Urban Transportation Showcase Program

Case Studies in Sustainable Transportation

CASE STUDY 74

Self-Service Public Bicycle Systems

Overview

Public bicycle systems are a form of bicycle sharing that is available in numerous cities in Europe and that is attracting considerable attention in North America. A public bicycle system is a bank of bicycles, with numerous pick-up and drop-off points, available to the general public for short-term uses for free or for a small fee. Preliminary evidence from recent European experiences suggests that public bicycle systems are a potential means for increasing the mode share of bicycles and for promoting bicycle-transit intermodality.

This issue paper focuses strictly on self-service (i.e., automated) public bicycle systems, also known as "smart bike" systems. It defines the basic types of public bicycle systems, provides a brief history of the concept, and outlines the general benefits of cycling and the specific benefits of public bicycle systems. The main types of public bicycle systems - fixed and flexible systems – are explored. Four brief case studies are presented, including two public bicycle systems from Europe – Paris' *Vélib* and Munich's *Call a Bike* – as well as one very recent North American system – Washington DC's *SmartBike DC* – and one soon to be deployed in Canada – Montreal's *BIXI*. The case studies are followed by discussions on design and financial considerations for setting up a public bicycle system, using the case studies to illustrate key points. The final section examines four potential barriers to the implementation of public bicycle systems in Canadian cities and suggests how they can be overcome.

Resources

BIXI (bixi.ca)

Call a Bike (www.callabike.de)

Clear Channel SmartBike (www.smartbike.com)

JCDecaux Cyclocity (www.jcdecaux.co.uk/development/cycles/)

NICHES (www.niches-transport.org)

SmartBike DC (www.smartbikedc.com)

The Bike-Sharing Blog (bike-sharing.blogspot.com)

Vélib (www.velib.paris.fr)

end of document for a full list of resources.

Introduction

Definition

Much like the distinction between car rentals and car sharing, bicycle-sharing programs are designed for regular use, including very short periods of use. The bicycle-sharing initiatives described in this paper are "public" in that they are open to the general public, in contrast to "private" or "closed" bike sharing systems that are open only to employees or clients of a particular institution. However, they are not necessarily publicly owned or operated.

Public bicycle systems provide numerous pick-up and drop-off points, enabling one-way use of bicycles. In self-service systems, bicycle loans and returns are automated through the use of electronically controlled locking devices. Some systems, called 'fixed' systems, have 'stations' with special racks to which public bicycles are locked. Other so-called 'flexible' systems allow the bicycles to be picked up and dropped off at undesignated locations; they do not need to be locked to special racks. The majority of public bicycle systems use fixed stations with special locking racks.

History

A pioneering public bicycle initiative was launched in Amsterdam in 1964. Regular bicycles were painted white and distributed across the city, unlocked and free for anyone to use (DeMaio and Gifford, 2004). The program was created as a measure to reduce bicycle theft. It was believed that wide availability of free, public bicycles would discourage theft of privately owned bicycles. The program failed as virtually all of the bicycles were stolen (i.e., taken out of free circulation) not long after the program was launched.

In 1995, Copenhagen was the first major city to launch a self-service, fixed station public bicycle system, called *Bycyklen* (IDEA, 2007). The concept was pioneered in the early 1990s by the small Danish cities of Farso, Grena, and Nakskov (DeMaio, 2008). Unlike the bikes used earlier in Amsterdam, these are custom made and include many parts that were not interchangeable with regular bicycle parts and require special tools for installation. Following a coin deposit at an automated station, a bicycle can be used

and then returned to any of the system's 200 stations, provided there are available docking spaces. The deposit is then returned. Theft and damage are ongoing problems.

In the late 1990s, a new generation of fully automated, self-service public bicycle systems with sophisticated, electronically controlled locking mechanisms emerged. These so-called 'smart bike' systems, unlike their predecessors, would require user identification – a major theft deterrent. User would have to register to obtain a special key card or use a credit card to take out bicycles. The pioneering system, operated by the advertiser Adshel (later acquired by Clear Channel) in exchange for advertising space in public areas, was launched in Rennes, France in 1998.

