The Influences of Public Transport on Parking Space: A Study on Travel Choice Behaviour between Private Cars and Public Transport

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Abstract. For the last decade when travelling the majority of people rely on cars. To this extent, every public building has the obligation to provide parking area. In transport studies, a long-standing debate has been arguing about in what ways the role of travel mode choices contributes to the association between built environment and travel behaviour. In regard to the presence of the new MRT system in Jakarta, this paper is to review the literature for a theoretical exploration study about how people make their travel mode decision from private cars to public transport. Focusing on travel-to-work behaviour, the study identifies comfort, awareness, location, time management, cost, regulation, and pre-planned activities as attributes which influence travel mode choice. In addition, socio-demographics characteristics and pre-condition habits on using public transport describe how individuals view the attributes. This paper proposes awareness of public transport strategy for the stakeholders. Keywords: travel behaviour, travel mode choice, public transport, built environment, parking, public transport, Jakarta MRT system, MRT

1. Introduction
Like other megacities urban in Asia, formerly the main public transport system in Jakarta - the capital city of Indonesia - was the conventional bus, which did not have as good service as private cars. This condition has accelerated the car ownership since car use becomes more as a necessity rather than a choice [1]. The first public transport system in Jakarta is Bus Rapid Transport System (BRT) which opened in early 2004. The Jakarta’s BRT was the first in South East Asia with a length of 251 km. The BRT system has its private right-of-way lanes and use a network of strategically located stations. Without anymore frequent bus stops, the Jakarta’s BRT system could be compared to subways or light rail with cheaper to develop and operate [2]. However, the BRT system could not give a solution for the traffic. The lubricant producer Castrol’s Stop-Start Index in 2015 reported that Jakarta was the city with the worst traffic in the world according to an index based on satellite navigation data. In that time, the population of Jakarta was around 9.6 million. Furthermore, there were over 4.4 million cars out of 17.4 million vehicles according to the greater Jakarta transportation body (BPTJ). Trying to solve the peak hour congestions, in March 2019, Jakarta has introduced a new operation of Mass Rapid Transportation, known as MRT, on the corridor of business district. It is expected this new system will bring some impacts, especially those related to travel behaviour patterns.

Meanwhile, there is an increasing tendency for people in the most of the world’s countries in car ownership [3]. Especially in the developing country the growth in car ownership and the use of cars are
very rapid [3, 4]. As follows the capacity of parking space are required. Mostly the structure of parking lots brings serious impacts on many environment responsibilities, such as urban sprawl and water quality [5]. Moreover, due to parking lots tend to require hardscape more than green coverage [6], they contribute also to the urban heat island effects [5]. Apart from the impacts of parking structure, parking is a significant topic in transport studies. Parking is an aspect that people always consider when selecting their transport mode, their destinations, or duration of the trip [7, 8].

In a big city, transportation becomes a crucial aspect for citizens’ day-to-day travel activities. Travelling creates concise behaviour patterns since people tend to repeat the same format every day, every week, or even every year [9]; for example, people have their own travel behaviour patterns in terms of transport mode, to go to the office, to go to school, or to go shopping. In the mean time, certain conditions may compel people to choose their transport modes, to either use their private cars or public transport. How people make their travel mode choice attracts many scholars to investigate. For examples in examining private cars, studies often discussed about instrumental factors and motives for car use [10], influences on the built environment including congestions [11, 12, 13], psychological factors [14, 15], users’ perceptions [16, 17], and parking requirement [18, 19]. Public transports are also frequently discussed in transportation studies due to the fact that they are environment friendly, efficient, and affordable. Regarding willingness of people to use public transport some studies have been demonstrated that for work trip people have a tendency to shift to public transports more than other purpose [20]. If people who travel-to-work shift their transport mode from private cars to public transports, then it will result on reducing the demand of parking space.

By making an exploratory study this paper aims to figure out attributes which people decide on their travel mode choice. It is expected that the attributes could be applied to make a better strategy for Jakarta MRT, so it can attract more people to use it.

