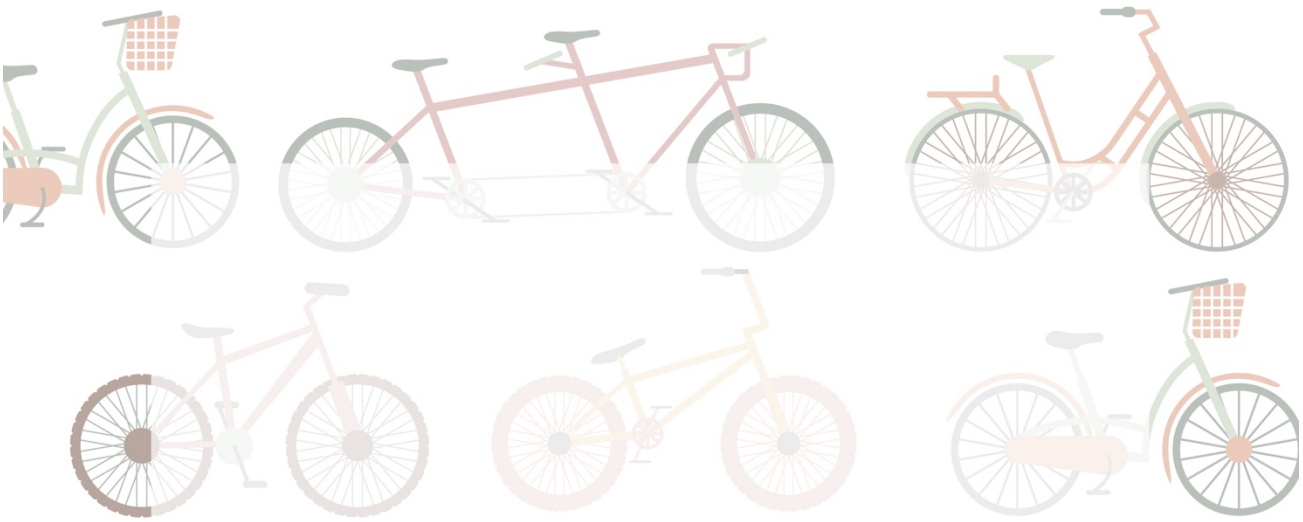

EDMONTON BIKE SHARE SCHEME

Siyi Xie

Edmonton Bike Share Scheme

by

Siyi Xie

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Abstract

Public transit system is the pulse of urban life. City planners are seeking solutions to promote public transit due to insufficient capacity of the road network and related environmental problems. Cycling, as one of the energy efficient transport modes, has high potential to improve the livability and sustainability of the city. Over the past decade, a significant number of bike sharing programs have emerged due to the benefits that cycling brings. Bike-sharing systems improve the accessibility and connectivity to other public transit, as well as encouraging citizens to participate in a healthy activity.

The cold climate and characteristic landscape forms a unique cycling culture in Edmonton. The purpose of this thesis is to propose a possible way of conducting a bike share scheme in the city of Edmonton. An internet-based bike sharing solution is introduced, including area plan, station and bicycle design, service design and marketing strategy.

Key words:

public bike sharing; sustainable transportation; bike infrastructure; internet-based service

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Introduction

The automobile has occupied a role in modern civilization for almost a century. According to Transportation Energy Data Book (Davis et al., 2014), the global ownership trends of vehicles have increased every year from 1960 to 2014. Sperling and Deborah (2009) estimated that the world automobile registration number will reach 2 billion by 2020. Growing motorization has attracted great awareness in energy consumption, climate change, automobile emissions and traffic congestion. Thus cities are seeking opportunities to encourage sustainable transit modes other than petrol consuming private vehicles to alleviate traffic congestion and alleviate the city from car emissions.

Cycling, as one of the mobility choices, offers more flexibility for short to middle distance trips compared to public transit modes like buses or trains. Compared to petrol-powered or electricity-powered vehicles, these human-powered vehicles require less energy consumption, which makes the costs more acceptable for user groups with incomes below the average. Despite the advantages, cycling is still not considered as a dominant transit option in many cities. Invented more than 70 years earlier than automobiles, bicycles once occupied cities and roads when private-owned automobiles were still extravagant luxuries for most people. The number of cyclists increased exponentially in the period of 1965 to 1975 in North America, later called the “bike boom” due to the popularity of bicycles (Pucher et al., 1999). Similarly, in the 1970s, citizens in China relied exceedingly on cycling that it gave the name to China as “Kingdom of Bicycles” (Shaheen et al., 2011). The United Kingdom underwent its bike boom in the 1990s. However, with the growth of world economies and the motorization of transportation modes, the automobile took over the roads and lead to the dwindling of

bicycle use. Following the popularization of automobiles, problems such as traffic congestion, air pollution and energy consumption have materialized. Hence cities are seeking opportunities to reintroduce cycling to daily transit to reduce the automobile usage.

Public bike share systems offer another chance for bikes. Bike sharing emerged in the 1960s in Europe. Public bike share programs have now been implemented in 1,139 cities by November 2016, according to The Bike-sharing World Map (initiated by Paul DeMaio in 2007). Cities are bringing bicycles back to the streets by offering convenience and flexibility with a fair user fee. Bicycle networks connect the residential area with other public transit modes, to make bus and metro services more accessible. The expanded public transit networks is expected to motivate more citizens to use public transit services and decrease personal vehicle use and by providing bikes for the "last mile trip" (Toole Design Group, & the Pedestrian and Bicycle Information Center, 2012). For bike riders, the user fee of renting a public bike is far less than owning a private bike, not to mention the cost of maintenance. For tourist travelers who would like to have a short ride trip, they can undergo the distinctive experience of visiting tourist destinations by riding bicycles.

Despite the benefits of traveling by bicycle, operating a public bike service and promoting cycling still has many prerequisites and barriers. Danger of injuries is a major factor preventing bike riders from riding on the road (Beck and Immers, 1994). With the growth of automobile use, the traffic environment for bike riders is getting severe. To relieve traffic congestion caused by even more automobiles, some cities dilate road capacity by sacrificing sidewalks and bike lanes. The result turns out to be more vehicles on the street and a more difficult riding environment for bike riders and pedestrians. The mix of bike riders and auto vehicle drivers raise more safety concern as riders are less protected than car drivers. Segregated bike lanes, mandatory helmet laws, and clear

cycling signs are ways to construct safer cycling environment. Efficient bike networks and quality of public bike facilities are also bicycle riders' concerns. Cold climate can be another problematic reason that is causing riders to use their bicycles less. For existing systems, complications such as theft and vandalism of bicycles and facilities are problems that harm the operation of the systems.

In this thesis, the author proposes a public bike share system for the City of Edmonton. The paper is organized into six chapters. The first chapter introduces the concept of public bike share and has a holistic view of public bike share systems in the world. The second chapter analyses the unique cycling culture of Edmonton. The third chapter is two case studies. The fourth chapter assesses the potential of conducting public bike sharing in Edmonton. The fifth chapter introduces a public bike sharing scheme designed for Edmonton, including service area, bike and station design, service design, and marketing strategy. Finally, the conclusion of this thesis.

Chapter I
Background

1.1 What is Bike Sharing?

Public bike sharing is a service that offers individuals bicycles that are shared use with other users with low fees for short distance travel. Bike sharing programs are usually offered in a designated service area to provide the populace an alternative transit option.

The development and evolution of public bike share programs are divided into three different generations (DeMaio, 2003; Shaheen et al., 2011). The first generation enabled users to ride a public bike without any user fees. Bikes were left unlocked and did not require riders to return the bike to the original bike station. The second generation was the coin-deposit based system that required a coin for users to get access to a bike. The coin would be given back to users after returning the bicycles. Riders could get a bike from one station and return it to any one of the stations within the station system to get their deposit back. The third generation, also called "IT-Based System," collects users' personal information such as phone number, personal identity information or credit card information to use a bicycle. Users can either activate a bike by using the membership smart card that was provided by the bike share company, authorizing credit card on a service terminal machine, or by using a smartphone application. Like the second generation systems, users have to return the bike back to a station. Depending on the total use time and different types of membership riders are holding, a user fee will be charged from the riders' credit card. The third generation system is currently the most used type of public bike sharing system in the world.

There are two types of operation modes for the second and third generation systems: manual systems and automated systems. Manual systems are mostly recommended in small cities with low population density, due to the effectiveness of the operating cost. A manual system usually consists of bicycles, and stations which allow users to return bicycles to where they took it or to any other station, where staff help bike users for the service. To get access to a bike, users may be asked for a riding fee, fund deposit and personal identification by the staff. Automated systems are recommended in large cites and cities with high population density. An automated system is usually composed of bicycles and stations with service terminals and an electronic rack to lock the bikes. To unlock a bike, riders need coins, a credit card, or an electronic card to release bikes from the station.

Most of the bike-sharing systems that many cities are using today are automated. Depending on the scale of the service area, the size of the system can vary from owning several bicycles to thousands of bicycles. The world's largest automated bike share system is the one in Hangzhou, China with 84,100 bicycles at 3,336 stations as recorded in August 2015. The largest system in Europe is the *Vélib'* in Paris with 20,600 bikes at 1,451 stations.

1.2 Why Bike Sharing?

In the past century cycling had experienced an upsurge in North America. The burgeoning of motorization and the growth of global economies enabled privately owned motor vehicles to become more accessible for households in both industrialized and underdeveloped countries (Schäfer et al., 2009). From 1990 to 2010, the number of worldwide percentage bike ownership declined from over 60% to about 40%(Oke et al., 2015), while the ownership of motor vehicles doubled in the same period (Davis et al.,

2014). With more preference on traveling by private automobiles, problems such as traffic congestions and air pollution rose. To diminish private vehicle usage public transportation and other sustainable transit modes are being encouraged.

Public bicycle systems offer more flexibilities for making short distance trips. The system can connect to other public transit system as a shuttle service. Given an alternative transit option to cover the "last mile" of reaching a final destination from transit stops and vice versa the public transit network becomes a more accessible and attractive option (Scott, 2009; Allen, 2012). Promoting cycling is also regarded as a way to motivate residents' everyday physical activities and build a positive impact on public health.

1.3 History of Public Bike Share

The world's first public bike share project was initiated in Amsterdam, which provide the model for the later bike projects in Europe (DeMaio and Gifford, 2004; Davis, 2014). The concept was called the *Witte Fietsenplan*, the White Bike Plan. The plan was originally conducted by a group of Dutch anarchist activities to evoke social attention rather than promoting public transit. Instead of today's specially designed bicycles, automatic service terminals, and smart membership cards, the plan was primitive and haphazard. Fifty regular bikes were painted in white and released onto the street without any locks, free for people to pick-up and drop-off at any location in the city with no user time limits. Due to theft problem, only half of the bicycles were ever reclaimed.

After the first failed endeavor, two Danish cities, Farso and Grena released a more systematic bike project. Bicycles were customized and installed by usage of special tools, which were considered as an improvement to prevent the bicycles from theft. To get access to one of these bikes, a coin deposit is required and was returned after dropping off the bike to the original station or any other station. Later the system was introduced to

the capital city Copenhagen, with a larger number of bicycles and more bike stations. The result was still discouraging due to the continuous theft problem.

In 1998, France launched a new self-served public bike system in Rennes. The system requires personal identifications such as a credit card or a membership electronic key card to get access to a bike, instead of direct coin deposit. Thus the “smart bike” system, or *Vélo à la Carte*, became a foundation for public bike share system many cities are using today.

Chapter II
Cycling in the City of Edmonton

The City of Edmonton is the capital of the province of Alberta, sitting on the North Saskatchewan River. In recent decades, the population of Edmonton has had a notable increase from about 650,000 to nearly 900,000 (City of Edmonton, 2016). The increasing population brings with it problems of traffic congestion and urban sprawl.

The city has mild weather during summer time, while the winter season that can last for up to five months can have significant snowfalls during this period. Due to the harsh climate and long-lasting winter season, Edmonton is a "winter city" of snow and ice (Pressman, 1985; Pressman, 1989). The Edmonton Transit System (ETS) and private motor vehicles are two mainstream transit modes in the city.

2.1 Cycling & Safety

There are now about 850 kilometers of street oriented and off-road bike routes in Edmonton, with most being shared routes (City of Edmonton, 2016). The Way We Move (Transportation Master Plan), the Bicycle Transportation Plan and the Active Transportation Policy were approved by the City Council in 1992 to build a bike-friendly city. In 2002, the City Council made an effort to connect all parts of the city with the downtown area and the River Valley by constructing a 62 km Multi-Use Trail Corridor (MUTC) network, together with a vast improvement of bike network (EDA Collaborative

Inc., 2001; Pucher and Buehler, 2006), cut by the North Saskatchewan River Valley, the downtown area and River Valley area has a significant connective biking network.

Although cycling culture in Edmonton appeared decades ago, creating a bike-friendly city still needs further planning. Riding bikes is more regarded as a recreation for children, and physical exercises during weekend rather than a daily transit option. The long duration of the winter season and slippery icy streets makes cycling unapproachable for inexperienced bike riders.

The City of Edmonton is making efforts to promote cycling and to increase cycling safety awareness. The ETS offers convenience for riders by providing bike racks on buses. Bicycles are permitted on light rail train (LRT), except for weekday rush hours (City of Edmonton, 2017). Bicycle racks have been placed near transit centers, schools, shopping malls, and other meeting places. Riders are encouraged by the city to propose requests for new bike rack locations. New bike routes are being added to bike networks every year. The City of Edmonton produced a series of bike safety education videos by using LEGO in 2012. All six videos attempt at educating road users about cycling safety and bike infrastructure use. These videos are available on the city website and YouTube and won the Canada National Transportation Safety Council Award for Edmonton in 2014.

