Aquatic Cities in the Central Plain of Thailand: Study of Urban Form and Maps of 1960

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ABSTRACT

This paper presents a study of cities located on floodable topography in the Central Plain of Thailand. These cities were once called aquatic cities, Bangkok was also known as the "Venice of the East" due to its extraordinary relationship with water. The study will analyses the transitional period of change from water-based to land-based cities using the surveyed and published maps in city's scale that were generated for the first time in Thailand in 1960. The paper will therefore explain the particular identity and characters of these water-based cities through urban form, size and articulation between water and land.

Keywords: *aquatic city, identity, central plain of Thailand, urban form , 1960's maps*

This study is a part of a research concerning city center maps of Thailand in 1960[i]. The original maps were published by the former Department of Municipal Public Works (current Department of Public Works and Town& Country Planning). The research is based on an analysis of maps published at that time of seventy cities. These series of maps were surveyed and published for the first time to scale for other provincial cities in the country. Other city centers were rarely surveyed and studied, except Bangkok and some big cities. (see figure 1)

RESEARCH QUESTIONS

An aquatic city's outstanding character is a water-based settlement. With a resourcefulness of its relationship with water, the aquatic city is obviously different from a "hydraulic city". Dutch cities are often hydraulic cities where water is controlled and manipulated by dikes, sluices, locks, windmills, pipes and reservoirs. In contrast, aquatic cities exist with and not against the forces of nature. They have neither the mechanisms nor the need to control water. They only adapt to natural hydrology[ii].

Cities in the Central Plain of Thailand were aquatic with their subtle characters and relationships with water. With floods and low topographies, settlements could adapt to water and create a unique way of living for centuries. It was not until the beginning of 20th century that these cities were progressively changed to land-based developments.

The series of maps in 1960 presents the new relationships of city, water and roads. Maps made to scale that are generally found and studied are mostly maps of Bangkok. Since the founding of the capital in the 18th century, Bangkok clearly illustrates the aquatic character by which water structured the capital through a network of rivers and canals. On the other hand, the maps of other cities have not been studied. This paper will then present an analysis of other cities in the Central Plain through the study of urban form in order to understand the their aquatic characters, whether similar or different from Bangkok's

Figure 1:
Example of original map of the city of Ang Thong
Source: Department of Public Works and Town& Country planning

The research questions are:

- What do the other cities look like through the study of urban form and what are their aquatic characteristics?
- What is the relationship of roads, which were the new intervention, to these aquatic cities?

RESEARCH METHODOLOGY

The methodology of selection for this study was made by analyzing the maps made to scale. Then the selection of the cities was made by considering the relation and the connection of cities to rivers and canals. The twenty cities chosen are located on the four main rivers of the Central Plain of Thailand; the Chao Phraya, Tha Chin, Mae Klong and Bang Pakong and their connected branch rivers.

An analysis of the maps was made by superposing the squares in many sizes to study the form of these cities and also to note the size of the cities. The original maps represented the cities in different scales but all are published in A3 format, the study then adjusts all the cities to the same scale in order to compare and to analyze.

After the study and analysis, the classification of these cities in term of form, size and composition of the city has been done in the map's illustration and matrix table.

INTRODUCTION OF THE TOPOGRAPHICAL CONTEXT

The Central Plain of Thailand is a flat, low lying delta. This flood plain consists of young fluvial, brackish and marine deposits. The major rivers of the delta are the Chao Phraya river and its distributaries, and the Tha Chin river. The plain's water system is also connected with two other rivers, the Mae Klong in the west and the Bang Pakong in the east[iii]. Water flows from the northern mountainous region to the Gulf of Thailand in the south by passing through the Chao Phraya river and the Tha Chin river.

Every year during the rainy season (mid of May to mid of October)[iv], the Central Plain is regularly flooded, depending on the frequency of monsoons and amount of water from the heavy rains. Water flowing from the north accumulates along the small water courses to the Chao Phraya river and the Tha Chin river in the lower part of the plain. The advantage of the abundant rain from the monsoon historically creates the fertile agricultural lands on this flood plain. The cities on the plain have all been connected through a river and canal system.

