Passenger Travel Profiles through Origin-Destination (OD) Surveys for Malayan Railways Limited

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Abstract: Origin and destination (OD) surveys are one method of field data collection in transport studies. The primary objectives are to identify people's travel patterns and relate them to vehicle movements. It will determine the existing traffic patterns and used as a baseline for future forecasts. The OD survey is often challenging and costly due to interviews with passengers and distribution of questionnaires. The OD survey was adopted to evaluate the passenger travel profiles for Malayan Railways Limited's commuter trains. The results of these surveys indicated the distributions of origin places, the distributions of destination locations, access travel time, distance and cost; egress travel time, distance and cost; transfer points and transfer time for a one-way trip. Distributions of questionnaires were made mainly during peak hours to obtain 230 (61.0%) users and inter-peak hours with 119 (31.6%) users for weekday trips.

Keywords: Travel Behaviour, Commuter Train Demand, OD Surveys, Passenger Travel Information, Modal Split Surveys

1. INTRODUCTION

Origin-Destination (OD) surveys provide information on both travel of transport system users and the movement of vehicles, in this case commuter trains (also known as *KTM Komuter*). It is also regarded as an empirical evaluation of existing commuter train service and trip by travel time or commuter train schedule. This is because the development of a timetable requires the level of services to satisfy the passenger flows between the OD stations within the hours of commuter train service (Albrecht 2009). The importance of evaluating the passenger travel profile for transit users has been much discussed in recent literature. (Memarian, Jeong et al. 2012) emphasized the importance of surveys in getting important information regarding trip characteristics, travel behaviour, demographic characteristics, and attitude toward services. (Lyons, Jain et al. 2007) reported the results of surveys in examining the passengers' worthwhile time in the train in Great Britain. Results of user travel time perceptions which might shed some light on the improvement of public transportation usage were highlighted by (Van Exel and Rietveld 2009).

These surveys involved the direct interview paper-based method and were done at both railway station platforms and on board trains. The OD surveys were done from 6.30 AM to 9.00 PM, targeting the three peak hours, particularly the evening peak 1630 – 2030 because the Malayan Railways Limited periodical studies have proven that this is the worst period with so many technical faults of train and overcrowding at platforms and coaches ((Malayan

Railways Limited 2004)).

Haphazardly uncontrolled land use development purposely planned for private cars has brought about the urban to suburban areas being poorly furnished with the national commuter rail service. This is due to the continuing phenomenon of KL urban sprawl (Denke 2003; Kenworthy 2009). Hence, proper planning and designing for an integrated regional rail route for KL city and Klang Valley would require in-depth investigations on the nature of the present commuter train travel demand and commuter train service. This paper presents and reviews the results of the OD surveys. The results provide

a) the travel behavioural patterns and information of commuter train users, which also means commuter train *demand and service pa*tterns; and
b) an understanding on the characteristics of the commuters primarily along the Pelabuhan Klang – Sentul line.

2. METHODOLOGY

At the beginning, six railway stations had been selected for the OD surveys. They were Kuala Lumpur Sentral (KLS), Kuala Lumpur (KL), Bank Negara, Putra, Shah Alam and Subang Jaya. They were selected for survey locations because they had a high ridership based on the previous Malayan Railways Limited studies and research in the Universiti Teknologi MARA. KLS and KL stations are the major transfer (interchange) stations whereas Bank Negara and Putra are the minor ones. Figures 2.1 and 2.2 show the commuter train route map and its integration with the other KL rail services. While doing the surveys at sites, it was found that the interviews cannot be completed at the platforms. To address this problem, the surveyors had to follow their respondents to be on board train and had to alight the train immediately whenever they had finished with the questionnaires or they had to alight the train where those respondents alighted at the final railway stations if could not finish interviewing. When this happened, the surveyors must avoid wasting time by simply finding respondents at that particular station. For this reason, there were fourteen survey locations, including Jalan Kastam, Pantai Dalam, Serdang, Klang, Kampung Dato' Harun, Padang Jawa, Sentul and Pelabuhan Klang.

