Halifax Bike Share Pre-Feasibility Study

Presented to Ben Wedge

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1 Executive Summary

This report provides a preliminary analysis of bike-share in Halifax. The purpose of this report is to provide an overview of the process of implementing bike-share as well as some of the challenges the Halifax municipality may encounter during implementation. The report also provides a brief summary of the costs of establishing and operating a bike-share system in Halifax. In addition the report takes into consideration Halifax's distinct topography, weather, population and density.

The topography of Halifax is characterized by steep hills surrounding the peninsula. The analysis found that although these topographical features discourage ridership, the structure of the urban area may reduce the effects of these features. The weather of Halifax was found to reduce the operational period to 210 days. The population, population density, topography, and weather lend themselves to a small bicycle share with an annual 210-day operating period. The city's limited bicycle infrastructure and steep hills along the perimeter of the proposed service area were found to be drawbacks to a successful bike share system.

This report finds that a bicycle share system will make a significant contribution to the city's goal of doubling bicycle mode share by 2026, improving bicycle trip data collection, and require a $1,500,000 capital investment and an operating subsidy of $86,000. The report finds that the possibility of a bicycle share system in Halifax warrants further analysis.

2 Background

There are now more than 800 bike-share systems worldwide. Bike-share systems make a fleet of bicycles available for short-term one-way rentals. Users pay a subscription fee as well as usage fees. Significant growth in the industry indicates demand and public interest in this kind of service. These systems provide an accessible entry point into bicycle commuting to more demographics, a study of bike-share users in Washington DC found that bike-short-term and annual members were more likely to be women, younger, and have lower incomes than private bicycle users (Buck, Buehler, Happ, Rawls, Chung, & Borecki, 2014). Users pick up bicycles at any self-serve station and deposit them at any self-serve station. Bike-share improves the short distance point-to-point range of pedestrians. Becoming a member of a bike share provides access to bicycles throughout a web of connection points within a pre-defined area. Users provide credit card information and purchase memberships of varying length. Usage rates are later charged to the credit card; however, many systems incentivize short trips by providing a free period, typically thirty minutes (Institute for Transportation and Development Policy, 2013).

3 Halifax Regional Municipality

Halifax is the capital of Nova Scotia, as well as the major regional center east of Montreal. The population of the HRM was 390,096 in 2011. The municipal area is a significant 5,490 square kilometres (Statistics Canada, 2012). Within the urban area around the Halifax harbour the population was 297,943 in an area of almost 270

square kilometres (Statistics Canada, 2012). The population of the Halifax peninsula was 62,900 in 2011 within an area of approximately 18 square kilometres (Statistics Canada, 2012), with an approximate population density of 3,500 per square kilometre. Each year the city welcomes more than 200,000 tourists by cruise ships alone (Port of Halifax, 2015).

4 Cycling in Halifax

There are more than 95 km of bike lanes in the municipality (Halifax Regional Municipality, 2014). These lanes are primarily in areas outside of the Halifax peninsula. The Halifax peninsula bicycle infrastructure grid is fragmented and incomplete (Halifax Regional Municipality, 2014). The Dalhousie Bike Centre describes bicycling in Halifax: "The bicycle lanes and trails on the peninsula of Halifax are choppy and underdeveloped at best. Bicycle lanes do exist on small portions of South Park Street, Windsor Street, and Brunswick Street". This statement reflects the ATPP report regarding the city's bike infrastructure. The ATTP states, "Most bicycle lanes have been built outside the regional center" (Halifax Regional Municipality, 2014). There has been an increasing emphasis on the implementation of active transportation facilities in the regional center; the regional plan intends to increase the amount of active transportation opportunities in the regional center (Halifax Regional Municipality, 2014).

Approximately 1% of Haligonians ride a bike to work, which is in line with the Canadian average. This is low when compared with cities like Vancouver, Minneapolis, Seattle, and Washington, which have a modal share between 1% and 4% (City Clock, 2014). In 2011 the modal share on the Halifax peninsula is higher at around 4% for Halifax Needham and Chebucto census tracts (Halifax Regional Municipality, 2014). Notably, this modal share statistic only includes trips to work, limiting its comparability with journeys that bike-share typically replaces.

Halifax's climate is not ideal for year round cycling. Several of the winter months create significant barriers to bicycling. In the remaining months of the year, the climate is mild, with frequent precipitation. Notably, rain, humidity, and cold temperatures deter bike-share usage, and behaviour differs between bicyclists and bike share users (Gebhart & Noland, 2014). In a study of the Washington D.C. bike share, Gebhert and Nolan found that during periods of precipitation the average number of trips by registered bike-share users decreased by 48.5%, and casual user trips decreased by 68.3% (Gebhart & Noland, 2014). Average trip durations were also effected by precipitation, registered users travelled for an average of 12.5 minutes, reduced by 10.1% in rain, and 9.4% in snow; casual users averaged 39 minute trips, reduced by 22.4% in rain, and 12.1% in snow (Gebhart & Noland, 2014). In their concluding remarks, the Gebhart and Nolan state "The sentiment that 'no-one bikes in the rain' is simply not true" (Gebhart & Noland, 2014).

The Halifax Active Transportation Priorities Plan states, "A fundamental precursor to a successful bike share program is a connected bikeway network. Until a greater number of residents feel comfortable using bicycles on the streets, the success of any bike sharing scheme will be limited" (Halifax Regional Municipality, 2014). Additionally, the ATPP states that it may be helpful to learn from the experiences of other jurisdictions with mandatory helmet laws before implementing a bike-share system (Halifax Regional Municipality, 2014).

