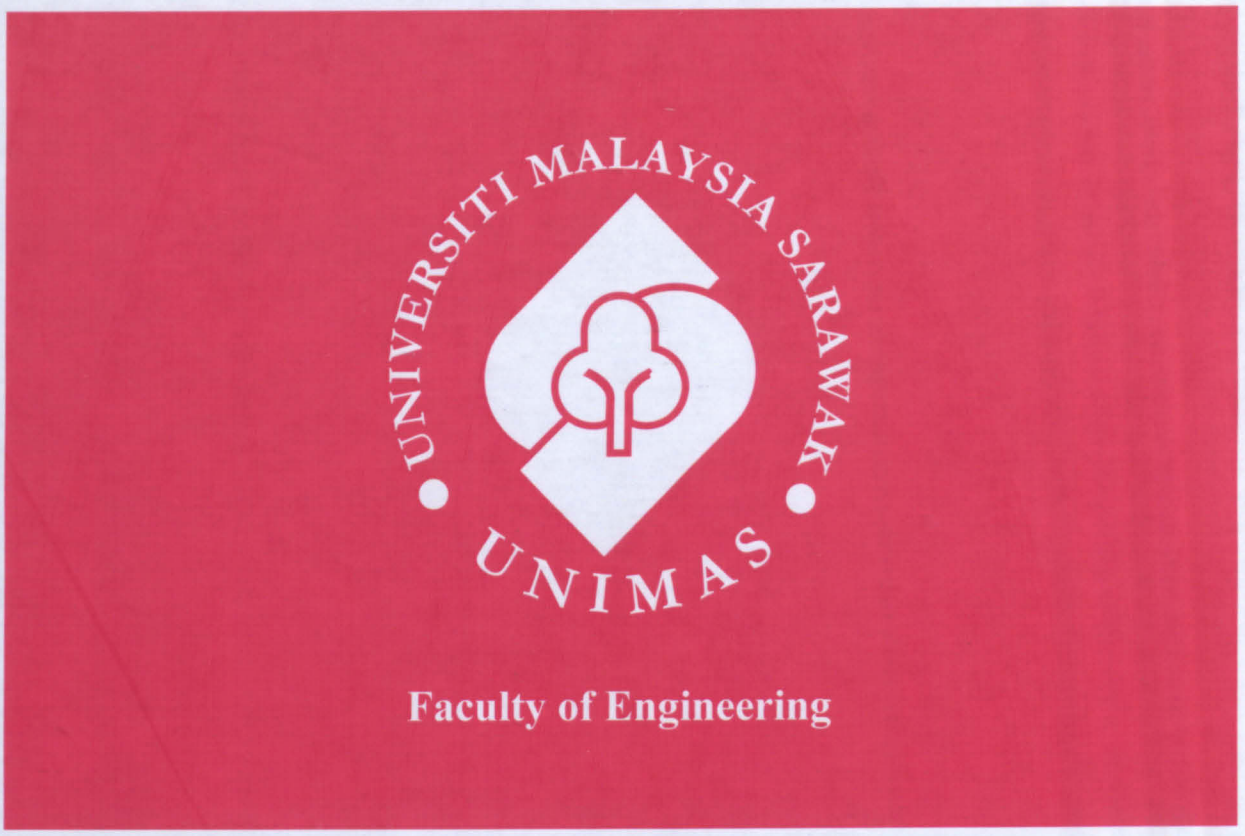

FEASIBILITY STUDY OF RIVER PUBLIC TRANSPORTATION SYSTEM IN KUCHING CITY

Sia You Gin

Bachelor of Engineering with Honours
(Civil Engineering)
2020

UNIVERSITI MALAYSIA SAWARAK

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Project Supervisor

25 AUGUST 2020

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Date

To my beloved family and friends

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ABSTRACT

Kuching city faces heavy traffic congestion every day. As Kuching city is having rivers passing through the centre of the city, River Public Transportation System (RPTS) is suggested as a transport alternative to resolve traffic congestion. Successful cases of implementing RPTS in other cities, such as Brisbane, Australia, can be found to effectively reduce land traffic congestion on the road network. This project studies the feasibility of RPTS in Kuching city. Factors such as travel pattern by residents in Kuching city and feasible terminal locations are determined, while routes for RPTS are designed. Land use map of Kuching city is generated and traffic condition of major highways are determined to know the travel demand within Kuching city. Service routes provided by local bus operators are obtained to determine integration between transportation modes of proposed RPTS terminal location. Few possible terminal locations are proposed and evaluated using an evaluation matrix with a rating of 0 – 4 and locations with rating more than 2.0 is considered feasible to include in route design. It is found that proposed route for RPTS is feasible within central business district of Kuching city. Travel demand originating from residential areas could not be resolved by RPTS due to lack of intermodal access in these areas. To further improve feasibility of RPTS in Kuching city, local bus operators are encouraged to extend their services to residential areas, while pedestrian walkway and bicycle lanes can be added to increase accessibility to the proposed terminals. Other factors such as mode shift, waterway characteristics (depth, width, etc.), and economic feasibility of RPTS can be carried out by other researches to have better understandings on feasibility of RPTS in Kuching city.

ABSTRAK

Kesesakan lalu lintas yang kronik berlaku tiap-tiap hari di Bandaraya Kuching. Memandangkan Bandaraya Kuching mempunyai sungai merentasi pusat-pusat Bandaraya Kuching, Sistem Pengangkutan Awam berdasarkan Sungai (SPAS) dicadangkan sebagai pengangkutan alternatif dalam usaha mengurangkan tahap kesesakan lalu lintas di Bandaraya Kuching. Pelaksanaan SPAS di Brisbane, Australia telah menunjukkan potensinya mengurangkan kesesakan lalu lintas secara efektif. Projek ini mengkaji kebolehlaksanaan SPAS di Bandaraya Kuching. Faktor-faktor seperti corak pejalanan penduduk Bandaraya Kuching dan lokasi-lokasi yang sesuai untuk dijadikan stesen SPAS telah diberikan