

Typology and Life Style Analysis of the Raft House (Ruan Pae) in Riverine Settlements in Thailand*

การจำแนกประเภทและการวิเคราะห์วิถีชีวิตของเรือนแพในการตั้งถิ่นฐานริมน้ำในประเทศไทย

Chaweewan Denpaiboon¹, Mamoru Tohiguchi², Hiroyuki Matsuda³, and Seiyu Hashimoto⁴

ฉวีวรรณ เด่นไพบูลย์ มะโมะรุ โตะฮิกุจิ ฮิโรยุกิ มัตสึดะ และเซยู ฮะชิโมะโตะ

¹ Ph.D. Eng., Dept. of Housing and Human Settlement Studies, the National Housing Authority

² Professor, Dr., Dept. of Environmental Design and Architecture, Tottori Univ. of Environmental Studies

³ Dr. Eng., Dept. of Engineering, Kinki Univ.

⁴ Dept. of Global Environment Engineering, Graduate School of Engineering, Kyoto Univ.

Abstract

This paper describes two areas concerning raft houses in Thailand for the purpose of (1) the classification of the raft house typology, measured by field surveys and mapping, and (2) the study of the way of life of the inhabitants and their satisfaction towards living in the raft houses, as well as the conditions of the raft house settlements, as researched by questionnaires and in-depth interviews. This study encompasses three subareas of study including (1) the physical features of the raft houses, (2) the way of living in them, and (3) the coexistence of the inhabitants, water and land. It is found that: (1) the typological features are varied by location, function and life style, (2) the conditions of the inhabitants in the raft houses are insecure for today's living, (3) the existence of the raft house communities depends on the coexistence of the environments of water and mankind.

บทคัดย่อ

บทความนี้นำเสนอการศึกษาเรือนแพในประเทศไทย โดยมีวัตถุประสงค์หลัก 2 ประการ ได้แก่ 1) เพื่อจำแนกประเภทเรือนแพ ด้วยการสำรวจภาคสนามและจัดทำแผนที่การตั้งถิ่นฐานเรือนแพ และ 2) เพื่อศึกษาวิถีชีวิตของชาวแพและความพึงพอใจต่อการอยู่อาศัยในเรือนแพไปพร้อม ๆ กับศึกษาสภาวะการณ์ในปัจจุบันของการตั้งถิ่นฐานเรือนแพ จากแบบสอบถามและการสัมภาษณ์ สำหรับวัตถุประสงค์ของมี 3 ประการ เพื่อศึกษา 1) ลักษณะโครงสร้างทางกายภาพของเรือนแพ 2) วิถีชีวิตในเรือนแพ และ 3) การอยู่อาศัยร่วมกันระหว่างชาวแพกับสภาพแวดล้อมของพื้นที่น้ำและพื้นที่บก การศึกษานี้ได้พบว่า 1) เรือนแพแตกต่างกันตามสภาพที่ตั้ง บทบาทหน้าที่ใช้สอยของแพ และวิถีชีวิตของชาวแพ 2) ในสภาวะการณ์ปัจจุบันการอยู่อาศัยในเรือนแพขาดความมั่นคงปลอดภัย และ 3) การคงอยู่ของสภาพชุมชนชาวแพนั้น ยังคงอาศัยพื้นฐานของการอยู่ร่วมกันระหว่างสภาพแวดล้อมของน้ำและมนุษย์

* This article was originally published in *Journal of Architecture, Planning and Environmental Engineering*, 533, (July, 2000), 173-180.

This new version has been re-edited by JARS editorial board.

Keywords (คำสำคัญ)

Raft House (เรือนแพ)

Typology (การจำแนกประเภท)

Life Style (วิถีชีวิต)

Aquatic Inhabitants and Coexistence (ผู้อยู่อาศัยบนพื้นที่น้ำและการอยู่ร่วมกันกับน้ำ)

1. Introduction

Nowadays, the number of raft house settlements in Thailand is quite small. Although the raft house life style was very popular in the past, especially during the Ayutthaya and Rattanakosin periods, it has gradually disappeared now. According to Panin [1], raft houses existed in 8 provinces [2]. In Bangkok, the raft house settlements have disappeared since 1945. In Chachoengsao province, at the present time, there are only 4 raft houses left, all registered as ancient buildings by the Department of Fine Arts. In Ayutthaya province, now there are only approximately 20 raft houses left. In Phitsanulok province, the raft house settlements have to be evacuated to land based residential quarters by the end of 1999 [3,4]. However, the raft houses in Uthaitхани and Kanchanaburi provinces are not affected. In Kanchanaburi, the raft houses have been renovated to become resorts and restaurants to promote tourism. The raft house settlements for fishery purposes are also found in Nongbualampoo and Lampoon provinces.

With these facts in mind, It is the authors' aim to build up the body of knowledge related to the raft houses as evidence for the new generations, and as an overview of aquatic habitation in Thailand, which has evolved over 300 years. The problem that there is nothing except a few comments on the raft houses in Thailand available, will finally be overcome.

1.1 Objectives of the Study

The aim of this study is to seek definitions and typology of the raft houses to clarify their characteristics and roles in water settlements. The

study also reveals the typical life styles of the raft house inhabitants, which are positioned between water-based and land-based development, and how they have evolved through the modernization of Thailand.

1.2 Methodology

This study is comprised of field surveys and individual interviews of 75 households in Phitsanulok and 120 households in Uthaitхани, where most of the primary data were collected during 1995-1997, and observation surveys in Chachoengsao, Ayutthaya and Kanchanaburi. Also, in-depth interviews were used to obtain detailed data from the raft house inhabitants with respect to their life style satisfaction, living conditions, and degree of environmental pollution.

1.3 Literature Review

Very little literature is devoted to raft houses in Thailand. There are only two studies and two theses. The first study is "Raft House in Uthaitхани and Phitsanalok Provinces" by Thammasat University in 1970s [5]. It is a quantitative survey, i.e. comparison of the socio-economic characteristics of the inhabitants in raft houses of Uthaitхани and Phitsanulok. The second study named "Living Condition of the Inhabitants in Phitsanulok Province" [6] followed up Thammasat University's study in 1978. It focuses on socio-economic characteristics of the inhabitants, connections with the urban communities, relationships of the inhabitants in the raft house community, attitudes of the inhabitants in the raft houses, and housing problems and demands of the inhabitants. Regarding the two theses, the first one is "Raft Houses in Paed Rew, 1978" by R. Sinsatid [7].

