Guidelines to Promote Cycling on University Campus: Case Study of Kasetsart University, Mahidol University and Thammasat University
แนวทางการส่งเสริมการใช้จักรยานภายในมหาวิทยาลัย: กรณีศึกษา มหาวิทยาลัยเกษตรศาสตร์ มหาวิทยาลัยมหิดล และมหาวิทยาลัยธรรมศาสตร์

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Abstract

The objectives of this research are to study means of transportation on university campuses and student opinions on bicycle use on university campuses. This research will also analyze difficulties and problems of cycling in order to offer practical guidelines to promote cycling on university campuses to meet student needs. The campuses where this research was performed are Kasetsart University (Bangkhen Campus), Mahidol University (Salaya Campus), and Thammasat University (Rangsit Center).

In this research, data was gathered by surveying the areas, and using questionnaires to collect 600 undergraduate student opinions about cycling on campus by using the quota sampling method (200 students per 1 university; 100 bicycle users and 100 non-users). According to the study, all 3 campuses have similar types of transportations: bicycle, cars, on foot and university public buses. In the past, a lot of students at Kasetsart University chose riding as their primary mode of transportation on campus, but the number has been decreasing. At present, Mahidol University succeeds in promoting greater cycling participation among students and in creating an environment suitable for cycling, while Thammasat University has just started its campaign on bicycle use. The main problems and difficulties of riding bicycles on campuses have been found to be the danger of the use of bicycles and unawareness of the benefits of riding bicycles. Thus, the guidelines to encourage the use of bicycles on campus are to provide a network of bicycle lanes and to improve existing parking space and presented bicycle lanes. Moreover, it would be helpful to have a campaign to encourage the use of bicycles, and to develope services for using public bicycles.

บทคัดย่อ

บทความวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาลักษณะการเดินทางภายในมหาวิทยาลัย ความคิดเห็นของนิสิต และนักศึกษาที่มีต่อการเดินทางด้วยจักรยานภายในมหาวิทยาลัย รวมทั้งวิเคราะห์ปัญหาและอุปสรรคของการเดินทางด้วยจักรยานภายในมหาวิทยาลัย เพื่อเสนอแนะแนวทางการส่งเสริมการใช้จักรยานภายในมหาวิทยาลัยที่สอดคล้องกับความต้องการของนักศึกษาและเป็นไปอย่างมีประสิทธิภาพ โดยมีกรณีศึกษา 3 แห่ง ได้แก่ มหาวิทยาลัยเกษตรศาสตร์ วิทยาเขตบางเขน มหาวิทยาลัยมหิดล ศาลายา และมหาวิทยาลัยธรรมศาสตร์ ศูนย์รังสิต ข้อมูลในการวิจัยได้จากการสำรวจภาคสนามและการใช้แบบสอบถามกับกลุ่มตัวอย่างนิสิต นักศึกษาระดับปริญญาตรี 600 คน จากการคัดเลือกตัวอย่างแบบกำหนดโควตา (มหาวิทยาลัยละ 200 คน โดยเป็นผู้ใช้จักรยาน 100 คนและไม่ใช้จักรยาน 100 คน) ผลการศึกษาพบว่า มหาวิทยาลัยทั้ง 3 แห่ง มีรูปแบบการเดินทางในมหาวิทยาลัยที่เหมือนกัน ทั้งในลักษณะของการขี่จักรยาน การขับรถยนต์ การขับรถจักรยานยนต์ การเดินเท้าและการใช้บริการรถบริการสาธารณะ โดยในอดีตมหาวิทยาลัยเกษตรศาสตร์มีนิสิตใช้จักรยานค่อนข้างมาก แต่ในปัจจุบันการใช้จักรยานภายในมหาวิทยาลัยลดน้อยลง มหาวิทยาลัยมหิดลประสบความสำเร็จอย่างเป็นรูปธรรมทั้งทางด้านลักษณะทางกายภาพที่เหมาะสมและความร่วมมือของนักศึกษาในการใช้จักรยาน ในขณะที่มหาวิทยาลัยธรรมศาสตร์อยู่ในช่วงของการเริ่มรณรงค์อย่างจริงจัง ปัญหาและอุปสรรคสำคัญของการไม่ใช้จักรยานได้แก่ ความไม่ปลอดภัยของการใช้จักรยานในการสัญจรและการขาดความตระหนักในความสำคัญของการใช้จักรยาน แนวทางการส่งเสริมการใช้จักรยานของมหาวิทยาลัย จึงควรจัดทำทางจักรยานให้มีความครอบคลุมและชัดเจนมากขึ้น ปรับปรุงเส้นทางจักรยานและจุดจอดจักรยานที่มีอยู่แล้ว เร่งประชาสัมพันธ์และรณรงค์การใช้จักรยานในมหาวิทยาลัย และการดำเนินการให้บริการจักรยานสาธารณะให้มีประสิทธิภาพ

Keywords (คำสำคัญ)

Guidelines to promote (แนวทางการส่งเสริม)
Bicycles (จักรยาน)
University (มหาวิทยาลัย)

1. Introduction

Universities have various modes of transportation provided in campus, such as cars, motorcycles, and bicycles. Nevertheless, students today need convenience and speed in commuting on campus, so the number of motor vehicles, such as private cars and motorcycles, has increased. This situation especially emerged in universities that offer dormitories on and around campus. The results lie in the following problems: noise and air pollution, increased budgets for road maintenance, shortage of parking space, and traffic jams during rush hour. Moreover, the number of students who commute by bicycle to and from campus has decreased in some universities where there used to be a large number of cyclists, despite the fact that this form of transportation provides many benefits to individuals and society, such as reduced fatal accidents, decreased amounts of automobile traffic, reduced environmental pollution, reduced travel cost, and enhance or improve physical health.

