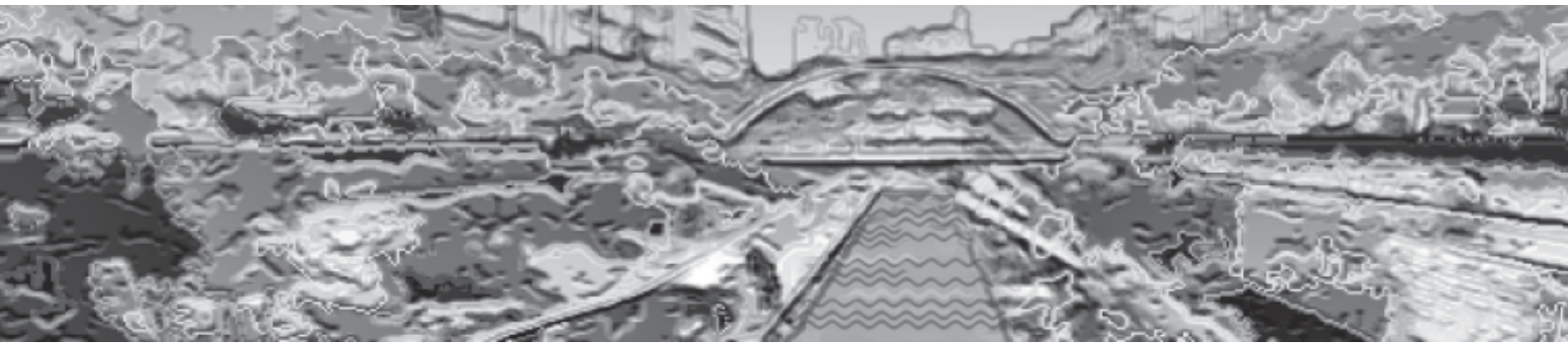
Water Transportation in Bangkok: Past, Present, and the Future
อดีต ปัจจุบัน และอนาคตของการคมนาคมขนส่งทางน้ำในกรุงเทพมหานคร

Moinul Hossain and Pawinee Iamtrakul, Ph.D.



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Abstract

Once, Bangkok was known to the world as the "Venice of the East." However, the role of water based transport has diminished gradually over the last few decades and has vastly been replaced by traditional land-based transportation system. Nowadays, most of the waterway networks have been paved over with roads and the existing water transport facilities along the Chao Phraya river and its canals in Bangkok. Moreover, the existing system lacks adequate accessibility, inter-modal linkages as well as safety. This research study intends to present an overview of this public transport system together with its role and characteristics. In addition, it also intends to recommend some measures to improve the transportation system along these canals in Bangkok and exhibits how the reincarnation of this mode of transport can leave the urban transportation planners with substantial alternatives to provide mobility when traffic congestion and safety issues still remain unsolved in Bangkok. The study provides insight to incorporate water transport within the mainstream of transportation planning and progress towards a sustainable integrate transportation system which can alleviate the existing congestion and safety problems and eventually pacify the transformation of Bangkok from the "Venice of East" towards the "Jungle of Concrete."

บทคัดย่อ

กรุงเทพมหานครเคยเป็นที่ประจักษ์แก่ชาวโลกในนามของ "เวนิสของตะวันออก" แต่ทว่าในปัจจุบันการขนส่งทางน้ำนั้นได้ถูกลบเลือนบทบาทไปจากสังคมไทยเป็นเวลาช้านาน เนื่องมาจากแม่น้ำและลำคลองซึ่งเคยทำหน้าที่เติมเต็มโครงข่ายคมนาคมขนส่งทางน้ำที่สำคัญได้ถูกถมและแทนที่ด้วยการพัฒนาระบบขนส่งทางบกเป็นถนนสายต่าง ๆ มากมาย โดยจะเห็นได้ว่าโครงข่ายที่ปราศจากการเชื่อมต่อกันอย่างเป็นระบบ และปัญหาด้านการบริการของระบบที่มีอยู่ในปัจจุบัน ไม่ว่าจะเป็นปัญหาทางด้านการเข้าถึงการเชื่อมต่อระหว่างการเดินทางประเภทต่าง ๆ ตลอดจนปัญหาทางด้านความปลอดภัย ล้วนเป็นปัจจัยสำคัญอันเป็นอุปสรรคต่อการพัฒนารูปแบบของการเดินทางประเภทนี้ จากประเด็นดังกล่าวทำให้การศึกษาวิจัยครั้งนี้ได้พยายามที่จะนำเสนอภาพรวมของลักษณะระบบการขนส่งทางน้ำที่ให้บริการอยู่โดยเฉพาะการขนส่งในคลอง โดยมุ่งเน้นที่จะเสนอแนะแนวทางในการพัฒนา เพื่อยกระดับระบบของการให้บริการอย่างสอดคล้องกับปัญหาที่มีอยู่ และจะเป็นอีกแนวทางหนึ่งซึ่งสามารถพลิกฟื้นสถานการณ์ที่เป็นอยู่ อีกทั้งยังเป็นอีกทางเลือกหนึ่งให้กับผู้ซึ่งทำงานด้านการผังเมืองและการขนส่งได้เล็งเห็นความสำคัญและมุ่งส่งเสริมให้เป็น

ทางเลือกของการพัฒนาด้านการขนส่งอย่างยั่งยืน ซึ่งทั้งนี้นอกจากจะช่วยให้เกิดความคล่องตัวของการจราจรทางบกแล้ว ยังช่วยลดปัญหาทางด้านความปลอดภัยในการเดินทางในสภาวการณ์ที่กรุงเทพมหานครกำลังประสบกับปัญหาการจราจรติดขัด และได้แปรสภาพเป็นป่าคอนกรีตอย่างที่เป็นอยู่ทุกวันนี้ได้อีกด้วย

Keywords (คำสำคัญ)

Bangkok (กรุงเทพมหานคร)
Water Transport (การขนส่งทางน้ำ)
Congestion (ปัญหาจราจรติดขัด)
Safety (ความปลอดภัย)
Sustainable Integrated Transportation System (ระบบบูรณาการทางด้านการขนส่งอย่างยั่งยืน)

1. Background of Water Transport in Bangkok

Bangkok was founded as capital of Thailand in 1782 by King Rama I. It was almost the same time, 1781 [1], when the Spanish Governor of California, Felipe de Neve, established the community known today as Los Angeles or "City of the Angels." Ironically the original name of Bangkok, "Krungthep" in Thai also means "Great City of the Angels." While the two angels' cities may or may not be able to maintain their 'angels' city' reputation, yet one similar mistake that Bangkok tends to follow is the automobile dependent transportation system development of Los Angeles. Conversely, Bangkok must try to avoid is to becoming the "Los Angeles of the East." On the contrary, if it is possible, Bangkok must try to regain her former reputation of "Venice of the East."

Once, perhaps too long ago for the young and new generation to realize, Bangkok used to be known as the "Venice of the East." Such pride and privilege has long perished due to the fact that the once dominating mode of city transport, the water based transport, has gradually lost its significant role to the road based transport system. Since the 20th Century, transport development in Bangkok witnessed a rapid transformation from water based transport to road based transport. Most of waterway networks have been paved over with roads, citing some widely known streets in the city like Silom Road, Sathorn Road, Sukhumvit Road, Phloenchit Road, for example. Since the ancient time, the Thais of Bangkok used to have their way of life around the river and canals [2]. In those days, people preferred to build their houses on stilts along the riverbanks and in boathouses as presented in Figure 1 and Figure 2, as mentioned by Sumet Jumsai, a leading and famous Thai architect.

