Non-Motorized Transportation in and around Sri Nakhon Khuean Khan Park, Samut Prakan
การเดินทางไม่ใช้เครื่องยนต์กับการเข้าถึงสวนศรีนครเขื่อนขันธ์ จังหวัดสมุทรปราการ

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Abstract

The objectives of this research article are: 1) To study the characteristics and networks of non-motor vehicle transportation routes inside Sri Nakhon Khuean Khan Park and the surrounding area; 2) To analyze peoples' attitudes and satisfaction levels concerning the safety of non-motorized transportation options on routes leading to Sri Nakhon Khuean Khan Park; 3) To suggest guidelines for developing the safety of non-motor vehicle routes to Sri Nakhon Khuean Khan Park. A field survey and questionnaire were used as research tools. The results of the research show that transport inside Sri Nakhon Khuean Khan Park are limited to non-motorized options. However, the roads that lead to the park (to a distance of 800 meters), have neither separate sidewalks nor bike paths, thus forcing pedestrians and cyclists to share paths with motor vehicles. This has led the questionnaire respondents to express only an average level of satisfaction concerning bike route safety. It is recommended that guidelines for developing non-motor vehicle roads to the park should focus on: 1) Construction of designated separate sidewalks and bike paths; 2) The improvement and development of physical features of the park in order to promote walking and cycling; and 3) Construction and development of bicycle parking stations to facilitate multi-modal transport.

Keywords
Non-motorized Transport
Sri Nakhon Khuean Khan Park
Walking
Cycling

บทคัดย่อ

บทความวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาลักษณะและโครงข่ายเส้นทางการเดินทางไม่ใช้เครื่องยนต์ ทั้งภายในสวนศรีนครเขื่อนขันธ์และบริเวณโดยรอบ วิเคราะห์ทัศนคติและความพึงพอใจที่มีต่อความปลอดภัยของการเดินทางไม่ใช้เครื่องยนต์ในการเข้าถึงสวนศรีนครเขื่อนขันธ์ และเสนอแนะแนวทางการพัฒนาเส้นทางการเดินทางไม่ใช้เครื่องยนต์ในการเข้าถึงสวนศรีนครเขื่อนขันธ์อย่างปลอดภัย เครื่องมือที่ใช้ในการวิจัย ได้แก่ การสำรวจภาคสนามและการจัดทำแบบสอบถาม ผลการวิจัยพบว่า รูปแบบการเดินทางภายในสวนศรีนครเขื่อนขันธ์จำกัดเฉพาะการเดินทางไม่ใช้เครื่องยนต์ ในขณะที่เส้นทางการเดินทางเข้าถึงสวนสาธารณะในระยะ 800 เมตร จากสวนสาธารณะไม่มีการจัดทำทางเดินเท้าหรือทางจักรยานแยกชัดเจนออกช่องทางการจราจรอื่นๆ แต่อย่างใด การเดินเท้าและการปั่นจักรยานจึงใช้เส้นทางร่วมกับพาหนะอื่น กลุ่มตัวอย่างตอบแบบสอบถามส่วนใหญ่จึงมีความพึงพอใจในความปลอดภัยของเส้นทางจักรยานเข้าสู่สวนระดับปานกลาง ดังนั้น การพัฒนาเส้นทางการเดินทางไม่ใช้เครื่องยนต์ซึ่งมุ่งเน้นเฉพาะเส้นทางเท้าและทางจักรยานเข้าสู่สวนสาธารณะจึงควรจัดทำและพัฒนาเส้นทางเท้าและทางจักรยานออกจากการจราจรประเภทอื่น การปรับปรุงและพัฒนาลักษณะทางกายภาพเพื่อสนับสนุนการเดินเท้าและใช้จักรยานท่องเที่ยว และการจัดทำและพัฒนาจุดจอดจักรยานเพื่อเชื่อมต่อเส้นทางคมนาคมประเภทต่างๆ

คำสำคัญ
การเดินทางไม่ใช้เครื่องยนต์
สวนศรีนครเขื่อนขันธ์
การเดินเท้า
การปั่นจักรยาน

1. Introduction

Bang Krachao is a large green area in close proximity to both Bangkok and neighbouring industrial districts. On 14 September 1977, the government initiated conservation efforts to protect this valuable green space leading to the founding of the "Garden amid the Metropolis Project" on 25 June 1991. Later, this public park and botanical garden was named Sri Nakhon Khuean Khan Park by His Majesty King Bhumibol Adulyadej. Currently, the area is under the supervision of the Royal Forest Department (Zthailand, 2013).