Local bike organizations run voluntary programs to support bike riders by providing bike rental service, self-service bike workshops, and CAN-BIKE safety courses for both youth and adults. Volunteers teach bike fixing techniques for free and offer tool rentals with low fees.

2.2 Winter Climate

Due to Edmonton's cold climate, cycling in winter needs strategies to avoid injury. Winter cyclists usually develop their own route by using specific passageways or ride on sidewalk if the bike lanes are covered with snow (Shirgaokar and Gillespie,2016). Shirgaokar and Gillespie conducted a research project of interviewing 33 winter cyclists in Edmonton, the majority of them being knowledgeable riders with an average of more than 7 years' cycling experience. Results indicated that riders were affected by unclear bike lanes due to snow windrows left on the road and by ice that forms later if the snow is not removed properly, which increases the difficulties and danger level for inexperienced riders.

According to research studies toward improving winter cycling (Bergström and Magnusson 2003; Miranda-Moreno, and Kho, 2012; Shirgaokar and Gillespie, 2016), rather than the cold weather itself, improving road condition and snow removing frequency would encourage more cyclists to ride in winter.

2.3 Bike Infrastructures

Bike infrastructures includes road infrastructures and parking infrastructures. According to the Bicycle Transportation Plan Summary Report (City of Edmonton, 2009) in 2009, on-street bicycle infrastructure includes more than 217 kilometers of separate bike lanes and shared-use lanes. Off-street bike infrastructure includes more that 595 kilometers of single-use and shared-use trails in the river valley, and more than 40 kilometers of trails along utility and pipeline routes.

Throughout the city, Edmonton has provided 665 parking spaces including both bike stalls and on-street bike racks (Shirgaokar and Gillespie, 2016). Bike racks are mostly

designed for summer use rather than all-weather purpose. In Shirgaokar and Gillespie's (2016) research of bicycle infrastructure supply statistics, Edmonton provides 82 parking spaces for each 100,000 populations. Compared to the number of 275 in Calgary and 670 in Toronto, cycling infrastructure in Edmonton is still under developed.

2.4 Bike Share History

In 2008, a group of cycling enthusiasts started a bike share program called "The People's Pedal" in Edmonton. About 100 recycled bicycles were painted red by the volunteers and distributed at 14 stations in the downtown area and university area. Charged with C$25 per year, riders could get access to the lock boxes by using a code. No credit or user identity information was required. The volunteers changed the code repeatedly to manage the lock boxes in case of improper use. The program developed about 200 members in the summer of 2008.

The intention of the system was to offer bikes for short one-way trips. However, after several months of operation, the program was devastated by theft and vandalism problems. Over 80 percent of the bicycles were stolen, some parts such as bike seats disappeared, while many members were complaining that they couldn't find a bicycle. Due to the voluntary system of the operating team, the number of volunteered mechanics failed to fulfill the demand of repairing damaged bikes. In December 2008, only 5 of the bicycles were found. One of the red bikes is now kept at the Bicycle Library in the University of Alberta. The People's Pedal only served one summer in Edmonton.

Besides public bike share, bike rental service is another choice to enjoy cycling rather than maintaining a private-owned bike. Local bike workshops, such as *Edmonton Bicycle Commuters Society* and *the University of Alberta Bike Library and Workshop*, and tour

companies, such as *River Valley Adventure Co.*, provide bikes for daily travel and mountain cycling.

The following two case studies research two public bike sharing systems in Canada. Research focuses on the design of the bike and station, and system management mode. The first research object is the Mobi system in Vancouver. Launched in 2016, Mobi is gradually growing by attracting new customers and implementing new bike stations. The second research object, BIXI Montréal, is the first large-scale project in North America with nine years' valuable operation experiences. With the similar cold climate as Edmonton, BIXI Montréal runs seasonally to avoid the harshest winter seasons. My research methodology involved interviews and field visit to these two locations.

Chapter III
Case Study

This chapter includes two case study of existing bike share systems in Canada. The first one is Mobi in Vancouver, the second one is BIXI Montréal. Mia Kohout from Mobi and Pierre Parent from BIXI Montréal were interviewed for my research.

3.1 Mobi: Vancouver bike share

Mobi is a newly launched (2016) public bike share system in Vancouver, British Columbia. The system is a city-owned program to promote public cycling. The system plans to implement 150 stations locally with 1,500 bicycles. Since March 2017, Mobi has distributed 1000 bicycles in 105 stations.

The bicycle stations are implemented primarily on the north side of Vancouver. The station distribution map (Figure 1.1) shows the service area that covers downtown and south downtown area as well. Installed every three to five blocks, the bicycles connect local train and bus service to increase the accessibility and flexibility of the transit network. The station map also lists the location of bike rental services (Figure 1.2) to help the development of local bike industries.

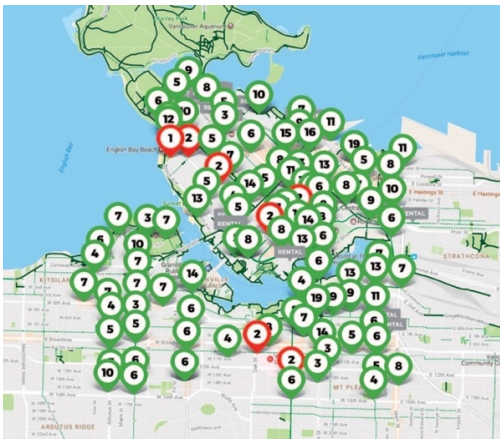

Figure 1.1: Mobi station map

Figure 1.2: Rental service marked on the station map

Funded by the city government, Mobi is operated by a private-owned company *Vancouver Bike Share Inc.*. The firm is a subsidiary to a bike share operator *CycleHop*, one of the largest public bike share operators in North America. All the equipment including bicycles, interactive devices, docking stations and information kiosks are provided by the French company *Smoove*. By utilizing the designs provided by *Smoove*, (figure 2.1) *Vancouver Bike Share* has been able to execute and manage the system in the city to serve riders better. In December 2016, the Canadian telecommunications company *Shaw Communications* became the largest sponsor. Thus the programs official name changed to Mobi Shaw Go (figure 2.2). All the bikes are painted in the blue brand color of *Shaw*, instead of their original turquoise.

Riding with Mobi

The Mobi system is an automated operator based program utilizing a user code method. Users no longer need to hold their credit card in hand and look for a service terminal machine. Bicycles are activated by user codes, which can be applied by registering either on the Mobi website or the Mobi mobile app. To sign up, users need to provide personal information to create a profile, authorize credit information, and then the users have access to a bike. Once they have been registered, users will receive a seven-digit user code by email. Riders then can decide to sign up for a day pass, a monthly pass or a year pass and enjoy their bike usage with Mobi.

Figure 2.1: Mobi station

Figure 2.2: Locked bikes at docking posts

Both the website (Figure 3.1) and the application (Figure 3.2) offers station maps that help users to locate a station with in stock bicycles. On each bike, there is one control pad with the keyboard, which is called the *Smoove Box* (Figure 4), sitting in the middle of the handlebar. Upon entering the access code, and after a short beeping sound, the rider is free to release the bike from the dock, put on the helmet and commence their ride. Due to the cycling law in British Columbia, it is mandatory to wear a helmet during cycling. A helmet is attached (Figure 5) to each of the bicycles for safety and compliance with the law.

Figure 3.1: Mobi mobile Application

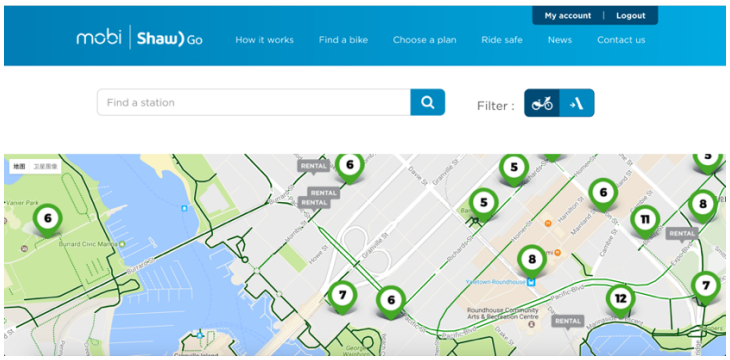

Figure 3.2: Mobi website

Figure 4: Smoove Box

Figure 5: Helmet on bike

Mobi also provides riders the convenience to have short stops during their journey. If there are no stations near where they would like to park, there is an integrated cable lock designed to satisfy this demand. After parking the bicycle, users can activate the screen to follow the instructions and use the cable lock. Pulling the cable from the right handle. They lock the bike to a solid object and lastly secure the bike by inserting the end of the cable into the fixed point right under the *Smoove Box* (Figure 6). While the riders have the bicycles locked by this method, instead of returning to a station, however, the rental time is still running. Since the user fee is charged depending on total using time, including the time of shortstops that are made during the trip, it is always recommended to find a near station. To restart riding the bike, riders simply wake up the *Smoove Box*, reverse the locking steps and continue their trip.

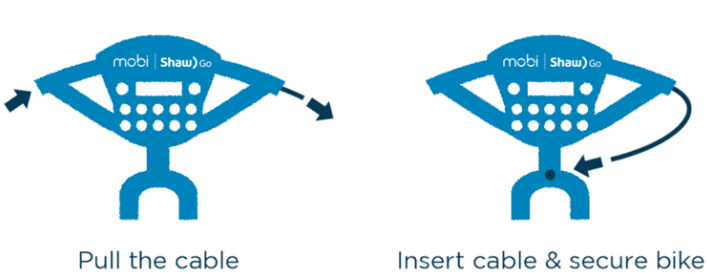

Figure 6: Lock the bike using integrated cable

Operating & Managing

The idea of operating a public bike share program in Vancouver was first proposed by *TransLink*, the South Coast British Columbia Transportation Authority, in 2008. In 2011, the City of Vancouver held an open house to get feedback on a public bike share system. After six years of negotiation and consultation, the system finally was launched in summer 2016. Before the official launch on August 18th, Mobi underwent a pre-launch of 250 bikes at 23 stations, distributed in Vancouver downtown, Mobi was running satisfactorily by connecting with bus services and three SkyTrain lines. Having been officially launched for three months, Mobi had 100,000 rides in October 2016.

After the success of the first several months, Mobi encountered its first winter season. The temperature in Vancouver hit its lowest point of -8℃ in January 2017. Snowfalls were predicted in January and February, with days accumulating less than 5 centimeters snow. According to *Vancouver Bike Share*, the number of trips made in winter season had a 15% reduction in comparison with summer and fall seasons. About 80% of the members are holding a monthly pass or an annual pass. 20% of the members are daily pass holders. Additionally tourists are using Mobi in the summer months. Stations cover popular locations of beaches, harbours, and parks in the downtown area, including Stanley Park, English Bay Beach, and Coal Harbour waterfront walkway

During a trip, data is collected twice: when the bicycle is activated, and when it is returned to a station. Each trip is corresponding to a start station and an end station. Using the collected data, *Vancouver Bike Share* has recognized five of the most popular sites all of them are located in the heart area of downtown close to the central transit routes.

Despite the continuous use of the bicycles, vandalism or theft isn't common to the Mobi system. Bike are installed by special tools. Racks are strengthened to avoid intentional damage. To Mia Kohout, the general manager of *Vancouver Bike Share*, the time and

cost on planning and implementing each of the stations is minimal. The implementation of each station takes about two hours, from installing the docking post, information kiosk to distributing bicycles. New locations for the upcoming stations are selected depending on user density and location to transportation network. Citizens are also welcomed to suggest a station site. From the 250 bikes at 23 stations in July 2016 to 1,000 stations at 105 stations in February, Mobi is gradually achieving its goal of 5,000 bicycles in 250 stations.

Condition for Use & Fees

The Users are required to sign up for a plan. There are three main categories, C$7.5 for a day pass, C$15 for a standard monthly pass, and C$129 for a year standard pass. Day pass and standard pass riders can have an unlimited number of 30-minute rides and will only have to pay extended fees (Table 1) if the ride exceeds 30 minutes.

Mobi also provides two options for riders who desire longer trips: C$20 for a monthly plus pass, and C$159 for a year plus pass. Riders holding a plus pass can enjoy a 60 minutes' ride, but will have to pay extended fees (Table 1) for longer use.

		Price	Unlimited Ride	Overage Fee
Day Pass		C$7.5	30 min	C$5/30 min
Monthly Pass	Standard	C$15	30 min	<60 min C$2/30 min >60 min C$3/30 min
	Plus	C$20	60 min	>60 min C$3/30 min
Year Pass	Standard	C$129	30 min	<60 min C$2/30 min >60 min C$3/30 min
	Plus	C$159	60 min	>60 min C$3/30 min

Table 1: Mobi user fee plan

3.2 BIXI Montréal

Launched in 2009, BIXI Montréal distributes 6,200 bicycles to 540 stations in the city area. It is the first extensive public bike share program in North America. After the City of Montreal took over the system from the original *PBSC* (*Public Bike System Company)*, BIXI Montréal now operates as a non-profit organization.

Station density is higher in downtown areas and radially spreads throughout the city (Figure 7.1). Maps are available both on BIXI Montréal website and BIXI mobile app. The system operates seasonally from April 15th to November 15th to take into consideration Montreal's winter.