Public Bicycles in Canada

A Toronto community group, the Community Bicycle Network (CBN), operated a small bicycle sharing system between 2001 and 2006. Operated by a community group, the system had 150 used bikes that had been refurbished, painted yellow, and distributed across 15 stations around downtown Toronto. Most stations were located at outside cafés or other businesses, with staff from these business providing bicycle loan and return services. The system required an annual membership ($25 or four hours of volunteer service) and there was no charge for uses up to 3 hours. The system relied primary on public subsidies and private sponsorships to cover its cost, as user fees generated only minimal revenues (see Case Study 9 in this series for details). Though the system operated at its capacity of 450 registered users, it was shut down in 2006 due to a funding shortfall after a key subsidy expired.

A prototype station and set of bicycles belonging to what is set to be the first smart bike system in Canada was demonstrated in Montreal in the fall of 2008 (Figure 1). The system, dubbed *BIXI* (contraction of BIcycle and taXI), is to be fully deployed in the spring of 2009. The only other smart bike system in North America was launched in the summer of 2008 in Washington, DC.

Figure 1 - *BIXI* demonstration in Montreal, October 2008.

Benefits of Public Bicycle Systems

Public bicycle systems can lead to greater transportation sustainability in two ways: (1) they can stimulate bicycle use and thus increase bicycle mode share; and (2) they can create conditions for bicycle-transit intermodality by facilitating the use of bicycles as a mode of access to and egress from transit facilities.

Bicycle use entails a number of benefits, particularly when compared to conventional, motorized modes of transportation. These include:

- Greater speed and flexibility on short distances (generally, up to 5 km)
- Health benefits for users, particularly improved cardiovascular health
- Environmental benefits, through reduced dependency on motorized modes of transportation
- Limited infrastructure requirements and low impacts on existing infrastructure

Policy reports from Europe (NICHES, 2007; IDEA, 2007) suggest the following specific benefits are offered by public bicycle systems:

- Helping increase the acceptance of bicycles as a utilitarian mode of transportation rather that just a recreational activity
- Relatively low-cost compared to motorized transportation systems
- Good for the city's image
- A tourist attraction

In addition, public bicycle systems require less space than cars. In the French city of Lyon, for example, it has been

observed that a car parking spot has on average six users per day while a five-rack public bicycle station, which takes up an equivalent amount of space, has on average 15 users per day (NICHES, 2007).

How It Works

Fixed Systems

Fixed smart bike systems have permanent stations that consist of a set of bicycle stands (Figure 2-A) and a service terminal (Figure 2-B). Bikes are locked to the stands via a special coupling mechanism. Registered users usually have a magnetic key card that is swiped at the terminal or directly at the bicycle stands in order to release a bicycle. Some systems allow unregistered users to purchase a pass at the station terminal using a credit card. The terminal usually dispenses a key card that is then used to release a bicycle from the stands. The key card is read at the bicycle stand itself, not the at the service terminal (Figure 3).

Figure 2 - Bicycle locking stand (A) and service terminal (B), the two basic components of a *Vélib* station.

Figure 3 - A *Vélo à la carte* bicycle being taken out in Rennes. Newer systems, such as *Vélib*, use contactless magnetic proximity cards instead magnetic swipe cards.

Ideally, stations in a fixed system have bicycles available for pick up and empty slots available for drop off at all times. To keep bicycles and empty slots available across all stations, bicycles are continuously redistributed. A central IT system monitors the capacity of the stations across the system and dispatches redistribution crews accordingly. In most cases, trucks equipped with bicycle racks are used (Figure 4). Redistribution might not always keep up with users and stations might become empty or full. To mitigate this problem, many fixed systems have stations close together – usually 300-500m apart. If a station is empty or full, a screen on the station terminal informs users which nearby stations have available bicycles or empty slots. Many smart bike systems allow users to check availability of stations via the Internet (see www.smartbikedc.com/smartbike_locations.asp).

Figure 4 - *Vélib* station being refilled.