5 Goals

This section describes how a Halifax Bike Share could help reach the goals set out by the ATTP by increasing bicycle ridership, improving liveability, and improving health.

5.1 Increase Bicycle Ridership

Over the next ten years, Halifax will attempt to double the current number of pedestrians and cyclists (Halifax Regional Municipality, 2014). City staff estimate that this will require a doubling of the current $5.3 million annual budget (Ruskin, 2015). Studies suggesting strong cost-benefit ratios in cycling interventions have tried to quantify this in an economically consistent way (Hintermann & Götschi, 2013).

Bike share encourages new segments of society to cycle (Buck, Buehler, Happ, Rawls, Chung, & Borecki, 2014) and contributes to increase overall bicycling modal share (DeMaio, 2009). Additionally, the complementary effect of cycling and public

transit has been shown to improve the efficacy of both modes (Fishman, Washington, & Haworth, Bike Share: A Synthesis of the Literature, 2013).

5.2 Improve Liveability

Bike share can contribute to reduced automobile dependence. It can also extend the "reach" of pedestrians, which may help reduce the number of short trips made by car, reducing traffic congestion and demand for on-street parking (Fishman, Washington, & Haworth, Bike Share: A Synthesis of the Literature, 2013).

Bike share may additionally reduce greenhouse gas emissions, although the substitution rate of car trips to bike share trips is unclear. Notably, bike share very commonly replaces walking trips rather than automotive trips. It is complementary to conventional transit systems, filling the "last mile" of many journeys (DeMaio, 2009).

5.3 Health

The health benefits of bicycling are well understood to improve cardiac health as well as reduce obesity (Hartog, 2010). De Hartog concludes that cyclists may lose 0.8 to 40 days in life expectancy due to greater exposure to accident and air pollution, compared with 3-14 months gained from physical activity (Hartog, 2010). A central theme regarding the implementation of bike share is integrated physical exercise, that is, the introduction of exercise into daily routines not directly for the purpose of exercise. Exercise integrated into daily routines through repetition increases habit strength (Brujin, Kremers, & Singh, 2009). Brujin et al. found that

when bicycle use was strongly habitual, intention to ride was "a weak and nonsignificant correlate of actual bicycle use" (Brujin, Kremers, & Singh, 2009). This health benefit is difficult to quantify however because many trips are convenience-based trips that would otherwise have been used by walking. The health benefits of bike-share have been not been analyzed.

6 Project Work And Services Scope

The purpose of this analysis is to explore the possibility of a bike-share in Halifax. This pre-feasibility study exists to identify Halifax specific challenges and barriers to bike-share. In addition the study analyzes the topographical limitations in Halifax and assesses how the topography will effect the operations of a bike-share in Halifax.

6.1 System Definitions

"Station" An installation that permits the locking and retrieving of bicycles. Typically a station allows for 10-20 bicycles

"Kiosk" A payment point for registration and subscription to the service, as well as to unlock bicycles

"Bicycle" A bicycle fitted with a terminal, allowing for unlocking by bike-share members

"Terminal" The system connection point for transmitting records of transactions

6.2 System Operations

A third-party organization would be need to be created to operate a bike share in Halifax. This pre-feasibility analysis suggests a non-profit organization as the ideal model. The Halifax Bike Share Cooperative would operate the system in Halifax. A

further description of the operational structure can be found in section 8.2. The organization would have to hire employees for operational tasks, perform maintenance, infrastructure, bike repair, rebalancing, and customer service. The organization would also upkeep software, communications, insurance, and IT.

A Halifax Bike-Share would provide a fleet of bicycles parked at secure, self-service, locations. The proposed system uses bicycles with a terminal attached to the frame. This would allow for more flexible, modular stations to be deployed, and relocated easily. Though station-based bike share has been widely applied, new more flexible systems exist that allow the use of non-system bike racks at an additional convenience fee. This feature may be enabled and disabled depending on system preferences. The local legal requirement of helmets limits the flexibility of such a system, though not entirely. Further discussion of the effects of mandatory helmet laws is included in Section 9. Additionally, the movement of bicycles in the proposed vehicles is tracked in real-time by GPS, improving data collection, as well as offering assistance to operators for recovering bikes left in inconvenient locations.

Redistribution of vehicles, i.e., “balancing” will be required to ensure that bicycle distribution is in line with system demand. Bicycles must necessarily be durable, resistant to vandalism and theft, and adaptable to multiple user groups.

This analysis evaluated two vendors (Social Bicycles and Bixi) who both offer similar systems and technology. Social Bicycles was found to be the more affordable

and flexible option. Additionally, Social Bicycles are integrated with a GPS, allowing for easier retrieval and user data collection. The system would support an integrated information technology network for the management of the bike share. This system would detail billing, communications, and maintenance.

6.3 Winter Weather Policy

The bike share system would require winter storage. This necessitates the removal of docking stations, bicycles, and other bike-share infrastructure. An estimated operational period of 210 days is feasible and conservative, between April 1 and November 1. Longer than this period is likely possible, and adaptations could be made as appropriate.

