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Environment - Behaviour
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AicQoL2017Bangkok

5th AMER International Conference on Quality of Life
Nouvo City Hotel, Bangkok, Thailand, 25-27 February 2017

e-IPH
e-International
Publishing House Ltd.,
United Kingdom

Improving Pedestrian Environment and Traffic Sign System with the Participatory Design at Anuban Ranong School

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Abstract
The objective of this study is to design and improve the pedestrian environment and traffic signs with the participatory design at Ranong Kindergarten School. The result of this study was brought to identify the promotion of pedestrian safety zone. In the participatory process, the four groups were started up for collaboration including teacher and student group, local community group, academics group, and private organization group. The important finding was the "Brave Walk Unit," the volunteer students who are the driven mechanism to promote other students who live near the school to walk or ride the bicycle to school on their own.

Keywords: Participatory Design; Pedestrian Environment; Traffic Signs System, School zone

1. Introduction

Road accidents are a significant problem currently faced in the real world. The World Health Organization (WHO) has reported road accident as the primary cause of death among people aged 15-29 years and the second leading cause of death in children aged 5-14 years. Furthermore, over 50 percent of all deaths caused by road accidents occur in pedestrians, cyclists, and motorcyclists. If no prevention plans are implemented to correct the problem mentioned above, the rate of death by a traffic accident in poor to moderately affluent countries is expected to double by 2020. Hence, the United Nations has called for all of its members to adhere to the Moscow Declarations, which designated years 2011-2020 as the Decade of Action for Road Safety 2011-2020 whose goal is to lower deaths and injuries caused by road accidents by half, or fewer than ten per 10 per 100,000 populations by 2020 (WHO, 2015).

In Thailand, the Department of Disaster Prevention and Mitigation (DDPM, 2011) presented that since the beginning of efforts to prevent road accidents in 2004 shows the national average number of deaths caused by road traffic accidents in 2006 average rate was 19.92 per 100,000 populations per year and reduced to 17.39 per 100,000 populations per year In 2009, which is higher when compared to high-income countries and certain Asian countries such as Singapore's rate of 4.8 per 100,000 populations and Japan's rate of 5.0 per 100,000 populations per year. The highlights the situation and challenges in resolving the problems mentioned above to government agencies and all parties involved. Accordingly, school grounds are considered areas in which there is the high likelihood of accidents as a result of students representing the majority of pedestrians, quiet road usage caution, lack of awareness about the dangers posed by cars and insufficient knowledge about traffic signs. Also, drivers are unable to predict the movements of children. Therefore, it is particularly dangerous when children crossroads and walk on pedestrian during heavy traffic (Ratanavaraha, 2011; OTP, 2004). According to a review conducted in research involving traffic sign systems, children have limited perception, especially children younger than 11 years of age. Furthermore, signs should be designed using specific shapes, colors, and materials (Waterson, 2012) with interpretations for different perceptions based on cultural backgrounds, education, and age (Hashim, Alkaabi & Bharwani, 2014). Therefore, signs or products for children should be designed with reliance on direct cooperation with end users such as

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DOI: http://dx.doi.org/10.21834/e-bpj.v2i5.625

students, teachers, and parents, In addition, from several research showed that physical learning environment are importance of the school because effect to quality of learning (Shaari & Ahmad, 2016) and local environments influence of children's health-related behavior (Majid et al., 2015). Hence, the urban planners and designers prepare environmental of children and considering safety and security to decrease parents' anxiety can motivate children to choose active travel to school (Rezasoltani, Behzadfar & Said, 2015).

The objective of this paper is to design the improvement of the pedestrian environment and traffic signs with the participatory design; Anuban Ranong School was the studied area. The research explained the participatory design process for extending to the other areas; Therefore, The research considers issues involved in the key success factors are describe.

2.0 Literature review

Many studies focused on school safety zone used the Participatory Design method. The objective of the participatory design process plays a key role in ensuring user satisfaction. This research will review the concept of the following.

2.1 Participatory Design

Sanoff (2000), Kang, Choo, Watters (2015), explains to the goal of the participatory design is to include all stakeholders in each step of the design process. Such stakeholders include designers, clients, users, the community, and others. Users were particularly valuable stakeholders when it comes to designing for the public, that the benefits of participatory studies as increasing social capital and promoting a sense of community that participatory study is an attitude related to a transforming power used in creating and operating environments for people.