"Sri Nakhon Khuean Khan Park" known as "Bang Krachao Park", located in Phra Pradaeng district, Samut Prakan is surrounded by the Chao Phraya River with a total area of 200 Rai (0.32 km^2). It is different from other public parks in that it is covered by various species of plants and contains unique biological features common to rural gardens and natural forests. Therefore, Sri Nakhon Khuean Khan Park and the Bang Krachao area have become a well-known, popular recreational space. It was voted "Best Urban Oasis of Asia" in 2006 by Time Asia magazine (ASTV, Manager Online, 2012).

The route to Sri Nakhon Khuean Khan Park and Bang Krachao is rather inconvenient due to traffic congestion and a lack of parking spaces. Thus, non-motorized transport, both walking and cycling, is an important transportation alternative. However, today the quality of sidewalks and bike routes to the park is poor because of the lack of attention paid to needs of commuters and indifference to international standards to promote user convenience and road safety. This increases the risk of traffic accidents and may destroy the efficacy of the park as a recreational place with unique scenery and natural landscapes.

This research article is thus focused on determining the characteristics of the sidewalk and bike path network in Sri Nakhon Khuean Khan Park and the surrounding area, as well as the behavior and opinions of sidewalk and bike path users, aiming to arrive at guidelines to develop the non-motorized transportation infrastructure with safety and efficiency in mind.

2. Objectives

1) To study characteristics and networks of non-motor vehicle routes in Sri Nakhon Khuean Khan Park and the surrounding area.

2) To analyze attitudes and satisfaction levels concerning the safety of non-motorized transportation options for people who use sidewalks and bike paths to get to Sri Nakhon Khuean Khan Park

3) To suggest guidelines to improve the safety of non-motor vehicle routes to Sri Nakhon Khuean Khan Park

3. Concept and Theory

The important concepts and theories used in this research refer to non-motorized transportation, walking, cycling as well as other research about Bang Krachao development.

1) Non-Motorized Transportation

Normally, there are 3 factors that affect choice of mode of transport when one travels. These factors are 1) trip characteristics 2) characteristics of the traveler and 3) characteristics of transport (Bruton, 1970; as cited in Arunkamol, 2010). Non-motorized transportation helps decrease unnecessary car use, environmental problems associated with motor vehicles, and is a suitable choice for trips of short distances. Walking and cycling are the two most familiar forms of non-motorized transportation in cities (Hoierli, 1993, as cited in Arunkamol, 2010; Summaniti, 2015, pp. 73-88).

2) Walking

Factors which affect the choice to walk on sidewalks are safety, continuity and accessibility, convenience and sidewalk environments (Leawpairoj,

2012). In measuring the width of a sidewalk, the number of users and utilization need to be taken into account. Normally, a width of 0.60 meters per pedestrian is considered a reasonable allowance (Standard Development Bureau, Department of Public Works and Town and Country Planning, 2006).

3) Cycling

Cycling is a mode of non-motorized transportation which has many benefits. It is convenient, faster than walking and allows one to transport a greater volume of baggage than when walking. For distances of 0.3-6.5 kilometers, a bicycle is faster than other modes of transportation (Hoierli, 1993, as cited in Tantiwittayapitak, 1997). There are two types of bicycle path: one separated from other vehicular traffic and one a lane shared with other vehicles. Dedicated bike lanes help create a cyclist-friendly environment, help determine the direction of movement of cyclists and drivers and generally increase physical security and level of security for cyclists on the road where there is vehicular traffic (The American Association of State Highway and Transportation Officials [ASSHTO], 1991, as cited in Arunkamol, 2010).

In cases of bike paths located on sidewalks, the standard width of the lane should be from 1.80-2.50 meters. If there is a high volume bicycle traffic, the recommended width should be 3.00-3.60 meters. In measuring quality of bike trails, factors that should be considered are location and accessibility, interesting scenery, links to tourist attractions, level of security for cyclists, information signage along the route, facilities, and activities along the bike trail (Urban Conservation and Regeneration Research Unit, Faculty of Architecture, Chulalongkorn University, 2007).

4) Research on Bang Krachao

Jariya Lohaphungragun (2553) conducted a study titled "Development and problem solving of a community by community based tourism management: a case study of Bang Nam Phung floating market, Phrapadaeng district, Samut Prakan", demonstrating that the success of tourism in the Bang Krachao area resulted from government policy, and strong leadership. Further study on the paths in Bang Krachao are important as the area is expected to increase in importance for tourists in the future.

