

*The Study of Design Elements and User's Behavior in Public Space:  
A Case Study of Pattaya Beach Road Public Space*

Akharapon Thanyagaset, Silpakorn University, Thailand

The Asian Conference on Sustainability, Energy & the Environment 2017  
Official Conference Proceedings

**Abstract**

This research aimed to investigate the user's behavior of the public open space, a case study of Pattaya beachfront public space, Chonburi province, the second most visited city in Thailand, after Bangkok. By studying the characteristic of landscape design elements, activities and the surrounding context to analyze the relationship of the various factors that affecting the use of the area, to find out the design guidelines to improve the physical design of Pattaya beachfront public space which based on the behavior and needs of users. The Post-Occupancy Evaluation methods were used to collect and analyze data by observation, interview and review the literature. The observations are divided into two parts: the overall physical and usage character of the whole area, the second part is the user's behavior in the space which was classified into 3 types, plazas, walkways and memorial place. Then analyze the current usage conditions of each area, positive&negative aspects and compare with the public open space design guidelines. The results showed that during the weekend at 04.00pm-06.00pm is the most active time of Pattaya beachfront public space. The user's both Thai and foreigner, intensively use in many kinds of recreational activity. The main application is the walkway between the north and south of Pattaya beach. And also be the space for recreations. The factors that promote the usage are the activities of the surroundings context Pattaya Bay and physical landscape design elements include: accessibility, the beauteous scenery, daylight&shading, appropriate dimension of space, security and the natural atmosphere.

Keywords: Public Open Space, Post-Occupancy Evaluation, Landscape Design, Pattaya Beach

**iafor**

The International Academic Forum  
[www.iafor.org](http://www.iafor.org)

## 1. Introduction

The public space is the social and recreational areas, a place to relax the body and help in healing the mind from the problems in everyday life. And enhance the life's quality of people at all levels. Which means the public space is definitely an area that needs to be sustainable in the urban community. The general public space may be a green shady area which are designed to provide the space for various actions. Especially the public space which is located in the high- density community area or the tourist attraction, the public space must respond the various type of use and people, who's come outside to spend their time in many purposes.

Pattaya City is one of the most attractive city of Thailand, which the urbanization process is suddenly growing too fast in the several decades. From the data of Designated Areas for Sustainable Tourism Administration found that in each year both Thai and foreigner had visited the city an annual average of about 6 million people and could bring income to the national average of 2 hundred million dollars, representing 10 percent of the whole tourism income of Thailand. By the number of visitors has increased every year, compared with the existing infrastructure. Make the current are environmental problems, In particular, a city is now experiencing a shortage of public spaces for recreation, which response to the users and amount of tourist and people of Pattaya.



Figure 1: Pattaya City, Chonburi province, Thailand (Image from Internet)

With the appearances of the coastal tourist city, makes the Beach area of Pattaya Bay to be the most important area of the city, the natural attraction and the location of the city's economic district include the area around Pattaya beach road from the north beach to the south beach. Therefore, this study aims to find out the way to develop the quality of the public space which been limited in Pattaya City. By studying the Pattaya Beach Road Public Space. The results from this study can be used as a design guideline to improve the physical characteristics of the public space, in accordance with the user's behavior and are consistent with the characteristic context Pattaya City. And also be related to the policy of the urgency of the development plan for the city of Pattaya.

## **The Aim, Objectives, and Questions of the study**

### **The aim of the study**

To find the design guidelines for the design and development of the public space, in accordance with the user's behavior and usage of the Pattaya beach road public space.

### **The objectives**

1. To study the user's behavior of the study area, Pattaya beach road public space.
2. To study the relationship between the physical characteristics of the area and the behavior of users in doing activities in Pattaya beach road public space
3. To propose the design guidelines for the public space that suits the user's behavior, and in accordance with the design guidelines for the good public space. To be a tool for improving the Pattaya beach road public space and another related area.

### **The questions of the research**

1. The physical characteristics of the Pattaya beach road public space are consistent with the usage behavior of users. And responds to the need to use the area in the proper way or not?
2. The physical characteristics of Pattaya beach road public space are in accordance with the characteristics of the good public space design?