2.2 Children and warnings

Earlier research on traffic sign symbols in a cross-cultural context has shown that familiarity and international standardization improves comprehension. Also indicates that aside from factors relating to the design and location of warnings, some behavioral and personal factors influence the effectiveness of warnings. (Shinar, Dewar, Summala & Zakowska, 2003) (Wogalter et al., 2002). Few explicit guidelines exist for the design of warnings for children. One of the key lessons from the available research is that because of the limited cognitive abilities of children, particularly the very young, warnings need to be designed very differently as compared to those targeted at adults (Rice & Lueder, 2008) Therefore, signs or products for children should be designed with reliance on direct cooperation with end users such as students, teachers, and parents, suggest that some aspects of guidelines aimed at adult populations can be adapted for use with younger children, these include: 1) Making warnings "stand out" 2) Use pictorial symbols (pictograms) 4).Use bright colors to reinforce the safety message 5) Sign in the form of a superhero or animal (Kashler & Wogalter, 2008) (Waterson & Monk, 2014)

2.3 Pedestrian Environment

Moura, Cambra & Gonçalves (2017) describe about walking activity, the walking is now gaining attention as a key factor in the promotion of healthier, environmental friendly and socially active communities, and purpose the key success of the pedestrian friendly environment has to be Connected, Convenient, Comfortable, Convivial, Conspicuous, Coexistence and Commitment. Majid, Danis, Sharoni & Khalid (2015) explain to the local environments influence of children's health-related behavior. There is increasing acknowledgment of the influence of local environments on children's health-related behavior. Because schools environment represents a vital environment in which children stay over a sustained period. Planners and designers should prepare suitable environmental conditions concerning children's play and considering safety and security to decrease parents' anxiety can motivate children to choose active travel mode in their school journey. (Behzadfar, Rezasoltani, Said, 2015)

3.0 Methodology

This research was aimed at improving pedestrian environment and traffic sign system based on a participatory design. The participant observation from the initial design processes to implementation then summarized the design processes and mechanisms for success with further adoption in other areas. The research methodology and procedures were as follows:

3.1 Site Inventory

At this collected, the physical, economic, social and environmental data, there are essential information foundation for the researcher to understand the environment concerning design.

3.2 Specifying Stakeholders

The primary objective of the participatory design was that all stakeholders in the project including designers, customers, communities and other parties could jointly summarize issues and cooperate in design work. For activities with multiple stakeholders, participation occurs through selected group representatives for group members. In any case, public space design is highly essential to communities and organizations entitled to significant preference (Kang, Choo & Watters, 2015). In this case, the stakeholders were divided into four groups as follows:

• Staff Group - Teachers and Students of Ranong Kindergarten Schools group. The number of teachers was 52 persons, while the number of kindergarten students was 204 persons and the number of primary school students was 915 persons
• Local Community Group - Population and Local Government Agencies consisted of parents, communities near the school and government agencies such as Ranong Provincial Administration Organization, Office of Public Works and Town and Country Planning of Ranong and Ranong Provincial Police.
• Academics Group - Academics and Independent Agencies consisted of King Mongkut Institute of Technology Ladkrabang (KMITL), Silpakorn University (SU), Federation of Pedestrians and Bike Users in Upper Southern Thailand (FPUUST).
• Private Organizations Group - Private Organizations consisted of Ranong Chamber of Commerce, PTT Exploration and Production Public Company Limited (PTTEP) and private entrepreneurs.

3.3 Participatory Design

Participatory design is an essential component for creating user satisfaction (Turan, Pulatkan & Beyazlı, 2016). Hence, designs, especially designs in public areas, have to rely on participation to produce results that are closely aligned with the demands of all groups. The core of the participatory design is that designers and users share information to their mutual benefit. Accordingly, multiple methods such as workshops, focus groups, and in-depth interviews are available. The methodology was shown in Figure 1.