2. Influences of New Public Transport System

The influences of a new public transport system on the changing of travel behaviour have been investigated for a long period. However, most of investigations were taken in countries where the public transport system is already well-planned and the people are well organized with their trips [21, 22, 23, 24, 25, 26]. Examining influences of the opening of a new railway station in the Netherlands, a study found some differences of travel patterns before and after the opening of the station. Results demonstrated some changes in the working patterns particularly there are an increase in leisure activities outside the house and a decline in trip chaining. Likewise, results showed there is a decrease in travel distance by car [21]. A study about travel behaviour after a launch of a new Metro system in Athens demonstrated the metro has attracted about 16% of private car users and about 53% of bus rider [22]. Counting how people use travel mode six months before and six months after the operation of a metro in Denmark, results showed the decrease in car traffic is between 6.5% and 7.5% [23]. However, in the study is not clear the number of private car users who shift to public transport. An experiment study in Cambridge, UK regarding a new public busway demonstrated that the new system is able to stimulate people to change their travel choice behaviour to walking, cycling or other physical activities [24]. Similar results also found in US that the new light rail transit could shift people to choose the new system as their travel mode and increase active travel, such as walking and other physical activities [25].

An observation on the impact of an extended new rail service and feeder bus routes in Australia demonstrated the users of cars who shift to use the new public transport are about 25%, while there are about 11% who previously not the users of public transports [26]. When a new Reserved Transport Public Lane (RTPL) was on the plan in Martinique island with 386,874 inhabitants, a study estimated that if RTPL in a day could transport 55,750 passengers then 37% of the passengers will be previous car users and 60% will be previous users of public transport [27]. To better understand the effects of RTPL, another study was also conducted through a survey. Results predicted that people who are using public transport system only one to three time per year have low intentions to use RTPL. Their intentions to shift to public transport depend on the social influence who tell them the good things of RTPL and how useful RTPL to them. Meanwhile, the current daily users of public transport system have full intentions
to use RTPL. The less frequent users of public transport system also have intentions to use RTPL, but they depend on who else uses the RTPL and their age [28].

Not every new transport system bring impact concerning the shift from using private cars. A study on Bus Rapid Transit (BRT) system in Jakarta demonstrated that BRT system could neither significantly increase transit ridership nor significantly decrease the private car users. Surprisingly, the users of motorcycle increase significantly and the number of passengers who formerly took the bus significantly decrease [29]. Through a natural experiment research design, a recent study examined the changing of travel mode before and after the opening of a new metro station in Nanchang China. The study showed people who shift travel mode to the new metro is those who formerly used to take the bus. And the number of people who used to take private cars is almost unchanged before and after the new metro [30].

Other topics related to the influence of a new transport system often discuss the implications of travel behaviour changes toward the built environment, such as air quality, congestions, and environmental impact and enhancing urban development [16, 23, 31].

It is obvious that when there is a new transport system the probability of people to shift their travel mode will exist. From the studies it can be seen that the habits which reflect the daily travel from the previous behaviour can predict the future behaviour [32, 33]. The users of public transport are eager to shift to the new transport system, as they already used to it. Unfortunately, not all of studies found a considerable number of private car users who shift to public transport. A new system of public transport may change travel behaviour, specifically related to travel mode and when this happens it will change built environment (see Figure 1). To this extent, this study will take the new MRT in Jakarta, as a proposition. It is expected the new MRT will bring some impacts on shifting travel mode to this public transport therefore parking space as built environment will be affected.

Figure 1. The impact of new transport systems on travel behaviour and the built environment

3. Parking Space

Parking is a vital aspect for the transportation system. It often happens that looking for parking space becomes an issue when travelling by car. As a result, there is a regulation that every public building should afford a certain portion of parking area to supply vehicles. This parking ratio could be different in every country, every city, or even city block, due to different availability and conditions of transport mode, and varying number of populations. Countries with cars as the main transport mode will require more parking space than countries that have public transport as a dominant mode. In China, for example, the rapid development increase in car ownership has far exceeded the supply capacity of urban parking lots [7, 8, 34].

Research study has been investigated to see what could influence the parking demand. A study in Dhaka found that in general socio-economic and demographic conditions effect on parking demand. However, it is interesting that in commercial or office buildings, socio-economics does not bring any influences on the parking demand [35].

Some early parking studies demonstrated that asking workers to pay for parking in downtown Los Angeles instead of parking for free may reduce about 25 to 34% of car users [36]. By using a mode choice model, a study in Portland predicted that there will be 21 fewer cars’ drivers for every 100 commuters if the policy change from a free daily parking into a pay daily parking. With the same model, to examine parking located at work sites showed a decrease in the percentage of people who drive alone to work [37]. Further, recent studies about parking tend to consider policy as a strategy to reduce parking requirement and car ownership [8, 11, 38, 39]. However, not every policy has been successful. A recent
study found that the changes of parking policies such as parking cost, parking search time, and egress
time (the time required to reach one’s destination from a parking spot) are more towards shifting parking
location rather than switching the travel mode [39].