Flexible Systems

Flexible systems rely on bicycles with built in chain or cable locks, enabling them to be attached to any bicycle rack, traffic sign, or other stationary objects. This is advantageous both to the operator and the user of the public bike system: the operator does not have to build a network of specialized stations whereas and the user is not bound to travel only between such stations. Some restrictions may apply as to where the user is allowed leave bikes when finished. For instance, the user may be required to leave the bicycle within a certain boundary and only in highly visible locations, such as at major intersections or along main streets. To ensure availability across the service area, flexible systems may require occasional redistribution of bicycles. Bicycles can have a GPS device built in, allowing both users and the operator to locate them automatically. Otherwise, users must report the location of the bicycle when they finish using it.

Case Studies

Vélib, Paris

City/metro population: 2.2 million/12.0 million
City population density: 24,948/km^2
System type: permanent fixed station
Operator: JCDecaux Cyclocity
Year started: 2007
Bicycles: 20,600 (end of 2007)
Stations: 1,451 (end of 2007)
Other cities using this system: France: Lyon, Aix-en-Provence, Besançon, Marseille, and Mulhouse; Austria: Vienna and Salzburg; Spain: Gijon, Cordoba, and Seville; Belgium: Brussels; Ireland: Dublin.

Source: Mairie de Paris, 2008

Figure 5 - *Vélib* bicycle.

The idea of starting a large public bicycle system in Paris was inspired by the success of the *Vélo'v* smart bike system in Lyon, France's third largest city. The city's mayor, Bertrand Delanoë, championed the idea. Though launched only in June, 2007, *Vélib* is already the largest bicycle sharing system in the world. It is superior to all other systems in terms of the number of bicycles and stations, the size of the service area, the number of registered users, and the volume of daily uses.

A user survey conducted in early 2008 (Mairie de Paris, 2008) found that there were 190,000 registered users and 70,000 average daily uses. Two thirds of the system's daily users live in the City of Paris itself whereas most of the remaining third live in the suburbs, beyond *Vélib*'s service area. In terms of age, 39% of users are 26 to 35 years old, 23% are 16 to 25 years old, 21% are 36 to 45 years old and the remaining 17% are 45 and up (children under 16 are not allowed to use the system).

The survey revealed several interesting facts about how *Vélib* is used:

- 61% regularly use *Vélib* for commuting to work or school.
- 19% of users stated that *Vélib* allows them to make trips that would have otherwise been impossible.
- 20% of users stated that used cars less.

Eighty-four percent of users said they used *Vélib* in combination with other modes of transportation. Among all *Vélib* users:

- 25% use it at the end of a trip taken on the metro (subway) or on suburban commuter trains
- 21% use it at the beginning of a trip, then continue using another mode of transportation (including transit, walking, or cycling on a private bicycle)
- 15% use it to connect between two other modes of transportation

Since the introduction of *Vélib*, bicycles have reportedly become considerably more visible on the streets of Paris – apparently, much to the annoyance of some motorists. However, the system's actual effect on mode shares has yet to be investigated.

Users are required to purchase as pass to use *Vélib*. An annual pass costs €29. Day and week passes are also available at a cost of €1 and €5 respectively. The first half hour of every loan is always free; the second half hour cost €1; the third half hours an additional €2; and each half hour afterwards costs an additional €4.

Call-a-bike, Munich

City/metro population: 1.4 million/6.0 million
City population density: 4,370/km^2
System type: flexible with some fixed stations
Operator: Deutshe Bahn (DB Rent)
Year started: 2001
Bicycles: 1,350 (2004)
Stations: 55 (2004)
Other cities using this system: Germany: Berlin, Frankfurt, Cologne, and Karlshruhe; France: *Allocyclo* in Orleans is very similar.

Source: DeMaio and Gifford, 2004 and IDEA, 2007

Figure 6 - *Call a Bike* bicycle.

German passenger rail operator Deutsche Bahn (DB) initially developed the *Call a Bike* system to enable rail commuters to cycle from train stations to their destinations. Though the system still emphasizes rail commuters, it is available to the general public. It can be used independently of DB trains, although train pass holders get discounts on membership and usage fees.

The original *Call a Bike* system in Munich, like most DB *Call a Bike* systems in other German cities, have some fixed stations (mostly at railway stations) but do not require that bicycles be dropped off at these stations. Rather, users are allowed to drop bicycles off at most major street intersections within the designated service area by locking them to a bicycle rack or a traffic sign.