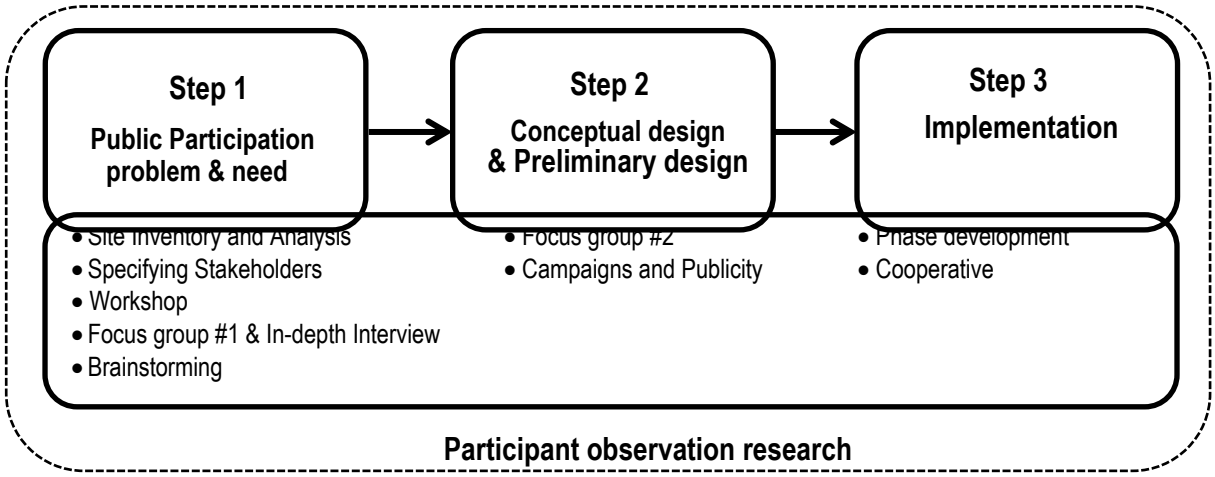

Fig. 1: Research Methodology

4.0 Study Area

The areas covered in Ranong Kindergarten School and neighboring areas covering Luwang Road, Kamlang Sap 1 Road, Kamlang Sap 2 Road and Ruangrat Road, an area of approximately 26,000 square meters, or 6.41 acre. The areas are located in Ranong Municipality. Other than, the buildings used in the areas are the mixed use of residential and commercial buildings with nearby tourist destinations and important landmarks such as the Ratatnarangsan Palace and Ho Phra Kao Keji Acharn (Tabernacle of Budda). Traffic around the school is congested during the morning rush hours (7:00-9:00 am) when parents deliver children to school. Congested traffic occurs due to frequent parking in no-parking zones by parents while carrying children. For the evening rush hours (3:00-5:00 pm), the school day ends, and the parents come to take their children back home. During the as mentioned above periods, numerous shops and food stalls are set up along the streets, causing traffic congestion and the potential for pedestrians and vehicles to interact. The overall conditions and traffic conditions are shown in Figures 2 and 3.

