Intercity Land Public Transport Challenges in Developing Country: A Case Study in Peninsular Malaysia

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Abstract: This research aims to determine the influencing factors for transport mode preferences which lead to existing competition among intercity land public transport modes in developing country such as Malaysia. In Malaysia, the intercity bus is preferred to the train, but now it is confronting increasing challenges. It is crucial that an answer be found to this problem as intercity bus transport plays an important role in the intercity transportation system in this country. A total of 5,880 data set was analyzed using Stated Preference technique and binary logit equation. It is really interesting finding that bus users have a different perception on the value service changes of their current mode toward their mode's competitor. This study considers providing a better understanding of higher intercity bus ridership against the train in Malaysia based on the determined explanatory attributes.

Keywords: Intercity Bus, Intercity Travel Characteristics, Stated Preference, Binomial Logit, Sensitivity.

1. INTRODUCTION

The intercity mobility in Malaysia is widely served by intercity land transport services (automobile, intercity bus and train) and an intercity air transport service. Each mode has specific characteristics that influence its preference. Air travel is much faster compared to road travel, which people claim as slow and tedious. The air transport service in Malaysia offers a frequent flight departure/day, high safety level and extremely comfortable journey for users. Travelling by airplane takes the shortest time to reach the destination compared to other alternatives. But similar to other developing country, the poor accessibility to the airport (requires transit), higher feeder transport cost, and longer waiting and access times have become the obstacles in air transport (Correnti *et al.*, 2007). Air travel requires considerable non-travel time, including the movement from the city to airport, processing and waiting times (Correnti *et al.*, 2007). In addition, air transport only becomes worthwhile for the passengers when the travel time is at least several times longer than the non-travel time. This becomes obvious when the distance between departure and destination point is sufficiently far apart. Travel time difference between road travel and air travel will be very wide. When the travel distance is over 300 km, air transportation possesses irreplaceable advantages over the other modes (Correnti et al., 2007).

In Malaysia, the automobile generally forms the largest mode share in intercity travel modes, followed by intercity bus and intercity train. The car itself is the second (40%) most common mode for transportation in Malaysia (Nurdden et al., 2007). Despite this, Malaysia relies on buses and trains for intercity land public transport movement.

Train is preferred because of good accessibility to the terminal, even though less comfort than the bus. Sometimes the travel time becomes longer in certain routes, since the conventional train is still single track, lower speed and the rail network coverage is limited. Bus services are available in all cities in Peninsular Malaysia. The fare is also affordable for long journeys. It offers more comfort and shorter travel time than the train. But accessibility to the terminal is sometimes poor since the bus terminal is usually located around the border of the city. Intercity bus is still the preferred mode. The wider route coverage of intercity bus, higher departure frequency, lower fare, shorter travel time are among the factors to choose an intercity bus rather than train in Malaysia. These two types of land public transport modes constantly compete against each other, so bus and rail will be considered in this further study of intercity land public transport. Table 1 shows a brief review of intercity land public transport mode characteristics in Malaysia.

Table 1. Intercity land public transport mode characteristics in Peninsular Malaysia

Transport Mode	The Characteristic of Transport Mode
Intercity Bus	• Intercity bus service is available in almost all of the cities in Peninsular Malaysia, unlike rail which has s limited track service, especially in the east corridors of Peninsular Malaysia. • The wider route coverage is among the reasons why intercity bus has become more popular than intercity train.
Intercity Train	• In Malaysia, the shortage of resources for locomotives and crews, the low average train speeds (60 kph), narrow 1 meter track gauge and old rolling stock have become the constraints in rail transport (Abdul *et al*., 2008). These constraints have resulted in longer travel times on certain routes. In addition, the restricted market coverage for the Keretapi Tanah Melayu Berhad (KTMB) network has also become a contributory obstacle in railway transport in comparison to the road network (Kumar, 2008). Therefore the bus is getting a high modal share since it is quick and comfortable. Train in Malaysia is preferred because of its good accessibility to the train station. Train also has advantages over the road transport industries in terms of the socio-economic benefits such as the number of road accidents and pollution (Abdul *et al*., 2008). • In terms of service, Malaysia's intercity train KTMB offers a more comfortable berth than the bus seat, but requires a higher price. However, at the same class level of service, the train is the less comfortable (seat) than the bus.

2. CURRENT SITUATION OF INTERCITY LAND MODE TRANSPORT SERVICE IN MALAYSIA

National Spatial Framework 2020 explains that future urban growth centers will be concentrated in strategic conurbations (JPBD, 2010). The concentration of development in conurbations means that urban-based economic activities will be concentrated in the main conurbations of Kuantan, Penang/ George Town, Johor Bahru (JB) and Kuala Lumpur (KL) to promote efficiency in land use and infrastructure planning which is globally competitive. The concentration of development and the attraction of KL and its conurbations may influence the intercity movement in these origin and destination pairs.

In relation with the concentration of development in the National Spatial Framework 2020, intercity travel to the north, south and east of Peninsular Malaysia were categorized into eight main corridors. The eight main intercity corridors are namely; KL - Alor Setar, KL - Penang, KL - Ipoh, KL - JB, KL -Melaka, KL - Kuantan, KL - Kota Bharu and KL - Kuala Terengganu (Figure 1).

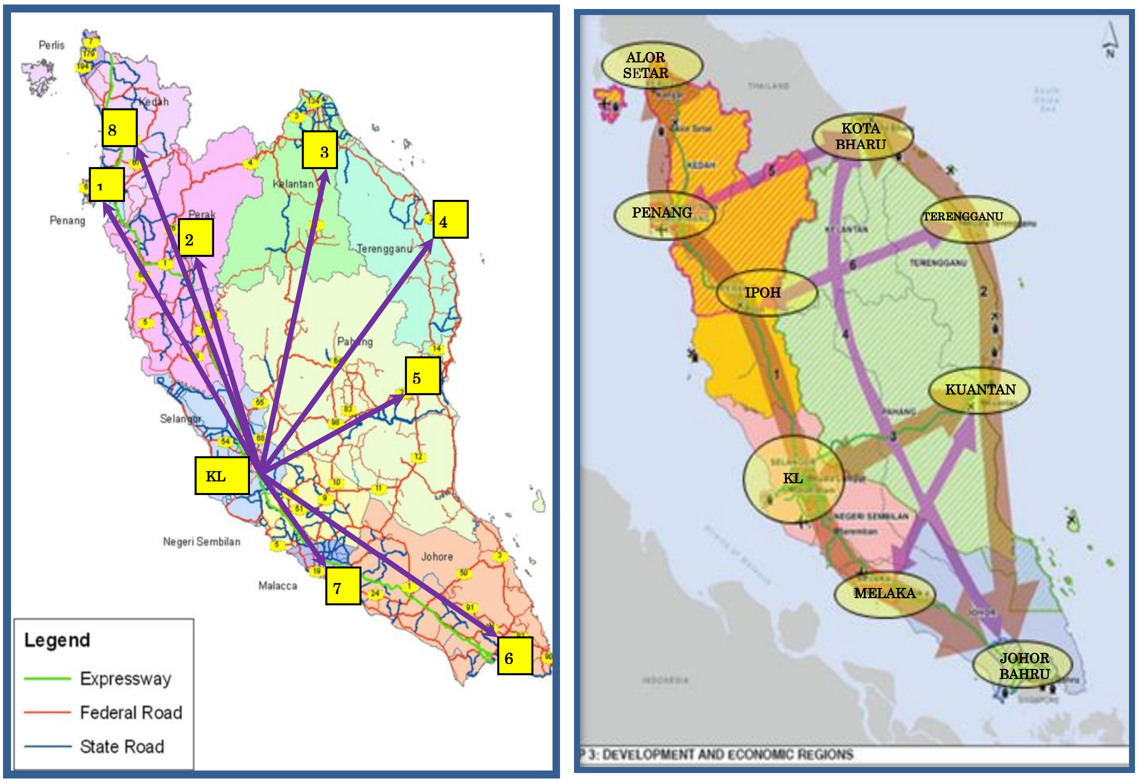

Figure 1. Basic road network and Main intercity transport corridor based on the development in economic region in Peninsular Malaysia (JPBD, 2005)

2.1. Road Transportation Network in Malaysia

Roads in Malaysia are generally categorized into Federal roads, State roads, Municipality roads and toll roads (privatized roads). These categories are based on ownership and administration of the road concerned. The total road length in 2010 is 157,000 km of which 12% are Federal Roads and 75% are State roads and Municipality roads. Toll roads are mainly interurban expressways and urban expressways and this amount to around 1,820 km. The basic road network in Peninsular Malaysia is illustrated in Figure 1.