In addition, the Faculty of Forestry, Kasetsart University (2556) did a study entitled "Guidelines for development of Bang Krachao green areas to be sustainable and in accordance with the royal ideas". The result of this research showed the development of green areas can be sustainable when the area incorporates bike paths for natural learning. This idea is in accordance with the ideas of Her Royal Highness Princess Maha Chakri Sirindhorn to promote eco-tourism in Bang Krachao.

Based on the information above, the present study was designed to investigate the following points: 1) characteristics and networks of non-motor vehicle routes in and around Sri Nakhon Khuean Khan park; and 2) people's opinions concerning the safety of non-motorized transportation. Data analysis will be used to offer practical guidelines for developing safety of non-motor vehicle paths to meet people's needs (Figure 1).

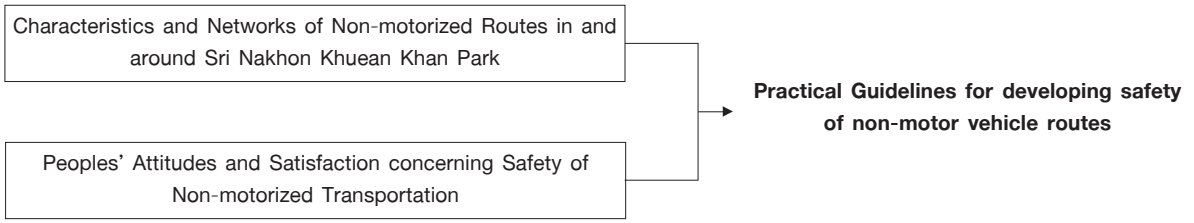

Figure 1. Research Framework.

4. Scope of Research

1) Content

The forms of non-motorized transportation this research will focus on are walking and cycling due to the facts that both modes are convenient and require no or low cost for trips of short distances and help decrease environmental problems, are popular among visitors to Sri Nakhon Khuean Khan Park, and are supported by public policy. Specifically, the study will consider the characteristics and networks of non-motor vehicle routes in and around Sri Nakhon Khuean Khan Park up to a distance of 800 meters outside the park since this is within walking distance, a standard of the American Planning Association (2007).

2) Area

Sri Nakhon Khuean Khan Park is a free access park open to the public from 6:00-19:00 daily, located in Prapadang, Samut Prakan with a total area of 200 Rai (0.32 km^2). Its border on the north connects to rural road 6024, on the east to Wat Rat Rang San Road 1, on the south to deserted land and residences, and on the west to Wat Rat Rang San Road 14 (Figure 2).

5. Method and Research Tools

The research method involved 7 important steps: 1) Review of related theory and concepts; 2) Exploration and study of the characteristics and networks of sidewalks and bike paths within and linking to the park; 3) Observation of the characteristics and behavior of visitors to the park; 4) Questionnaire (with validation); 5) Data collection from sample group of users; 6) Data analysis; 7) Suggested guidelines to develop and improve safety of sidewalks and path traveling to and inside the parks in the Bangkok Metropolitan Region.

Research tools used in the study are of 2 types: 1) A survey to collect data relating to physical features such as names of routes, number of traffic lanes, right-of-way width, surface of traffic lanes, bike paths, sidewalks, parking areas, etc.; 2) A questionnaire to collect data relating to attitudes and satisfaction levels regarding the perception of users with respect to safety for non-motorized transportation.