Because the delta has virtually no slope, water cannot immediately drain away but accumulates steadily. Life for man is hard in such an "amphibious" environment[v].

BRIEF SITUATION IN THAILAND AROUND 1960

After the termination of the World War II, Thailand was proposed by the FAO (Food and Agriculture Organization) for a loan from the World Bank to resolve the world's famine problem as a food producer. Thailand then considered implementing "The Great Chao Phraya Scheme". This scheme was based on a plan proposed in the beginning of 20th Century by the Dutch hydraulic engineers to install modern irrigation systems throughout the whole Central Plain. The construction of the Chao Phraya dam (1952-1957) was one of the first keystones to expand the irrigation area in the Central plain.

In the 1960's, the cities and infrastructures rapidly switched from water-based to land-based in order to support the country's policy as a world agricultural exporter. The government started the first national economic plan in 1961-1966, which emphasized the construction of new infrastructures. Road networks and modern irrigation systems such as dams, irrigation canals and equipment were constructed in order to support the export agri-business Water and agricultural systems were also changed from traditional to modern ones. This was the transitional period that later became the Green Revolution in the Central Plain of Thailand. The construction of highways has gradually progressed, Highway Number 1 was constructed northward from Bangkok. The highway passed Ayutthaya, Saraburi and reached Lopburi in 1950.

In 1961, the First National Economic Plan had drastically influenced all of the country's development. Before 1960, Thailand had experienced poverty and lack of basic infrastructures. As part of this first plan, the policy of "… new 1,000 kilometers highways and standardized existing roads for 1,000 kilometers…" was implemented. The policy solely emphasized economic development. Therefore the new construction of supporting infrastructures for the country's agri-exporter role was rapidly completed. To assure adequate water for expansive plantations, two big dams were effectively constructed, Bhumibol dam in 1964 and Sirikit dam in 1975. Located in the upstream river in the Northern Region, these dams control 22% of all water in the Chao Phraya delta.

Due to the implementation of first national economic plan, the country's investment was for infrastructures. Later national economic plans, during second and third plan (1967-1971/ 1972-1976), had continued developing the infrastructure and began an intensive exploitation of country's natural resources to improve the economy.

AQUATIC CITIES FROM THE MAPS

All of the selected cities are located along the rivers and they are all connected by rivers and canals. The city located in the North of the Central Plain is the city of Nakorn Sawan, at the confluence of the rivers from Northern region. The Chao Phraya river which is the main artery of the Central Plain starts from this city and runs southward through the cities of Uthaithani, Chai Nat, Singburi and Ang Thong. The Chao Phraya river joins the Pasak river and the Lopburi river at the city of Ayutthaya. Then the river flows downstream through the cities of Pathumthani, Nonthaburi, and the capital Bangkok. It then reaches the Gulf of Thailand just after the city of Samut Prakarn.

Tha Chin river runs parallel to the Chao Phraya southward where the cities of Suphanburi and Samut Sakorn are located on its banks. In the west, three cities are located along the Mae Klong river. The Tha Chin river and the Mae Klong river can be connected through canals at the lower part of the plain. In the east, the Bang Pakong river also connects to the Chao Phraya river through canals in the east-west direction.

The size of the cities on the Central Plain represents the importance of the cities in relation to their locations, Nakorn Sawan and Ayutthaya are bigger than the other cities due to their location at the confluence of the rivers. The size of Bangkok is extremely outstanding according to the map of 1960. (see figure 2)

Figure 2:
Map of the 20 cities on the Central Plain
Source: Extracted from 1960 maps and recomposed by Prin Jhearmaneechotechai

CHARACTER/ IDENTITY OF AQUATIC CITIES BY CLASSIFICATION

Group 1 (S)

Groups of small sized cities are located between the big cities along the river. The small cities are found continuously south of Nakorn Sawan to Bangkok on the Chao Phraya river. These small cities lay parallel to the rivers, and are located on one side or both sides of river. These cities are composed of the squares of 200 X 200 meters or smaller. The continuous block of squares created the shape of linear beads in single or double lines along the river.