When discussing to calculate a parking space, no similar rule of thumb is clear to decide the size.
Due to the fact that different types of building make a different calculation on parking. To illustrate,
commercial buildings, for example, will require more parking space compared to apartment buildings.
When talking about office building, some countries calculate the requirement of parking space according
to the number of users in the building per square meter. As an example, in California, one parking space
is demanded for every 4 employees. While the same type of regulation in other countries calculates the
demand of one parking space according to a certain square meters of building area. In City of Austin,
for example, one parking space is obligated for every 27.5 square feet of building area; while in the UK
one parking space is required per 3000 square meter GFA.

Based on the parking regulations, a multi-storey office building in Jakarta should provide between
235 to 238 parking space per 1000 employees or between 22.5 and 52.5 square meter per 100 square
meters of GFA. In other words, the ratio of parking is between 1.5 and 3.5 cars per 100 square meters
[40]. However, the implementation of the regulation is still uncertain, since an empirical study on
parking space at office buildings in Jakarta demonstrated that in general, the parking space is only
between 23.6 and 27.5 square meter per 100 square meters. In other words, the ratio of parking is
between 1.6 and 1.8 cars per square meter [41]. This indicates that practically office buildings provide
less parking space than it should be.

It seems obvious that driving a car is significant for people who want to have convenience, comfort,
individual freedom, and privacy, especially in Jakarta. The easiness to have private cars on account of
the increasing of income generates the massive rise of private vehicles [42]. Every day Jakarta has more
than 4.4 million people who use cars. Regardless of the fact that Jakarta has already BRT system, people
who shift from private cars to public transport is not significant [29] and it could not solve the traffic.
In March 2019 Jakarta opened MRT, the new transport system, which operates almost 285 trips daily
from morning to midnight with 5 minutes headway and with 6 compartments in every trip that could
commute over 1900 people at once. MRT lies on the corridor of business district, which mostly consists
of offices and commercials. This implies, people who employ at the buildings nearby the MRT lines
have the highest opportunities for the use of MRT. Reflecting from the literatures above, people or
employees who have commuting routines with regular time constrains are the potential users of daily
travel with public transports. If the condition is ideal, thus, the operation of Jakarta MRT will result in
reducing the number of people who use their own vehicles.

The discussion above demonstrated that in many countries the new public transport system is
introduced to decrease private vehicles users. However, the results are not similar. Studies found that
many factors may influence people shift from private car users to public transport users. It is clear that
cars require parking space and buildings should provide these spaces, as well, including office buildings.
Regarding to the literature review, when there is shifting from the users of private cars to public transport
consequently there will be some empty spaces in the building. Thus, it is important to examine what
attributes people consider when making their decision on the travel mode.

4. Travel Mode Choice Decision

4.1. Travel Behaviour

The scope of travel behaviour literature mostly focuses on daily trip, especially work trip. The reason is
because people commonly make the longest trip length in travel-to-work, for example people in Jakarta
[43]. Supporting the previous result, a study found workers and students in Jakarta visited the highest
out-of-home [44]. Numerous studies about travel behaviour investigated people’s feeling while
travelling to and from work; and they have indicated that commuter journeys have affective rating for
both private cars and public transports. On one hand, results demonstrated that travelling by car may
cause stressful feeling because of congestions or the behaviour of other road users [45, 46, 47, 48]. On
the other hand, cars could give a practical and psycho-social gain in society for people who commute a long distance and indirect routes, because the benefits of choice and convenience are highly valued [49].

Study on travel behaviour involves the way people consider their transport choice. Results showed that people attempt to avoid public transports due to a poor infrastructure facility [46] and a lot of stress with unpredictability [45] and travel time [50, 51]. Some users of public transport evaluated that using public transport brings unpleasant and boring feeling [45, 46, 50]. Therefore, to attract people using public transports regarding to satisfaction, public transports need to improve comfort and cleanliness [16, 52, 53], thermal comfort with air conditioning system, services for women [53], network coverage [54], reasonable distance from home to public transport stations and from home to work [55]. Feeling of safety also become a significant factor to consider when taking decision on using public transports [51, 56]. Several studies have foreseen that an appropriate system of public transports, which has an on-time schedule or service reliability and frequency [16, 48, 54, 57], a better travel time and giving incentives of fares would trigger people to use public transports instead of a private car [55]. Further study found that having reduction on the public transport’s fare as promotions and some habit-interrupting on a transport policy, such as providing promotional low-price ticket offers or creating events that break car-using habits may encourage the car users to shift and try public transport [48]. However, most of studies do not explain if the changing associates with reducing the car ownership.

