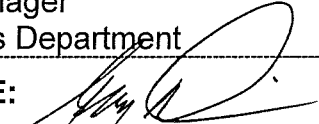




Hamilton

**CITY OF HAMILTON**
**PUBLIC WORKS DEPARTMENT**  
*Transportation Division*

<b>TO:</b> Mayor and Members General Issues Committee	<b>WARD(S) AFFECTED:</b> CITY WIDE
<b>COMMITTEE DATE:</b> February 25, 2013	
<b>SUBJECT/REPORT NO:</b> Public Bike Share Transit System Implementation Plan (PW13015) - (City Wide)	
<b>SUBMITTED BY:</b> Gerry Davis, CMA General Manager Public Works Department	<b>PREPARED BY:</b> Peter Topalovic Project Manager, Transportation Demand Management (905)546-2424, Extension 5129
<b>SIGNATURE:</b> 	

**RECOMMENDATION**

- (a) That the implementation of a public bike share transit system be approved, as outlined in Appendix "A" to Report PW13015, subject to finalization of an agreement to secure a system supplier and operator through a Request for Proposals (RFP) process;
- (b) That staff report back to Council with the results of the RFP process;
- (c) That the General Manager of Public Works be given delegated authority to negotiate with potential system sponsors and enter into agreements for the purpose of fully offsetting the operating costs of the system for a minimum period of three years;
- (d) That the capital and start-up costs of the Public Bike Transit System, as outlined in Appendix "A" to Report PW13015, be funded from the Rapid Transit Capital Reserve (108047) to an upset limit of \$1,600,000, subject to available funding and approval from Metrolinx.

**EXECUTIVE SUMMARY**

This report recommends that the City of Hamilton implement a Public Bike Share Transit System, as outlined in the Public Bike Share Transit Business Case (attached

as Appendix "A"). It also recommends that the capital and start-up funding for the system be funded through Rapid Transit Capital Reserve (108047) for \$1.6 million. It is intended that the system be operationally self-sustaining over a ten (10) year period, guaranteed through a service level agreement with a third party operator.

A Public Bike Transit System is a public service in which bicycles are made available for shared use to members of the public who do not own the bikes, but pay a small fee to use them on a daily, monthly or yearly basis. Numerous public bike share systems have been developed in the United States, Canada and Europe in large and medium sized cities including Paris, France, London, England, New York, Minneapolis, Minnesota, Montreal, Toronto and more recently Chattanooga, Tennessee, a city of five hundred thousand (500,000) people.

The intent of developing a Public Bike Transit System in Hamilton is to:

- (a) Improve access to the A-Line and B-Line transit corridor by offering residents within two (2) to five (5) kilometres of the corridors a quick and efficient way to get to the bus service and make a connecting trip
- (b) Provide bicycles to households which do not currently own bicycles or to those households that wish to have access to commuter bicycles that do not have to be stored, locked up or are subject to the threat of theft
- (c) Develop a public bicycle network that is located near existing cycling networks, transit corridors, transit stops, transit stations and key areas of interest
- (d) Establish a true multi-modal transportation network in the City by offering a bike transit network that complements the existing bus transit network in a way that builds on existing ridership patterns and encourages use of both bicycles and busses as connecting trips

The Public Bike Share Transit System combines pedestrian, cycling and transit facilities in an integrated fashion and is based on a successful North American model which views public transit from a new perspective that includes all modes and recognizes that a commute trip can be fast and more convenient when it combines multiple modes in one (1) trip. The innovative nature of the project helps fill a niche that traditional transit cannot provide. This is an 'on demand' transit service that facilitates connectivity to the A and B express bus lines in the most convenient way possible for the transit rider.

Since 2009, a bike share feasibility study and market research project, in partnership with McMaster University researchers was conducted, including two (2) stakeholder workshops and a physical demonstration of bike sharing systems in front of City Hall. The results of these studies have been incorporated into the Bike Share Transit Business Plan, attached as Appendix "A".