The study covers the physical characteristics and designs. The second one is “Waterfront Dwelling in the Lower Part of the Chao Phraya Delta: Case Study of Klong Bangkuwiang” by T. Tachakitkachorn [8]. The study centers on the physical structures of waterfront houses that affect the existence of the waterfront society. It is found that three factors: spatial use of waterfront, canal networks, and gardens, are closely related. The literature reviews make a number of significant points which respond to the gap identified in this study between the socio-economic aspects and the physical designs of water based dwellings.

2. Typological Analysis of the Raft House

The field studies reveal that raft houses have various styles and designs. However, they seem to have common components especially building structures, materials, and building functions. That is why it is necessary to summarize raft houses by definition, raft style, location, and function in order to understand that the role of raft houses is still in

existence in Thailand. These topics will be discussed in part two and three.

2.1 Definitions

There are various definitions of a raft house as follows.

1) In general terms, it is defined by the Royal Institute’s Dictionary [9] from two Thai words, “Ruan” and “Pae.” Ruan means house or residential building and Pae means raft. Thus, it could mean:

- a) A house on the water, and
- b) Several logs tied together as a raft on the water

2) During the Rattanakosin period, it is defined as “a house set up on a raft on the water” [10].

3) It is defined by an expert in traditional Thai house, Ruethai Chaichongrak [11], as “a shop house which can float on the water, move around, and can be used for living and sleeping.”

However, in authors’ opinion, the raft house (Ruan Pae) should mean a building in traditional Thai architectural style located on a raft structure on the water. (see Figure1)

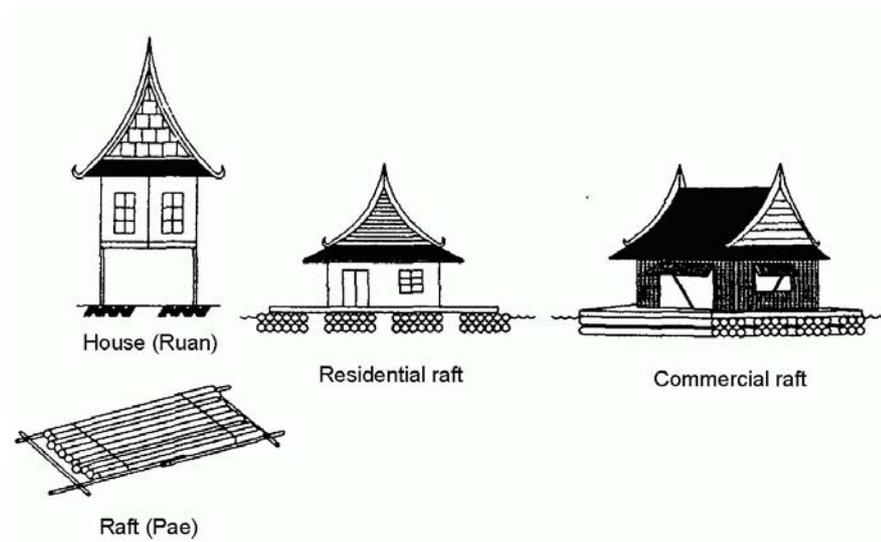


Figure 1 Typology of the raft house

2.2 Architectural Typology of the Raft House

Raft houses in different locations have been built using various kinds of material and techniques. The surveys reveal that the raft houses can be categorized by their components: roofs, walls, and foundations, as follows (see Figure 2).

Figure 2 Architectural features of the raft house

	Feature	Characteristic	Picture	Material Use	Size (m.)	Still remains	Remark
House Style Typologies	Traditional THAI house : "Single gable roof" style	RUEAN THAI : "RUEAN KREUNG SUB"		Galvanized iron Corrugated sheet the roof ornament has a "PANLOM"	3x9x3.5 (WxLxH)	Ayuthaya, Chachoengsao and "NGAO"	0.50 m. wide of walk way
	Traditional THAI house : "double gable roof" style	RUEAN THAI : "RUEAN KREUNG SUB"		Galvanized iron Corrugated sheet the roof pitch of Chachoengsao will be lower of Ayuthaya	3x9x3.5 (2)	Ayuthaya, Chachoengsao	-
	Traditional THAI house : "Tribble gable roof" style	RUEAN THAI : "RUEAN KREUNG SUB"		Galvanized iron Corrugated sheet	3x9x3.5 (3)	Uthaithani	-
	THAI house : "Punya roof or Malila roof" style	RUEAN THAI : "RUEAN KREUNG SUB"		Galvanized iron, Corrugated sheet	-	Uthaithani, Phitsanulok	-
	Typical THAI house : "THATCH roof and single house"	RUEAN THAI : "RUEAN KREUNG SUB"		Galvanized iron Corrugated sheet	-	Uthaithani	-
	Typical THAI house	RUEAN THAI : "RUEAN KREUNG POOK"		Plan leave	-	Kanchanaburi	-
Wall Style Typologies	Partition Wall	"Sai Bao" or "Pakon"		Wooden	-	Ayuthaya	-
	Timber Wall	Timber sheet		Wooden	-	Uthaithani Phitsanulok Kanchanaburi Ayuthaya	-
	Typical Wall	Weaven bamboo or corrugated sheet		Weaven bamboo or corrugated sheet	-	Kanchanaburi Phitsanulok Uthaithani	-
Floor	Normal Floors	Normal Floors		Hard wood, Teak wood Floors have made of teak or hard wood	3x9 per house	Every place use	-
	Foundation Style Typologies	Traditional Style	Luffa shape Bamboo raft		Bamboo tree 50 bamboos tied together per 1 set	3-5 sets per house	Phitsanulok Uthaithani Kanchanaburi
Traditional Style		Boat		Hard wood	2 boats	Now out of use	-
Traditional Style		Pontoon		Wooden and concreat this type was developed for life long use	(2x12x12)x3 or (1.5x8x1.2)x5	Chachoengsao Ayuthaya	-
Modern Style		Steel sheet Pontoon		Steel sheet This type was developed for supporting heavy weight	3-6 sheet per Building	Kanchanaburi	Restaurant Recreation Building
Modern Style		Steel barrel		Empty steel barrel This type was developed for low income family	6 empty steel barrels	Phitsanulok	-

Remarks: Characteristics of Thai House (Ruan Thai) in the central part are categorized into 2 types: "Ruan Kreung Sub", a house made of wooden structure, and "Ruan Kreung Pook", a hut or a house made of bamboo structure.