## **2. Related Literature**

### **Street Plaza - Linear Open Space**

Linear open space is one type of the downtown Plaza, the public space which located nearby the downtown or the attraction place of the city. And the location might be located along the side of building, the road or the waterfront. The shape and size of the space generally being long and narrow, and the function is similar to the path or walkway. The important elements that make the linear open space being different from the other type of downtown plaza are the expanded space or elements that can support the various use, moreover being the only walkway. Such as the green shade, seating and the waiting area or the place for looking the people's activity and the happening of the city (Cooper Marcus & Francis, 1990) the main design recommendations for the linear open space can be shortly described as 4 points: Location, The Size, The Visual Complexity and The Activity of the space.

## 12 Quality Criteria for Designing/Detailing the Good Public Space

In the 1960s, Jan Gehl start to study what people actually do in the public spaces and in his book “Life Between Buildings”, which was published in English in 1987, he describes the logic of how people use the physical environment and led to the new research which explain about the 12 quality criteria for the design of good public space and this topic had been published in a new book “New City Life” in 2006

The Quality Criteria are divided into three groups: Protection, Comfort, and Enjoyment with the details of aspects are as the following diagram:



Figure 2: The quality criteria for designing the good public space

### 3. The Research Methodology

This study is the Qualitative Research which aims to investigate and identified the physical design characteristics and the current usage of Pattaya beach road public space. To know the current quality of the public space in responding and supporting the needs of users. The details of the process are as follows.

#### 3.1 Scope of the study area

Pattaya beach road public space is located in the area of Pattaya Bay nearby the Pattaya Sai 1 Road (Pattaya Beach Road), Nongprue, Banglamung, Chonburi province, Thailand.

The estimated distance of the Pattaya beach road public space is about 2.7 kilometers (From the north beach to the south beach)



Figure 3: Scope of the study area, Pattaya Beach Road Public Space (source by the author)

### 3.2 The Field Data Collecting.

The field data collecting method that was used in this research was developed from the Post-Occupancy Evaluation (POE) methods. POE is defined as a process for the evaluation of built environments from user's perspectives and it is used to find out the way to improve the quality of the provided space, to raise the effectiveness of the place and productivity of users. In this research, POE was used to investigate in 3 aspects of spatial performances: 1. Physical Elements 2. Functions and 3. User's Behavior. The processes of POE to evaluate the study area are:

1. Pilot Observation: A preliminary surveying of the area to know the overview characters of the physical settings and usage's behavior from 08.00-18.00 of the day throughout the week, to specify the date and time of the public space which is used the most heavily. (The most heavily used time is the time that might have the problems and conflicts of using which proper to study and identified the issues or problems of the place)
2. Observation of the place: An indicative surveying is used to identify the physical design elements and the happenings of user's activity in the sub-areas which were classified from the pilot observation. By recording in the behavior map and table of usage quantity.
3. Interviewing the users that are involved in the study area. To know the purposes, intentions, behavior in each using period and attitudes in using Pattaya beach road public space.

### 3.3 Period of the Observation.

The date and time of the field data observation were chosen by the tourism's peak period (High-season) of Pattaya city, which starts from November to April of each year.

### 3.4 The Data Interpreting and Analyzing.

1. Analyze the pilot observation's data that include the overall physical characteristics and current usage of Pattaya beach road public space to conclude the use of the study area throughout the week (Monday-Sunday) and specified the date and time of the most heavily used of the area. And also classified the characters of the public space into several sub-areas, to study the use of the area thoroughly.
2. From the subarea's observation, analyzing the data in terms of user's behavior and circulation by using the behavior map and table of usage quantity. Conclude the usage quantity in each area to identify which the activity and the area are the most and least usage, the analysis also is combined with the current physical design elements.
3. Analyze the physical factors that promote the uses of Pattaya beach road public space by considering the relationship of the elements, including the characteristics of the surrounding context of Pattaya Bay and the physical design elements of the study area.
4. Analyze the physical design of the Pattaya beach road public space, consistent and inconsistent with the design guidelines or criteria of good public space which based from the reviewing the literature.
5. The conclusion of the analysis phase will be led to answer the research question and propose the design recommendations to improve the quality of Pattaya beach road public space.