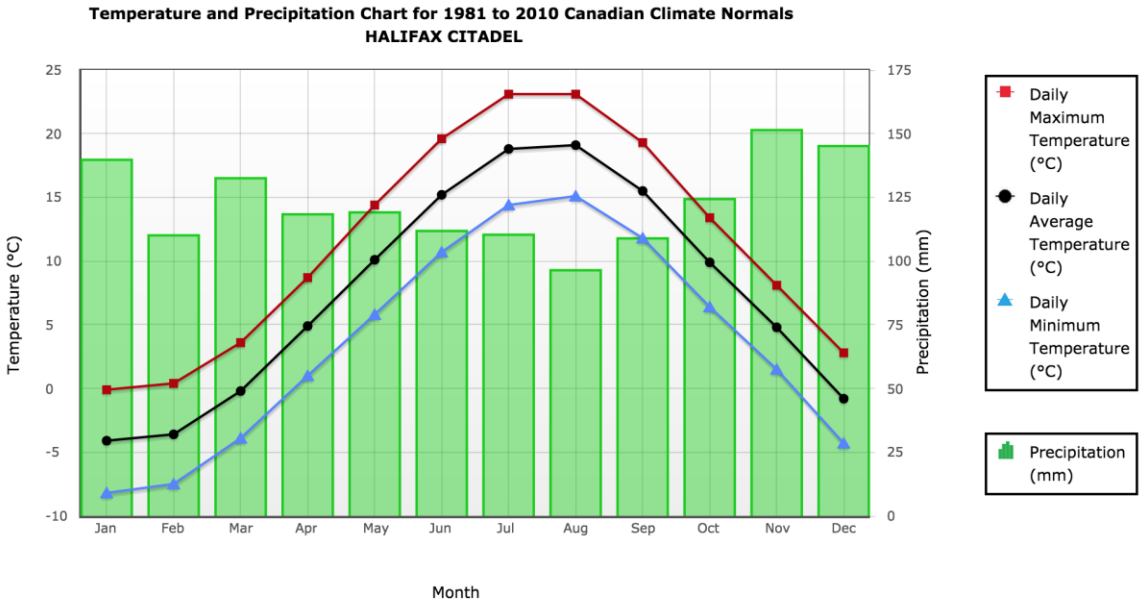

Figure 1. Temperature and Precipitation Chart. Copied from Climate, by the Government of Canada. 2015. Copyright 2015 by Government of Canada. Reprinted with permission

The proposed operational period between April 1 and November 1 spans 210 days with above average temperatures greater than 0 degrees Celsius. The precipitation

during this period is lower than during the winter, while still higher than many cities implementing bike-share. During the period between November 1 and April 1, a storage space would have to be found, which would increase costs.

6.4 Implementation Zone

The population density within, and the population in the surrounding area impact the service area for bicycle share. Employment density also contributes to the usage of bicycle share. Population density on the Halifax peninsula was approximately 3,500 per square kilometre in 2011. Due to the steep hills that border the peninsula, Halifax is considered "hilly", however, there is a large plateau that is not as challenging to bicycle as the more memorable inclines surrounding the city. The highest density populations typically reside on the plateau portion of Halifax. In Figure 1, below, the population of each census tract has been included in blue, with population density included in green.