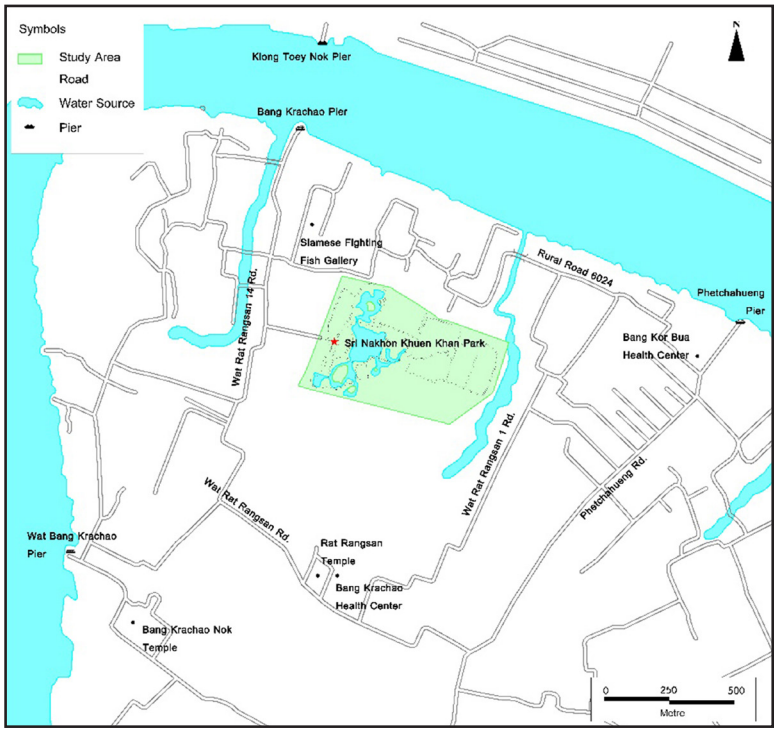

Figure 2. Sri Nakhon Khuean Khan Park location.

The sample population in the study was divided into 2 groups (total = 200): sidewalk users and bike path users. Each group contained 100 participants selected by quota sampling. The questionnaire content validity was verified by 3 experts and improved in accordance with their suggestions before being used with an experimental sample group of 25 people with similar characteristics to the sample population (pilot test). The reliability of the questionnaire was analyzed with Cronbach's Alpha Coefficiency formula based on the data collected from the pilot study. The Cronbach's Alpha of this questionnaire was 0.93 which is close to 1 which indicates that the questionnaire's reliability was high and suitable to be implemented for data collection.

6. Result

The result of the research can be divided into 3 important parts as follows:

1) General Condition of the Park

Sri Nakhon Khuean Khan Park is considered different from other public parks since it is covered by various species of plants with unique biological characteristics similar to those of a rural garden. Important activities engaged in by users include walking, cycling, and bird-watching. At the front of the park there is a large pond and pavilions created for recreational purposes. At the back of park is a garden ditch that resembles a natural forest. The park is thus the residence of various kinds of birds such as Indian Rollers, White-throated Kingfishers, Coppersmith Barbets, and Orange-breasted Pigeons (Zthailand, 2013). The land nearby the park is used for residential purposes, agriculture, and has various water sources (ditch, canal, farm ditch, and Chao Phraya River.) The residences in the area are single houses of no more than 3 stories on farms. Most cultivation in the area is given to banana plantations, coconut orchards, and other fruit and vegetable farms and orchards with mixed residential areas and deserted land.

2) Characteristics of Networks of Road Routes

It was found that travel inside Sri Nakhon Khuean Khan Park is limited to non-motorized forms of transportation. There is one entrance-exit to the park on Wat Rat Rang San 14 Road which is 10 meters wide with parking for tourists and park visitors on both sides. For visitors without a bicycle wishing to ride, the park provides rental bikes located at the entrance to the park starting at 40 baht for the first hour and 100 baht for a day. The bicycles can be used both inside and outside of the park. The route inside Sri Nakhon Khuean Khan Park is used by both pedestrians and cyclists with no bike paths physically distinct from the sidewalk or any clear indication for shared-use. The hierarchy of the route can be divided into 3 types: 1) Main asphalt surfaced routes with an average width of 5 meters; 2) Secondary routes with an average width of 3 meters with surfaces in wood or asphalt; 3) Supplementary routes with average width of 1 meter, most of which are dirt track nature trails. The condition of the park's routes is rough with potholes in some spots. The Royal Forest Department, which is the main organization that is responsible for managing Sri Nakhon Khuean Khan Park, repairs and improves the park's routes from time to time (Figure 3).

Within the perimeter of 800 meters from the park, the hierarchy of the routes can be divided into 3 types: 1) Main road (Phetchahung road); 2) Secondary road (Rural Road 6024 and Wat Rat Rangsan road); and 3) Supplementary road. Main and secondary roads have asphalt surfaces with 2 lanes but no median strips. The road is narrow and cuts across community areas and deserted land. Traffic is thus heavy during rush hours (7-9 a.m. and 5-7 p.m.) workdays, and all day on public holidays. There are supplementary concrete surfaced sidewalks leading to residential areas with an average width of 1 meter. In some spots, the road is elevated in order to cope with flooding (Figure 4).

