Mode Choice for Children's School Trips: A Case Study on Independent Mobility in Schools Proximate to Mass Transit Stations in Bangkok, Thailand

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Abstract

Transit-oriented development (TOD) is essential to promote independent travel and encourage mass transit use among students, which has several advantages for their physical well-being and boosts their confidence in society. Despite a decade of mass rail transit development and TOD development in Bangkok, cars still queue to drop students at schools, even near transit stations. This presents a paradox: Why do students go to school in proximity to the mass transit system but not use the mass transit system? The high reliance on personal cars will inevitably shape children's transportation habits in adulthood, significantly impacting the city's air quality and exacerbating environmental pollution and traffic conditions. This research builds on the necessity for students attending schools near mass transit stations to use public transportation more.

This study reveals critical factors influencing school trips, including safety concerns, parental permission, and travel costs. Notably, children's independence levels from their parents affect their mode choice and the frequency of using mass transit for school trips. The socioeconomic, demographic, trip characteristics, and transportation traits explain students' high reliance on private cars.

A significant finding of this study underscores the enduring impact of the typical lifestyle of Thai households and their strong reliance on private cars on travel behavior in Bangkok. The outcomes of this study provide valuable insights for urban strategic policies, advocating and encouraging students to use mass transit for school trips and normalizing its usage. This study holds potential benefits for BTS, MRT companies, and the Bangkok metropolitan administration in achieving their goal to promote mass transit.

Keywords: *children's independence mobility, mode choice, Transit Oriented Development (TOD), Travel Demand Management (TDM), school trip*

Introduction

Transit-oriented development (TOD) involves creating a mixed-use complex that integrates residential, workplace, and commercial buildings within the neighborhood, advocating walking, and purposely maximizing public transportation and reducing car use. Encouraging students to travel independently for school trips is significant for children's well-being, such as increasing physical activities, enhancing social skills, and reducing parental stress and traffic congestion around the school area.

Bangkok introduced its first rail system, the BTS Sky Train, in 1999. Since its operation, it has expanded significantly in 2009, connecting two provinces, Pathum Thani and Samut Prakan, with Bangkok's inner city, and it now serves 62 stations (BTS Skytrain, n.d.). The BEM MRT, Bangkok's first underground railway system, includes the 20-kilometer Blue Line that connects 18 stations (BEM Bangkok Expressway and Metro, n.d.). Although Bangkok's mass transit system has existed for more than two decades, car ownership rates in TOD areas are not lower than in non-TOD regions, contributing to peak hour congestion, ranking Bangkok as the second most congested city in the world (Pongprasert & Kubota, 2017).

A previous study on middle-class travel patterns in the TOD area of Bangkok reveals a dominant daily trip purpose breakdown: 86.2% for work, 6.3% for education, 2.8% for shopping, and 4.7% for other purposes (Charoentrakulpeeti et al., 2006). The study also highlights that private modes are the most dominant across all zones. However, there has been limited focus on school trips in Bangkok's TOD area, even though daily school trips are also heavily concentrated in Bangkok's center and contribute to traffic congestion.

Hence, this drives this study's motivation to understand students' travel attitudes toward school trips and investigate why they still commute in car mode despite their school's proximity to a mass transit station. Consequently, this led to research questions: (1) Why do students go to school in proximity to the mass transit system but not use the mass transit system? (2) What factors affect the frequency of using MRT and BTS? (3) What is the student's perception and attitude toward the mode choice for school traveling? Based on the research questions, the hypothesis is constructed on how students' independence level from their families affects their travel mode choice. This study aims to identify different groups of students and understand what influences their travel mode choice.

Literature review on factors affecting mode choice decision

Extensive literature has highlighted socioeconomic and sociodemographic factors like middle-class household characteristics, household location, and cultural and social norms influencing children's independent traveling. Furthermore, transportation characteristics such as travel cost, travel time, and travel attitude also significantly affect children's independent traveling rate over the past year.