perhatian, dengan laluan SPAS dicadangkan pada masa yang sama. Peta penggunaan tanah dan keadaan lalu lintas di jalan raya utama Bandaraya Kuching ditentukan demi mengetahui permintaan perjalanan di Bandaraya Kuching. Laluan perkhidmatan disediakan oleh pengusaha bas tempatan diperoleh untuk menentukan tahap penukaran mod pengangkutan di stesen-stesen SPAS yang dicadangkan. Lokasi-lokasi yang berpotensi dijadikan stesen-stesen SPAS telah dicadangkan dan dinilai dengan menggunakan matriks penilaian yang mempunyai skala penilaian 0 – 4, manakala lokasi-lokasi yang mempunyai nilai melebihi 2.0 dianggap sesuai untuk dijadikan salah satu terminal dalam penyediaan laluan perkhidmatan SPAS. Hasil projek ini menunjukkan kebolehlaksanaan laluan perkhidmatan SPAS di daerah pusat perniagaan Bandaraya Kuching. SPAS didapati kurang bermampuan dalam usaha melayan permintaan perjalanan dari kawasan-kawasan perumahan disebabkan oleh kekurangan laluan perkhidmatan pengangkutan awam dalam kawasan terserbut. Pengusaha bas tempatan digalakkan meluaskan zon perkhidmatan bas sehingga meliputi kawasan-kawasan perumahan demi meningkatkan tahap kebolehlaksanaan SPAS di Bandaraya Kuching, manakala laluan pejalan kaki dan lorong basikal boleh ditambah bagi meningkatkan tahap akses ke terminal-terminal yang dicadangkan. Faktor-fakor lain seperti peralihan mod pengangkutan, ciri-ciri laluan sungai (kedalaman, kelebaran, dan lain-lain lagi), dan kebolehlaksaan SPAS dari perspektif ekonomi boleh dikaji untuk memahamkan kebolehlaksanaan SPAS di Bandaraya Kuching dengan lebih dalam lagi.

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RPTS	-	River Public Transportation System
CBD	-	Central Business District

CHAPTER 1

INTRODUCTION

1.1. Background

Transportation, as defined by Cambridge University Press (2008), is the movement of goods or people from one place to another. Transportation systems are subdivided into few modes, namely waterborne, rail, road-based, air and pipeline transportation systems (Association of American Railroads (AAR), 2013). Water transportation system involves passengers or freights carried by boats, ferries, ships, or any waterborne vessels (McCraken, 2003). This paper focuses on movement of passengers using water transportation systems.

Land transportation systems, involving the use of public or private vehicles throughout the system, is widely used in Malaysia. Ibrahim (2009) indicates the extremely-high usage of land transportation (96%) for passenger and goods transportation in Malaysia. According to Royal Malaysia Police (2018), registered vehicles in Malaysia over a period of 10 years (1998 – 2017) experiences an incredibly increase, from 9.1 million in 1998 to 28.7 million in 2017. Ministry of Transport Malaysia (2017) have recorded a huge amount of Average Daily Traffic (ADT) flow of 229.7 thousands vehicle per day running on existing highways in Kuala Lumpur in the year of 2017.