If a canal joins the river perpendicularly, there are linear beads along the canal. This perpendicular shape of blocks can also be found along a road that bridges the river. Most of the cities' forms are basically linear, indicated by these small beads of squares, but at the city's center, such as a government centre or market areas, the size of squares are bigger. These civic facilities are also found along the road in the form of T-shapes, these are found where the main road cuts the river perpendicularly.

The small city's mean length along the river is less than 2 kilometers and the mean width, which is located perpendicular to river, of the city's block is not wider than 400 meters. These small cities have one or two strips; a strip is designated by the road of areas leading away from the river's bank

By putting the various sizes of squares on the cities, the results showed that the small houses dispersed along the river or canals have the mean size of 20X20 meters. The 50X50 meters and 100X100 meters squares can be put on the densely grouped houses. The bigger squares can be found where Buddhist temples are located, normally in the center of communities. The sizes of temples are about 100 to 200 meters and are generally bigger than the communities' squares.

The biggest square that can be put on this group is 200X200 meters maximum (150X150 meters found in some cities), these squares are located around the city's center. The city's center is composed of several buildings: government offices or departments such as provincial hall, provincial court, governor's residence and government officer's residence, police station, post office, school and small prison.

The relationship of the government area to the city can be found in three patterns; First the government area is superposed on the linear existing city, secondly the government area is extended and connected to the existing city along the river, or third the government area is located on the opposite side of the river and is connected by bridges and roads from other areas. (see Figure 3)

Group 2 (M)

Cities in this group are bigger than the first group. It is obvious that these cities are located on the other rivers and distributaries other than the Chao Phraya river. Three cities are found on the Mae Klong river; Kanchanaburi on the upstream, Ratchaburi in the middle and Samut Songkram at the mouth of the river where it enters into the Gulf of Thailand. Nakorn Nayok and Chachoengsao are on the banks of the Bang Pakong river. It is also found that Suphanburi, Lopburi and Saraburi are located at the confluence of the river around the city of Ayutthaya, halfway between Bangkok and Nakornsawan.