Several studies have indicated that the residential location has a relation with the use of public transport. For example, research studies in European cities have shown that the acceptance of public transport decreases in an exponential form with the distance of public transport from home [58, 59]. Urban morphology forms differences on the transport choice. Results indicated the number of people who use private cars and lives in suburban area are higher than those who lives in urban due to public transports in the suburban area are less accessible than in the urban area [60].

It is obvious that a public transport could accommodate more people inside the vehicle compare to a private car. Therefore, studies about public transport often discussed the positive impact of public transport in reducing traffic congestions, lowering the rate of air pollution and energy consumption [16]. For those reasons studies on travel behaviour have further attentions to how people make a switch from their private cars to public transports. A study in Northern California examined that in a residential area transport mode choice is affected by changing in the spaciousness and accessibility of the built environment [61]. From a study in Northeast England results also demonstrated that the changing in using public transports is determined by accessibility features of the built environment, alongside socio-demographic and travel attitude characteristics [12]. By observing a longitudinal data about employees commuting habits, results presented only between 0 and 3% of employees use public transport to work in UK, due that many employees live too far from the workplace to use public transport. The study explained that location or the starting point of traveling plays an important role on the travel mode decisions [62]. Meanwhile, other investigation argued it is not the accessibility that makes people switch to public transport. A study found that the efficient way to attract people and switch them to use public transports is by making a force to change their daily routines of driving to work. By doing so, people will be alerted to look for other alternatives, such as public transports [63]. Supporting these results, a study found changing travel behaviour to public transport will happen when frequent drivers are forced to use it for a short period [64]. By assessing some variables, such as socio-demographics, trip purpose, time of day, access and frequency of public transport, parking, travel time, convenience and cost, results indicated that the use of public transport is able to work successfully regarding to these situations: there are difficulties to find the parking and arrangements, the destination is impossible to asses by any vehicles, and the journey is cheaper to reach by using public transport than using a private car. The results also showed that travel time, convenience, and accessibility are less important than other variables [65].

Regarding to better understand the underlying patterns of travel behaviour, some scholars argued that investigating differences in tastes, preferences and behaviour expression of people are useful for the development of strategies to get more public transports usage [16]. To those extents, most of research studies demonstrated that a good service quality related to reliability and competitive fares in public
Transport service will likely convert people from using a private car to using public transport [46, 48, 51]. A study through a modeling regarding public transport users in Jakarta demonstrated that increasing the comfort or the speeds of public transport does not significantly bring impacts on the greater number of passengers. However, in line with the previous research that fare pricing would attract more people on using public transport. Additionally, the study also predicted that pricing mechanism will be valuable to change travel behaviour and increase public transport use [29].

In planning a trip, scholars found that the distance of the new location that people intend to go affects the decision on changing travel modes [66]. Within the study, they found that demographics, such as gender and age, are remarkably related with reasons for rescheduling travel modes. Furthermore, they found that the shifting from planning to use private vehicles to executing public transport or walking is because of changing in the location of the pre-planned activity which closer or offered better access with non-private vehicles [66].

While investigating the willingness of faculty members and students at a university in Columbia to change private cars for the work trip, results showed that waiting times, travel times, urban transport fares and on-campus parking fees could make people changing the transport mode. On top of that those who own an expensive car have weaker pro-environmental attitudes than others. This means their willingness to use public transport is not that much [67].

As we can see it here, the feelings that private cars could bring are very different compare to the feelings of using public transport. In addition, locations (the starting point and the destination point) and the planning to travel that people make are important factors to consider in travel choice behaviour. Although there is a tendency that people will react if there are some changes on the public transport system or transport system policies, still people travel choice behaviour may be varied regarding to different factors such as socio-demographics, perceptions and nations [68]. For those reasons, the chance of private car users to shift to other transport mode would be a challenge.