Middle-class household

The rise of the national economy contributes to increased household income and expands the middle-class households in Vietnam and Thailand. It simultaneously causes urbanization and urban sprawl outside the city, affecting urban infrastructure and travel behavior. Thailand has been one of the countries with rapid economic growth since the 1990s (Daquila, 2005). Therefore, the economic growth leads to an

expansion of middle-class households and a shift in lifestyle. Consequently, new lifestyles influence people to reside in new developments outside the city with a high rate of both car ownership and reliance on cars.

Le and Trinh (2016) find that people with high household incomes in Ho Chi Minh City prefer owning a private vehicle for convenient traveling due to insufficient public transportation. Therefore, high reliance on private modes of transportation causes road congestion and poor air quality. In Danang City, 57% of middle-class households travel to university by private vehicle (Nguyen-Phuoc et al., 2018). Indeed, this demonstrates that owning a vehicle increases the likelihood of choosing private mode.

Household location

The household location is an essential component of accessibility to the mass transit station and influences children's independent mobility (Fyhri & Hjorthol, 2009). A study suggests that living in a high-density area around mixed-use buildings and mass-transit stations significantly increases accessibility and promotes the utilization of mass-transit. High-density areas promote non-motorized mode, enhance children's physical movement, and are crucial for independent traveling (Waygood & Kitamura, 2009). In addition, it reduces travel distance and time, enhances security, and increases visibility with eyes on the street. A study conducted in Shinagawa City, Japan, finds that 90% of children aged 10-12 were allowed to travel independently, including cycle and crossroads unassisted for school trips (Drianda & Kinoshita, 2011). Moreover, it helps develop social skills by bonding and connecting with the community, boosting their confidence, and enhancing their social skills better than children traveling by car (Waygood & Friman, 2015).

The increasing distance between the household and the city center is an influential factor that negatively impacts independent travel, which leads to a declining number of children on public transportation and a high preference for private cars in Norway (Fyhri & Hjorthol, 2009).

Transportation characteristic

Travel cost & travel time

People have a limited budget and priority with their expenses. Therefore, fare fees may influence their daily travel decisions. In addition, the availability of transportation, travel time, reliability, and access distance may shape their mode selection. A study in Texas discovers that travel costs and time are key factors influencing students' mode choices (Mahlawat et al., 2007).

Furthermore, a study in Thailand shows a relationship between travel time and car users, demonstrating that if the 'travel time' variable increases, the probability of choosing a private car is high (Witchayaphong et al., 2020). A study finds that most respondents in Bangkok prefer taking the bus over the railway system due to travel costs and availability of transportation (Charoentrakulpeeti et al., 2006).

Travel attitudes

Parents in Great Britain, Denmark, Norway, and Finland are concerned about the safety of their children, such as unforeseen traffic threats and the potential of assault molestation from strangers when traveling to school. Consequently, this leads to declining independent traveling and high reliance on private modes, influencing their transportation choice in adulthood (Fyhri & Hjorthol, 2009).

A previous study has identified several factors that affect the mode choice, including comfort, convenience, security/safety, and reliability. A conclusive study conducted in Ho Chi Minh City, Vietnam, shows that university students and workers prioritize comfort and flexibility when choosing a mode of transportation. People prefer private mode due to its high independence, convenience, flexibility, and time efficiency (Le & Trinh, 2016).

Travel Demand Management (TDM) to reduce traffic congestion.

Singapore is moving toward a car-free city with the release of LTMP 2040, which aligns with a 15-minute, 20-minute, and 45-minute city, emphasizing convenient, well-connected, and rapid public transportation (Manifesty & Park, 2022). Given its small geographical size, Singapore has implemented the Vehicle Quota System (VQS) through the Land Transport Authority (LTA). The VQS involves bidding for the certification of entitlement (COE) to regulate the car population, ensuring eligibility for purchasing a car. Additionally, integrating the Electronic Road Pricing (ERP) system aims to increase driving costs during peak hours, effectively reducing heavy commutes in private mode (Phang, 1993). As a result, the combination of high travel costs and complications of the car-owning process makes driving in Singapore less desirable.