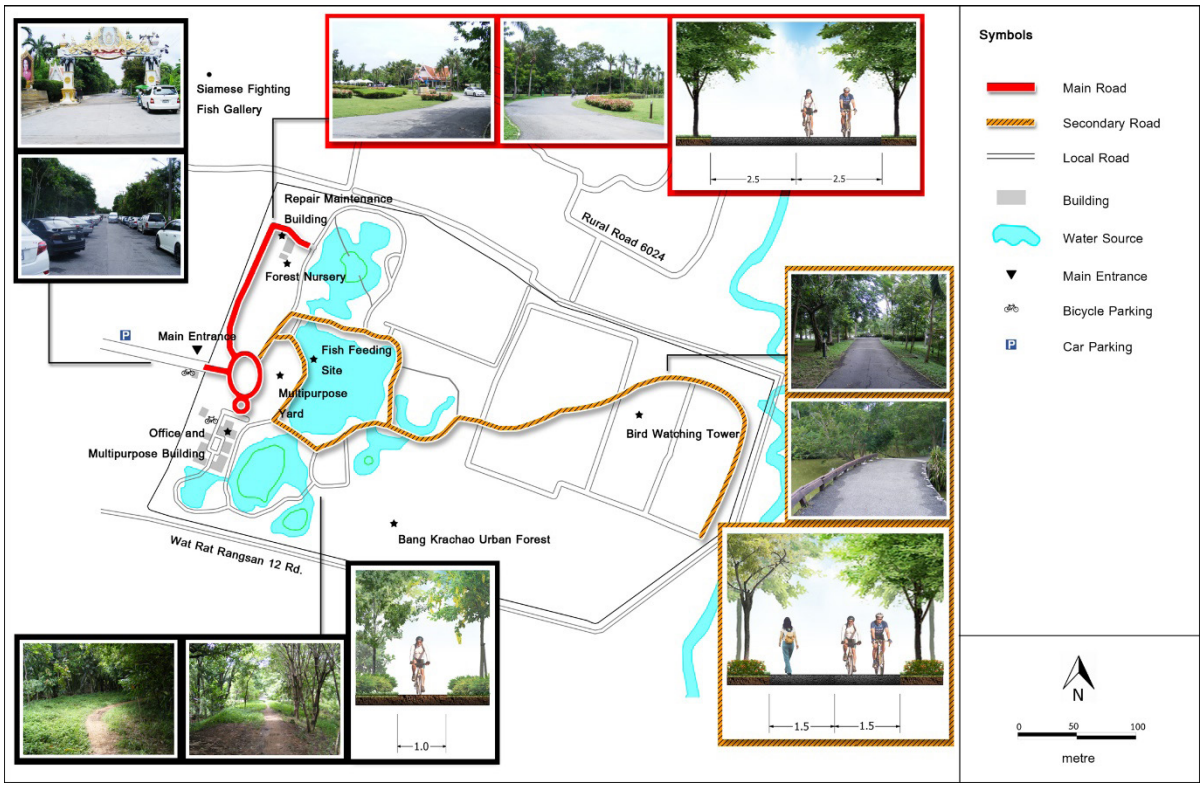

Figure 3. Routes inside Sri Nakhon Khuean Khan Park.