When looking at universities' guidelines for promoting bicycling on campus, the researchers found that they have failed to study transportation modes on campus and students opinions towards bicycle use. The ineffective guidelines lead students to continue using private cars or motor vehicles while the number of bicyclists remains limited. According to the above problems, studying the modes of transportation on university campuses and student attitudes towards bicycling will help analyze problems and difficulties related to bicycle use on campus. The final results of this study are practical guidelines to encourage cycling on campus to meet student needs.

2. Objectives

1) To survey existing conditions of transportation on the three campuses.

2) To study students' opinions about bicycle use on the three campuses.

3) To analyze problems and difficulties related to cycling on the three campuses.

4) To offer the practical guidelines to encourage cycling on campus to meet student needs.

3. Related literature

Related concepts used in this research are the concept of bicycling and bicycling on campus and case studies.

3.1 Bicycling

Bicycles are a mode of non-motorized transportation that have many benefits, such as reducing environmental problems and reducing the cost of journeys.

The types of bicycle paths can be divided into 3 categories (The American Association of State Highway and Transportation Officials [ASSHTO], 1991; as cited in Arunkamol, 2010, p. 34).

1) Bicycle path - a path separated from motorized vehicular traffic by an open space or barrier.

2) Bicycle lane - a portion of roadway which has been designated for exclusive use by bicyclists by pavement markings or signs.

3) Shared Roadway – a roadway which is open to both bicycle and motor vehicle to travel.

When designing bicycle paths, one should consider various factors associated with bike path design. This includes safety, security, way finding system, continuity of bike path, attractive cycling route, quality of flow on bicycle path, and universal design (Litman, 2009; as cited in Suksen, 2009, p. 22). According to support the use of bicycles, there are 4 main factors which are 1) bicycle path (width, light, safety, traffic volume, surface, route, speed, crossroad, attractiveness), 2) bicycle and parking, 3) personal factors (objective and socio-economic factors), and 4) other factors (weather, law and policy, etc.) (Srisurapanon et.al, 2003, p. 19)

3.2 Bicycling on campus and case studies

Bicycling is one mode of sustainable transportation on campus which provides flexibility and produces no pollution. Many campuses are now considering to the benefits of bicycling, for example the study of Cleary and McClintock (Balsas, 2003, pp. 35-49) found that in the US, several campuses already have realized this opportunity and have undertaken many actions to provide safe cycling and walking conditions for their campus communities (Balsas, 2003, pp. 35-49).

Numerous universities support bicycling on campus. In the case study of Seattle University, it provided information for students who were registered bicyclists, such as parking and facilities (Transportation and Parking Service, Seattle University, 2013). The campus of the University of Colorado, worked with the city to foster a better transit system and to encourage greater walking and bicycling. Bicycle stations were provided for repairing and providing information, also with free bicycles that students can check out for immediate travel needs (Schiller, 2010). Likewise, at the State University of New Jersey, information required for cyclists, including equipments, riding skills, bicycle route, and signs were all in the New Jersey bicycle manual (New Jersey of Department Transportation, 2013). Boston University provided bike campaigns and bike safety learning (Boston University Parking and Transportation Services, 2013). Also, Stanford University and the University of Minnesota, provided bicycle support programs including safety, routes, and bike shops (Stanford University, Parking &Transportation Services, 2013; University of Minnesota, Parking and Transportation Services, 2013). All of these university cycling strategies include cycling policy, cycling safety, designate bicycle parking and bicycle paths, and providing rental bicycle in order to support green transportation.

Based on the information above, the research has been studied under the following frameworks: 1) trip characteristic on campus; 2) student opinions towards bicycle use on campus; and 3) problems and difficulties of bicycle use on campus. Data analysis will be used to offer practical guidelines to encourage bicycling on campus which meet student needs. (Figure 1).

4. Scope of study area

This research limits its study area to Kasetsart University (Bangkhen Campus), Mahidol University (Salaya Campus), and Thammasat University (Rangsit Center).

Kasetsart University is located in Khwaeng Lat Yao, Khet Chatuchak and has a total area of 846 *rai* or 1.36 square kilometers. Mahidol University is located in Tambol Salaya (Amphoe Phutthamonthon) and Tambol Bang Krathuek (Amphoe Sam Phran), Nakhonprathom Province. This university has a total area of 1,240 rai or 1.99 square kilometers. As Thammasat University is located in Tambol Khlong Nueng, Amphoe Khlong Luang, Pathum Thani Province and has a total area of 1,727 rai or 2.76 square kilometers.

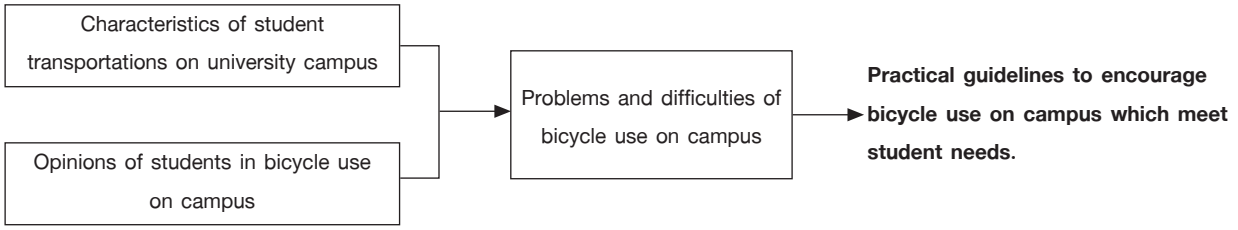

Figure 1. The research framework

5. Tools for collecting data

Data was gathered by surveying the areas, studying relevant documents, interviewing experts and using questionnaires to ask 600 undergraduate students using quota sampling with equal proportions (200 students per 1 university; 100 bicycle users and 100 non-users). Data was conducted during January – February 2013.