Although today water transport in Bangkok still exists, it is mostly confined to the Chao Phraya River which runs through Bangkok and Thonburi (Figure 3), the twin city of Bangkok. The canals, to some extent, are still in use but they are merely a fraction of those that once criss-crossed the city. Nevertheless, the last left canals still offer the services to cater for transportation needs particularly for those who wish to travel faster than the existing public bus services. Also to some, especially those who are living along these canals, this alternative water mode of transport still remains significant.

Figure 1. Floating houses in Bangkok. [3]

Figure 2. Living along the watercourse in Bangkok. [4]

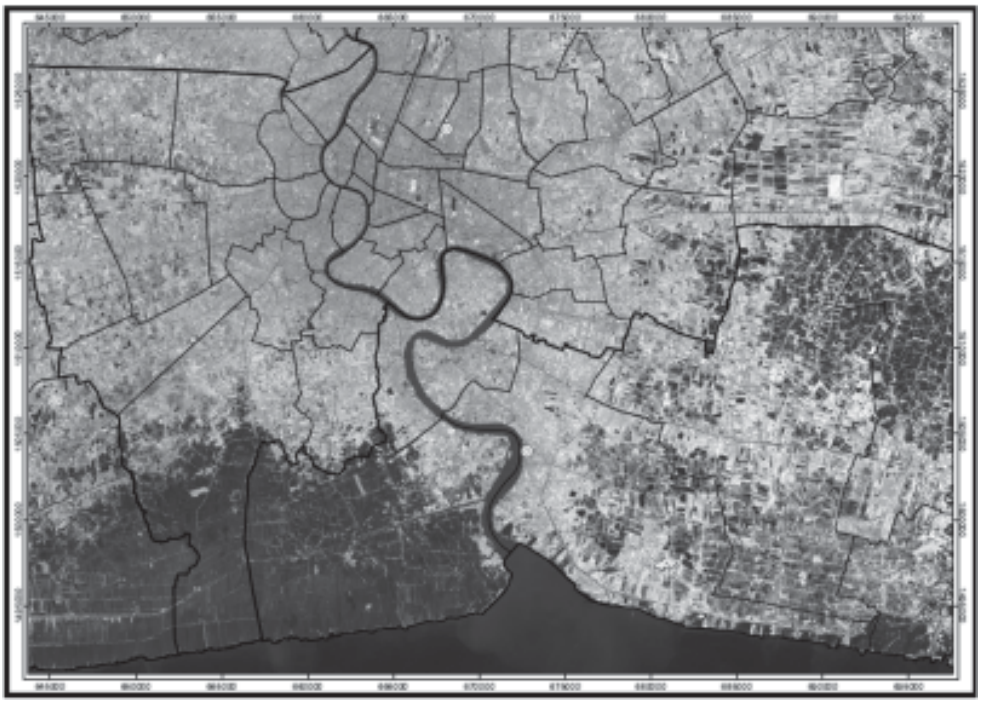

Figure 3. Chao Phraya River Basin, Thailand. False color composite (742:RGB) Landsat-5 TM (25/10/1994). [5]

This paper intends to highlight the existing public water transportation facilities along the canals in Bangkok. It aims to present an overview of this public transport system together with its role and characteristics. In addition, this paper also intends to recommend actionable measures to improve water transportation system along these canals in Bangkok and make it effective to share the existing burden on the road based transportation system and alleviate traffic congestion thereby.

2. Public Transportation System in Bangkok

Prior to present the status of existing water transportation system in Bangkok, it is perhaps best to highlight the current situation of the public transportation systems in Bangkok. Presently, Bangkokians can commute in the city by various public transport modes. They can have a choice to travel either by land or water transport due to the geographical advantages of the Chao Phraya River and its tributaries. Land transit modes are comprised of rail, bus and paratransit systems both in conventional and unconventional forms. The most recent and modern transit in Bangkok is the rail transit which includes both underground (subway) and elevated rail systems. The current major workhorse transit mode of the city, the bus transit, comprises of air-conditioned and non-air-conditioned bus services. In addition, there are minibuses running around the city to provide supplementary services. In Bangkok, apart from these typical transit modes of rail and bus, commuters can also commute by the more personalized paratransit system which includes the typical paratransit of taxis and a unique 3-wheeled taxi locally known as "tuk-tuk" as well as the informal or unconventional paratransit modes of hired-motorcycles widely known as motorcycle-taxis and passenger vans.

On the other hand, the geographical location of the waterway network provides possible accessibility through their tributaries and local commuters have this alternative means to travel by utilizing the boat services. Three different types of boat operations are catering their services which include express boats, ferryboats and long-tailed boats. These boats are different in various sizes and purposes. Express boats cater to the needs of those who commute along the Chao Phraya River. While ferryboats serve passengers within the breadth of Chao Phraya River, enabling them to cross the river the long-tailed boats offer their services to passengers who commute into the canals locally known as "klongs." Figure 4 presents the schematic view of the public transport systems in Bangkok.

3. Water Transport in Bangkok: Long-Tailed Boat Service

Despite the experience of three different types of water transport services in Bangkok, this study focuses on the more specific type of service that is the service along the canal. This is due to the reason that it is now struggling for its existence with burgeoning land transportation modes although it could have been a part of sustainable transportation system and reduce the load on existing land transportation system of Bangkok. The name 'long-tailed boat' mainly came from its design which incorporates a motor mounted onboard at the end part which also serves as a steering for the boat (Figure 5).

The spear-shaped body has a flat bottom which is suitable to be used in narrow canals with water depth as low as one meter. The boat is open-sided which can be easily accessed by passengers on both sides of the boat. Long-tailed boat comes in various sizes with the length of hull ranging between 10 to 20 m. The boat is normally fitted with the detachable wooden seats and backrests of about 10 to 20 rows depending on the size which can serve up to 100 passengers as demonstrated in Figure 6. Long-tailed boat can be considered as a low cost transport mode because the investment in this boat service cost only about

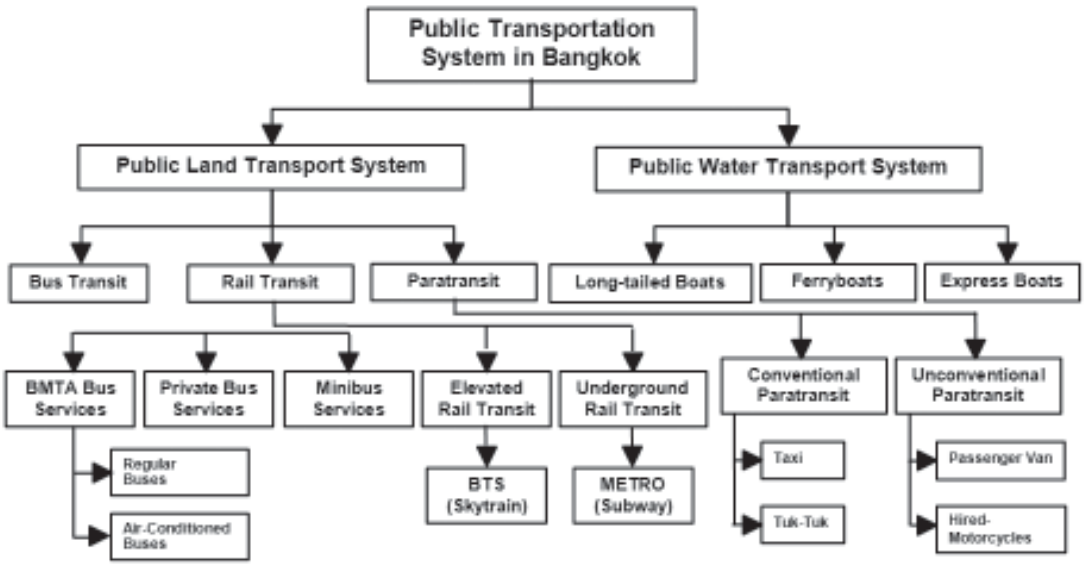

Figure 4. The schematic views of public transportation system in Bangkok.