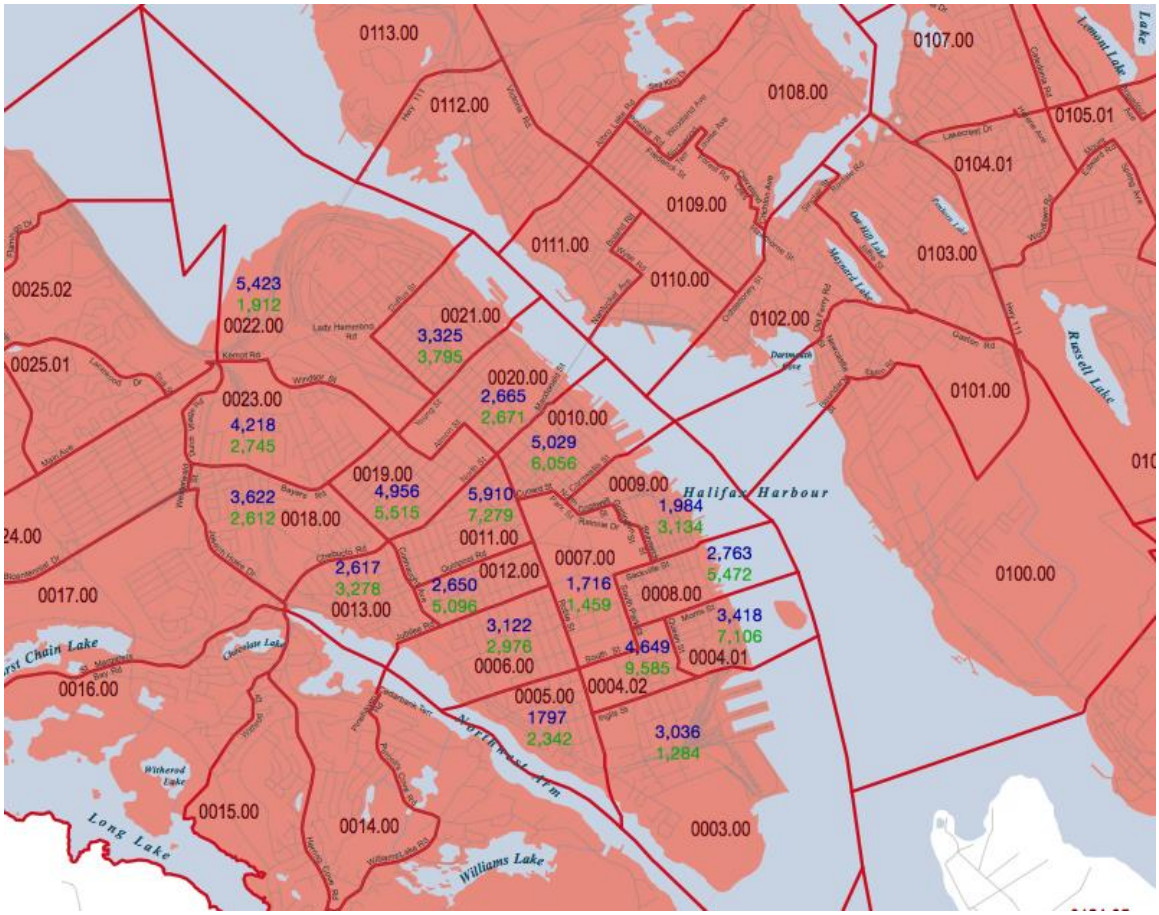

Figure 2. Population and Population Density on the Halifax Peninsula. Adapted from Statistics Canada, by Statistcs Canada, 2015. Copyright 2007 Statistics Canada. Adapted with permission

The highest employment density on the peninsula is found on Barrington Street and Spring Garden Road (Stantec, 2013). It is important to note that the high rate of employment density in the nearby Burnside Industrial Park may attract many who live on the Halifax peninsula, eliminating the potential for those trips to be captured by bicycle share.

The Halifax peninsula is comprised of favourable demographics to bike share. In 2011 the typical resident of downtown Halifax is between 20 and 34 years old, with

a university education (Gregory, 2014). This conforms to demographics of bike share users in other jurisdictions, where lower average age and significantly higher education levels are expected (Fishman, Washington, & Haworth, Bike Share: A Synthesis of the Literature, 2013). Although the student population may be considered an asset to bike share, the student population is seasonal, spending much of their time in Halifax during months when a bike-share would be out of operation. A sufficient population is located on the Halifax peninsula. The minimum viable service area is ten square kilometres. (Institute for Transportation and Development Policy, 2013). At 11 square kilometres, the proposed area on the Halifax peninsula is slightly larger than this minimum. Unlike many bike shares, the proposed service area is bordered steep hills. These hills may create distribution problems, with many bikes pooling in the lower areas, while fewer are accessible on the plateau. Additionally, a large portion of the northern tip of the peninsula is mostly inaccessible to bicycles, and thus provides a natural barrier to bicycle pooling in that region.

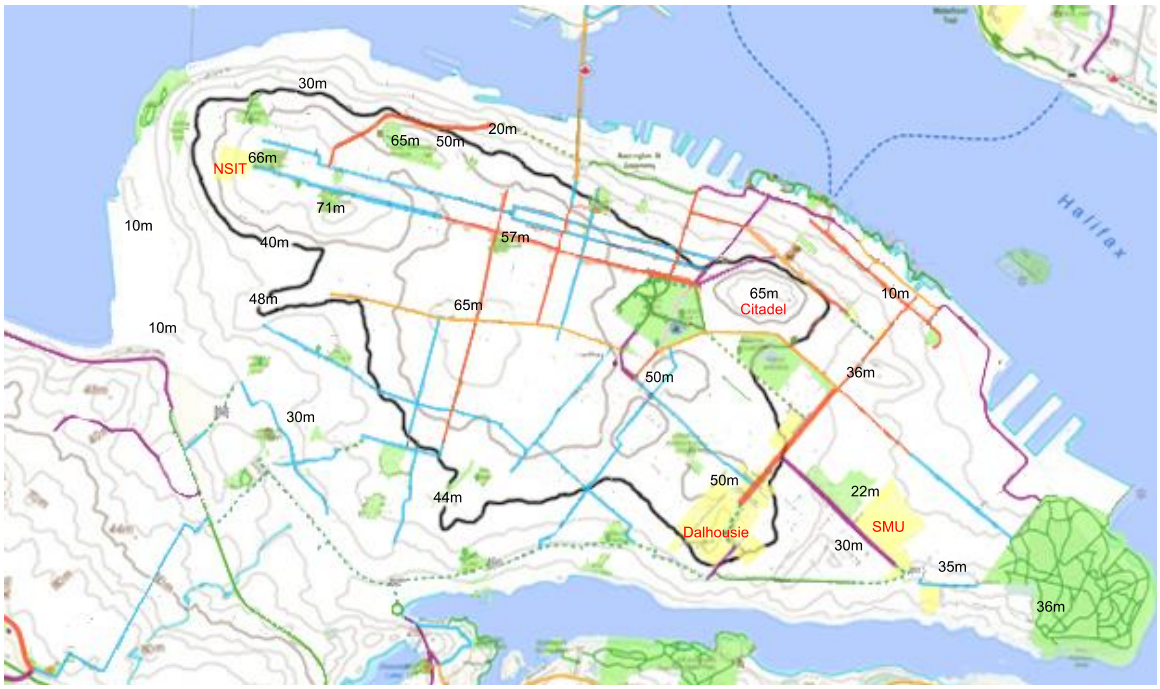

Figure 3. Topography of Halifax and Proposed On Track for 2020 Bicycle Lane Network. Topography Adapted from Atlas of Canada. Adapted with permission. Bicycle Network Adapted from Halifax On Track for 2020. Adapted with permission.