6. Study procedures

The research procedures are divided into 5 key steps as follows: 1) review and study theory and concept 2) collect and study data, 3) analyze data, 4) interview the experts and 5) conclude and propose effective guidelines to encourage bicycle use on campus. (Figure 2).

7. Results

The research results are divided into 3 main issues: 1) travel characteristic on campus, 2) opinions of students towards cycling, and 3) problems and difficulties of cycling on campus.

7.1 Travel characteristics on campus

Road systems in all 3 universities are divided into 5 main categories: 1) main roads, major arterial roads that runs through areas such as Thoet Chakri Road (Mahidol University), Suwanvajokkasikij Road (Kasetsart University), and Yoongthong Road (Thammasat University), 2) secondary roads, which supplement main roads, usually wide enough and suitable for two-way traffic such as Damrong Wichai Road (Mahidol University), Xujati Kambhu Road (Kasetsart University), and Pridi Banomyong (Thammasat University), 3) sub-secondary roads, which are small streets that lead into the buildings, 4) bike paths, and 5) sidewalk (Figure 3 to Figure 5).

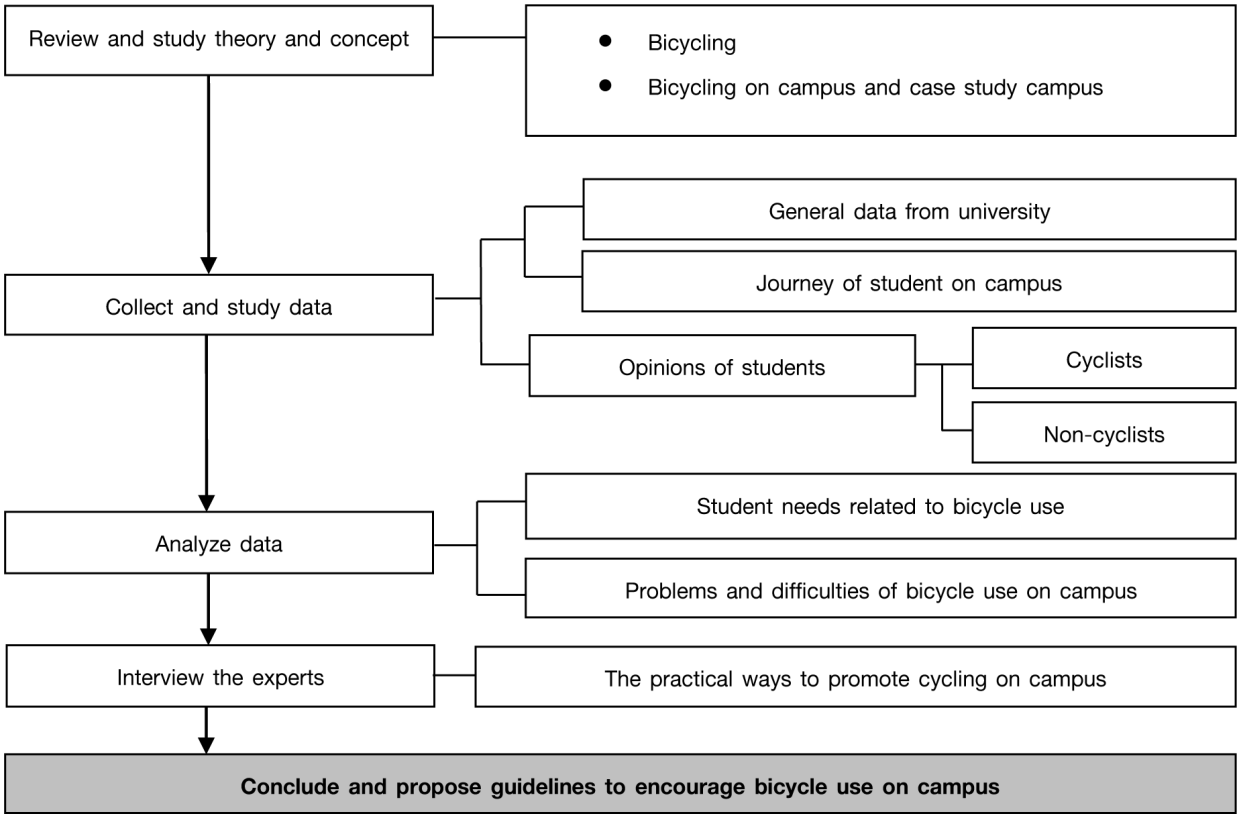

Figure 2. The research procedure

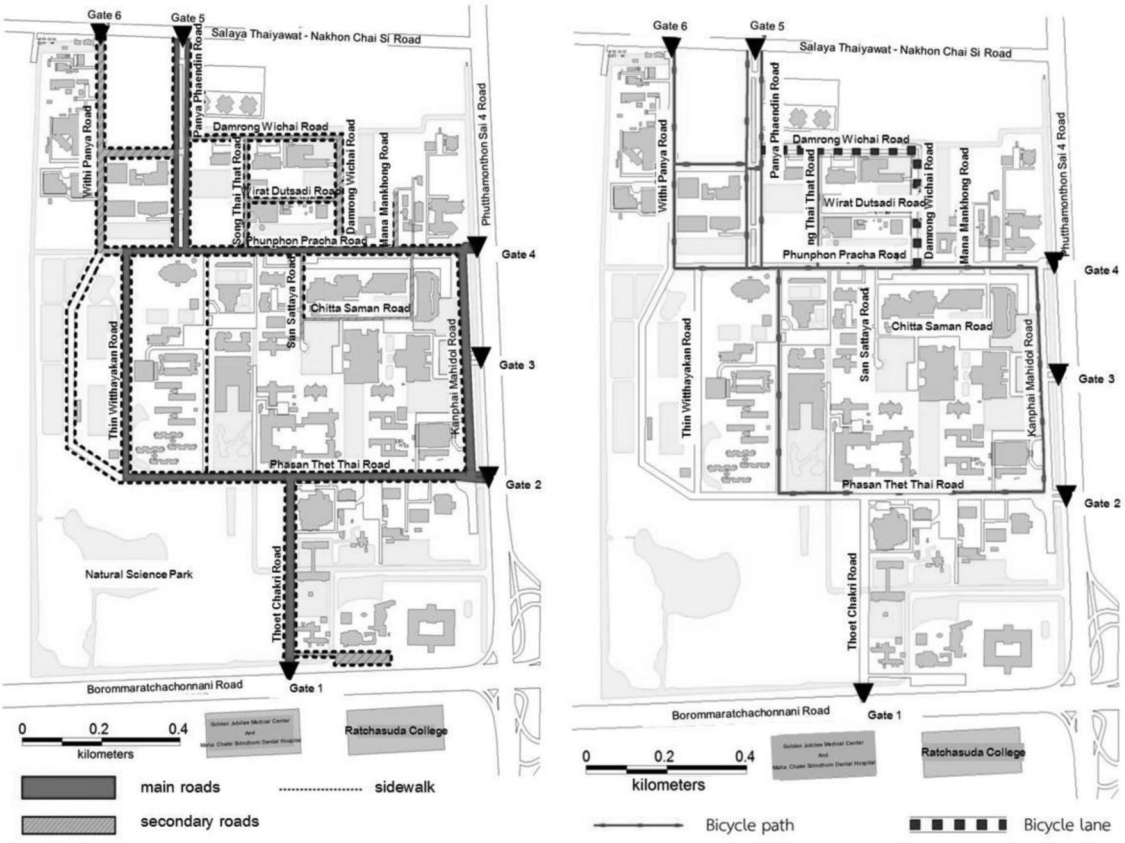

Figure 3. Road system in Mahidol University (Salaya Campus)

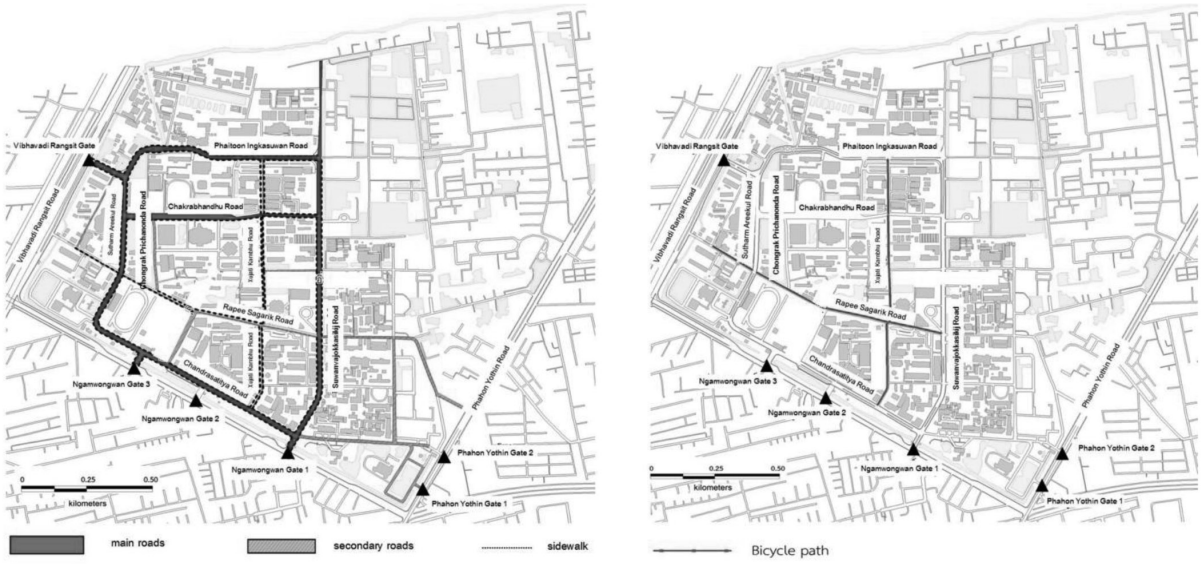

Figure 4. Road system in Kasetsart University (Bangkhen Campus)

