Problems and barriers affecting sustainable commuting: Case study of people’s daily commute to Kasetsart University, Bangkok, Thailand

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Abstract. Bangkok is one of the cities with the worst road traffic congestion in the world. The city needs to shift toward a more sustainable commuting mode as soon as practicable. This study aims to explore modes of transportation that students and staff of Kasetsart University, Bangkok, use to commute to the university. Data was collected from 315 students and staff through online questionnaires. Interviews with selected respondents were also conducted to gather more insights relating to the perceived barriers to sustainable commuting. Observation of surrounding infrastructure was also conducted. The daily commuting were divided into 4 categories: pure active commuting including walking and biking (19.05%), pure active commuting and public transportation (18.41%), combination modes including private motorized vehicles (25.40%), and the least sustainable mode, pure private motorized vehicles (37.14%). The study further investigated the perceived barriers to 5 modes of sustainable transportation available to most respondents, namely, walking, biking, city bus, public van, and rapid transit. The most significant barriers to pure active commuting was the hot weather and the lack of walking and biking infrastructure. The major barrier to using city buses was the waiting time, together with the longer travel time especially during rush hours. For public vans, the barrier was found to be the safety issue due to careless drivers as well as the van condition. Most of the respondents would like to use the rapid transit, however, they thought the cost was a little high for daily commute.

1. Introduction
It is widely recognized that sustainable transportation plays important role in reducing energy consumption and greenhouse gas emission, especially in big cities [1, 2]. Sustainable transportation can be achieved through good active commuting infrastructure together with attractive public transportation system. The role of active commuting in increasing physical activity of both children and adult have been emphasized in many countries since it lowers the risk of chronic diseases [3]. The role of public transport is extended beyond reducing energy to creating economic equity and establishing good public value [4].

Bangkok is the capital city of Thailand, with population of 9.4 million according to the last census held in 2015 by the National Statistical Office of Thailand. In 2018, the number of registered vehicles in Bangkok was 9,778,661, which was one fourth of total vehicles registered in Thailand. Around 37% of the vehicles in Bangkok are motorbikes. Approximately 65% of the city’s residents use private vehicles to get to work and return home, while only 35% use rapid transit, city bus, taxis and other modes of public transport [5]. The city has been consistently ranked as one with the worst traffic in the world for many years. Moreover, Thailand has the second highest road traffic fatality rate in the world with an annual estimate of 66 deaths every day and more than two third of those resulting from motorbikes [6].
University students have been reported in many studies as the group that use the most sustainable commuting [7, 8, 9]. The university has an important role in promoting, reinforcing, as well as reshaping sustainable development behaviour and awareness, especially in sustainable transportation. The university education helps craft the right attitude and behaviour necessary to develop positive changes in the society as they grow [7, 10]. It is evident that Bangkok has a problem in developing sustainable transportation. It is necessary to understand how people commute daily and what the barriers to sustainable commuting are. This study aims to investigate the issues by using Kasetsart University as a case study. The university is situated in the northern part of Bangkok where access to public transport is between less than 12 minutes to half an hour. The area has been classed as high density urban area as shown in Figure 1.

![Figure 1. Access to road public transportation of Bangkok and vicinity area adapted from Guntamuanglee thesis at Chulalongkorn University [11].](image)

2. Factors affecting mode of transportation
Factors influencing travel behaviour are divided into 4 categories: physical environment, social & cultural environment, intra-individual factors, and policy and regulatory environment [12, 13]. The physical environment includes factors such as safety, accessibility, neighbourhood environment, weather, and distance. In the study conducted in Glasgow, the distance to workplace, bad weather, and danger from motor traffic have been found to be the barriers to walking and cycling to workplace [14]. Lack of adequate cycling infrastructure which was associated with safety was the major barrier found in Brazil [15]. Bus passengers in Edinburgh reported feeling unsafe due to drunk people and the behaviour of other passengers [16]. Study of public transport in Portugal identified discomfort in public bus due to hot weather, crowding and smell. Light rail in Portugal was perceived as a more reliable and comfortable mode than bus [17]. Santos et.al. also found that numbers of days of rain affected the use of public transportation [9].

Social & cultural environment includes factors related to social norms. In countries with high economic inequality both crime and traffic safety are higher than in more equal societies. Therefore, parents in high economic inequality societies often restricted their children’s independent mobility [18]. Stradling et.al. also indicated that travelling by bus did not create right impression to others [16].