- 1) Roof Style is categorized into 3 styles:
 - a) *Traditional Roof Style* that consists of single gable, double gable, and triple gable
 - b) *Punya (Hip) or Manila Roof*
 - c) *Thai Vernacular Style*, roof is made of different materials such as galvanized iron, corrugated sheet, palm leaves, and so on, in particular area. However, the most favorite materials are corrugated sheet and galvanized iron due to their stability and durability. Also, the light-weight material will not make the raft swing.
- 2) Wall Type is categorized into 2 types:
 - a) *Traditional Wall Type*, named “Sai Bua” or “Pakon” in Thai, is prefabricated wall made of hard wood.
 - b) *Local Type* is traditionally made of wood or woven bamboo skin. The modern material like corrugated sheet can also be seen.
- 3) Foundation of Raft (Pae) is categorized into 4 types:
 - a) *Luffa-shaped Raft (Pae Look Baob)*. A luffa-shaped raft house sits on 3-5 sets of 50 or so bamboo stems tied up together. It is popular in locations that have normal flow of watercourse, i.e. Ayutthaya, Kanchanaburi, Phitsanulok and Uthai Thani.
 - b) *Rectangular Pontoon* has been used for a long time in Ayutthaya and Chachoengsao communities. It is normally made of hard wood with keel inside like that of a

boat and smeared with resin. However, the modern day pontoon is made of concrete with steel lining and wood planks with sealant. A normal raft house needs 2-3 pontoons, or 3-5 pontoons for larger ones.

- c) *Steel Sheet Pontoon* has been developed to meet special requirement of heavy loaded rafts such as the ones used for travelling or special purpose such as discotheque in Kanchanaburi, and
- d) *Empty Steel Barrel*, steel barrel has recently been used to substitute luffa-shaped raft structure. It is popularly used by low-income families in Phitsanulok community because it is cheap and durable.

3. Functional Typology of the Raft House

In general, a raft house has limited space, arranged for residential, commercial, fishery, and recreational purposes as shop-room, bedroom, living room, kitchen and toilet. However, bathroom is not necessary as most inhabitants take baths in the river. The front entrance with a panel wall used for protection from the rain and sunlight, is opened to the river. Also, the household may be enlarged by adding kitchen for storing things under the bedroom gable.

The results of the surveys can conclude that functions of the modern raft houses may be classified into 4 types as follows (see Figure 3).

1) Residential

In this case, the raft houses are built for the purpose of living only. The size of the family crucially affects the style of the raft house, i.e. a single family usually lives in a single raft house. When the family expands, the raft house can be extended to 2 or 3 raft houses, and combined into a group. Residential raft houses were commonly found in the past in Bangkok and regional areas.

2) Shop-house

Commercial raft houses were very popular since the watercourse was the main thoroughfare in the past.

3) Fishery

The raft houses have served fishermen very well from the past up to the present time. However, there are some illegal fishing rafts on the reservoir in Kanchanaburi and newly opened areas, i.e. Nongbualumpoo and Mae Ping River in Lamphoon.

4) Commercial and Recreation

The most practical function of the raft houses nowadays is for commercial and recreational use. Tourists can enjoy the river cruise on the raft houses especially in Kanchanaburi. However, all tourist raft houses must acquire permissions that suit their purposes, either being restaurants, resorts or discotheques.

