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Utilization patterns of park and ride facilities among Kuala Lumpur commuters

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Abstract A parking utilization survey was undertaken with the main objective of analyzing and comparing the daily workday utilization patterns of two main park and ride stations within the Kuala Lumpur conurbation. This study also aimed to gauge the level of usage of the park and ride facilities. The findings showed that the overall utilization pattern of the facilities was very high with a utilization rate of between 80 and 95%. The stations, however, recorded a contrasting accumulation pattern. The study further revealed that most of the rail-based suburban park and ride users were long term parkers. The results of this study are comparable to results of similar studies in Seoul, Calgary, Tyne and Wear and others. Since parking availability is an important factor that has influence on the behavior of a park and ride user, more accurate information relating to the supply and demand of the park and ride facility will assist in planning new transport infrastructure.

Keywords Park and ride · Utilization · Accumulation · Duration · Volume

Introduction

The city of Kuala Lumpur, with a population of 1.42 million people, occupies a land area of 243 sq. km (City Hall Kuala Lumpur 2005). Kuala Lumpur city, together with its conurbation (referred to as KLC) forms part of the central region and is the most industrialized and the fastest-growing economic region in the country. Its economic contribution of 47% to the nation's GDP in the year 2000 reflects its rapid urbanization process. With a recent focus on the development of knowledge-based and high value-added manufacturing industries, the city of Kuala Lumpur continues to grow rapidly.

Kuala Lumpur's urban growth has led to a further increase in private car ownership and much higher land prices in the city centre. Combined with improvements in transport infrastructure connecting the suburbs and the city and relatively cheaper housing in the

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outskirts of the city, there exists a mismatch between residential and employment concentration. With jobs concentrated in the city centre, the commuting patterns of the trip makers tend to be that of morning/evening peak hours and this has led to congestion on some of the major highways leading into and out of the city. With the over-utilization of the roads and highways as well as the limited capacity of these infrastructures in accommodating the increase in the traffic volume, the issue of accessibility to the city centre has become one of the main agenda of the urban planners.

An in-depth review of the research literature on park and ride reveals that there are a few established definitions on the term 'park and ride'. Fouracre and Dunkerly (2003) explained in detail the various types of the rail-based systems that can serve as the main form of public transport for the scheme. They are made up of light rapid public transport, metros and the suburban rail system. In the case of the light rapid public transport system, it refers to the system that employs a fully segregated and often grade-separated right-of-way (ROW), advanced control system, but light trains that may be not dissimilar to modern tramcars. They are often seen as intermediate between bus and metro systems in terms of both capacity and cost.

The Department for Transport UK (2004) further illustrates a more detailed definition of park and ride. It defines park and ride as a means to access public transport in which patrons drive private automobiles or ride bicycles to a public transport station, stop, or carpool/vanpool waiting area and park the vehicle in the area provided for that purpose (e.g. park and ride lot). They then ride the public transport system or a parking shuttle, or take a carpool or vanpool to their destination. It is often provided in urban areas as an alternative to parking in the city centre where the road conditions are commonly congested while the parking spaces are rather limited and costly.

Spillar (1997) focused on the concept of intermodalism. He elaborated that park and ride can be classified as an intermodal transfer facility since it allows travelers to transfer between the private vehicle and the public transport or between the single occupancy vehicle and other higher occupancy vehicle modes. He added that in any park and ride scheme, the majority of the trip length is made by public transport while only a small percentage is made by private vehicle. It is against this definition that the park and ride facility users are categorically defined as a public transport user. Savings wise, the total travel time and cost per trip is lesser than by the alternative mode such as the highway.

Both Hole (2004) and Turnbull (1995) proposed park and ride scheme as an integral component of many Travel Demand Management (TDM) programs and that its application be further supported by the use of other TDM strategies. Such strategies would include the reduction in city centre area parking spaces as well as control over its parking charges. Through this definition, it can be further interpreted that park and ride scheme is indeed capable of making a contribution to traffic reduction but only if parts of the right package of restraint measures are being implemented accordingly.

An appraisal of the definitions presented above suggests that the definition of a park and ride scheme would incorporate the following aspects:

1. involving the use of private vehicle user whose journey begins at the suburban or the fringe of the city centre
2. the facility acting as an 'interceptor' as well as an intermodalism point to those who would have driven to the city centre rather than use the public transport
3. the public transport mode itself (here, the rail) being the main mode for the whole journey
4. the final destination is in the city centre.

All the above components would make up the characteristics of the trips made by a park and ride user.