Intra-individual factors include factors such as health condition, personal attitude, economic status, and lifestyle. The study of students and staff of University of Western Australia found that the
time it took to travel, the forward planning required and also the need to pick up and drop off others on
the way prohibit them from travelling more sustainably [7].

Policy and regulatory environment refers to government interventions to support sustainable
commuting such as investment in high quality infrastructure and public transportation, tax incentives,
development of smart cards or applications to facilitate sustainable commuting.

3. Transportation mode in Bangkok
There are several modes of transportation available in Bangkok and its vicinities as shown in Figure 2.
For this study, these modes were divided into 4 categories ranging from the most sustainable to the least sustainable.

![Figure 2 Modes of transportation in Bangkok.](image)

3.1 Active commuting: the most sustainable way to commute. This consisted of 2 modes, namely
walking and biking.

3.2 Active commuting with public transportation: this was also considered sustainable commuting
since it utilizes mass transportation services provided in the neighbourhood. Mass transportation
available in Bangkok and its vicinities included city bus, passenger train, rapid transit, public
van, public boat, and Songthaew, a modified pickup truck used to transport people in a
neighbourhood.

3.3 Sustainable commuting in combination with private motorized vehicles was considered partially
sustainable. The private motorized vehicles included 4 modes: private car, private motorbike, car
taxi, and motorbike taxi, very popular in Bangkok because of the heavy congestion.

3.4 Pure private motorized vehicles: this was classed in not sustainable category. Single person
transportation with private motorized vehicles was considered the most inefficient mode to travel
in the city.

4. Research Approach
The design of the study was a cross-sectional descriptive survey using a self-reported online
questionnaire. The questionnaire was developed based on the study by The University of Western
Australia [7] due to its availability and in great details with the aim of gathering comprehensive
information regarding daily travel patterns and barriers to sustainable commuting. Barriers to sustainable
commuting were obtained from previous literatures and discussions with commuters. The questionnaire
went through several revisions due to complexity of travel patterns in Bangkok before adoption into the
actual survey. The population for the study consisted of students and staff who routinely commute to
Kasetsart University. A total of 400 questionnaires were distributed and 315 questionnaires were
returned.

The questionnaire consisted of three main sections: section 1 elicited personal demographic
information (11 questions); section 2, existing travel patterns (18 questions); section 3 was concerned
with perceived barriers toward 5 modes of sustainable transportation, namely, walking (31 factors),
biking (27 factors), public bus (29 factors), public van (27 factors), and rapid transit (29 factors). The
respondents had to rate these factors on the Five-point Likert scales. These 27 – 31 factors for each mode
were divided into 4 subgroups: physical environment, social & cultural environment, intra-individual factors, and policy and regulatory environment. The qualitative study was conducted by observation of the neighbourhood within 1 kilometre around the campus. Face-to-face interview of staff and students was also conducted with those who indicated willingness in the online questionnaire to gain further insight on the barriers to sustainable commuting.

5. Case study
Kasetsart University is a public research university with the area of 335 acres as shown in Figure 3. There are approximately 35,000 students and 7,500 employees. The university is flanked by three major roads on the east, west, and south sides. There are city bus stops around the university along 5 main gates, which are also used as public van stops. Passenger train station is on the west side across the road. Rapid transit line and stations are under construction on the east and west sides of the university. Monorail system on the south side is expected in the near future. The nearest rapid transit station is 3.6 kilometres from the university. Motorbike taxis are widely available in the neighbourhood, in which most of the students reside.

![Figure 3. Kasetsart University and its neighbourhood (adapted from OpenStreetMap.com)](image)

6. Kasetsart University current mode of transport
Most of the respondents are students between 21 – 25 years old living within 2 kilometres from the campus. Almost half of the respondents use walking as part of their travelling. One fourth of the respondents reported that they used motorbike taxi, city bus, and private car as part of their daily commute. Only 15% used private motorbike. Biking was used by less than 10% of the respondents.