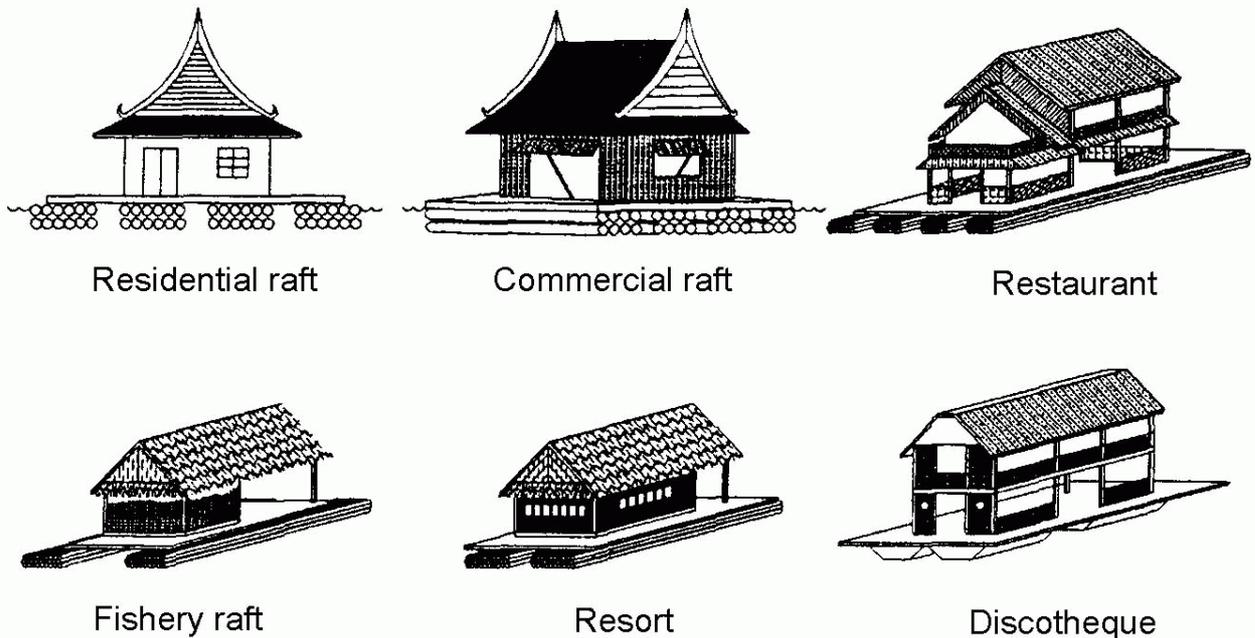


Figure 3 Functional typology of the raft house

4. Current Status of Raft House Settlements: Case Study in Phitsanulok and Uthaithani Provinces

Thailand population in 1998 was 60.8 millions [12]. In Bangkok, the population was 6.3 times and 17 times larger than those of Phitsanulok and Uthaithani, respectively. Although population in the raft house settlements is quite small, compared to the population as a whole, the average raft house density (3.3-4 persons per house) in 1998 was similar to the average density of the whole kingdom (see Figure 4). In our study, we chose to compare the characteristics of the raft house settlements in Phitsanulok and Uthaithani [13].

4.1 Characteristics of the Raft House

Uthaithani was behind Phitsanulok in many ways. In 1994 figures, population and population density in Uthaithani was significantly lower than those in Phitsanulok. In terms of urbanization, the percentage of urban population in Phitsanulok was 21% while in Uthaithani, it was only 15% in 1990. Phitsanulok also exceeded Uthaithani in daily traffic (see Figure 5).

Figure 4 Populations and number of houses in 1998

	Population	No. Of Houses	Person per House
Whole Kingdom	60,816,227	15,495,755	3.9
Bangkok ¹	5,604,772	810,530	6.9
Phitsanulok ¹	865,408	222,407	3.9
Uthaithani ¹	328,978	83,919	3.9
Raft House Settlement ²			
• Phitsanulok	1,029	259	3.9
• Uthaithani	846	250	3.3
• Kanchanaburi ³	1,000	750	4.0
• Ayutthaya	100	20	5.0
• Chachoengsao ⁴	8	4	2.0

Source:

1. Department of Local Administration Office in 1998
2. Survey by the research team in 1995-1997
3. 500 raft houses are resorts, 250 raft houses are residential.
4. Raft houses in Chachoengsao province are listed buildings by Dept. of Fine Arts.

Figure 5 Populations of Uthaihani and Phitsanulok provinces compared to the whole country

	Uthaihani	Phitsanulok	Whole Country
Population in 1994 (person)	307,798	795,187	56,961,030
Population Density (person/km ²)	45.7	73.5	111.0
Urban Population in 1990 (person)	36,563	151,232	-
<i>Percentage of urban to total population*</i>	14.21 %	19.51 %	-
Urban Population in 2000 (person)	43,496	182,013	-
<i>Percentage of urban to total population*</i>	15.14 %	21.07 %	-
Daily Traffic Avenue in 1989	14,121	91,318	7,882,908
<i>Increase ration base on 1985</i>	13.07 %	38.24 %	54.58 %

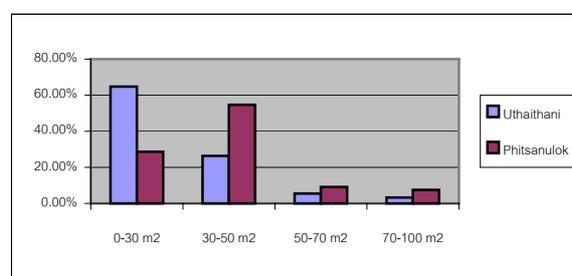
* BMA = 100%

Source: Office of the National Economic and Social Development Board "National Urban Development Policy Framework– Final Report." Vol.1 (Joint NESDB/UNDP/TDRI)

As the results of field surveys, we find the difference in the size of the house. The average area of a house in Uthaihani is 26 m², while it is 40 m² in Phitsanulok (see Figure 6). Figure 7 to Figure 10 show the distribution and typical plans of the raft houses in both Uthaihani and Phitsanulok. They show that most of the raft houses are moored in front of vegetative backyard along the riverbanks. The floor plan in Figure 9 shows that some raft houses own fishing baskets. In Phitsanulok, more raft houses are gathering near the marketplace. They are mainly residential and commercial raft houses.

Figure 6 Raft house size

	Uthaihani (%)	Phitsanulok (%)
0-30 m ²	64.8	28.7
30-50 m ²	26.4	54.7
50-70 m ²	5.5	9.1
70-100 m ²	3.3	7.5
	Uthaihani (m²)	Phitsanulok (m²)
Average size	26	40



Source: Survey by the research team during 1995-1997

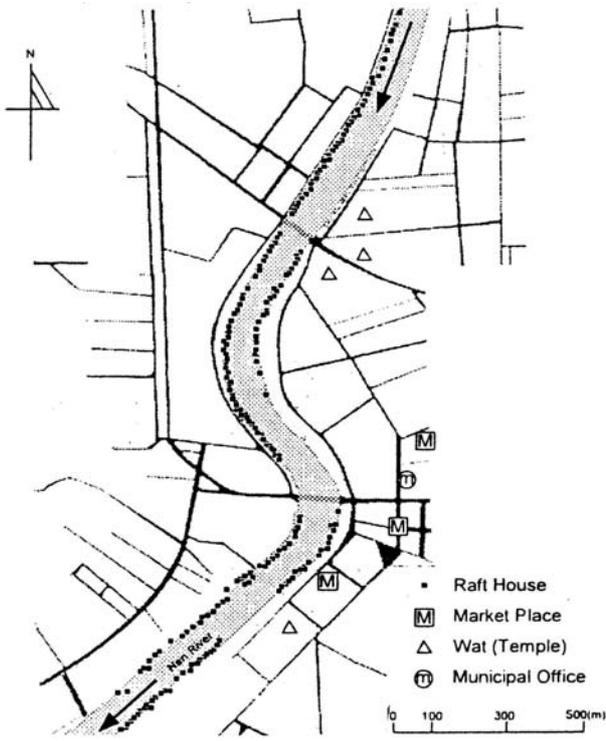


Figure 7 Location of raft house settlements along Nan river in Phitsanulok province