### 4. Pattaya Beach Road Public Space

The physical character of Pattaya beach road public space is the linear open space which located along the Pattaya Sai 1 Road (Pattaya beach road). The road is one of the minor streets with concrete one-way driving and has 2 traffic lanes, the width of the traffic territorial include vehicles lane and sidewalk is 12 meters. The traffic density of the road is between medium and low and the velocity of the vehicles is quite low because of the downtown surrounding context and also people's activity on the beachfront area.

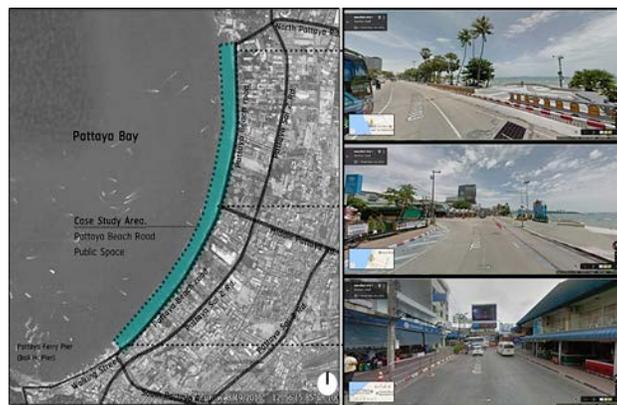


Figure 4: The Pattaya Sai 1 Road (Pattaya Beach Road). (Revised from Google Earth)

From the pilot observation, Pattaya beach road public space can be classified the physical characteristics into 3 types as follows:

1. **Multi-Purpose Space/Plazas:** the area which was extended from the other part of the walkway to be a large space with the internal area that can be utilized a variety of activities and also can support the installation or exhibition in the special occasion.
2. **Walkways/Promenades:** the area with the long and narrow space which serve for people to walk along the public space and connect each sub-areas. And also be the buffer space between the beach area and the vehicle lanes (Pattaya beach road)
3. **Memorial Place:** the area or place which is important and valuable in the history of Pattaya city and also related to the belief of the native people.

By the classification of the overall physical design and activities on the Pattaya beach road public space, the case study area can be separated into 7 sub-areas to be easy and convenient in observation the happenings of the place. The sub-areas are as follow:

**Area No.1** Plaza at the north Pattaya

**Area No.2** Plaza at the King Taksin the great's shrine

**Area No.3** Promenade between the north and the middle of Pattaya

**Area No.4** Plaza at the middle Pattaya

**Area No.5** Plaza opposite the Central Festival Pattaya Beach (Department store)

**Area No.6** Royal Varuna yacht club memorial

**Area No.7** Promenade between the middle and the south of Pattaya

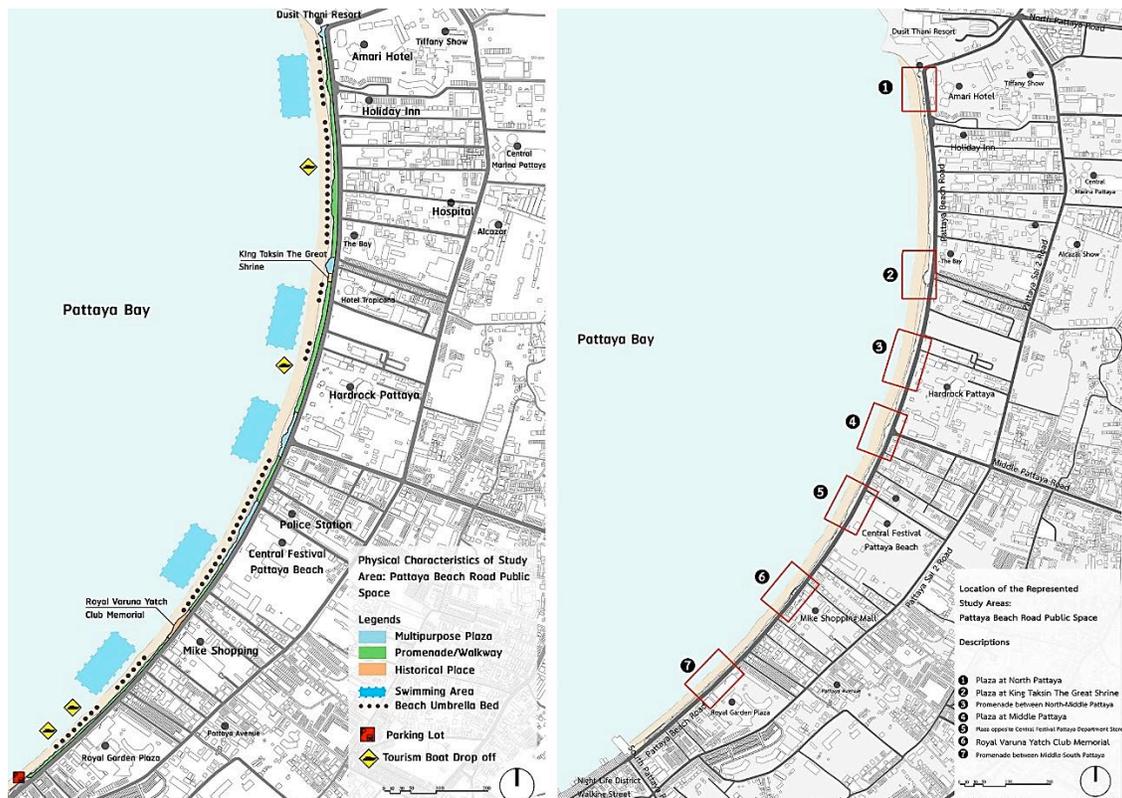


Figure 5: The overall characteristics of physical design and activities on Pattaya beach road public space. And the location of the sub-areas study (drawn by the author)

## 5. The Uses of Pattaya Beach Road Public Space

### 5.1 Conclusion of the overall observation in the behavior of the whole study area.

#### Types of User's Activity, The Users and The Most Heavily Using Time of Pattaya Beach Road Public Space

From the pilot observation of the overall using in the study area, the surveying shows that the activity which was taken place in the study area can be classified into 2 types including:

- 1. Passive Activity:** (1) Standing/Sight Seeing, (2) Sitting, (3) Picnic/Sitting on ground
- 2. Active Activity:** (4) Walking along, (5) Jogging

The users which were found in the study area are both Thai and foreigner tourist. The most of the tourist are the foreigner from overseas and mostly stay in the hotels, resort and other accommodations from 5-7 days.

If classify users according to the gender and age, found that the number of male users is more than female. Most of the male users usually come together as a group of friend, but female users usually come with the families. The users of Pattaya beach road public space are mostly adults and the young people are found in less amount to none.

The date and time which are the most-heavily using time of Pattaya beach road public space are during the evening between 04.00pm-06.00pm at the weekend (Saturday-Sunday). Because in this period, the weather is quietly cool down from the heat of the sun and people also can archive the beautiful scenery of the sunset view. Moreover, the beautiful view and the proper climate, the atmosphere of the nightlife district also becomes more active than daytime which brings people to come out and enjoy the happenings events of Pattaya.



Figure 6: The uses of the public space during the 04.00pm-06.00pm at the weekend

## 5.2 Observation of the user's behavior and activities in 7 sub-areas of the case study

The data from observation of the user's behavior in each sub-areas was recorded at the time 04.00pm-06.00pm at the weekend. By using the behavior map, to identify the location of the activities and amounts of users which were represented in different color points. The maps also show the circulation inside the study area