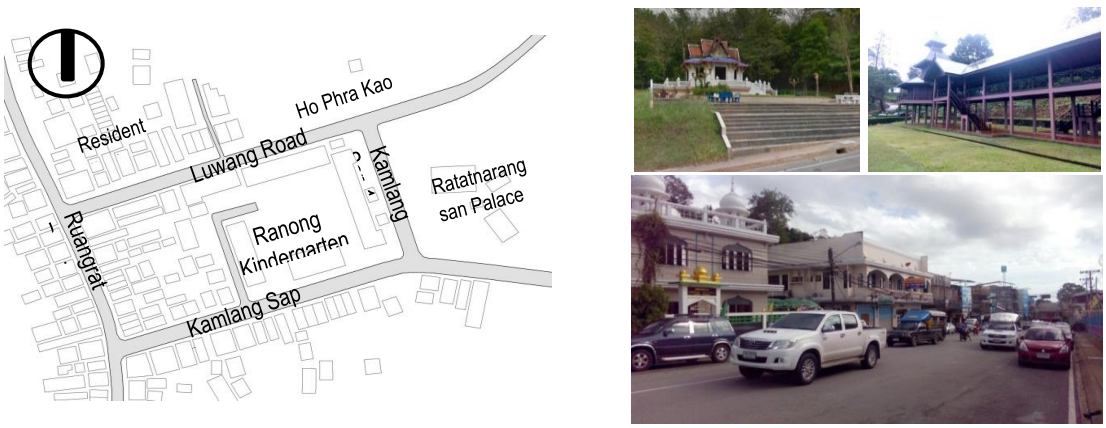

Fig. 2: Studied Areas at Ranong Kindergarten School and Nearby Areas

Fig. 3: Morning and Evening Traffic and Pedestrian Behaviors

5. Research Findings

5.1 Participatory Design

1) Workshop

The target group for the activities was composed of Staff Group because the research was aimed to foster values about walking and bicycle use among youths to promote adaptation to the values as mentioned above in daily routines. The format for activities consisted of instruction on the benefits of walking and bicycle use combined with listening to problems, demands, and development concepts. Lecturers were representatives from the FPUUST.

The activity began by dividing the students into subgroups. The students were instructed to draw mind maps to describe problems and capabilities in walking and riding bicycles to schools. Teachers provided assistance and summarized topics. The responses of the educators and students indicated keen interest due to relevance to daily activities such as school traffic congestion and insufficient safety in walking. The students proposed many projects for promoting walking and bicycle use such as road and pedestrian improvements and repairing school bikes. At the conclusion of the activity, a Brave Walk Unit was formed led by the student body president and work committee. The objective of the Brave Walk Unit was to promote students who live near the school to walk or bicycle to school on their own, traffic discipline and supervision of the travel safety of juniors. The first activities were organized to form a clear picture of the work of the Brave Walk Unit. Therefore, a team symbol was created based on the "Kayu" fruit, which translates from the local Ranong dialect into "cashew nuts," to ensure that the unit is easily recognized and to express the unique identity of Ranong Province, as shown in Figure 4.

2) Focus Groups

Activities were organized on two occasions. The first event was held with the objective of listening to the views, problems, and needs of teachers and school administrators. The focus group drew the conclusion that walking and bicycle use is a good concept that should be promoted because the school traffic is heavily congested. Hence, teachers and personnel initially dealt with the problem by informing parents about the problem and requesting their cooperation in delivering their children more quickly. However, the association received was inadequate because parents were concerned for their children and anxious about road safety. Meanwhile, the second focus group was organized after a preliminary model was created. The preliminary design was discussed along with action guidelines and government officials, namely, Ranong Provincial Administration Organization, Office of Public Works and Town and Country Planning of Ranong and Ranong Provincial Police. According to the conclusions drawn from the meeting, the focus group approved of the preliminary design and would like to push the project forward to request financial support from relevant agencies as shown in Figure 5.

3) In-depth Interviews

To provide complete data, three important persons were interviewed. The details can be summarized as follows:

- Mrs. Wannee Pumsuwan, School Director, Ranong Kindergarten School, explained the guidelines for improving the school in the future: "*They would support parents' waiting areas and stationing of more teachers at entrances to boost confidence in parents…*"
- Miss Sunee Mahamad, a teacher, described the student pick up behaviors and problems: "*The school entrance facing Kamlang Sap 2 Road has heavy traffic congestion, especially during school hours because many personal vehicles frequently park longer than the legally permitted time, which reduces traffic space. If the problem above could be resolved, it would solve traffic problems for a while.*"
- Mr. Charoon Tawichsri, Director, Engineer Division, Ranong Provincial Administration Organization, gave information regarding the design: "*Ranong Provincial Administration Organization has public spaces adjacent to the Ho Phra Kao Keji Acharn. The area can be*

developed into a parking lot for parents or public benefits. However, a rather large fund might be required to realize the construction because of the highly sloped characteristics of the area…"

(a)

(b)

Fig. 4: (a) Teachers and students workshop activities; (b) Brave Walk Unit of Ranong Kindergarten School

(a)

(b)

Fig. 5: (a) Focus Groups 1 for listening to problems, needs; (b) Focus Groups 2 for preliminary design corrections

4) Brainstorming

The meeting was held on 16 June 2016 at the meeting room of Ranong Kindergarten School, chaired by Mr. Chatupot Piyamputra, Ranong Provincial Governor. The attendees were divided into the following four groups: (1) Staff Group and the Brave Walk Unit; (2) Local Community Group such as representatives of parents, Ranong Provincial Administration Organization, Office of Public Works and Town and Country Planning of Ranong and Ranong Provincial Police; (3) Academics Group composed of representatives from KMITL and FPUUST and SU; and (4) Private Organizations Group, namely, Ranong Chamber of Commerce and PTTEP. Academic lectures sustained the first activity period. Next, a public forum was opened to receive opinions about the problems associated with walking and bicycle use and traffic problems.