Figure 5. Propeller shaft of long-tailed boat.

Figure 6. Physical outlook of long-tailed boat.

200,000 to 300,000 Baht (about $5,000 to $7,500, assuming 1 US$ = 40 Thai Baht) per boat. This price includes the hull costing 185,000 Baht and the second-hand engine available at around 100,000 Baht. The annual operating and maintenance costs are summarized as shown in Table 1 based on owner-driven boat or daily hired basis.

In spite of the fact that long-tailed boat is one of the low cost transport modes together with its low operating costs especially if compared with other land transit modes, their passenger demand is declining as illustrated by Figure 7. It can be seen that the average daily passengers are reducing year by year. However, it must be noted that these passenger demand figures does not include the newly introduced routes in Bangkok. Recently, the new route of boat service that was suggested by Office of Transport and Traffic Policy and Planning (OTP) is Padung Krungkasem Canal with the service distance about 4.5 km. It also plays a role as an alternative for linkage between other mode of transportations (BTS, Subway, and BMTA bus) and located as a multimodal point to promote the public transport for tourism in Bangkok.

Table 1. Annual operating and maintenance costs of a long-tailed boat.

Item of Consideration	Owner-driven Boat (Baht)	Hired Boat (Baht)
Fuel (i)	511,000	511,000
Minor Servicing (ii)	7,400	–
Hull Maintenance (iii)	93,300	–
Propellers (iv)	16,200	–
Depreciation and Interest (v)	26,900	–
Rent (vi)	–	72,000
Registration and license	1,500	–
Insurance	1,600	–
Pier usage fee (vii)	51,100	51,000
Total annual operating cost	709,000	634,100

Note: *(i) Diesel fuel costs 25.3 Baht per liter.*

(ii) Minor servicing includes oil change every two or three months.

(iii) Hull maintenance includes hull repainting and hull fixing every one or two years.

(iv) Propellers are changed two to four times a month. Each costs 300-600 Baht.

(v) Based on ten-year period, at 6 percent interest per annum. Initial cost of the boat is 250,000 Baht.

(vi) Rent is 6,000 Baht per month.

(vii) Pier usage fee is 35 Baht per trip.

(viii) The information was collected in the year 2005 based on field survey by the authors.

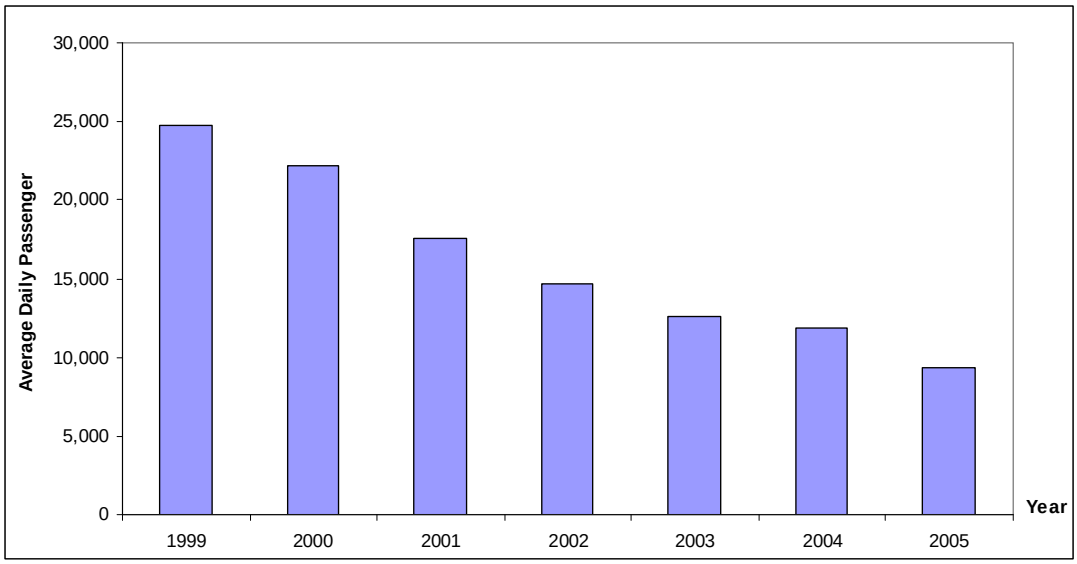

Figure 7. Average daily passenger demands of long-tailed boats (1999-2005). [6]

4. Characteristics of Long-Tailed Boat Service

Long-tail boats in the canals of Bangkok offer two types of services: regular services which cater to the public commuters with specified route and a fixed fare rate set by operators and the irregular services which serve as for-hired or chartered boat like water taxi service. The scope of this paper focuses on the regular long-tailed boat service only. In the past, while Bangkok commuters still relied on the service of long-tailed boats, several routes were in operation to cater the needs of public especially those who live along the canals. To some, they had no other alternative except to rely on this public mode of transport for their commuting. However, with the later development of road based transport, several areas which must solely depend on water transport became more accessible by land transport modes. Slowly but surely the needs for long-tailed boat services began to decline and subsequently some long-tailed boat routes began to cease their operation due to unpopular demand and reduction in revenue collected through their operation. Besides, some routes were no longer suitable for navigation purpose due to the installation of flood protection facilities. At present, there are a total of 14 long-tailed boat routes still offering their services to the interior canals connecting with the Chao Phraya River. In addition, two long-tailed boat routes along the canals in Bangkok are also catering their services which are Sansaeb Canal and Phrakanong Canal as shown in Table 2.

The details of these long-tailed boat services are separated into three categories in this paper for easier explanation—long-tailed

Table 2. Routes of long-tailed boat services. [6]

No	Route	Description
	Origin–Destination	
1	Pakkret-Pakklong Bangbuatong	Bangbuatong Canal
2	Pakkret-Pratunam Bangbuatong	Bangbuatong Canal
3	Pakkret-Pratunam Pra Udom	Prau Udom Canal
4	Nontaburi-Bangyai (section 2)	Om Canal
5	Nontaburi–Bangyai	Om Canal
6	Khunkoay-Pratoonam Chimplee	Chao Phraya River-Bangkoknoi Canal-kudchaiyaperk Canal
7	Ta-Chang–Bangyai	Chao Phraya River-Bangkoknoi Canal-Bangkokyai Canal
8	Ta-Chang-Bangchuaknang	Chao Phraya River-Mon Canal-Bangchuaknang Canal
9	Ta-tien–Bangnoi	Chao Phraya River-Mon Canal-Bangnoi Canal
10	Rachinee–Bangwak	Chao Phraya River-Bangkokyai Canal-Bangwak Canal
11	Sapanput–Bangwak	Chao Phraya River-Bangkokyai Canal-Bangwak Canal
12	Bangkhea-Bangchuaknang	Paseejarern Canal
13	Wiboonsee–Sahakorn	Chao Phraya River-Sampasamit Canal
14	Wiboonsee–Watsakla	Chao Phraya River-Sampasamit Canal-Sakla Canal
15	Phanfa Leelad–Bangkapi	Sansaeb Canal
16	Phrakanong–Iamsombat Market	Phrakanong Canal

Locations of each route of long-tailed boat service can be graphically viewed as shown in Figure 8.