### **Alternatives for Consideration - See Page 8**

**FINANCIAL / STAFFING / LEGAL IMPLICATIONS**

**Financial:**

The Metrolinx Quick Wins Funding program for transit improvements awarded the City of Hamilton \$29.8 million in 2009 for the purpose of making transit infrastructure improvements in the A-Line and B-Line corridors. A variety of projects associated with this funding are in the planning stages including the construction of a park and ride facility at the Mountain Transit Centre, and bus stop amenity improvements in the corridor.

It is proposed that, in addition to the existing projects, the Public Bike Share Transit Project also be funded from the available Quick Wins funding, for a total value of \$1,600,000, to cover capital and start-up costs, as outlined in the Public Bike Share Transit Business Plan (Appendix "A").

Using Quick Wins funding eliminates the need for a loan to fund the capital costs. In older systems, interest payments on the loan were prohibitive to operating the system in a revenue neutral fashion. Quick Wins funding will make the Public Bike Share System in Hamilton operationally self-sustaining, eliminating the inflated costs associated with loan repayment. The most profitable public bike share systems in other cities are those whose capital costs are covered through government funding and grants. With capital costs covered, sustainable operating revenues for the proposed Hamilton system are based upon three thousand (3,000) annual subscriptions and half (0.5) non-subscribed trips per station, per day, as outlined in Appendix "A".

**Staffing:**

It is intended that the actual operation of the bike transit system would be operated by a non-profit service provider or by the provider of the bike transit system through a service level agreement and contract for full system operation, maintenance and marketing of the system.

The Project Manager, Transportation Demand Management would act as the key liaison between the City and the System Operator.

Purchasing staff and Mobility Programs and Special Projects staff would work with vendors through an RFP process in order to award the contract.

Public Works staff would be required to allocate and manage station locations; however, the System Operator would be responsible for the operation and maintenance of the stations, bikes and supporting infrastructure.

**Legal:**

The service level agreement and contract with the system Operator will be developed by the City's Legal Services staff to ensure that the Operator will provide the required level of service. The agreement will also define the relationship between the City and the System Operator to ensure the smooth operation of the system and integration of the system with the existing transit network, fare media and other integration

considerations. If the recommendations in this report are accepted by Council, Public Works staff will work closely with Legal Services, Risk Management and Corporate Finance staff to ensure that the agreements are satisfactory to the City and result in a system that is operated in the best interests of the public.

## **HISTORICAL BACKGROUND**

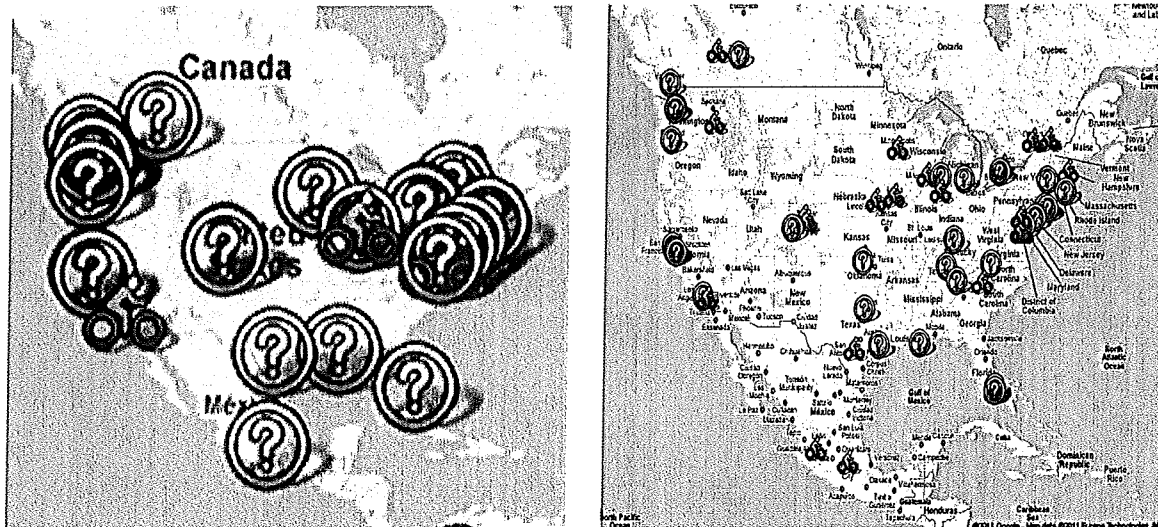
The success of bike sharing in North America coupled with demand and commitment from cycling advocates, public transportation advocates, McMaster University, Mohawk College and members of the Smart Commute Hamilton Transportation Management Association necessitated an investigation into establishing a Public Bike Share System in Hamilton. Between 2009 and 2011, the City partnered with McMaster University, Mohawk College, Green Venture and Hamilton CarShare to develop:

- (a) A series of two (2) workshops open to the public and interested stakeholders in August of 2010 and November 2011
- (b) A physical demonstration of Bixi and B-Cycle technologies in front of City Hall
- (c) A feasibility study and market analysis as part of an internship research program with McMaster University Arts and Science and MBA students in 2009 and 2011
- (d) A functional analysis developed in partnership with Green Venture in 2011
- (e) A station location analysis developed in partnership with a Mohawk College student as part of their final capstone project in 2012

These documents are summarized in the Public Bike Transit Business Plan attached as Appendix "A" to this report. It was determined that Hamilton's urban population density, number of jobs per hectare, cycling culture, transit routes and mode split will support a next generation public bike share with up to forty (40) stations and three hundred and fifty (350) bikes as a kernel, from which to base a larger system in the future.

During the same period as our research was conducted, the number of public bike share systems in North America grew from four (4) in 2009 to twenty (20) in 2011 and continues to grow into 2012-2013. The number of worldwide systems now totals two hundred (200).

The public bike share transit project was presented to Metrolinx in October of 2012 as a Quick Wins project and received verbal approval from Metrolinx staff.



**Figure 1 - Bike Sharing Systems in North America in 2009 (4 systems) and 2011 (20 systems) – green cyclists icons represent operating systems and blue question marks represent planned systems**

**POLICY IMPLICATIONS/LEGISLATED REQUIREMENTS**

In October 2011, Council directed SMT to develop an organizational structure and community engagement strategy to support, over the long term, an integrated public transportation program for the City that encompasses provincial, inter-regional, inter-city, rapid transit, public transit, active transportation and transportation demand management no later than Q1 2012. As result, an 'integrated public transportation' program – Mobility Programs and Special Projects – was established by combining several individual public transportation related programs into one consolidated program that fits into the City's policies and principals. This is a new concept combining all modes of public transportation under one (1) umbrella.

TDM is an integral component of this new approach and the Public Bike Share Transit System unites these concepts showcasing the convenience, efficiency, cost effectiveness and ridership impact that a multi-modal transportation system can have on the City's transportation network.

This plan also satisfies the recommendations of the following policies and plans:

- (a) Transportation Master Plan recommendations and metrics to reduce single occupancy vehicle use by twenty percent (20%) of projected mode split in 2031
- (b) Downtown Transportation Master Plan TDM recommendations
- (e) Metrolinx Big Move #2: Enhance and Expand Active Transportation Metrolinx Big Move #4: Create an Ambitious Transportation Demand Management (TDM) Program

## **RELEVANT CONSULTATION**

Relevant internal consultation includes:

- Public Works - Mobility Programs and Special Projects
- Public Works - HSR
- Public Works - Central Fleet
- Public Health - Active Living Division
- Public Health - Health Protection Division
- City Manager's Office - Sustainability
- Corporate Services - Finance

Relevant external consultation includes:

- Metrolinx, Innovation and Smart Commute
- McMaster University, Office of Sustainability
- McMaster University, Students Union
- McMaster University, Institute of Transportation Logistics
- Mohawk College, Office of Sustainability
- Mohawk College, Students Union
- Mohawk College, Student researchers
- Green Venture
- Hamilton CarShare
- Environment Hamilton
- Public demonstration participants in August 2010
- Public Bike System representatives
- B-Cycle representatives
- City of Toronto, Cycling Infrastructure and Programs staff
- Capital Bike Share staff
- Chattanooga Bike Share staff
- Alta-Bixi staff