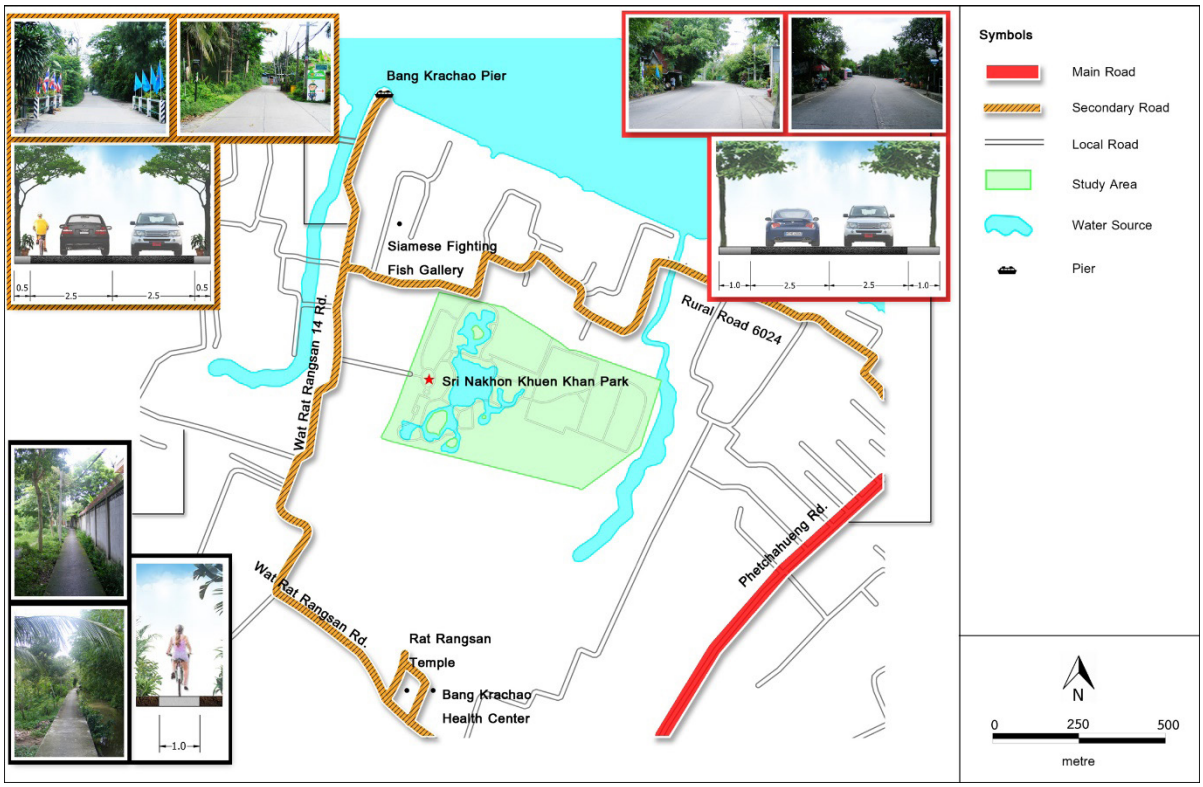

Figure 4. Routes outside Sri Nakhon Khuean Khan Park.

There are no dedicated sidewalks or bike paths for non-motorized transport within 800 meters of the park; thus, pedestrians and cyclists share roads with motor vehicles. For cyclists, however, there are bike paths along the sides of the road.

3) Attitudes and Satisfaction Levels of Users

The sample group of sidewalk and bike path users share several characteristics. Most sidewalk users are female (55%) under 30 years old (51%) with high school or vocational education and bachelor's degrees (47% and 33% respectively) with incomes under 20,000 baht per month (76%). As for bike path users, most in this survey were male (53%), under 30 years old (59%) with a bachelor's degree or high school or vocational education (44% and 35% respectively) with an income of less than 20,000 baht per month (58%).

As for the behavior of park visitors, study participants indicated they visited the park rarely. 64.5% indicated they can get to the park within 30 minutes and tend to visit on weekends (90.5%). Most bike path users visit the park before noon (9-12) (51%), whereas the sidewalk users tend to visit the park in afternoons (12-3 p.m.) (66%). 81% of bike path users and 73% of sidewalk users spend 1-3 hours in the park for recreational purposes. In terms of cycling behavior, the sample group indicated that they prioritize avoiding accidents relating to barriers or parked cars on the road, giving way and not causing harm to pedestrians, following warnings on traffic signs, and not cycling in the wrong direction.

According to the analysis of attitudes and levels of satisfaction of the 2 sample groups concerning safety of the sidewalks and bike paths, most were highly satisfied with the sidewalks and bike paths both inside and leading to the park. For example, they expressed satisfaction with bicycle parking connected to external forms of transportation and indicated they enjoyed the fact that bike paths were shady and close to nature, that the bike paths were an appropriate width, etc. The satisfaction concerning safety of bike paths leading to the park indicated by respondents was at an average level, especially with respect to issues relating to signage along bike routes, bike parking stations connecting to other modes of transportation and convenience of access, levels of sunlight/ electric lights along the bike path, and the absence of unguarded or dangerous points along the path (Figure 5).

7. Conclusion and Discussion

According to the results from the survey and questionnaire, it can be concluded that:

1) Factors which lead people to choose to walk or cycle to the park derive from characteristics of each form of transportation. This corresponds to Bruton's ideas and research from Kasetsart University (Bruton, 1970, as cited in Arunkamol, 2010; Kasetsart University, 2556). Walking and cycling are modes of transportation which bring visitors close to nature. Thus, traveling through the park this way allows them to experience and appreciate natural scenery which is most visitors' purpose in visiting the park. According to most answers in the questionnaire, the majority of visitors come to the park for recreational purposes. The fact that cycling is a faster mode of transportation for distances of 0.3 - 6.5 kilometers corresponds with the behavior of most respondents who were able to reach the park in under 30 minutes.