For the brainstorming, the participants were invited to walk along the pedestrian around the school with the Brave Walk Unit commenting on physical problems and identifying physical problems such as damaged signal lights, disconnected pedestrian, absence of warning signs or signs for specify drop-off areas and vehicles obstructing traffic and pedestrian. In demonstrating the aforementioned problems, the Brave Walk Unit role-played the use of pedestrian to illustrate the problems. The aforementioned

process involved communication between users, who were students, and relevant groups in jointly seeking solutions. The participation are shown in Figures 6-7.

Fig. 6: Brainstorming involving All Stakeholders to Set Design Guidelines.

Fig. 7: Identifying Physical Problems and Role Play of the Brave Walk Unit.

The brainstorming, focus groups and identification of physical problems with all four groups of stakeholders summarizing the physical problems resulting from the participatory design as follows:

4.1) Pedestrian and Facilities

The students, teachers and parents mutually identified problems such as rough path surfaces, slippery spots caused by algae, many paths with different heights, damaged and obstructive street furniture, all of which create challenges to walking. Meanwhile, the people and government agencies informed that the paths around the school have been in use for over twenty years. Many parts have become damaged due to inadequate maintenance funding. Additionally, the highly sloping geography posed an obstacle to designs and resulted in numerous sloping and different levels of paths.

4.2) Student drop-off areas

All groups agreed accordingly that weather of Ranong involves year-long precipitation, hindering the delivery of children and creating parental anxiety. Hence, the students should be dropped off as close to the school entrance as possible.

4.3) Traffic and Safety Problems

Teachers, students the people and government agencies agreed accordingly that the traffic congestion in front of the school is caused by parents' preference for delivering their children close to the school entrance due to parental anxiety for harm caused by traffic and rain.

5) Brainstorming

Campaigns and publicity are geared toward information awareness among the people residing around the school and disclosure of information about the activities of the Walk and Bike Friendly Cities Project. The activities were organized with financial support from private organizations led by PTTEP, and many private organizations within the province provided support. The media used for publicity were signs, brochure and community radio broadcasts. In addition, the Brave Walk Unit led students on walks to communities to provide brief explanations about the project. Conclusions of participation are shown in Figure 8. Publicity activities are presented in Figure 9.