4.2. Travel Mode Choice

With no doubt, a private car is still the most desired transport mode. Thus, by understand the attributes of private cars choice decisions, it is expected that we could provide public transport with the similar attributes. Research literature in the field of transportation regularly reviewed that there is a strong relationship between car ownership and household (family) life-cycle [69, 70, 71, 72, 73, 74, 75]. People have different motives to have a car and the essential thing leading people to have a car is the changing in the household. Many studies showed that the presence of a child or children in the household creates a substantial reason for people choosing private cars to commute over public transports [70, 72, 75]. With a bagful of baby's belongings to bring, including a baby stroller, it will be impractical for a mother to go alone using a public transport, specifically in a bad weather. After the baby was born, the tendencies of car ownership increase until the head of the household reaches 50 years old. Not only the presence of a child or children that stimulates the demand for having a car, older people also tend to have their own car to be independent on their mobility, specifically, those who have difficulties to walk or to cycle [69]. While a qualitative study in Bristol UK reported that the car ownership tends to increase as people move the house, or change their jobs [75]. By using models, results showed slightly similar that car ownership changes related to life events [72, 74]. Regarding a set of data about household life-cycle in UK, the tendency of car ownership starts to increase (and sometimes it follows with increase in number of cars) on younger adults, cohabiting younger adults with or without children, and on families with offspring of driving age or couples with leisure cars. When the families are with offspring leaving home, cohabiting older adults moving into retirement, older adults relinquishing cars, due to health or income constrains the tendency begins to decreases as well as the number of cars in the household [72]. To understand the possibility of increasing number of cars in a household, some studies explored by questioning why people buy an extra car [35, 73]. Research study in Jakarta, for example, found every household who owns cars on average has 1.2 cars [76]. Some studies found that the yearly income, the number of person with driving license and number of workers in the household are positive results of an increasing number of cars in the household [43, 77].
Convenience, comfort, individual freedom, and privacy are the reasons why people use a private car [78, 79, 80]. However, people have many different motives when buying a car. Regarding to a study at two cities in the Netherlands, results found that a car is not always perceived as how it functions [10]. It has a far more meaning than just a transport mode. Some studies in Europe argued that a car consists of some instrumental functions which play an important role, such as feelings of sensation, power, freedom, status, and superiority [10, 16]. Supporting the previous results, another study also found that a car has a social-symbolic perception on people, as well as a symbol of success [81]. A study in Scotland concluded the perceptions that people have in using a car depend on their lifestyle and socio-spatial, or the sort of places that they are willing to travel [82]. The study also demonstrated that cars give more value when people have less sophistication and restriction to a particular place. A similar result from a study in Singapore discovered the popular choice of using a private car as a transport mode is due to the reason that it gives symbolic and wealth status for the user [80]. A survey on Indonesian respondents by AC Nielsen in 2014 found that using a car in Indonesia shows symbols of status and wealth. While in Hong Kong a study found that people may have a strong attachment to a car. The study showed that once people acquire a car, they will attach to it due to lifestyle and social status [14], even though there is a good accessibility of public transports [83]. A study among Chinese university students suggested that socio-psychological aspects, such as status symbol and thoughts, play the important role in car ownership [84]. Almost identical, a study among Indonesian university students reported that arrogant prestige aspect is significantly affect students’ decisions on purchasing cars [85]. With those backgrounds to change attitudes towards car ownership should count the social norms including the immediate social environment, as a fundamental influence on car purchases [84].

Interestingly, in the last decade some scholars found a tendency to have lower car ownership in young adults from some developed countries, for example US, China, and Netherlands [86, 87, 88]. The investigation found changing lifestyle, easy accessibility by bicycle or public transport within the city may change young adults’ preferences toward the automobile [86]. However, according to a panel study in US once these young adults have their own economically independent from their parents the tendency to have more cars is increasing [87].

By using models some studies found that parking supply is a significant determinant of car ownership [89, 90] From these point of view one of the most effective way to promote alternative transport modes and make car ownership less attractive is by enforcing of smart parking management as a restrictive policy for private car use [91]. A study on parking policy in Asian cities demonstrated that the conventional parking policies in Bangkok, Manila, Kuala Lumpur, and Jakarta have been encouraged car ownership due to the government enforces parking requirements on building developments [11]. Similar studies also examined that if there is an oversupply of parking space then the car ownership tends to increase [89, 92]. On the contrary the limitation access of parking space may result on decreasing the use of private car [18, 92].