2) Limiting modes of transportation inside the park to walking and cycling, and providing bike rentals in the park allowing cyclists to ride outside the park within Bang Krachao area, corresponds with the concepts and principles which suggest that non-motorized transportation should be used for short distances in order to decrease excessive car use and harmful environmental effects of motor vehicle traffic (Hoierli, 1993, as cited in Arunkamol, 2010).This will also help to promote ecotourism (Kasetsart University, 2556).

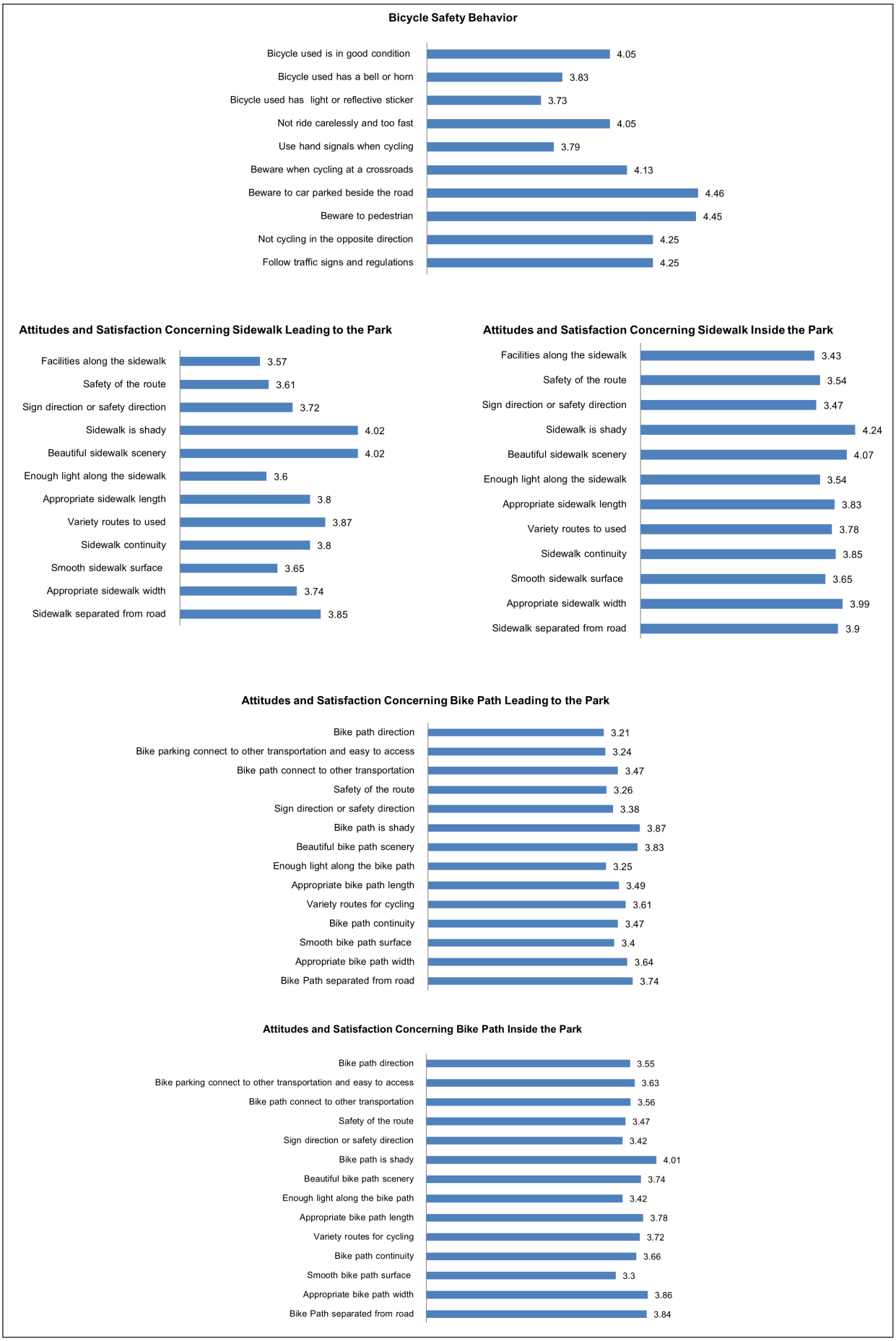

Figure 5. Attitudes and satisfaction levels of respondents.