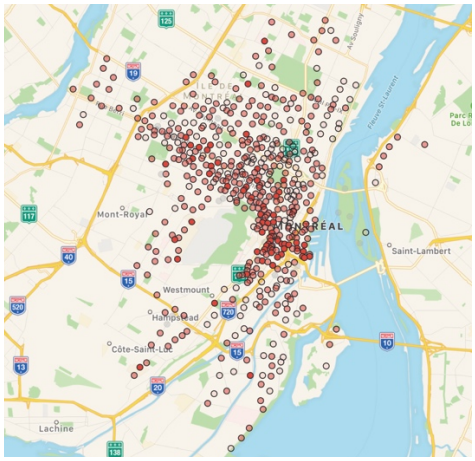

Figure 7.1: BIXI station map

Figure 7.2: map detail

Ride with BIXI Montréal

BIXI Montréal operates based on membership key and user key code that consists of three possible membership plans. BIXI members will get a key after registering online. Members have choices of 30-days membership, 90-days membership, 1-year memberships and occasional memberships. Personal information and credit card information are required to proceed with registration. Occasional users can get the

unlocking code after paying from the service machine, or from the mobile app. Users can choose from a one-way ride, 1-day ride, and 3-day ride. Credit card information is required to charge a C$100 deposit fee. A coded five-number will show up on the screen after successful payment.

To unlock a bike from a dock, insert the key in the top left if the bike dock. Occasional users just enter the code on the keypad (Figure 8.2) in the top left of the dock. After the green light flashes, pull the bicycle out of the dock, and then users can start their ride. To return the bike, riders just need to locate a station (Figure 8.1) and push the front wheel of the bicycle into an empty dock.

Figure 8.1: BIXI station

Figure 8.2: Code keypad

Operating & Managing

The City of Montreal (Ville de Montréal) proposed the public bike sharing idea in their transportation plan in 2007. A private owned company *PBSC* was contracted by the city to design the city bike share system It was managed by *Stationnement de Montréal* and the public parking administrator of the city. Initially 5,000 bicycles were distributed in Montreal in 2009, with more than 10,000 members at the end of the year. In 2011, the BIXI team became an independent organization no longer under the supervision of *Stationnement de Montréal*.

The technology BIXI Montréal uses was developed by *Stationnement de Montréal*. The service terminals are using wireless network and powered by solar energy (Figure 9). Supported by a metal pillar, the solar panels above the terminal can provide power and need no extra power support.

Figure 9: Solar powered bike station

Each station contains a service terminal, bike docks, and bicycles. The service machine and docks are installed onto portable platforms, which are a module that can add on or be moved to other locations. When riders find a defective bicycle, they can report the problem by pressing the red fixing button on top of the dock after returning the bike to a bike dock. Mechanics will come pick up the malfunctioning bike and proceed to subsequent repair and maintenance.

The system suffered from theft and vandalism when first released to the public in 2009. Bike docks were destroyed with the parked bicycle stolen. Docks were later strengthened, and there appears no notable theft or vandalism after the re-design.

Most of the trips in a year are made in June, July and August, as summer time is tourism peak season in Montreal. According to the data of purchasing BIXI memberships and occasional pass in 2016, 95% of the purchases are made by occasional short-term users.

Most of the memberships were purchased in March and April, which is around the time of the system starts serving each year. User data is collected when the bicycles are unlocked and when returned.

Condition for Use & Fees

Membership holders can choose a plan from 1-day pass to 1-year pass and enjoy a 30 to 45 minutes' free ride. Additional fee will be charged if the riders exceed the limited time use. Members receive their key by mail after registration. Occasional users have the choice of getting a flexible 1-way ride for C$2.95 for 30 minute's unlimited ride. Day pass occasional riders have unlimited number of trips within pass period and can enjoy free 30 minutes' ride for each loan. A deposit fee of C$100 will be charged on occasional riders and will be refunded within 10 days.

		Price	Unlimited Ride	Overage Fee
Membership	1-day	C$5	30 min	<60 min +C$1.75 >60 min C$3/15 min
	30-day	C$30	45 min	
	90-day	C$55	45 min	
	1-year	C$89	45 min	
Occasionally Use (C$100 deposit fee)	1-way	C$2.95	30 min	<60 min +C$1.75 >60 min C$3/15 min
	1-day	C$5	30 min/loan	
	3-day	C$14	30 min/loan	

Table 2: BIXI Montréal user fee plan

Chapter IV
Assessing Edmonton's Bike Share Potential

The past limited successes of a public bike sharing experience plus the experiences in other Canadian cities warrants the reintroducing of bike sharing into Edmonton. Following questions need to be answered during the design procedure: What kind of bike share does Edmonton need? How to design a system that can adapt with changing demands and winter season? How to improve the connections between different transport modes by promoting bike share? How to involve and encourage Edmontonians in bike share? What goals are to be achieved by a bike share?

4.1 Credit-based

Learning from Edmonton's past experience, bike theft was the main problem that devastated the bike share scheme. The case of Mobi and BIXI Montréal are based on the third bike share generation comprising modular stations with service terminals, electric docks and bicycles. The telecommunications technology enables the use of a credit based rental system that significantly reduced bike theft.

The People's Pedal used a code box to protect bike keys, the using time and number of trips were not limited or tracked. Long trips and over-time misappropriated uses were not supervised or charged appropriately. The system was operated under a users' self-discipline mode. The donated share bicycles and regular locks, however, were easily damaged and could hardly prevent misuse and theft. An efficient credit system would rectify users' behavior.

4.2 Station-to-station

Station-to-station is the most used service type among existing bike share programs, such as with Mobi Vancouver and BIXI Montréal. By operating station-to-station service user riding times are tracked to accurately time each trip's duration. The collected data can also help the operator locate the most and least favored station and direct future adjustments.

The rise of dockless bike share system is a new approach toward the evolution of next bike share generation (Parkes et al., 2013). Dockless bike share is a public bike share systems without modular stations and designed bike racks. The integrated Global Positioning System (GPS) offers real-time information on bicycles. When users find a bike close by, they can unlock the electric bike lock by making a phone call or by the bike share mobile application, ride to wherever they need to go, stop using the bike by parking at the nearest public bike rack instead of returning it to a bike share station. Over-time use will be charged a fee, which is the same as station-based systems. Dockless systems offer convenience and flexibility, as well as less cost for the hardware and installation. Ofo and Mobike in China are two examples of systems without designated stations.

Despite the advantages, the prerequisites and following issues are inevitable. High population density and comprehensive bike infrastructures can better support the operation of the system. Operators cannot restrict and track the bicycles due to large service area. Bikes may be parked in unreachable positions such as inside private property. There is high rates of theft and vandalism which have been difficult to control. With a lower population density and insufficient bike infrastructures adopting a dockless system could be a challenge for Edmonton.

4.3 Eco-friendly & Sustainable

The City of Edmonton has been making efforts to create an eco-friendly and livable city for all residents. The Edmonton's Community Energy Transition Strategy published in 2015 proposes energy efficient goals in transportation. The future bike share systems are moving towards a system more sustainable, flexible and human-centered generation (Midgley, 2011; Shaheen et al, 2010).

The operation of the third generation system, both station-to-station system and dockless system rely on electric lock for security. Station-to-station may have service terminals to power. The BIXI Montréal system are solar-powered by two panels on top of the service machines. Because the stations are completely self-supported and need no wires to connect to the network, the installation of the station module is more flexible with no necessity to accommodate wire configuration for power grid connection. Mobike bicycle locks are powered by the energy generated from the spinning wheels when users ride the bike. The power generator hides inside the bike frame. However, the self-powered design brings the problem of weight to the bike and can cause an uncomfortable riding condition. The second generation, Mobike Light, uses solar-power to support the lock by adding solar panels in the bottom of the basket. After the redesign, the bicycle is now 8 kilograms lighter than the older version.

4.4 Electric Bike

In 2011 the University of Tennessee launched an on-campus electric-powered bike sharing program, cycleUshare to research the potential of e-bike share (Langford et al, 2013). Copenhagen's e-bike system Bycyklen, and Barcelona's electric scooter share program Motit are attempts to move bike share to the next level.

E-bikes enable riders to travel longer distance with less effort. Researchers (Johnson and Rose, 2013; MacArthur et al., 2014; Popovich et al., 2014; Allan, 2016) suggest that e-bike has the potential to be an auto mobiles' substitution. Some safety issues remain a deterrent to introducing e-bike into public bike share. A comprehensive E-bike policy should be established before launching an e-bike share system onto the street, such as speed limitation and power output. The idea of using e-bikes can be considered for future development.

4.5 Winter Climate

Extreme weather such as the snowy windy winter season discourages some of the cyclists from riding bikes (Bergström and Magnusson, 2003; Winters et al., 2007; Flynn et al., 2012), which can also be a barrier for local bike share. BIXI Montréal's solution is to reclaim all the bicycles and stop the service for five months to avoid the winter season.

Researchers are also seeking feasibilities to increase winter cycling in urban area (Bergström and Magnusson, 2003; Shirgaokar and Gillespie, 2016). Studies point out that cold weather is not the principle reason that keep cyclists away from winter riding. Bergström and Magnusson's view is that riding experience is essential for riders to decide whether they will ride again. Improving road condition may be one way help to gain a better riding experience. Shirgaokar and Gillespie proposes that adding separate bike lanes, improving winter bike-friendly infrastructures and policies, and increasing snow cleaning frequency will help promote winter cyclists.

Changing from regular bike tires to fat winter tires provides safer riding and enables the cyclists to better adapt to snow. However, reclaiming bicycles to change tires is time-consuming and expensive. Winter also causes the decrease of bike sharing users in the case of Mobi. 63% of bike sharing operators chose to run their system seasonally due

to reasons including weather (Shaheen et al, 2012). Considering the danger of winter cycling and the expense of winter bike infrastructures in Edmonton, a seasonal bike sharing system is a better option.

4.6 Cycling for All

The public bike share scheme is expected to reduce car trips, expand transit networks and encourage the improving of cycling infrastructures. The introduction of public bike share into Edmonton is an opportunity to raise public concern of living a sustainable healthy life. Basic physical activity related to transportation, walking and cycling, have a considerable value of benefiting public health (Oja et al., 1998; Rojas-Rueda et al., 2001; Pucher et al., 2001). The City of Victoria, BC, experienced a bike network revolution in 2015. Citizens were recruited for advice to develop a comprehensive bicycle network regardless of ages and abilities. Copenhagen, the world famous cycling city, has invited more bicycles into the traffic mobility by improving cycling condition and safety. The number of cyclists riding to work and attend education institutions experienced a significant rise from 1975 to 2005 (Gehl, 2010).

Urban planner Jan Gehl summarized several factors of good cities for cycling, including safety and comfortable bike network, and good integration with traffic (Gehl, 2010). He proposes that creating a safety bike network is the most essential step in promoting cycling. By inviting more people into daily cycling, a new bicycle culture will emerge and shift from automobile-relied city to “a lively, safe, sustainable, and healthy city” for all ages, all genders, all occupations.

Setting up a public bike share in Edmonton is only one step of creating a cycling Edmonton for all.

Chapter V
Edmonton Bike Share Scheme

The Edmonton bike share scheme proposed represents a sustainable and healthy attitude as part of an Edmontonians' lifestyle. It should work as an option for daily transit mode, an improvement to better connect with the city, a sustainable tool toward a healthy living for its user. A potential design proposal of Edmonton' public bike share system is presented in the following chapter, including planning, bicycle and station design, visual identity design, system operation and management. Future studies and limits will be discussed and suggested.

5.1 Planning the System

5.1.1 Service Area

Edmonton has a seasonal cycling culture due to the cold climate. Eight bridges connect northbound and southbound providing automobiles, walking and cycling trails. Along the North Saskatchewan River river valley area are the most popular workout routes, as well as a tourists' favored destination with picturesque scenery of the city landscape. Together with the university area which sits at the south side of the river, the downtown area, and the river valley all form the core of the city (City of Edmonton, 2016) (Figure 10).

The designated service area covers the central area of the river valley and popular parks along the river valley ribbon. It is proposed a pioneering project would be the optimum way to start the system. The first stage of the system covers Jasper Avenue to the north,

and Whyte Avenue (82 Ave NW) to the south, including Waterdale Park, Victoria Park, Constable Ezio Faraone Park, Monsignor William Irwin Park, Grant Notley Park, Kinsmen Park, Emily Murphy Park, and William Hawrelak Park (Figure 11). With high density living in this area, the system provides a flexible transit mode and a physical activity option.