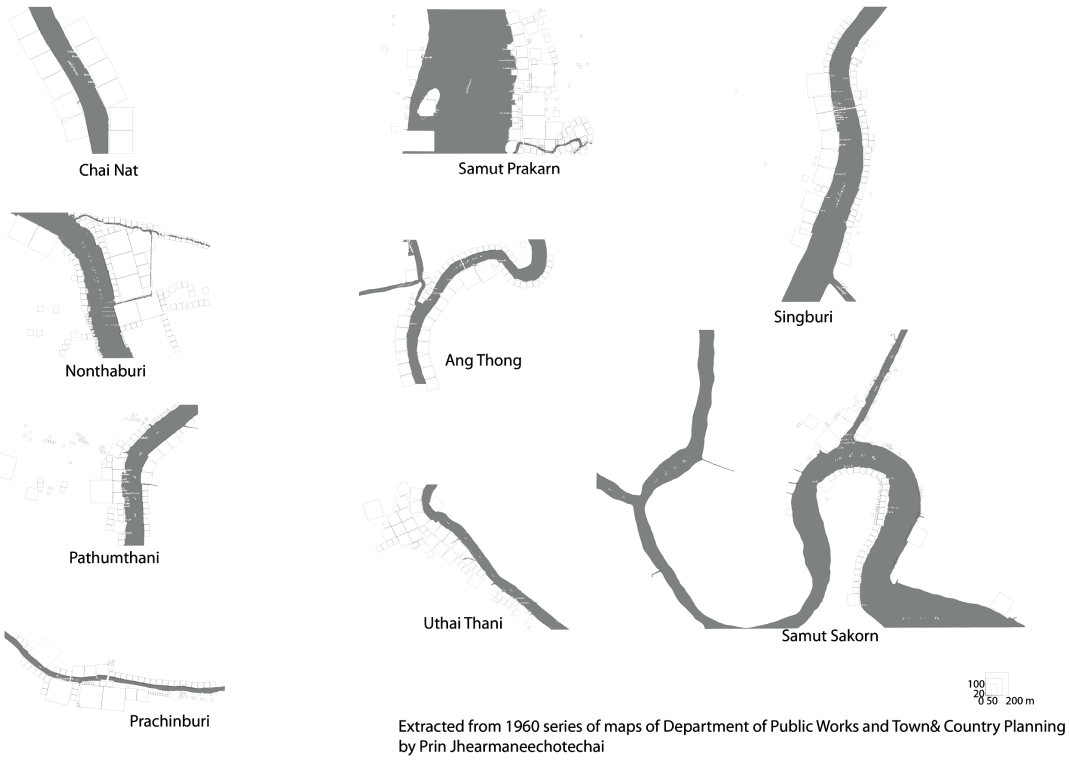

Figure 3:
Group of small cities (S), extracted from 1960 maps

The medium cities have similar characteristics as the small cities, basically a composition of small squares of 20X20 meters which are dispersed along the river. The group of squares of 50X50 meters and 100X100 meters are found in dense communities around Buddhist temples.

The cities in this group are apparently longer or wider than the first group. The sizes of the squares which can be superposed on these cities are 300X300 meters and 400X 400 meters. The length of cities in this group varies from 1.5 kilometers to 4.5 kilometers. The number of strips is two to five strips near the river banks. The characteristics of these cities can be categorized as medium cities by three aspects: the length of the city is longer than 2 kilometers, the width of the city from the river bank must be wider than 200 meters (from 300 to 400 meters) and the number of strips must be more than two. The criteria of the city in this group must match at least two of the three aspects.

Even though the mean width of the cities in this group is 400 meters, the city of Lopburi is an excepion with the biggest square of 600X600 meters. This is because the city center of Lopburi is obviously shaped by the historic moat. It is also found that most of these cities have military camps which are evident in the city's center (see Figure 4)

Group 3 (L)

There are two cities in this group both of which express outstanding characteristics of an aquatic city. The city of Ayutthaya was known as the water-based city from the 14th to 18th century and was the capital of Siam (former Thailand). Surrounded by rivers, the city as an island.

By putting three squares of a one kilometer on the city, Ayutthaya formed horizontal rectangles. The length of city along the river is around 11.6 kilometers and the city is created from the composition of squares of 20, 50, 100, 150, 200, 500 and 1,000 meters. The blocks on the city's riverfront are square sizes of 20X20, 50X50 and 100X100 meters. Small block sizes of 20X20 and 50X50 meters overlay the communities located on the opposite river bank of the city.