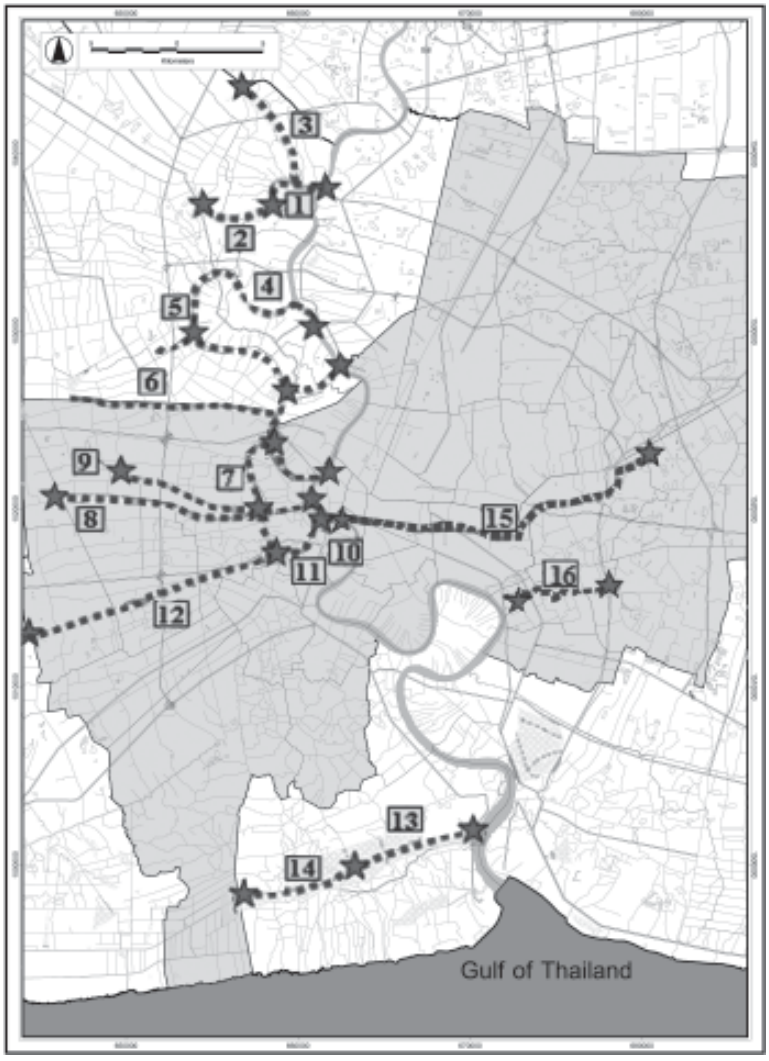

Figure 8. Routes of long-tailed boat services. [7]

boat along Sansaeb Canal, Phrakanong Canal and other long-tailed boats to link between Chao Phraya River and Canal.

4.1 Long-Tailed Boats along Sansaeb Canal

4.1.1 General Information

For Sansaeb Canal, the route starts from Sriboonruang Temple Pier and ends at Phanfa-Leelad Pier with 17.24 km. route length or approximately one hour travel time. The service is daily operated ranging from 05:30 hr. to 20:30 hr.; however the period of service vary depending on the day of service (weekday and weekend) as shown in Table 3.

Likewise, headways also vary in weekday and weekend as well as in the peak periods and off-peak periods. Generally, headways during peak periods range from 2-5 minutes and 5-14 minutes during the off-peak period on weekdays and about 5-15 minutes during the weekends. Long-tailed boats along Sansaeb Canal vary in sizes with the average size approximately 2.71 m. wide and 20.10 m. long. Currently, there are a total of 74 long-tailed

Table 3. Operating schedule of long-tailed boats along Sansaeb Canal. [8]

Direction	Pier	Trip	Weekday	Weekend	
				Saturday	Sunday
Inbound	Wat Sriboonruang Pier	First trip	05:30 hr.	06:00 hr.	06:00 hr.
		Last trip	19:15 hr.	18:30 hr.	18:00 hr.
	Pratunam Pier	First trip	06:00 hr.	06:30 hr.	06:30 hr.
		Last trip	19:45 hr.	19:00 hr.	18:30 hr.
Outbound	Phanfa Leelad Pier	First trip	06:15 hr.	06:50 hr.	06:50 hr.
		Last trip	20:00 hr.	19:30 hr.	19:00 hr.
	Pratunam Pier	First trip	06:30 hr.	07:00 hr.	07:00 hr.
		Last trip	20:30 hr.	19:45 hr.	19:15 hr.

Table 4. Headways during weekday and weekday. [8]

Pier	Weekday		Weekend	
	Period	Headway	Period	Headway
Wat Sriboonruang Pier (Inbound)	05:30 hr.-09:00 hr.	2-5 min.	06:00 hr.-18:30 hr.	5-12 min.
	09:00 hr..-16:00 hr.	10-14 min.		
	16:00 hr.-19:15 hr.	2-5 min.		
Phanfa Leelad Pier (Outbound)	06:15 hr.-09:00 hr.	2-4 min.	06:50 hr.-19:30 hr.	5-15 min.
	09:00 hr.-16:00 hr.	10-13 min.		
	16:00 hr.-20:00 hr.	2-4 min.		

boats operated by a private company, the Kraubkrua Transport Company along this route of 26 piers from Wat Sriboonruang Pier to Phanfa Leelad Pier. Boat fares vary between 5 to 15 Baht per trip depending on the travel distance. The fare is cheaper than bus service with the shorter travel distance that ranges between 7 to 22 baht from normal bus to air condition bus (Euro 2). Field survey conducted in this research study suggests that the long-tailed boats provide service between 05:00 to 20:00 hr., however there are variations between schedule of service depending on different times of the day as well as weekdays and weekends as presented in Table 4.

4.1.2 Demand Information

The Sansaeb Canal provides a significant role to serve Bangkok by commuting about 35,931 passengers per day for the latest survey conducted in 2003. The statistical figures regarding daily passengers between 1995 and 2003 are presented in Figure 9. It is interesting to note that the inbound direction that starts from Wat Sriboonruang Pier to Phanfa Leelad Pier has higher passenger demands than the

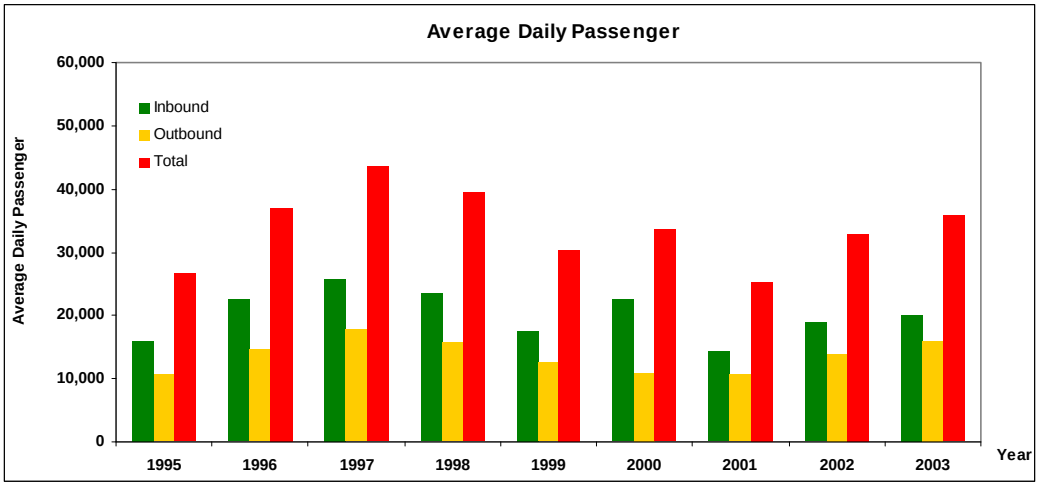

Figure 9. Average daily passengers in 1995–2003. [8]