Background of study

The Shah Alam commuter station is located 30 km from the city of Kuala Lumpur and is managed by KTM (Car Park) Sdn. Bhd. (Fig. 1). Located in the western part of the city and built in 1991, the station had its first commercial operation in late August 1995 with the inaugural service from Sentul station (Keretapi Tanah Melayu Berhad 2004). It has a car park size of 1,150 sq. m. providing 142 parking lots altogether. Apart from cars, it is also accessible by the feeder buses Triton that has a maximum zonal fare of USD 0.70 per trip. There are also bus services served by the RapidKL that runs from a few stops in the city that goes to the city centre (under local shuttle services) with a flat fare of USD 0.57. The rate for the use of its park and ride facilities is USD 0.57 per entry. Shah Alam station

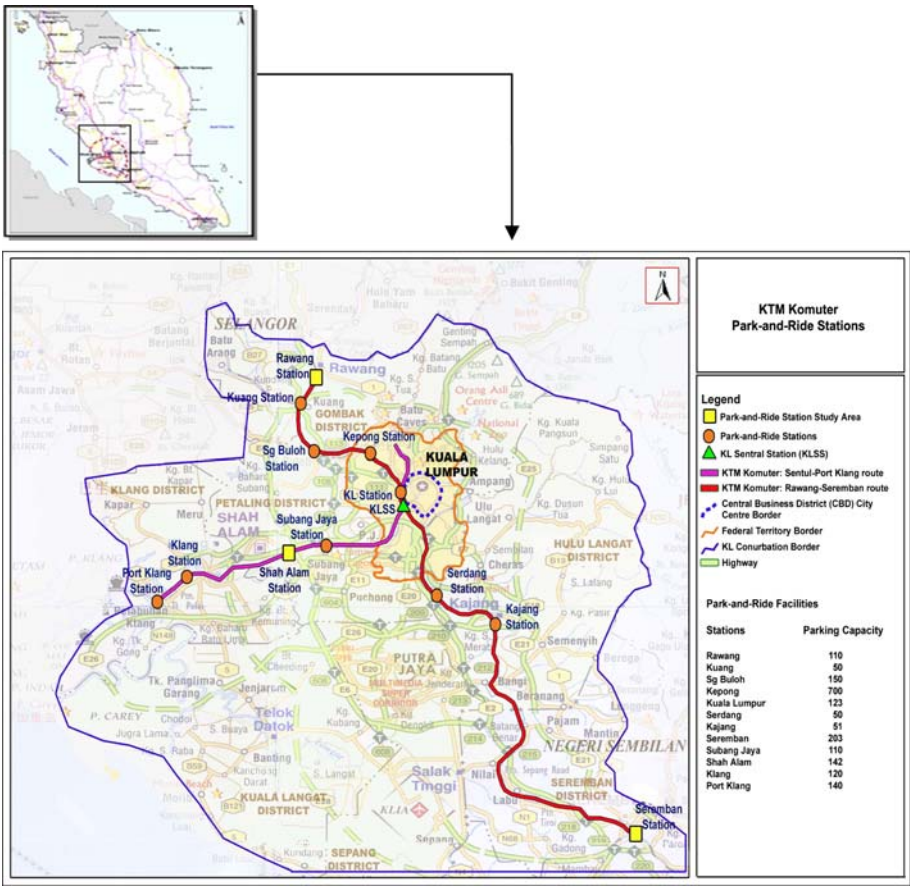

Fig. 1 Geographic region of study area and the commuter route

recorded an average daily ridership of 2,880 passengers per day in 2004 and rose to 2,922 passengers per day in 2005 (Keretapi Tanah Melayu Berhad 2006).

On the other hand, the historical Seremban intercity station built in 1924 serves as a state heritage. It is located at the southern end of the Kuala Lumpur Federal Territory and is adjacent to the town's main shopping complex and postal centre. Vehicles can have direct access to the station from the nearby roundabout. Due to the high demand for an alternative form of transportation to the city centre from the commuters, the station went through a 'facelift' in February–April 1994. Now both the intercity and the KTM Komuter services operate at this station. The station has a total of 203 park and ride parking spaces and built on a 1,554 sq. m. area of land. The use of the park and ride facility space is based on a USD 0.86 daily charge. The rail connection for Seremban town was first constructed in the late 1890s as a stop on the Kuala Lumpur–Singapore intercity main line (Seremban Municipal Council 2006). In 1995, it, however, experienced its first commercial commuter operation. Both the stations apply the closed ticketing system with trip makers from the suburban and the city centre of Kuala Lumpur conurbation as their typical primary passenger market. In terms of the types of parking charges being used at the stations, both have casual users as well as season parkers.

High private vehicle ownership

Changes in the economic structure of the nation have led to an increased level of urbanization in the country from 27.6% (1970) to 65.4% (2000) (Federal Department of Town and Country Planning 2005). With the increase in the country's overall average income level, there exists an increase in the demand for private vehicle ownership. Such is the case of the residents of the city of Kuala Lumpur where 23.5% of Kuala Lumpur households earned more than USD 1,429 per month compared to 9.8% for Malaysia as a whole. In 1999, Kuala Lumpur's average household income, as compared to the national average of USD 706, was higher by 66.0% (City Hall Kuala Lumpur 2005).