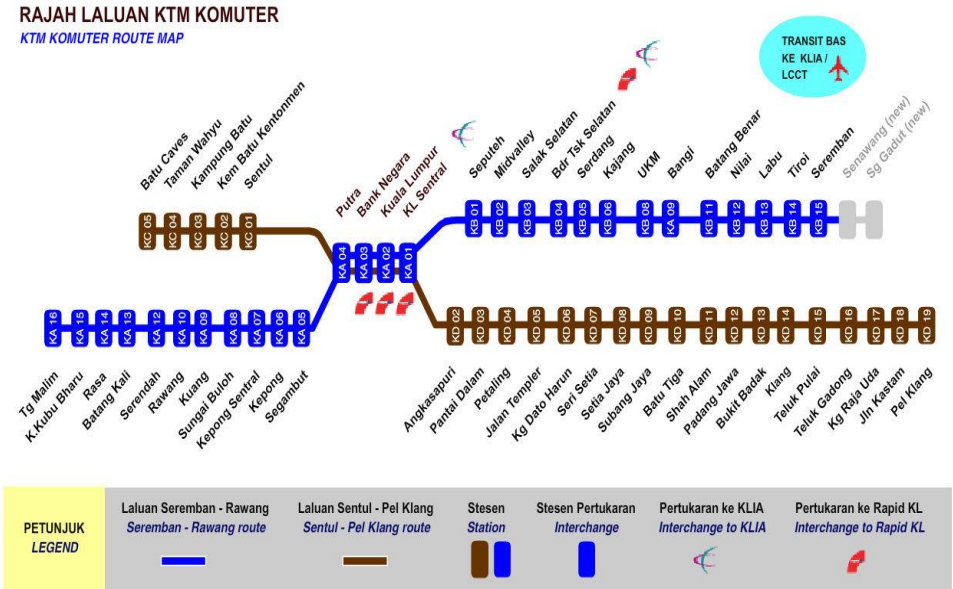

Figure 2.1 Commuter Train Route Map

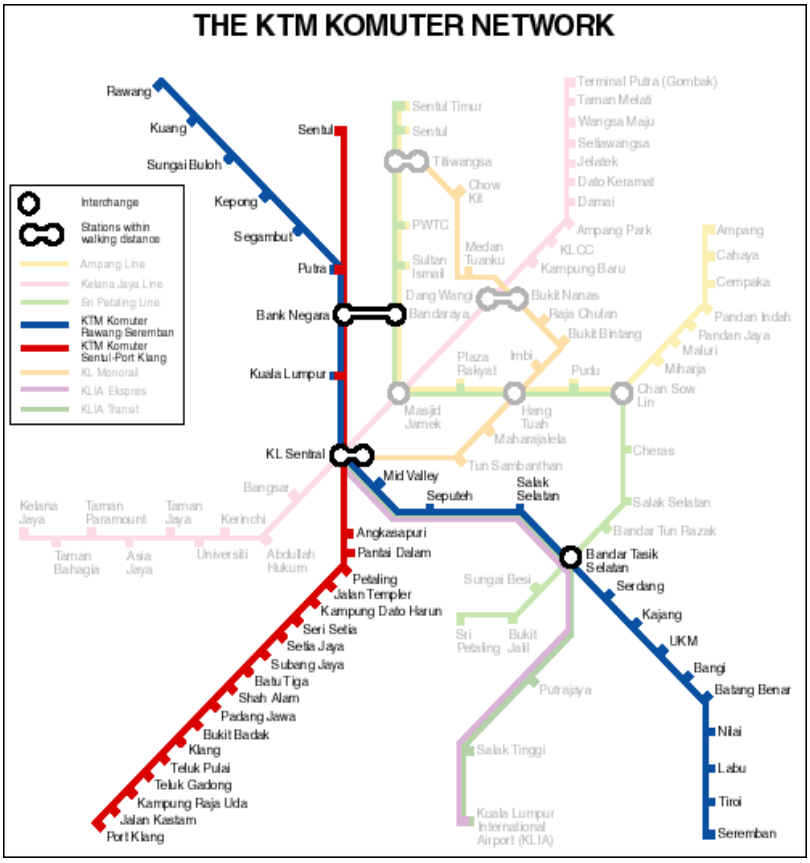

Figure 2.2 Commuter Train Route Integration with the Other Rail Services

2.1 Data Collections

The OD surveys were conducted from February 2010 to early April 2010 on a sample of 377 commuter train passengers. The questionnaire was close-ended. The questionnaire form comprised the following structure. The questionnaire form was divided into three main sections that contained the introductory information, commuting characteristics including the origin-destination, trip purposes, the services' and operation's attributes of the train tested and the last section was geared towards getting the personal characteristics of the expected respondents. The first section consisted of the introductory information. This introductory information contained the project title, the objectives of the project, number of forms, name of station, name of observer, day/date/time of survey, weather and direction of the train. The personal characteristics (user profile) were described by age group, gender, nationality, occupation, employment status, respondent's status, average monthly income, car ownership and car usage.

A random sampling method was used to collect more responses and to increase the generalizability (Tseng 2012). The sample must be random in order to ensure that it is representative of the population, which means that it has similar characteristics as of the population. Data was collected from the passengers who wanted to board (in the vicinity of stations and platforms) and in the train coaches. In successfully conducting this transit user surveys, face-to-face interviews also occurred at the platform while passengers waited for incoming train and when they were inside the train for every origin-destination. The population studied in this research were all passengers who travelled on the Malayan Railways Limited trains during the surveyed period. The respondents included all groups of people who used railway service. In exchange for completing the survey, the first 120

respondents were provided with a fridge magnet provided by the Malayan Railways Limited. This fridge magnet is one of the Malayan Railways Limited souvenirs in the gift shop at the Malayan Railways Limited. The sample was stratified by peak, off peak and interpeak users. The questionnaires were distributed to the respondents selected by explaining the purpose of the research (Ceder 2007). Respondents were asked about their socioeconomic characteristics considering their origin, destination, access mode, time, costs, distance; egress mode, time, costs, distance; walking time, in-vehicle time, transfer time at major transfer stations, main purpose of trip, first begin to use commuter train in year, trip frequency, waiting time at stations, total journey time, number of transfers required to get to destination, fare category, type of tickets, fare charged to travel or fare cost, where do you get information about commuter train?, what is the return transport?, number of private vehicles available for use by her/his household and was a car available for a trip? Data was reviewed immediately after the surveys to observe unusual patterns and to assure accuracy.

3. RESULTS AND DISCUSSIONS

3.1 Travel Behavioural Patterns and Information of the Commuting Commuter Train Users and the Commuter Train

OD survey results provided travel behavioural information such as the distributions of origin places, boarding and alighting railway stations, destination locations, access travel time, distance and cost; egress travel time, distance and cost; transfer points and transfer time for a one-way trip. Such results really contribute to the detailed investigation of the travel behaviour effects with respect to the feasible parameters estimation since the key research objective is to model the travel behaviour of commuter train users (Mohd Khalis Ikhwan 2007; Amri 2008; Harmize 2008; Larrain 2008) This travel behaviour is further described by the capacity and level of services (LOS) of commuter train with the assumption that users have no information about the timetable and those the on-board signages should be ready to inform them (Nökel 2009).

The railway station with the highest proportion of boarding passengers where the survey was conducted was KLS with 113 person trips (30.0%). This is most likely because of its vital role as an integrated public transportation hub in KL. Other stations with a substantial number of passenger demand were Subang Jaya with 91 (24.1%), 71 (18.8%) person trips were from Shah Alam, 58 (15.4%) from KL and 27 (7.2%) started trip from Bank Negara. All these stations are already established ones.

The origin railway station with the highest proportion of boarding passengers was Subang Jaya with 88 person trips (23.3%). Other stations with a substantial number of passenger demand were KLS with 74 (19.6%), 71 (18.8%) person trips were from Shah Alam, 45 (11.9%) from KL and 29 (7.7%) started trip from Bank Negara.

The national travel demand study had done observations on the total cross-cordon private transport and public transport to obtain the distribution of mode choice in 2002. Geographically, OD zones can be divided into two major areas, namely OD zones within KL Central Planning Area (CPA), which is spatially estimated by the Middle Ring Road 1 (MRR1) cordon with a radius of 2.5 km length and OD zones out of KL Metropolitan or within the suburban areas in the Klang Valley, which is spatially estimated at the outer Middle Ring Road 2 (MRR2) cordon of a ring with a radius of at least 10.0 km length. KL CPA represents the KL city centre with KLS serves as a strategic focal point (multimodal transport hub transfer) for transferring of bus, taxi and rail services between stations. OD zones are used to group the responses to questions 1 and 4.

KL was the most frequently recorded origin place with 106 person trips (28.1%). Other most frequently reported origins were Shah Alam (77 or 20.4%) and Subang Jaya (73 or 19.4%).

Destination railway stations with high passenger demand were also KLS the same as the result of origin railway stations with 74 (19.6%), Subang Jaya (26 or 6.9%), Shah Alam (25 or 6.6%), Bank Negara (24 or 6.4%), Mid Valley (22 or 5.8%) and Klang (20 or 5.3%).

KL appeared to be the most frequently reported destination place with 47 trips (12.5%). Other frequent destinations were Shah Alam (33 or 8.8%), Klang (25 or 6.6%), Subang Jaya, KLS and Mid Valley (22 or 5.8%), Petaling Jaya (19, 5.0%) and Sogo, Tunku Abdul Rahman (TAR) and Masjid Jamek shopping areas (15 or 4.0%).