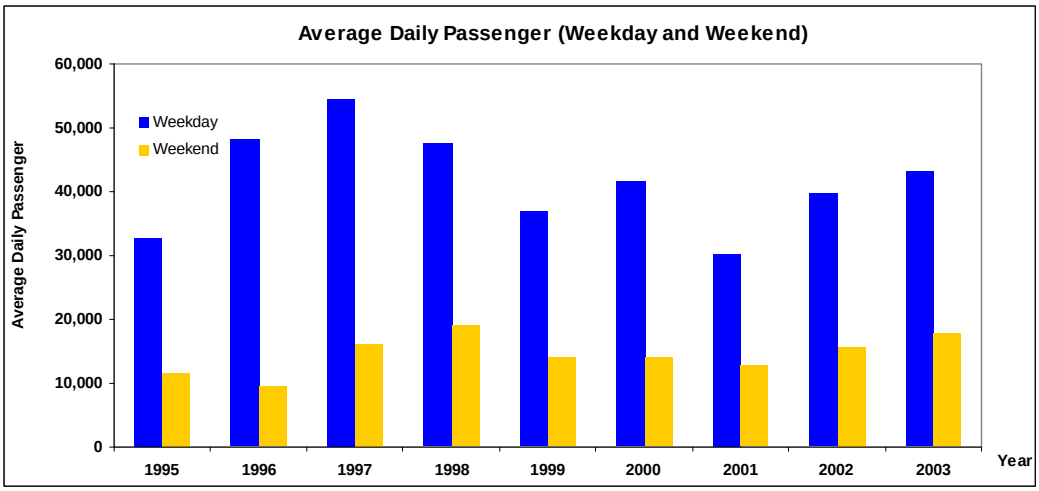

Figure 10. Average daily passengers (weekday and weekend) in 1995–2003. [8]

outbound direction. This may be due to the reason that commuters need to travel to city center to work or study by using this long-tailed boat service, but they may use other modes for their return trips resulting in lower demands on the outbound direction. However, when considering all passenger demands of both inbound and outbound directions as depicted in Figure 9, it can be clearly seen that the 9 years statistics show some fluctuations in demands but on the declining trend. Perhaps, concerned authorities need to persuade commuters to patronize this boat service more often especially to help encourage the use of more efficient and energy saving mode of transport rather than the private vehicles. Moreover, higher demand on this service will result in lower burden on the already congested road networks.

The comparison for both weekday and weekend also shows the significant difference in number of daily passengers. Most of the boat users prefer to travel to work or to school during weekday, however on weekend the commuters preferred to commute by other modes as shown in Figure 10.

The statistics also confirm that long-tailed boat users prefer to select boat service for their work and school trips during weekday rather than other modes to avoid traffic congestion in the vicinity of canal route but for leisure activities or when they have some extra time, they may use alternative modes for their trips. Therefore, the numbers of users who commuted by long-tailed boats on weekdays are all greater than weekend trips for these 15 piers along this route as graphically depicted in Figure 11.

Thus, this echoes the previous statement that concerned authorities need to further encourage more usage of this boat service especially for leisure trips to help minimizing the city traffic problems.

4.2 Long-Tailed Boats along Phrakanong Canal

4.2.1 General Information

Phrakanong Canal provides the long-tailed boat service for commuters along the route between Talad Iamsombut Pier and Phrakanong Pier covering totally 13 piers. They provide this service with a total of 6 boats with 30 minutes travel time and about half hour average headway. Although their service time varies between weekdays and weekends, generally this long-tailed boat route offers their services around 12 hours on the average to Bangkok commuters. Boat fares vary between 5 to 10 Baht for children and adult, respectively. This fare is probably cheaper than bus fare for adult, however, when taking into account for the travel distance and travel time, traveling by boat provides much superior service than others. Table 5 shows the service schedules of this long-tailed service route.

4.2.2 Demand Information

In order to understand the long-tailed boat passenger demands along this Phrakanong Canal, the overall trend of number of users along this route is summarized as shown in Figure 12. Based on average number of daily passenger between 2001 and 2005, the statistics show that unlike the passenger demands along the

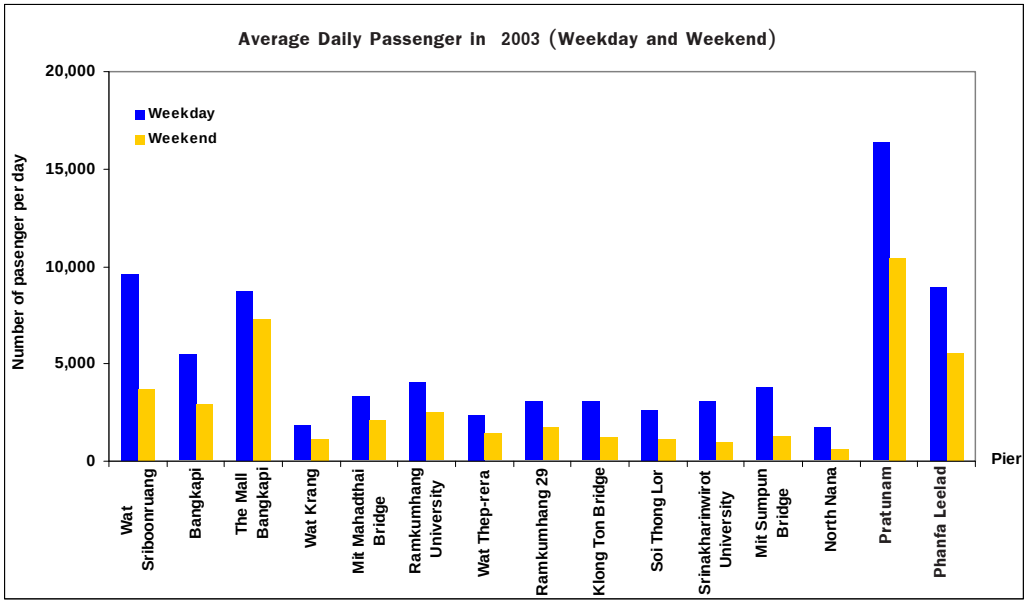

Figure 11. Average daily passengers (weekday and weekend) in 2003. [8]

Table 5. Schedule of long-tailed boat service along Phrakanong Canal. [9]

Day	Talad Iamsombut Pier		Phrakanong Pier	
	First Trip	Last Trip	First Trip	Last Trip
Weekday	06:00 hr.	18:30 hr.	07:00 hr.	19:30 hr.
Saturday	06:30 hr.	18:00 hr.	07:30 hr.	19:00 hr.
Sunday	07:00 hr.	18:00 hr.	08:00 hr.	19:00 hr.

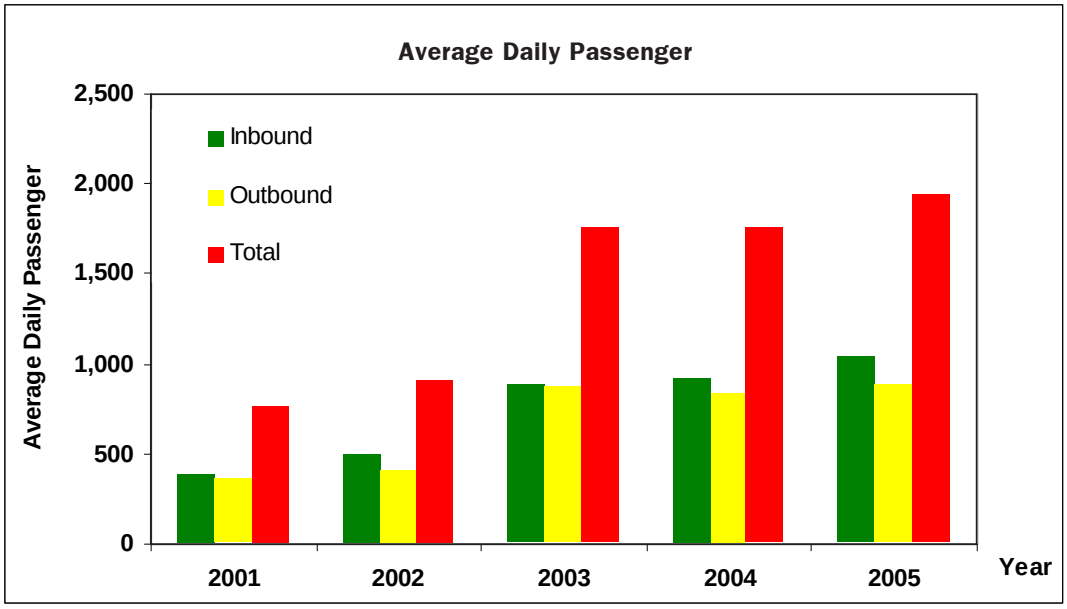

Figure 12. Average daily passengers in 2001-2005. [9]