JPBD (2005) noted that the ninth Malaysia Plan (9MP) for the period 2006-2010 marked the expansion of infrastructure development with an effort to increase the efficiency of existing facilities and improve the accessibility and linkages in rural areas. All major economic centers are linked to one another and have good connection to the ports with relatively good road networks (Abdul *et al*., 2008). Malaysia road transportation accounts for 96% of total passenger and goods transport in the country.

Intercity movement via the road network along the corridors of KL-Ipoh, KL-Alor Setar, KL-Penang, KL-JB and KL- Melaka are accommodated by the existing North-South Expressway (NSE). According to Projek Lebuhraya Utara-Selatan Berhad [PLUS] (2011a), the NSE is the longest expressway in Malaysia, with the total length of 772 kilometers spanning from Kedah (near the Malaysian-Thai border) to JB (at the southern tip of Peninsular Malaysia). Besides the NSE, intercity movement along the five corridors mentioned is also accommodated by others 3 expressways which adjoin each other, with a total of 847.7 km of inter-urban toll highways, used to support traffic movement in Malaysia.

In addition, the Butterworth-Kulim Expressway (BKE) supports a connection of the east (Kedah and Kulim) with the west (Penang and Butterworth). BKE is also a main route to Federal route (East-West Highway) toward Perak, Grik, Kedah and Baling (PLUS, 2011b).

This expressway supports the intercity movement along KL - Kuantan, KL - Terengganu and KL - Kota Bharu corridors.

2.2. Rail Transportation Network in Malaysia

Kumar (2008) highlights that the Malaysian Government made one of the most vital shifts in its urban transport policy by introducing rail systems in the capital city of Kuala Lumpur (KL) in the 1990's. KTMB is a private-sector company that operates the railway network in Malaysia. It was corporatized in August 1992 (KTMB, 2012). Intercity movement via the railway network has been accommodated through three major routes (Figure 2).The first route from KL to the North (ending at Padang Besar), supports rail transport demand along the KL-Alor Setar, KL-Penang and KL-Ipoh corridors, the second route from KL to the South (ending at JB), supports the demand along the KL-Melaka and KL-JB corridors, while the third line from KL to the East with the final destination at Tumpat supports the demand along the KL-Kota Bharu corridor. Unfortunately, certain corridors such as KL-Melaka, KL-Kuala Terengganu and KL-Kuantan are not yet well-connected towards these three major routes.

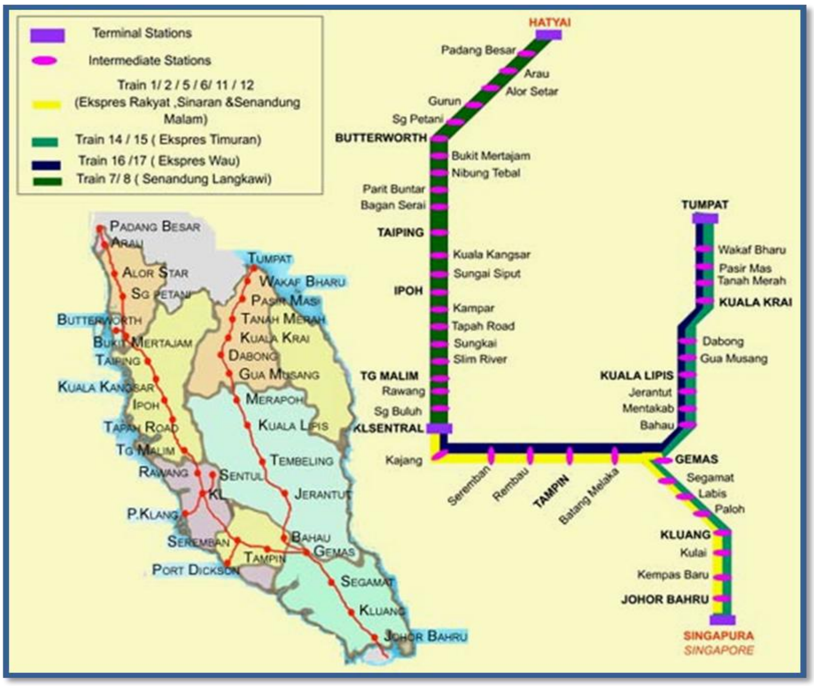

Figure 2. Intercity train route in Peninsular Malaysia (KTMB, 2012)

After a long period of limited investment in KTMB, the intercity railway infrastructure is now being expanded and modernized (Abdul *et al.*, 2008; Kumar, 2008). Intercity train service under KTMB management has improved its performance in many aspects, such as offering better service and faster travel time. KTMB continues with its program of refurbishing the third class coaches that ply the east coast corridor (Abdul *et al.*, 2008).

At present, the country has about 2,200km of railway tracks, with plans for more to come. KTMB operates train services such as intercity travel, suburban commuter services, freight services, container's haulage and property storage (KTMB, 2012).Currently the KTMB intercity runs 24 intercity passenger trains daily, consisting of 16 express trains and 8 local trains (Abdul *et al.*, 2008). In 2010, KTMB introduced the Electric Train Service (ETS), a rapid intercity service between KL and Ipoh, ultimately running 32 services a day. Based on these facts, rail transport would play a crucial role in the development of public transport facilities in Malaysia (Kumar, 2008).

3. METHODOLOGY

The data used in this research is a combination of primary and secondary data. In this preliminary study, the secondary data was obtained from government agencies such as the Ministry of Transport (MOT), Suruhanjaya Pengangkutan Awam Darat (SPAD), Keretapi Tanah Melayu Berhad (KTMB), and Malaysia Airport Holdings Berhad (MAHB) and used in the modal competition analysis. Meanwhile, the primary data was collected through a field survey since secondary data was not available. A preliminary survey for eight origin-destination pairs in Malaysia have been conducted in order to analyze the modal competition with regards the trunk mode service and access and egress mode services to the terminal. A paper based survey has been developed in order to gather information of intercity public transport user's characteristics.

For the case study area (KL – Penang and KL – JB), the field survey conducted in this study uses a combination of 5 minute on-site interviews and 15 minute on-site questionnaire sessions in terminals. A number of 120 intercity bus users were the respondents of this questionnaire-based study for both corridors. A total of 5,880 data set of stated preference data set have been analyzed for both corridors.

The questions are designed in the form of Reveal Preference (RP) questions and Stated Preference (SP) questions. The SP questions were designed in the form of two scenarios: intercity bus scenario and intercity train scenario. The intercity bus scenario represents the changes to intercity bus service values when the intercity train values remain constant. The intercity train scenario represents the changes to intercity train service values when the intercity bus values remain constant. The intercity mode preference in both scenarios was evaluated by using the four attributes: travel time, fare, frequency and access time. Binary Logit equation and Regression analysis had been employed in SP data analysis. Remains that U_{Bus} = intercity bus utility as effect of its service value changes, U_{Train} = intercity train utility as effect of its service value changes. Thus, P_{Bus} = Probability of choosing intercity bus can be written as equation (3.1):

$$P_{Bus} = \frac{\exp\,(U_{Bus} - U_{Train})}{1 + \exp\,(U_{Bus} - U_{Train})} \quad \ldots\ldots\ldots\ldots \quad (3.1)$$

The dependent variable in the regression model was the intercity mode utility as the effect of the intercity mode service value changes. The independent variables in this model were the mode service value differences. The mode service value which was evaluated consists of travel time, fare, frequency and access time. Therefore, equation (3.2) above can be explained as equation (3.2):

$$Y = U_{Bus} - U_{Train} = b_0 + b_1\,(X_{1\,Bus} - X_{1\,Train}) + b_2\,(X_{2\,Bus} - X_{2\,Train}) + b_3\,(X_{3\,Bus} - X_{3\,Train}) + b_4\,(X_{4\,Bus} - X_{4\,Train}) \ldots\ldots \quad (3.2)$$

Whereas; A, b_0 = intercept, B, b_1, b_2, b_3, b_4 = model parameter, X_1 = intercity mode travel time difference, and $X_1 = X_{1\,Bus} - X_{1\,Train}$, X_2 = intercity mode fare difference, and $X_2 = X_{2\,Bus} - X_{2\,Train}$, X_3 = intercity mode frequency difference, and $X_3 = X_{3\,Bus} - X_{3\,Train}$, X_4 = feeder mode access time difference to intercity land public transport mode terminal, and $X_4 = X_{4\,Bus} - X_{4\,Train}$.

This model was uses adjusted R^2 to cross-validate the model. To check the statistical significance for statistical model validations, T-test and F-test are used. Those tests are performed at a 5% significance level (α).