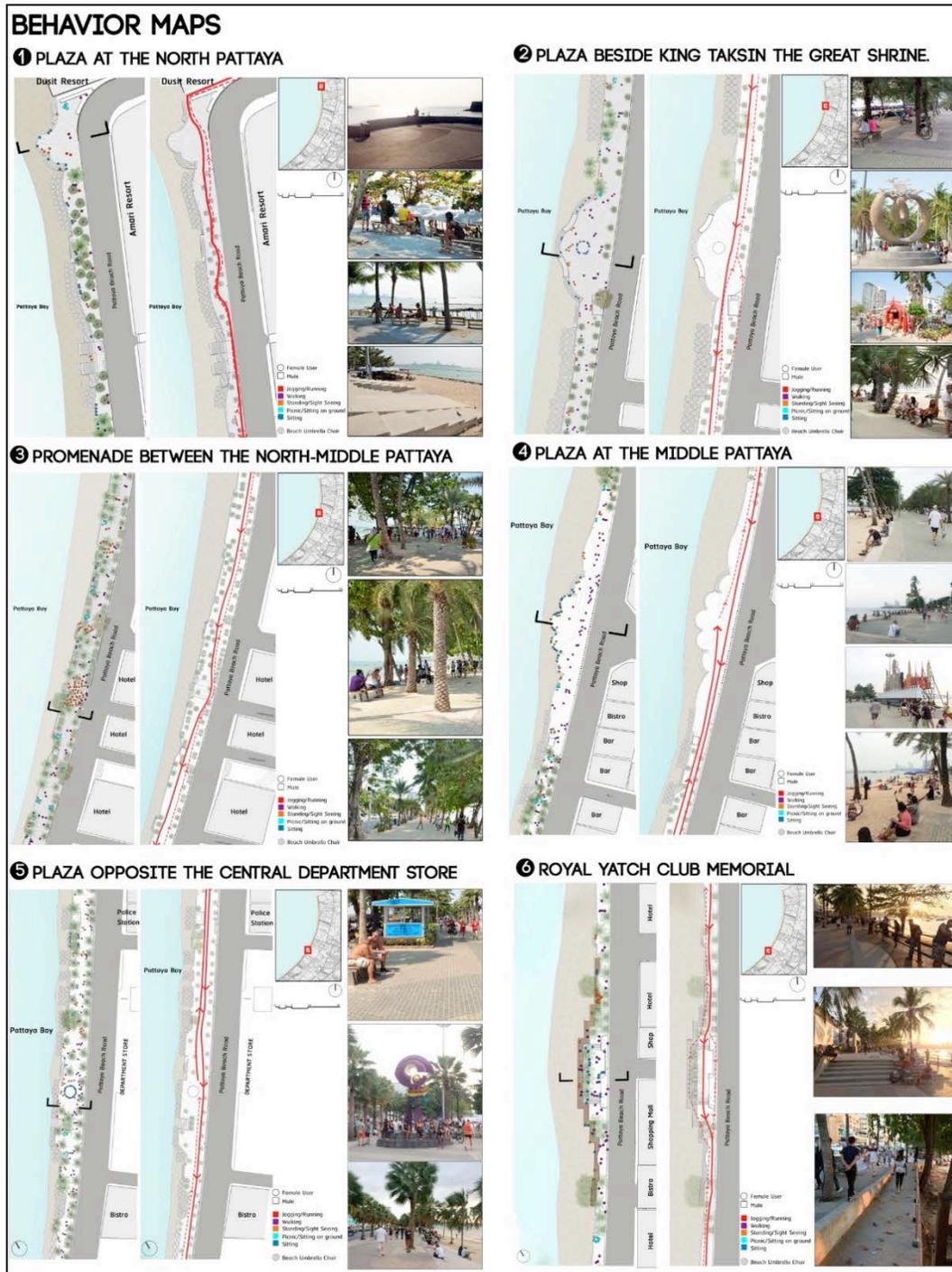


Figure 7: The behavior maps of 7 sub-areas (drawn by author)

And from the Table 1, the data from observation can be described the usage quantity of each activity in 7 sub-areas during the most heavily use time, 04.00pm-06.00pm on Saturday and Sunday. In terms of the location of the activity, the frequency of use per day. To find out and conclude the total usage quantity of Pattaya beach road public space in the most heavily use time.