Research Methodology

This study employed a mixed-method approach, incorporating qualitative and quantitative methods, to explore students' perspectives on independent travel using mass transit. The questionnaire comprised three sections: (1) General information, frequency of using mass transit, living arrangements, trip companions, and factors influencing mode choice evaluation; (2) Household distance, travel cost, travel attitude, perception of mode choice, and future car ownership, (3) A behavioral attitude evaluation.
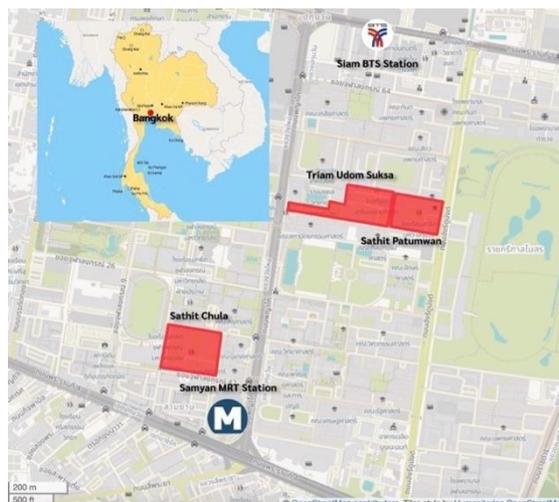
Study area

Figure 1 Study area for this research

This research examined Triam Udom Suksa, Chulalongkorn University Demonstration Secondary School (Sathit Chula), and Patumwan Demonstration School (Sathit Patumwan). These schools are adjacent to Chulalongkorn University, which has unique characteristics with a premium location surrounded by shopping malls and a walkable distance to Siam BTS and Samyan MRT station. In addition, these schools have free access to a shuttle bus called "Pop-bus" as a feeder mode offered by Chulalongkorn University.

Data collection

The data were collected by using an accidental sampling method through a questionnaire survey. This study collected primary data from 90 participants, with 30 from each of the following schools: Sathit Chula, Triam Udom Suksa, and Sathid Patumwan.

Data Analyze

SPSS software was utilized to analyze the quantitative data, including inferential statistics, descriptive statistics, and crosstabulation. In inferential statistics, Chi-square analysis was used to test significant differences in mode choice among the three student groups. For qualitative data analysis, Python software was employed to generate a "word cloud" to identify the most mentioned word from respondents.

Research findings

The travel behavior of a students

The results from the respondents reveal that students' socioeconomic and sociodemographic characteristics significantly influence their mode choice for school traveling. Among the various factors considered, safety, travel cost, and parental permissions are the most significant factors affecting students' travel mode choices. Furthermore, the statistical analysis indicates a strong correlation between the independence level and the mode selection for school trips.

Socioeconomic and sociodemographic characteristics and travel information

This section summarizes students' socioeconomic and sociodemographic characteristics and travel information. The total number of respondents from Sathit Chula, Sathit Patumwan, and Triam Udom Suksa is 90. The participant distribution is 48.9% male and 51.1% female (see Table 1) Table 1 further categorizes the average allowances provided by participants into three groups: less than THB 8,000 (low), THB 8,000-13,000 (medium), and over THB 13,000 (high). A comparison of monthly allowance and travel expenses reveals inconsistent data, which may explain the factors that affect student travel frequency on mass transit.

The finding shows that students with high monthly allowances but spend less on travel fees tend to use cars and have lower travel frequency on the BTS and MRT systems. For instance, 53.6% of Sathid Chula students receive more than 13,000 THB allowance, but 70% spend less than 500 THB on travel. Consequently, the majority (73.3%) of Sathit Chula students use BTS/MRT less than once a week, indicating a higher dependence on cars within this group. In contrast, 56.7% of Triam Udom Suksa students use mass transit daily, making this group the highest, followed by Sathit Patumwan students with 36.7% (see Table 1)

Furthermore, these three schools' household characteristics are similar, and most of the participants live in the TOD area and have high car ownership in their households. As depicted in Table 1, 30% live

within 500m of mass transit stations, and 26.7% live within 500-1000m. Surprisingly, despite the proximity to mass transit stations, 77% of students report 1-2 cars in their households. Therefore, a high presence of car ownership in households may lead to high reliance on car mode. Based on the findings, most Sathit Chula (73.3%) commute in car mode, followed by Sathit Patumwan (43.4%). On the other hand, Triam Udom Suksa students have the highest rate of using BTS and MRT, with 73.3%, followed by Sathit Patumwan at 53.3%. It underscores that even students' residences near BTS/MRT stations, many still commute in private mode.

