	Ranking (from field data analysis)	Total Point	Ranking
1.	LRA	Noise	3	10	2
		Vibration	1		
		Speed	4		
		Coach design layout	2		
2.	LRB	Noise	2	10	2
		Vibration	2		
		Speed	3		
		Coach design layout	3		
3.	MRL	Noise	4	14	3
		Vibration	4		
		Speed	2		
		Coach design layout	4		
4.	CTR	Noise	1	6	1
		Vibration	3		
		Speed	1		
		Coach design layout	1		

Note: LRA, LRB, MRL and CTR denote the different types of rail system in Kuala Lumpur. LR means the light rail, MRL means the monorail and CTR means the Commuter system.

MRL system is the worst because of the effects of noise and vibration in the coach is the lowest such an arrangement coaches. If the ranking was made without involving the CTR system as it is categorized as sub-urban rail transit, the LRB system is the best as it categorized as urban rail transit, followed by the LRA system and MRL system. However LRB system and LRA system is distinguished only by the speed compliance during operation. This system does not use weighted method but rather direct observation values based on ranking made by respondent's feedbacks and field observations value.

Summary of passenger feedbacks were obtained through questionnaires conducted during the research study duration. It took ten months for the researchers to gather enough feedbacks from the passengers as many were reluctant to sit and answer the questionnaires due to their busy schedules. The followings are the results obtained as shown in Table 5 and Table 6.

Table 5. Ranking from RCC (parameters) and RCC (passenger feedbacks).

No.	Types of rail system	RCC (Parameter)	RCC (MBP)
1	LRA	2	3
2	LRB	2	2
3	MRL	3	4
4	CTR	1	1

The results and analyses of the research case study showed that different train systems will generate different comfortability levels. The research was able to rank the different train systems which operate in Kuala Lumpur City according to field data observations and passenger feedback analysis. From these analyses, as shown in Table 6, it was found that the commuter system is ranked the best whereas light rail transit is ranked second and third. However, trailing close is the monorail which is considered a new addition to the urban rail transit in Kuala Lumpur. The commuter system is classified as a sub-urban train service and it is expected that it will give a better service compared to the light rail and the monorail. By disregarding the commuter system, it leaves the light rail as the best urban rail transit option over the monorail and the setbacks of the service found during the research can be improved for better future rail transit service. The ranking showed in Table 7 were based on respondent feedbacks which gave their opinions as whether the rail coach condition and environment are best or worst. From Table 5, CTR was voted the best coach in all questions posed to passengers whereas MRL gets 7 worst votes from 7 questions. LRB and LRA are ranked second and third best if compared to MRL.

Table 6. Respondent rating (best or worst) through questionnaire for different rail coaches.

Question		A1	A2	B	CI	C2	D	E1	E2	E3	E4
Rating	Best	CTR	CTR	CTR	CTR	CTR	CTR	CTR	CTR	CTR	CTR
	Worst	MRL	MRL	MRL	LRA	LRA	MRL	MRL	MRL	LRB	MRL

Table 7. Overall performance ranking of different rail transit services in Kuala Lumpur.

Overall Feedback Ranking Analysis			
No.	**Nos of Best Ranking (Based on Parameters and Feedbacks)**	**Nos of Lowest Ranking (based on Parameters and Feedbacks)**	**Ranking**
1.	LRA = 0	LRA = 2	**3**
2.	LRB = 0	LRB = 1	**2**
3.	MRL = 0	MRL = 7	**4**
4.	CTR = 10	CTR = 0	**1**

5 Conclusions

As a conclusion, it may be summarized that passenger comfortability is important as it may be the pulling factor for the public to commute to and from their offices or for leisure, using the urban rail transit system. The case study conducted by the researcher is a continuing research project. Thus, determining the comfortability level or range will somehow enhance credibility of the train services and enhance the traffic mobility in a city such as Kuala Lumpur. In many metropolitan cities such as London, Paris, New York, Seoul, Shanghai and Tokyo, traffic congestions are tremendously organized and controlled during peak hours. However, in cities such as Jakarta, Bangkok, New Delhi and several cities without rail transit systems, traffic mobility and congestion are still experienced by the local residents. Thus, this has an impact to the well-being of the city population and the economy of the country.

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