In 2014, the Halifax Cycling Coalition produced a report named "On Track for 2020" suggesting which roads could support a protected bicycle lane network on the Halifax peninsula (Halifax Cycling Coalition, 2014). Here in Figure 3 the suggested On Track for 2020 bicycle lane network has been placed over a topographical map of Halifax. The most accessible topography for bike share on the Halifax peninsula is the plateau (Bolded in black). It is nearly 7.5 square kilometres. The proposed service area may be viewed in Figure 4, Section 6.5. Bike share pooling can be expected to occur along the outside of the system. This may lead to additional rebalancing, which leads to higher operating costs. Notably, the least accessible region to bike-share on the Halifax peninsula is unlikely to require rebalancing. This

raises questions of the operational area for rebalancing efforts. Rebalancing vehicles may only be required in certain popular, bike friendly areas along the perimeter.

6.5 System Size

A bicycle share in Halifax exceeds the minimum service area suggested by the ITDP of 10 square kilometres. Of the peninsula's 18 square kilometres, only between 10 and 12 square kilometres are suitable for a bicycle share service area. With 45 stations, a bike share in Halifax can be distributed such that individuals are typically no further than 350m from a nearby station. This is a station density of only slightly more than 4 per square kilometre (Or 10 per square mile). The National Association of City Transportation Officials suggests a station density of 28 per square mile as the optimal station density to encourage usage (National Association of City Transportation Officials, 2010). A number of well performing systems do not have this station density, and expert Paul DeMaio states "This proposed station density won't work well in all settings, such as suburban areas, college campuses, or less dense areas" (Goddin, 2015). Station placement would be a mix of both public and private land, suggesting the need for public outreach and municipal participation. Figure 4 shows the proposed service area in purple.

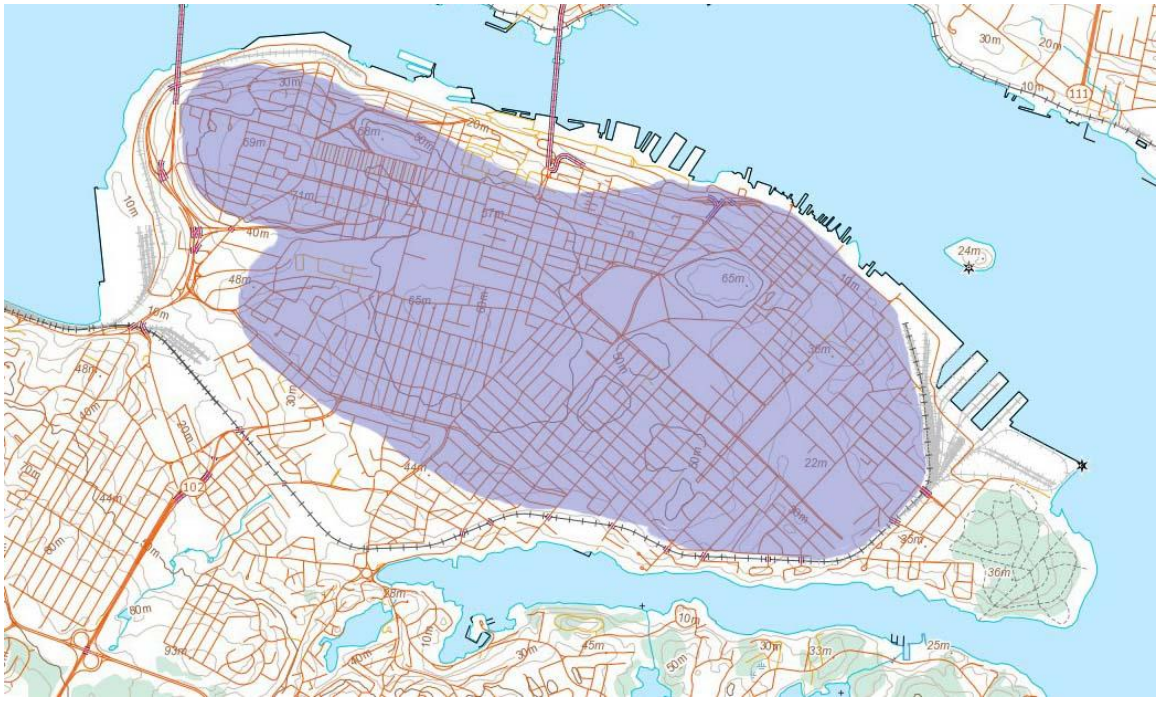

Figure 4. Suggested Service Area. Adapted from The Atlas of Canada. Copyright by The Atlas of Canada 2015, Adapted with permission

While Halifax's bicycle grid has experienced considerable growth in recent years, the bicycle infrastructure is not yet comparable to other similarly sized cities containing or proposing bicycle share. Further, the bicycle lane network has primarily grown outside of the peninsula (Ruskin, 2015). The completion of the On-Track for 2020 plan would remove significant infrastructure-related barriers. Given the population density and income levels, the growth in bicycle lanes in North End Halifax is of considerable interest for a Halifax-based bicycle share.

6.6 Phase Build Out

Many bike-share systems choose to phase project expansion. Given the small potential size for a proposed system, systematic phase-in and scaling of a system is

more difficult and should be reflected as a barrier. As shown in section 6.5 the proposed system is just larger than the minimum recommended size. Smaller systems than this reduce the viability of bike-share for completing short trips, the most typical form of trips on bike-share (Institute for Transportation and Development Policy, 2013). It is recommended to implement the entire Peninsula network in one phase; other areas could be added at another time.

7 Role and Potential Contributing Stakeholders

Bike-share aligns with the Halifax ATPP goals of increasing the modal share of pedestrian and bicycle transit. In addition it actively supports the objectives of the ATPP: Mobility, Health, Quality of Life, Economic, Environmental, Recreational. Bike-share is often assisted through public subsidy; government involvement in the process provides considerable benefits in programming to provide greater participation across multiple income ranges.