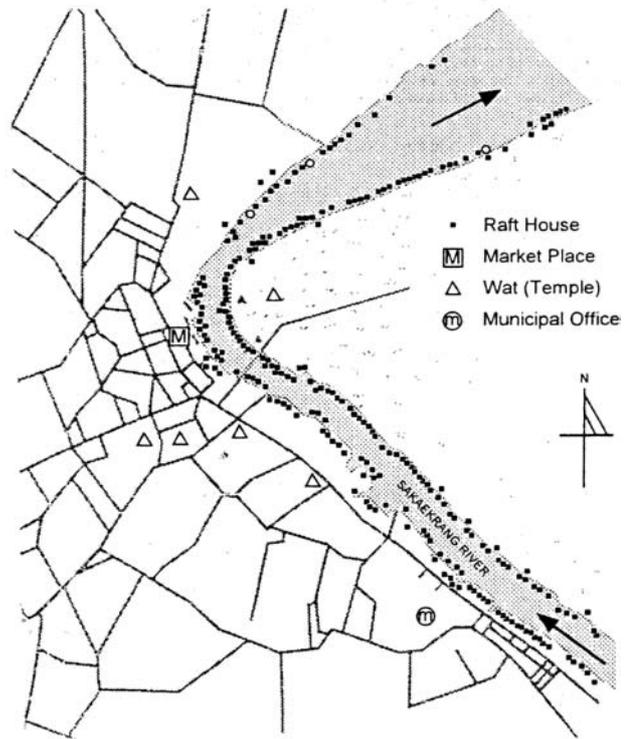


Figure 8 Location of raft house settlements along Sakaekrang river in Uthaithani province

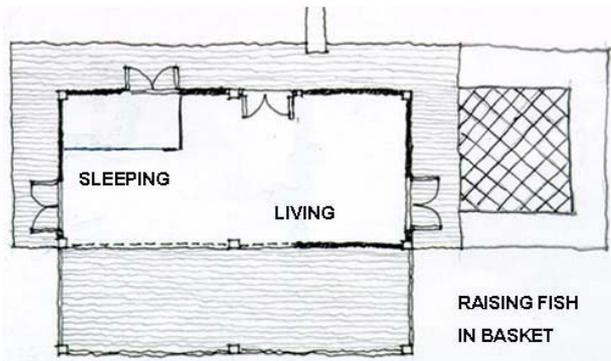


Figure 9 Fisherman/farmer house in Uthaithani

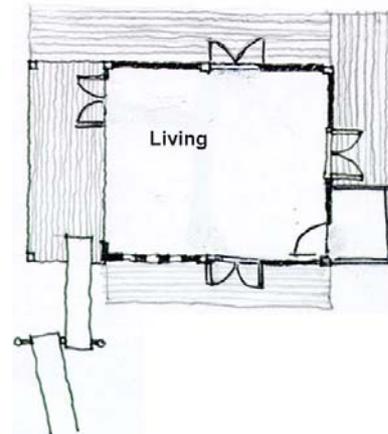


Figure 10 Worker's raft house in Phitsanulok

4.2 Characteristics of the Raft Inhabitants

The results of surveys of 120 households, 846 inhabitants in Uthaithani and 75 households, 1,029 inhabitants in Phitsanulok indicate that most of them own their houses (see Figure 11).

Figure 11 House ownership status

Ownership	Uthaithani (%)	Phitsanulok (%)
Owner	97.2	88.0
Rental	1.8	12.0
<i>Total</i>	100.0	100.0

Source: Survey by the research team during 1995-1997

The average household income (2-person earning) was about 4,500 baht/month in Uthaithani in 1995, and 6,783 baht/month in Phitsanulok in 1996 (see Figure 12). As shown in Figure 13, the common occupation of inhabitants was merchant, but the figure in Uthaithani was much less than that in Phitsanulok. There were mainly two-generation family, each had family members of three to four, which was smaller than the average of the whole kingdom (see Figure 14 and Figure 15).

Figure 12 Monthly income of interviewees

Monthly Income	Interviewee's Income ¹		Monthly Household Income (1996) ²	
	Uthaithani	Phitsanulok	Northern	Whole Kingdom
	(%)	(%)	Region (%)	(%)
0 –2,999 Bht.	35.8	5.0	22.3	15.5
3,000 – 4,999 Bht.	33.7	40.0	33.7	22.3
5,000 – 9,999 Bht.	22.1	37.5	32.1	31.3
10,000 Bht. and more	8.4	17.5	11.9	30.9

Source: 1. Survey by the research team during 1995-1997

2. 1996 Household Socio-Economic Survey, National Statistic Office

Figure 13 Occupational status

Occupation	Uthaithani (%)	Phitsanulok (%)
Fisherman	16.1	3.2
Farmer	0.8	0.0
Production and Technical Worker	1.8	5.3
Office and Service Worker	1.8	12.8
Merchant (trader)	33.9	72.3
Self-employed Worker	13.4	2.2
Unemployed	5.4	4.2
Others	26.8	0.0
<i>Total</i>	100.0	100.0

Source: Survey by the research team during 1995-1997

Figure 14 Family types

Family types	Uthaithani (%)	Phitsanulok (%)
Single	12.9	20.0
Childless Couple	2.6	10.0
Two-generation Family	62.1	57.1
Three-generation Family	14.7	7.1
Extended Family (brothers and sisters)	4.3	2.9
Extended Family (relatives and others)	3.4	2.9
<i>Total</i>	100.0	100.0

Source: Survey explored by the research team during 1995-1997

Figure 15 Number of the family members

	Uthaithani ¹ (%)	Phitsanulok ¹ (%)	Northern Region ² (%)	Whole Kingdom ² (%)
One to Two	19.3	29.1	17.3	16.2
Three to Four	49.1	38.0	50.8	42.2
Five to Six	25.4	22.8	24.3	28.7
more than Seven	6.1	10.1	7.6	12.9

Source: 1. Survey by the research team during 1995-1997

2. 1990 Population and Housing Census, National Satatistic Office

Moreover, concerns of the inhabitants towards environments and water resources, i.e. for drinking and other uses were different between Uthaithani and Phitsanulok as shown in Figure 16 and Figure 17. Dealing with rubbish and garbage from the houses, the inhabitants in Uthaithani showed higher concerns than those in Phitsanulok by dumping rubbish or garbage in containers on a specific date.