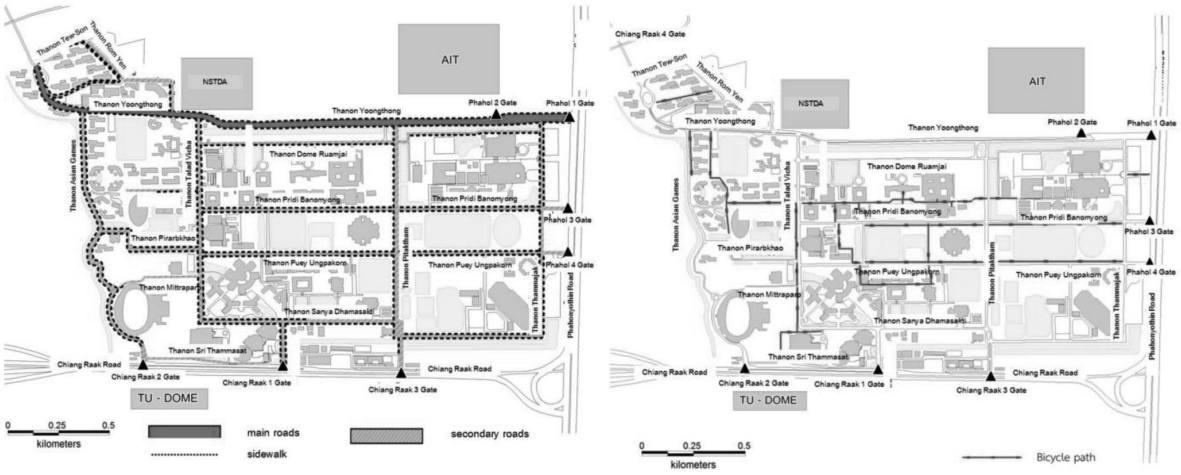

Figure 5. Road system in Thammasat University (Rangsit Campus)

The transportation mode is classified into 2 types: individual transportation (personal transportation) and group transportation (public transportation). In the past, a lot of students at Kasetsart University chose riding as their primary mode of transportation on campus, but now the number has been decreasing and the main transportation on campus is motorcycle taxi. This is because of the convenience it provides when traveling. Plus, there is motorcycle taxi stand at every university gate. As for group transportation, all 3 universities provide shuttle service for students and faculty to travel around campuses with different routes. Many students choose to travel around campus with this form of transportation.

When considering bicycle routes on campuses, bicycle paths and bicycle lanes are clearly and beautifully constructed at Mahidol University. The routes for bicycles are linked to the buildings and bicycle parking is distributed throughout the area. Moreover, this university offer bicycle rentals for using in the campus. Mahidol University succeeds in promoting greater cycling participation among students and in creating a suitable environment for cycling. Kasetsart University has bicycle paths and shared roadways, but the bicycle path still lacks in safety because it is shared by other vehicles. For the bicycle rentals, this university provided plenty of bikes, but many have become defective after the flood in 2011. As for Thammasat University, there are both bicycle paths which are completely covered parallel to the sidewalk and shared roadways on the secondary roads. Bike routes offer clear connections between the buildings and dormitories. This university has just started its campaign on bicycle use and offers bicycle rentals for use at the campus.

7.2 Student opinions towards bicycle use.

- **Responses from non-cyclists**

Non-cyclists at Kasetsart University and Mahidol University share the same reason for not choosing to ride. They view bicycle as a burden for its user (22.95% and 22.93%, respectively). As for respondents at Thammasat University, they said that the climate is not suitable for cycling (25.41%) (Table 1).

- **Non-cyclists' mode of transportation on campus.** While most respondents at Kasetsart University and Thammasat University commute with the university's shuttle buses (41.22% and 38.76%, respectively), the primary **mode** of transportation of respondents at Mahidol University is on foot (58.73%) (Table 2).

Table 1. Reasons for not cycling according to non-cyclists' responses

Reasons for not cycling	Kasetsart University		Mahidol University		Thammasat University	
	Number	%	Number	%	Number	%
Rough road surface	9	3.69	4	1.95	6	2.46
Narrow/ unsafe path	21	8.61	13	6.34	15	6.15
No cycling company	44	18.03	32	15.61	42	17.21
Hot and humid weather (unsuitable climate)	39	15.98	40	19.51	62	25.41
No bicycle parking	11	4.51	19	9.27	7	2.87
No bike path link to buildings	7	2.87	7	3.41	7	2.87
Long distance	29	11.89	12	5.85	36	14.75
Bike route does not connect to other mode of transportation	10	4.10	8	3.90	5	2.05
Difficulty of parking and risk of bicycle being stolen	56	22.95	47	22.93	46	18.85
Other reasons	18	7.38	23	11.22	18	7.38
Total	244	100.00	205	100.00	244	100.00

Note: Respondents could answer with more than one choice

Table 2. Means of transportation of non-cyclist on campus

Means of transportation	Kasetsart University		Mahidol University		Thammasat University	
	Number	%	Number	%	Number	%
Private car	6	4.58	4	3.17	14	10.85
Personal motorcycle	2	1.53	4	3.17	6	4.65
Public vehicle	1	0.76	-	-	21	16.28
Motorcycle taxi	17	12.98	3	2.38	7	5.43
On foot	51	38.93	74	58.73	30	23.26
University shuttle buses	54	41.22	32	25.40	50	38.76
Other	-	-	9	7.14	1	0.78
Total	131	100.00	126	100.00	129	100.00

Note: Respondents could answer with more than one choice

● **Ways to encourage non-cyclists bicycling on campus** –Response of non-cyclists at Kasetsart University and Mahidol University agreed upon their university offering bicycle rentals (22.37% and 33.78%, respectively), while respondents at Thammasat University say that the university should improve and develop the existing bicycle paths (25.85%) (Table 3).

● **Cyclists' needs concerning bicycle use around campus** – Respondents from all three universities need to see improvements in bicycle paths most. Bike paths need to be separated from other vehicle roadways (the mean of respondents needs of Kasetsart University, Mahidol University and Thammasat University is 4.27, 4.53, and 4.15, respectively). From the physical survey, Thammasart University still has some bike routes which require cyclists to use shared roadways, while at Kasetsart University, most bike routes are shared roadways. Bike lane at Mahidol University are rather sufficient, but respondents still need more bike routes and more bike parking near educational buildings (the mean of respondents needs is 4.52) (Table 4).