In terms of the entire route choice of the users, observations had recorded that 57.6% trips covering city destinations [or commuter train routes (corridors) into the centralized business district, CBD] whereas 13.0% of these trips involved transferring to final railway stations to continue their single trip. The passenger flows were identified primarily on directions such as Pelabuhan Klang (34.2%) to the western regions of Peninsular Malaysia and as far as Pulau Indah, Klang where the location of West Port is, Tanjung Balai and Dumai, Riau in Sumatera, Indonesia, Sentul (33.7%), which refers to the dispersion of passengers towards city centre and to the northern part of the outer KL city centre, and heading to south i.e., Seremban (11.1%).

Data for Question ‘is this your house?’ can be associated with home-based and non-home-based trips. 219 (58.1%) responses were not originating from home. Figure 3.1 shows the primary trip purposes. Work commute was the largest reported purpose with 175 trips (46.5%). The next largest recorded purposes were home-based trips with 71 (18.8%) and social trips were 58 (15.5%). Social trip like visiting friends/relatives consisted of 53 (14.1%). Complex trips which were characterized by multipurposes were amounted by only 1.5% of the overall sampled trips. It can be said that 246 (65.3%) of the users made work and home trips regularly. Questionnaires distributions were made mainly during peak hours to obtain as high as 230 (61.0%) users and inter-peak hours with 119 (31.6%) users for weekday trips. Moreover, the data were quite reliable and valid with more than 80.0% have been observed during weekdays. 317 (84.0%) of the respondents were travelling between Monday and Friday.

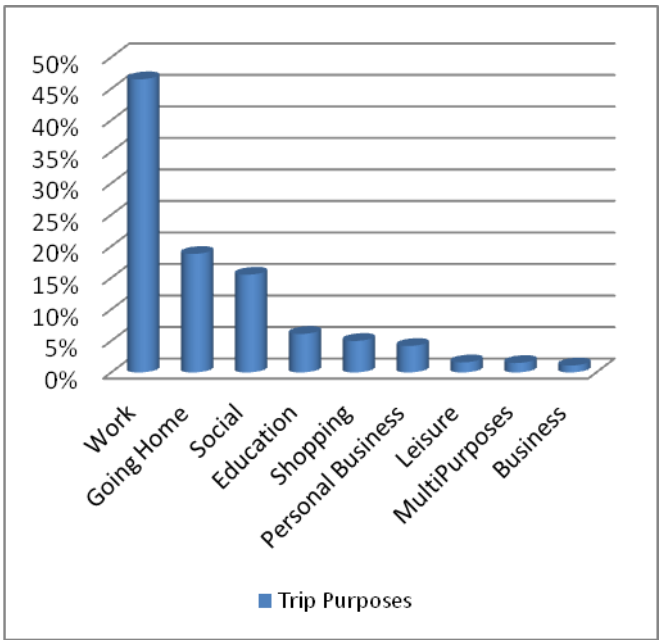

Figure 3.1. Trip purposes

Figure 3.2 summarizes the results of travel frequency. The largest proportion respondents reported that they took commuter train for ride for more than five days a week were 144 trips or 38.2%, followed by 89 (23.6%) for one to three times a month and 66 (17.5%) responded that they travelling between two and four days a week. So, 246 (65.3%) of the users were regular or daily users considering they had made six different categories of trips from at least five days a week to once a week. The remaining users were irregularly using commuter train service.

Of 293 (77.6%) respondents, 50.9% obtained frequent information about commuter train service from friends/relatives , 16.4% obtained information about commuter train service from the advertisement at rail stations and other places, and 10.3% respondents found similar information from the websites of the internet. Figure 3.3 summarizes modes of transport in the category of unimodal transports i.e., 23.2% were total purely unimodal transports to origin railway stations and 40.4% were unimodal transports from destination railway stations to the final destinations. In this context, unimodal transports can be defined as walk, car (passenger) and taxi. In accordance with ADB (2009), there is more than 40.0% mode share for public transport and non-motorized transport in KL compared to the most of the other Asian cities that have 70.0% (Chatterton 2010). Previous studies have shown high urban public transport and non-motorized transport shares promote sustainability (Denke 2003; Acharya 2005; Amri 2008).