Figure 16 Disposals of rubbish and garbage

	Uthaithani (%)	Phitsanulok (%)
Always dump in the river	0.9	6.3
In the river sometimes	4.3	34.2
In container	37.1	50.6
In container on a specific date	57.8	8.9

Source: Survey explored by the research team during 1995-1997

On the preference of social context, Phitsanulok got high points in the following items: “invite my friends to my house”, “limit neighborhood relationships” and “enjoy success at work.” While Uthaithani was higher in the following items: “spending money for convenience”, “challenge of new innovations”, “pride in my country”, “goal of my life is to get promotion” and “water environment.” The results indicate that most of the inhabitants in Phitsanulok tend to have sociability and mercenary motives while those in Uthaithani tend to have conservative mind as well as sense of community and water environment (see Figure 18).

Figure 17 Water usage by function

Type of water use	Uthaiythani (%)				Phitsanulok (%)			
	A	B	C	D	A	B	C	D
1. Drinking	3.0	55.4	5.9	35.6	6.0	26.0	9.3	58.7
2. Cooking	13.7	38.9	28.4	18.9	48.1	7.6	10.1	34.2
3. Utensil washing	94.6	1.1	4.3	0.0	86.0	0.0	12.7	1.3
4. Clothes washing	95.3	1.2	3.5	0.0	97.5	0.0	2.5	0.0
5. Face washing/tooth brushing	87.1	6.5	6.5	0.0	79.7	2.5	15.2	2.6
6. Bathing	93.6	6.4	0.0	0.0	92.4	1.3	6.3	0.0
7. Toilet	96.7	3.3	0.0	0.0	98.7	0.0	1.3	0.0

Remarks: A = River, B = Rain, C = Tap, D = Bought

Source: Survey explored by the research team during 1995-1997

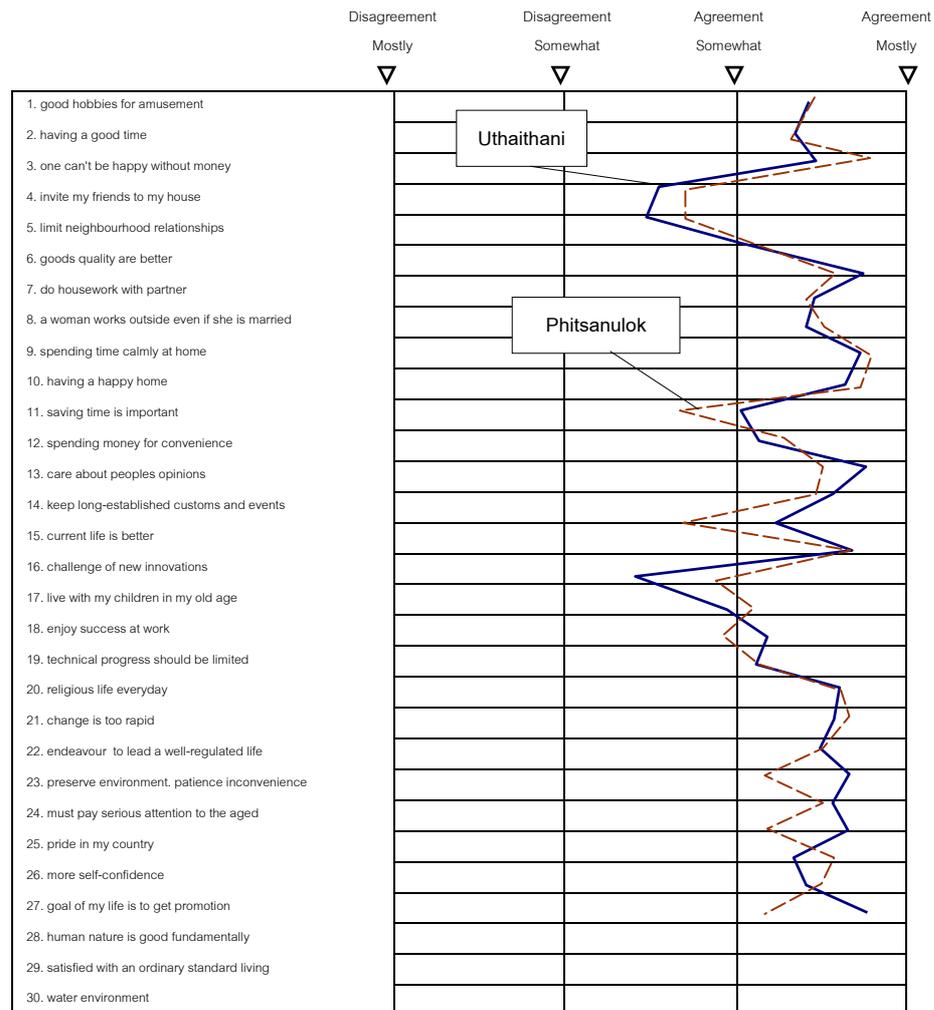
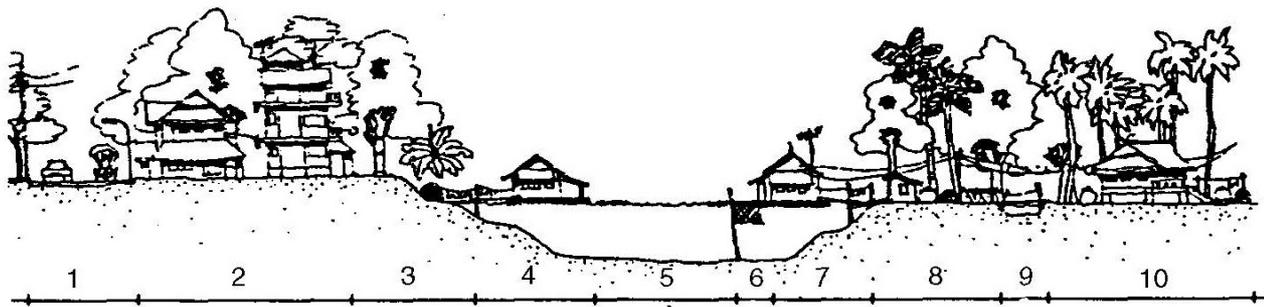
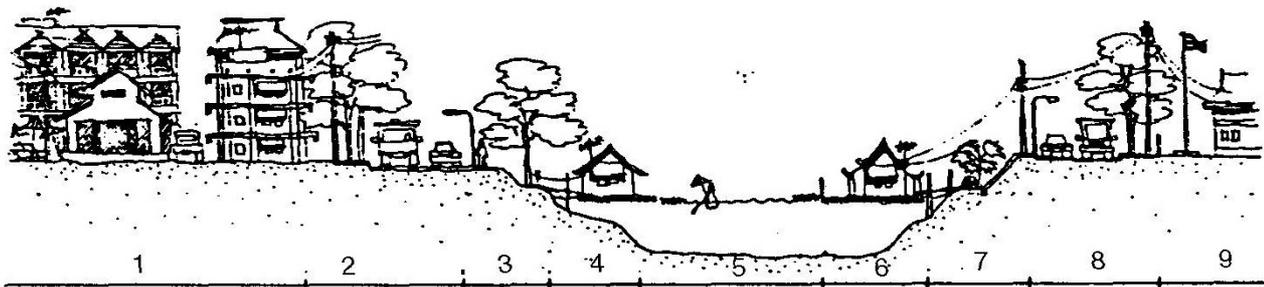