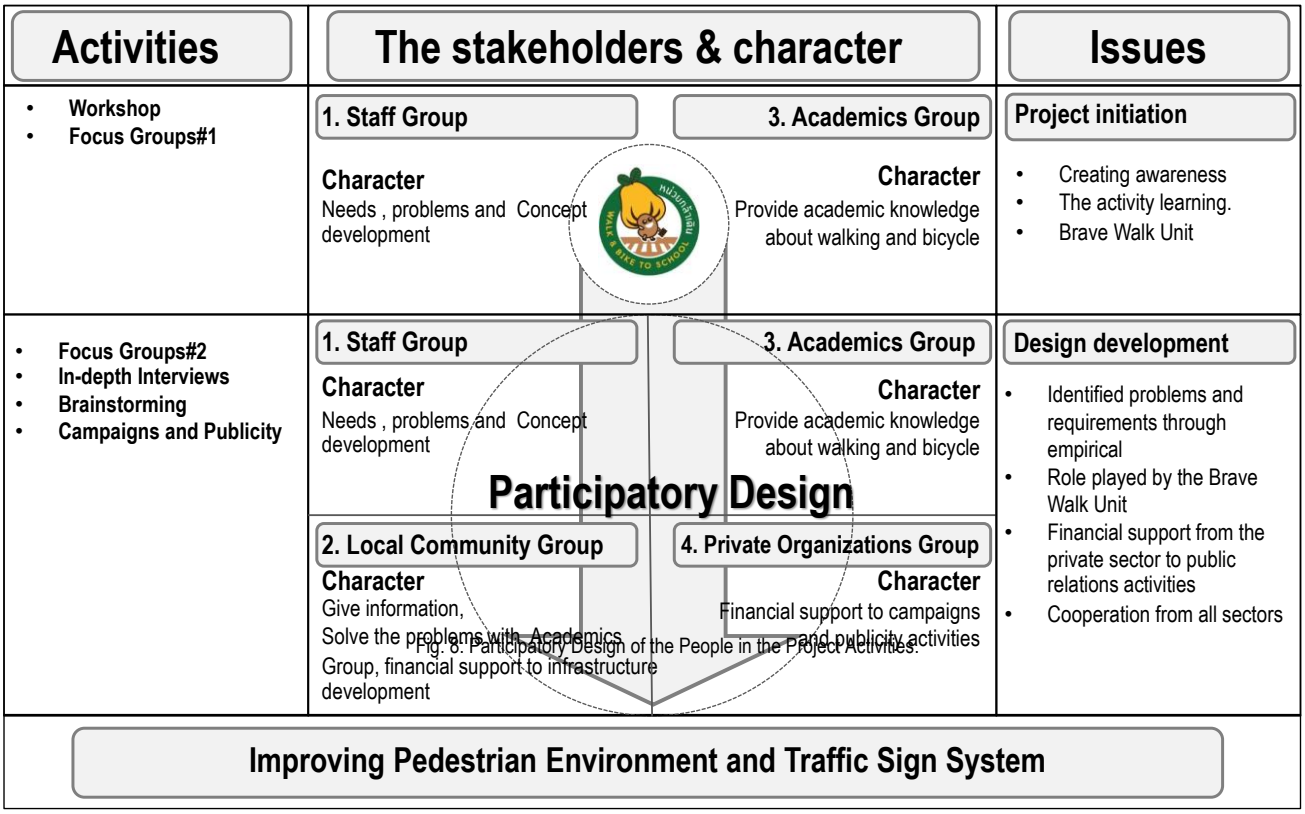

Fig. 8: Participatory Design of the People in the Project Activities.

Fig. 9: Campaigns for Promoting Walking and Bicycle Use by the Brave Walk Unit

5.2 Improvement for Pedestrian Environment and Traffic Signs

1) Preliminary design based on a Participatory Design

The identification of physical problems and participation of various sectors led to walk and bike promotion by first reducing the speed of vehicles in school areas. The review of relevant literature found that designs can be implemented in many ways such as road markings, traffic signs, optional traffic signs and rumble strips. Displays of road markings such as zebra crossings, lane lines or street paintings should also have warning signs for drivers before they arrive at crossings. Furthermore, road markings should not be so thick that driving is hindered. In any case, the use of social measures by creating motivation and educating communities would be a more essential and effective guideline for legal enforcement (Hidayati & Montgomery, 2012). Hence, the present study chose road markings and designated Kamlang Sap 1 Road as the "promotion of pedestrian safety zone" in order to create pedestrian safety zones. In road marking designs, bright colors and the cartoon symbols of the Brave Walk Unit were used to attract interest among students, especially students younger than eleven years of age (Waterson & Monk, 2014) (Waterson et al., 2012).

Promotion of walking is essential to sustainable urban development. Proper pedestrian for walking must be composed of the following: (1) walking comfort; (2) connectivity and accessibility and (3) walking safety (Zakaria & Ujang, 2014). Promotion should also be concurrent with the basic principles for pedestrian design composed of the 7Cs, namely, connection, convenience, comfort,

conviviality, conspicuity, coexistence and commitment (Moura et al., 2017). Hence, design guidelines by phase development were as follows:

1.1) Short term plan. (1-5 years)

Closed to traffic on Kamlang Sap 1 Road as the "promotion of pedestrian safety zone" in order to create pedestrian safety zones, bicycle park and motorcycle park for the parent.