From the four categories, the least sustainable mode, pure private motorized vehicles, was used by most, at 37.14%. Followed by the group that used combination mode with private motorized vehicles at 25.04%. The most sustainable mode, walk and bike, was used by 19.05% and the public transportation in combination with walk and bike was used by 18.41% of the respondents. Table 1 shows the adoption percentage of each mode of transportation by each class of respondents. It is evident from the table that the higher the monthly salary was the less they actively commute, and the more they used private motorized vehicles. Also, the greater the distance of residence from the university, and also of the residence to the main road the less they use active commuting.
Table 1. Modes of transportation divided by different groups of respondents.

|                          | Walk & Bike | Public with Walk & Bike | Combi with Private Motorized | Private Motorized |
|--------------------------|-------------|-------------------------|-----------------------------|------------------|
| **Persons**              | 60 (19.05%) | 58 (18.41%)            | 80 (25.40%)                 | 117 (37.14%)     |
| **Sex**                  |             |                         |                             |                  |
| Male                     | 197         | 19.80%                  | 19.80%                      | 24.37%           | 36.04%           |
| Female                   | 118         | 17.80%                  | 16.10%                      | 27.12%           | 38.98%           |
| **Age**                  |             |                         |                             |                  |
| Less than 20 years old   | 44          | 36.36%                  | 15.91%                      | 25.00%           | 22.73%           |
| 21 – 25 years old        | 212         | 17.92%                  | 18.87%                      | 27.83%           | 35.38%           |
| 26 – 30 years old        | 24          | 16.67%                  | 20.83%                      | 25.00%           | 37.50%           |
| More than 30 years old   | 35          | 5.71%                   | 17.14%                      | 11.43%           | 65.71%           |
| **Student or Staff**     |             |                         |                             |                  |
| Student                  | 234         | 23.08%                  | 17.95%                      | 27.78%           | 31.20%           |
| Staff                    | 81          | 7.41%                   | 19.75%                      | 18.52%           | 54.32%           |
| **Monthly Salary**       |             |                         |                             |                  |
| Less than 5,000 Baht (120 GBP) | 35 | 34.29% | 20.00% | 20.00% | 25.71% |
| 5,000 – 10,000 Baht      | 149         | 22.15%                  | 21.48%                      | 26.17%           | 30.20%           |
| 10,000 - 20,000 Baht     | 85          | 12.94%                  | 16.47%                      | 30.59%           | 40.00%           |
| More than 20,000 Baht    | 46          | 8.70%                   | 10.87%                      | 17.39%           | 63.04%           |
| **Distance from the Campus** |         |                         |                             |                  |
| Less than 1 kilometer    | 84          | 48.81%                  | 8.33%                       | 23.81%           | 19.05%           |
| 1 – 2 kilometers         | 58          | 29.31%                  | 12.07%                      | 29.31%           | 29.31%           |
| 2 – 10 kilometers        | 90          | 2.22%                   | 27.78%                      | 20.00%           | 50.00%           |
| More than 10 kilometers  | 83          | 0.00%                   | 22.89%                      | 30.12%           | 46.99%           |
| **Distance from Residence to the Main Road** | | | | |
| Less than 0.5 kilometer  | 136         | 33.82%                  | 17.65%                      | 20.59%           | 27.94%           |
| 0.5 – 1.0 kilometer      | 92          | 8.70%                   | 19.57%                      | 35.87%           | 35.87%           |
| More than 1 kilometer    | 87          | 6.90%                   | 18.39%                      | 21.84%           | 52.87%           |

The percentage of active mode found in this study was comparable to the University of Western Australia’s students [19] and District of Columbia working people [20]. However, it was significantly lower than 55% found in McMaster University’s students [21], 47% found in Netherland adolescents [22], 35% found in University of Alabama’s students [23], 31% found in Hochimin adolescents [24], 28% found in England [25], and 25% found in University of California Los Angeles’s students [8]. It was also found that if the people living within 1 kilometre around Kasetsart University is excluded from study, the active mode drop significantly down to only 8% as shown in Figure 4.

Moreover, within the walking range of 1 kilometre from the university, the results indicated that only half of this group actively commuted to the Kasetsart University compared to 90% of University of Western Australia’s students, 83% of people in England [25], and 58% of staff in University of Western Australia [19].
Figure 4. Compare Kasetsart University and other studies

7. Barriers to sustainable commuting

The questionnaire also asked the respondents who used private motorized vehicles whether they ever consider changing to the more sustainable mode of transportation, only one fourth of this showed their willingness to change. The barriers to five mode of sustainable transportation available to most of the respondents: walking, biking, city bus, public van, and rapid transit, were explored.