The presence of multiple local universities offers opportunity for coordination, although as noted, the program would primarily be out of service during the winter semesters.

The North End Business Association, Quinpool Road Mainstreet District Association, and the Spring Garden Business Association, all may have an interest in the implementation of bike share. Improving bicycle access to stores offers the potential

for patronage to a wider audience (Clifton, Muhs, Morissey, Morissey, Currans, & Ritter, 2013).

In Melbourne and Boston helmet distribution has been subsidized through road safety and community health grants (Fishman, Barriers to bikesharing: an analysis from Melbourne and Brisbane, 2014). The mandatory helmet legislation in Nova Scotia would require the participation of similar granting agencies in order to provide helmets to users.

The provincial government's *Connect2* grant is "based on a vision that all trips under two kilometres to key community destinations in… urban areas of Nova Scotia could be made using sustainable modes of transportation" (Province of Nova Scotia, 2014). The *Connect2* grant objectives are fulfilled in a variety of ways. The project is a form of sustainable transportation infrastructure in the form of a collaborative service to benefit active transportation planning. *Connect2* could provide grants up to $150,000 for the initial start-up cost.

8 Financial Plan

This pre-feasibility study suggests a bike share system with 300 bicycles, with 45 stations and 570 docking points, this assumption will be applied to the pro-forma financial analysis. The proposed feasible area for a Halifax Bike Share system would encompass primarily the plateau spanning the north and central portions of the peninsula, as well as downtown and the south end, an area of approximately 11

square kilometres. This area represents the most attractive area for initial deployment due to topography, employment density, and population density. The system could be expanded to include the entire Halifax peninsula if demand is sufficient to allow for increased rebalancing. The weather in Halifax would necessitate a multiple month closure of a bike share; there is a possible 210-day operational period between April 1 and November 1, although this is likely a conservative estimate since often the weather in Halifax is milder.

8.1 Scope of Financial Plan

This analysis does not capture the full scope of a feasibility study and does not contain a detailed analysis of demand or a complete financial feasibility analysis. This analysis does contain a preliminary Pro-Forma. No complete demand analysis is included; instead a more cursory uptake-rate approach as recommended by the ITDP has been applied (Institute for Transportation and Development Policy, 2013). The limiting factors (weather, topography, infrastructure) to bicycle ridership on the Halifax peninsula encourage a preference for a low uptake scenario. This is arguably a conservative assumption given the 4% modal share on the Halifax peninsula excluding the area nearby the Citadel.

8.2 Operating Structure

Multiple operating structures exist, such as: Non-profit, Privately owned and operated, direct contract with operator, transit owned and operated, administrative non-profit with private operator. For the purposes of this pre-feasibility analysis, a non-profit operating structure was chosen due to the frequency at which it has been used for other bike share systems throughout North America. A non-profit would be

formed to manage and operate the bike share system. The organization would be responsible for procuring funding, equipment, defining system guidelines, launching the system, and providing expertise for operations.

8.3 Capital and Installation Costs

There are a number of general start-up costs. Capital and installation costs associated with the creation of a bicycle share system include equipment purchases, site planning, installation and deployment costs. The Mineta Transportation Institute found that the targeted bicycle-to-docking-port ratio in Canada is 1.9 (Shaheen, Susan A; Martin, Elliot W; Cohen, Adam P; Finson, Rachel S, 2012). For the purposes of this pre-feasibility analysis a ratio of 1.9 docking points per bicycle has been chosen. Including additional expenses such as rebalancing vehicles, bicycle kiosks, maps, cards, and promotional materials. If this equipment is included in the cost in a 45-station scenario the average cost per station increases to $27,900. (Appendix XX) Included in the capital and installation costs is an estimation of employee expenses in the pre-launch term. The pre-launch period is assumed to be 6 months, and includes salaries for administration and management, as well as installation and training services. Not included in the analysis are expenses incurred for legal consultation, accounting, insurance, outreach, bicycle replacement, and real estate acquisition.

8.4 Annual Operational Costs

Annual operating costs after system launch are also included. These costs include salaries, equipment maintenance and replacement, rebalancing equipment, system

software upkeep. Estimations of costs associated with warehousing, operations facilities, vandalism and theft have not been made.

Bicycle replacement is required within any bike-share system. The bicycles from the proposed vendor have an expected lifetime of 5 years. The accessories, components, and locks of the bicycles are covered by a one-year warranty. The bicycle frames are covered by a 3-year warranty. An analysis of deterioration and replacement rates of the bicycles should be undertaken to determine additional annual operating costs.

8.5 System Revenue

Although no formal demand analysis is included in this pre-feasibility analysis, the Institute for Transportation and Development Policy suggests the following for a less rigorous analysis: three uptake rate scenarios, low (3%), medium (6%), and high (9%) based on population within the service area. The uptake rate represents the percentage of the service area population who will purchase an annual membership. Although there are 62,900 residents on the Halifax peninsula, approximately 50,000 are within the proposed service area. Based on the three scenarios there will be 1,500, 3,000, or 4,500 annual members. As stated earlier, we will assume a low uptake scenario (3%) in the proposed service area of with an approximate population of 50,000.