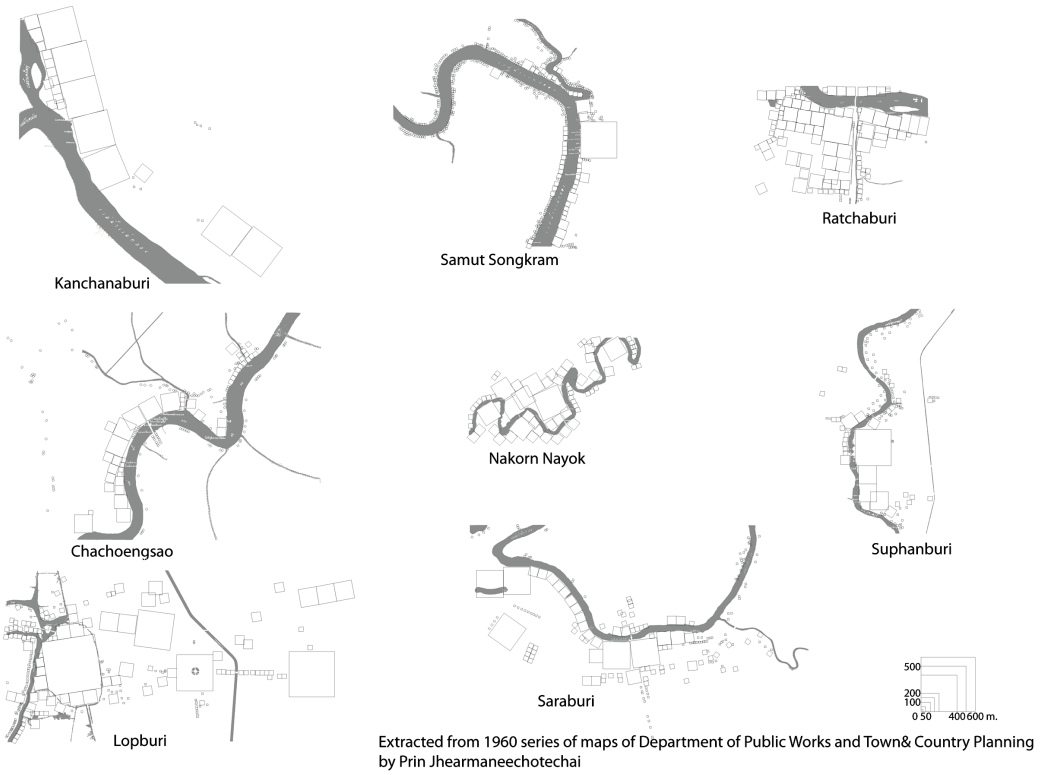

Figure 4:
Group of medium cities (M), extracted from 1960 maps

The second is Nakorn Sawan where the confluence of the Chao Phraya river starts. This city is dispersed along the river of Ping on the upper part and the river of Nan on the lower part. With the city's length of 7.6 kilometers, Nakorn Sawan formed a particular long ribbon on the rivers.

It has to be noted that many raft-houses are densely indicated on the map at the confluence and along the two rivers. The natural flow of rivers creates many shallow sandbars in the rivers. The raft-houses can dock and moor on these sandbars. These groups of raft-houses are composed of small but dense squares of 20X20.

Nakorn Sawan can be divided in three areas; residential and commercial areas, the government center area and a military area.The residential and commercial areas are where the two rivers join and the city is located. The waterfront of this area is attached directly to sandbars. The 2 kilometers length of the linear raft-houses along the river Nan is clearly designated on the map. The blocks 150X150 meters, indicate a variety of structures along the Nan river banks, that of temples, rice mills and sawmills. On the banks of Ping river, the city lays parallel to the river. The temples of this area are not directly attached to waterfront.

The government area is located on the west side of the Dechatiwong bridge where the city's length is divided into half by this bridge. The squares of 150X150 and 200X200 meters can be superimposed on area. Also a strip is created by a road which runs parallel behind these blocks. This area is composed of these functions: a Provincial hall, the court, the financial department, the land department, a police station, schools and prisons.

The last area is the military area which is the biggest area composed of square sizes of 500X500 and 200X200 meters creating a particular compact form. This military area can be accessed only by a road from Bangkok and it is isolated from other areas on the opposite side of the river with no connection to the river. Many communities and temples are found opposite this military area on the other bank of the river. The temples of 150X150 meters and the continuous communities of 50X50 and 20X20 meters along the river can obviously be seen.

These two cities are located at strategic locations along the Chao Phraya river. Their relation of city to water is obviously different: Ayutthaya, an island surrounded by water, Nakorn Sawan the organic ribbon city along the river. (see Figure 5)

Group 4 (XL)

Brief Situation of Bangkok since the foundation of the capital to 1960

Since being formed as the capital in 1782 on the east bank of the Chao Phraya river., Bangkok has been connected to water. She was called "The Venice of the East" by foreigners when sighting the abundance of canals. The many manuscripts written by the foreigners describes of an images of an aquatic city and its cityscape of continuous vegetation.