7.3 Problems and difficulties of bicycle use on campus

Kasetsart University and Thammasat University share similar problems concerning bicycle paths. Students of Kasetsart University feel unsafe to commute by bicycles because there are a lot of cars on campus and most bike paths are shared roads. While the main types of bicycle paths at Thammasat University are designated bicycle paths, it is not shaded, and cyclists need to ride a rather long distance. Moreover, students at both universities are not yet aware of cycling and lack support from the universities. Mahidol University has an appropriate physical environment and suitable facilities for cycling, but students still have a high demand for bike parking and bicycle rentals.

8. Conclusions and recommendations

Based on the results provide above, all 3 campuses have similar types of transportations: bicycle, cars, on foot and university public buses. In regards to bicycle routes on campuses, bicycle paths and

Table 3. Ways to encourage non-cyclists bicycling on campus

Ways to encourage bicycling on campus	Kasetsart University		Mahidol University		Thammasat University	
	Number	%	Number	%	Number	%
Offer bicycle rentals	34	22.37	50	33.78	28	19.05
Campaign and promote cycling	25	16.45	15	10.14	13	8.84
Improve existing bike paths	27	17.76	20	13.51	38	25.85
Increase bike routes	16	10.53	20	13.51	26	17.69
Establish university cycling association	9	5.92	8	5.41	5	3.40
Launch student activities to promote bicycling	10	6.58	10	6.76	10	6.80
Motivate students to bike	29	19.08	22	14.86	19	12.93
Conduct bicycle workshop	-	-	-	-	-	-
Other	2	1.32	3	2.03	8	5.44
Total	152	100.00	148	100.00	147	100.00

Note: Respondents could answer with more than one choice

Table 4. Cyclists' needs concerning bicycle use around campus

Issues	Kasetsart University		Mahidol University		Thammasat University	
	Mean	SD	Mean	SD	Mean	SD
Bicycle paths						
Separate from roadway	4.27	0.87	4.53	0.67	4.15	0.89
Separate from pavement edge	4.13	0.90	4.41	0.68	3.84	1.04
Wide enough to ride comfortably	4.13	0.80	4.40	0.81	3.99	0.92
Not level or steep	3.93	1.04	4.06	1.01	3.97	1.01
Shaded by trees	4.05	1.12	4.40	0.95	4.08	1.18
Has cover from heat and rain	3.49	1.37	3.91	1.27	3.99	1.15
Has a beautiful surroundings	3.82	1.03	4.19	0.88	3.74	1.05
Offer shorter route than automobile route	3.98	1.04	4.00	1.01	4.12	0.99
No air pollution (soot from cars/ motorcycles).	3.84	1.22	4.43	0.80	3.98	0.95
Equipped with lights	3.97	1.13	4.28	0.97	3.90	1.22
Smooth road surface	4.18	0.96	4.36	0.92	4.01	1.06
Bicycle parking						
Safety parking - no bike theft	4.04	1.19	4.45	0.78	3.96	1.08
Near educational buildings	4.16	0.92	4.52	0.69	4.08	0.96
Shaded	4.17	0.91	4.41	0.85	4.02	1.12
Link with other modes of transportation	4.14	0.84	4.44	0.74	4.01	1.03
Adequate bicycle parking facilities	4.21	0.87	4.40	0.90	3.88	1.10
Bike signs and rules						
Have warning signs for safety cycling	3.94	0.91	4.12	0.86	3.71	0.99
Have guidepost introducing bike route at every connecting point	3.98	1.01	4.08	0.86	3.79	0.97
Create bicycle education programs	3.48	1.22	3.67	1.03	3.36	1.10
Regulation and enforcement for bicycle use	3.74	1.13	3.83	0.97	3.53	1.00
Facilities						
Adequate air station and bike repair shops	3.91	1.24	4.32	0.88	3.79	1.21
A temporary bike rental	4.15	1.02	4.42	0.81	3.71	1.20
A long-term bike rental	4.03	1.12	4.18	1.14	3.86	1.12
Good condition of rental bike (ready to use)	4.11	1.12	4.24	0.96	3.84	1.14
Bicycling Motivation						
University cycling club	3.65	1.25	3.91	0.84	3.53	1.02
Practical plan/policy encouraged bicycle use	3.98	1.10	4.18	0.78	3.74	1.12

bicycle lanes are clearly and beautifully constructed at Mahidol University, while bicycle routes at Kasetsart University and Thammasat University are primarily un-shaded shared roadways or bicycle paths. According to the opinions of students, the main problems and difficulties of riding bicycles on campus are the danger of the use of bicycles (data in table 4 were shown that cyclists' needs bicycle path especially separate bicycle path) and the inconvenience of using bicycles (for example in table 1, non-cyclists' reasons for not cycling are difficulty of parking and risk of bicycle being stolen).

Moreover, the results of the study in terms of road systems, transportation modes, problems and difficulties of bicycle uses show that all 3 campuses are like small towns. These universities have a variety of road systems and have both individual and group transportation. Therefore, the practical guidelines to encourage cycling at all 3 universities must focus on student needs and quality of life for people in the community. These guidelines can be divided into 2 aspects: physical guidelines and policy guidelines. Details are as follows:

1) Physical guidelines (Figures 6 to 8)

- **Create unique bikeway and increase bike route**

Universities should consider the characteristics of the route before creating bike lanes or bike paths by considering the width of the bike lane standards, 1.5-1.8 meters (Pujinda, 2013). Moreover, the bike routes should be linked to all the destinations of the trip. For example, the preparation bicycle lane on Thoet Chakri Road, Mahidol University, the creation bicycle path on Chandrasatitya Road, Kasetsart University, and the construction bicycle path on Pridi Banomyong Road, Thammasat University. This will solve problems concerning the security of cyclists and discontinuous bike routes and will also meet the needs of students that want a bike path separated from other traffic. (The mean of respondents need of Kasetsart University, Mahidol University and Thammasat University is 4.27, 4.53 and 4.15, respectively)