4. RESULT AND DISCUSSION

4.1. Preliminary Study

In the developing world, intercity travel is dominated by bus and conventional rail travel (Ribeiro *et al*., 2007). Similarly, intercity travel in Malaysia is also dominated by these intercity land modes. The intercity land modes challenges will be an interesting issue to discuss and are related to fare, travel time, departure frequency and feeder mode access time competition. A field survey has been conducted in order to collect some information on selected Origin-Destination pairs for further modal competition analysis.

The distance is categorized into three categories; the first is short distance (less than 300 km), the second is medium distance (301-400 km), and the third is long distance (more than 401 km). Intercity bus demand is relatively higher compared to other modes for the same distance traveled (Table 2). Intercity bus is more flexible regarding its departure frequency compared to the train. A great number of intercity buses depart from KL to the selected corridors everyday (Table 2).

4.1.1. General description on intercity transport mode share

The intercity transport modes under investigation included bus, rail, air, and automobile. According to travel distance (Table 2), this study found that the mode share pattern in Malaysia was varied.

(I) Short distance category

Table 2 shows that the automobile is very dominant in the short distance category. In the corridor with less mode competitors, the automobile also gains a higher mode share, for example in KL-Melaka (automobile 86.2%, intercity bus 13.8%), in KL-Kuantan (automobile 71.8%, intercity bus 16.0% and air 12.1%), and in KL-Ipoh (automobile 60.5%, intercity rail 18.4% and intercity bus 21.1%).

A high dependency on the automobile in the short distance corridor makes the air transport mode less favorable compared to other modes. Air transport failed to compete with the automobile (i.e., KL-Melaka corridor) or rail and bus (i.e KL-Ipoh). Except for KL-Kuantan, air transport is still getting a high mode share (12.1%) after the bus (16.0%), since no rail infrastructure is provided in this corridor. An interesting condition appears on the KL-Ipoh corridor. There’s slightly less dependency on the automobile (60.5%) for this corridor compared to KL-Kuantan (71.8%) or KL-Melaka (86.2%).

(II) Long distance category

In contrast to the short distance category, public transport has a dominant mode share for the long distance category (as in the KL-Kota Bharu, KL-Alor Setar or KL-Terengganu corridors). Passenger willingness to take public transport (bus, train or air transport mode) for the longer distances usually tends to increase. This is in line with Correnti *et al*. (2007), who state that as the travel distance increases private cars lose their competitive advantage. When the long distance corridor is provided by an air transport service, the air transport mode becomes dominant, i.e., KL-Kota Bharu 52.3%, KL-Alor Setar 33.7% and KL-Terengganu 61.3%.

(III) Medium distance category

In the medium distance category, intercity public transport modes compete with the automobile (i.e. KL-Penang and KL–Johor Bahru). The air transport mode gets a higher mode share percentage than the automobile for intercity ridership in the KL–Penang corridor, however air transport is often out of reach due to its relatively high service cost. Therefore, the intercity land public transport mode is an alternative. Within the intercity land public transport, rail and bus are barely competed with one another.

Table 2. Demand, frequency and mode share competition in selected corridors

O-D Pairs (From Kuala Lumpur)	Road Dis-tance	Intercity Mode Demand by Mode (Passenger/day)				Intercity Mode Frequency (Departure/day)				Intercity Mode Share in Selected main corridor (%)			
		Bus a), e)	Rail b)	Air c)	Auto Mo-bile d)	Bus a), e)	Rail b)	Air c)	Auto Mo-bile d), e)	Bus a), e)	Rail b)	Air c)	Auto Mo-bile d), e)
Penang	369	1,218	791	3,514	4,550	42	4	32	3,500	12.1	7.9	34.9	45.2
Ipoh	205	1,815	1,578	-	5,200	55	-	-	4,000	21.1	18.4	0.0	60.5
Kota Bharu	474	1,144	656	2,086	104	52	3	3	80	28.7	16.4	52.3	2.6
Kuala Tereng-ganu	455	546	-	988	78	26	-	9	60	33.9	0.0	61.3	4.8
Kuantan	259	726	-	549	3,250	33	-	5	2,500	16.0	0.0	12.1	71.8
Johor Bahru	368	3,082	777	1,098	5,850	128	3	10	4,500	28.5	7.2	10.2	54.1
Melaka	144	1,148	-	-	7,150	41	-	-	5,500	13.8	0.0	0.0	86.2
Alor Setar	462	552	439	769	520	24	4	7	400	24.2	19.3	33.7	22.8

Source: a) SPAD (2011), b) KTMB (2011), c) MAHB (2011), d) JKR (2008), and e) Primary Data Analysis (2011)

4.1.2. Factor influencing intercity land public transport mode preference in selected corridors

As seen in Table 3, fare and travel time attributes make the intercity bus the most popular transport mode option. Intercity land public transport traveling costs are much cheaper than either flight fare or automobile fuel consumption costs within each corridor. From observation of the selected corridor, intercity bus travel time is shorter than intercity train (Table 3).

4.2. Study Case Area

In relation with the concentration of development in the National Spatial Framework 2020, intercity travel to the north, south and east of Peninsular Malaysia were categorized into eight main corridors. Referring to Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (2005), the population of Malaysia is likely to increase in several national conurbations such as Pulau Pinang and Johor Bahru (Department of Statistics, 2011). High density of population, concentration of development and the attraction of KL and its conurbations may influence the intercity movement in these origin and destination pairs.

In this study, the selected corridors for intercity land transportation competition in Malaysia are possibly the north or the south corridors. The east corridors need to be excluded, since the east corridors are not well-connected with the KTMB railways major routes. Since all of the intercity modes services only exist in the medium distance corridors, the medium distance is selected as the study area. Thus, the further intercity travelling characteristic from KL to the north corridor (medium distance) is represented by KL-Penang corridor and from KL to the south corridor (medium distance) is represented by KL- Johor Bahru corridor.

Table 3. Fare and travel time competition in selected corridors

O-D Pairs (From Kuala Lumpur)	Average Intercity Mode Fare (RM)				Average Intercity Mode Travel Time (Hour)			
	Bus	**Rail**	**Air**	**Auto-mobile**	**Bus**	**Rail**	**Air**	**Auto-mobile**
Penang	41.30	46.40	156.00	157.00	4.50-5.50	6.50-7.50	0.80	3.50-4.00
Ipoh	21.30	27.60	-	92.00	2.50	2.00-3.00	-	2.00
Kota Bharu	34.00	55.00	137.00	147.00	8.00-8.50	12.00	1.00	4.50-5.00
Kuala Terengganu	43.00	-	125.00	165.50	8.00	-	0.90	4.50
Kuantan	19.60	-	198.00	107.00	3.50	-	0.70	2.50
Johor Bahru	40.30	54.50	125.50	156.00	4.50-5.50	6.50-7.50	0.90	3.50-4.00
Melaka	12.60	-	-	64.00	3.00	-	-	1.50
Alor Setar	40.60	50.60	130.00	194.60	5.00-7.00	10.00	1.10	4.00

Remarks:
1) Automobile refers to Car 2011, Fuel efficiency 12 km/liter, Fuel price 0.637 USD/liter (Model Car: Proton Saga 1600 cc, Automatic Transmission)
2) Toll fare and fuel consumption are included in automobile fare calculation for single passenger.
3) Exchange Rate in 2011: 1 USD = RM 3.05
4) Bus mode fare refers to average fare for 1st, 2nd and 3rd class
5) Rail mode fare refers to average fare for 1st, 2nd and 3rd class of conventional rail. For Ipoh, ETS was included.

4.2.1. The competition of intercity transport travel time, travel cost and accessibility in KL- Penang and KL- Johor Bahru (JB) corridors

Comprehensive information regarding intercity trunks and feeder mode service has been derived for the mode competition analysis in the KL–Penang and KL-JB corridor. Travel time, fare and feeder mode access time were consistently detected as the reasons to prefer an intercity bus in this case study area.

In Figure 3, it can be seen that intercity bus fare is cheaper than the train fare for both corridors of KL-Penang and KL-JB. The total travel time when travelling by bus is much shorter compare to travelling by train for both corridors of KL-Penang and KL- JB. Total travel time of travelling by bus along KL-JB is 5.83 hours and KL-Penang is 6.22 hours. While total travel time of travelling by train along KL-JB is 8.64 hours and KL-Penang is 8.83 hours. Based on Figure 3, the total travel time by bus is shorter than the train.

Intercity travel using land public transport would be very much affected by the degree of accessibility to the transport terminals, be it the intercity bus terminal or train terminals. Wee *et al*. (2001) mention about the importance of accessibility. Accessibility indicator implies the greater or lesser the ease of access to activity center (Gutiérrez & Urbano, 1996). Accessibility may also influence travel demand as the transport component and the time needed to carry out activities as the temporal component (Geurs & Wee, 2004). Appropriate and adequate infrastructure has to be made available for direct and easy access to these terminals, in order for the final door to door travel time between origin and destination can be minimized.