## **ANALYSIS / RATIONALE FOR RECOMMENDATION**

This innovative ridership enhancing infrastructure strategy is being proposed because examples across North America point to the success of multi-modal strategies to enhance transit use and act as a seamless extension to the public transit system. Cities such as Toronto, Montreal and Minneapolis are providing a transportation network that consists of integrated multi-modal nodes that facilitate cycling, pedestrian and transit connectivity. The Public Bike Share System plan is a part of the overall Quick Wins and rapid transit strategy, and its innovative nature helps fill a niche that traditional transit cannot provide – an 'on demand' transit service that facilitates connectivity to the main rapid transit spine in the most convenient way possible for the transit rider.

### **Market Survey, Consultation and Demographic Analysis**

The market survey of five hundred (500) people, conducted online, demonstrated that eighty four percent (84%) of respondents were interested in using a Public Bike Share System in Hamilton. The stakeholder group, consisting of the various groups listed in the "Relevant Consultation" section of this report, overwhelmingly supported the establishment of a 4<sup>th</sup> generation Public Bike Share System. The Business Plan, attached as Appendix "A", examined demographic information, community characteristics and various Statistics Canada measures to determine there is a sufficient market of citizens to support a public bike share system of forty (40) stations and three hundred and fifty (350) bikes. It is predicted that three percent (3%) of the population in the service area would purchase annual public bike share memberships at the price of one (1) monthly HSR bus pass. This translates to three thousands (3,000) annual subscriptions and half (0.5) non-subscribed trips per station, per day.

### **Station Land Allocation**

Public Works staff, in partnership with the Hamilton Municipal Parking Service, Planning and Economic Development and land owners along the corridor, will require further consultation regarding the placement of stations. Stations can be placed in public spaces, on-street, private land or within the boulevard space so as not to block sidewalks. Stations are solar powered and do not require hydro connections or any fastening to the ground, nor do they require bollards to protect cyclists if properly located. All efforts will be made to place stations so that they are convenient for the user but do not interfere with traffic operations or pedestrian flows. This includes placing stations at intersection side streets rather than on main thoroughfares.

### **Ridership Impact**

It is predicted that eliminating "first and last mile" commute barriers will attract new riders to the A-Line and B-Line, by providing them with an effective means to travel to rapid transit stations. Detailed Canadian bike share data indicates that bike share systems are transit supportive, as they give single occupant vehicle (SOV) driver's viable alternative options. The data indicates that bike share users are more likely to own a bike, take transit and less likely to own more than one car. With thirty five (35) to forty (40) stations strategically placed around the city, they can also be used to promote rapid transit, system maps and the HSR and its commitment to multi-modal connectivity. It also meets the demand of local residents who want to access the rapid transit system with no transfers from local to rapid transit lines.

It is important to note that, while there are already bike racks on busses, this does not accommodate riders who wish to pick up a bike and leave it at a station, rather than take it with them, as they are only using their bike to get to transit.

### **Next Steps for Implementation**

In order to properly implement the Public Bike Share Transit System, the following steps will act as a guide:

**SUBJECT: Public Bike Share Transit System Implementation Plan  
(PW13015) - (City Wide) - Page 8 of 9**

---

1. Accept the Public Bike Share Transit Business Plan, approve the allocation of funding and notify the various departments involved of their potential role in implementation
2. Issue a Request for Proposals (RFP) process for the bike share hardware including stations, bikes and supporting infrastructure, contingent on selecting a suitable system operator and system sponsor, if required
3. Enter into a service level agreement with a system operator for a ten (10) year period that guarantees the proper and efficient operation of the system and guarantees the operation of the system will be revenue neutral to the City
4. Allocate Public Bike Share Station locations as outlined in the Public Bike Share Transit Business Plan (Appendix "A"), and in consultation with City departments and external stakeholders, ensuring minimal disruption to traffic operations
5. Deliver stations, bikes, tracking systems, payment systems and on-line resources required for full system operation