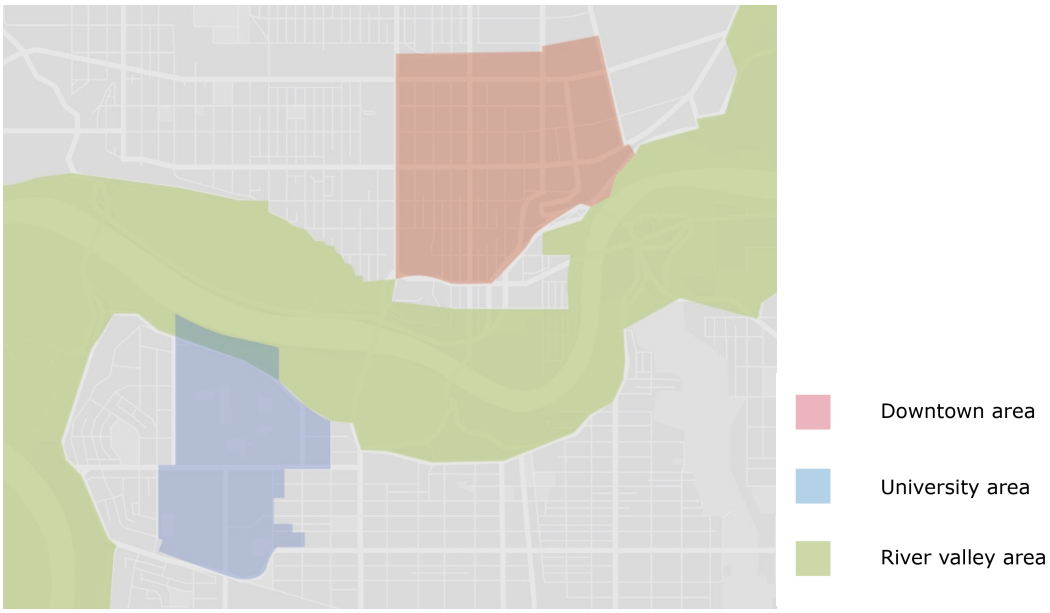

Figure 10: Zone Map

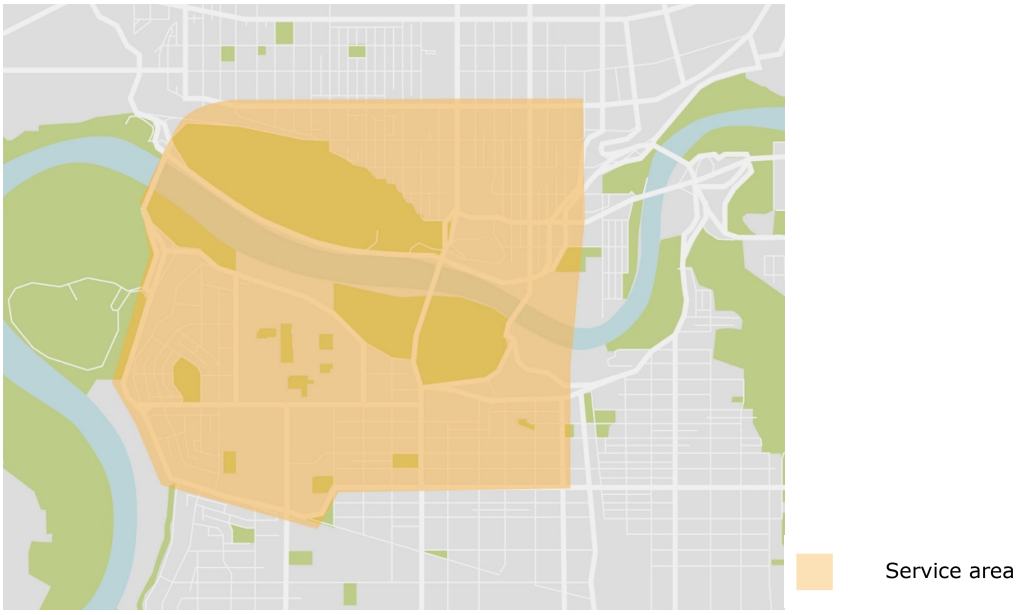

Figure 11: Service area Map

The service area illustrated serves as an initial project that keeps the flexibility for further adaptation. Future expansion of the covered area and station locations will be taken from suggestions during operation. The initial operation of the system will develop a group of regular users. Regular surveys and customer support services can help then guide the progress to build a more expansive and comprehensive system.

5.2.2 Station Distribution Plan

Mobility Study

There exists 30 bus lines and five LRT stations in the service area to provide for public transit (Figure 12). Bus networks connect LRT stations with local communities to all directions of the city. Two public transit centers, university transit center and government center provide a high volume of traffic flow to satisfy travel demand, bus stations are set every 3 to 5 blocks apart. Users in the residential area can reach the nearest bus station within a 10 minutes' walk.

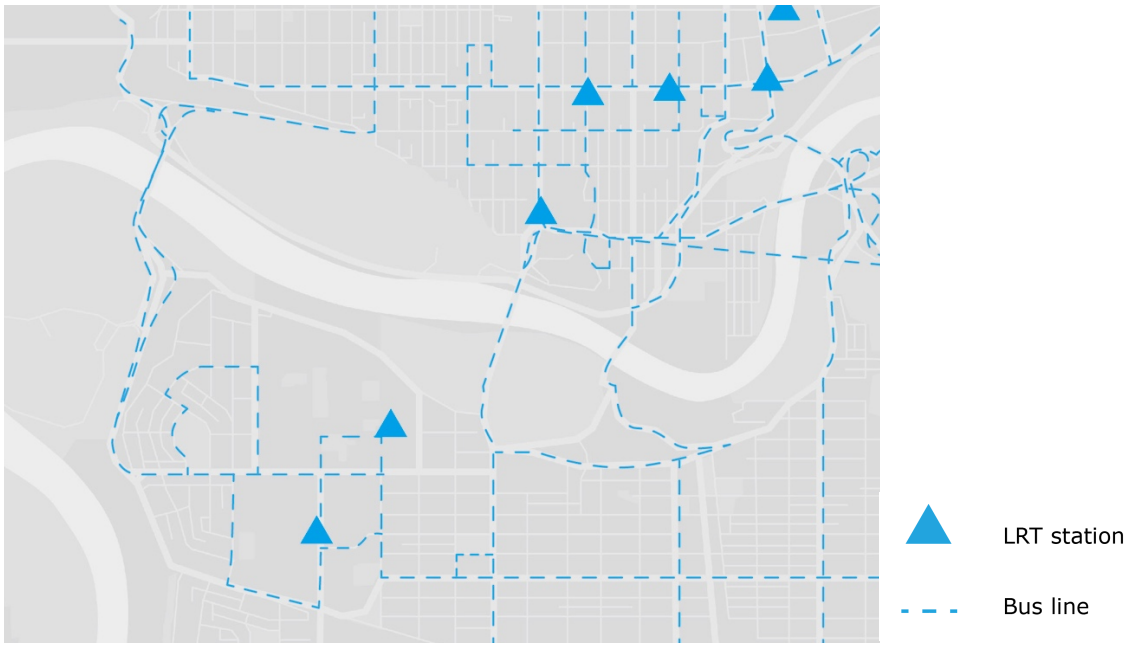

Figure 12: Public transit system map

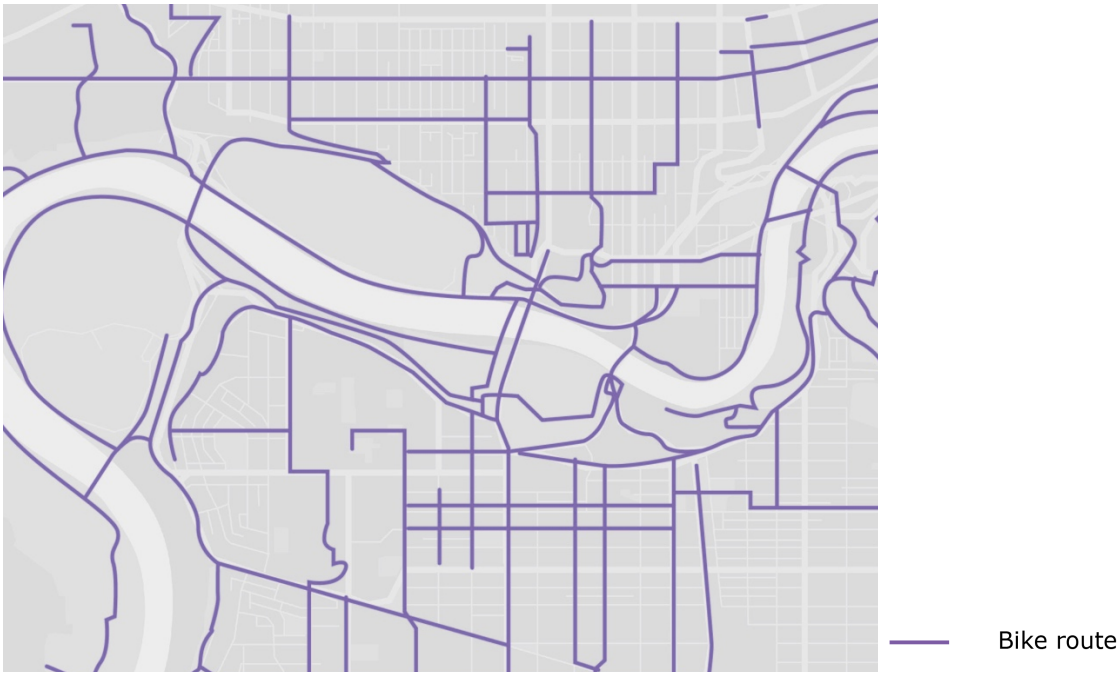

Figure 13: Bike route map

Bike networks developed along the river valley provide optimum routes for recreation and physical exercise (Figure 13). The Dudley B. Menzies Bridge, the High Level Bridge and the Walterdale Bridge connect the university, downtown and river valley with shared paths with the pedestrians, creating the most popular cycling routes in the summer season.

The bike stations are distributed under the following criteria:

- along main street and streets with higher traffic volume
- near transit centers, bus stations, LRT stations
- accessible from high density residential areas
- accessible to public facilities: schools, hospitals, park, etc.

Station Distribution Map

According to the Bike-Sharing Guide published by Transport Canada in 2009, it is recommended the proportion of 150 to 175 residents per serving bicycles. Hence 5150 to

6,000 bicycles should serve the city well, by using the 2016 population statistic. However, a more comprehensive bike network should be refined before implementing such a large scale bike share system.

In this thesis, the pioneer system will be discussed and designed. The first wave of bicycle distribution would contain 300 bicycles in 22 bike stations (Figure 14). Residents within this area can reach the closest bike share station within a 6-minute walk. All stations are set at the location near bus stations and LRT stations within a 3-minute walk. Riders can ride a short trip and transfer to bus or LRT by dropping off the bicycle at a station near to a bus stop. Tourists can better enjoy the views of the river valley by cycling along the river and crossing any of the bridges. The bike share system provides a more flexible, 24-hour service with no extra waiting time once the users finish registering.

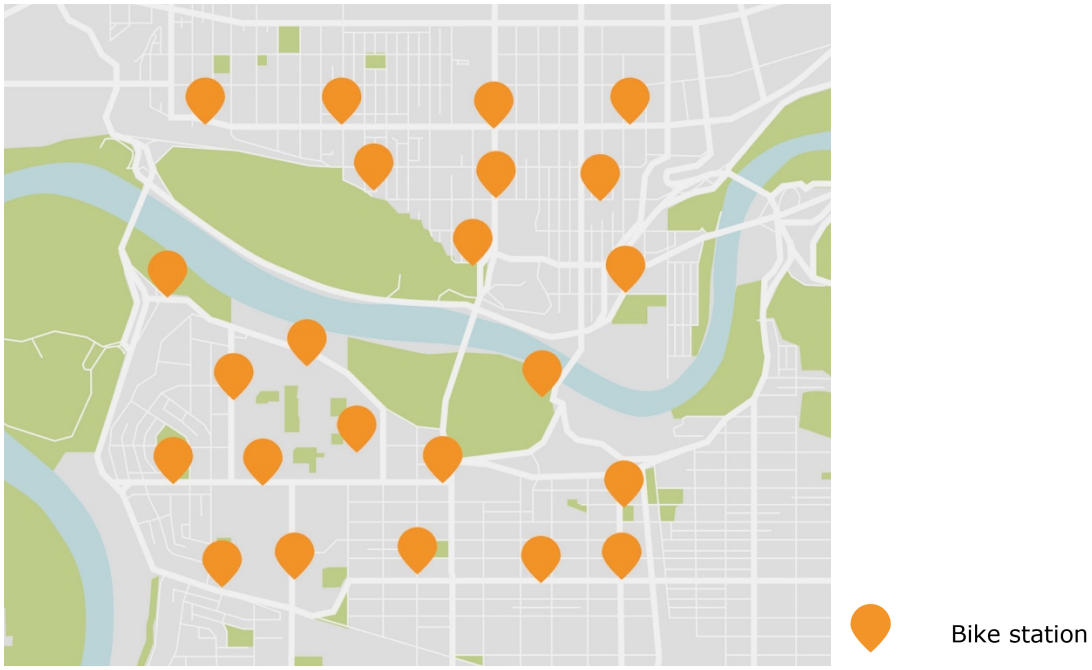

Figure 14: Bike station map

More bicycles will serve stations at two transit centers and the routes within the higher traffic streams. Due to the station space occupied, each station has a capacity range of 10 to 20 bicycles (Frade and Ribeiro, 2015). 4 bike stations at transit centers and LRT stations have 20 racks, others are distributed with 15 racks.

5.2 Bicycle and Station Design

5.2.1 Bicycle Design

In order to deal with the prevention of vandalism and theft, public share bicycles are deliberately designed with lower long term riding comfort due to heavy weight, compared to lighter self-owned bicycles. Bicycles are inconvenient to carry and unable to disassemble without special tools. Some bike sharing programs have started considering riding comfort by reducing bike weight. This effort improves the riding experience of the bicycles but the high mobility and flexibility also triggered increases in bike theft.

When designing the bicycle, riding experience should be balanced with bike security. As users become encouraged to ride more often with the system for recreation and physical exercise this will also create the demand for bicycles to be better suited to this usage.

Ergonomics and Dimensions

Having users with diversities of height, leg lengths and arm reach public bicycles have to have the universality to fulfill all riders' measurements.

Figure 15 shows the basic measurements of a bicycle frame require (Burke, 1996) for comfort. Seat tube angle varies from 72° to 74° for the average angle for an average-sized rider to step on the bike pedals comfortable. Head tube angle is

recommended between 73° to 75°. Chain stay length is normally 16 in., while the wheelbase sits in between 38 to 40 in. long. Bottom bracket height has a range from 11 3/4 to 13 in. The length of the seat tube determines the size of the frame. When selecting frame size, a formula of inseam length minus 14 in. can get a proper frame size. With the average inseam length of 30 in. of adults (Gupta and Zakaria, 2014; Yumiba et al., 2013), a 16 in. frame is able to satisfy most bike riders' demand. The structure is not restricted for non-racing bikes. In some forms, the top tube can be removed for ease of mounting and esthetics. A 16 in. frame with 26 in. wheels appear to be commonly used on mountain bikes, city bikes and road bikes, with stable performance compared to larger or smaller size wheels and frame (Hurst et al., 2017).