With the society becoming more affluent and with the sales of locally-manufactured cars being at relatively affordable prices, the nation recorded a high increase in the ownership of private vehicles. Kuala Lumpur city alone had 985.7 cars and motorcycles per 1,000 population in 2000 compared to 421.9 per 1,000 population for Malaysia as a whole, indicating a rate twice that of the national average (ibid). The high travel demand made by private vehicles within the city centre is further reflected by the fact that although the population of the city centre accounts for only 3.3% of total population of the conurbation, approximately 19% of the 8.3 million person trips made daily within the conurbation are trips generated in the city centre (ibid). The increasing dependence on private vehicles has indeed put pressure on the extent of the capability of the road network, thus forcing the provision of mass form of transit system, highways as well as ring roads in and around the city.

Underutilization of public transport services

Despite continuous increase and heavy investments made towards improving the 'hardware' of the urban transportation system of the nation particularly for KLC, there somehow seems to be a parallel pattern in terms of the decline in the use of the public transport services. Table 1 illustrates the above scenario. Between 1985 and 1997,

Table 1 Physical investments and percentage of public transport services utilization for KLC

Types of rail system	Year service commence	Share of public transport users
Suburban rail commuter system KTM Komuter Rawang-Seremban line and the Sentul-Port Klang line	1995	NA
LRT system The Ampang line and Sri Petaling line	1996	NA
LRT system The Kelana jaya line	1998	19.7% (1997)[#]
Multimodal transportation hub Opening of nation's biggest urban multimodal transportation hub, the KL Sentral Station	2001	NA
Monorail system Opening of the inner city KL Monorail system	2003	16%[#]

Source: [#] BinaFikir (2005)

Kuala Lumpur saw a decline in the modal share of its public transport system from 34.3 to 19.7%. In 2000, private cars made up a total of 56.6% of all motorized trips into the city centre. The situation further worsened in 2003 with only 16% of the modal split going to public transport, of which 10% were accounted for by the rail services (BinaFikir 2005).

The above scenario reflects a major shift away from the public transport mainly that of the buses. Various factors seem to have been attributed to the decline in the use of the public transport services today, although it used to be heavily-subscribed. Jamilah (1995) highlighted that although the overall coverage of the bus network then was only reasonably comprehensive, the buses were heavily used and operating at peak capacity at peak periods. Various inadequacies in the bus public transport system has now surfaced including that of failure in route planning by the operator leading to route fragmentation, lack of connectivity between modes (Sarban 2006), expensive as well as relatively slow (Minderjeet 2005; Ghani et al. 1999).

Kuala Lumpur parking policy

In 2000, there were approximately 65,206 car parking spaces in the city centre of which office premises made up an average majority of 71% of the total spaces followed by the retail and commercial sectors. The core areas of these parking spaces are those along Jalan Ampang, Pudu and Sultan Ismail as well as those along Jalan Raja Chulan and Jalan Bukit Bintang. In terms of supply, car parking provision in the city of Kuala Lumpur is indeed more than adequate. Parking charges are subjected to market forces and are not at all regulated. Apart from its attractive cheap seasonal parking tickets, the parking charges imposed by the many operators favour regular long-term parkers (City Hall of Kuala Lumpur 2005). With such wide 'flexibility' in terms of its parking policy plus the easy ownership of private vehicles, the city is indeed a haven for private vehicle users. The whole situation, however, does not seem to be consistent with the move towards enhancing the use of the public transport.

Utilization patterns of the park and ride facilities: case of Shah Alam and Seremban rail stations

The introduction of the KTM Komuter double-electrification system has the aim of reducing the chronic traffic congestion on the roads within the KLC. The rail commuter system is seen by the trip makers from the suburbs to the city centre as the better alternative form of transportation than the private vehicles. Together with the provision of the rail commuter system are the designated park and ride facilities at some of its selected stations. These facilities are being provided so as to encourage and thereon to intercept the journey of those trip makers, especially those that are used to driving to the city centre by private vehicles, to park their vehicles at these facilities and then to continue the remaining journey by public transport, i.e. rail. In the short term, this would lead to less congestion on the streets in the city centre (with the presence of fewer cars). Its long-term aim is to improve the modal split that favours public transport as well as providing a more sustainable form of transportation.

The first 110 km sector of the commuter line connecting Rawang to Seremban, traversing the KLC, was built in 1995 (Fig. 1). This was then followed by the 43 km Sentul-Port Klang sector having a total of 42 stations and halts including 13 stations with park and ride facilities. Its park and ride facilities have a moderate number of spaces ranging from 50 (Serdang and Kuang station) to as high as 700 spaces (Kepong Sentral). Since its opening, the demand for its park and ride facilities has improved positively. This can be seen with the recent expansion in terms of parking spaces at Rawang, Shah Alam and Bangi stations. On an average for the month of April 2005, a total of 5.2% of the average daily train riders at the Seremban rail station parked their vehicles while for Shah Alam, it was at 4.6%.