**ALTERNATIVES FOR CONSIDERATION**

Alternatives for consideration include:

- (a) Council may direct staff not to implement a Public Bike Share Transit program. This would be contrary to the information presented in the Public Bike Transit Business Plan (Appendix "A"), which states that such a system is feasible for the City of Hamilton.
- (b) Council may direct staff to carry out additional work, such as further research, marketing, or securing an operator and sponsor and then report back with more details prior to implementing the project. This option is not recommended because the Public Bike Transit Business Plan (Appendix "A") is robust and gives thorough consideration to implementation with a broad consultation of stakeholders. Furthermore, the project is more likely to succeed with clear Council direction so that potential sponsors and system operators are assured of Council support and that the implementation of the system has full Council authorization.
- (c) Council may direct staff to change the minimum operating term for the system operator service level agreement to be shorter than ten (10) years. This is not advisable, as it is predicted that a full ten (10) year cycle will ensure system stability and that the system is fully revenue neutral or profitable, taking into account station and bike replacement costs at the five (5) to seven (7) year milestone period.
- (d) Council may not wish to allocate Quick Wins funding to the Public Bike Share Transit System. This is not recommended as the project represents an integrated multi-modal strategy to operating public transportation services in the City. It is important to offer a variety of sustainable modes for citizens to facilitate access for those who wish not to use a personal automobile as their primary mode. It can also assist households that wish to complement the use of a primary personal automobile with other modes so that they can reduce the amount of



vehicles owned, thereby reducing the overall cost of vehicle ownership in the household.

**ALIGNMENT TO THE 2012 - 2015 STRATEGIC PLAN**

**Strategic Priority #1**

A Prosperous & Healthy Community

*WE enhance our image, economy and well-being by demonstrating that Hamilton is a great place to live, work, play and learn.*

**Strategic Objective**

- 1.2 Continue to prioritize capital infrastructure projects to support managed growth and optimize community benefit.
- 1.3 Promote economic opportunities with a focus on Hamilton's downtown core, all downtown areas and waterfronts.
- 1.4 Improve the City's transportation system to support multi-modal mobility and encourage inter-regional connections.
- 1.5 Support the development and implementation of neighbourhood and City wide strategies that will improve the health and well-being of residents.
- 1.6 Enhance Overall Sustainability (financial; economic, social and environmental).

**Strategic Priority #2**

Valued & Sustainable Services

*WE deliver high quality services that meet citizen needs and expectations, in a cost effective and responsible manner.*

**Strategic Objective**

- 2.1 Implement processes to improve services, leverage technology and validate cost effectiveness and efficiencies across the Corporation.

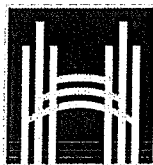
**APPENDICES / SCHEDULES**

Appendix "A"          Public Bike Share Transit Business Plan

# **Business Plan for Hamilton Bike Share Transit System**

Drafted in Partnership with:  
City of Hamilton and Green Venture

Peter Topalovic – Final Version, January 2013  
Matthew Sweet – Final Integrated Version, September 2012  
Matthew Sweet – Version 2.1, July 2012 - Updated with Station Location Analysis  
Peter Topalovic – Version 2.0, May 2012 – Updated data based on Bixi Toronto  
Pete Wobschall – Finalized Version, January 2012  
Dean Anderson – Version 1.1, Dec 30, 2011  
Dean Anderson – Version 1.0, Sept 22, 2011



Hamilton



Green Venture

## EXECUTIVE SUMMARY

City of Hamilton staff, community partners and interested stakeholders have been evaluating the implementation of a bike share transit program to feed the A-Line and B-Line transit corridors, encourage the use of sustainable modes of transportation, decrease residents' dependence on single-occupancy vehicles, increase physical activity in daily commuting amongst households and foster a culture of cycling in the City. The city conducted a feasibility study and coordinated an information session and bike share expo in August 2010 to identify and assess a variety of bike share program models, and to determine best suited models for Hamilton.