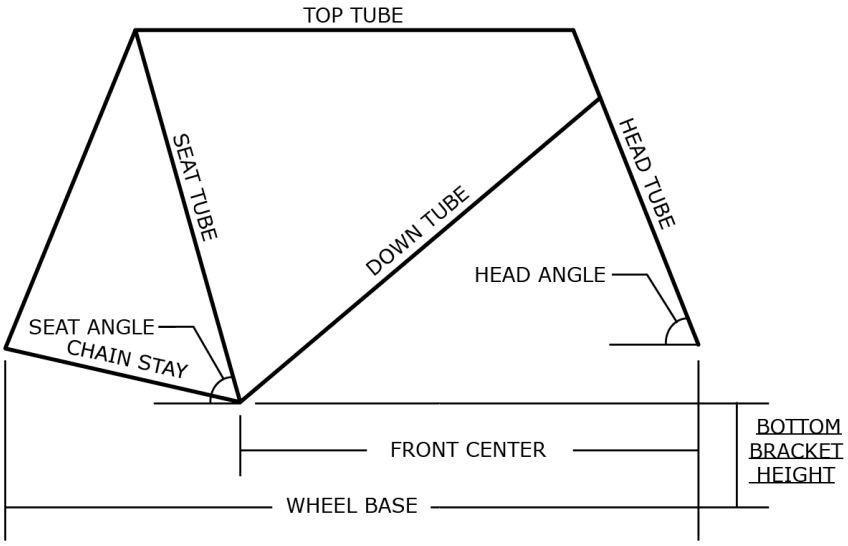

Figure 15: Bike frame structure

Designing and Modeling

Common frame materials are steel and aluminum. Steel frames have the longest history in the bicycle market. Steel has extraordinary flexibility to offer comfortable riding

experience with less vibration on the bumpy road. Frames made with steel have great durability but are usually heavier than other materials and can deteriorate by rust. With the addition of molybdenum and chrome frames can resist the problem of corrosion. Aluminum frames are lighter in weight and more rust resistant. However, the durability is not as good as steel and offer less comfortable riding experience.

Some bike manufacturers have developed their own mixture of metal alloy and processing techniques to produce frames. An alloy steel is recommended as shared bike's frame material due to advantages of price, durability and strength.

Rim brakes, disc brakes and drum brakes are three main bicycle brake types. Equipping proper brake system on the bicycle can reduce the dangerous while emergency braking situation happens. Rim brake systems are easy to maintain and inexpensive but have poor performance in wet and muddy weather conditions. Disc brake systems have advantages including better control in all environments and lighter in weight. Drum brakes are enclosed mechanisms provide good breaking in wet conditions. However, they are often weaker than rim brake systems. Disc brakes are recommended for their stable performance. However, for cost purposes the initial pilot program rim brakes will be installed.

A comfortable bike seat improves the riding experience, especially long distance travel. Bike saddles are categorized by different type of bikes. Seats of racing bikes usually have narrow and less padded seat. Mountain bike saddles are narrow with medium padding. City bike seats are usually wider and heavily padded. To choose a comfortable bike seat, wide and soft are two crucial factors for short distance riding experience (Schwarer et al, 2001; Jeong et al, 2002). Most of the trips make by bike sharing are short trips with 30 minutes, therefore a wide seat with medium padding is sufficient to satisfy a bike shared bicycle.

The bicycles of a bike share system work as a mobile brand as well as a transit component. The bike frame is designed with a simple and recognizable shape as Figure 16 shows. The frame is supported mainly by strengthened seat tube and the down tube for longevity of use. Instead of having a top tube, female bicycles often have twin, parallel or curved reach tubes joining the handlebar. Removing the top tube also provides ease of mounting and extra leg room for elders and overweight riders (Bonham et al., 2015).

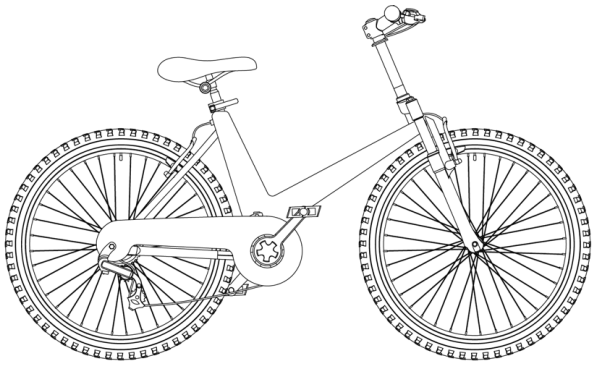

Figure 16: Bike side view

Figure 17: Rendered bike side view

A representation of a bike is shown in the rendered model with texture and paint on (Figure 17). The frame is painted silver metallic color with the orange and blue arrow as a symbolic visual character. Bike break cables are integrated into the frame with minimal in the open to avoid damage (Figure 18). The seat is adjustable with calibrations on the seat tube (Figure 19) so that the riders can remember their most comfortable height.

When riding next time, users alter the seat height by adjusting the seat tube to the best height number without fitting every time.

Figure 18: Integrated break cable

Figure 19: Adjustable seat with calibrations

Edmonton does have uphill trails. A gear shifter on the bike improves riding experience and makes uphill trips easier. The more gear levels the gear shifter offers, the more expensive it is. A 5 speed shifter is sufficient to satisfy the daily demands in Edmonton.

Figure 20: 5 speed shifter

The rear wheel gear changer is located on the right handle (Figure 20), offering 5 different speeds for different riding situations. Speed setting No.5 provides fast and smooth cruising with the bike drivetrain system works at low RPM (revolutions per minute). Setting No.1 assists in riding uphill with high RPM and a slower speed. Using

their right thumb, riders can roll the gear up and down to alter the speed without moving the hand from the handlebar. The pedals are basic metal with ribbed edges that allow for easy grip and will accommodate a variety of shoe types and sizes. The whole transmission chain system will be fully enclosed for safety to avoid catching clothing or other elements (shoe laces) and spraying chain oil on users.

5.2.2 Station Design

The station is designed as an internet-based module with 5 docks on each of the pedestal (Figure 21). No service terminal as in other systems is needed for this design. Users rely on a smartphone app to initiate and finish registration procedure, input personal information, hire a bicycle and return a bicycle to a station. Modules connect with one another seamlessly for increasing bicycle capacity.

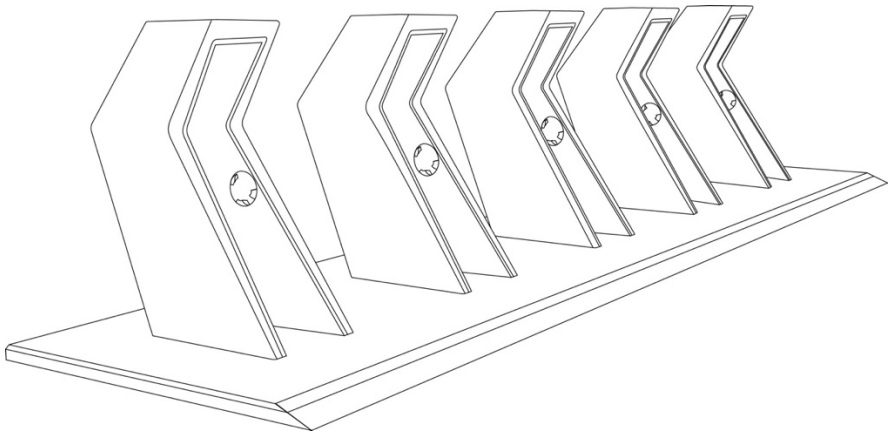

Figure 21: Bike station perspective view

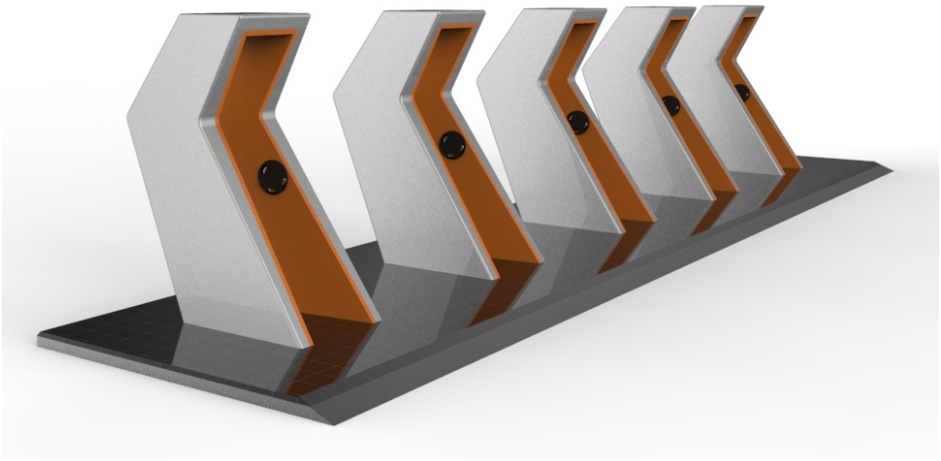

Figure 22: Rendered bike station perspective view

The bike front wheel axle bearing is integrated with a sensor to activate the lock of the station dock. Three metal teeth will be energized when the receiver in the rack are triggered and lock the bike by clasping the front wheel bearing (Figure 23). When the lock receives a command to release the bike, the teeth will pull back into the lock and free the bike from the rack.

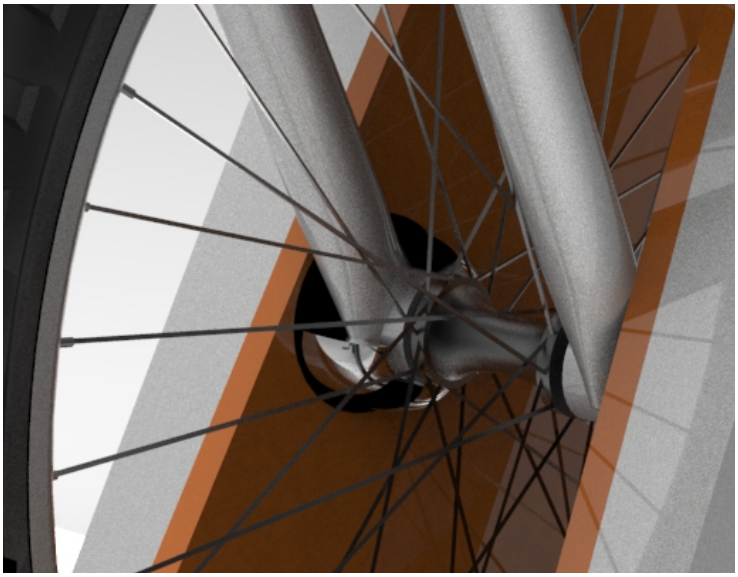

Figure 23: Dock lock

The station power is supported by the solar panel covers on top of the station base. An earlier design approach has been made in the Netherlands on their innovative solar bike

share system. The transparent glass layer on the top helps the solar modules beneath to collect energy and transform it into electricity to power the electronics. The hardness of the glass supports human weight and bicycles. Snow may cover the solar panel in winter and cause not enough light to be transformed to energy. A seasonally operated system can avoid the snow seasons. Due to the variance of different solar cell efficiency, further research should be conducted in order to specify the correct materials for efficient operation.

5.3 Visual Identity Design

The visual identity design for the public bike share system includes a brand logo, color option, and visual images. The brand logo Edmonton Bike Share (Figure 24) represents the Edmonton bike share system. By using irregular paint strokes, the logo forms a man and a sun to illustrate a vivid dynamic of bicycle riding. The logo is expected to deliver the message of pursuing a healthy, sustainable and pleasure lifestyle.

Figure 24: Logo

R 45 G 146 B 192 #2D92C0	R 255 G 150 B 28 #F2961C	R 98 G 107 B 136 #626B88

Figure 25: Theme colors

Theme colors (Figure 25) are extracted from the logo and can be used for future promotion and advertising. The light blue originates from the blue colors used in the Edmonton Transit System and the city logo but tinted lighter. With expansion and development, the Edmonton bike share system is expected to be part of the transit system along with LRT and bus service. Century Gothic is used as the logo font.

5.4 System Operation and Management

5.4.1 Register, Rent and Return

Register

Before getting access to a bicycle, users have two options to register themselves. Steps and instructions are provided on the bike rack (Figure 26). Users can either download the mobile app or open the official website of Edmonton Bike Share. Individuals over 18 with an valid credit card (PayPal, Apple Pay) are eligible to register. Personal information and payment information is required. Fee assessment will not be charged before choosing a plan.

Website users are offered an option of using a smart key. However, mailing a smart key takes extra fees and extra days before users can get access to a bike. Mobile application users can start renting immediately after finishing registration.

After creating an account, users can choose a plan from day pass, monthly pass or annual pass. Users can easily re-purchase again after the service period was expired.