All of the vegetation and agricultural areas were developed by the creation of the water network. From the Ayutthaya period[1] until mid 19th century, the objective of excavating canals was to connect Bangkok with the other cities. With the founding of Bangkok, the canal excavations were under the king's command to facilitate transportation along the river or between the rivers. Until the end of 19th century to the beginning of 20th century, the excavations were executed by the elites and noblemen as private business projects.

To the west, on the opposite bank of the Chao Phraya river, the old capital Thon Buri is located. The area was full of orchards and Khlong networks.[2]

Between 1906-1941, roads were gradually constructed in both Bangkok and Thon Buri, but they served only the cities. Therefore the transportation between the cities was still by rivers, canals or by trains. It was not until 1950, that the first trans-regional road, Phet Kasem road, was constructed in Thonburi to connect Bangkok to western and southern provinces. This road has

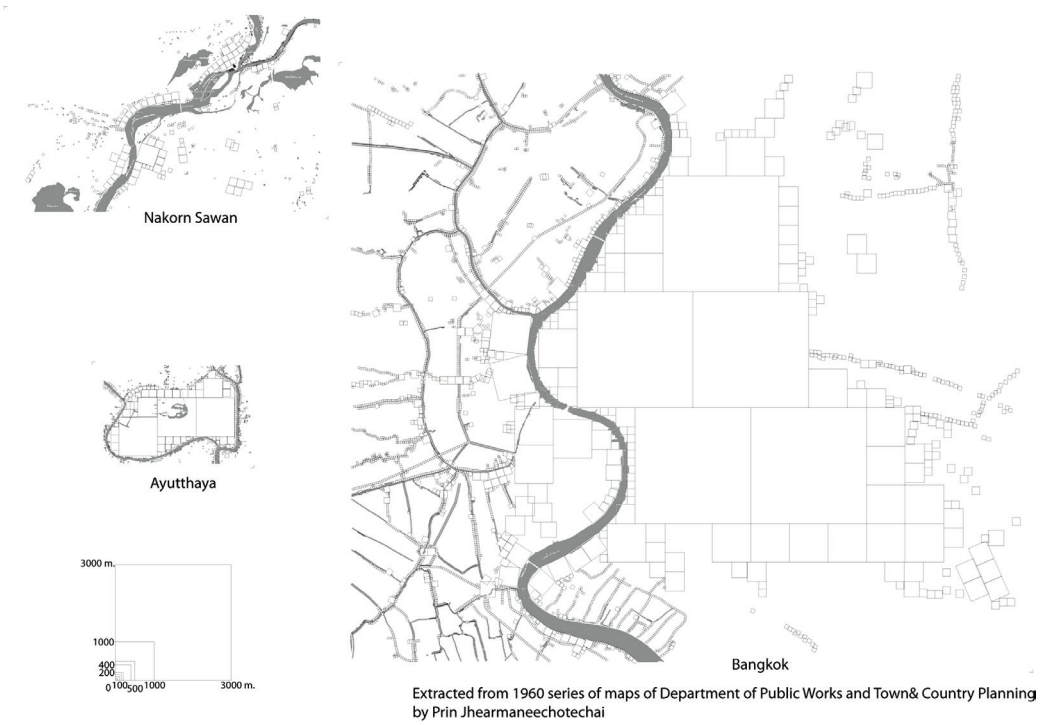

Figure 5:
Group of large cities (L) and extra large city (XL), extracted from 1960 maps

1 Ayutthaya Period, 1350-1767 means old capital of Siam

2 Khlong means canal in Thai

brought an immense change in the development of new urban settlements, a change from water based communities to land based ones that located along the road. It has to be noted that the population of Bangkok at that time was 1.78 million peoples (1956[3]).