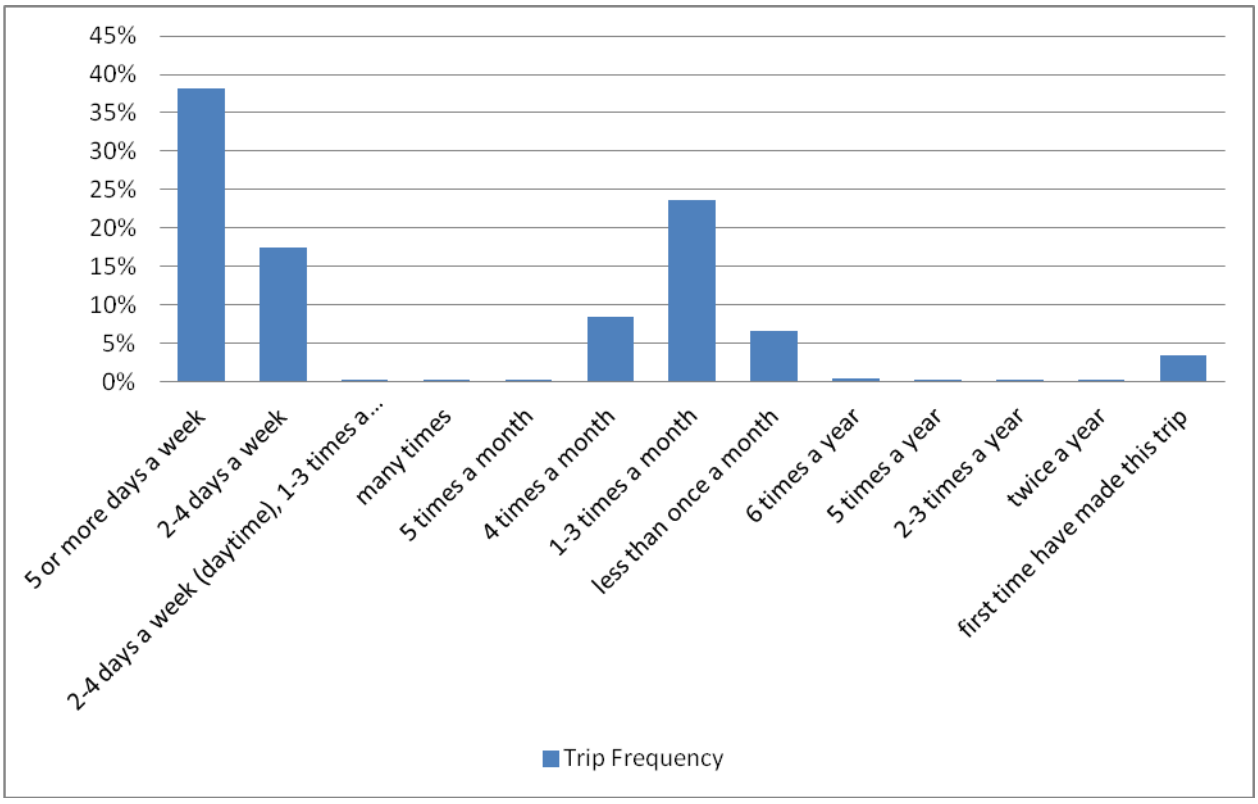

Figure 3.2. Trip frequency

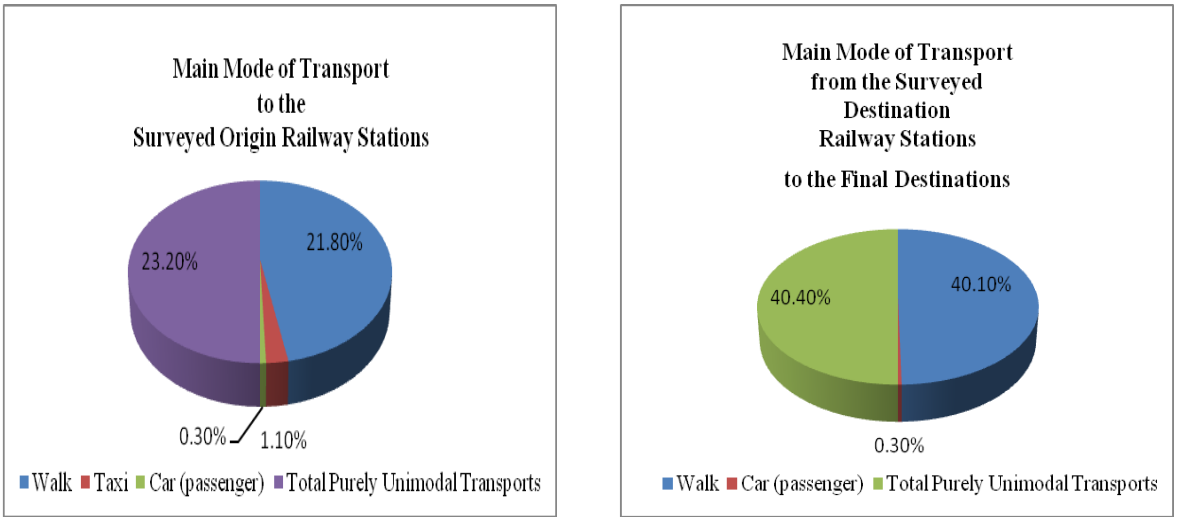

Figure 3.3. Unimodal transport to the origin railway stations and from the final railway stations to the final destinations

A review of the means of mobility and modal choice to origin railway stations and from destination railway stations to the final destinations for a single person trip resulted in the high usage of multimodal transport that is approximately 77.0% and 60.0%, respectively. Therefore, these percentages of multimodal transport (Figure 3.4) suggests a very significant number of person trips and that an indication of a very significant mixed access and egress travel modes have caused poor public transport system integration in KL and Klang Valley. In other words, this had involved number of stages between four and fifteen (Figure 3.5) and number of transfers between zero and three (Figure 3.6) in order to get to the final destinations. Transfer between modes in this context embraced the transfer from the last mode of transport to the first railway station, the event of changing platforms to get to different main route, the event of alighting from the commuter train to board the LRT systems or the ferry at the related stations and jetty, and finally the transfer from the commuter train as a mainline journey to the connecting mode on the road.