Methodology

A car park utilization survey was undertaken in April 2005 with the main objective of analyzing and comparing the daily workday utilization patterns of the park and ride facilities of two main KTM Komuter stations, namely Shah Alam intermediate station and Seremban terminal station. This study also aims to gauge the present level of usage of the park and ride facilities of the stations in terms of its level of utilization (occupancy rate), its pattern of accumulation as well as the extent of its parking duration. The methodology employed is based on a license plate survey involving a continuous observation for a period of 18 h, from 05:30 morning to 23:30 in the evening. It was carried out on a weekday for each station. The number plate and time of all access and egress vehicles were recorded throughout the period on a formatted sheet.

This research was carried out with the purpose of generating a pattern in terms of the daily workday parking demand of the users of the rail-based park and ride facility of commuter stations that are spatially located outside or the fringe of the city. The term demand refers to the propensity of people to make trips. However, in the context of park and ride facility here, demand refers to the estimated number of vehicles that will require parking spaces at staging areas to transfer trip makers to higher occupancy modes, in this case, to rail (Drake et al. 1994). The parking demand here is further analysed by means of its parking utilization indices namely its utilization (occupancy rate), accumulation as well as the duration of the facility itself. Utilization here refers to the occupancy of the designated spaces within the facility and is calculated as the number of spaces occupied over

the total number of spaces available (Papacostas and Prevedouros 2001). Accumulation relates to the number of vehicles parked at a given time (ibid) while duration explains the total hours of the vehicles being parked at the facility and is divided into short-term parking, mid-term parking and long term parking (ibid; Bolger et al. 1992). Short-term parking here is defined as those parking duration of less than 5 h while long-term parking refers to those exceeding 8 h. Mid-term parkers would therefore be those that park their vehicles betwe. As for the term 'supply', supply here refers to the sum (capacity) of all the parking with the exception of spill over while demand is equal to the sum of all parking including the spill over. The case of spill over here relates to both the on-site spill over as well as the off-site spill over.

With respect to the choice of the stations, factors of locations and geographic background of the study areas are taken into account. Shah Alam at 30 km distance from the city centre as well as being a small sized city provides contrasts to Seremban, an established town located 70 km from the city centre. The factor of capacity is also taken into account so that there is an even mixture of 'ample' and 'tight' parking situations.

Results

The results below are summarized based on three main aspects namely its utilization (occupancy rate), parking accumulation and duration factors. In the case of Shah Alam park and ride facility that has a capacity of 142 spaces, the 05:30–06:30 weekday period saw the morning peak of its in and out-vehicle flow with a relatively high number of pick-up and drop-off passengers (PDOs) (Fig. 2). This situation of a relatively high number of morning PDOs is somewhat similar to that of the 255-parking space Berne station in

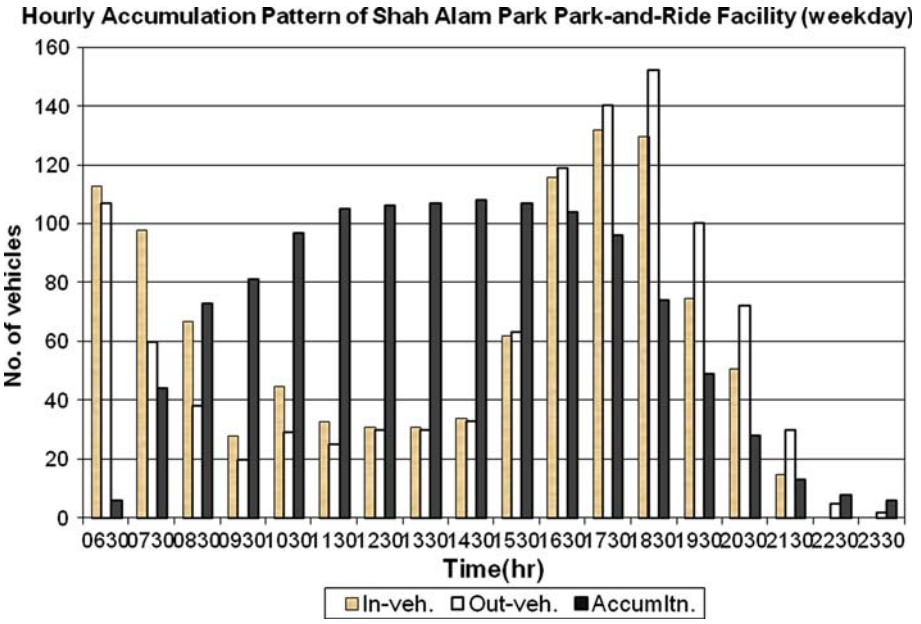

Fig. 2 Hourly accumulation pattern of Shah Alam park and ride facility

Germany (Dickins 1991). From 7:30 a.m. onwards saw a significant accumulation of vehicles and reached its peak at 2:30 p.m. with 108 vehicles. The evening peak period of 5:30–6:30 p.m. saw the highest number of out-vehicles recorded with 14.4% (152) of the total number of vehicles. A relatively significant number of in and out-vehicles began to re-emerge at the evening peak period from 4:30 p.m. up to 8:30 p.m.. This scenario reflects the regular weekday morning and evening rush hour for commuters and are consistent with the trip patterns of those on compulsory trips namely to work and/or school/college.