The system's bicycles are equipped with a wirelessly controlled combination lock. Users must locate a bicycle at one of the fixed stations or at a major intersection and check whether it is available. A green light on the bicycle's electronic lock indicates availability while a red light indicates it is in use. Registered users can send a text message to obtain a combination to unlock the bicycle. The message includes a serial number that is painted in large characters on the bicycle (see Figure 6). They receive a reply containing a combination to open the lock on the bicycle. Unregistered users, including tourists, can call a 24-hour hotline to instantly register using a credit card and obtain the combination to unlock the bicycle.

Whenever users relock the bicycle, its onboard computer asks them whether they wish to the keep the bicycle (and resume use later) or end the loan. If they choose to keep the bicycle, the combination they were given earlier remains valid and they continue to be charged for use. If they chose to end the loan, the combination is reset and the timer for usage charges stops.

A €5 registration charge is required to access the system. Usage fees are assessed per minute of use at a rate of €0.08/minute (€0.06/minute for DB pass holders) up to a maximum of €9 per 24-hr period. As of recently, users can purchase an annual *Call a Bike* pass for €99 (less for DB pass holders) which entitles them to use bikes for free for up to 30 minutes at a time for the entire year; after 30 minutes they are assessed the regular per minute charge.

SmartBike DC, Washington DC

City/metro population: 0.6 million/5.3 million

City population density: 3,700/km²

System type: permanent fixed station

Operator: Clear Channel SmartBike

Year started: 2008

Bicycles: 120

Stations: 10

Other cities using this system: Norway: Drammen, Oslo, and Trondheim; Sweden: Gothenburg and Stockholm; France: Caen, Dijon, Perpignan, and Rennes; Spain: Barcelona and Zaragoza.

Source: www.smartbike.com

Figure 7 - *SmartBike DC* bicycle.

Inspired by the success of smart bike systems in Europe, planners at the District Department of Transportation (DDOT) became interested in setting up a similar system in the US capital. In 2004, DDOT issued a call for tenders for ads in bus shelters and included a requirement for a small smart bike system. The contract was awarded to Clear Channel, which deployed its SmartBike technology in the District – the same technology that was deployed a year earlier in Barcelona, Spain to create the extensive *Bicing* public bicycle system.

In October 2008, less than three months after *SmartBike DC*'s opening, the system had 930 registered users and an average of 150 average daily users. Registration and daily use were growing steadily, according to a DDOT official. Clear Channel and DDOT are currently planning an expansion of the system but were unable to provide further details.

The system is open only to users who have purchased a US$40 annual membership. Bicycles can be taken out for up to 3 hours at no additional charge; after three hours, sanctions, such as suspension of rental privileges, may apply. If not returned within 24-hours, the user will be assessed a bicycle replacement fee of US$550.

BIXI, Montréal

City/metro population: 1.6 million/3.6 million

City population density: 4,439/km²

System type: portable fixed station

Operator: Stationnement de Montréal

Year started: 2009 (piloted fall 2008)

Bicycles: 2,400

Stations: 300

Other cities using this system: None – the unique system was developed by Stationnement de Montréal.

Source: bixi.ca

Figure 8 - *BIXI* bicycle.

The idea of having a public bicycle system in Montreal came up during the elaboration of the City's recent Transportation Plan (*Plan de transport*) (Ville de Montréal, 2008). Instead of partnering with an advertiser or other private sector partner, the mandate to develop and operate the system was given to Stationnement de Montréal, the City's public parking operator. It was believed that Stationnement de Montréal had existing capital and human resources that could be easily adapted to handle a bicycle sharing system.

A few years prior to obtaining the mandate for *BIXI*, Stationnement de Montréal had developed a wirelessly networked and solar powered parking payment terminals. The new solar powered service terminals for that it has developed for *BIXI* stations use them same wireless networking technology and will use the same IT infrastructure as the existing parking payment terminals.