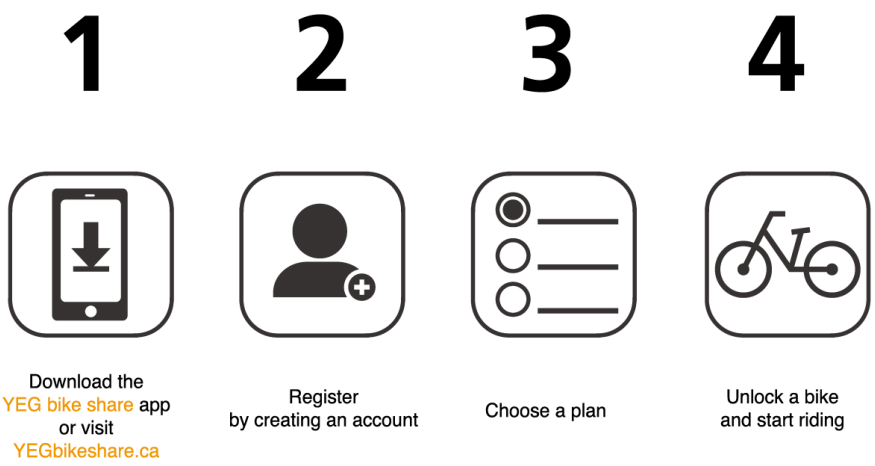

Figure 26.1: Instructions of how to use the system

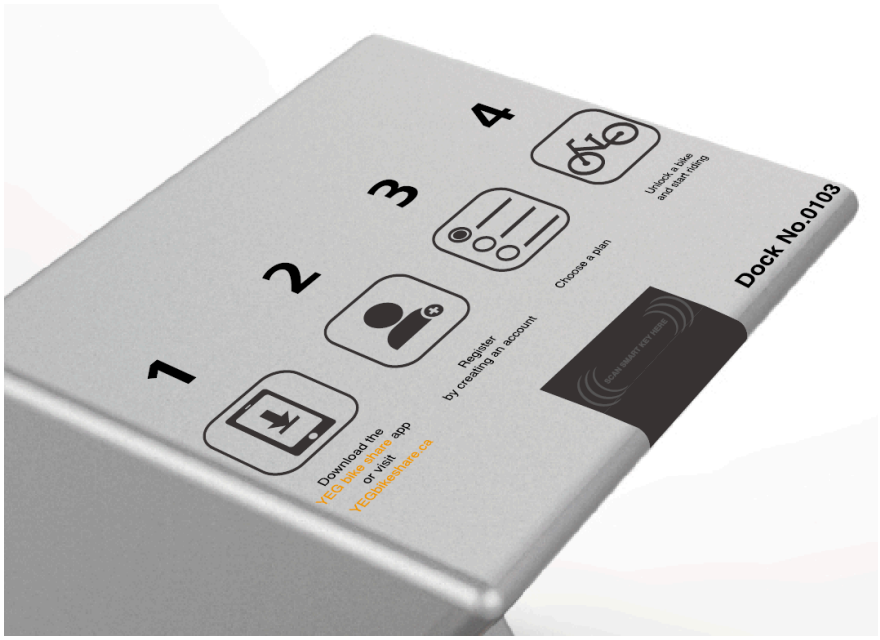

Figure 26.2: Instructions on dock

Rent

Riders can locate a station from the application or the website station map. Smart card users bring their key and scan the key by touching the sensor at the dock they want to unlock. After a short beep verification sound and visual green light flash (Figure 27), the bike is successfully unlocked.

Mobile users open the app screen page of unlocking a bike and insert the dock number that they want to unlock. When the mobile screen shows unlock successfully, and a short verification beep sound and green green light flash on the dock, the bike is ready to be released from the station.

Before riding on the bike, the first step is to check the bike overall for safety operation to make sure the bike is safe for riding, which includes: ①wheels: tires are inflated, wheels are tight and spin perfectly without wobble ②brakes: squeeze the front brake and back brake separately, make sure the wheels are locked solidly when the brake is activated ③ saddle: adjust the seat to the most comfortable height and record the measurement number on app for riding next time. If the bike is not working as expected or has any problem, return the bike to the dock. Report on the application or by call with the dock number, so that the staff can pick up the bike and send it for maintenance. Repeat rent process to release a new bike.

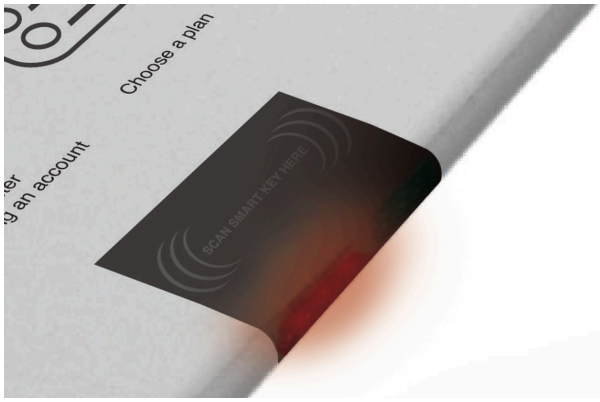

Figure 27.1: Rental failed

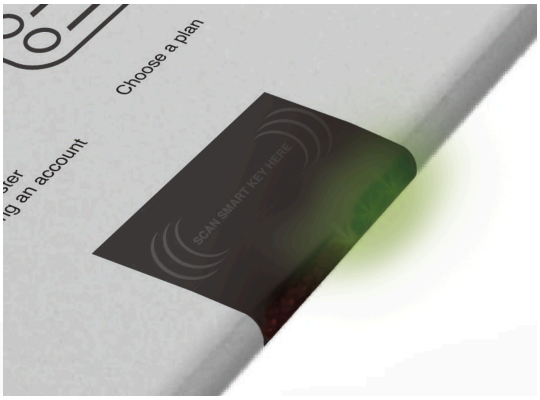

Figure 27.3: Rental successful

Return

When returning a bike, find a station close to the destination. Push the bike into an empty rack and finish service as the green flashes. Pull the bike out and try again if the red light flashes.

If the bike station found has no empty racks, check the station map on app and return the bike to the nearest station. The number of empty racks at station is shown on the station map. When arriving at the station, repeat the return process to finish using the service.

5.4.1 Service Networks

With no external service terminals, the system operation relies on the internet for the registering, renting and returning process. Either smartphone app (Figure 28) or the website connects users with the system directly including personal credit information, user payment transfer, service plan selection, bike station locating, inquiries and problem reports.

Mobile apps are the most convenient and direct method for accessing the system. Users should spend approximate 5 minutes to register and create an account. As users finish registration and payment verification, the next renting process will take far less time. After having verified credit information (credit card, PayPal, Apple Pay, etc.), riders choose a plan, unlock a bike and start their riding.

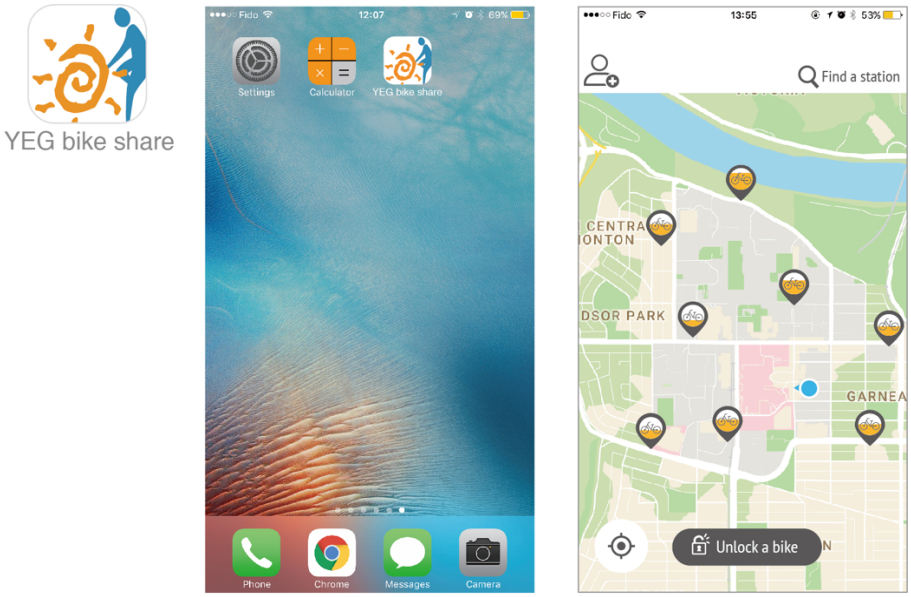

Figure 28: Mobile application

The website (Figure 29) offers information to acquaint users with the system before going to a station, giving users a better comprehension of how the system works, and the ability to manage their membership account. The website can assist users with the mobile application, or obtain a smart key to get access to the system.

Figure 29: Website

5.4.2 Marketing Strategies

The visual identity and branding series is designed based on the theme colors. Triangular elements are rotated and reorganized for different pattern combinations (Figure 30). The patterns are further developed and used as a part of brand identity. A set of practical visual brand identity applications is demonstrated in Figure 31. More expanded utilization of visual elements can be developed for future use.

Figure 30: Pattern evolution

Figure 31: Brand VI

In Figure 31, items 1 to 11 include visual identity for office supplies and promotion use. Items 1, 2, 3, 4, 5, 6, and 9 are office supplies including staff name badge, letter paper, envelop, brand flag, business card and book cover. Items 7, 8, 10, and 11 are pen, USB flash drive, note book and water bottle. These items can use for promotion by distributing as gifts.

The bicycles can work as mobile advertising with an identifiable frame and paint color scheme. Besides having one color scheme, bike colors can be changed intermittently for particular theme activities, for example, bikes with different theme colors as festival edition. Varieties and example color options are given in Figure 32. Events such as personalize a bike activity, gives people the opportunity to propose their color idea and can be a promotion to engage the public and attract new users. The bikes in form are

aesthetically different from the regular personally owned bikes and as such they will be easily recognized.

Figure 32: Bike color variations

5.4.3 Bike Maintenance and Rebalancing

Mechanics collect bikes with malfunctions and send bikes to the workshop for maintenance. Bicycle are balanced between stations with few empty racks and insufficient bicycles. Rental service data is collected when a bike is released and returned, so the maintenance team can inspect bikes that have more riding trips. It is recommended to have a complete maintenance at minimum of every two months (Bailey and Gates, 2009; Shirgaokar and Gillespie, 2016).

The situations of empty stations and all-parked stations can happen to stations with fewer users and popular stations close to a transit center. The maintenance team collect and re-distribute bicycles to try to ensure a balance at each station of at least 5 bikes and 5 empty racks.

5.4.4 User Fee Assessment

The Edmonton Bike Share system operates from March to November for nine months, due to weather safety and maintenance concerns. The users can choose plans from a 1-way trip, 1-day plan, 3-day plan, 1-month plan and all-year plan. All-year plan renewals will automatically be applied with a 3 months' fee charged. Other plans require users to update plans manually on application or website.

The prices of user fees (Table 3) referenced fares and passes of local ETS public transit service, and user fees of bike share systems in North America. The system is expected for daily transit use so fair and acceptable charges need to be applied.

	Price	Unlimited Ride	Overage Fee
1-way	C$3	30 min	<60 min +C$2 >60 min C$3/30min
1-day	C$5	30 min	
3-day	C$12	30 min	
1-month	C$85	30 min	<60 min +C$1 >60 min C$2/30 min
All-year	C$75/month	30 min	

Table 3: User fee plan

Chapter VI
Conclusion

Public bike sharing is an opportunity to develop sustainable urban mobility but it also is a time-consuming activity to introduce a system into Edmonton with its unique cycling culture. The internet-based station reduces hardware equipment such as service terminal and information board by integrating the function of external infrastructures into the dock station and supporting application. The self-supported stations satisfy the system's energy consumption and do not need any external power supply. A sustainable, flexible, and approachable system is the design that I intend to present. Material and solar panel selection requires further research with manufacturers.

The gifted natural landscape of the river valley area influences Edmonton's cycling culture. Due to the long winter seasons, Edmonton residents cherish the sunlight in summer. Edmonton Bike Share is expected as a daily transport mode for both local and tourists with fair fees compared to other public transit mode or bicycle rental. By having distribution bicycle stations on the street, the scheme's goal is to motivate more people to have a healthy lifestyle attitude while offering convenient transit.

Convenience and safety are two crucial factors to engage people in public bike share (Shaheen et al., 2012; Fishman et al., 2014). Public bike sharing provides bicycles for short-term use with convenient access and no maintenance efforts. Cycling safety in public bike sharing is a topic that is worth the research and study. A complete bike network and bike infrastructures will support local ridership and the bike share business. Local cycling industries and organizations are potential collaborative partners for safety education and promotion of the system.

Future Developments

The public bike sharing has a variety of future and possible benefits to fit the needs of the multi-user demands. As a self-service system, customer support service is an essential component once the system starts operating. Regular surveys, user questionnaires, interviews are all possible methods to get information on the user experience for system adjustments. These adjustments are intended to help in creating a stronger connection between the user and the service to enhance the system attachment possibilities. Future expansion can take into consideration the usage advice from this research. The expansion pace depends on the development of the system along with ridership numbers. Advanced services such as linking the bike share service to a bus pass so access to both the ETS and bike share can be possibilities in the future for greater ridership.

With the difference between street riding and the trail riding in the River Valley it may be that the stations close to the River Valley be equipped with two different styles of bikes. Bike 1 would be designed primarily for smooth road surfaces while Bike2 would be better suited to trail riding conditions. Additional features such lighting, reflective elements for high visibility are elements to be considered in future designs.

Replacing regular bikes with electric bikes is another possible direction that could save travel times, increase the distance from stations to destinations and user energy. E-bikes enable longer distance and have potential to take the place of the automobile. However, e-bikes need to be charged regularly and requires more power support and costs of infrastructure. A cheaper power supply system may fulfill this demand and make e-bike share become a reality.

The system still needs to be further developed and requires professional guidance from experts in related fields, such as electrical engineering, traffic engineering, and urban

planning. Winter season is avoided in this plan due to the complexity of implementation and possible labor costs but is still a valuable research topic to look into in the future. The system should anticipate future improvements and make adjustment for a thoughtful sustainable development.

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APPENDIX I: ETHICS APPLICATION

Date: Tuesday, July 25, 2017 1:30:59 PM Print Close

1.1 Study Identification

*All questions marked by a red asterisk * are required fields. However, because the mandatory fields have been kept to a minimum, answering only the required fields may not be sufficient for the REB to review your application.*

Please answer all relevant questions that will reasonably help to describe your study or proposed research.