Even though walking is conceivably accessible to all able-bodied students and was used by half of the respondents, the other half did not use walking as part of their daily commute. The perceived barriers were the distance, the inconvenience including lack of time. Hot and rainy weather also discouraged them from walking. The respondents also showed concerns regarding safety issues including both safety from crime as well as traffic safety. The respondents indicated that the walk path was not well-connected and not separated from motor vehicles. From observation, there were often no footpath around residences. Walkways to the main road were often shared with cars, motorbikes, bikes, parked vehicles and street food stalls. Street lights are often dim, affording little comfort to passers-by. Where there were footpaths, they were often intermittently obstructed by power line poles, trees, street food stalls and motorbike taxis stations. The respondents also mentioned that there was no policy to promote or regulate the foot path in Bangkok. Moreover, the existing law and regulations related to the sidewalks had not been enforced effectively. The motorbikes were seen running on the sidewalks everywhere in Bangkok especially during rush hours due to traffic congestion.

Most of the respondents reported that they could ride a bike but only one fourth of them used it daily. The barriers to biking in the study were found similar to walking. The interview with respondents found that they were afraid of traffic accidents since most of the time they had to share the road with cars and motorbikes. They also mentioned that there was no dedicated bike crossing to the university, making reaching the university a dangerous undertaking. These issues were common in large cities in Southeast Asia such as Hochimin, Vietnam [24] and Kota Bharu, Malaysia [26] where there were no active commuting infrastructure and well enforced regulations.

A barrier to the use of city bus was the waiting time, since there was no bus schedule. When one arrives, it was always too crowded, especially during rush hour. Since the bus has to stay on the bus lane and stop at bus stops, it was perceived as the slowest way to commute during rush hours. However, it was perceived as a more convenient mode compared to walking and biking due to the hot and rainy weather in Bangkok. The respondents also felt that it was safer than walking and biking to the university.

Public van is like a minibus, taking people from the Bangkok’s vicinities into the city. Public van is faster than the bus since it does not stop as frequently as the city bus and it can take toll road and fast lane depending on the lines. However, due to the driver and van conditions, public van often gets into
accidents resulting in passenger casualties. Female respondents also mentioned their fear of criminal act from the driver and fellow passengers.

There was no major barriers to the use of rapid transit, except for the high fare, ranging from 20 to 100 baht, depending on the length of the travel. The respondents felt the rapid transit was the only public transport that offered convenience, comfort and safety.

8. Conclusions
Most people commuted to Kasetsart University via non-sustainable mode including private motorized vehicles along or in combination with other public transports. The most private motorized vehicles used were motorbike taxis, especially when the residence was far from the main road, or when it was too hot or when safety was an issue. It was found that as much as 39% of the alleys in Bangkok were dead end, compared to 19% in London, around 7% in Singapore and Tokyo, and only 3.6% in New York [28]. Instead of walking from the residences situated in these dead end alleys as observed around university, they were willing to pay the minimum charge of 20 baht per trip for the motorbike taxi twice a day. Although walking distance of up to 800 meters has been acceptable in many countries, the lack of appropriate walking infrastructure made this distance untenable in Bangkok.

Most transportation infrastructure developed in Bangkok during the last few decades seems dedicated to cars only. Many roads, tollways, bridges, and even tunnels have been developed and expanded continuously with the hope of alleviating the traffic congestion in the city. Instead, the development has worsened the traffic situation in Bangkok. The development which concentrates solely on cars has forced people living in the city to get a car of their own prior to buying a house so they can commute safely. The infrastructure has shaped the attitude and behaviour of the people in a way that has not been realized before.

Commuting in as big a city as Bangkok consumes substantial energy and emits large amount of carbon dioxide. If the policy is not directed toward more sustainable commuting, the energy consumed and the resulting pollution will harm the population in this city. Priority has to be shifted toward non-motorized mode of transportation while restricting the number of private motorized vehicles. Rapid transit is currently developed to cover most part of Bangkok. Government subsidies to lower the rapid transit fare should be considered. Good walking and biking infrastructure must be designed and developed to ensure the connectivity and the safety of people from their residence to the public transportation. City bus should be improved in terms of number of buses as well as application to ascertain the availability as well as the bus location. Moreover, car ownership costs should be increased including excise tax, vehicle registration tax, parking costs, etc. to discourage people from buying motorized vehicles.

Measures need to be implemented to incentivize people to commute more sustainably. Investment in walking and biking infrastructure is less capital intensive than those directed at building roadways, but can yield greater benefits when environmental cost is factored in. Sustainable commuting is no longer a choice for Bangkok, it is rather a necessity if Bangkok is to remain a liveable capital city of Thailand.

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