Sansaeb Canal which indicate the fluctuation trend with a tendency toward the declination of demand, passenger demand along this Phrakanong route demonstrates an increasing trend. In fact, a number of users in 2005 are about 2.5 times more than that of passenger demand in 2001. The gradually increasing of the average number of daily passenger can be demonstrated in Figure 12. The statistics shows the number of daily passengers for both inbound and outbound directions for Phrakanong Canal as illustrated in Figure 12 clearly indicating that there is slight difference in number of users when compared with both directions of travel. In other words, commuters use this boat service more evenly in both inbound and outbound directions which are different from the characteristics of Sansaeb Canal.

Two important points to be noted here are:

- Variation of passenger demands on weekday and weekend
- Variation of passenger demands by pier of service

Considering the passenger trends on both weekdays and weekends, it can be seen from Figure 13 that even though demands on weekdays are higher than weekends, which is a normal trend for any commuter trips, their differences are not substantially high and are rather consistent among the 5 years period (2001

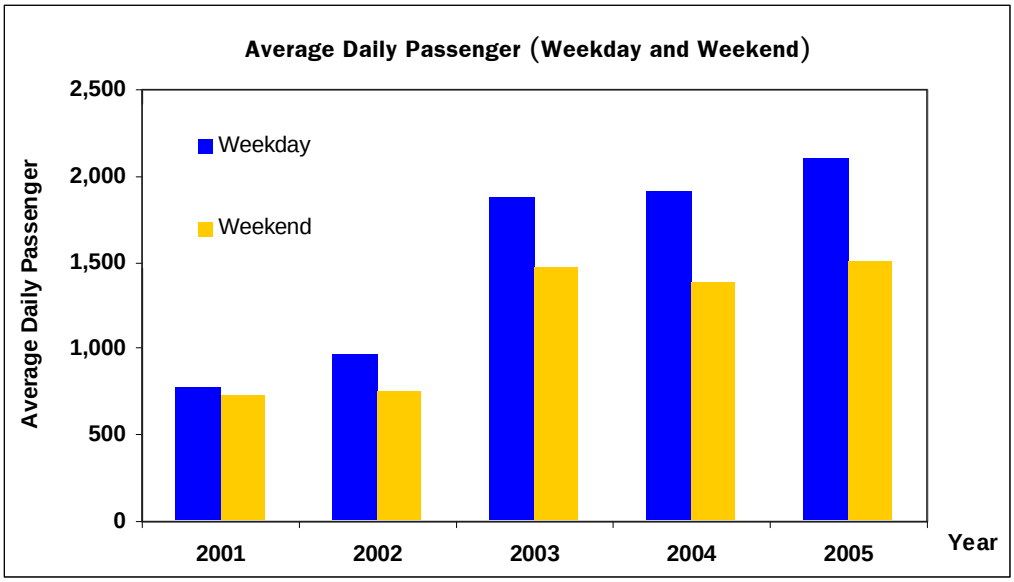

Figure 13. Average daily passengers (weekday and weekend) in 2001–2005. [9]

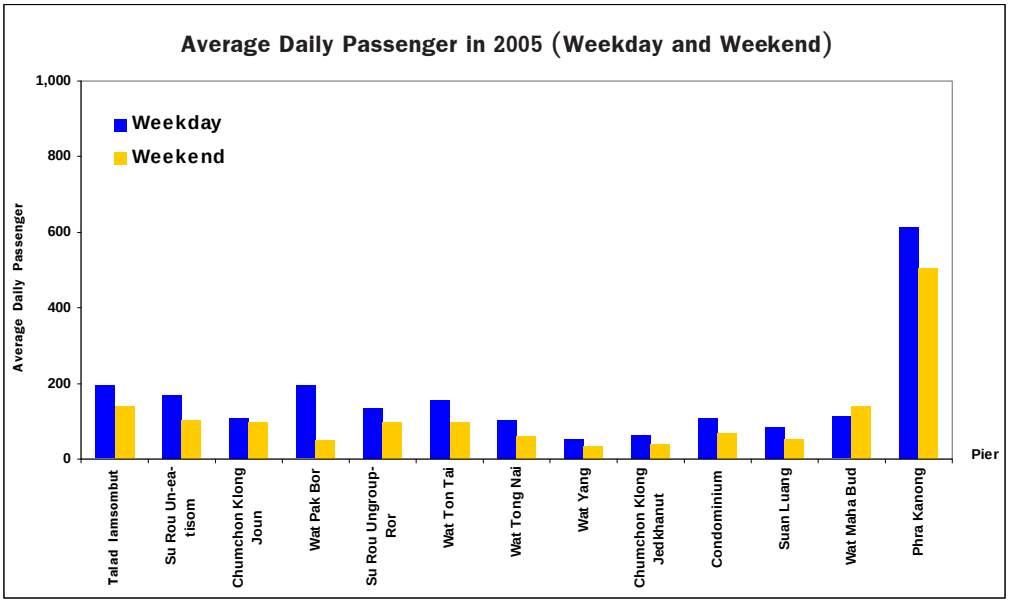

Figure 14. Average daily passengers (weekday and weekend) in 2005. [9]

to 2005). In other words, commuters of this long-tailed boat route are using the service not only for work and school trips but also for leisure activities.

When considering the details distribution in number of passengers boarding and alighting on each of the total 13 piers along this route by using information gathered in 2005, it can be seen that a similar trend can be observed among all piers except for one pier—Wat Maha Bud. In this case, the weekday passengers are slightly higher than weekend passengers indicating a rather balanced usage of this long-tailed boat route. Figure 14 shows these findings.

4.3 Other Long-Tailed Boats to Link Between Chao Phraya River and Canal

4.3.1 Long-Tailed Boats along the Canals in Thonburi

As mentioned earlier that other than the two previously mentioned long-tailed boat routes which operate along the canals in Bangkok, there still exist 14 other long-tailed boat routes which operate mainly in Thonburi area. These long-tailed boats offer their services to connect the interior canals with the Chao Phraya River. As it is not possible to present separately the details of each individual route, this study therefore presents the characteristics of these 14 routes together as well as their demands. It can be seen that some route provides its service from as early as 04:00 hr. in the morning and does not terminate the service until as late as 11:20 hr. for both weekdays and weekends. However, some routes (Tatien-Bangnoi route and Rachinee-Bangwak route) do not offer their services on the weekends. This may be due to inadequate demand during weekends that makes weekend operations financial unattractive the service providers.

These 14 long-tailed boat routes serve for the commuters with a variety of numbers ranging between 5-48 boats depending on the demand of each service route. Some popular routes may accommodate commuters with more boats such as Tachang-Bangyai route which operates with 48 boats. On the contrary, Wiboonsee-Watsakla operates with only 5 boats. Not only these 14 routes operate with different number of long-tailed boats but also these 14 routes charge different fares which range from as low as 5 Baht to the highest of 40 Baht. Moreover, among individual route, operators also charge various fare rates depending on the time of service. Normally, fares are increased during night time, especially late night services. Route lengths vary from 4 to 13 km. with a range of travel time of 25-45 minutes.