1.0 * **Short Study Title** *(restricted to 250 characters)*:
Public Bike-sharing System Case Study

2.0 * **Complete Study Title** *(can be exactly the same as short title)*:

Public Bike-sharing System Case Study

3.0 * **Select the appropriate Research Ethics Board (***Detailed descriptions are available by clicking the HELP link in the upper right hand corner of your screen***):**
REB 1

4.0 * **Is the proposed research:**
Unfunded

5.01 * **Name of local Principal Investigator:**
Siyi Xie

6.0 * **Type of research/study:**
Graduate Student

7.0 **Investigator's Supervisor (required for applications from undergraduate students, graduate students, post-doctoral fellows and medical residents to REBs 1 & 2. HREB does not accept applications from student PIs):**

Robert Lederer

8.01 **Study Coordinators or Research Assistants:** People listed here can edit this application and will receive all email notifications for the study:

Name	Employer

There are no items to display

9.01 **Co-Investigators:** People listed here can edit this application and will receive email notifications *(Co-investigators who do not wish to receive email, should be added to the study email list team below instead of here)*.

Name	Employer	IMS Relationships.Relationship.Name	Employer.ID

There are no items to display

10.01 **Study Team:** *(co-investigators, supervising team, and other study team members) - People listed here cannot view or edit this application and do not receive email notifications.*

Last Name	First Name	Organization	Role/Area of Responsibility	Phone	Email

There are no items to display

1.5 Conflict of Interest

1.0 * **Are any of the investigators or their immediate family receiving any personal remuneration (including investigator payments and recruitment incentives but excluding trainee remuneration or graduate student stipends) from the funding of this study that is not accounted for in the study budget?**
○ Yes ◉ **No**

2.0 * **Do any of investigators or their immediate family have any proprietary interests in the product under study or the outcome of the research including patents, trademarks, copyrights, and licensing agreements?**
○ Yes ◉ **No**

3.0 * **Is there any compensation for this study that is affected by the study outcome?**
○ Yes ◉ **No**

4.0 * **Do any of the investigators or their immediate family have equity interest in the sponsoring company? (This does not include Mutual Funds)**
○ Yes ◉ **No**

5.0 * **Do any of the investigators or their immediate family receive payments of other sorts, from this sponsor (i.e. grants, compensation in the form of equipment or supplies, retainers for ongoing consultation and honoraria)?**
○ Yes ◉ **No**

6.0 * **Are any of the investigators or their immediate family, members of the sponsor's Board of Directors, Scientific Advisory Panel or comparable body?**
○ Yes ◉ **No**

7.0 * **Do you have any other relationship, financial or non-financial, that, if not disclosed, could be construed as a conflict of interest?**
○ Yes ◉ **No**

Please explain if the answer to any of the above questions is Yes:

Important
If you answered YES to any of the questions above, you may be asked for more information.

1.6 Research Locations and Other Approvals

1.0 * **List the locations of the proposed research, including recruitment activities. Provide name of institution, facility or organization, town, or province as applicable**
The research will take place in Los Angeles, US and Vancouver, CA.

2.0 * **Indicate if the study will use or access facilities, programmes, resources, staff, students, specimens, patients or their records, at any of the sites affiliated with the following** *(select all that apply)*:
Not applicable

List all health care research sites/locations:

3.0 **Multi-Institution Review**

* **3.1 Has this study already received approval from another REB?**
○ **Yes** ◉ **No**

4.0 **If this application is closely linked to research previously approved by one of the University of Alberta REBs or has already received ethics approval from an external ethics review board***(s)*, **provide the study number, REB name or other identifying information. Attach any external REB application and approval letter in the Documentation Section – Other Documents.**

2.1 Study Objectives and Design

1.0

Provide planned start and end date of human participant research.

Start Date
11/10/2016

End Date:
12/31/2016

2.0 * **Provide a lay summary of your proposed research which would be understandable to general public**

Public transport service is the pulse of urban life. Many cities are promoting public transit due to insufficient capacity of the road network and related environmental problems that caused the increase of private transport mode. Cycling, as the most energy efficient transport mode, has high potential to improve the livability and sustainability of the city.

However, there are numerous of prerequisites and barriers to operating bike-sharing system successfully. Building efficient, dedicated and interconnected bike network is the first step to start bike sharing. Sufficient docking stations, parking infrastructure, and other bicycle facilities can highly increase cyclists' riding experience. Theft and destruction of bicycles are two main problems that can impede the ongoing operation for almost all bike-sharing systems.

This research aims to study the existing bike-sharing system and talk to the operators of the bike-sharing system as well, to understand how the system works as well as the barriers and complications they have. The result of the research can teach experience and expose potential problems to cities who want to build their own bike-sharing system.The participants will be operators of Metro Bike Share and Vancouver Bike share.

3.0 * **Provide a full description of your research proposal outlining the following:**

- **Purpose**
- **Hypothesis**
- **Justification**
- **Objectives**
- **Research Method/Procedures**
- **Plan for Data Analysis**

The public bike-sharing system is gradually implemented in cities since the 1960s to promote cycling as another mobility choice. Toronto, Vancouver, and Montreal made significant attempts to change people's transit habit by introducing bike-sharing into a city. However, the process of implementation and maintenance of the system will have to confront challenges such as theft and deconstruction of bicycles.

The research aims to study operating bike-sharing systems in North America, analyze their operating mode, and problems they have during the operation.Two systems will be researched: the Metro system in Los Angeles, US, and the Mobi system in Vancouver, CA.

To have a better view of how the system is operating, managers/operators of the system will be contacted. The researcher will have interviews with the operators. The researcher may need to contact with different department members or members of the operating committee to complete the study. The interviewees will be asked questions on operating details based on their current system. The method will be one-on-one in-person interviews. The researcher will spend five days in Los Angeles. Depending on the schedule, there may also be phone interviews in the case of Metro. The researcher will take notes to record the interview content.

4.0 **Describe procedures, treatment, or activities that are above or in addition to standard practices in this study area** *(eg. extra medical or health-related procedures, curriculum enhancements, extra follow-up, etc)***:**

5.0 **If the proposed research is above minimal risk and is not funded via a competitive peer review grant or industry-sponsored clinical trial, the REB will require evidence of scientific review. Provide information about the review process and its results if appropriate.**

6.0 **For clinical trials, describe any sub-studies associated with this Protocol.**

2.2 Research Methods and Procedures

Some research methods prompt specific ethical issues. The methods listed below have additional questions associated with them in this application. If your research does not involve any of the methods listed below, ensure that your proposed research is adequately described in Section 2.1: Study Objectives and Design or attach documents in the Documentation Section if necessary.

1.0

* **This study will involve the following** *(select all that apply)*
Interviews and/or Focus Groups
Surveys and Questionnaires (including internet surveys)

NOTE 1: Select this ONLY if your application SOLELY involves a review of paper charts/electronic health records/administrative health data to

answer the research question. If you are enrolling people into a study and need to collect data from their health records in addition to other interventions, then you SHOULD NOT select this box.

NOTE 2: Select this option if this research ONLY involves analysis of blood/tissue/specimens originally collected for another purpose but now being used to answer your research question. If you are enrolling people into the study to prospectively collect specimens to analyze you SHOULD NOT select this box.

2.5 Interview and/or Focus Groups

1.0 **Will you conduct interviews, focus groups, or both? Provide detail.**

2.0 **How will participation take place (e.g. in-person, via phone, email, Skype)?**

3.0 **How will the data be collected (e.g. audio recording, video recording, field notes)?**

2.9 Surveys and Questionnaires (including Online)

1.0 **How will the survey/questionnaire data be collected (i.e. collected in person, or if collected online, what survey program/software will be used etc.)?**

2.0 **Where will the data be stored once it's collected (i.e. will it be stored on the survey software provider servers, will it be downloaded to the PI's computer, other)?**

3.0 **How will you ensure the data is kept secure, both during and after it is collected?**

4.0 **Who will have access to the data?**

5.0 **How long will the data be kept? If it will be destroyed, when and how will destruction occur?**

3.1 Risk Assessment

1.0 * **Provide your assessment of the risks that may be associated with this research:**
Minimal Risk - research in which the probability and magnitude of possible harms implied by participation is no greater than those encountered by participants in those aspects of their everyday life that relate to the research (TCPS2)

2.0 * **Select all that might apply:**

Description of Possible Physical Risks and Discomforts

No	Participants might feel physical fatigue, e.g. sleep deprivation
No	Participants might feel physical stress, e.g. cardiovascular stress tests
No	Participants might sustain injury, infection, and intervention side-effects or complications
No	The physical risks will be greater than those encountered by the participants in everyday life

Possible Psychological, Emotional, Social and Other Risks and Discomforts

No	Participants might feel psychologically or emotionally stressed, demeaned, embarrassed, worried, anxious, scared or distressed, e.g. description of painful or traumatic events
Possibly	Participants might feel psychological or mental fatigue, e.g intense concentration required
No	Participants might experience cultural or social risk, e.g. loss of privacy or status or damage to reputation
No	Participants might be exposed to economic or legal risk, for instance non-anonymized workplace surveys
No	The risks will be greater than those encountered by the participants in everyday life

3.0 * **Provide details of all the risks and discomforts associated with the research for which you indicated YES or POSSIBLY above.**

There will be questions about the economic profit of the bike-sharing system to have an overall view of how the system is operating. Participants may consider these data as confidential information and refuse to provide.

4.0 * **Describe how you will manage and minimize risks and discomforts, as well as mitigate harm:**

I will ask for permission whether I can ask questions relate to a certain topic. If the participants show they do not feel like to answer or refuse to answer, I will not keep asking.

5.0 **Is there a possibility that your research procedures will lead to unexpected findings, adverse reactions, or similar results that may require follow-up** *(i.e. individuals disclose that they are upset or distressed during an interview/questionnaire, unanticipated findings on MRI, etc.)***?**

◯ Yes ◯ No

6.0 **If you are using any tests in this study diagnostically, indicate the member(s) of the study team who will administer the measures/instruments:**

Test Name	Test Administrator	Organization	Administrator's Qualification
There are no items to display			

7.0 **If any research related procedures/tests could be interpreted diagnostically, will these be reported back to the participants and if so, how and by whom?**

3.2 Benefits Analysis

1.0 * **Describe any potential benefits of the proposed research to the participants. If there are no benefits, state this explicitly:**
There will be no benefit to the participants.

2.0 * **Describe the scientific and/or scholarly benefits of the proposed research:**
By conducting this research, the researcher will analyze how existing public bike-sharing system works, as well as the barriers and complications they have. The result of the research can teach experience and expose potential problems to cities who want to build their own bike-sharing system.

3.0 **If this research involves risk to participants explain how the benefits outweigh the risks.**
There will be no benefits nor risks for participation.

4.1 Participant Information

1.0 * **Will you be recruiting human participants** *(i.e. enrolling people into the study, sending people online surveys to complete)***?**
(•) **Yes** ( ) No

1.1 Will participants be recruited or their data be collected from Alberta Health Services or Covenant Health or data custodian as defined in the Alberta Health Information Act?
( ) Yes (•) **No**

4.2 Additional Participant Information

1.0 **Describe the participants that will be included in this study. Outline ALL participants** *(i.e. if you are enrolling healthy controls as well):*
Managers or operators of Metro Bike Share and Vancouver Bike share.

2.0 * **Describe and justify the inclusion criteria for participants** *(e.g. age range, health status, gender, etc.):*

The name of the participants will be noted for the authenticity of the information. Interviewees will be staffs/operators who have the knowledge of the operating bike share systems.

3.0 **Describe and justify the exclusion criteria for participants:**

4.0 **Participants**

4.1 How many participants do you hope to recruit *(including controls, if applicable?)*
2
4.2 Of these, how many are controls, if applicable?
None.
4.3 If this is a multi-site study, how many participants do you anticipate will be enrolled in the entire study?

5.0 Justification for sample size:
At least one interviewee is needed for each of the two study cases.

4.4 Recruitment of Participants (non-Health)

1.0 Recruitment

1.1 How will you identify potential participants? Outline all of the means you will use to identify who may be eligible to be in the study *(i.e. response to advertising such as flyers, posters, ads in newspapers, websites, email, list serves, community organization referrals, etc.)*
I will contact the organization first and ask who I can interview with. The initial contact information is found on the website of the bike share system.

1.2 Once you have identified a list of potentially eligible participants, indicate how the potential participants' names will be passed on to the researchers AND how will the potential participants be approached about the research.
The participants will contact with the researcher directly if they are able to take the interview.

2.0 Pre-Existing Relationships

2.1 Will potential participants be recruited through pre-existing relationships with researchers *(e.g. Will an instructor recruit students from his classes, or a physician recruit patients from her practice? Other examples may be employees, acquaintances, own children or family members, etc.)?*
○ Yes ◉ **No**

3.0 Will your study involve any of the following? *(select all that apply)*
None of the above

4.5 Informed Consent Determination

1.0 Describe who will provide informed consent for this study *(i.e. the participant, parent of child participant, substitute decision maker, no one will give consent – requesting a waiver)*

1.1 Waiver of Consent Requested
If you are asking for a waiver of participant consent, please justify the waiver or alteration and explain how the study meets all of the criteria for the waiver. Refer to Article 3.7 of TCPS2 and provide justification for requesting a Waiver of Consent for ALL criteria (a-e)

1.2 Waiver of Consent in Individual Medical Emergency
If you are asking for a waiver or alteration of participant consent in individual medical emergencies, please justify the waiver or alteration and explain how the study meets ALL of the criteria outlined in Article 3.8 of TCPS2 (a-f).

2.0 How will consent be obtained/documented? Select all that apply
Signed consent form

If you are not using a signed consent form, explain how the study information will be provided to the participant and how consent will be obtained/documented. Provide details for EACH of the options selected above:

3.0 Will every participant have the capacity to give fully informed consent on his/her own behalf?
○ Yes ○ No

3.1 Explain why participants lack capacity to give informed consent *(e.g. age, mental or physical condition, etc.).*

3.2 Will participants who lack capacity to give full informed consent be asked to give assent?
○ Yes ○ No

Provide details. IF applicable, attach a copy of assent form(s) in the Documentation section.

3.3 In cases where participants (re)gain capacity to give informed consent during the study, how will they be asked to provide consent on their own behalf?