Heavy congestions in land transportation of Malaysia are as expected, despite handling this enormous amount of traffic flow on the land transportation network daily. Cameons (2020, March 18) reported a major traffic congestion along the North-South Expressway (NSE) directly after the announcement of interstate travel ban during Movement Control Order, on *TheStar*. Kin (2020, May 4) reported too, on an inconsiderable traffic jam on roads between Seberang Jaya and the Penang Bridge right after the relaxation of Movement Control Order, with reference to the released images and video footages from Malaysian Highway Authority (LLM)'s traffic cameras. Early in 2015, Ji (2015, February 18) has discovered a surprising fact in a press conference by Wong King Wei, the Padungan assemblyman, where a ratio of 1:2 (one car for every two people) has been found in major cities of Sarawak (Kuching, Miri, Sibu, etc.), revealing the high congestion level on Sarawak's roads and highways. Kota Samarahan Municipal Council (MPKS) are concerned on traffic congestions during peak hours at Kota Samarahan, and is getting worse due to rapid development (Yeo, 2020, March 14).

Ibrahim (2009) explains the effects of low level of LOS to road users, that is, travelling at lower speed, longer travel time, and losses in time where road users can actually utilize for much beneficial and productive activities, with supports from Falcocchio and Levinson (2015), stating heavy land congestions lead to longer travel time, lower mobility faced by travellers, and lower accessibility to a destination. Hennessy and Wiesenthal (1999) in their studies reveals a fact that road users experience higher stress and are more aggressive in high-congestion condition, while Emo, Matthews and Funke (2016) supports Hennessy and Wiesenthal's statement, concluding the emergence of unusual, aggressive driving styles shown by road users 'trapped' in a congestion when they are given a chance to overtake other drivers in a risky condition. Furthermore, Sweet (2011) suggests the delay of metropolitan growth and economics are effects of traffic congestion, and is supported by a case study in US, indicating higher ADT is actually dragging a country's productivity (Sweet, 2014). Steg and Gifford (2005) discover that most private vehicle users agree on the fact that reducing volume of cars on road reduces traffic congestion, but they are unwilling to use other transportation modes other than private vehicles.

The idea of sustainable transportation emerges within Ministry of Transport Malaysia, as current existing infrastructures in Malaysia are handling traffic flows higher than their design capacities. Steg and Gifford (2005) agree on the need of sustainable transportation system in any countries. Litman and Burwell (2006) defines sustainable transportation system as a transportation system fulfilling current and future transportation demands, enables ongoing economic development without compromising natural resources and social factors, while encouraging long-term development in future.

Recently, urban linear ferries as a public transport alternative quickly showed up and being implemented in few urban countries. Urban linear ferries, frequently known as water bus, water taxi or water transit, offer passenger transportation services using selected high-speed waterborne vessels on rivers located in urban cities as corridor, and is implemented and operated with fare systems and fixed schedules at the same time. While most countries still recognize water transportation system as traditional ferries or motorboats, Tanko and Burke (2015) defines the innovative urban linear ferries as high speed vessels running on routes parallel to rivers, connecting key areas and establishes integration between land public transportation systems.

Figure 1.1-1 Conceptual view of Urban Ferries.

Retrieved from https://www.reaktor.com/work/autonomousferry/

New York City Economic Development Corporation (NYCEDC) (2015) defines urban ferries' role as one of the alternatives resolving congestions on land transportation system. While highways and land public transportation systems operating at their maximum capacity and intolerable congestions still occurring at commuter peaks, urban ferries could be a workable alternative to help reducing congestions on land transportation systems, including highways and public transportation systems which operate based on existing road networks in the city. Nelson | Nygaard Consulting Associates Inc. (2006) in their feasibility study on Willamette River Ferry in City of Portland, highlights the fact that RPTS do reduces amount of commuters and visitors having their own vehicles on road as RPTS provides another way of travelling to their destinations.