The service terminals along with a set of bicycle locking stands are mounted onto platforms, creating a portable, standalone station modules. On-street installation entails merely anchoring the station module to the pavement. As they are solar powered and wirelessly networked, no wiring is required. As a result, station installation is rapid and

inexpensive. As stations are portable, distribution could be rapidly adapted to respond to demand. This will also allow the equipment to be removed during winter (mid-November until mid-April) when it could be damaged by the elements and could obstruct snow removal. Furthermore, it allows additional stations to be temporarily deployed for special events, such as festivals. Stationnement de Montréal intends to begin full operations of the first phase in May 2009, when 2,400 bikes and 300 stations will be deployed across the dense, central boroughs of Ville Marie (which includes the downtown business district and Old Montreal), Plateau–Mont-Royal, and Rosemont–Petite-Patrie. The system's second phase, to be deployed later in 2009, will add several hundred additional bicycles and dozens of new stations. The new stations are to expand the service area to adjacent boroughs.

Users will be required to pay a membership fee to use the system. Memberships will cost $78 for the season (mid-May to mid-November), $28 per month, or $5 per day. The first half hour of every loan will be free; the second half hour will cost $1.50; the third half hour will cost an additional $4.50; and each half hour afterwards will cost an additional $6.00.

Design Considerations

Target Users

Public bicycle users include both local residents and non-residents, including tourists and residents of other parts of the city, each with different travel needs. European experience shows that the group most likely to use public bicycles is composed of young people, aged 18-34, who live in dense urban areas, do not own cars and are frequent transit users (NICHES, 2007; IDEA, 2007; DeMaio and Gifford, 2004). They tend to make multiple trips at irregular hours to numerous destinations such as work, school, shopping and entertainment districts.

Less frequent public bicycle users include commuters from other parts of the urban area, or tourists. Commuters are likely to use public bicycles at rush hours, for trips between a transit node, such as a train or subway station, and final destinations such as work or school. Tourists are likely to use the public bicycles throughout the day to travel between tourist attractions.

Service Area

Public bicycle systems (both fixed and flexible) are implemented in central parts of urban agglomerations, in which population and employment densities are high and where commercial and public amenities are the most concentrated. For example, *BIXI* will be deployed only in the Plateau–Mont-Royal, Ville Marie, and Rosemont–Petite-Patrie boroughs, which are among the densest and most amenity-rich areas of greater Montreal.

Number and Distribution of Bicycles and Stations

There are no rules for determining the number of bicycles and stations and their spatial distribution. In general, fixed systems have stations between 300-500m apart within the service area. The stations are usually placed at street intersections to maximize accessibility. In areas where demand is especially high (e.g., near transit stations and educational institutions) stations may have to be larger or more concentrated. This is a case where a travel survey may be useful for assessing demand.

Common criteria for determining station locations include the following:

- Population density
- Employment density
- Proximity to transit stations
- Proximity to bicycle routes
- Proximity to educational institutions
- Proximity to museums, galleries, libraries, parks and other public facilities

The careful selection of station locations is especially important for fixed systems with permanent stations, (e.g., *Vélib, SmartBike DC*). It is not as critical for fixed systems with moveable stations (e.g., *BIXI*) and flexible systems (e.g., *Call a Bike*) as they allow the redistribution of stations after initial deployment.

Bicycle Design

Most bicycles share the following features (see Figure 5-Figure 8):

- No top tube or a low top tube to allow easy mounting and dismounting while preventing more than one person from sitting on the bike
- A large, handlebar-mounted basket or bag rack
- Wide tires for stability
- An enclosed chain to protect users' clothes from getting dirty
- Internal hub gears rather than external derailleur gears, to eliminate the risk of dropping the chain and to minimize chain wear
- Highly adjustable seat and handlebar heights to accommodate users in wide range of different sizes
- Automatic front and rear lights that stay on so long as the bicycle is in use

The bicycles of some fixed systems have a built in cable lock that allows them to be locked for stopovers between

stations. Other systems' bicycles lack this feature, requiring that they be locked only at stations.

Financial Considerations

Pricing

Most public bicycle systems require users to register and pay a membership fee. As most systems aim to have a large pool of registered users, membership fees are generally low. Users of most systems are charged time-dependent usage fees each time they take out a bicycle (e.g., *Vélib*, *Call a Bike*, *BIXI*). The usage fees are usually designed to encourage short-term uses, compelling users to return the bicycle to a station (or deactivate the bicycle in the case of a flexible system) at the end of each trip. Many systems have a grace period, usually half an hour, during which usage is free; afterwards, fees grow exponentially with every additional half-hour of use (e.g., *Vélib*, *BIXI*). Most fixed systems give users an additional grace period if they check in at a station that is full and are forced to proceed to another station to drop off their bicycle.