According to Table 2, students rank safety (74%), travel cost (69%), and parental permission (66%) as the main factors influencing their mode choice. This indicates that students perceive cars and mass transit systems like BTS and MRT as the safest commuting options. Additionally, the concern over travel costs, expressed by 69% of students, suggests that budget constraints may be a significant consideration. It implies that students might want to spend their allowance more on personal spending rather than travel expenses, potentially impacting their travel frequency on mass transit.

Table 1 Socioeconomic, sociodemographic, and travel characteristics of students

| | | School | | | | | | Total | |
| | | Sathit Chula | | Sathit Patumwan | | Triam Udom Suksa | | | |
		N	%	N	%	N	%	N	%
Living Status	Parents	28	93.3%	26	86.7%	24	80.0%	78	86.7%
	Relatives	1	3.3%	2	6.7%	1	3.3%	4	4.4%
	Roommate	0	0.0%	1	3.3%	1	3.3%	2	2.2%
	Siblings	1	3.3%	0	0.0%	0	0.0%	1	1.1%
	Alone	0	0.0%	1	3.3%	4	13.3%	5	5.6%
Total		30	100.0%	30	100.0%	30	100.0%	90	100.0%
Average Monthly Allowance	THB < 8,000	5	17.9%	14	46.7%	11	39.3%	30	34.9%
	THB 8,000-13,000	8	28.6%	12	40.0%	12	42.9%	32	37.2%
	THB > 13,000	15	53.6%	4	13.3%	5	17.9%	24	27.9%
Total		28	100.0%	30	100.0%	28	100.0%	86	100.0%
Car Ownership in Household	None	0	(0.0%)	0	(0.0%)	0	(0.0%)	0	(0.0%)
	1-2 Cars	19	65.5%	25	83.3%	23	82.1%	67	77.0%
	3 Cars	6	20.7%	2	6.7%	5	17.9%	13	14.9%
	4 or more	4	13.8%	3	10.0%	0	0.0%	7	8.0%
Total		29	100.0%	30	100.0%	28	100.0%	87	100.0%
Distance from Household to BTS/MRT stations	less than 500m	10	33.3%	8	26.7%	9	30.0%	27	30.0 %
	500m-1000m	9	30.0%	10	33.3%	5	16.7%	24	26.7%
	1km-10km	7	23.3%	12	40.0%	10	33.3%	29	32.2%
	more than 10km	4	13.3%	0	0.0%	6	20.0%	10	11.1%
Total		30	100.0%	30	100.0%	30	100.0%	90	100.0%
Average Travel Cost Monthly	THB 0-500	21	70.0%%	14	46.7%	8	26.7%	43	47.8%
	THB 500-1500	8	26.7%	4	13.3%	10	33.3%	22	24.4%
	THB 1500-3000	0	0.0%	12	40.0%	9	30.0%	21	23.3%

	THB 3000-4000	1	3.3%	0	0.0%	3	10.0%	4	4.4%
Total		30	100.0%	30	100.0%	30	100.0%	90	100.0%
Travel	less than 1 time	22	73.3%	11	36.7%	6	20.0%	39	43.3%
Frequencies on	1-3 times/week	4	13.3%	3	10.0%	2	6.7%	9	10.0%
BTS/MRT	3-5 times/week	2	6.7%	5	16.7%	5	16.7%	12	13.3%
	Everyday	2	6.7%	11	36.7%	17	56.7%	30	33.3%
Total		30	100.0%	30	100.0%	30	100.0%	90	100.0%
Mode Choice	Car	22	73.3%	13	43.3%	6	20.0%	41	45.6%
	Motorcycle	3	10.0%	0	0.0%	0	0.0%	3	3.3%
	BTS/MRT	4	13.3%	16	53.3%	22	73.3%	42	46.7%
	Bus	0	0.0%	1	3.3%	1	3.3%	2	2.2%
	Walk	0	0.0%	0	0.0%	1	3.3%	1	1.1%
	Paratransit	1	3.3%	0	0.0%	0	0.0%	1	1.1%
Total		30	100.0%	30	100.0%	30	100.0%	90	100.0%