- **Improve existing bicycle paths.**

Improving existing bicycle paths includes placing roofs, planting trees for shade, adding bicycle crossing signs at crossway or intersections, manipulating warning signs, and offering bicycle maps (To meet the needs of respondents who said the climate is not suitable for cycling and the requisite of respondents from all three universities that need to see the improvement in bicycle paths). For example, the preparation of bicycle-crossing in the junction area between Chakrabhandhu Road and Rapee Sagarik Road, Kasetsart University, the improvement of bikeways on Rapee Sagarik Road, Kasetsart University, and the development of sightseeing on Puey Ungpakorn Road, Thammasat University.

- **Improve existing bicycle parking.**

Improving the existing bicycle parking includes creating roofs and planting trees for shade. (To meet the needs of the university students who want to park the bike close to the building). For example, the provision of bicycle parking in front of the dormitory, Mahidol University, and the development parking area at Asian Games Zone C dormitory, Thammasat University.

2) Policy guidelines

- **Publicize and campaign on bicycle use on campus**. These operations include creating posters which provide knowledge about cycling, organizing university cycling clubs, motivating students to ride by decreasing tuition fees, etc. These methods will lead students to have a positive attitude towards cycling and help to create a new attitude towards the bicycle as a burden for its user. Moreover, educating young people is an important factor to promote the effective road safety. (Iamtrakul, Simcharean & Jantawon, 2012, p. 66)

- **Provide public bike rentals**. Universities should offer bicycle rentals which are in good condition and ready to use bicycles for the students (To respond

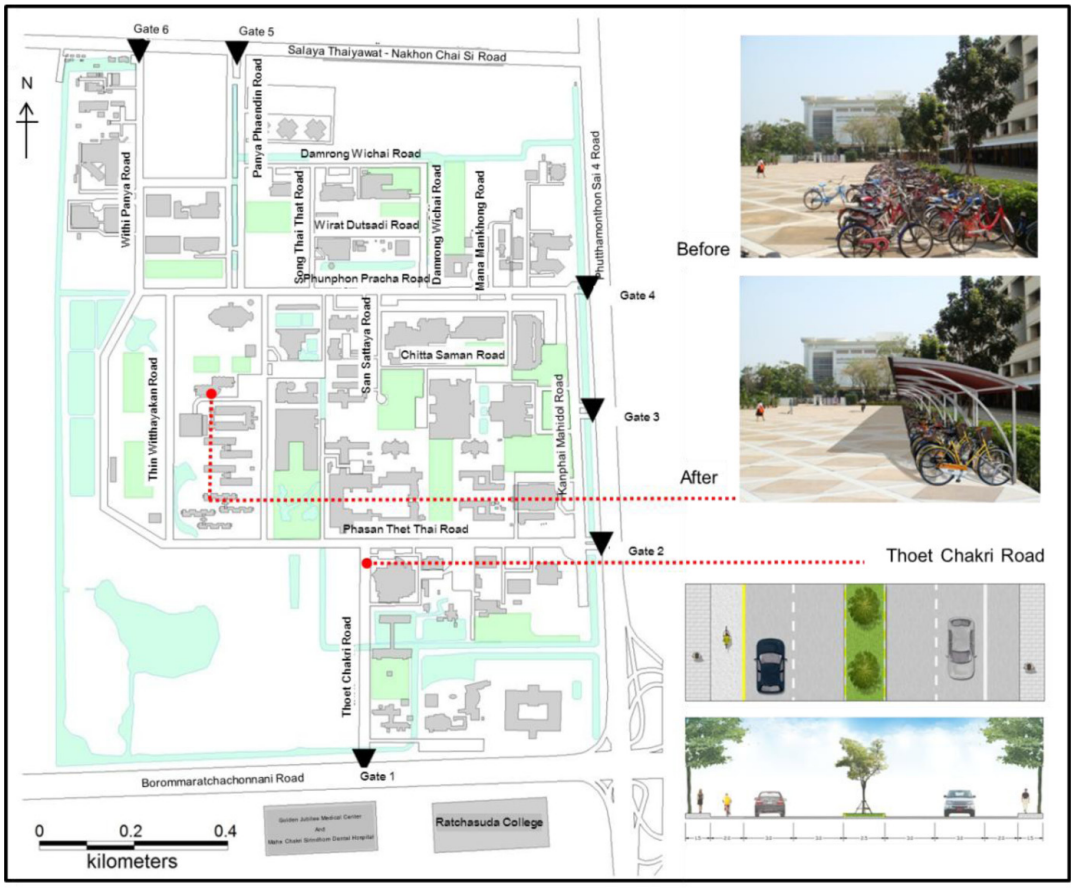

Figure 6. Example of physical guidelines in Mahidol University (Salaya Campus)