With the supply of spaces higher among the two stations (203 spaces), the Seremban station, however, projects a rather different scenario in terms of its utilization pattern (Fig. 3). In contrast to the rather active in and out-vehicle 16-h flow pattern of the Shah Alam station, the Seremban station, however, saw an active 2-h in and out-vehicle flow only from 05:30 to 07:30 morning. Beyond this time, vehicles began to accumulate and reached its peak at 10:30 a.m. with 190 vehicles. This pattern of early morning peak accumulation is also seen in the case of the Calgary rail parking facility where all the park and ride lots in the south of the city experienced full accumulation as early as 9 a.m. (Bolger et al. 1992). Such situation can also be related to the case of the Hong Kong experience where its average flow entering to one of its park and ride facility (trial scheme) on critical days was found to be greatest during the morning peak period of between 7:00 and 9:00 a.m. (Lam et al. 2001).

The same pattern of early morning 7:00 to 9:00 a.m. peak accumulation can be said of the Tyne and Wear Metro park and ride stations (Pickett et al. 1986). Active out-vehicle movement was only observed at 7:30 p.m. onwards. Similar to Shah Alam station, this scenario also reflects the regular weekday morning and evening rush hour for commuters and is consistent with the trip patterns of those on compulsory trips. Comparatively, the overall utilization rate of Shah Alam station was at 95.1% (a total of 135 parkers) while Seremban was at 97.5% (with a total of 198 parkers). When comparing this utilization rate

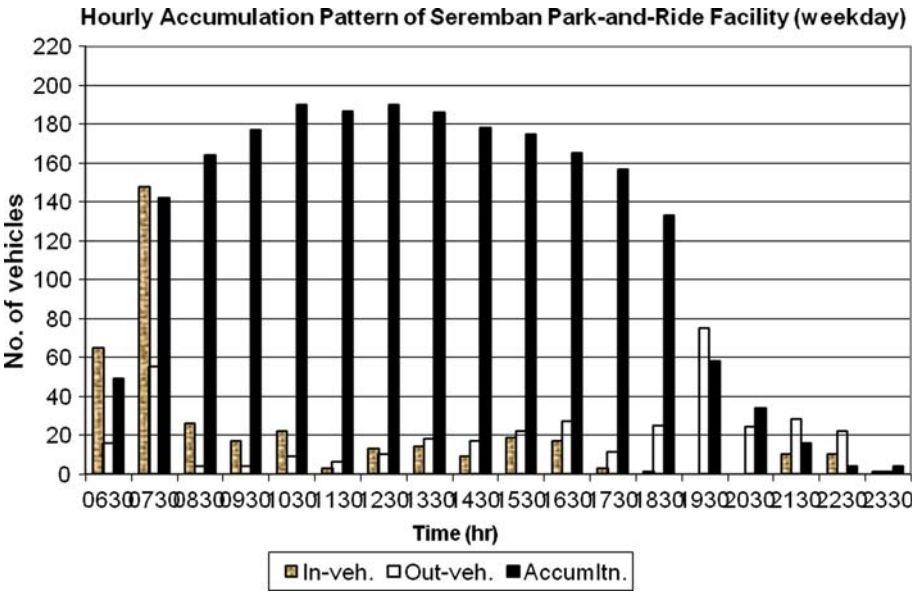

Fig. 3 Hourly accumulation pattern of Seremban park and ride facility

(occupancy level) with parking facilities that are within the size of 100–300 spaces per station, it can be seen that the stations in the north western part of Calgary also achieved an average weekday utilization rate of between 80% to even 100% (ibid). As in the case of Shah Alam and Seremban station, this scenario reflects the relatively high demand for the use of the park and ride facility in the weekdays.

There was, however, a significant difference in terms of the hourly accumulation of out-vehicles for both stations. Shah Alam station experienced a sharp increase in out-vehicles between 4:30 and 6:30 p.m. The majority of the parkers during these times are thought to be those among the government departments whose office hours ended at 4:30 p.m. then. Since the location of Shah Alam station is relatively nearer to the city than that of Seremban station, it can be expected then that the out-vehicle rush would be earlier at Shah Alam station than that of the Seremban station.

The above pattern accordingly then shows a rather parallel flow pattern of both the cumulative in-vehicle and cumulative out-vehicles for Shah Alam station, as shown in Fig. 4. While both stations clearly show the existence of two main types of motorists that utilized the stations namely, the PDOs and the genuine parkers, accumulation of the vehicles at Shah Alam station reached its saturation between the 10:30 a.m. and 4:30 p.m. (6 h) with a maximum of 108 vehicles attained at 2:30 p.m. (Fig. 4). In the case of Seremban station, the accumulation of its vehicles was rather saturated over a longer period i.e. from 7:30 a.m. to 5:30 p.m. (10 h). It attained its highest total accumulation of vehicles at 10:30 a.m. with 190 vehicles (Fig. 5).