4.3.2 Demand Information

Considering the 6 year daily passenger demand statistics of these 14 long-tailed boat routes during the most recent period of 2000 to 2005, it can be clearly seen from Table 6 that passenger demands of these long-tailed boat services indicate a declining trend. In fact, based

Table 6. Total number of daily passengers for 14 routes. [10]

Year	Total No. of Daily Passenger	Percentage of Reduction (Related to Peak Hour Traffic in 2000 = 100)
2000	15,246	-
2001	11,737	23.0
2002	11,641	23.6
2003	9,776	35.9
2004	9,115	40.2
2005	6,251	59.0

on the passenger demand in 2000, it can be observed that the passengers show about 36% reduction. This alarming trend and high reduction rate in passenger demands deserve an attention from concerned authorities. If this declining rate still continues, some of these service routes may need to cease down their services and embrace the fait that have already occurred to several long-tailed boat routes in the past.

In order to further investigate the demand characteristics of these 14 long-tailed boat routes, this study presents the passenger demands of each individual route during the 6 year period, 2000 to 2005 as shown in Table 7. It can be seen that most of these long-tailed boat routes indicate the similar trend of diminishing demand. Only few routes show the inconsistent trend but eventually these routes are showing the declining sign indicating the losing in passenger demands especially during the past few years (2003-2005). As previously recommended, the concerned authorities need to address this issue seriously, otherwise future generations may not be able to use some of these services especially those low demand routes.

Like other two long-tailed boat routes along the two canals in Bangkok, this study also examines the demand characteristics on weekdays and weekends by utilizing the demand data of 2000 to 2004 (classification of demands by weekday and weekend in 2005 are not available during the time of this study). Figure 15 shows these findings of the passenger demand on weekdays and weekends of these 14 routes. It is known that like other two long-tailed boat routes along the canals in Bangkok, commuters of these 14 routes also patronize the long-tailed boat services mostly on weekdays rather than weekends. Although this is a normal trend, the substantially higher number of passengers on

Table 7. Average daily passengers during 2000-2005. [10]

No	Route	Average Daily Passenger					
	Origin-Destination	2000	2001	2002	2003	2004	2005
1	Pakkret-Pakklong Bangbuatong	1,032	1,789	1,879	1,817	1,785	1,426
2	Pakkret-Pratunam Bangbuatong	958	649	590	553	513	439
3	Pakkret-Pratunam Pra Udom	132	941	971	895	760	571
4	Nontaburi-Bangyai (section 2)	1,724	1,436	1,397	1,107	999	660
5	Nontaburi-Bangyai	988	1,103	1,058	929	876	598
6	Khunkoay-Pratunam Chimplee	562	517	627	504	476	384
7	Ta Chang-Bangyai	2,782	2,133	2,145	1,737	1,667	1,109
8	Ta Chang-Bangchuaknang	686	570	683	594	579	440
9	Ta Tien-Bangnoi	173	150	148	124	104	109
10	Rachanee-Bangwak	1,130	524	600	280	266	188
11	Sapanput-Bangwak	1,356	684	673	407	370	289
12	Bangkhee-Bangchuaknang	1,040	833	587	528	487	409
13	Wiboonsee-Sahakorn	216	232	176	185	152	148
14	Wiboonsee-Watsakia	367	176	107	116	81	75
Tatal		13,146	11,737	11,641	9,776	9,115	6,845

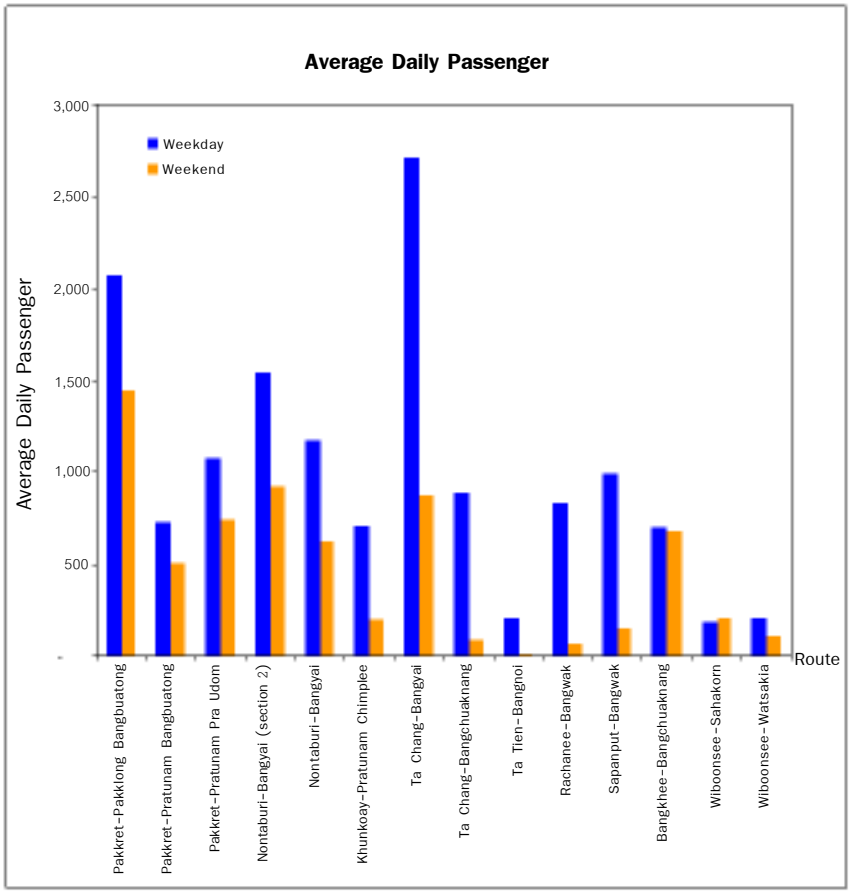

Figure 15. Average Daily Passengers on Weekday and Weekend, 2000–2004. [10]

weekdays than weekends of these routes indicates that commuters mostly prefer to use the long-tailed boat only when they need to and they are willing to shift to other modes if they have an option. The extremely low demands on weekends also show that commuters of these routes prefer to use other modes for their leisure activities.

5. Overlooked Problems of Long–Tailed Boats

To promote and encourage the higher usage of this long-tailed boat service, several overlooked problems must be addressed and searched for proper remedies. The following issues are highly recommended to be addressed:

5.1 Polluted Water

Polluted water is one of the main causes of the declining trend of demand of the long-tailed boats. While these passengers are commuting using these long-tailed boat services, they have to face with unpleasant odors resulted from the polluted water along the canals. Moreover, sometime the polluted water would splash to the commuters while sitting inside the boat. Although, long-tailed boats normally use plastic shades to protect this splashing problem as shown in Figure 16, in most cases it proves to be not enough to protect or convince the commuters. When considering the water quality among all canals in Bangkok, the statistics collected by the Department of Drainage and Sewerage [11] stated that the average level of