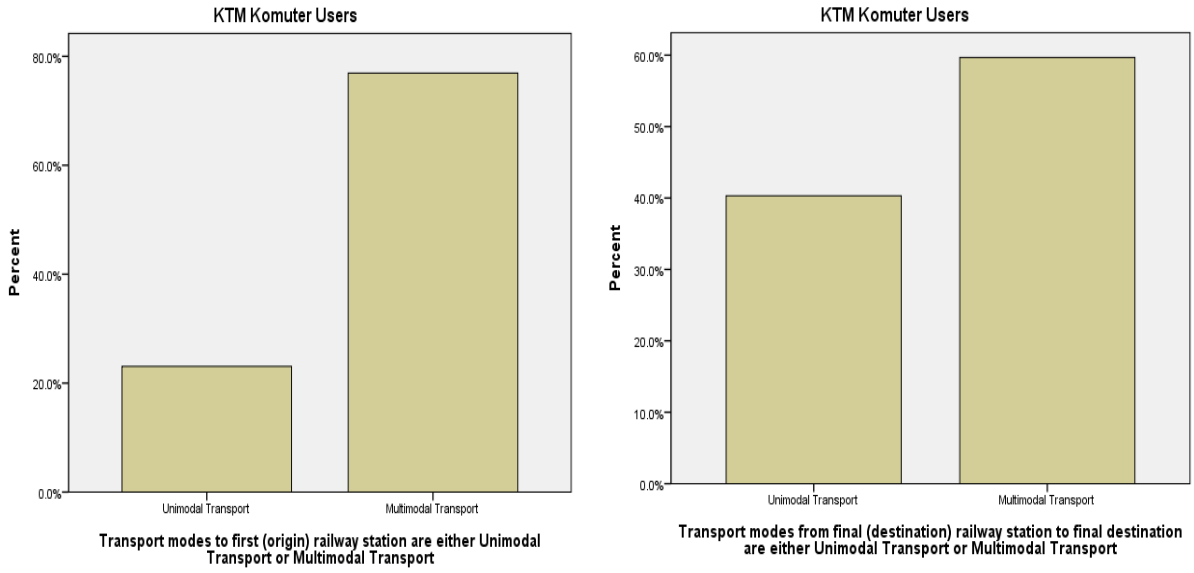

Figure 3.4. Multimodal transport to and from railway stations

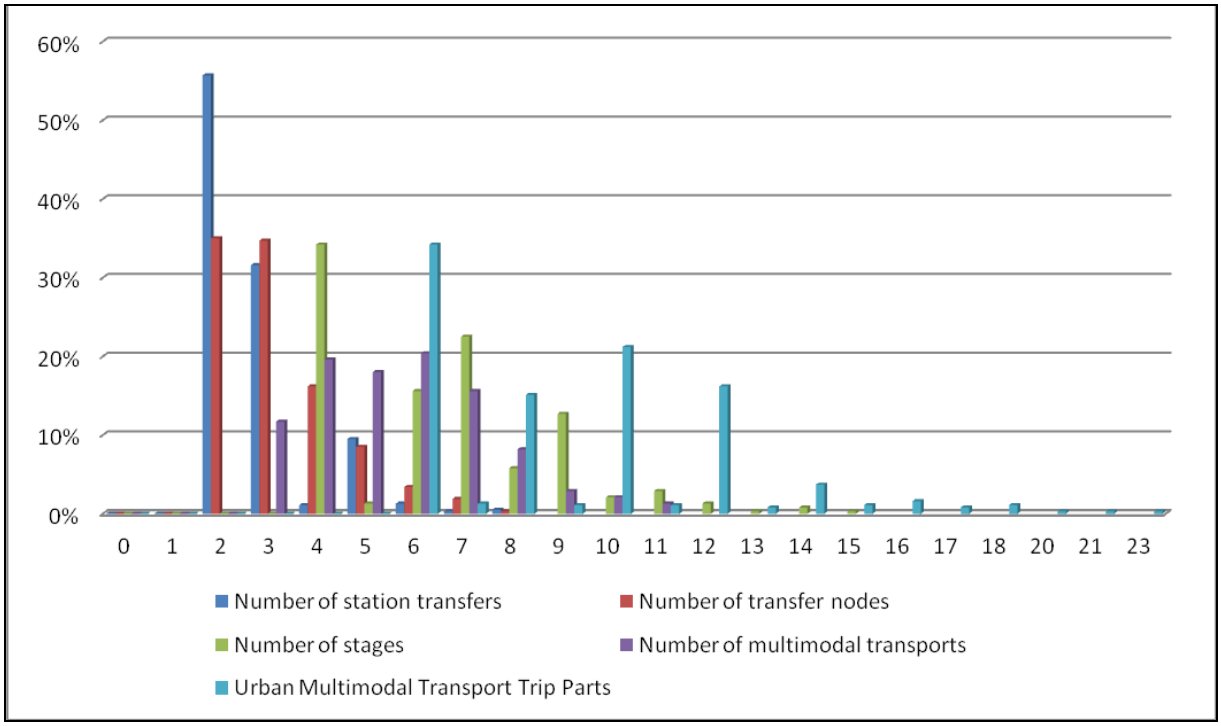

Figure 3.5. Number of station transfers, transfer nodes, stages, multimodal transports and number of parts within the urban multimodal transport trip for a one-way person trips

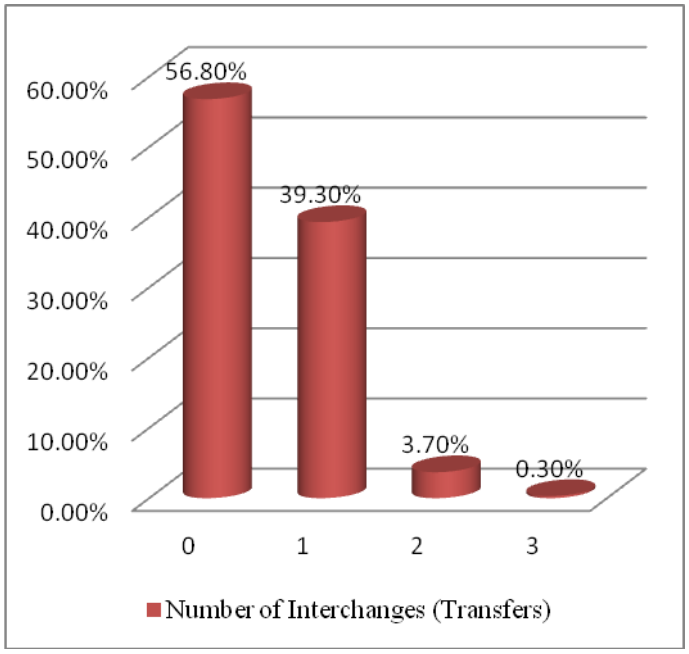

Figure 3.6. Number of transfers for the entire number of cases or 377 respondents

On-site measurements had resulted in poor transfer time at both origin and destination railway stations with averages of 35 minutes and 25 minutes, respectively. The corresponding number of observed users to origin stations and number of observed users to the final destinations were 177 (46.9%) and 267 (70.8%). These data highlight the poor functions of the existing transfer points or transfer unsmoothness (Ceder, 2007) and that there is an urgent need to improve both the transfer facilities and the provision of transfer station

with proper inter-connectivity or convenience of use of commuter train (Vuchic 2007).

3.2 Characteristics of the Commuter Train Users

Figure 3.7 presents the age group split among the users of the commuter train. A review on the demographic profile has resulted in the largest group of users was 189 (50.1%) with ages of 20 to 29 years. The second largest group was a total of 86 (22.8%) that were referring to user group of 30s. Only 37 (9.8%) represented the age group of 40s. 91.5% represented the adults with no restriction covering ages from 20 years to 64 years.

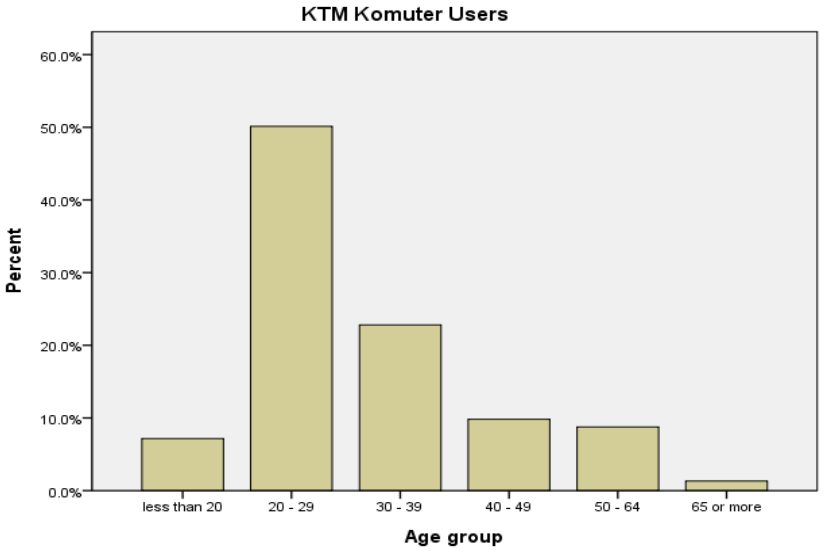

Figure 3.7. Age group split

From Figure 3.8, the KL's population in 1991 and 2000 for age group between 20 and 29 were estimated 22.4% and 21.9%, correspondingly. Also, Klang Valley was approximated having population of 22.6% and 21.6% for the same period and age group. City age structure in 2000 can be broken down into below 27.0% were teenagers of under 15 years old while 67.0% represented the 15 – 59 age group. Only 6.0% of the KL residents were group of elderly persons KLCH (Kuala Lumpur City Hall (KLCH) 2005).

The estimated total population of KL and Malaysia in 2010 were 1.68 million and 28.25 million, respectively. The details for 2010 data were ranging from the age groups of below 20, 20 – 29, 30 – 39, 40 – 49 to 65 – 95 and above with the respective values of 38.0%, 12.9%, 17.9%, 13.9% and 4.6%. Similarly, the details for Selangor's 2010 data were ranging from the age groups of below 20, 20 – 29, 30 – 39, 40 – 49 to 65 – 95 and above with the respective values of 39.5%, 15.4%, 16.8%, 13.5% and 3.4% out of 5.29 million (MalaysiaEconomy 2010). Therefore, the commuter train users of age group between 20 and 29 to population in KL and Selangor ratios are 3.88 and 3.25, respectively whereas the other ratios remain constant.