A recent study investigated if to increase public transport would have an effect on car ownership. By taking data from residents at apartment buildings in Melbourne results found the car ownership decreases about 0.9-1.2% when there is a 10% increase in public transport. Based on apartment size result also showed the increasing of 0.8-1.4% in zero car households [93].

As it could be seen there are some attributes to consider when people decide their travel mode (see Fig. 2). Since travel-to-work is a daily behaviour, most of individuals consider comfort as important on their travel mode choice. The feeling of enjoyment, convenience, safety become essential for daily-travel. Moreover, having freedom and privacy, showing self-esteem and status may effect travel mode choice. The location such as how well is the infrastructure (streets and congestions), what kind of housing, how the morphology of the city looks like, and also the accessibility to approach by travel mode influence travel behaviour decisions. As working has highly regular time, therefore time management or everything related to punctuality becomes a priority. Additionally, cost related to expenses to spend by travel mode (fares, promotions, parking fees), the regulation towards using travel mode, as well as whether there are incentives for using public transport somehow become necessary to consider travel mode choice. Although, travel-to-work is a routine behaviour, travel mode choice might
be unusual due to some pre-planned activities. Socio-demographics, such as age, gender, households, income, necessity of traveling-to-work, life style as well as the car that an individual already has may result in different attitude towards each attributes of travel mode choice. Furthermore, the former habit of using public transport will affect the travel mode choice.

**Figure 2. Attributes on the Travel Mode Choice**

5. **Conclusions and Further Research Study**

In this article, the exploration study of the daily travel provides the background information necessary to better understand travel mode choice towards public transport. A better understanding of travel mode decisions’ background is important to figure out what people expect when making these decisions. This paper emphasizes on how people decide to travel by public transport, due to fact that using of cars has a direct impact on the demand of parking.

Regarding to travel behaviour, people tend to choose a similar type of travel mode for their daily activity, such as going to work. Therefore, we take Jakarta MRT as a case study, not only because it is a new public transport in Jakarta, but also the route is crossing the business district. This study examines the attributes which people consider for their travel mode to work, so that the stakeholders could arrange suitable strategy to improve the MRT’s competitiveness relative to private cars.

The exploration study is derived from some literature reviews of several studies in Europe, US, and Asia to identify attributes on travel behaviour, specifically their travel mode choice between private cars and public transport. Discussion from the literature reviews demonstrates that there are some attributes influence travel mode choice to-work, including comfort, awareness, location, time management, cost,
regulation, and pre-planned activities. Socio-demographics characteristics and pre-condition for using public transport habit explain differences in how individuals consider these attributes.

Given the attributes to consider travel mode from the exploratory literature review, the future research agenda should work on an empirical study and develop a comprehensive investigation in terms of the choice of MRT.