Analyzing the parking behavior of the parkers of both stations as seen in Fig. 6 and 7, and taking 8 h as the cut-off point, a total of 44.4% of the total parkers at Shah Alam station parked less than 8 h while a majority 55.6% parked more than 8 h. This contrasted with Seremban where 18.2% of the total parkers were short term parkers (less than 8 h) as compared to 81.8% of the parkers were long term parkers (more than 8 h). This again reflects the spatial factor of the station as well as the travel pattern of the users being mainly commuters (Hamid et al. 2007). This finding on the parking behavior of the

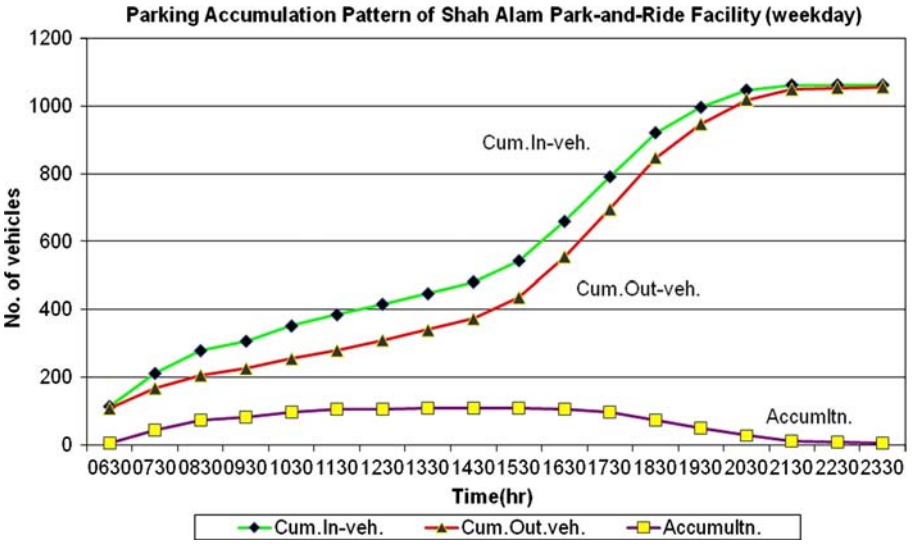

Fig. 4 Parking accumulation pattern of Shah Alam park and ride facility

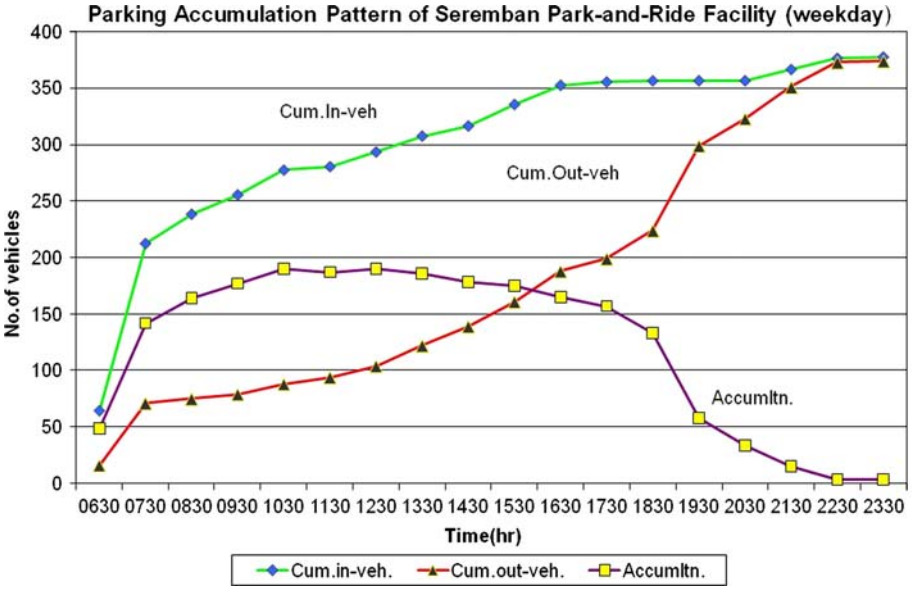

Fig. 5 Parking accumulation pattern of Seremban park and ride facility

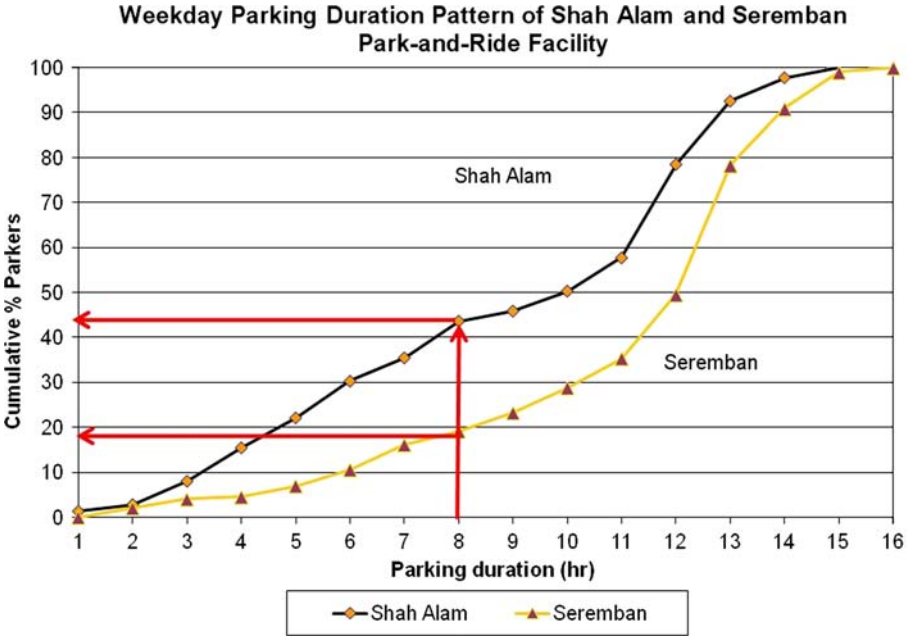

Fig. 6 Weekday parking duration pattern of Shah Alam and Seremban P & R facility (cumulative)

long-term parkers seem to have a similarity with those of the parking facility users of the Seoul Metropolitan Area (SMA) where it was found that 52.8% of the parkers were those that parked on an average of 8 h per day (Kwon, 2001). Such pattern on parking duration is

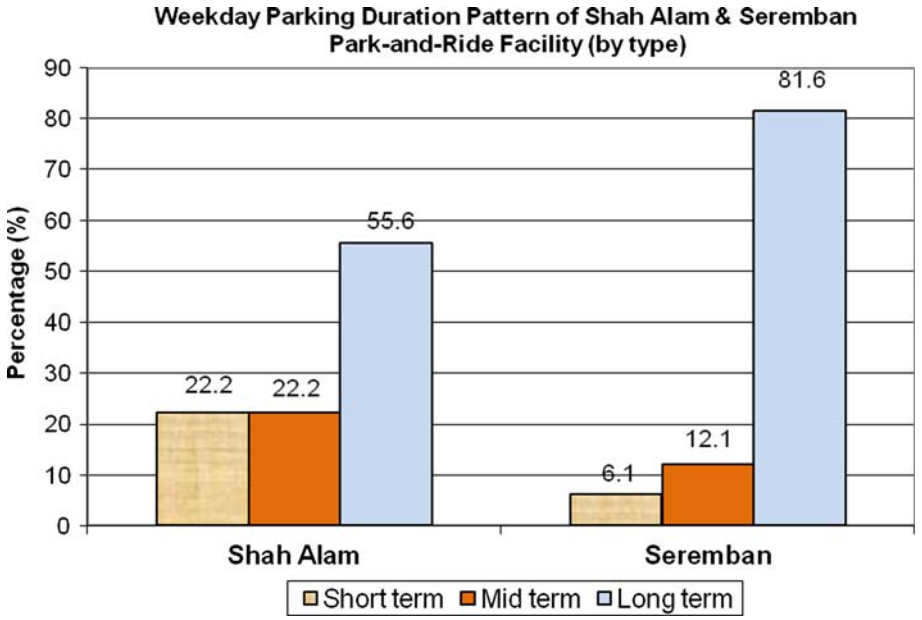

Fig. 7 Weekday parking duration pattern of Shah Alam and Seremban Park and ride facility (by type)

also noted in the case of the Metro car park users where 60% of the users of the stations were expected to be long term parkers (more than 4 h; Pickett et al. 1986).

Implications of findings

The parking utilization study was undertaken to analyze the demand and supply of the rail-based park and ride facility of two commuter stations located at the fringe of the KL conurbation. The analysis was done based on utilization (occupancy rate), accumulation and duration pattern of the parkers of the stations. The study found out that both stations show a relatively good level of utilization, well exceeding the 80% mark and below the 95% level. While Seremban station showed a 43% higher in terms of its maximum accumulation of vehicles, both stations, however, have majority of their parkers as long-term parkers with Seremban recording an average duration parking hour per vehicle of 10.9 h compared to Shah Alam with 8.7 average parking hours per vehicle. The above findings show that the park and ride facilities at both Shah Alam and Seremban are well-utilized and reflect on the worthiness of the investment expended by the government and the operator.

The main similarity from the travel pattern of the parkers with respect to the utilization of the stations are that since majority of the parkers are long term parkers (more than 8 h), it can be explained that majority are on work trips. The significant difference, however, is that for Seremban parkers, the demand for long term parking is indeed relatively higher than that of Shah Alam. This gives implication on the general transport policy whereby there is indeed demand for the use of the park and ride facility for even a relatively small conurbation. The high percentage of long term parkers indicates that there is a keen interest to use the facility particularly among the work trip makers of the suburban population.