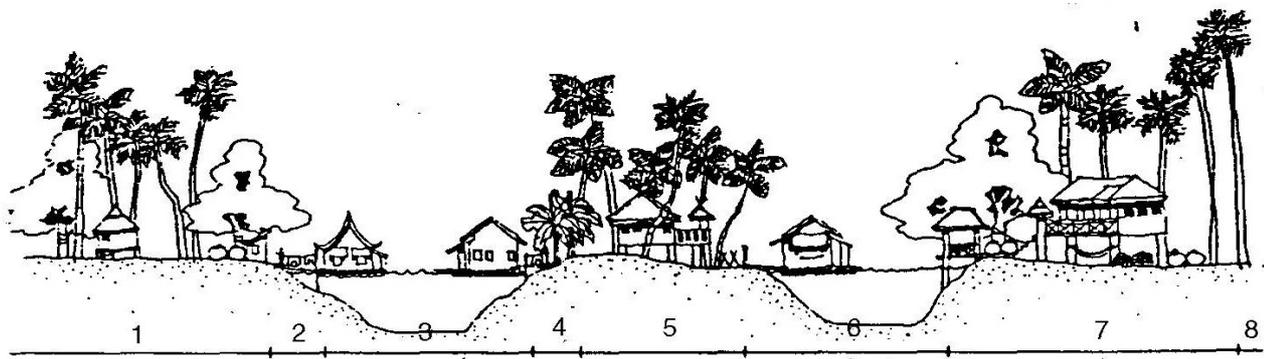
Figure 18 Preference in social contexts



(a)



(b)



(c)

Figure 19 Characteristics of watercourse and land based development in raft house community in (a) Uthaithani, (b) Phitsanulok, and (c) Kanchanaburi

5. Coexistence of Mankind, Water and Land

In this part, the relationship among watercourse, land and raft houses, and inhabitants' life style of the raft house communities in Uthaithani, Phitsanulok and Kanchanaburi, where observation surveys have been conducted, will be analyzed (see Figure 19).

5.1 Uthaithani

In August 1995, the research team went to survey a raft house community situated in a semi-urban-rural area in Uthaithani, 219 km. north of Bangkok. Most inhabitants are agriculturists, mostly farmers and fishermen, as well as traders. Figure 19a shows the coexistence of inhabitants of the raft

houses, watercourse and land on both sides of Sakaekrang river. The raft houses are moored at the front of the marketplace, which is the center of the community. The other side of the river is used mainly for agriculture without any sign of civilization. The numbers indicated in the figure show:

- 1) A road in urban area
- 2) A marketplace and shophouses at the center of the community where agricultural products are traded
- 3) The slopes of the riverbank on both sides are not very high or steep. Therefore, the inhabitants can build a long bridge to connect their raft houses to the land.
- 4) Raft houses are moored in the river. The inhabitants use the watercourse for many purposes, for example, watering their plots of vegetative backyards, fishing and commercial activities.
- 5) Sakaekrang river is the travelling route for the inhabitants to the town.
- 6) Fishing with a Krachang, a rectangular woven basket
- 7) Raft houses on the other side of the river with land lots near the houses for plantation. The inhabitants might also establish fish farms for additional income.
- 8) Small fruit gardens along the riverside owned by the people living in the land beyond.
- 9) A ditch, or Khu in Thai, is used as a conduit to bring water to the inner land for agriculture.
- 10) Houses built on land in the fruit gardens.

The inhabitants of the raft houses treat the water and the environment well by keeping them clean. Garbage and waste have to be collected and dumped thoughtfully to preserve a pleasant environment. Consequently, the inhabitants could cultivate water vegetables and fish farming. The community's close relationship with the water environment is the significant factor for a strong community.

5.2 Phitsanulok

Surveyed in 1996, the raft house community in Phitsanulok, 377 km. north of Bangkok, is located in an urban district. The raft house settlement starts from Wat Prasri Rattana Mahathat (Wat Yai) to the tail end of the marketplace, which is very close to the commercial centers and governmental offices. As a result, the good locations where inhabitants can be easily connected to the land based community are very densely occupied. It is because most inhabitants are employees, workers and vendors. Figure 19b describes the coexistence of the inhabitants of the raft houses, watercourse and land on both sides of Nan river. The numbers indicated in the figure show:

- 1) Marketplaces, commercial areas and shophouses are the neighbouring vicinity.
- 2) A road along the river that is connected to the main roads
- 3) Riverbank is very steep, 20 m. in height. It is very difficult to climb up and down in summer when the tide is very low. However, the riverbanks area can be utilized as plantation in ladder's rung fashion.
- 4) Raft houses on the west of Nan river

- 5) Nan river nowadays has limited its role to a thoroughfare for travelling.
- 6) Raft houses on the east of Nan river
- 7) The riverbank. Again, the inhabitants use this space for farming, raising livestock, and laundry services to generate additional income.
- 8) A road along the river is connected to the main roads.
- 9) Schools and governmental offices

The inhabitants are still coexisting with the land and the watercourse eventhough the major coexistence areas and activities are mostly on the riverbanks.