Table 2 Factors Affect Mode Choice

	N	Count	Mean	Sd. Deviation
Safety	90	67 (74%)	0.7444	0.4386
Travel cost	90	62 (69%)	0.6888	0.4655
Permission from parents	90	59 (66%)	0.6555	0.4778

The levels of independency from family and mode choice

According to Table 2, 66% of the students rank permission from their parents as a third factor affecting their mode choice. 86.7% of students live with their parents as their primary living arrangement, and it is less common for students to live with relatives, roommates, and siblings (see Table 1) It implies that parental permission holds a significant influence over students' decision-making. Consequently, it is hypothesized that students with higher levels of independence from their parents may be more inclined to use mass transit than those with lower levels of independence. In this study, the students were grouped into three independent levels based on their living status, permission to take BTS/MRT and their frequencies on mass transit.

The crosstabulation demonstrated that students with the lowest independence level travel in car mode (36.7%), and students with higher independence levels mainly travel on BTS and MRT (35.6%) (see Table 3)

The statistical analysis shown in Table 4 indicates there is a strong correlation between the independence level and the mode selection for school trips. The Pearson Chi-square value is 60.651 with df 10 and the p-value less than 0.001, showing high statistical significance. The likelihood ratio value is 76.391 with df 10 and the p-value less than 0.001, implying that there is a highly significant linear relationship. The linear-by-linear association value is 49.202 with df 1, and the p-value was less than 0.001, indicating a strong linear relationship between the variables. This suggests that the relationship is not a

result of chance and there is a noticeable trend or gradient present. Therefore, the null hypothesis can be confidently rejected: the level of independence from the student's family does affect the student's mode choice.

Table 3 Independency Level * Mode Choice Crosstabulation

			Mode Choice						Total
			Car	Motorcycle	BTS/MRT	Bus	Walk	Paratransit	
Independency Level	Low Independency	Count	33 (36.7%)	2 (2.2%)	1 (1.1%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	37 (41.1%)
	Med Independency	Count	6 (6.7%)	0 (0.0%)	9 (10.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	15 (16.7%)
	High Independency	Count	2 (2.2%)	1 (1.1%)	32 (35.6%)	1 (1.1%)	1 (1.1%)	1 (1.1%)	38 (42.2%)
Total			41 (45.6%)	3 (3.3%)	42 (46.7%)	2 (2.2%)	1 (1.1%)	1 (1.1%)	90 (100.0%)

Table 4 Chi-square test chart

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	60.651[a]	10	<.001
Likelihood Ratio	76.391	10	<.001
Linear-by-Linear Association	49.202	1	<.001
N of Valid Cases	90		
a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is .17.			

The attitude of student's mode choice

This section employs a word cloud method to analyze children's perceptions of school trip mode choices. It visually represents the most frequently mentioned words from the findings, facilitating easier comprehension of themes and data. Out of 90 respondents, 82 answered, among which 72% of the respondents were allowed to take BTS/MRT, while 28% were not allowed to.

Students who are allowed to use mass transit: According to Figure 2, safety, convenience, reliability, and trust in a child's independence are the primary themes mentioned by respondents.

Students who are not allowed to use mass transit: Factors that affect their permission to use mass transit are anxieties about strangers, crowds, and safety issues. Furthermore, these students cited "limited access to transit" and "parents working at the same destination" as common factors impacting their mode

choice. In sum, parental permission has a high influence on children's travel attitudes and frequency on BTS/MRT.

Figure 2 Word Cloud for "Do your parents allow you to take mass transit BTS/MRT to come to school? Why?"

Figure 3 Word Cloud for "In your opinion, how do you think your mode of transportation impacts your daily life, studies, social skills, and overall well-being?