Costs

Startup capital costs include the cost of bicycles and station equipment, station installation, repair and maintenance equipment and facilities, and redistribution equipment. These costs can be considerable, especially for fixed systems since a large number of bicycles and stations are needed from the start for the system to work. Using solar powered, wireless networked, platform-mounted stations, like in Montreal, can help mitigate station installation costs. Flexible systems can have even smaller startup costs because they do not require any station infrastructure at all. Also, they can allow bicycles to be phased in more gradually. Beyond capital costs, there can also be significant startup costs associated with research, planning, and marketing.

The main ongoing cost factor for public bicycle systems is staff for operation, service and maintenance. For example, *Vélib*, with 20,600 bicycles and 1,451 stations requires approximately 400 staff members. The much smaller *Vélo à la carte* (Clear Channel) system in Rennes, with 200 bicycles and 25 stations, requires four fulltime staff members.

In terms of annual costs, for example, *Vélo'v* (JCDecaux) in Lyon costs approximately €1,000 (C$1,600 at the time of writing) per bicycle per year, as does *Vélo à la carte* (Clear Channel) in Rennes (NICHES, 2007).

Financing

Public bicycle systems are generally not profitable. Membership and usage fees must be kept relatively low for the systems to attract and retain large pools of users. In most cases, the fees are not sufficient to cover costs and therefore ongoing funding is required.

The overwhelming majority of public bicycle systems in Europe are operated as public-private partnerships (PPPs); fully publicly owned and operated systems are unheard of. Most systems are operated as partnerships with large advertizing companies. In exchange for advertising space provided by the municipality, the advertising company commits to operating a public bicycle system. Usually, the municipality specifies the requirements for the public bicycle system, such as the service area, the number of bicycles and stations and their distribution, in a call for tenders for advertising space, which is then subjected to a competitive bidding process.

On its end, the municipality provides advertising space to generate revenues to support the public bicycle system and space for bicycle stations (for a fixed systems) and for maintenance facilities. In most cases, no public funding is provided per se, but the municipality forgoes potential advertising revenues. As for the advertising company, it provides all of the hardware (bicycles, stations, service vehicles, maintenance and repair equipment) and assumes responsibility for operations, service, and maintenance. The advertiser usually collaborates with the municipality to establish station locations (e.g., *Vélib*, *SmartBike DC*) and in designing the station hardware to meet urban design requirements (especially the case with *Vélib*). There are two large, international advertisers that offer public bicycle systems, including: JCDecaux, whose *Cyclocity* systems are operating in France (including *Vélib*, among others), Austria, Spain, Belgium and Ireland; and Clear Channel, whose *SmartBike* systems operating in France, Norway, Sweden, Spain, and the US (so far only *SmartBike DC*). A number of smaller competitors also operate in Europe.

An arrangement with an advertiser is not necessarily the only solution for financing a public bicycle system. Deutsche Bahn, the government-owned train operators backs *Call a Bike* with revenues from its other operations. *BIXI*, is owned and operated by Stationnement de Montréal, a subsidiary of the City of Montréal, and will be sponsored by the aluminum giant Rio Tinto Alcan. The company is to provide funding for the project as well as aluminum for the construction of the bicycles. With this sponsorship, the system is expected to be financially self-sufficient.

Lessons Learned

City Size and Density

In Europe, public bicycle systems have been implemented in cities ranging from as small as Drammen, Norway (population 60,145 in 2008) to as large as Paris (population 2,167,994 city, 12,067,000 metro). Drammen notwithstanding, public bicycle systems have been recommended in a report to the European Commission

for cities with a population greater than 200,000 (NICHES, 2007).

It is important to consider that European cities are generally denser and have more mixed land uses than Canadian cities. The share of the population living in areas sufficiently dense and mixed to support high levels of bicycle use is likely to be larger in a European city than in a Canadian city with a comparable population. Thus, the minimum size of the population required to sustain a public bicycle system could be considerably greater in Canada. The service area of a public bicycle system should cover only areas in which the population is sufficiently dense to support cycling as an everyday mode of transportation.