In the late 1950s Bangkok was still a relatively compact city. After the accession to power through the 1957 coup, Field Marshal Sarit Thanarat was committed to a program of economic and social development. The aim was to unify against the danger of communism and to advance modernization. Following the USA strategy to cultivate Thailand as the bastion of anti-communism in the region, more military aid, technical support and development funding were requested by Sarit's government. The establishment of National Economic Development Board (NEDB) in 1958 and the Board of Investment (BOI) had boosted industrial growth, foreign investment and diversification in the national economy.

According to Sarit's basic understanding of what was needed, one of the first pilot programs and planning for Bangkok to become a "modern city" was developed. As part of this plan clearing some of the major slums, reducing street begging and sending the increasing flood of rural-urban migrants back to the country side were considered. Therefore the development plan for the Bangkok metropolis was set as The Greater Bangkok Plan 2533 (C.E. 1990), developed by the American consultant team Litchfield Whiting Bowne & Associates in 1960. Their aim was to establish land-use zoning and direction of urban growth for the Bangkok by 1990[vi].

At the time of Litchfield's study, Bangkok had already made the transition to an automobile and road-based city in place of the water-based infrastructure. The number of private cars in the municipalities of Bangkok and Thon Buri increased by over 650 per cent in a decade (1947-1957) representing 87 per cent of all private cars in the country[vii].

By 1960 a large number of major and minor canals had already been filled in and roads constructed in their place. The significance of Khlongs was acknowledged by the Litchfield as disposal of sewage, drains of storm water and fire protection[viii].

Bangkok from the 1960 map

There is an obvious difference between the two banks of the Chao Phraya river, Phra Nakorn on the east side and Thonburi on the west side.

Phra Nakorn is composed of squares 3X3 kilometers, which run northward, eastward and southward. Since the founding of the capital in 1782, these are the directions in which the city expanded. The mixture of communities, government areas and private areas are alternately found along the riverfront from north to south, with continuous squares relating to the water and roads. The squares of 200X200 and 500X500 meters can be put on the city center's riverfront, on Rattanakosin island as the historic center in the east, the block size of 50X50 and 100X100 meters can be put on the riverfront next to the this historic center. On the southern part, there are small communities of size 50X50 meters which run continuously along the network of canals. This area is where the mixture of orchards, canals and communities are found with the temples of 100X100 meters as the center of these communities.

Thonburi is created contrarily to Phra Nakorn on the east bank is smaller, but looks fluid. The squares of 1X1 kilometer can be put on the old city of Thonburi, opposite Rattanakosin center. This creates the linear shape composed from squares size of 1 kilometer along the river. A group of compact squares forms the bigger area around which continues from the Buddhayodfa bridge to the Wongwienyai round-about. This is the only area of Thonburi where a large and compact area is found. The rest of the areas on the west side are noted for forming a continuous linear shape of small beads covering the whole plain. The form of the beads is shaped by the character of waterways. These are the natural and organic lines along the natural canals and the geometric or straight form along the excavated canals. The squares of 50x50 meters are mostly found along the main canals and are of 20X20 meters along the sub canals. At the intersection of canals, the bigger squares of 100X100 and 200X200 meters are found. Temples are also dominant along the waterway with the size of 100, 150 and 200 meters.

The road network found in Thonburi is composed of small squares of 20X20 and 50X50 meters

[3] Statistic sector, Department of Provincial administration and center of Bangkok's information: http://203.155.220.230/m.info/bangkokforyou/d_rattanagosin.html.

which are the new settlements along both sides of the roads, with the sharp and straight cut unlike the organic forms of traditional communities along canals. The roads found on the map are parallel to Chao Phraya in the north-south direction, these are the Charansanitwong road on the north and Suksawasdi road on the south. There is only Phet Kasem road (highway) which runs from the center of Wongwienyai to suburban areas in an east-west direction.(see Figure 5)

CONCLUSION

This paper studies the twenty cities in the Central Plain of Thailand from the 1960 maps which generates a better understanding of the aquatic cities. These cities were created by their relation to the water, which is represented through the organic and linear forms along the rivers. Unlike the hydraulic cities in the Netherlands that control the water, the aquatic cities were organically settled with the cities being shaped by the water. This study found that the common characteristic of these cities is the uncertain edge or limits. Their communities and temples are dispersed continuously along the rivers.