According to Figure 3, respondents' traveling method impacts their daily lives due to efficiency, time management, convenience, time wasted, long travel, fatigue, and social connection. Many students expressed that traveling on mass transit positively affects their time efficiency, enabling them to complete more tasks instead of being stuck in traffic. Moreover, traveling by mass transit makes them more punctual to school or appointments, which is crucial for their time management.

However, several students mentioned that they had experienced exhaustion and physical discomfort at the end of the day due to long commutes on mass transit. Especially during rush hour when they have to stand for a very long time and walk from the station to their home.

Despite receiving positive feedback from the students on how travel on mass transit positively impacts their daily lives with convenience, efficiency, punctuality, and time management, it was surprising that 83 out of 90 participants responded that they intended to buy a car in the future. Figure 4 illustrates that students want to purchase a car due to convenience, car ownership, easy access, independence, freedom, comfort, and reliability. This result significantly indicates the widespread characteristics and behavior toward car ownership in Thai society, suggesting that owning a car has become a normative lifestyle as individuals grow up.

Figure 4 Word Cloud for "When you grow up, are you going to buy a car? Could you give us a reason why?

Conclusions and discussions

This study shows that students from these three schools are predominantly middle-class, with a significant 77% of participants owning 1-2 cars on average. Most of the students receive high allowances but spend less on their traveling costs. Car and BTS/MRT are the most commonly used for commuting among students. Students with higher independence levels favor BTS/MRT, while those with lower independence prefer the car mode. The study further reveals a strong correlation between children's independence and their mode of transportation for school trips. Despite the benefits of mass transit mentioned, owning a car is a long-term goal for most students. In conclusion, the key findings are:

- Students' independence from their parents affects their mode choice for school trips and how frequently they utilize BTS and MRT. Therefore, students who have lower independence levels from their parents still travel in car mode.

- Travel fees were found to be a concern among some students, affecting their travel frequency on BTS and MRT. Hence, it suggests that some students want to spend their allowance budget on personal stuff rather than travel fees.

- While acknowledging the benefits of public transportation by students, they still desire to own a car, potentially influenced by convenience, car ownership desire, easy access, independence, freedom, comfort, and reliability.

The findings of this study align with the study of Pongprasert and Kubota, conducted in Bangkok, which concludes that car ownership rates in TOD households are not lower than in non-TOD households (2017). Moreover, students who commute by private car have a higher desire to own a car in the future, which aligns with the study by Fyhri and Hjorthol (2009). Based on these results, it is recommended that Bangkok City implement policies to manage travel demand and regulate the growing car population in TOD areas. In addition, subsidizing transit fees may encourage more people to use mass transit and promote the TOD lifestyle in the city. Such initiatives would benefit the BTS and MRT companies and the Bangkok Metropolitan Administration in reducing traffic jams by promoting the use of mass transit.

Recommendations

Policy recommendations

Strategic policies to reduce car use in TOD area

Implementing Travel Demand Management (TDM) in the TOD areas of Bangkok is recommended to control car usage and discourage car ownership. Introducing the TDM policy and promoting park-and-ride facilities may reduce heavy commutes into the inner city.

A land-use policy that reduces parking ratios by allocating an additional floor area ratio (FAR) to common spaces or public areas can contribute to more efficient land use and sustainable urbanization (Hendrigan & Newman, 2017). Limiting parking space makes driving less attractive, optimizing mass transit usage in the TOD area. This approach encourages new Thai generations to adopt a mass transit lifestyle and increase mass transit use for school travel.

Strategic policies to promote mass-transit use among students

A subsidized fare fee for mass transit during weekdays would lower the traveling cost and increase student passengers on mass transit for school trips. Reducing travel fees eases concerns about traveling costs, motivating passengers to use public transportation (Shannon et al., 2006). Additionally, students can utilize BTS/MRT more frequently for their school commutes, alleviating concerns about travel costs and saving their expenses for other aspects.

Future Research

The restricted house location information, incomplete personal data, and small population size constrain this study on students' independent mobility. Future research could expand to include more schools closer to mass transit stations in Bangkok City for a more comprehensive analysis.