5.3 Kanchanaburi

Kanchanaburi is 129 km. west of Bangkok. The raft houses in Muang and Sangklaburi districts were investigated, observed and interviewed. They are varied in functions and styles, mainly used for entertaining businesses such as resort, restaurant, discotheque, cruising and fishing. The raft houses in Muang district, however, have been widely used by the provincial tourism authority to promote tourism. Therefore, all of the rafts have to be registered to the local port authority. The raft houses in Sangklaburi district are mainly moored in Wang Wivakaram area near the Thai-Myanmar border. Most inhabitants are exiled Burmese squatters as well as Thais and Mons. They do fishing for a living. Figure 19c describes the coexistence of the inhabitants, watercourse and land in the raft house settlement located at Sam-pra-sob Delta where the Ranti stream converges with two

bigger streams, Bekli and Songkalia. The numbers indicated in the figure show:

- 1) Houses located on the hill
- 2) Small path connects the raft houses to the bank.
- 3) The raft houses for many purposes. Resort rafts, cruising rafts, and fishermen's rafts, used as fishing equipment storage, are settled around the delta.
- 4) Small path connects the raft houses to the bank.
- 5) Tourist resorts located on the hill
- 6) The raft houses located on another part of the hill
- 7) Tourist resorts located on the hill
- 8) A road

6. Conclusion

Raft houses, similar to other human settlements, form a water-based community with distinguish characteristics. The physical features of the raft houses are quite similar to those of the traditional Thai houses. There are many roof styles such as gable, manila or hip. Wall types are also varied. Originally they were made of different natural lightweight materials such as woven bamboo mats or screw pines. The wall can be made as a lifted up panel or a sliding partition wall, which can be removed and stored away. However, the major difference between the raft house and the traditional Thai house is the foundation. The raft house has no pillar. It sits on a raft that supports the whole weight of the house. There are two kinds of raft: Luffa-

shaped rafts and Rectangular pontoon. Moreover, the raft house structure is not tightly fixed together.

Economic aspects of the raft house are also analyzed. The inner part of the house is generally used for living and sleeping while the outer part is used as commercial space like a conventional shop-house with removable walls and panels.

Social features of the raft house are also revealed. The raft house community is based on self-reliance, sharing labour, affordability, sustainability and community cohesiveness. Moreover, inhabitants have closely associated with water. Watercourses are used for bathing, washing and watering plantations.

The study also finds the coexistence among the raft houses, water environment and urban-rural activities in various locations. In Uthaithani, due to the settlement of the raft houses in the semi urban-rural area, the inhabitants are still working in the agricultural fields. Daily activities such as agriculture, fishing, washing and transportation are closely related to water. That is the reason why inhabitants of the raft houses treat the environments and water resources carefully. In Phitsanulok, the location of the raft house settlement is in the urban area. The inhabitants have changed their life style to suit the environment. They are no longer working in agricultural sector. New careers such as general service worker or land-based vendor are more preferable. The raft house settlement is affected by this phenomenon. It is gradually disappearing to give way to urban modernization. The raft houses in Kanchanaburi have been widely utilized for tourism as tourist attractions. They are usually transformed into resorts, restaurants or discotheques. Therefore,

the coexistence between the raft houses, the watercourse and urban activities is relatively more complex than that in the rural area such as in Sangklaburi district. Squatters from many origins occupy and live in the raft houses. They are using the raft houses as safe houses and trying to keep the houses in good conditions.

Acknowledgements

This paper is a part of the research study from 1996-2001 in the topic "Transformation by Modernization of the Traditional Waterfront Settlements in the Context of their Coexistence with the Aquatic Environment: A Case study of Raft Houses and Pillar Houses in Thailand." The research is possible with a grant provided by the Japan Society for Promotion of Science and the National Research Council of Thailand. The authors also thank the National Housing Authority for its great help and Kinki University for data processing and tabulation.

References

- [1] Ornsiri Panin. (1995). Typical houses and villages. Bangkok: Silpakorn University.
- [2] The raft houses survive only in 8 provinces: Kampaengpetch, Phitsanulok, Uthaithani, Ayuthaya, Chachoengsao, Samutsakorn, Nakornpathom and Kanchanaburi. Recently, the authors rechecked and found that raft houses in Kampaengpetch, Samutsakorn and Nakornpathom had disappeared. However, they have been found in 2 other provinces, Nongbualampoo and Lampoon.
- [3] National Housing Authority. (1998). The relocation of raft house settlements in Phitsanulok. Bangkok.
- [4] The survey was conducted by students of Kinki University and the staff of the National Housing Authority during the year 1995 in Uthaithani, and was rechecked in the year 1997 in Phitsanulok and Uthaithani.
- [5] Faculty of Social Welfare. (1973). Research report on raft houses in Uthaithani and Phitsanulok province. Bangkok: Thammasat University.
- [6] Srisuwan Saengsiri. (1978). Living condition of residents in raft houses on Nan river. Phitsanulok: Srinakarinwirot University.
- [7] Rukthai Singasatid. (1978). Raft houses in Pad-Rew, MA. diss., Silpakorn University.
- [8] Terdsak Tachakitkachorn. (1998). Waterfront dwellings in the lower part of the Chao Phraya delta: Case study of Klong Bangkuwaing, Nonthaburi. Japan: Kobe University.
- [9] Royal Institute. (1982). Thai dictionary. Bangkok.
- [10] Viboon Leesuwan. (1978). Thai heritage. Bangkok: Panya publication.
- [11] Ruethai Chaichongrak. (1996). Traditional Thai houses of the central plain area (2nd ed.). Bangkok.
- [12] Local Administration Office. (1998). Population and housing in 1998 monthly report. Bangkok.
- [13] We chose these provinces because the characteristics are different in settlement locations, house sizes, inhabitants' life style and so on. Additionally, Uthaithani province was the first to introduce trash can in every household.