It was determined that the best suited model for a bike share program in Hamilton is a "4th Generation Model". This model includes a number of bikes housed at strategically placed stations, which are fully integrated with other transportation modes such as rapid transit, car share and conventional transit. Planning has begun for a 35 station 300 bicycle system for the City of Hamilton which will focus on providing a new and convenient method of accessing higher order transit modes along the B-Line and A-Line corridors, including GO Transit nodes. Bike sharing systems work best under a specific set of conditions and are typically used by a specific target demographic. By isolating those areas of the city where population demographics best match those that are identified as supporting bike share programs in other cities, and by identifying neighbourhoods within those areas in which opportunities to expand transit services exists, a set of 35 recommended station locations emerges.

Bike Sharing is quickly emerging as a desirable mode of travel that integrates seamlessly with transit and eliminates barriers to using transit such as the first and last mile of the commute. It offers a fast and convenient way to get to one's desired bus stop or station. Most major urban centres in North America, Europe and Asia have set up systems including Toronto, Montreal and New York City. However, in recent years a number of medium-sized urban centres such as Ottawa, Minneapolis, Chattanooga and Madison, Wisconsin, have set up moderately sized systems with much success.

City of Hamilton Transportation division staff, wishing to build on the success of other medium sized urban centres, approached Green Venture, Hamilton CarShare, City of Toronto staff who

manage the Toronto Bixi project, Mohawk College students and McMaster University students to develop a business plan which outlines the procurement, start-up, and operation a bike share program in Hamilton.

The anticipated target area is located within Hamilton's downtown to west end. This area boasts a total population of over 53,000 residents, with an additional 30,000 staff and students at McMaster University<sup>1</sup> and 21,000 staff and students at Mohawk College. It includes many commercial businesses and also attracts visitors and tourists. The Mohawk College Fennel Avenue Campus and McMaster University West Hamilton campus have a total student population of nearly 30,000 students.

This plan proposes that 300 bikes and 35 stations are purchased. The main factor affecting profitability of the bike share is the number of people who purchase subscriptions. In its initial stages, the program must build reserves that will be needed in future years for bicycle and equipment replacement due to age and potential expansion. This report will illustrate the sensitivity of the business case to the number of subscriptions sold and will propose a series of measures to guarantee revenues.

This business plan identifies the financial case for the City of Hamilton, and provides the necessary information for city officials to make an informed decision regarding the risk of committing funds to support this endeavour.

---

<sup>1</sup> Census data used to determine populations does not include McMaster students that rent their properties.

# TABLE OF CONTENTS

<b>Executive Summary</b> .....	<b>2</b>
<b>Table of Contents</b> .....	<b>4</b>
<b>Background, Situational Analysis</b> .....	<b>7</b>
<b>and Services</b> .....	<b>7</b>
What is a bike share system?.....	7
Industry Overview .....	7
Situational Analysis .....	9
Barriers to Entry .....	11
Description of Services.....	13
Station and Bike Placement .....	17
<b>Station Location Analysis</b> .....	<b>20</b>
Identifying Suitable Wards for Bike Share .....	25
System Size .....	34
Station Location Rationale .....	35
Station Locations.....	40
Anchor Stations.....	40
Conclusions of the Station Location Analysis .....	42
Recommendations .....	43
<b>Operating Budgets</b> .....	<b>45</b>
Pricing.....	45
Advertising Revenue .....	46
Warehousing and Inventory Requirements.....	47
Bicycle Maintenance and Repair Depot.....	48
Operations / Materials Suppliers .....	48
Estimated Target Market Capture .....	51
Twelve-Year Operating Budgets .....	52
<b>Marketing Plan and Promotional Strategy</b> .....	<b>56</b>
Marketing Strategies .....	56
<b>Financing Plan</b> .....	<b>59</b>
Bulk Pass Purchases .....	60
<b>Implementation Plan</b> .....	<b>61</b>
Stakeholders .....	61
Administration and Operational Structure .....	61
Work Plan .....	62
Human Resources .....	63
<b>Appendix A – Residential and Business demographics</b> .....	<b>66</b>
<b>Appendix B – Web Resources</b> .....	<b>67</b>
Background.....	67
Bicycle Sharing Systems.....	67
Car Sharing.....	68
<b>Appendix C – Case Studies</b> .....	<b>69</b>