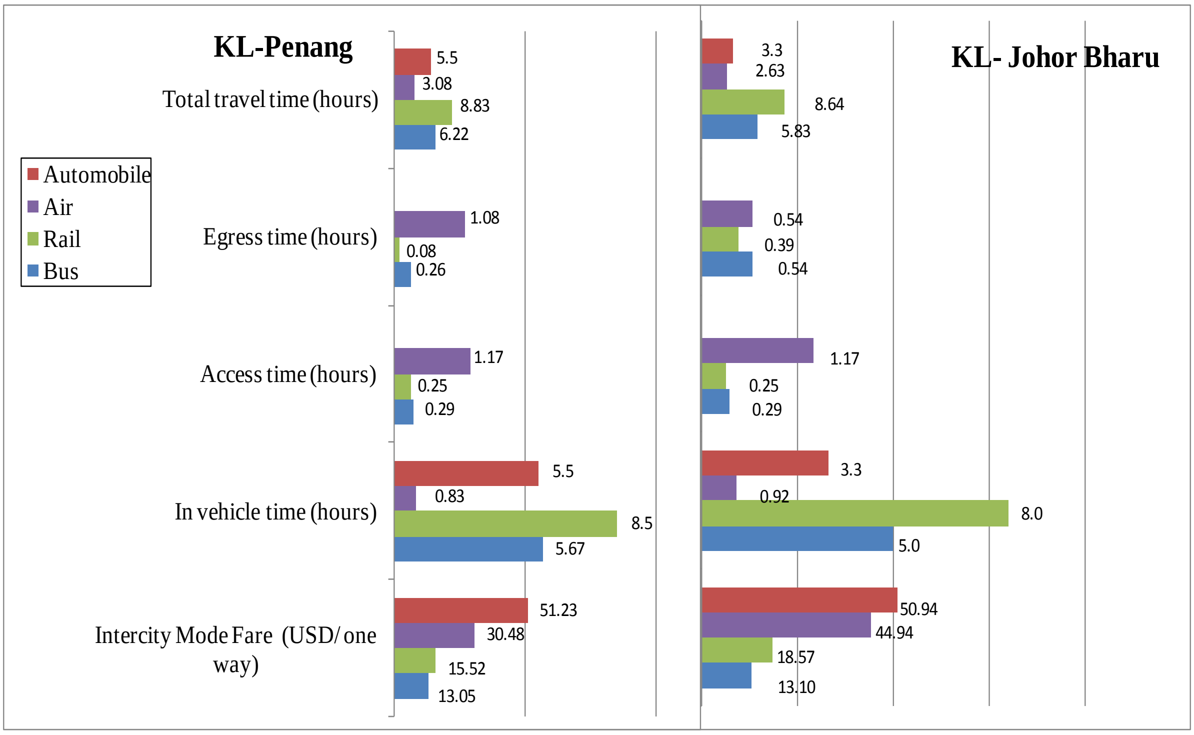

Figure 3. The competition of intercity transport travel cost and travel time

Figure 3 describes that the intercity train mode has a plus point in accessibility. As the parameters, all the feeder access & egress time (to/from intercity train station) are calculated as the shortest one. In specific, access time to bus terminal for both corridors (feeder mode waiting time +in feeder access mode time) is longer (0.29 hours) than access time to train station (0.25 hours). For KL-JB corridor, the feeder mode egress time spent from bus terminal (feeder mode egress waiting time +in feeder egress mode time) to final destination is 0.54 hours while access time spent from train station to final destination is only 0.39 hours. Similarly, for KL-Penang corridor, the feeder mode egress time spent from bus terminal to final destination is 0.26 hours, while access time spent from train station to final destination is only 0.08 hours.

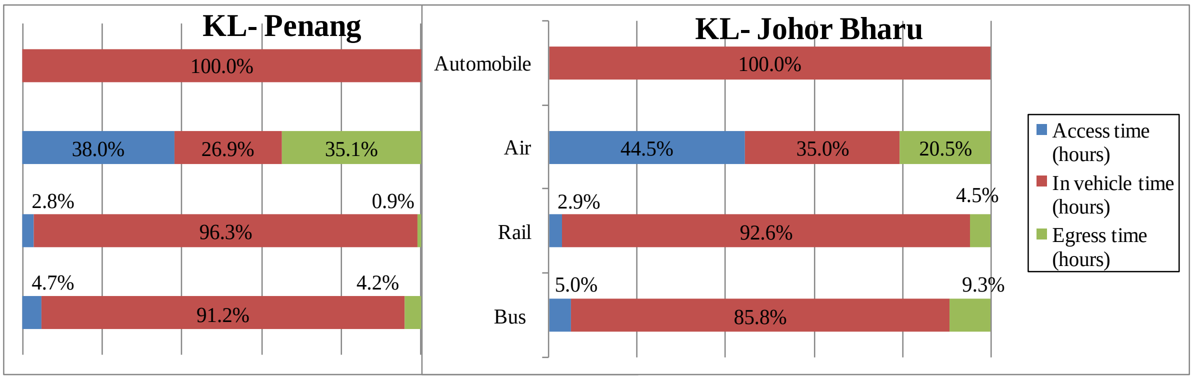

Figure 4. The component of time of a total travel time

Refers to the fractional time bar in Figure 4, it is proven that the accessibility from/to terminal for intercity train is better than the bus. According to Figure 4 the fraction value of in vehicle time for intercity bus is lower than for intercity train. In details, in vehicle time (intercity train) from KL to Penang is 96.3% of its total travel time, while from KL to JB it is 92.6%. Intercity bus in vehicle time value is 91.2% for KL-Penang and 85.8% for KL-JB.

Lack of public facilities and route coverage limitation has force intercity passenger to transfer several times to access an intercity bus terminal. Bus terminals should be constructed with foresight, from good accessibility to well thought out and planned location (thestar.com.my). It should be assigned to a single agency to manage the system.

Improvements are currently being made to enhance public transport accessibility. New integrated terminals for land public transport are being developed as transport hubs to facilitate commuting to the North, South and East of Peninsular Malaysia. All three integrated transport hubs will ultimately replace existing interstate terminals across Kuala Lumpur. The integrated terminal in Bandar Tasik Selatan (BTS) caters for southbound movements (has just been completed and is in operation in March 2011), while the Sungai Buloh terminal is for northbound and the Gombak terminal is for eastbound buses (expected to be completed in 2011 and operated by 2012). The accessibility for feeder transport would be a big challenge for intercity bus in the future intercity land transport competition.

4.2.2. Socioeconomic, demographic and travel behaviour characteristic analysis

In exploring intercity bus preference based on respondents behaviour characteristics, some of variables are considered; such as: alternative mode for intercity travelling, traveler perception on the distance to terminal, reason for taking bus intercity mode travel time, intercity mode fare, respondents age, marital status, gender, occupation, monthly income, for feeder mode, travel time for intercity bus feeder mode (access), total travel time of feeder mode (access), intercity bus feeder mode fare (access), travel time in intercity bus feeder mode (egress), total travel time of feeder mode (egress), intercity bus feeder mode fare (egress) and waiting time in the terminal/station.

A field survey was conducted in three months at several intercity bus terminals and train stations in Kuala Lumpur, Johor Bahru and and Penang. Intercity bus terminals observation included: bus terminal of Bukit Jalil, Puduraya bus terminal, bus terminal of Shah Alam in Kuala Lumpur, Larkin bus terminal in Johor Bharu and Butterworth in Penang. In addition, a field survey has been conducted at intercity train stations, in Kuala Lumpur, Johor Bharu and Penang.

The results from the field survey reported that the majority age of the respondent is below 25 years old (53.6 and 56.7%) and single (76.7% and 70.0%). In some interview sections involving female respondents (73.3% and 46.7%), they said that they preferred to use the intercity bus because of shorter bus travel time. They do not feel comfortable being in train for a long time.

In this paper, intercity travel was divided into 4 purposes: working & business purpose, educational purposes, recreational/social purposes and other purposes. Working & business purpose and others purpose in this paper are categorized into work travel, while recreational/social purposes and educational and other purposes are categorized into non-work travel. Regarding the survey result, mostly respondents are dominated by non-work travelling purpose.

Figure 6 shows that for both corridors (KL – Penang and KL – JB), majority of respondent is student (66.7% and 66.7%). As can be seen from Figure 5, the intercity travelling is commonly done every month (26.7% and 30%). Respondents' major trip purposes are social visit & recreation (53.3% and 50.0%) followed by for educational purpose (28.3% and 41.7%).