References

[1] Morichi S 2005 J-STAGE 6 p 1-22
[2] Wright L and Hook W 2007 Bus Rapid Transit Planning Guide (New York: Institute for Transportation & Development Policy)
[3] UN Habitat 2013 Planning and design for sustainable urban mobility: Global report on human settlements (New York: Routledge)
[4] Dimitriou H T and Gakenheimer R 2011 Urban transport in the developing world: A handbook of policy and practice (Cheltenham: Edward Elgar Publishing)
[5] Kremer P, Hamstead Z A, McPhearson T 2013 Landscape Urban Plan 120 p 218-233
[6] Banfield K 1997 NSW Royal Australian Planning Institute Conference, Sydney
[7] Feeney BP 1989 Transportation Plan Techn. 13 229
[8] Guo Z 2013a J Transp Geogr 26 18
[9] Kitamura R, Chen C, Pendyala RM, Narayanan R 2000 Transportation 27 25
[10] Steg L 2005 Transport Res A-Pol 39 147
[11] Barter P 2011 Parking policy in Asian cities (Manila: Asian Development Bank)
[12] Aditjandra PT, Cao X, Mulley C 2016 JILU 9 77
[13] Ding C, Wang D, Liu, C, Zhang Y, Yang J 2017 Transport Res A-Pol 100 p 65-80
[14] Fujii S, Kitamura R 2003Transportation 30 81
[15] Kaewkluengklom R, Satiennam W, Jaensirisak S, Satiennam T 2017 Transp Res Procedia 25 p 5072-5082
[16] Beirão G, Cabral J S 2007 Transp Policy 14 478
[17] Le Loo L Y, Corcoran J, Mateo-Babiano D, Zahnow R 2015 J Transp Geogr 46 p 99-111
[18] Christiansen P, Engebretsen Ø, Fearnley N, Hanssen 2017 JU Transport Res A-Pol 95 198
[19] Litman, T 2017 Understanding transport demands and elasticities (Victoria Transport Policy Institute)
[20] Elias W and Shiftan, Y 2012 Transport Res A-Pol 46 8 p 1241-1251
[21] Arentze T, Borgers A, Ponje M, Stams A, Timmermans H 2001 Transp Res Rec 1752 1 p 47-52
[22] Golias J C 2002 J Transp Geogr 10 2 p 91-97
[23] Vuk G 2005 J Transp Geogr 13 3 p 223-233
[24] Panter J, Heinen E, Mackett R, Ogilvie D 2016 J Prev Med 50 2 p e45-e53
[25] Hong A, Boarnet M G, Houston D, 2016 Transport Res A-Pol 92 p 131-144
[26] Lui J Y 2003 J Urban Plan D-ASCE 129 2 p 84-96
[27] Ranély Vergé-Dépré C 2012 Revue Géographique de l’Est 52 p 1-17
[28] Fointiat V and Feliot-Rippeault M 2019 ISJ 14 2
[29] Gaduh A, Gracner T, Rothenberg A D 2020 JEL R41 L92 submitted
[30] Sun G, Zhao J, Webster C, Lin H 2020 Environ Int 138 105605
[31] Van Wee B, De Vos J, Maat K 2019 J Transp Geogr 80 102540
[32] Verplanken B and Roy D 2016 J Environ Psychol 45 p 127-134
[33] Scheiner J 2018 Erdkunde 72 1 p 41-62
[34] Wang R and Yuan Q 2013 Transp Policy 30 p 109-116
[35] Sobhani M G, Sadeek S N, Rahman M N, Islam A, Hossain M 2017 Proc Eastern Asia Society Transportation Studies 11
[36] Wilson R W 1992 Reg Sci Urban Econ 22 p 133-145
[37] Hess D B 2001 Transp Res Rec 1753 1 p 35-42
[38] Litman T 2018 Parking Management Strategies Parking Management Best Practices (Routledge) p 86-225
[39] Yan X, Levine J, Marans R 2019 Transp Policy 73 p 41-50
[40] Abubakar I, Sinaga E A, Budiarso, Sinulingga T, Gd Agung T, Sembiring N, Djajasinga N, Surti B H, Ginting R, Yani A, Nurida C, Sutiamo E 1998 Pedoman Perencanaan dan Pengoperasian Fasilitas Parkir (Jakarta: Direktorat Bina Sistem Lalu Lintas dan Angkutan Kota Direktorat Jenderal Perhubungan Darat)
[41] Tedja M 2013 ComTech: Computer, Mathematics and Engineering Applications 4 8
[42] Hasibuan H S, Soemardi T P, Koestoer R, Moersidik S 2014 Procedia Environ Sci 20 p 622-631
[43] Japan International Cooperation Agency/JICA and Badan Perencanaan Pembangunan Nasional/BAPPENAS 2000 The Study on Integrated Transport Master Plan for JABOTABEK (Phase 1), Household Visit Survey (Jakarta: Pacific Consultants International and ALMEC Corporation)
[44] Japan International Cooperation Agency/JICA and Badan Perencanaan Pembangunan Nasional/BAPPENAS 2003 The Study on Integrated Transport Master Plan for JABOTABEK (Phase 2), Interim Report 2: Technical Report Vol. 1 (Jakarta: Pacific Consultants International and ALMEC Corporation)
[45] Evans G W, Wener R E, Phillips 2002 EAB 34 521
[46] Gatersleben B, Uzzell D 2007 EAB 39 416
[47] Wener R E, Evans G W 2011 Transp Res Part F Traffic Psychol Behav 14 111
[48] Redman L, Friman M, Gärling T, Hartig T 2013 Transp Policy 25 p 119-127
[49] Hiscock R, Macintyre S, Kearns A, Ellaway 2002 A Transport Res D-Tr E 7 11
[50] Wener R E, Evans, G W, Phillips D, Nadler N 2003 30 2 p 203-220.
[51] Fellesson M and Friman M 2008 JTRF 47 p 93-103
[52] Eboli L and Mazzulla G 2007 J Public Transportation 10 p 21-34
[53] Anik M A H, Ahmed F, Atin F N, Ahmed N T, Mutsumma A, Al Imran M, Haque N, Zihan T, Rayhan R 2018 IJTTE 8 1
[54] Tyrinopoulos Y and Antoniou C 2008 Transp Policy 15 p 260-272
[55] Nurdden A, Rahmat R A O K, Ismail A 2007 J App Sci 7 7 p 1013-1018
[56] Delbosc A and Currie G 2012 Transp Policy 24 p 302-309
[57] Shiwakoti N, Stasinopoulos P, Vincic P, Qian W, Hafsr R 2019 Transp Policy 84 p 12-23
[58] Knoflacher H 2007 Sadhana 32 4 p 293-307.
[59] Ewing R and Cervero R 2010 JAPA 76 3 p 265-294
[60] De Vos J, Ettema D, Witlox F 2018 J Transp Geogr 73 p 131-147
[61] Cao X, Mokhtarian PL, Handy SL 2007 Transportation 34 535
[62] Kingham S, Dickinson J, Copsey S 2001 Transp policy 8 151
[63] Fujii S, Gärling T, Kitamura R 2001 EAB 33 796
[64] Fujii S, Gärling T 2003 Transp Res Part F Traffic Psychol Behav 6 117
[65] Corpuz G 2007 30th Australasian Transport Research Forum p 11
[66] Mars L, Ruiz T, Arroyo R 2018 Int J Sustain Transp 12 8 p 572-582
[67] Márquez L, Macea L F, Soto J J 2019 J Transp Land Use 12 1
[68] Chatterje K and Carey R 2018 JTH 10
[69] Dargay J, Vythoulkas P 1999 J. Transp. Econ. Policy 33 287
[70] Prillwitz J, Harms S, Lanzendorf M 2006 Transp Res Rec 1985 1 p 71-77
[71] Dargay J and Hanly M 2007 Transport Res A-Pol 4 10 p 934-948
[72] Clark B 2012  Doctoral dissertation University of the West of England