Amnuay-ngerntra & Sonoda (2013) in their research on river tourism along Upper Mekong River, highlights the crucial benefits of having river as one of the transportation mode, including urban developments and as tourist attractions. According to Amnuay-ngerntra & Sonoda (2013), most cities' development relies heavily on riverside, while tourists and visitors are having much interest on how locals adapt themselves and play their unique role in riverside developments. "Rivers provide a wealth of attractions and aesthetic appeal for tourists, while making use of rivers as a transportation corridor further boosts urban developments by transporting raw materials and manufactured products to and fro the riverside cities" (Amnuay-ngerntra & Sonoda, 2013).

Transport for London (2010) backups Amnuay-ngerntra & Sonoda (2013)'s research findings by displaying their statistics after implementing RPTS on River Thames penetrating through the heart of London city. As shown in *Figure 1.1-2*, significant growth on journeys made by passengers using RPTS have been examined in a 10-year period (2003 – 2012) after implementation of RPTS. Transport for London (2010) explains the significant growth on RPTS usage by relating RPTS's role: as a transportation alternative while offering

passengers a unique, exclusive and relaxing option going around attractive locations in the city. Thus, it is clear that RPTS do explores new potentials – encouraging urban developments and additional tourist attractions in a city.

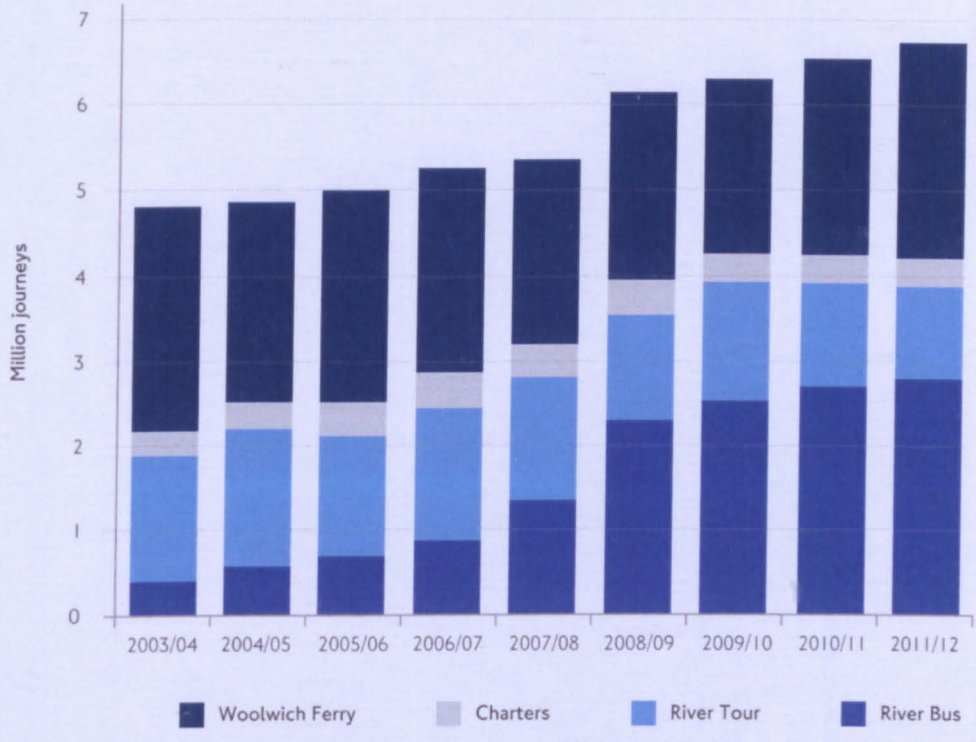

Figure 1.1-2 Growth of Passenger Journeys on the River Thames. Retrieved from Transport for London (2010)

Kabran & Eguavoen (2019) further pinpoints the importance of RPTS in Abidjan, Africa. As Abidjan locates herself by the sea, the city is having a huge coverage of water bodies across most activity centres. Abidjan faces intolerable congestions on land transportation systems: as almost every citizen is having their own vehicles, most bridges are working beyond their maximum capacity, while the congestion level at those bridges are expected to worsen as private car ownership increases in years to come.