Figure 7 proves that the fare is the main reason in choosing intercity mode (43% and 30%). The second important factor is comfort (16.7% and 20%), following by travel time (8.3% and 25%) and feeder transport accessibility (13.3% and 8.3%). Comfort can be attached as an effect of travel time. In some of interview sections, respondents said not feeling comfortable in the intercity train with its long travel time. Safety seems becoming the reason only by 10% of respondents (KL-JB) and 13.3% of respondents (KL-Penang).

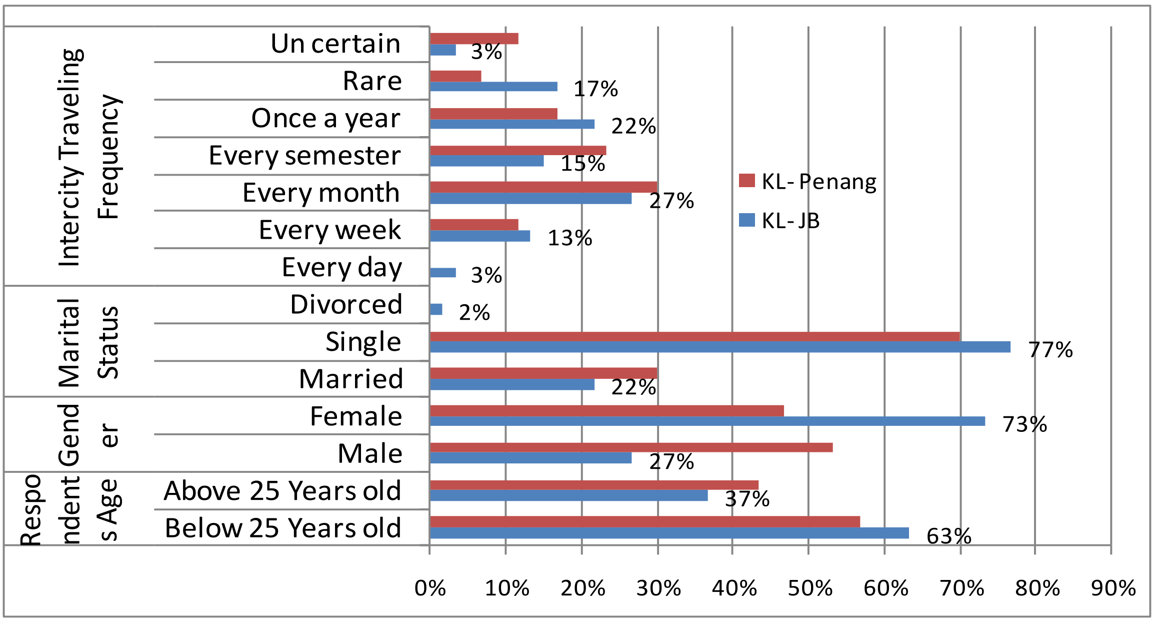

Figure 5. Respondent age, gender, marital status

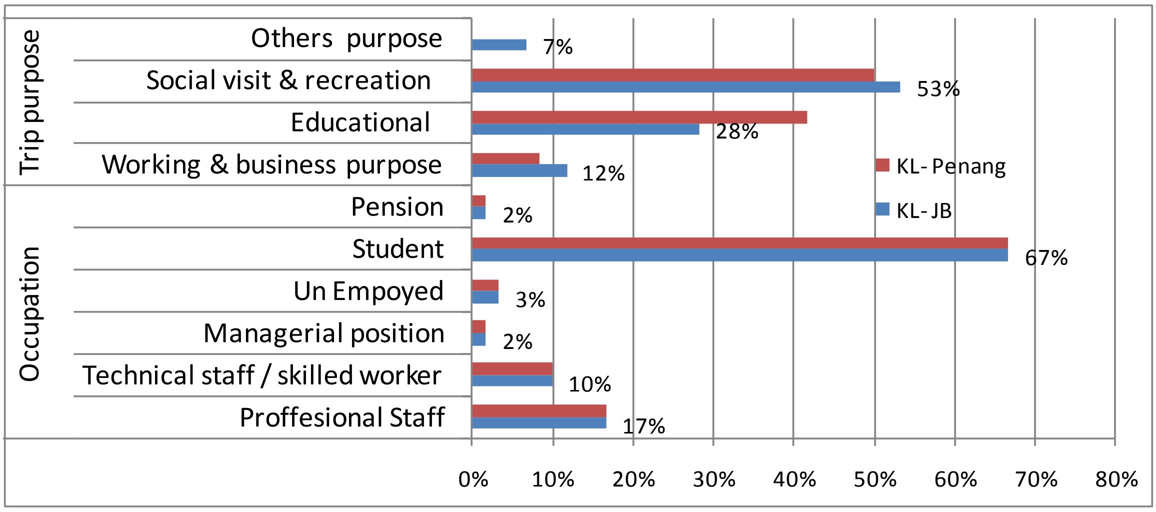

Figure 6. Respondent occupation and trip purpose

Respondents travelling perceptions of particular intercity modes and traveller attitudes may affect their preference and choices (Correia & Antunes, 2012;Yang, *et al.*, 2009). The distance to terminal also affects the intercity traveler perception in choosing an intercity transport mode. A longer distance usually related to a longer access time for feeder mode service. Only 13.3% (KL-JB) and 10% (KL-Penang) of the respondent mentioned that the distance to terminal is not important for them to decide what intercity mode to use (Figure 7).

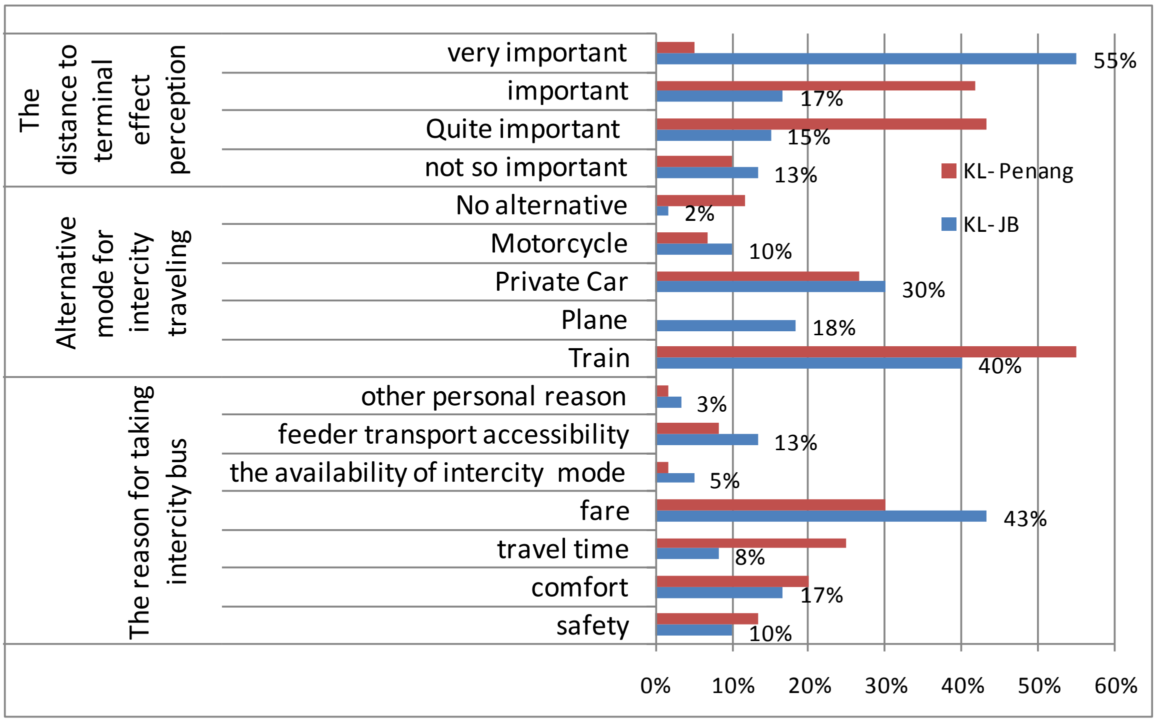

Figure 7. Traveler perception on the distance to terminal, reason for taking bus, mode alternatives for intercity travelling

In deciding to use public transport, respondents usually consider the feeder (access/egress) mode service, the feeder (access/egress) mode time, mode waiting time, the number of transfer, transit fare, and transit pass ownership, and the schedule flexibility (Yang, *et al.*, 2009). If there were no available public transport services, private car will be an alternative. Although so, driving own car for intercity travelling was not so much of a preference for a long trip, since they should consider fee, toll, transit pass ownership, schedule flexibility and the number of people who shared the trip with them (Correia & Antunes, 2012; Yang, *et al.*, 2009). Hu and Jen (2007) argue that if in-vehicle-travel-time is considered, customers may choose other intercity bus companies or alternative modes of transport with similar or better service quality but with a lower service sacrifice. This survey found the train as the main competitor of intercity bus (KL-Penang 55% & KL- JB 40%). Some other respondents prefer to use private car as an alternative of bus (KL-Penang 27% & KL- JB 30%).