4.0 What assistance will be provided to participants or those consenting on their behalf, who may require additional assistance? *(e.g. non-English speakers, visually impaired, etc.)*

5.0 * **If at any time a PARTICIPANT wishes to withdraw from the study or from certain parts of the study, describe when and how this can be done.**
Participants can withdraw anytime if they feel they do not want to continue.

6.0 Describe the circumstances and limitations of DATA withdrawal from the study, including the last point at which participant DATA can be withdrawn *(i.e. 2 weeks after transcription of interview notes)*
Some potential problems of the system will be unclear and will miss information to lead to the conclusion. Participants can ask for data withdrawal before two weeks after the interview by email.

7.0 Will this study involve any group(s) where non-participants are present? For example, classroom research might involve groups which include participants and non-participants.
○ Yes ◉ **No**

5.1 Data Collection

1.0 * **Will the researcher or study team be able to identify any of the participants at <u>any stage</u> of the study?**
◉ **Yes** ○ No

2.0 Primary/raw data collected will be *(check all that apply)***:**
Directly identifying information - the information identifies a specific individual through direct identifiers (e.g. name, social insurance number, personal health number, etc.)

3.0 **If this study involves secondary use of data, list all original sources:**

4.0 **In research where total anonymity and confidentiality is sought but cannot be guaranteed** *(eg. where participants talk in a group)* **how will confidentiality be achieved?**

5.2 Data Identifiers

1.0 * **Personal Identifiers:** will you be collecting - at any time during the study, including recruitment - any of the following *(check all that apply)*:
Surname and First Name
Telephone Number
Email Address

2.0 **Will you be collecting - at any time of the study, including recruitment of participants - any of the following** *(check all that apply)*:
There are no items to display

3.0 * **If you are collecting any of the above, provide a comprehensive rationale to explain why it is necessary to collect this information:**
The participants' name will be recorded as they are representing local bike-sharing system.

4.0 **If identifying information will be removed at some point, when and how will this be done?**

5.0 * **Specify what identifiable information will be RETAINED once data collection is complete, and explain why retention is necessary. Include the retention of master lists that link participant identifiers with de-identified data:**
Only their name will be retained.

6.0 **If applicable, describe your plans to link the data in this study with data associated with other studies (e.g within a data repository) or with data belonging to another organization:**

5.3 Data Confidentiality and Privacy

1.0 * **How will confidentiality of the data be maintained? Describe how the identity of participants will be protected both during and after research.**
All the data will be kept in researcher's personal computer and protected with a password. The supervisor can get access to the raw data with the presence of the researcher, but he will not get the password to where the data is kept.

2.0 **How will the principal investigator ensure that all study personnel are aware of their responsibilities concerning participants' privacy and the confidentiality of their information?**

3.0
External Data Access

*** 3.1 Will identifiable data be transferred or made available to persons or agencies outside the research team?**

○ Yes ◉ **No**

5.4 Data Storage, Retention, and Disposal

1.0 *** Describe how research data will be stored, e.g. digital files, hard copies, audio recordings, other. Specify the physical location and how it will be secured to protect confidentiality and privacy.** *(For example, study documents must be kept in a locked filing cabinet and computer files are encrypted, etc. Write N/A if not applicable to your research)*

All the data will be kept in researcher's personal computer and protected with a password.

2.0 *** University policy requires that you keep your data for a minimum of 5 years following completion of the study but there is no limit on data retention. Specify any plans for future use of the data. If the data will become part of a data repository or if this study involves the creation of a research database or registry for future research use, please provide details.** *(Write N/A if not applicable to your research)*

The data will be retained for five years after the study is completed. No future use is needed.

3.0 **If you plan to destroy your data, describe when and how this will be done? Indicate your plans for the destruction of the identifiers at the earliest opportunity consistent with the conduct of the research and/or clinical needs:**

Documentation

Add documents in this section according to the headers. Use Item 11.0 "Other Documents" for any material not specifically mentioned below.

Sample templates are available in the REMO Home Page in the **Forms and Templates**, or by clicking HERE.

1.0 **Recruitment Materials:**

Document Name	Version	Date	Description
There are no items to display			

2.0 **Letter of Initial Contact:**

Document Name	Version	Date	Description
Contact information | History	0.01	10/27/2016 4:14 PM	

3.0 **Informed Consent / Information Document(s):**

3.1 What is the reading level of the Informed Consent Form(s):

3.2 Informed Consent Form(s)/Information Document(s):

Document Name	Version	Date	Description

INFORMATION LETTER and CONSENT FORM-Metro | History	0.02	11/4/2016 4:48 PM
INFORMATION LETTER and CONSENT FORM-Mobi | History	0.02	11/4/2016 4:48 PM

4.0 Assent Forms:

Document Name	Version	Date	Description
There are no items to display			

5.0 Questionnaires, Cover Letters, Surveys, Tests, Interview Scripts, etc.:

Document Name	Version	Date	Description
Interview questions | History	0.02	11/24/2016 1:31 PM	

6.0 Protocol/Research Proposal:

Document Name	Version	Date	Description
There are no items to display			

7.0 Investigator Brochures/Product Monographs:

Document Name	Version	Date	Description
There are no items to display			

8.0 Health Canada No Objection Letter *(NOL)*:

Document Name	Version	Date	Description
There are no items to display			

9.0 Confidentiality Agreement:

Document Name	Version	Date	Description
There are no items to display			

10.0 Conflict of Interest:

Document Name	Version	Date	Description
There are no items to display			

11.0 Other Documents:

For example, Study Budget, Course Outline, or other documents not mentioned above

Document Name	Version	Date	Description
There are no items to display			

Final Page

You have completed your ethics application! Click "Continue" to go to your study workspace.

This action will NOT SUBMIT the application for review.

Only the Study Investigator can submit an application to the REB by selecting the "SUBMIT STUDY" button in My Activities for this Study ID:Pro00068562.

APPENDIX II: INFORMATION LETTER & CONSENT FORM

INFORMATION LETTER and CONSENT FORM

Study Title: Public Bike-sharing System Case Study

Research Investigator:

NAME Siyi Xie
ADDRESS
109 Industrial Design Studio(IND)
University of Alberta
Edmonton, AB, CA T6G 2E1
EMAIL sx3@ualberta.ca
PHONE NUMBER +1(780)716-5039

Supervisor:

Professor Supervisor Robert Lederer
ADDRESS
101 Industrial Design Studio(IND)
University of Alberta
Edmonton, AB, CA T6G 2E1
EMAIL rlederer@ualberta.ca
PHONE NUMBER +1(780 492-4195/6367

Background

- You are invited to participate in this research to help the researcher studying current operating public bike-sharing system.
- All contact information is obtained from the official website of the bike share system.
- This research will be used in support of the researcher's thesis in Master of Design.

Purpose

- By conducting this research, the researcher will analyze how existing public bike-sharing system works, and discover the barriers and complications of the system. The result of the research can teach experience and expose potential problems to cities that want to build local bike-sharing system.

Study Procedures

- The study method will be Q&A interviews. The process will take about forty minutes. Interviewees will be staffs from Metro Bike Share.
- The interview method will be in-person or phone interview, depending on the coordination of the researcher and the interviewees.
- The interview content will be recorded by the researcher in written format. All the information will be stored by the researcher and is accessible to the researcher only.
- After the interview, interviewees can request for a copy of the research report from the researcher to verify data collection.

Benefits

- There will be no benefits for the participants.
- The researcher hopes that the information gets from doing this study will help us better understand crucial factors to build bike-sharing system and further promote cycling as a sustainable transit mode.

Risk

- There will normally be no risks for the participants. If the participants feel they may encounter any danger or potential risks, please do not hesitate to contact the researcher.

Voluntary Participation

- Participants are under no obligation to participate in this study and are not obliged to answer any specific questions even if they agree to participate in this study. The participation is completely voluntary.
- Participants can opt out without penalty and can ask to have any collected data withdrawn from the database and not included in the study. The latest point to ask for data withdrawn is **two weeks after the interview**. In the event of opting out, all data that asked for withdrawn will be removed from the study and destroyed.

Confidentiality & Anonymity

- The research will be used in the researcher's thesis and have the potential to be published as research articles, posted on world wide web, used as teaching materials, or presented in public. Participants may be personally identified in some of these cases. If you have any concerns about the use of the data and personal information, please feel free to contact the researcher.
- Anonymity cannot be guaranteed, and participants may be identified in the dissemination of the research. If you have any questions and concern any further changes, please feel free to contact the researcher.
- Data will be kept confidentially by the researcher. Only the researcher has access to the data. The supervisor can ask for access to the raw data with the presence of the researcher only.
- Data are to be kept in a secure place for a minimum of 5 years following completion of research project. Electronic data will be password protected.
- Participants can request for receiving a copy of a report of the research findings after the interview.
- The researcher may use the data from this study in future research, but if the researcher does this it will have to be approved by a Research Ethics Board.

Further Information

- If you have any further questions regarding this study, please do not hesitate to contact
  Siyi Xie
  Tel: +1(780)716-5039
  Email: sx3@ualberta.ca
- The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at 1-(780) 492-2615.

Consent Statement

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

_____ _____

Participant's Name (printed) and Signature Date

_____ _____

Name (printed) and Signature of Person Obtaining Consent Date

APPENDIX III: INTERVIEW SCRIPTS & RAW DATA

Interview Questions

- During the operation of the system, has the system faced any barriers? Which was the most serious one among all the problems?
- Do you think the Metro (Mobi) system has changed people's travel habit? / Do you think the system has a positive impact on public transit? If the answer is affirmative, what are the main factors that caused such satisfactory result? If the answer is negative, what are the barriers that impede the development of the system?
- What was the initial purpose of implementing the bike share system? Who were the targeting user groups?
- Are the dominant user group tourists or users holding monthly/year pass?
- How the user fees are assessed?
- How is the system funded? / Is the Metro (Mobi) a private or public system?
- Is Metro (Mobi) facing theft and destruction of bicycles? Have any precautions or follow-up actions been taken to prevent theft?
- How are the bicycles rebalanced between stations that are emptying out and those that are filling out in Metro (Mobi)?
- Were there any support projects to better serve the bike share system, such as implementing single bike lanes, increasing bike parking, etc.?
- Is the data of the bike/user flow collected? What kind of information is collected?
- How are the locations of the docking stations selected? / What are the main concerns choosing the locations?

Mobi:

Q1. 105 stations 1000 bikes
van min. main pro: install 2 hrs./station
app & website update

Q2. survey. more prefer bike & train
use in2 other transit modes

Q3. winter less. 15%.

Q4 80% local 20% tour. day pass. Summer.

Q5. Compare to bus/train. local. ~~HK~~ & other

Q6. ~~public~~ public bike share

Q7. specially designed. tools to install

Q8. balance team community based.

Q9. separated bike lanes.
build ↑ networks. & infrastrat
Connectivity

Q10. data. unlock & return

Q11. 3 ~ 4 blocks
near bus/train stop. residential. office area
visible.

experience survey
+ stations.
Helmet.
Coop in2 local bike rental

3/2X2.

Q1: X van/ theft. user stream. June - July : Aug.
busy season.

Q2. integrate wiz local ~~transit~~.
bus/ metro. ↑ networks. connection.

Q3. 7-80%. membership (trips made) 2~30% occasion | 90-95% (pass purchase) occa.

Q4. seasonal. X winter.

Q5. us. bus / metro fares.

Q6. public. owned by city
private → public

Q7. X much theft / van/ destruction.
maintain regularly 2 - 3 months

Q8. rebalance (by staff). moving truck.

Q9. ↑improve bike infra. ~~more~~ more racks.

Q10. data. user buy passes. unlock bike.
station status. open data online.

Q11. bus / metro. stops. density. main street

~~Q12~~. Sustainable. Solar. wireless.
encourage cycling
more connected wiz bus/metro
↑ app.

APPENDIX IV: CASE STUDY PHOTOS


mobi
Shaw Go
Shaw Go
Shaw Go


Shaw Go
Shaw Go
Shaw Go


REGISTER
Create an Account
Download the Mobi Bike Share App or visit mobibikes.ca or use a kiosk
RIDE
Check out a bike
Press ENTER and choose Tap membership and enter PIN, or Enter Account # and enter PIN
RETURN
Push into dock
1 beep = good
3 beeps = retry
@mobi_bikes
778 655 1800
mobibikes.ca
Shaw Go


mobi


778 655 1800
Shaw Go
WEAR A HELMET
RIDE WITH TRAFFIC
RIDE SOBER
WATCH FOR CAR DOORS
STAY OFF SIDEWALK
OBEY SIGNS & SIGNALS
SIGNAL TURNS
CAREFUL AT INTERSECTIONS
YIELD TO PEDESTRIANS


REGISTER
Create an Account
RIDE
Check out a bike
RETURN
Click into rack
1 beep = good
3 beeps = retry
Shaw Go
Shaw Go


Metro Bike
Metro
Metro
St


SHARE
How to Ride
Swipe your credit card, read screen instructions.
Choose a bike and remove it from dock.
Adjust seat and have fun on your ride.
Check bike back into any station and securely dock.
Ways to Pay
Single Ride
Frequent Rides
GET A PASS
Good to Know
Information
Rules
TOUCH SCREEN TO START


Bike


Metro Bike


capital bikeshare


Bikeshare.com
join.
take.
ride.
capital bikeshare
Your cost = Membership fee + Usage fee per trip
Membership Fee
Usage Fee (Per Trip)
Customer Service: 1-877-430-BIKE (2453)
Start
Insert Card
capital bikeshare


Hermitage Ave
Wheaton Library
Arcola Ave
Wheaton Interim Library
Franwall Ave
Leesborough Dr
Blueridge Ave
Reedie Dr
WHEATON
Prichard Rd
Bucknell Ter
Alberti Dr
Mc Mahon Rd
Windham Ln
Parkway Park
Homestead Dr


capital bikeshare