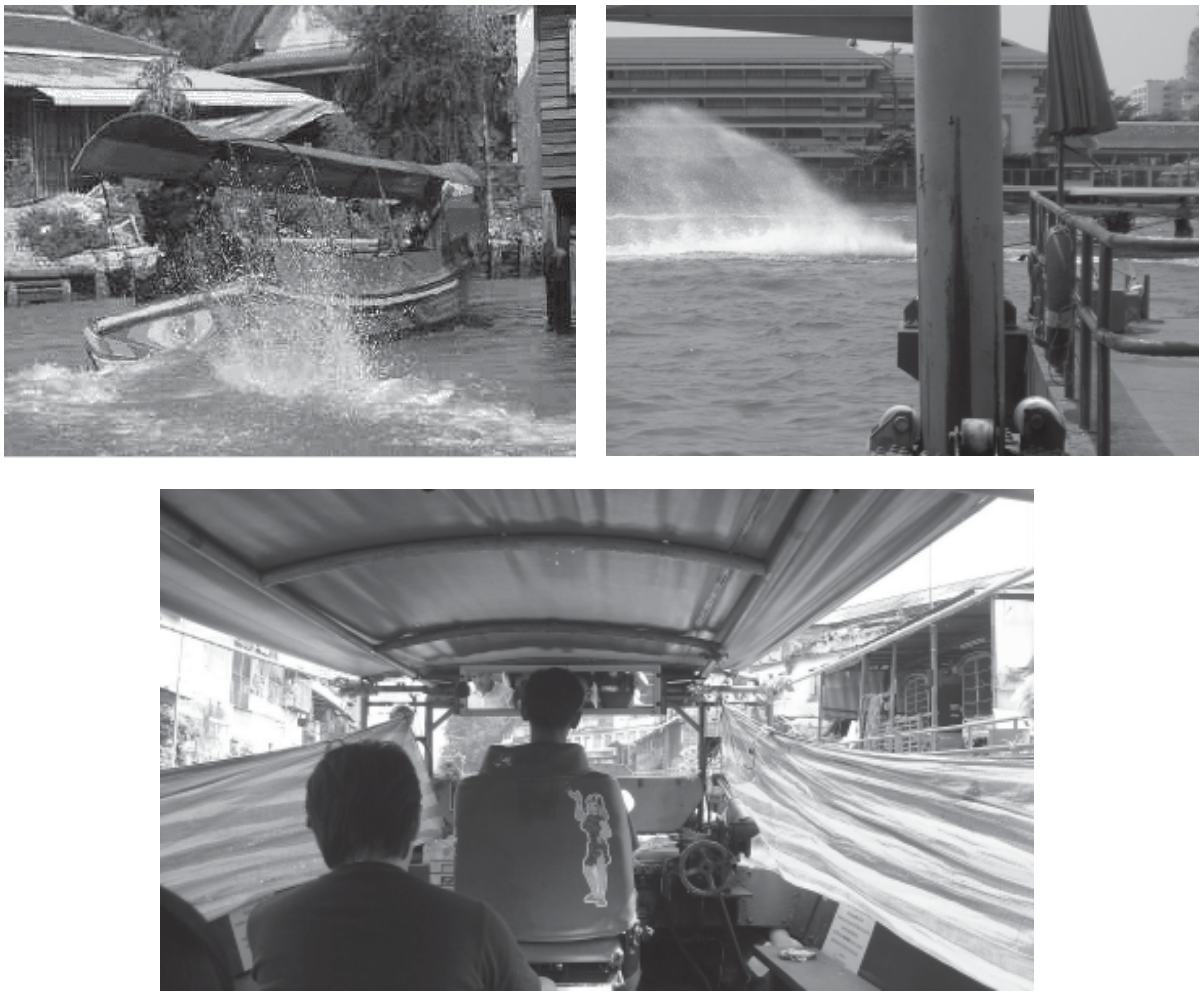

Figure 16. Problem of long-tailed boat service due to polluted water.

Dissolved Oxygen (DO) is about 1.63 mg/l and Biochemical Oxygen Demand (BOD) is 14.09 mg/l. Although the level of DO can be categorized the quality of water into class 4 for consumption but requires special treatment process before using, however the level of BOD is classified to use only for navigation since the level of BOD is greater than 4 mg/l. In addition, the attention should be paid for the noise level generated by long-tailed boat services. Although the existing service create the average noise level (Leq) about 64.8-73 or approximately 69 dBA that is lower than the standard of 100 dBA. However, for the future service, the poor maintenance of the boat machine can increase the noise level of engine to be above than the standard that required for proper inspect for maintain the standard of pollution control level.

5.2 Safety

Although previous statistics do not indicate any severe accidents of water transportation services, lacking of proper safety equipment and poor maintenance of safety gear can be clearly seen in the long-tailed boats as demonstrated in Figure 17.

Lack of sufficient safety jackets inside these boats can be easily noticed. This safety

aspect can not be overlooked especially if authorities need to encourage more usage of this public service mode in the future. In addition, the physical appearance of the long-tailed boat seems to be more risky than other public water transportation modes such as express boats and ferryboats due to their smaller sizes. Although they operate in the interior canals which do not face the dense traffic problem, the boats occasionally creates wave that may be risky to passengers inside these long-tailed boats. Furthermore, it is rather difficult to board on and alight from the long-tailed boats due to the pier structure and boat characteristic which can not properly serve passengers as demonstrated in Figure 18.

5.3 Access to Pier

To encourage more usage of long-tailed boat service, it is essential to promote the proper

Figure 17. Lack of safety aspect of boat service.

Figure 18. Boarding/alighting the long-tailed boat.

Figure 19. Poor condition of pier.

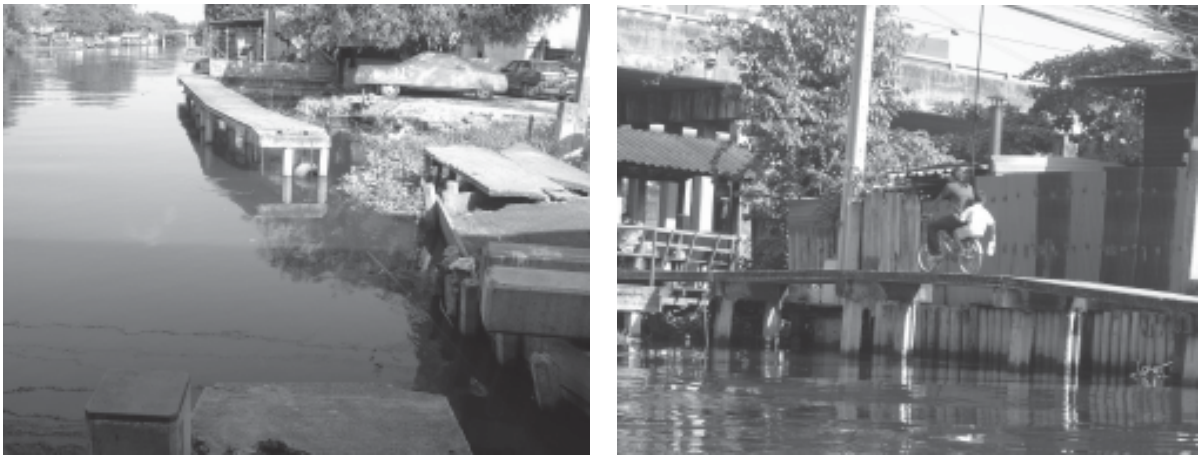

Figure 20. Poor access of waterway.

accessibility to the pier. However, some piers are not in good and safe conditions. Figure 19 and Figure 20 show sample photos of the poor condition of piers and poor access of waterway, respectively.

6. Conclusion and Recommendations

Despite the fact that demands for long-tailed boats are declining, hopefully this public water transport mode will continue to provide mobility to Bangkokians as a key alternative mode especially when traffic congestion problems still remain unsolved. However, to promote this public water transport mode to be more effective and as a key part of sustainable development, several problems must be addressed—especially the improvement on the safety aspects in particular at the pier and safety equipment on boat. More importantly, concerned authorities have to seriously consider the significance of this mode of transport as it can be actively promoted in readiness to serve and relief road based traffic problem as well as to be a part of a multi-modal transportation network in Bangkok.

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