Climate

In Europe, public bicycle systems have been successfully implemented in cities with very different climates – from Nordic climates in the Scandinavian countries to warm, temperate climates in France and Spain. Systems in Northern Europe tend to be shut down during the colder months while others remain open year-round. In Copenhagen, Denmark, for example, the *Bycyklen* system shuts down between early December and early April.

In most Canadian cities, however, the winter is generally longer, colder, and snowier than anywhere in Northern Europe. In Copenhagen, for example, average high and low temperatures in January are 2˚C and -2˚C respectively whereas in Montreal they are -6˚C and -15˚C. The severe winter could further limit the number of months during which the public bicycle system can operate and generate revenues. An important exception are Pacific coastal communities, in which winters are comparable to or even milder than in northern Europe. In Vancouver, for example, average January temperatures range from high 6˚C to low 1˚C, while in Victoria they range from high 7˚C to low 3˚C. In this case, the public bicycle system could operate over a longer period or even remain open year-round.

In light of constraints imposed by long and snowy winters, fixed station public bicycle systems, such as *Vélib* and *SmartBike DC*, may not be viable in colder Canadian cities due the high capital costs they entail and limited annual period of operation they allow. Beyond costs, permanent public bicycle station infrastructure could be damaged by ongoing exposure to extreme low temperatures, snow, ice, salt and abrasives and might interfere with snow removal equipment. A system with moveable stations, like *BIXI*, or a flexible system, like *Call a Bike*, could be more cost effective by avoiding the construction of expensive permanent stations and would avoid many of the aforementioned winter-related problems.

Level of Bicycle Use

European experience suggests that public bicycle systems need not be implemented only in places that already have high levels of bicycle use. Some public bicycle systems have been developed in countries that tend to have a very high mode share for cycling in urban areas, such as The Netherlands (27%) and Denmark (20%) but also in countries in with low levels of urban bicycle use, such as France (4%) (deMaio and Gifford, 2004). In effect, European experience suggests that public bicycles can be a "door opener" for increased bicycle use (NICHES, 2007).

Canadian metropolitan areas have even lower levels of bicycle use than the average in France. Most mid-sized and large cities have a bicycle mode share for trips to work under 2% (e.g., 0.8% in Toronto, 1.3% in Montreal, 1.9% in Vancouver and Ottawa-Gatineau). A notable exception is Victoria, BC, where the bicycle mode share for trips to work is 4.8% (Pucher and Buehler, 2006). Although on a metropolitan scale the mode shares are generally low, there are nonetheless urban areas in which bicycle use is relatively high. For example, while only 1.3% of trips to work are made by bicycle in City of Montreal as a whole, in the Plateau–Mont-Royal borough, one of the three that will be served by *BIXI* as of next spring, 7% of trips to work are made by bicycle (Ville de Montréal, 2004). An estimate by the cycling advocacy group Vélo Québec (2001) suggest that as much as 12% of all trips in the Plateau–Mont-Royal borough are made by bicycle during the warmer months. The dense, mixed-use central areas of Montreal, Toronto, and Vancouver (as well as Victoria and a number of other medium-size cities) have more bicycle activity. This is the case in the three boroughs of Montreal in which *BIXI* is being deployed.

Bicycle Facilities and Bicycle Friendly Roads

For a public bicycle system to succeed, cycling must be perceived as a safe activity. A number of researchers have identified the perception of danger as one of the key barriers to bicycle use. The extent and the quality of bicycle facilities, such as dedicated bicycle paths and lanes, are likely to have bearing on the perception of safety (FHWA 1995; Landis 1998). Traffic calming and measures for limiting automobile use can also have a positive impact on cyclists' perception of safety. In many of the European cities in which public bicycle systems have been implemented there have been widespread commitments to curtailing automobile use.

Aside from merely being perceived as safe, the network of bicycle routes must also be interconnected and have a layout that affords direct trajectories, given that the practical range of cycling trips is limited; a layout that forces cyclists to take circuitous routes is likely to discourage cycling. Adaptations to the road network that provide cyclists with short cuts and direct routes are likely to have a positive impact on bicycle use.