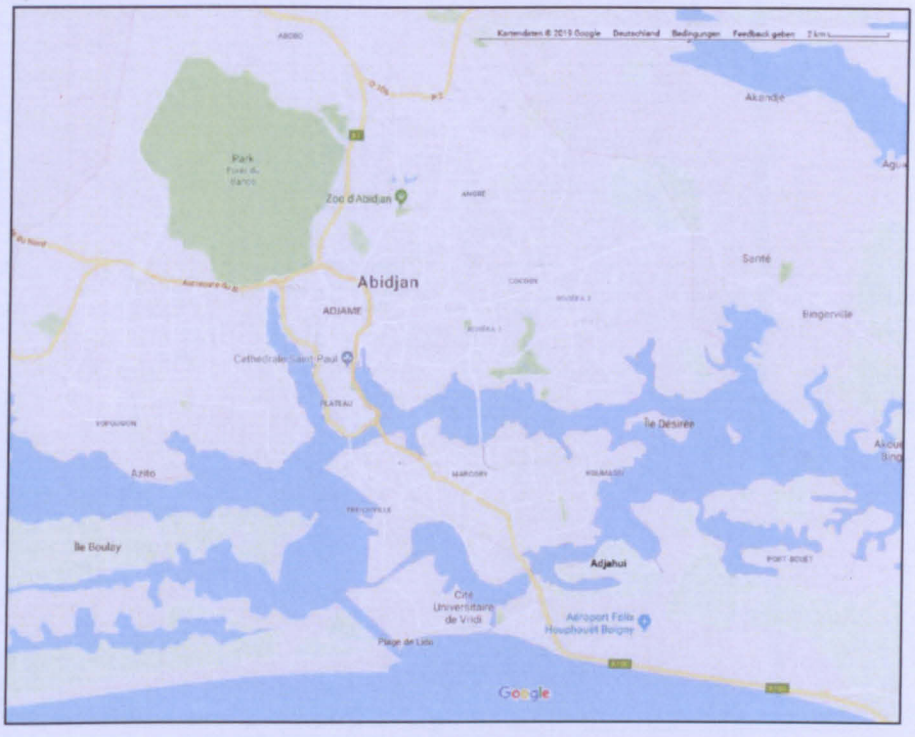

Figure 1.1-3 Abidjan Metropolis. Retrieved from Kabran & Eguavoen (2019)

On the other hand, the unique geography of Abidjan do facilitates the implementation of RPTS. Large demand on travelling by commuters using RPTS can be estimated, as Abidjan's large urban water body provides high accessibility to most commercial and institutional activity centres along the waterfront. Similar geographical conditions can be found at few cities implementing RPTS, including few cities in Washington, California, Brisbane, and London (Friends of Frog Ferry, 2019). To conclude, presence of large water bodies connecting activity centres in a city enhances the implementation of RPTS in the city.

Few cities implementing urban ferries into their existing public transportation system have brought them great successes, either in efforts reducing land transportation system's congestions, increased land economic value, and others. A successful example implementing urban ferries in transportation system is Brisbane, Australia. Brisbane City Council (2019) gives a head start providing urban ferries, widely recognized as CityCats, as a brand new component of the city's public transportation system since year 1996. Celebrating CityCats' 20 years of service in 2016, TransLink, the operating company of

CityCats, further provides different ferry services such as CityHopper and SpeedyCat, using expresses and even double-decker ferries, linking different locations within the city. Scheduled to reach each respective terminals within 10 – 15 minutes, urban ferries in Brisbane provides a time-effective, well-developed public transportation system to the city. As proven by Tsai, Mulley, Burke and Yen (2017) in their works, the successful implementation of urban ferries having high coverage area in Brisbane's public transportation system significantly increases land use value of the linked areas in the city, benefits the city economically in the long run.

Despite successful implementation of urban ferry in public transportation system of Brisbane, there exists cities seriously considering to implement urban ferries as part of their public transportation system. Renaissance Planning Group (2005) in efforts preparing water taxi feasibility study in Sarasota and Manatee City, shows high possibility in implementing urban ferries in both cities. Cang, Tuan and Phuc (2013) suggests few criteria in their feasibility study implementing urban ferries in Ho Chi Minh City, including suitable routes, schedules fulfilling passengers' travelling demand and psychology, and various models to be used in the city.

1.1. Problem Statement

Despite successful cases and feasibility studies on RPTS conducted in different cities, a brilliant idea emerges in between: does the concept of RPTS being adaptable as part of the urban public transportation system in Kuching city? How does this concept being suitable and is there any limitations implementing this new transportation concept? Knowing the fact that residents of Kuching city experiences intolerable congestion level on land transportation system every day, low coverage and under-developed Land-based public transportation system in Kuching city, and there exists no studies concerning RPTS being conducted in Kuching city, this project looks into the suitability on RPTS in Kuching city: to know the demand of travelling by commuters and visitors in Kuching city, to evaluate potentials of different locations along waterfront of Sungai Sarawak to become a terminal for RPTS, and to propose routes for RPTS based on available information.