| Area<br>Activity                       | Usage Quantity of Each Activity in The 7 Sub-Areas during 04.00-06.00 PM on Saturday - Sunday. |                         |                         |                         |                         |                         |                       |                       |
|--|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------------------|-----------------------|
|  | 1  | 2                       | 3                       | 4                       | 5                       | 6                       | 7                     | Total                 |
| Walking                                | 15<br>(4.13%)  | 40<br>(11.01%)          | 49<br>(13.49%)          | 82<br>(22.58%)          | 77<br>(21.21%)          | 53<br>(14.60%)          | 47<br>(12.94%)        | 363<br>(100%)         |
| Jogging                                | 4<br>(21.05%)  | 2<br>(10.52%)           | 5<br>(26.31%)           | 5<br>(26.31%)           | 3<br>(15.78%)           | (0%)                    | (0%)                  | 19<br>(100%)          |
| Standing/<br>Sight<br>Seeing           | 12<br>(5.50%)  | 31<br>(11.84%)          | 68<br>(31.19%)          | 29<br>(13.30%)          | 49<br>(22.47%)          | 20<br>(9.17%)           | 9<br>(4.12%)          | 218<br>(100%)         |
| Sitting                                | 27<br>(14.59%)   | 33<br>(17.83%)          | 11<br>(5.94%)           | 39<br>(21.08%)          | 40<br>(21.62%)          | 24<br>(12.97%)          | 11<br>(5.94%)         | 185<br>(100%)         |
| Picnic<br>/Sitting<br>on<br>Ground     | 3<br>(2.5%)  | 14<br>(11.66%)          | 32<br>(26.66%)          | 31<br>(25.83%)          | 17<br>(14.16%)          | 6<br>(5%)               | 17<br>(14.16%)        | 120<br>(100%)         |
| <b>Total of<br/>Usage<br/>Quantity</b> | <b>61<br/>(6.65%)</b>  | <b>120<br/>(13.10%)</b> | <b>165<br/>(18.01%)</b> | <b>186<br/>(20.30%)</b> | <b>186<br/>(20.30%)</b> | <b>103<br/>(12.47%)</b> | <b>84<br/>(9.17%)</b> | <b>905<br/>(100%)</b> |

Table 1: The usage quantity of each activity in each sub-areas during 04.00pm-06.00pm at the weekend.

**(1) The areas which have the most usage quantity are** Area no.4 Plaza at the middle Pattaya, Area no.5 Plaza opposite the Central Festival Pattaya Beach (Department Store). Both of the plazas have the same percentage of the total usage quantity, 20.30% of the total. Because the area has the elements that provide the opportunities to use the area such as the seating at the edge of the plaza and the sculpture with the seat around the base. Moreover, the physical elements, the location of the plazas is located nearby the district of commercial stores, bars and also the accommodations which appeal a lot of people to come and the atmosphere of the area is bustling and vibrant. (Figure 8)

**(2) The area which has the least usage quantity is:** Area No.1 Plaza at the north Pattaya. The plaza has the percentage of the usages about 6.65% of total usage quantity of Pattaya beach road public space. The reasons that make this area has the least usage quantity might because of the privacy atmosphere of the accommodations nearby and

also the location of the plaza is far from the district of commercial stores/bars, then the overall atmosphere is not being active as similar as the other zone of surroundings context along Pattaya Bay. (Figure 9)



Figure 8: The use of the area no.4 and no.5 which are the area with the most usage quantity. (Source by the author)



Figure 9: The use of the area no.1 which are the area with the least usage quantity. (Source by the author)

| Acitivity                   | Percentage of Usage Quantity | Amounts of Usage |
|-----------------------------|------------------------------|------------------|
| 1. Walking                  | 39.62%                       | 363              |
| 2. Jogging                  | 2.07%                        | 19               |
| 3. Standing/Sight Seeing    | 23.79%                       | 218              |
| 4. Sitting                  | 20.19%                       | 185              |
| 5. Picnic/Sitting on Ground | 14.30%                       | 120              |
| <b>Total</b>                | 100%                         | 905              |

Table 2: Summary of the public space usage amounts of each activity during 04.00pm-06.00pm at the weekend.

**(3) The activity which has the most usage of doing is:** Walking, with the percentage of usage quantity, is 39.62%. Because of the overall physical characteristics of Pattaya beach road public space is the linear public space which has the main function in term of walking corridor along the beach and people also came out to enjoy the scenery of Pattaya beach and heading to the nightlife district.

**(4) The activity which has the least usage of doing is:** Jogging, with the percentage of usage quantity, is 2.07%. The reason that jogging is the activity with the least usage, the public space did not design the pavement or running track in the proper way which should be clearly separated from the walkway. And also be provided the width of the walk/running track consistently.



Figure 10: Walking, the active activity which has the most usage of doing in the Pattaya beach road public space during 04.00pm-06.00pm at the weekend (source by the author)

### 5.3 Analysis of the physical design elements of the Pattaya beach road public space in accordance with the design guidelines for good public space.