Year 1	Year 2	Year 3	Year 4	Year 5
1500	1500	1500	1500	1500

Typical membership fee in public bike share systems ranges between $50 and $95, most typically nearer to $70, with many systems offering preferential rates to students. Most bike share systems offer an initial thirty free minutes to users and begin charging after the first 30 minutes each day. Typical usage fees are between $1.50 and $3.00 per half hour beyond the initial free 30-minute period. For revenue forecasting, the pro forma assumes the pricing structure:

Access Fee		Usage Fees	
		0-30 Minute	30+ minutes
Annual	$80.00	$0.00	$3.00
Daily	$5.00	$0.00	$3.00

Tourism can also contribute to the usage of a public bike share system through the use of daily and weekly passes; again using a crude estimated uptake rate of 3%. If we assume that, of the 200,000 annual cruise passengers some 6,000 will purchase daily passes to the system. With a daily pass cost of $5 the program will earn $30,000 annually from cruise ship passengers.

Usage rate revenues are difficult to predict. They are a product of distance from station to destination, within the context of each individual city. The pro forma

assumes an average usage fee incurred by annual members at $3 a year, and $6 per casual member.

Advertising revenues can be drawn from on-bike advertisements. These can be used to help fund the system, or are used as part of a package to a system sponsor. Annual advertisement revenue of $200 per bicycle has been assumed. This results in $60,000 each year.

Under these assumptions, low uptake rate, 200,000 tourists, usage fees of $3 per annual member and $6 per tourist respectively, $200 per bike in advertising revenue, the projected annual non-grant revenue of the system is approximately $250,000 each year over 5 years. It is estimated that there would be an operating shortfall of $86,000 not including, an operations facility, a warehouse facility, bicycle replacement, and helmet replacement, legal and accounting expenses, and any costs associated with land maintenance and acquisition. The pro-forma may be referred to in Appendix 2.

9 Additional Considerations

The legal environment in Halifax differs in a key respect from most other cities containing bicycle shares. There is a mandatory helmet law across all age groups. A similar law in cities with bicycle shares exists in Seattle, Brisbane, and Melbourne. In Melbourne and Brisbane, discounted helmets have been offered at nearby shops; ridership is significantly lower than elsewhere, “Some 61% of respondents cited

helmet issues as their main barrier" (Fishman, Barriers to bikesharing: an analysis from Melbourne and Brisbane, 2014). In Seattle there has been considerable success using simple free helmet bins. Originally Seattle's Pronto Cycle Share had planned to use "helmet dispensers" which has been a proposed solution in Vancouver, however the system experienced considerable success with free helmet bins. Annual users of Pronto Cycle Share receive frequent emails with a code to unlock bins filled with free-to-use helmets, which they later deposit at "used helmet bins" at the next station (Fucoloro, 2015). The helmets are cleaned and replaced in bins regularly (Fucoloro, 2015). Individuals buying 24 hour or 3-day passes must pay $2 for this code (Fucoloro, 2015). Each of the cities facing this barrier is considerably larger than Halifax.

Notably, the behaviour of bike-share users and bicyclists differ. Bike-share is often used as a convenient means of asymmetric travel on unanticipated trips. These trips tend to be spontaneous (Fishman, Washington, & Haworth, Factors influencing bike share membership: An analysis of Melbourne and Brisbane, 2014). Under a mandatory helmet law, the number of steps required to start a trip are increased, reducing the total number of trips. A bike-share provider in Halifax should seek to make provisions against this factor.

10 Summary and Conclusions

Bike-share implementation in cities without complete bicycle networks is not a well-understood proposition. Though there are a number of similar sized regions

that have implemented bike-share, typically the weather, infrastructure, and topography are more amenable to the system. This limits the comparability between Halifax and other similar sized cities. However, this does not necessarily imply that the system does not encourage increased ridership. Further, the implementation of a newer generation bike-share system provides travel data outlining the most popular and most frequent routes. This could provide a considerable amount of value in assisting transit planners to economize the implementation of an efficient bike-lane network. Given the conservative estimates applied during the financial analysis, it is unlikely that a bike-share in Halifax could be self-sustaining, and would thus require additional funding from other sources. An estimated operating shortfall of $86,000 could be expected, not including a variety of expenses discussed in section 8.5.

The small size of Halifax prevents a larger bike share. Given the incomplete cycling grid, weather, and topography, more analysis is necessary to come to conclusions regarding bike-share use in Halifax. There is unknown variability of use caused by the local legal environment. Examining the adaptations of other bike-shares under mandatory helmet law regimes can provide further clarity regarding the efficacy of different measures. A more complete demand analysis should be undertaken to identify financial feasibility. Installation, implementation, and marketing costs also require additional investigation.

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Appendix 1 – Rationale and Assumptions

We have made a considerable number of assumptions in this study:

- A low uptake (3%) scenario regarding memberships from both the general population and tourists from cruise ships.
- An average usage fee incurred by annual members at $3 a year, and $6 per casual member.
- An initial membership of 1200 annual members with a 10% growth rate.
- A 210 day operational period between April 1 and November 1
- The implementation of bike share of approximately 300 bicycles and 570 docking stations. Note that the number of bicycles per 1000 residents is below the ITDP recommended 10-30, and reflects closer to 5 bikes per 1000 residents.
- An average station cost of $23,600, given 45 twelve-bicycle stations with 8 kiosks and 8 map and ad panels, this produces an average of 6 to 7 bicycles per station.
- A six-month pre-launch period has been appropriated for general start-up related tasks and installation.
- We have assumed that the service area of a bike-share in Halifax would encompass 11 square kilometres.
- Annual advertising revenue of $200 per bicycle.
- In my Pro-Forma I have used system prices from the firm “Social Bicycles”.