Relocating shop stalls obstructing pedestrian into promoting a pedestrian safety zone. The aforementioned action would Increased capacity pedestrian around the school.

Consideration was given to one-way vehicle routes on Luwang Road, Kamlang Sap 2 Road in during peak traffic for improve traffic flow and strict traffic discipline.

1.2) Long term plan. (6-10 years)

- Development of covered pavements to reduce the problem of rain in the drop-off zone and loosen the nervousness of parents.
- Development the parents' waiting area of the school. The facilities in the waiting as chair and label information. Plan and perspective are shown in Figure 10-11.

2) Implementation Activities

Ongoing campaigning activities and publication of the model have attracted the interest of many government agencies and independent organizations. The aforementioned has also led to the signing of an MOU on 16 September 2016 at the Rattanarangsan Palace among five local administrative organizations, the Thai Health Promotion Foundation (THPF), Thailand Cycling Club (TCC), FPUUST, KMITL, SU and PTTEP under the Walk and Bike Friendly Cities Project. The MOU mentioned above will lead to exchanges of knowledge and overview of the participatory process for implementation for other areas. The Implementation activities and the signing date of the MOU are shown in Figure 12.

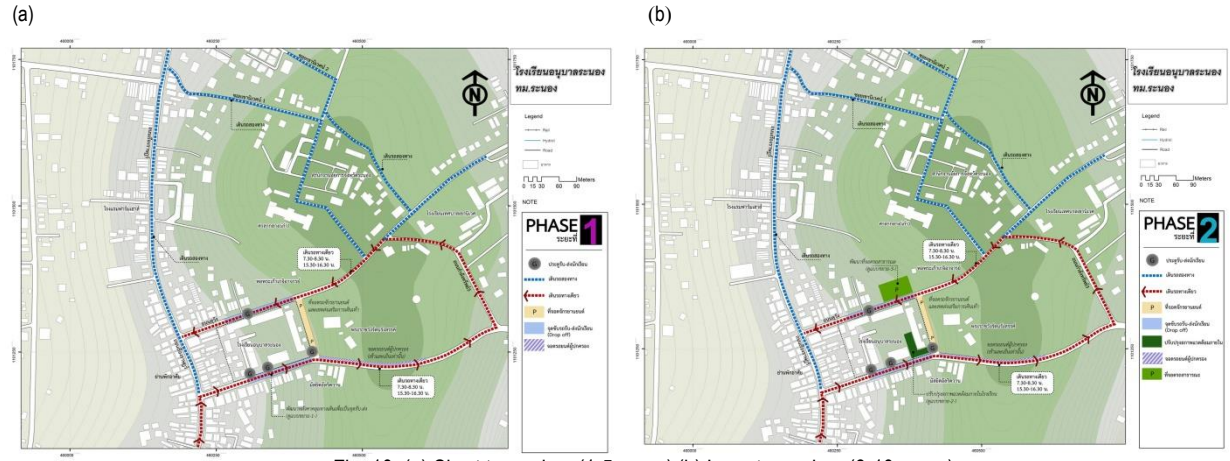

Fig. 10: (a) Short term plan. (1-5 years) (b) Long term plan. (6-10 years)

(b)