From the literature review, the 12 quality criteria for good design of public space by Jan Gehl was chosen to be a tool in comparing analysis with the physical design elements of Pattaya beach road public space. The topics of interest are including 1. Protection 2. Comfort and 3. Enjoyment, and found that there are some consistency issues with the following details:

| Types of Sub-Areas of Pattaya Beach Road Public Space   | The Quality Criteria for Good Design of Public Space   |   |  |
|---|--|---|--|
|   | Protection   | Comfort   | Enjoyment  |
| <b>1. Plazas:</b><br>- <b>Area No.1</b> Plaza at the north Pattaya<br>- <b>Area No.2</b> Plaza at King Taksin The Great Shrine<br>- <b>Area No.4</b> Plaza at the middle Pattaya<br>- <b>Area No.5</b> Plaza opposite Central Festival Department Store | - Lack of access facilities, such as crossing way or transition space.<br>- The boundary between the area and the road is divided only by the elevated pavement, no fences or barrier<br>- The bustling atmosphere and open space make the area can be able to see and ensure the security.<br>- Plants provide shady area but cannot protect users from bad weather | - The plazas can be easily accessed from the walkways but in Area no.1 was not designed the transition approach between the outside path and the beach road public space.<br>- The areas are all connected with the walkways and other parts of the public space<br>- The areas have the seating around the sculpture but insufficient inside the plazas<br>- The locations are conducive to able to see the good view of Pattaya Bay | - The size of the plazas area is related to the human scale, except the area no.4 which is too large and make people feeling unpleasant.<br>- The surface materials are placed in the different patterns which make the area looks interesting.<br>- The tropical plants are the important elements that are consistent with the surrounding atmosphere. |
| <b>2. Walkways</b><br>- <b>Area No.3</b> Promenade between the north and the middle of Pattaya<br>- <b>Area No.7</b>  | - The walkways are all separated from the vehicle lanes with no fences or barriers to protect the users, but the width of the area can make more safety to walk except area no.7   | - The width of the area is wide enough for a traffic except for area no.7 which is narrow and has too many obstacles.<br>- The surface of pavement are all smooth, no level   | - The tropical plants are the important element which makes the walkways appeal people to walk along and create the tropical   |

| Types of Sub-Areas of Pattaya Beach Road Public Space                      | The Quality Criteria for Good Design of Public Space   |  |  |
|--|--|--|--|
|  | Protection   | Comfort  | Enjoyment  |
| Promenade between the middle and the south of Pattaya                      | <ul style="list-style-type: none"> <li>- Lighting is installed along the area but still have some blind corner.</li> <li>- Plants provide shady area but cannot protect users from bad weather</li> </ul>  | <ul style="list-style-type: none"> <li>changed too much</li> <li>- The areas are lacking of the elements which support the other uses such as seating area, street furniture, etc.</li> </ul>  | <ul style="list-style-type: none"> <li>atmosphere.</li> <li>- The walkways have a simple format which is not complicated in pattern or shape.</li> </ul>   |
| <b>3.Memorial Place</b><br>- Area No.6<br>Royal Varuna Yatch Club Memorial | <ul style="list-style-type: none"> <li>- The area of the memorial place is clearly divided from the road with the existing walls, but in the walkways has no fences or barriers to protect users.</li> <li>- The area is an open space that provides the possibility of seeing and makes users feel more safety</li> <li>- The area is lack of the shelter or the sky cover elements.</li> </ul> | <ul style="list-style-type: none"> <li>-The area can be easily accessed from the walkways on the public space, but there is no transition space between the opposite sides of the road.</li> <li>- The secondary seating in the area is the main element that promotes the use of the space.</li> <li>- The wooden terrace is contributing to lean or stand and take a sightseeing.</li> </ul> | <ul style="list-style-type: none"> <li>- The physical character of the area is different from the other parts of public space, which was designed to use the variety of the materials and shapes.</li> <li>- The size of the area is consistent with the human scale, not too large but might be too narrow when there has the heavy usage.</li> </ul> |

Table 3: Conclusion of the analysis the physical design of Pattaya beach road public space in accordance to the quality criteria for the good design of public space.