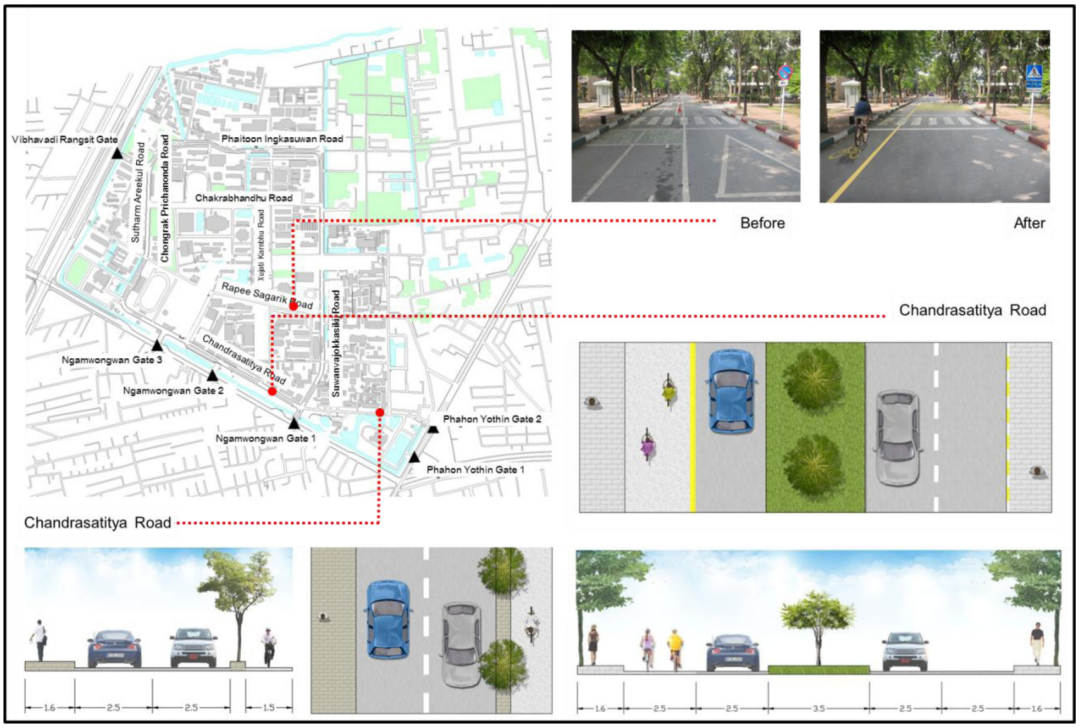

Figure 7. Example of physical guidelines in Kasetsart University (Bangkhen Campus)

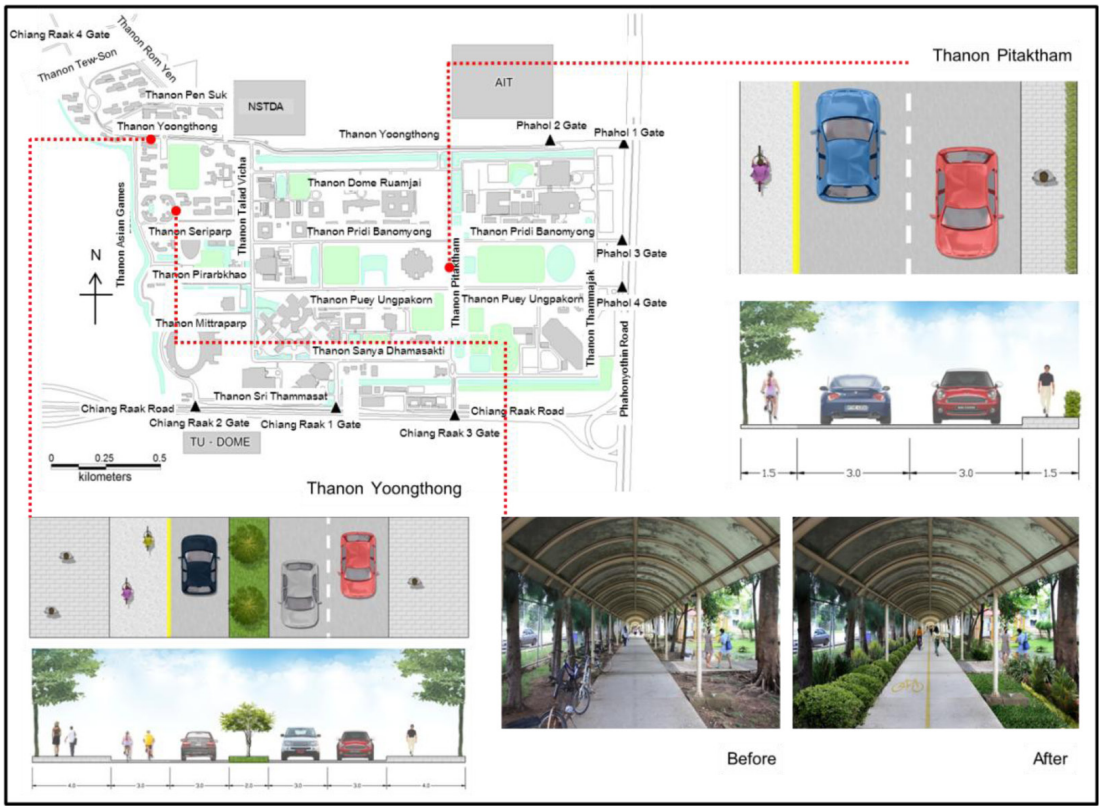

Figure 8. Example of physical guidelines in Thammasat University (Rangsit Campus)

to the opinions of students who have a high demand on bicycle rentals). Moreover, universities should have bike stations thoroughout campus.

9. Suggestion for future research

This study focuses on existing conditions of transportation and students' attitude with bicycling on campus. The main purposes are to describe situations related to cycling on each campus. The final results lead to the practical guidelines to encourage cycling on campus which meets student needs. However, there are some issues which this research did not address, such as the safety of riding, quality of flow on bicycle path, and universal design. Therefore, in future studies, the researcher should consider these issues. (Litman, 2009; as cited in Suksen, 2009, p. 22).

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