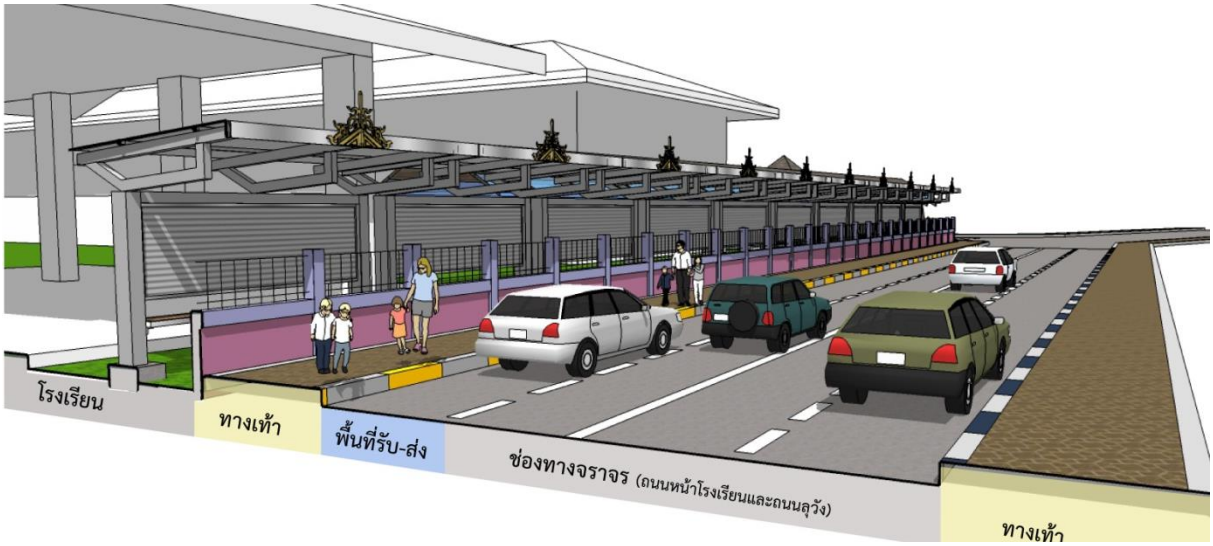

Fig. 11: (a) Promotion of Pedestrian Safety Zone on Kamlang Sap 1 Road;
(b) Improvement pedestrian and drop off zone.

6.0 Summary

The objective of research providing an overview of the participatory design processes of various sectors involved in the environmental improvement design for pedestrian and traffic signs as part of the Walk and Bike Friendly Cities Project. The procedures and roles of all parties concerned are as follows:

6.1 Components to Project Initialization Success

At this stage, success was influenced by the following two key components: (1) realization of the significance of the problem and a desire for environmental changes; teachers and students identified the physical problems; (2) knowledge promotion by academics, the mechanism for success at this stage was the formation of the Brave Walk Unit, which represented students in expressing opinions and acting as guardians for the pedestrian and traffic safety of juniors.

(a)

(b)

Fig. 12: (a) Implementation activities to painting road markings to designate the Promotion of Pedestrian Safety Zone;
(b) MOU Signing Ceremony activities

6.2 Driving Force behind Successful Model Design Activities

1) Brainstorming

As all sectors acknowledged the benefits resulting from the project as evaluated through the cooperation that occurred during activities, the next stage was to collect data for designing the model. At this stage, a combination of participation methods was used, namely, brainstorming meeting and focus groups for identifying physical problems. The mechanism for success was the role played by the Brave Walk Unit in representing students as the primary users of pedestrian. This identified problems and requirements through empirical designation of locations involving other project participants, namely, the private and public sectors, government agencies, academics and independent organizations. The aforementioned techniques helped identify the problems and requirements of primary users and resulted in a public forum for exchanges of ideas aimed at obtaining solutions for the problems.

2) *Campaigns and public relations were carried out continuously*

The activities were led by teachers and students with the support of academics and private groups as well as public and government agencies. The mechanism for success at this stage of the project was financial support from the private sector by PTTEP, which helped the project achieve its objectives. The public relations activities were walking campaigns by the Brave Walk Unit and putting up of signs in public spaces. The content of the aforementioned activities invited the public to walk and use bicycles in their daily activities while promoting driving safety and caution in school areas.

7. 0 Recommendations for Future Research

The workshop activities found the majority of students to continue to lack proper knowledge about traffic signs, possibly because the traffic signs were primarily designed for adults and neglected the perceptions of students fewer than eleven years of age. If walking and bicycle use is to be promoted to students, it is highly recommended that future in-depth research shall be conducted on the types of signs used to promote walking in addition to sign colors and shapes that would produce perception.

Acknowledgments

The authors would like to acknowledge the valuable comments and suggestions of the reviewers, which have improved the quality of this paper, and thank all parties involved in the project, namely, Mr. Koson Na-Ranong , Farmhouse hotel ranong, Mr. Pornthep Dissayabut, Secretary of the Federation of Pedestrians and Bicycle Users in Upper Southern Thailand (FPUUST), the Director of Ranong Kindergarten School, Thai Health Promotion Foundation (THPF), all parties involved in Ranong Province.

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