## 6. Conclusion

This research analyses the results of an investigation in Pattaya Beach Road Public Space, Pattaya Bay, Chonburi Province, Thailand into the tourists and local citizens' aspirations for different types of beach road public space that related to the social functions and user's activity. The results will serve in the improvement of urban public space for making the public space become the place for people who come to use in many activities and be related to the characteristics of urban context which will contribute urban greenery system planning in Pattaya city.

In case of Pattaya beach road public space, the quantity of use and the limitation of the number and several of activities are caused by the spatial condition which could not respond to the real need of users. Some activities are taken in the wrong places like people and tourists are standing and waiting to get in the tourism speedboat on the paving. Some place and elements of public space are properly unused and inattentive while some other are over capacity, like Plaza at North Pattaya where's no good access to use, Pedestrian and another plaza that have a lot of people and no place to take a seat or place for take an ocean view to enjoy the moment, and also lack of the space for doing exercise and other recreations.

By the analysis also found that there have many factors which influence the uses of the public space, like the surroundings activities in the context of Pattaya Bay which are different from the North Pattaya to South Pattaya. The north Pattaya is the accommodation zone, The Middle is the mix-used district between the accommodations, bars and commercial stores, and in the south Pattaya is the most active nightlife entertainment district. Moreover, there have the physical landscape design elements such as the good accessibility, the beautiful scenery from the ocean and sunset view, the shading from the plants and trees that make the properly climate, the appropriate dimension of space which have a lot of potential for making people to come and use, and also the elements that makes the people being secured like the lights, the security cameras, and the police boxes.

### **Design Recommendations**

The brief description of design and amenity changes recommended to improve the quality of settings as a place for people to use and enjoy in Pattaya Beach Road Public Space are:

1. Quantitatively, the public space should be provided the space and well distributed in each cluster or zone of the surrounding buildings in appropriate size needed and suitable the density of users and population, such as the sitting area, the place for taking an ocean view and the walking corridor (plus jogging trail and bicycle lane)
2. The functions of the space for each activity should be re-arranged and distributed in term of the privacy and avoid the disturbance from the different activities.
3. In case of the microclimate is very hot, it should be more vegetation and canopy for shading the area and cover the user from the rain, especially in the Plazas.
4. Night lighting is the important element that should be added more in the public space, especially in the blind corners and along the promenade.
5. The transition space at the both ends of the beach road public space should be designed for making the good and continuous access and giving some elements to approach people.

## References

Ali Madanipour. (1996). "Design of Urban Space: an inquiry into socio-spatial process". United States of America: John Wiley & Son: 148

Aldo Aymonino, Valerio Paolo Mosco. (2006). Contemporary Public Space Unvolumetric Architecture. Italy: Skira Editore.

Cerasella Crăciun, Maria Bostenaru Dan. (2014). Planning and Designing Sustainable and Resilient Landscapes. United States of America: Springer.

Clare Cooper Marcus, Carolyn Francis. (1998). PEOPLE PLACES Design Guideline for Urban Open Space. United States of America: Van Nostrand Reinhold.

Jan Gehl. (1988). Life Between Buildings: Using Public Space. United States of America: Van Nostrand Reinhold.

Nicha Muninnimit. (2012). A Post Occupancy Evaluation of Landscape in General Hospital: A Case Study of Sena Hospital, Sena, Ayutthaya. Thesis of master degree program in landscape architecture. Silpakorn University, Thailand

Stephen Carr, Mark Francis, Leanne G. Rivlin and Andrew M. Stone. (1993). Public Space (Cambridge Series in Environment and Behavior). United States of America: Paperback.

Turid Horgen, Sheila Sheridan. (1996). "Post-occupancy evaluation of facilities: a participatory approach to programming and design". In Facilities, Vol. 14 Issue: 7/8. Pp.16-25. Accessed 12 November 2015. Available from <http://www.emeraldinsight.com>.

Whyte, W. (1980). The Social Life of Small Urban Space, United States of America: Project for Public Space Inc.

Wolfgang F.E. Preiser, Harvey Z. Rabinowitz and Edward T. White. (1988). Post-Occupancy Evaluation. United States of America: Van Nostrand Reinhold.

**Contact email:** akharaponbb@gmail.com, thanyakaset\_a@silpakorn.edu