For Seremban in particular, consideration can perhaps be made to provide more spaces for specifically long term parkers. Allocating specific spaces for only long term parkers can give an assurance to the users of a parking space when they arrive at the station, particularly in the early morning hours. This can in the long run, influence a relative percentage of permanent diversion from the alternative mode of transport namely the private vehicles, thereby assisting in the reduction of the level of congestion of the city centre. With land being scarce and expensive in the city centre, vehicles parked for long hours are indeed a waste of scarce resources. In this context, implementing the park and ride scheme would certainly allow a certain percentage of these vehicles to be diverted off the roads, thereby possibly reducing the potential environmental problems that may have been posed by these vehicles.

Conclusion

Comparison of the above results with those of similar studies in Seoul (East Asia), Calgary (Canada), Germany (Western Europe) and Tyne and Wear (UK) clearly exhibit overall similarity in the usage patterns of the park and ride facilities in terms of vehicle accumulation, parking duration and also utilization pattern. By monitoring and measuring the pattern of usage of park and ride facilities in the above three main aspects, transport planners in particular, can begin to enhance their knowledge base in terms of having better indicators of the parking demand in an area. Since factors such as parking availability and easy accessibility are important factors that have some influence on the behavior of a park and ride user, hence more accurate information relating to the supply and the demand of the parking facility will inevitably assist in the development of new transport infrastructure.

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References

BinaFikir.: Restructuring Klang Valley's urban public transportation system. Paper presented at the Conference on Public Transport Integration, Kuala Lumpur, Malaysia, September 2005

Bolger, D., Colquhoun, D., Morrall, J.: Planning and design of park and ride facilities for the calgary light rail transit system. Transp. Res. Rec. **1361**, 141–148 (1992)

City Hall Kuala Lumpur: Structure plan Kuala Lumpur 2020. City Hall Kuala Lumpur, Kuala Lumpur (2005)

Department for Transport.: Putting it all together—Chapter 6. Department of Transport, London. Available from: http://www.dft.gov.uk. [Accessed on 18/2/2004]

Dickins, I.J.: Park and ride facilities on light rail transit systems. Transportation **18**, 23–36 (1991)

Drake, P.G., Gerald, R., Mann, W.W.: Parking demand analysis for HOV facilities. ITE, Washington (1994)

Federal Department of Town, Country Planning: National physical plan. Ministry of Housing and Local Government, Kuala Lumpur (2005)

Fouracre, P., Dunkerly, C.: Mass rapid transit systems for cities in developing world. Transp. Rev. **23**(3), 299–310 (2003)

Ghani, P.A., Hamid, N.A., Haron, H., Daud, N.: Proceedings of BRC seminar. Institut Teknologi MARA, Shah Alam (1999)

Hamid, N.A., Mohamad, J., Karim, M.R.: Parking duration of fringe park-and-ride users and delineation of stations catchment area: case of the Kuala Lumpur conurbation. J. Eastern Asia Soc. Transp. Stud. **7**, 1296–1310 (2007)
Hole, A.R.: Forecasting the demand for an employee park and ride service using commuters' stated choices. Department of Economics Working Paper, University of St. Andrews, Scotland (2004)
Jamilah, M.: Stage bus operations in Kuala Lumpur: a view before consolidation. Malaysian J. Trop. Geogr. **26**(2), 111–120 (1995)
Keretapi Tanah Melayu Berhad: KTM komuter statistics. KTMB, Kuala Lumpur (2004)
Keretapi Tanah Melayu Berhad: KTM komuter statistics. KTMB, Kuala Lumpur (2006)
Kwon, Y.: A study on the classification of park and ride facilities in the Seoul Metropolitan Areas. Paper presented at the 9th Conference on Transportation Research. Korea, The Korea Transport Institute (2001)
Lam, W.H.K., Nicholas M.H., Lo, H.P.: How park-and-ride schemes can be successful in Eastern Asia. J. Urb. Plan. Dev. 63–78 (2001)
Minderjeet, Kaur: Fewer people using public transport. New Straits Times, Kuala Lumpur, Malaysia (2005)
Papacostas, C.S., Prevedouros, P.D.: Transport engineering and planning. Prentice Hall, New Jersey (2001)
Pickett, M.W., Perrett, K.E., Charlton, J.W.: Park and ride at Tyne and Wear Metro Stations—a summary report. Research Report 40. Transport Road Research Laboratory, London (1986)
Sarban, S.: It's all to do with connection. New Straits Times, Kuala Lumpur, Malaysia (2006)
Seremban Municipal Council.: The early history of Seremban. Available from: http://www.mpsns.gov.my. [Accessed on 28 /1/2006]
Spillar, R.J.: Park and ride planning and design guidelines. Parsons Brinckerhoff Inc., New York (1997)
Turnbull, K.F.: Effective use of park–and–ride facilities. NCHRP synthesis 213. Transportation Research Board, Washington (1995)

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