Appendix 2 – Pro Forma Financial Information

Initial Start-Up Costs

Initial Bicycle/Dock/Terminal Costs			
Item	Price Per Unit	Number of Units	Total Price
Bicycles	1500	300	$450,000.00
			$0.00
Docks	450	570	$256,500.00
Helmets			$0.00
Terminals	10,000	8	$80,000.00
Map and Ad Panels	2,750	8	$22,000.00
Equipment Cost USD			$808,500.00
Equipment Cost CAD (Aug 30)			$1,067,220.00
System Cards (1yr supply)	0.5	4000	$2,000.00

Rebalancing Vehicle and Trailer			$90,000.00
Installation			Unknown
Implementation Services			Unknown
Employee Startup Expense			$139,550.00
Transport and Tariffs and Sales Tax			$194,815.50

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Item	Price Per Unit	Number of Units	Total Price
Bicycles	1500	300	$450,000.00
			$0.00
Docks	450	570	$256,500.00
Helmets			$0.00
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Equipment Cost CAD (Aug 30)			$1,067,220.00
System Cards (1yr supply)	0.5	4000	$2,000.00
Rebalancing Vehicle and Trailer			$90,000.00
Installation			Unknown
Implementation Services			Unknown
Employee Startup Expense			$139,550.00
Transport and Tariffs and Sales Tax			$194,815.50
Total Initial Cost			$1,493,585.50

Start-Up Initial Employee Expenses

Initial Employee Expense (6 Months)							
Position	Number of Full Time	Seasonal Employee	Hourly Wage	Annual Salary	Benefits + Taxes	Cost	Startup Cost

	Employees	s					
Director	1		35	$70,000.00		$70,000.00	$35,000.00
Operations Manager		1	30	$60,000.00		$60,000.00	$30,000.00
I.T. Specialist	1		30	$60,000.00		$60,000.00	$30,000.00
General Administrative		1	15	$21,000.00		$21,000.00	$10,500.00
Bicycle Mechanic		1	13	$20,800.00		$20,800.00	$10,400.00
Intern-Bicycle Mechanic (5 Month)		2	11	$4,400.00		$8,800.00	$4,400.00
Public Relations Specialist		1	25	$38,500.00		$38,500.0	$19,250.0

						0	0
Total							$139,550.00

Annual Operational Expenses

Employee Expense						
Position	Number of Full Time Employees	Seasonal Employees	Hourly Wage	Salary	Benefits + Taxes	Cost
Director	1		35	$70,000.00		$70,000.00
Operations Manager		1	30	$60,000.00		$60,000.00
I.T. Specialist	1		30	$60,000.00		$60,000.00
General Administrative		1	15	$21,000.00		$21,000.00

Bicycle Mechanic	0.5	1	13	$20,800.00		$31,200.00
Intern-Bicycle Mechanic(5 Month)		2	11	$4,400.00		$8,800.00
Total Employee Expense						$251,000.00
Ongoing Expenses						
Item	Price Per Unit	Number of Units				Total Price
Replacement Parts	100	300				$30,000.00
Platform Connectivity Fee	96	300				$28,800.00
Software License Fee (9 Months)	2500	9				$22,500.00
Kiosk Connectivity Fee (9 Months)	50	8				$3,600.00
Helmets						$0.00
Helmet Bins						$0.00
Warehouse (Winter)						Not

						Included
Operations Facility						Not Included
Rebalancing Vehicle and Trailer						Not Included
Total Annual Operational Expense						$335,900.00

Demand Analysis

Membership Rate (Individuals)	Year 1	Year 2	Year 3	Year 4	Year 5
Low (3%)	1500	1500	1500	1500	1500
Medium (6%)	3000	3000	3000	3000	3000

High (9%)	4500	4500	4500	4500	4500
Direct Revenue (Low Rate)	Year 1	Year 2	Year 3	Year 4	Year 5
Annual Membership Revenue	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00
Non-Member Subscription	$30,000.00	$30,000.00	$30,000.00	$30,000.00	$30,000.00
Member Trip Revenue	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00
Non-Member Trip Revenue	$36,000.00	$36,000.00	$36,000.00	$36,000.00	$36,000.00
Indirect Revenue	Year 1	Year 2	Year 3	Year 4	Year 5
Per Bike Advertisement	$60,000.00	$60,000.00	$60,000.00	$60,000.00	$60,000.00
Corporate Sponsorship (?)					
University (?)					
Total	$250,500.00	$250,500.00	$250,500.00	$250,500.00	$250,500.00

Tourism Participation Rate (Of 200,000)	Year 1	Year 2	Year 3	Year 4	Year 5
3%	6000	6000	6000	6000	6000
6%	12000	12000	12000	12000	12000
9%	18000	18000	18000	18000	18000

Medium Uptake Rate (6%)

Direct Revenue (Medium Rate)	Year 1	Year 2	Year 3	Year 4	Year 5
Annual Membership Revenue	$240,000.00	$240,000.00	$240,000.00	$240,000.00	$240,000.00
Non-Member Subscription	$60,000.00	$60,000.00	$60,000.00	$60,000.00	$60,000.00
Member Trip Revenue	$9,000.00	$9,000.00	$9,000.00	$9,000.00	$9,000.00
Non-Member Trip Revenue	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00

Indirect Revenue	Year 1	Year 2	Year 3	Year 4	Year 5
Per Bike Advertisement	$60,000.00	$60,000.00	$60,000.00	$60,000.00	$60,000.00
Corporate Sponsorship (?)					
University (?)					
	$441,000.00	$441,000.00	$441,000.00	$441,000.00	$441,000.00