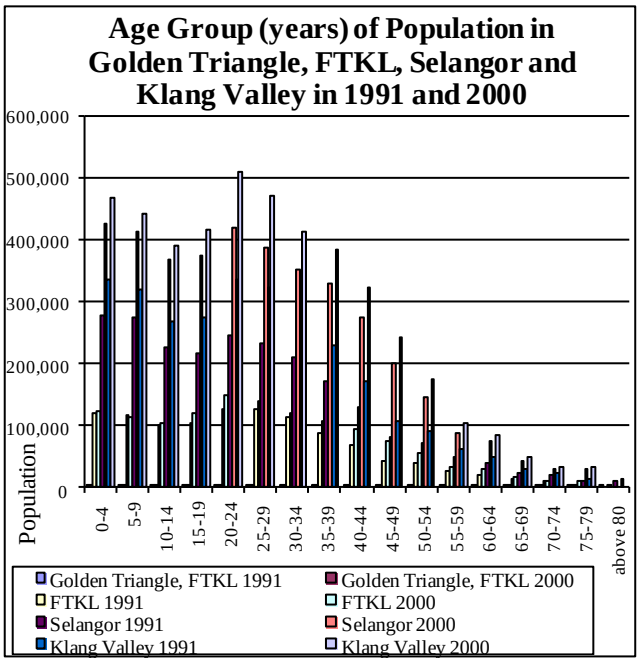

Figure 3.8. Age group of population in the Golden Triangle, FTKL, Selangor and Klang Valley in 1991 and 2000

Sources: Department of Statistics, Malaysia (DOSM, 2009)

From Figure 3.9, 14.6% were parent with small children. 19.4% were special group and this special group includes pregnant women, disabled persons, elderly persons and wheelchair users. It can be concluded that about 73.0% were adults with no guardian, physical and disability restrictions. The entire adults were 91.5%. The ages of the adult commuter train users were ranging from 20 years to 64 years. It was evident that a very small percentage of senior citizens i.e., 1.3% who use commuter train. The small proportion of this user group probably attributed to some of the pedestrian bridges and staircases, and the transfer facilities were inconvenient, as well as they did not need regular travel due to their physical limitation and limited personal affair. Only 4.8% of the users were adults such as pregnant women, disabled persons, elderly persons and wheelchair users owing to the pertinent provision of services and facilities were still in poor quality. Some of them were requesting convenient, user-friendly and priority accessible services. For example, a-37 year male wheelchair user had to call the Malayan Railways Limited officer up every time he took the Shuttle Train from Kuala Kubu Bharu to Batu Tiga for his work trip because the shuttle train had to change to the connecting commuter train at the correct platform at the Rawang transfer station only for him. This was because the platform did not have a lift for enabling him to change platform on his own. However, he admitted that the staff were very helpful and friendly and that he was very satisfied with the current fares for the disabled. This wheelchair user was a good example of a regular user.

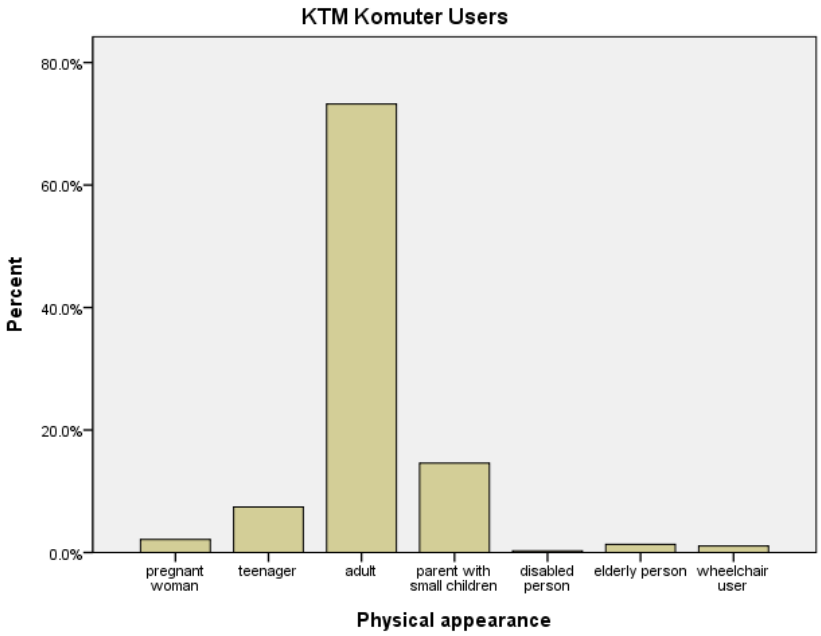

Figure 3.9. Physical appearance of the commuter train users

Figure 3.10 shows the gender among the commuter train users. It is evident that women riders were the dominant users with 241 (63.9%) in comparison to the men. From Figure 3.11, there were approximately 49.5% females in the KL population and 49.2% females in the Klang Valley in 2000.