1.2. Research Questions

This research answers few questions emerging from the careful considerations – how feasible is RPTS to be implemented in Kuching city. Questions answered by this research are as follows:

1. What is the possible passenger demand for RPTS in Kuching city?
2. Why a selected location is suitable to be used as terminal locations for RPTS?
3. What are the possible routes for RPTS in Kuching city?

1.3. Aim & Specific Objectives

This research aims to investigate how feasible is RPTS to be implemented in Kuching city. To know this, few specific objectives are set up as follow:

1. To determine travel patterns by residents of Kuching city within selected area
2. To evaluate potentials of selected locations as possible terminal locations
3. To design suitable RPTS routes based on proposed terminal locations

1.4. Research Organisation

This research comprises of 6 chapters, namely: Introduction (Chapter 1), Literature Review (Chapter 2), Methodology (Chapter 3), Results & Analysis (Chapter 4), Discussions (Chapter 5) and Conclusions (Chapter 6). The structure of different chapters are summarized as below:

Introduction, the first chapter of this research, provides explanations and clarifications on the study background of this research. This chapter highlights the research objective, research objective and specific objectives to be achieved by this research.

Chapter 2 – Literature Review further describes key factors and evaluation criteria involved in this research. Detailed explanations and relationships between these factors are discussed in this chapter.

Methodology (Chapter 3) basically describes on the evaluation method used to analyse information collected during data collection process. This chapter also explains in detail on the data collection process – how information are being collected, analysed, evaluated and designed

Information obtained from different sources are processed, evaluated and displayed in Chapter 4 (Results & Analysis). Here, results of collected information are shown, either in the form of maps, tables, and etc.

Discussions, the chapter followed after Results & Analysis, provides careful explanations on analysed information in details, together with the findings from the processed information. This chapter provides an intuitive answer to the research questions with reference to the results obtained.

Conclusion, final chapter of this research, summarizes and wrap up this research with important findings from previous chapters. Limitations of this research, together with suggestions and recommendations for future researches are included in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1. General

Martino (2014) foresees the importance of public transportation, on its great potentials in accompanying huge travel demand, and its high practicality on reduction of traffic congestion. However, to know whether a specific public transportation service is possible to be implemented in certain area, a feasibility study is required.

2.2. Previous Studies

A feasibility study on any transportation system is important in justifying the practicality of the suggested transportation system in selected area. Few feasibility studies on transportation system, particularly, RPTS, have been proposed and carried out by authorities, including Nelson | Nygaard Consulting Associates Inc. (2006) in City of Portland, Renaissance Planning Group (2005) at Sarasota and Manatee Region, Fairweather Consulting (2010) at City of Kingston, and etc.

Nelson | Nygaard Consulting Associates Inc. (2010) demonstrates a successful RPTS feasibility study on Willamette River, City of Portland, where potential urban ferry service markets together with existing and potential terminal locations are analysed, evaluated and potential urban ferry routes are proposed. An evaluation matrix concerning passenger demand and connectivity of proposed terminal site location is developed and used to justify potentials of selected locations, while urban ferry routes are proposed based on terminal locations showing high potentials on both demand and connectivity.

Renaissance Planning Group (2005) examines in depth on characteristics of RPTS's potential markets, including population and employment concentration in their feasibility study on water taxies at Sarasota and Manatee region. A simple 3-rating evaluation matrix is developed, while proposed terminal locations are evaluated and justified whether the site favours RPTS or not. Results of the evaluation supports short routes to be implemented within Sarasota and Manatee region, providing travel alternatives for passengers as a method to handle congestions on land transportation system, while the existing markets do not facilitate long routes due to relatively low travelling demand of Sarasota and Manatee's residents.

Fairweather Consulting (2010) further modifies Renaissance Planning Group (2005)'s evaluation matrix in their RPTS feasibility study on City of Kingston, New York. While the potential travelling demand of Kingston city's residents being determined based on average ridership on existing urban ferries' service counts and residents' commute demand in different residential areas, the evaluation matrix do provides a simple and direct view on potential terminal locations and routes to be proposed in the city.

Among all reviewed feasibility studies as stated above, similar design procedures on RPTS in a feasibility study can be summarized: Define study area, Examine selected area's social demographics and commuters / visitors' travel demand, Evaluate possible terminal locations and Design routes for RPTS. Sections below further discusses and explains on these components, which will be highlighted in this project.