Table 4. Feeder transport from/to intercity bus station

Feeder transport to/from intercity bus terminal	**Access**		**Egress**	
	KL- JB	**KL- Penang**	**KL- JB**	**KL- Penang**
private car	43.3%	36.7%	41.7%	36.7%
motorcycle	3.3%	6.7%	5.0%	6.7%
Commuter bus	20.0%	16.7%	6.7%	16.7%
LRT/ Commuter Train	25.0%	15.0%	10.0%	15.0%
taxi	5.0%	21.7%	35.0%	21.7%
others	3.3%	3.3%	1.7%	3.3%

Table 4 (feeder transport from/to intercity bus station) shows that private vehicle as the feeder transport mode is accounted for 46.3% for KL-JB and 43.4% for KL-Penang. However, there is 20% (KL-JB) and 16.7% (KL-Penang) of the respondent still keen on using commuter bus as an access mode. Others (25% and 15%) prefer LRT/ Commuter train. Similarly, for egress mode, private vehicle is still being the main feeder mode in both KL- JB and KL-Penang corridors (41.7% & 36.7%). Commuter bus and taxi are public feeder transport in Larkin intercity terminal (in JB). But in these two corridors, the commuter bus (6.7% and 16.7%) is not as popular as taxi (35% and 21.7%).

Crisalli (1999) argued that, feeder transport service to the intercity terminal also affects the intercity traveller on choosing their intercity transport mode choice (Crisalli, 1999). This field survey interview found the similar result. Amounts of 13.3% (KL-JB) and 8.3% (KL-Penang) respondents argued to state that feeder service is important for them in deciding what intercity mode to prefer; whether bus or train. A better access to its station is an advantage offered by train. For example in KL, train station is located inside the KL central building in Kuala Lumpur city, while in JB train station is inside the JB central building.

Some intercity passengers avoid taking certain mode because of its poor access to the terminal, i.e. Duta bus terminal. There are only two options for feeder public transport mode to access Duta terminal; commuter bus or taxi. Duta terminal is quite far from downtown KL. Public transport feeder fare to Duta bus terminal is almost 2 times higher than to intercity train station in city center. Commuter bus as a feeder access mode in Kuala Lumpur normally has a normally long waiting time interval (around 30 minutes). To access Duta terminal, there are only 2 direct commuter bus from city center per day. So the commuter bus waiting time to access Duta terminal is even longer than normal. If the passenger concern about waiting time, the taxi is an option. Taking the taxi from the city center means there will be around RM20 extra costs. The taxi fare can be as expensive as the intercity bus fares itself. BTS is a part of an integrated transport network in Malaysia to resolve the connectivity issues (http://transitmy.org). It provides a better public facility and enhancement such as decrease the feeder transport service waiting time.

Figure 8 shows the comparison of respondent monthly income, budget for transportation and budget for intercity travelling. Most of respondent's monthly income in this study is between $ 322.6 and $ 977.8, which most of them spent $ 16.3 - $32.6 for transportation and less than $ 16.3 for intercity budget. As Hensher (2007) emphasize that as individuals age and increase their income, individuals see existing service quality as increasingly satisfying their requirements for service quality (Hensher, 2007).

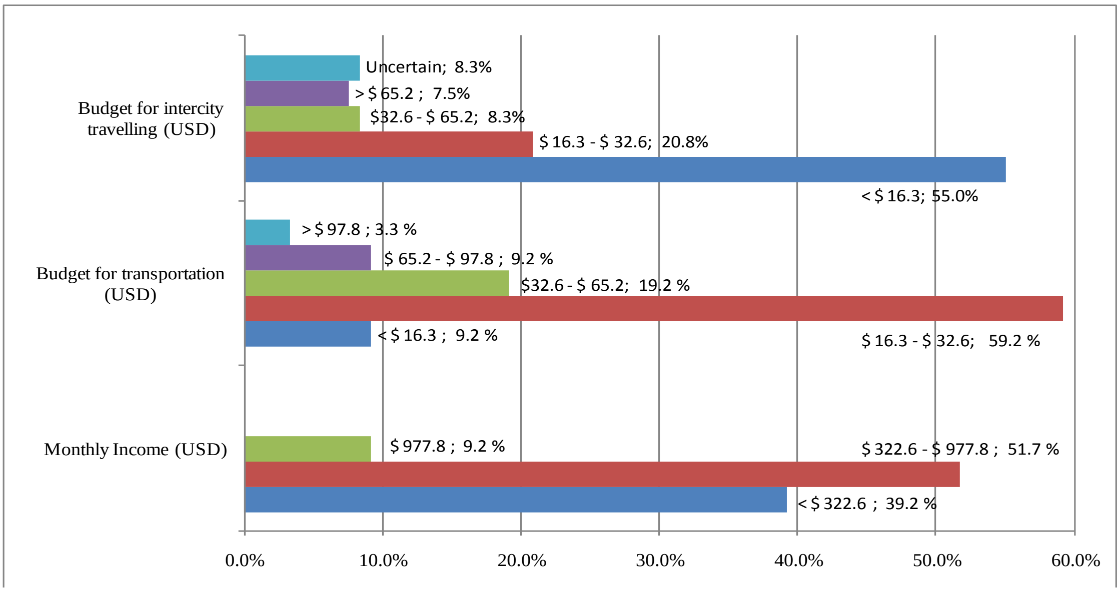

Figure 8. Monthly income, transportation budget and intercity travelling budget

4.2.3. Stated preference data analysis

(I) Scenarios on intercity bus service

Regression model involving scenarios on intercity bus service for KL–JB was shown in Table 5 and for KL–Penang corridor was shown in Table 6. As shown in KL-JB corridor (Table 5), when the scenario on bus service changes applied, travel time difference (t(196) = -18.22, p < .05), fare difference (t(196) = -26.69, p < .05), access time difference (t(196) = -14.68, p < .05), waiting time (t(196) = 5.11, p < .05), were found significantly influence the bus preference. While access mode's fare were found not significantly influenced the bus preference.

As shown in KL- Penang corridor (Table 6), when the scenario on bus service changes applied, travel time difference (t(196) = -18.06, p < .05), fare difference (t(196) = -26.46, p < .05), access time difference (t(196) = -14.55, p < .05) were found significantly influence the bus preference. But the waiting time and access mode's fare were found not significantly influenced the bus preference.

Table 5. Regression model involving scenarios on intercity bus service for KL–JB corridor

	Scenarios on intercity bus service	**Unstandardized coefficients**		**Standardized coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
KL – JB corridor	(Constant)	-1.449	.095		-15.228	.000
	Travel time Difference	-.015	.001	-.405	-18.217	.000
	Fare Difference	-.069	.003	-.591	-26.693	.000
	Access time Difference	-.023	.002	-.323	-14.675	.000
	Waiting Time	.212	.041	.105	5.117	.000
	Access Mode's fare	.008	.006	.028	1.346	.178

Model JB Bus R= .608, Adj. R Square=.367, R Square Change= .369, and F(5, 1494) = 174.865

Table 6. Regression model involving scenarios on intercity bus service for KL – Penang corridor

	Scenarios on intercity bus service	**Unstandardized coefficients**		**Standardized coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
KL – Penang corridor	(Constant)	-1.043	.087		-12.055	.000
	Travel time Difference	-.012	.001	-.405	-18.058	.000
	Fare Difference	-.066	.003	-.591	-26.460	.000
	Access time to intercity terminal Difference	-.023	.002	-.323	-14.547	.000
	Waiting Time	.001	.003	.007	.323	.746
	Access Mode's fare	.005	.004	.023	1.111	.267

Model Penang Bus R= .598, Adj. R Square=.358, R Square Change = .358 and F (5, 1494) = 166.639.

Based on stated preference data in the model result, the coefficients for 'travel time difference', 'fare difference', and 'access time difference' scenario are negative. It means the increasing of these values will decrease the intercity bus preference. An interesting result is that intercity bus feeder mode fare (access) and waiting time in the terminal/station is found not significantly decrease the probability for bus preference. Moreover, the coefficients for waiting time and access mode fare are positive. It means the increasing of these values will increase the intercity bus preference. It is rationally unacceptable. Based on this condition, it the feeder access mode fare and waiting time should be excluded from the model. Thus the waiting time and access mode fare would be no longer considers to influence the bus preference.