[73] Oakil A T M, Ettema D, Arentze T, Timmermans H 2014 Transportation, 41 4 p 889-904

[74] Clark B, Chatterjee K, Melia S 2016 Transportation 43 4 p 565-599

[75] Clark B, Lyons G, Chatterjee K 2016 J Transp Geogr 55 110

[76] Japan International Cooperation Agency/JICA and Badan Perencanaan Pembangunan Nasional/BAPPENAS 2001 The Study on Integrated Transport Master Plan for JABOTABEK (Phase 1), Volume I: Summary Report (Jakarta: Pacific Consultants International and ALMEC Corporation)

[77] Maltha Y, Kroesen M, Van Wee B, van Daalen E 2017 Transp Res Rec 2666 1 p 103-111

[78] Hagman O 2003 Transport Res D-Tr E 8 1

[79] Anable J 2005 Transp Policy 12 65

[80] Han S S 2010 J. Transp. Geogr. 18 314

[81] Gatersleben B 2011 The car as a material possession: Exploring the link between materialism and car ownership and use. In Auto motives: Understanding car use behaviours ed K Lucas et al (UK: Emerald Group Publishing Limited) p 137-148

[82] Hiscock R, Macintyre S, Kearns A, Ellaway 2002 A Transport Res D-Tr E 7 119

[83] Cullinane S and Cullinane, K 2003Transport Res D-Tr E 8 2 p 129-138.

[84] Zhu C, Zhu Y, Lu R, He R, Xia Z 2012 J Transp Geogr 24 p 315–323

[85] Beligiawan P F, Schmöcker J D, Fuji S 2016 Int J Sustain Transp 10 4 p 295-307

[86] Oakil A T M, Manting D, Nijland H 2016 J Transp Geogr 51 p 229-235

[87] Klein N J and Smart M J 2017 Transp Policy 53 p 20-29

[88] Zhou M, Wang D 2019 Transport Res D-Tr E 72 261

[89] Guo Z 2013b JAPA 79 1 p 32-48

[90] Manville M 2017 J Transp Land Use 10 1 p 27-55

[91] Schuppan J, Kettner S, Delatte A, Schwedes O 2014 Transp Res Procedia 4 0 p 553-556

[92] Christiansen P, Fearnley N, Hanssen J U, Skollerud K 2017 Transp Res Procedia 25 p 4185-4195

[93] De Gruyter C, Truong L T,Taylor E J 2020 J Transp Geogr 82 102627