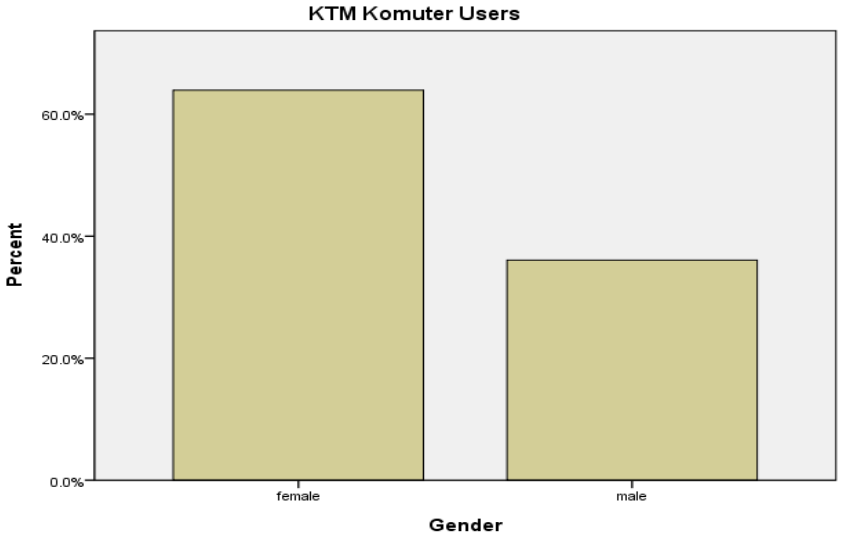

Figure 3.10. Gender split

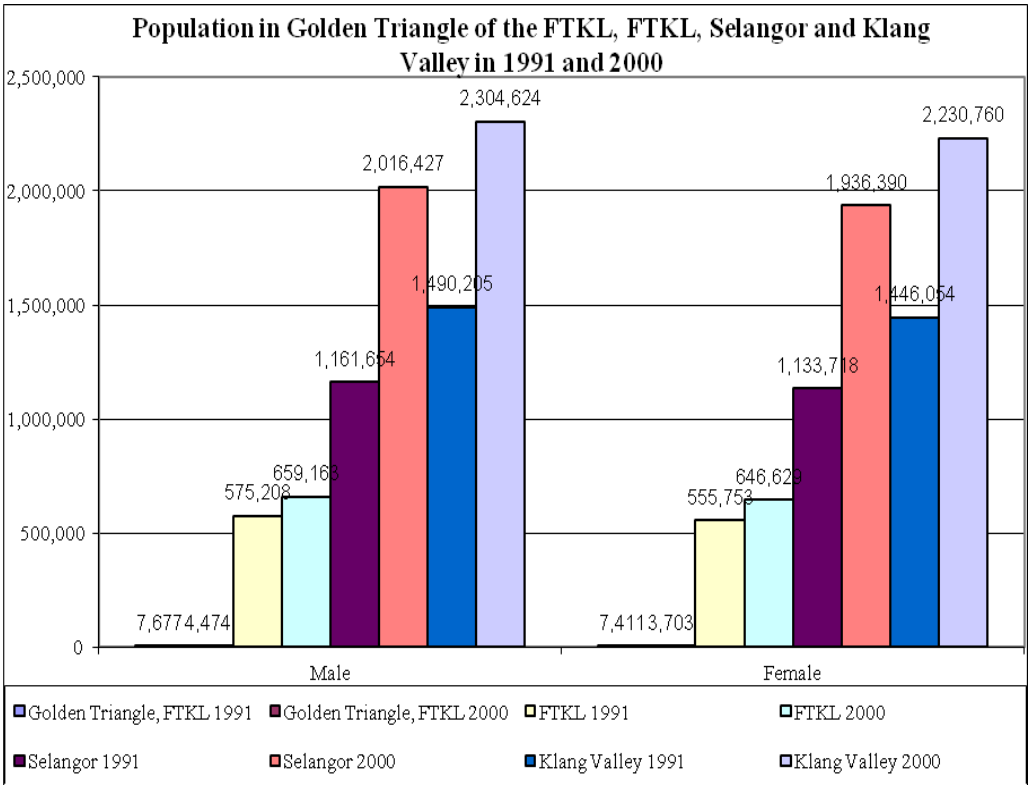

Figure 3.11. Population in the Golden Triangle of the FTKL, FTKL, Selangor and Klang Valley in 1991 and 2000
Source: Department of Statistics, Malaysia (DOSM, 2009)

Recent gender data in 2010 for KL and Selangor by the same age groups highlighted in the preceding paragraph about age group, they are ranging from the age groups of below 20, 20 – 29, 30 – 39, 40 – 49 to 65 – 95 and above with the respective values for males are 38.7%, 13.1%, 17.3%, 13.8% and 4.3% whereas for females are ranging from 37.2%, 12.7%, 18.5%, 14.1% to 4.8% for KL residents; and those of Selangor are including 40.2%, 15.2%, 16.6%, 13.3% and 3.2% for males whereas 38.9%, 15.6%, 17.0%, 13.6% and 3.8% for females. Of the estimated total population of KL in 2010, 49.4% are still females. For the same year, Selangor is populated by 48.9% females of the 5.29 million (MalaysiaEconomy 2010). Comparatively, the ratios of commuter train woman users to total population in KL and Selangor are 1.30.

Overall, the KL population growth rate is slow due to high net out-migration of people in KL to the suburban areas i.e. from 17.1% to only 9.0% from 1980 to 2000. It is because of enormous housing opportunities in the areas outside KL (Kuala Lumpur City Hall (KLCH) 2005). KL offered 58.0% employments from the sum of 838 400 employments in 2008 (Leong 2010). At the national level, the recent unemployment rate is at 3.6% (Allyhunt 2010).

Further analysis on the socioeconomic profile of the commuter train users, a majority of the users were ranging from full time private staff with 161 (42.7%), 74 (19.6%) students to 43 (11.4%) were full time staff from government sector. Figure 3.12 shows the graphical form of occupation distribution.

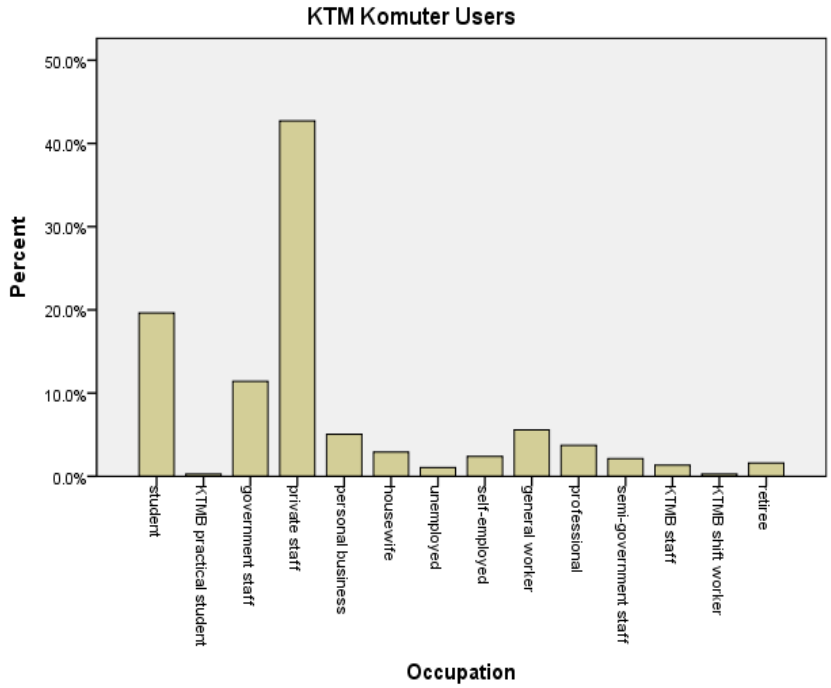

Figure 3.12. Occupation distribution of the commuter train users

Figure 3.13 indicates the monthly income distribution of the commuter train users. The largest group was made up of the RM1000 to RM1999 (£206.01 - £411.81) (117, 31.0%). 179 (47.5%) of the commuter train users were categorized in the low income group where they earned less than RM2000 (£412.02) per month. The group with monthly income from RM2000 to RM2999 (£412.02 - £617.82) (71 or 18.8%) was the second. The third group (44 or 11.7%) earned income from RM500 to RM999 (£103.00 - £205.80) per month. KL residents with monthly income under RM1000 (£206.01) are categorized in an urban poor who cannot afford to buy a low cost house ((KLCH) 2005). 62 (16.5%) of the users were categorized in such urban poor. Based on 377 valid observations, the current service levels had positive impact on the demand for commuter train among these middle to low income groups consistent with the high income group, which had a high propensity to use a private vehicle in the city environments (Mackett 2006). It is necessary to note that commuter train is also the preferred mode of travel among the users with monthly income in excess of RM3000 (£618.02). They were 77 (20.4%) out of the total 377 commuter train responses. None referred to the 50 users (13.3%) with no monthly income.