(II) Scenarios on intercity train service

Regression model involving scenarios on intercity bus service for KL–JB was shown in Table 7 and for KL–Penang corridor was shown in Table 8. As can be seen from Table 7, all the intercity train service variables involved; travel time (t(196) = -12.22, p < .05), fare difference (t(196) = -12.78, p < .05), access time difference (t(196) = -10.20, p < .05), waiting time (t(196) = 5.73, p < .05), access mode's fare (t(196) = -2.69, p < .05) were found significantly to influence intercity bus preference.

Table 7. Regression model involving scenarios on intercity train service for KL–JB corridor

	Scenarios on intercity train service	Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
KL – JB corridor	(Constant)	-.735	.095		-7.772	.000
	Travel time Difference	-.009	.001	-0.43	-12.216	.000
	Fare Difference	-.029	.002	-0.43	-12.779	.000
	Access time to intercity station Difference	-.018	.002	-0.36	-10.202	.000
	Waiting time	.274	.048	-0.11	5.733	.000
	Access mode's fare	-.019	.007	`-0.13	-2.693	.007

Model JB Train R= .414, Adj. R Square=.172, R Square Change= .971 and F (5, 1434) = 59.407.

As can be seen from Table 8, intercity train service variables involved; travel time (t(196) = -12.07, p < .05), fare difference (t(196) = -12.63, p < .05), access time difference (t(196) = -10.08, p < .05), were found significantly to influence intercity bus preference. The coefficients for these significance variables: 'travel time difference', 'fare difference', 'access time difference' and 'access mode fare' are negative. It means the increasing of these values will decrease the intercity bus preference.

Table 8. Regression model involving scenarios on intercity train service for KL– Penang corridor

	Scenarios on intercity train service	Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
KL – Penang corridor	(Constant)	-.520	.081		-6.407	.000
	Travel time difference	-.007	.001	-.321	-12.071	.000
	Fare difference	-.031	.002	-.335	-12.627	.000
	Access time difference	-.018	.002	-.265	-10.081	.000
	Waiting time	-.004	.003	-.030	-1.232	.218
	Access mode's fare	.010	.005	.049	2.028	.043

Model Penang Train R= .389, Adj. R Square=.149, R Square Change= .152 and F (5, 1434) = 51.214

(III) Sensitivity analysis

The purpose of the analysis is to determine the probability of intercity bus preference toward the changes of each parameter. For the sensitivity analysis, the initial conditions for each parameter were set to be as written in Table 9.

Table 9. The initial conditions of intercity mode (bus/train) services

Intercity bus/train service	KL - JB	KL - Penang
Access time to intercity bus terminal	15 minutes	15 minutes
Access time to intercity train station	15 minutes	15 minutes
Intercity bus travel time	4.5 hours	5.5 hours
Intercity train travel time	8 Hours	8.5 hours
Intercity bus fare	$10.30	$10.76
Intercity train fare	$13.69	$13.04

Regarding the analysis result in Table 5, 6, 7 and 8, it is proven that in both corridors (KL-Penang and KL- JB), attributes of 'travel time difference', 'fare difference', and 'access time to intercity terminal difference' are significantly influence bus mode preference. Actually the effect of each attribute based on bus user perception can be discussed separately by using sensitivity analysis. Sensitivity graphs (Figure 9, 10 and 11) indicate that for both corridors, intercity bus service value changes effect (travel time, fare and access time attribute) is higher than the train service value changes effect (travel time, fare and access time attribute).