The images and locations of city centers on all of the maps are usually composed of government areas, and the residential and commercial areas. This paper can categorize the areas in the city into three relationships. First, the government area is superposed on the existing city or it creates another strip next to the riverfront by a road. Second, the government area is the extension of the existing city along the river. Third, the government area is located on another bank of river, with the two banks connected by a bridge. In the latter case the construction of the new government area on another bank of river is created by the new roads' network.

From the study, the roads' networks influence the aquatic cities in three ways. First, a road which runs parallel to the river creates direct accessibility to the existing waterfront strip, this waterfront can be accessed from both the river and the road from the back. Secondly, a road that runs perpendicular to river extends the city's area away from the river and links the inner area to the river. The last found that road networks which cut across the river to connect both sides has no association with the water

Among these twenty cities, four groups of cities are categorized as small cities (S), medium cities (M), large cities (L) and extra large city (XL) by the physical aspects as shown in the matrix table as the length of the city along the river, the width of the city, the size of squares and the number of area's strips from the river bank.

This paper presents the images of aquatic cities of Thailand during 1960, a remarkable period of transitional change of these aquatic cities to land-based cities. The maps of these aquatic cities, illustrated in this paper, can be used as a basic inventory and can be the inspiration for city planning to reconsider the strong connections of city and water.

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SUMMARY OF THE CITIES FROM 1960 MAPS

City name	Type	City area on bank of river	City's Length along river	City's width from river bank	Composition of blocks	Number of strips perpendicular to river	remarks
Chai Nat	S	Both	1.2 km.	200 m.	200	1	
Nonthaburi	S	Both	1.4 km.	400 m.	20/50/200	2	
Pathumthani	S	Both	1.5 km.	300 m.	20/50/100/200	2	
Prachinburi	S	Both	2 km.	250 m.	20/50/100/200	2	
Samut Prakarn	S	Both	1.4 km.	300 m.	20/50/100/150/200	2	
Angthong	S	Both	2 km.	150 m.	50/100/150	2	
Uthaithani	S	Single	1.6 km.	300 m.	50/100/150	2	
Singburi	S	Both	2 km.	200 m.	20/50/100/150/200	2	
Samut Sakorn	S	Both	1.8+1 km.	150 m.	20/50/100/150	1	*
Nakorn Nayok	M	Both	3.8 km.	300 m.	50/100/200/300	2	
Ratchaburi	M	Both	1.5 km.	350 m.	20/50/100/150/300	3	
Kanchanaburi	M	Single	2.3 km.	400 m.	20/100/150/400	2	
Chachoengsao	M	Both	3.7 km.	200 m.	20/50/100/150/200	3	
Samut Songkram	M	Both	4.5 km.	400 m.	20/50/100/400	2	
Saraburi	M	Both	4 km.	300 m.	20/50/100/150/300	3	
Suphanburi	M	Both	3.5 km.	400 m.	20/50/100/150/200/400	2	
Lopburi	M	Both	2.1 km.	700 m.	20/50/100/150/600	5	**
Nakorn Sawan	L	Both	7.6 km.	700 m.	20/50/100/150/200/500	4	
Ayutthaya	L	Both	11.6 km.	1800 m.	20/50/100/150/200/500/1000	6	***
Bangkok	XL	Both	33 km.	8000 m.	20/50/100/150/200/400/500/1000/3000	10	****
Ramarks:	* City connects from river to perpendicular canal ** City composed of Historic city in Ayutthaya period and new part as military city *** City is surrounded by rivers as an island **** Bangkok is composed of two cities, Pranakorn on the East and Thonburi on the West side						