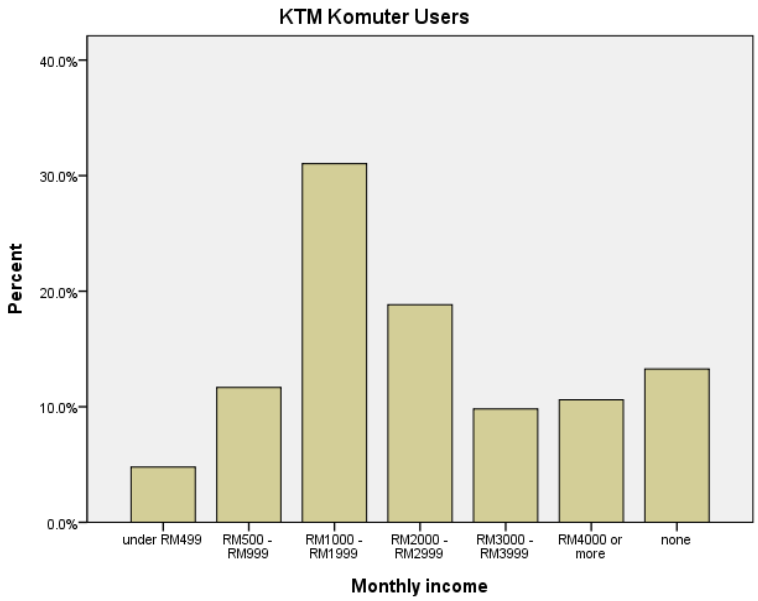

Figure 3.13. Monthly income distribution of the responses on the commuter train service

The average journey time is 115.5 minutes and the average journey cost is RM9.71. Based on the Passenger Demand Forecasting Handbook ((ATOC) 2002) , generalised journey time (GJT) represents journey time, frequency of service and interchange in a single term and is expressed entirely in equivalent *minutes* of journey time. The related graph is as shown in Figure 3.14.

Table 3.1. Total average journey time

Average Journey Time	**Mean (Standard Deviation)**
Average Access Travel Time	35.0 minutes (37.8)
Average Wait Time	17.5 minutes (8.9)
Average Ride Time	38.1 minutes (24.6)
Average Egress Travel Time	24.9 minutes (38.4)
Total Average Journey Time	**115.5 minutes (109.7)**

Table 3.2. Total average journey cost

Average Journey Cost	**Mean (Standard Deviation)**
Average Access Travel Cost	RM3.35 (5.10)
Average Ride Cost	RM3.63 (3.61)
Average Egress Travel Cost	RM2.73 (7.14)
Total Average Journey Cost	**RM9.71 (15.85)**

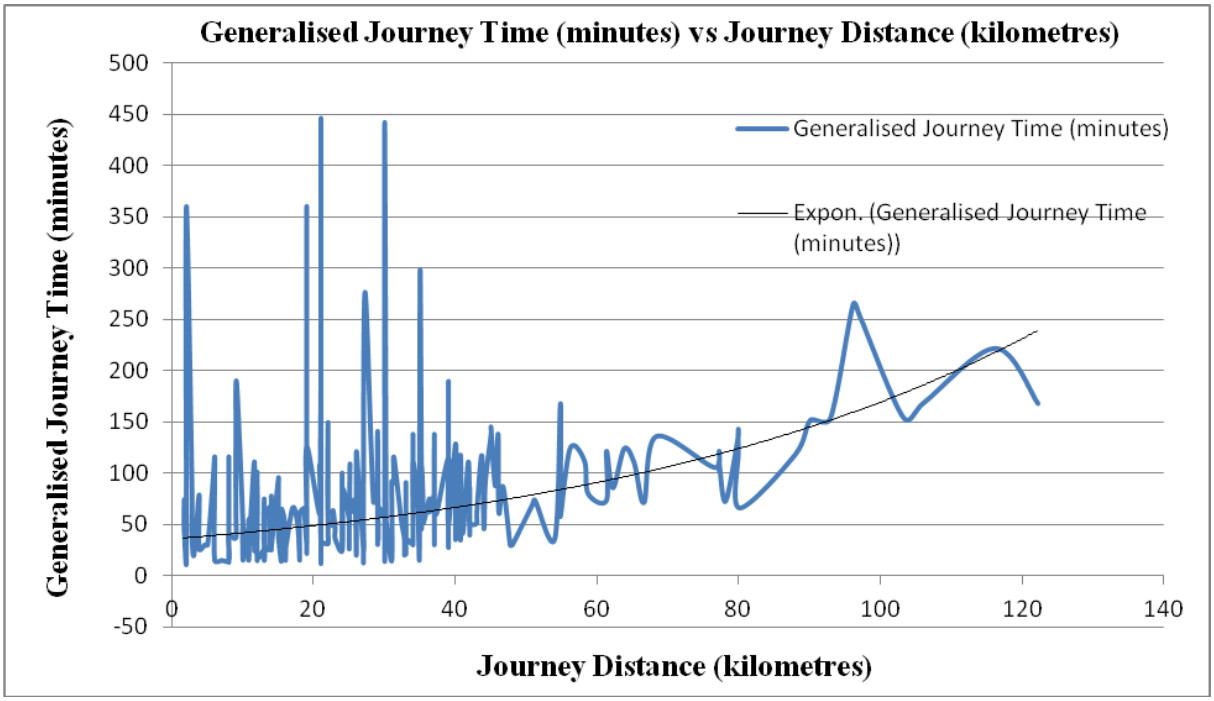

Figure 3.14. Generalised Journey Time vs Journey Distance

4. CONCLUSIONS

Users' patience, tiredness and stress is worsened by unreliable train operations. This is exacerbated where there is very high capacity utilization of the coaches and platforms in the absence of adequate electric multiple units (EMU) and rail coaches. In view of that, the analysis on the in-vehicle time, user waiting time and journey time due to existing and additional users must be taken into consideration for the design of commuter train services. Concurrently, there are is considerable high demand from the users at each OD station and substantial numbers of train delays without any prior notice, particularly during the peak hours of the weekdays and over the weekends. This unexpected overwhelming demand and operation technical faults have brought about increases in the load (crowding) levels at both the station platforms and on the train coaches and waiting time, and the inconvenience of use.

On average, the journey time from Pelabuhan Klang to Sentul and vice versa took 83.0 minutes and this was considered a transfer-free connection. This also indicates that the service frequency and schedule need immediate changes due to high headways or time intervals between trains.

This study has contributes towards a better understanding of adopting OD survey approach in evaluating Malayan Railways (commuter train) services. The findings presented here provide a starting point for further investigation of the improvement of Commuter Train travel time. Adding more samples of survey are possible with sophisticated statistical modelling is possible in the future.

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