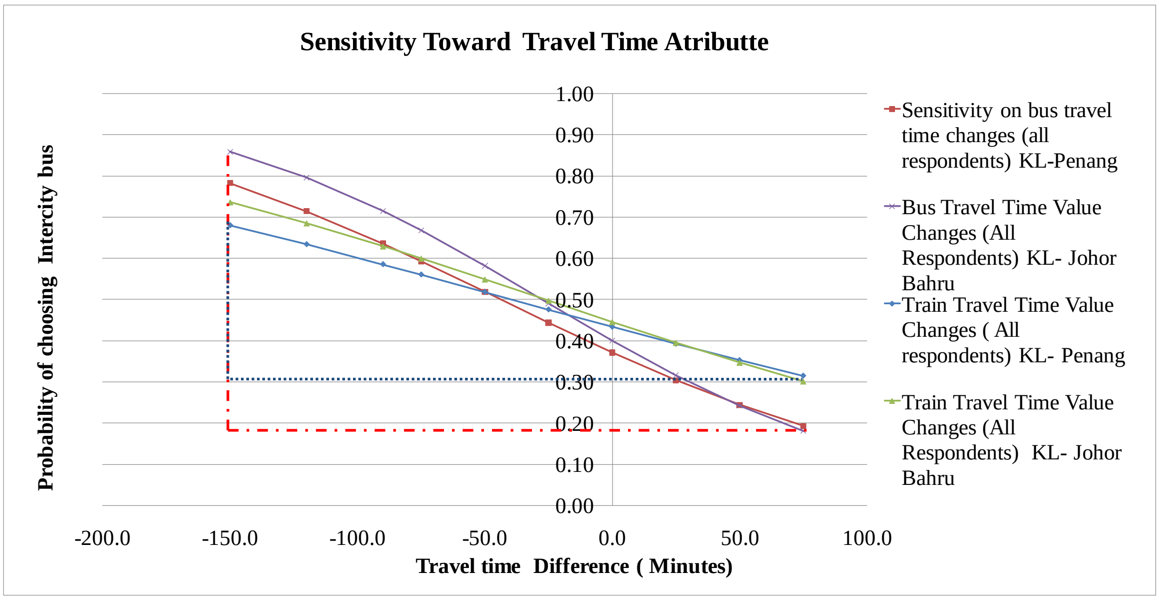

Figure 9. Sensitivity of bus preference toward travel time attribute

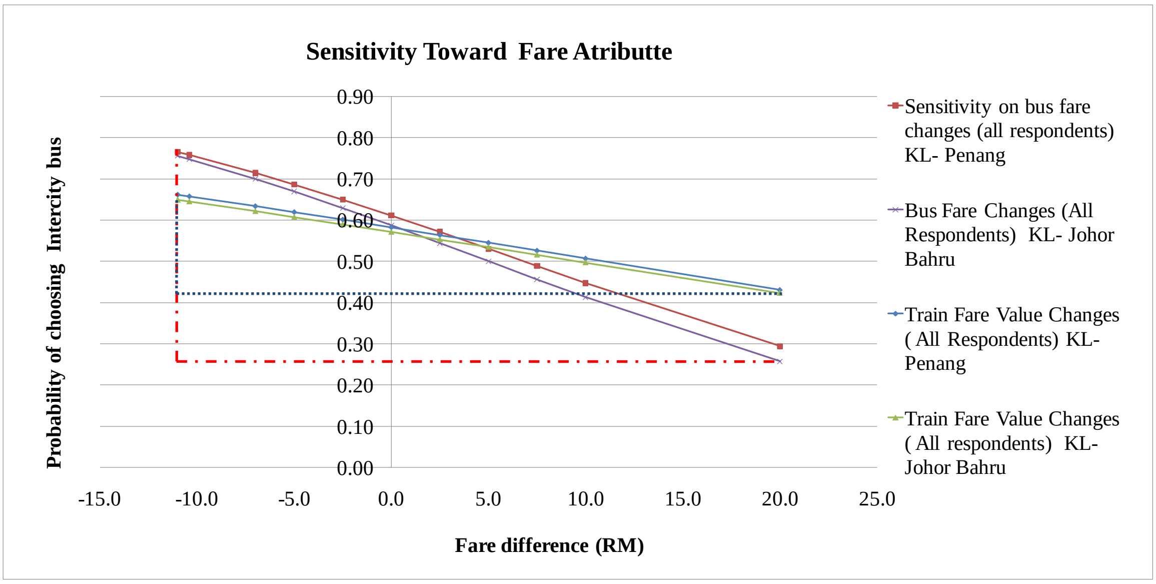

Figure 10. Sensitivity of bus preference toward fare attribute

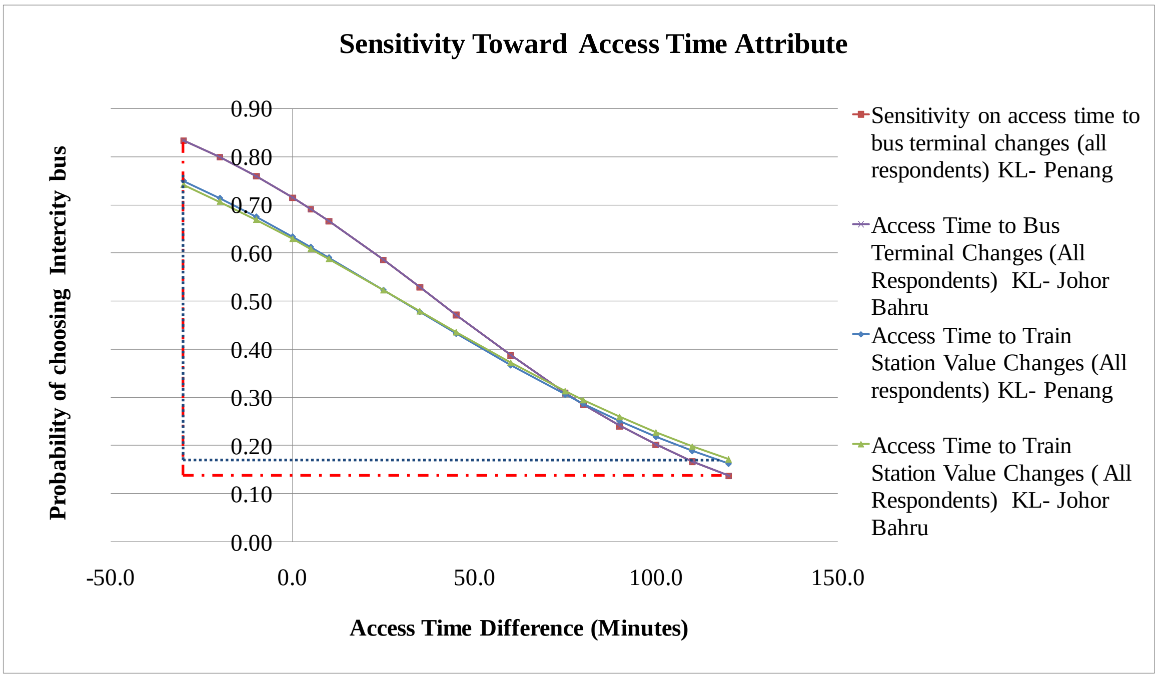

Figure 11. Sensitivity of bus preference toward access time attribute

(IV) Travel time attribute

The travel time attribute changes were evaluated using both scenario of intercity train service and bus service for both KL- Penang and KL-JB corridor. As for details, see Figure 9, the graphs for sensitivity of bus preference toward the changes of travel time. The axis value in that figure is the difference between bus travel time and train travel time and the ordinate value is bus preference probability.

In KL- JB corridor, when the scenario of intercity bus service involved, bus preference probability decreased 67.4% in the range travel time difference of (-150) minutes to 75 minutes. When the scenario of intercity train service involved, bus preference probability decreased 43.5% in the range travel time difference of (-150) minutes to 75 minutes.

In KL-Penang corridor, when the scenario of intercity bus service involved, bus preference probability decrease 58.9% in the range travel time difference of (-150) minutes to 75 minutes. When the scenario of intercity train service involved, bus preference probability decreased 36.5% in the range travel time difference of (-150) minutes to 75 minutes.

The distance from KL to Penang is not much different when using the bus or train, but the bus travel time is shorter than the train because the average bus speed is higher (98 kph) than the train (60 kph). In addition, bus stops are only for loading unloading passengers. For unloading passengers, the bus stops depend on demand. This is lower compared, to the train (12-19 stops).

From this result, it is implied that bus users would probably be attracted by the efforts of KTMB to cut the total travel time on the rail line. Shortening the total train travel time can be achieved by reducing the riding time, waiting time or stopping time. The effort to cut intercity train riding times by upgrading the rail track to support the speed (from 60 kph) of the new ETS (average on 90 kph) is still ongoing.

Efforts to shorten the waiting time are quite challenging since the train has a low departure frequency and departing time reliability. Respondents usually prefer to arrive at an intercity mode terminal before the departure time. This makes respondents feel there is a longer waiting time than their actual waiting time. Indeed, the bus waiting time is usually shorter than the train, and the times of bus departures are more reliable than the train. KTMB currently only allows train users to wait on the platform 30 minutes before the departure time. This is considered a good strategy for eliminating the users' perception of a longer waiting time than their actual waiting time.

The effort to shorten train service stopping times (which been implemented on ETS) would probably attract intercity travelers, but something that the service provider should not forget is that offering passengers a train service with fewer stops will reduce passenger travel time but may require higher train frequency and higher operating costs. It would also cause the train fare to rise, which is not really favorable to the passengers. However, it seems that the provision of public services is constrained by the availability of money, knowledge, manpower and materials (Marsden & Bonsall, 2006).

The result of those two lines models indicates a stronger effect of intercity bus travel time changes on the bus preference probability. Bus users may be worried about the longer travel time of their current intercity mode, for example while the road is congested. Therefore, the bus user response to the scenario is more obvious and shows them switching to the train. Eventually, the current phenomenon is a high demand for road infrastructure because of the low public transport modal share which contributes to traffic congestion. This is a big challenge for SPAD and the bus industry in the future.

Bus users have a different perception on the changing travel time attributes. There may be another consideration for a bus user to voluntarily move from their current mode to an intercity train if bus travel times were changed. Comfort can probably be a consideration. Many intercity travelers stated they preferred the intercity bus because of shorter travel time. In interview sections, bus users argued that they do not feel comfortable sitting in the train because of its long travel time. When there was no optional mode except for the train, bus users would prefer sleeping in a coach to deal with the train's long travel time. Although it requires a higher travel cost, users can feel comfort during the journey.

Based on interviews with some other respondents, they argued that it is better to take the bus when a traveler needs to get to destination faster, but if the traveler prefers to enjoy the journey, it is better to take a train and get the sleeping coach. Moreover, they argued that the worse performance of buses was during the festive season when it is subjected to congested roads. From the analysis results, which are supported by respondent arguments, it is clearly predicted that changes in travel time attributes would result in a strong effect on the bus preference in the future.

(V) Fare attribute

Figure 10 shows the sensitivity of bus preference to fare attribute changes. The x-axis represents the fare difference between the intercity bus and train in Ringgit Malaysia (RM). From Figure 10 it is implied that bus users would really be concerned about fare increments of their current mode, but they would expect a lot from a train fare reduction. In an economic perspective, there is supposed to be no difference to the money the respondents spent, whether using the intercity bus company or the intercity train company. But based on the sensitivity result, bus users have a different perception to the value of the intercity bus and train fare changes. It was an interesting result that setting an equal fare on intercity bus and train services provides no evidence that it would create a similar ridership attraction. There may be a reason for users' different perspective this case, which is not included in the model. Probably it is related to the additional feeder transport mode costs needed to access an intercity mode terminal.

(VI) Access time attribute

Figure 11 shows the sensitivity of bus preferences to access time attribute changes. The x-axis represents the time difference between accessing the intercity bus terminal and the intercity train station in minutes. The gap between these two lines for both KL- Penang and KL- JB corridors was not really obvious. It is implied that bus users would show similar reaction towards changes in the access time attributes for these two intercity modes.

Feeder public service improvement is currently a big issue and is being used to promote intercity land public transport usage. The Government has declared a vision for comprehensive and efficient transportation system networks with good inter and intra city linkages in Malaysia (DBKL, 2011). A transport hub to facilitate commuting to the North, South and East of Peninsular Malaysia is urgently required.

5. CONCLUSION

The impact of certain policies can be quite far reaching and this has also been experienced in the case of mode choice. The policy on having better roads connecting major cities in Malaysia through the construction of high quality expressways between large cities and urban areas affect the preference of road transport mode.

In specific, for both corridors (KL- Penang and KL- JB), attributes of ‘travel time difference’, ‘fare difference’, and ‘access time difference’ can help to explain the high bus performance compared to the train in Malaysia. The increasing value of bus travel time, bus fare and access time attributes will decrease the value of the intercity bus utility. Based on the perception of bus user, changes on bus service attributes will be much higher affecting the bus preference rather than the changes on train service attributes.

The analysis results indicate a stronger effect of intercity bus travel time changes on the bus preference probability. It is implied that bus users may be worried about the longer travel time of their current mode, but they are probably attracted by the efforts to shorten the total train travel time (by reducing riding time, waiting time or stopping time). Similarly, shifting from bus to the train would probably occur because of fare reduction of intercity train, but the impact of shifting will probably stronger when the policy of bus fare increment taken. And finally, bus users would show similar reaction towards changes in the access time attributes for these two intercity modes.

It is now well understood that the bus has become a predominant intercity transport mode in this country. To increase ridership of intercity trains, a certain level of service should be designed related to these four attributes. The approaches of this study will hopefully be a platform for public transport service improvement in order to face intercity land public transport competition in the future.

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