The absence or limited availability of bicycle facilities, the lack of traffic calming and measures limiting automobile use, as well as the layout of the road network in Canadian cities are a barrier to bicycle use in general and are a factor that could potentially limit the success of a public bicycle system. Canadian municipalities should consider undertaking bicycle facility improvements and traffic calming to provide a network of safe and interconnected bicycle routes before delving into public bicycle systems. Other measures that curtail automobile use, such as road and parking pricing, may also yield increased bicycle use and favour the success of a public bicycle system.

Resources

Contacts

Michel Philibert
Director – Communications and Marketing
Stationnement de Montréal
Telephone: (514) 868-3795
Email: mphilibert@statdemtl.qc.ca

Paul DeMaio
Managing Member
MetroBike LLC
Telephone: (202) 684-8126
Email: paul@metrobike.net

Jim Sebastian
Manager – Bicycle Program
District of Columbia Department of Transportation (DDOT)
Telephone: (202) 671-2331
Email: jim.sebastian@dc.gov

Documents

DeMaio, P. (2008). Before Copenhagen - Early 2nd Generation Programs. *The Bike-sharing Blog*, Wednesday October 15 (http://bike-sharing.blogspot.com/2008/10/before-copenhagen-early-2nd-generation.html).

DeMaio, P. and Gifford, J. (2004). Will Smart Bikes Succeed as Public Transportation in the United States? *Journal of Public Transportation*, 7(2), 1-14.

Federal Highway Administration (FHWA) (1995). Bicycle Safety-Related Research Synthesis (FHWA-RD-94-062). Report.

Instituto para la Diversificación y Ahorro de la Energía (IDEA) (2007). *Guía metodológica para la implantación de sistemas de bicicletas públicas en España*. Madrid: IDEA (http://www.idae.es/index.php/mod.documentos/mem.descarga?file=/documentos_Guia_Bicicletas_8367007d.pdf).

Landis, B. et al. (1998) Real-Time Human Perceptions: Toward a Bicycle Level of Service. *Transportation Research Record*, 1578, 119-126.

Mairie de Paris (2007). *Vélib: Press Release*. Press release (http://www.velib.paris.fr/content/download/777/5528/version/1/file/Dossier+de+presse+Anglais.pdf).

Mairie de Paris (2008). *La Lettre Vélib 10: Aujourd'hui, nous vous connaissons mieux!*. Newsletter (http://www.velib.paris.fr/les_newsletters/10_aujourd_hui_nous_vous_connaissons_mieux).

NICHES (2007). *New Seamless Mobility Services: Public Bicycles*. Brussels: European Commission (http://ange.archangelis.com/typo3/niches/fileadmin/New_folder/Deliverables/D4.3b_5.8_b_PolicyNotes/14397_pn4_public_bikes_ok_low.pdf).

Pucher, J. and Buehler, R. (2006). Why Canadians cycle more than Americans: A comparative analysis of bicycling trends and policies. *Transport Policy* 13, 265-279.

Vélo Québec (2001) *État du vélo au Québec en 2000*. Public report (http://www.velo.qc.ca/velo_quebec/Documents/etat_velo/Etat-velo-2000.pdf).

Ville de Montréal (2004). *Portrait socio-économique – Arrodissement du Plateau-Mont-Royal*. Public document (https://servicesenligne2.ville.montreal.qc.ca:443/sel/publications/htdocs/porteaccespublication_Fr/porteaccespublication.jsp?systemName=10213559).

Ville de Montréal (2008). *Plan de Transport 2008*. Policy document (http://ville.montreal.qc.ca/pls/portal/docs/PAGE/TRANSPORT_V2_FR/MEDIA/DOCUMENTS/PLAN_DE_TRANSPORT2008.pdf).

Websites

BIXI (bixi.ca)

Call a Bike (www.callabike.de)

Clear Channel SmartBike (www.smartbike.com)

JCDecaux Cyclocity (www.jcdecaux.co.uk/development/cycles/)

NICHES (www.niches-transport.org)

SmartBike DC (www.smartbikedc.com)

The Bike-Sharing Blog (bike-sharing.blogspot.com)

Vélib (www.velib.paris.fr)