Reference

BEM Bangkok Expressway and Metro. (n.d.). https://metro.bemplc.co.th/MRT-System-Line?pid=3&lang=en

BTS Skytrain. (n.d.). https://www.bts.co.th/eng/info/info-history.html

Charoentrakulpeeti, W., Sajor, E., & Zimmermann, W. (2006). Middle-class travel patterns, predispositions and attitudes, and present-day transport policy in Bangkok, Thailand. *Transport Reviews*, *26*(6), 693-712. https://doi.org/10.1080/01441640600746927

Daquila, T. C. (2005). *The economies of Southeast Asia: Indonesia, Malaysia, Philippines, Singapore and Thailand.* Nova Publishers.

Drianda, R. P., & Kinoshita, I. (2011). Danger from traffic to fear of monkeys: Children's independent mobility in four diverse sites in Japan. *Global Studies of Childhood*, *1*(3), 226-242.

Fyhri, A., & Hjorthol, R. (2009). Children's independent mobility to school, friends and leisure activities. *Journal of Transport Geography*, *17*(5), 377-384. https://doi.org/10.1016/j.jtrangeo.2008.10.010

Hendrigan, C., & Newman, P. (2017). Dense, mixed-use, walkable urban precinct to support sustainable transport or vice versa? A model for consideration from Perth, Western Australia. *International Journal of Sustainable Transportation*, *11*(1), 11-19. https://doi.org/10.1080/15568318.2015.1106225

Le, T. P. L., & Trinh, T. A. (2016). Encouraging public transport use to reduce traffic congestion and air pollutant: A case study of Ho Chi Minh City, Vietnam. *Procedia Engineering*, *142*, 236-243. https://doi.org/https://doi.org/10.1016/j.proeng.2016.02.037

Mahlawat, M., Rayan, S., Kuchangi, S., Patil, S., & Burris, M. W. (2007, January 21-25). *Examination of student travel mode choice* [Paper presentation]. Transportation Research Board 86th Annual Meeting, Washington, DC.

Manifesty, O., & Park, J. (2022). A case study of a 15-minute city concept in Singapore's 2040 land transport master plan: 20-minute towns and a 45-minute city. *International Journal of Sustainable Transportation Technology*, *5*, 1-11. https://doi.org/10.31427/IJSTT.2022.5.1.1

Nguyen-Phuoc, D. Q., Amoh-Gyimah, R., Tran, A. T. P., & Phan, C. T. (2018). Mode choice among university students to school in Danang, Vietnam. *Travel Behaviour and Society*, *13*, 1-10. https://doi.org/https://doi.org/10.1016/j.tbs.2018.05.003

Phang, S.-Y. (1993). Singapore's motor vehicle policy: Review of recent changes and a suggested alternative. *Transportation Research Part A: Policy and Practice*, *27*(4), 329-336. https://doi.org/https://doi.org/10.1016/0965-8564(93)90005-6

Pongprasert, P., & Kubota, H. (2017). Why TOD residents still use car? Understanding the factors affecting the automobile ownership and use of residents living near transit stations of Bangkok. *Urban and Regional Planning Review*, *4*, 231-250.

Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., & Bull, F. (2006). Active commuting in a university setting: Assessing commuting habits and potential for modal change. *Transport Policy*, *13*(3), 240-253. https://doi.org/https://doi.org/10.1016/j.tranpol.2005.11.002

Waygood, E. O. D., & Friman, M. (2015). Children's travel and incidental community connections. *Travel Behaviour and Society*, *2*(3), 174-181. https://doi.org/10.1016/j.tbs.2015.03.003

Waygood, E. O. D., & Kitamura, R. (2009). Children in a rail-based developed area of Japan: Travel patterns, independence, and exercise. *Transportation Research Record*, *2125*(1), 36-43. https://doi.org/10.3141/2125-05

Witchayaphong, P., Pravinvongvuth, P. D. S., Kanitpong, K., Sano, K., & Horpibulsuk, S. (2020). Influential factors affecting travelers' mode choice behavior on mass transit in Bangkok, Thailand. *Sustainability*, *12*, 9522. https://doi.org/10.3390/su12229522