<b>Appendix D – Bike Share Feasibility Study</b> .....	<b>70</b>
<b>Feedback from that expo strongly favoured investigating a 4<sup>th</sup> generation bike share model for the City of Hamilton.</b> Introduction.....	<b>71</b>
Project evolution.....	72
Project Relationship to Provincial Policy Initiatives .....	72
Project Relationship to Hamilton Goals and Initiatives.....	72
Project Relationship to Existing Cycling Culture in Hamilton.....	73
<b>Market Analysis</b> .....	<b>74</b>
Profile of the City of Hamilton .....	74
Online Survey of Public opinion.....	79
Summary of Key Online Survey Findings .....	79
<b>Hamilton Bike Share Market Evaluation</b> .....	<b>81</b>
Operational Models .....	81
Local vs. Area-wide Operations.....	82
Residential Target Market .....	83
Recommended Operational Model(s).....	83
Advantages .....	83
Disadvantages .....	83
Hybrid Model.....	83
<b>Proposed Hamilton Pilot Project</b> .....	<b>84</b>
Outline for library hybrid model.....	84
Kiosk Location Map.....	86
<b>Project</b> .....	<b>87</b>
Case Study Review.....	87
Best Practice Review and the Hamilton Pilot Actions .....	90
<b>Feasibility Assessment</b> .....	<b>97</b>
Strengths and Weaknesses.....	97
Opportunities and Threats.....	99
<b>Conclusion</b> .....	<b>102</b>
<b>Appendix AA – Bike Share in Hamilton, Justification and Recommendations Regarding 4th Generation Models</b> .....	<b>104</b>

Figure 1 - Trip Cost vs. Length.....	10
Figure 2 - Percent of Obesity compared to Percent of walking, cycling and transit .....	16
Figure 3 - Examples of bike stations located on sidewalks, roadways and in public spaces .....	19
Figure 4 - Nice Ride Survey Results - Uses .....	21
Figure 5 - Nice Ride Survey Results - Frequency and Preference .....	22
Figure 6 - Capital Bikeshare Most Common O/D Trip.....	24
Figure 7 - Capital Bikeshare Co-branding.....	24
Figure 8 – Population Density .....	26
Figure 9 – University Level Educational Attainment.....	27
Figure 10 – Non-University Post-Secondary Educational Attainment .....	27
Figure 11 – Commute Distance .....	28
Figure 12 – Employed Workforce using a Sustainable Commute Mode.....	29
Figure 13 – Downtown Community Improvement Project Area .....	29
Figure 14 – Job Distribution, City of Hamilton .....	30

Figure 15 – Transit Network .....	31
Figure 16 – Cycling Infrastructure, Existing and Planned .....	32
Figure 17 – Median Income Levels .....	33
Figure 18 – Proposed Station Locations for Hamilton .....	40
Figure 19 – Bycyklen bicycles in Copenhagen display advertising on wheels and frames .....	47
Figure 20 – Typical Bicycle Maintenance and Repair Depot .....	48
Figure 21 – Bicycle Redistribution Vehicle, Paris.....	64
Table 1 – Trip Type Replaced by Bike Share .....	23
Table 2 – TTS Data on Trips using Active Modes .....	28
Table 3 – Housing Stock by Ward .....	32
Table 4 – Age Ranges in Wards One and Two .....	33
Table 5 – Typical Pricing of Public Bike Share Systems Worldwide.....	45
Table 6 – Estimated Capital Costs .....	49
Table 7 – Estimated Launch Costs .....	50
Table 8 – Replacement Schedule.....	53
Table 9 – Estimated Cash Flow with BIXI's Projected Uptake Rates .....	54
Table 10 – Estimated Subscriber Rates .....	55