3) Attitudes and satisfaction levels of park users concerning the safety of bike routes leading to the park was moderate, especially with respect to signage along bike paths, access to bike parking stations connecting to other modes of transportation, quantity of sunlight/ electric light along bike paths, and absence of dangerous spots which might lead to accidents. These factors should be considered when designing bike trails, including the location of and access to tourist attractions, tourist security, information boards and direction signs (Community Reserve and Restoration Research Unit, Faculty of Architecture, Chulalongkorn University, 2007).

4) The levels of satisfaction expressed with respect to sidewalks and bike paths in the park was high reflecting the importance of factors providing convenience and ease of use for pedestrians and cyclists in the park.

5) When it comes to the matter of cycling, the cycling group valued bicycle safety as their first priority. They considered it important to be careful not to cause accidents with barriers and parked cars, giving way to pedestrians and being careful not to cause them harm. Besides this, the field survey shows that respondents found paths narrow and congested. Both of these reflect the likelihood of a perception of inadequate levels of physical safety for cyclists on the road.

Thus, following from the results and discussion, the participants in this study were highly satisfied with the quality of sidewalks and bike paths in the park. Therefore, the guidelines for developing non-motor vehicle routes should focus on the quality of sidewalks and bike paths which lead to the park. This corresponds to Her Royal Highness Princess Maha Chakri Sirindhorn and Jariya Lohaphungragun's idea that studying and expanding the paths in the Bang Krachao area is important (Lohaphungragun, 2553; Kasetsart University, 2556). Detailed recommendations are as follows: (Figure 6).

Figure 6. Guidelines for Developing Non-motor vehicle Routes.

1) Create and Develop Dedicated Sidewalks and Bike Paths

According to the bicycle safety behavior of the study participants showing their concerns about potential accidents and from the results of the field survey indicating that users found the roads narrow and congested, a suitable way to develop non-motor vehicle routes in the park would be to construct sidewalks and bike paths separated from motor vehicle routes. This would help decrease the risk of accidents to pedestrians and cyclists.

However, in order to construct pedestrian and bike routes on a practical level, several significant factors besides the concerns of commuters' should be kept in mind. These include engineering standards - for example, for shared sidewalks/ bike paths, the width of the bike lane should be 1.80-2.40 meters - opinions of local communities, the gradient and condition of land, etc. These issues should be studied in steps before constructing non-motor vehicle routes.

2) Improve and Develop Physical Features to Promote Walking and Cycling

● Improve Traffic Signs and Route Maps

Though the roads in the Bang Krachao area are equipped with information boards and direction signs, they are currently in poor condition, i.e. texts are unclear and details incomplete. Traffic signs, such as stop, turn, and crossroad signs, should be improved and supplemented. Route maps providing clear complete information, including the location of tourist attractions and bike rental shops, should be installed. They should be made with durable materials and equipment that are weather resistant and located in highly visible areas. These provisions would meet the concerns of the sample groups' opinions and increase the level of security for cyclists and pedestrians as well as increasing the awareness of vehicular commuters to be cautious of non-motorized users.

● Create a Pleasant and Safe Route

Since the respondents indicated they value convenience and safety of thoroughfares, the park routes should be safe and convenient for commuters, allowing them to experience nature more intimately. This can be accomplished through a campaign inviting community members to conserve the environment and infrastructure by, for instance, installing electric lights, appointing stopover rest areas for tourists, setting up snack bars, etc.

3) Construct Bicycle Parking Stations which Connect to Other Forms of Transportation

Following from the average level of satisfaction indicated by respondents with regards to bicycle parking stations to connect to other modes of transportation and in consideration of non-motorized forms of transportation that may be used to connect to public transport system from greater distances, constructing and developing bike parking stations which connect to other transportation services will help promote non-motorized transportation (cycling), allowing more people to ride to the park. Thus, bike parking stations should be provided at the Bang Krachao, Phetchahung, and Bang Nam Phung Floating Market piers, etc. Moreover, there should be adequate parking spaces provided for motor vehicles at little charge, as well as bike rentals and repair facilities at minimal cost for users (Khongouan & Sakulrattanakulchai, 2014, pp. 59-72). These services should be provided with the cooperation of the government and private businesses or individuals.

8. Future Research

1) Because pedestrians and cyclists may have different attitudes and behavior, future research results of analyzing in the different of 2 groups can be more clear and interesting.

2) The future research based on a systematic evaluation of pedestrian and cycling routes will give more accurate and more reliable results.

3) Bang Krachao is a unique leisure area that has been the focus of both the public and private sectors. Consequently, research on the subject is unique and may bring more noticeable recommendation about Non-Motorized Transportation.

Acknowledgement

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