TransLink
Public Bike System
Feasibility Study

Environment Scan
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Quay Communications Inc

This report is Volume 1 of a 3 part feasibility study on Public Bike Systems[PBS] prepared for TransLink South Coast British Columbia Transportation Authority. This volume provides findings from a scan of available information on PBS and related areas of infrastructure, policy and safety.

This report was compiled based on public data including publications, reports, media coverage and internet sites. While every effort has been made to confirm the validity of supplied facts and figures some inaccuracies may exist. E&OE. Please report all such corrections to pbs@quaycom.com.

The area of PBS is evolving rapidly, the data in this report is as was available at 28 February, 2008.

cover page photo credit - Velib, Paris by photographer tofz4u

1 Introduction

"Imagine walking to a sidewalk corner and finding a public bicycle. With a cell phone call or swipe of a card, you unlock it from its bike rack and ride it across town. Once at your destination, you steer to the closest bike rack and, with one more call or card swipe, return the bike to the public network. You pay less than $.50 for the trip, and the bike is once again available for the taking. Bike-sharing already exists in cities across Europe, revolutionizing transportation networks and greening the urban fabric." -New York

The objective of this report is to provide an overview of current and planned Public Bike Systems [PBS] in urban settings, with an emphasis on mainstream systems. It also seeks to identify the major system components, alternative design, operating and funding models; and to examine the role of infrastructure and policy on implementation and uptake.

1.1 A Description of Public Bike Systems

For the most part, PBS coming on line in the past two years have been positioned as a new form of public transport for short trips – one that is energy efficient, zero emission and quick to implement as compared to other transportation initiatives. Cycling further offers health benefits to users and can effectively deliver the 'last mile' of mass transit systems. They have been described as a system of individual public transport.

"Very quickly, we have moved from being a curiosity to a genuine new urban transport mode. We invented the public/individual transport system." -Gilles Vesc, Vice-president Grand Lyon

Today's systems bear little resemblance to the free bike initiatives of the 60's, the best known of which included the white bikes of Amsterdam. Intended to encourage ecologically friendly travel the majority of the donated bikes ended up vandalized or stolen. New technology - such as electronic payment, tracking and locking systems - has helped reduce crime and revive bike-sharing efforts worldwide. The development of mountain bikes in the 1980's, and hybrids in the 1990's, has also had an impact. Their upright sitting position, modern gear shifters and brakes, light weight, rugged construction and maneuverability make them well-suited for urban travel, especially when equipped with fenders, lights and baskets. An increasing emphasis on the need for sustainable cities provides further impetus for consideration of these systems.

A typical public bike system consists of a fleet of bicycles, a network of stations to lock up the bikes when not in use, a user registration system, a system status information system, a maintenance program and a bike redistribution mechanism.The systems are intended for short trips, 5 km or less, to serve people living and working in urban centres for day to day transportation needs. PBS allows individuals the benefits of bicycle use without having to purchase a bike, store it or bring it into the city. Bicycle purchase and maintenance costs are borne by the system operator.

Common System Characteristics include:

- Open to all registered users/clients
- Available on demand 24/7
- Automated self-serve systems to take and return the bikes
- Docking stations or points are located in public places
- Sufficient capacity – described as a ratio of residents to bikes
- Located in high density mixed use districts
- Average 300m walking distance between stations
- Serve major destinations and transportation hubs
- Free or almost free for very short periods (typically first 30 minutes)

The early PBS were largely funded through donations, or donations of old bikes. However, in the late 1990s two global advertising competitors, JCDecaux and Clear Channel, identified a new opportunity to access advertising space in key urban markets by entering the public bike operation arena. Already engaged in contracts to provide street furniture and transit shelters to transportation and municipal agencies both companies went on to establish successful automated bike sharing programs, notably Clear Channel in Barcelona and JCDecaux in Paris and Lyon.

The Vélib program in Paris has attracted worldwide attention due in part to the large number of bikes in the system, it will reach 20,600 in 2008. However the ratio of bikes per citizen is probably a more important comparator – with the systems in Caen, Copenhagen, Dijon, Lyon and Paris all providing an average of one bike per 200 citizens or less.

Public bike systems, whether as a complement to public transportation or not, are spreading rapidly in France and gaining attention across Europe, North America and Australia.

1.2 History of Biking In North America

Many of the early white bikes in Amsterdam ended up in the canals

Bicycles gained prominence as transportation vehicles over 100 years ago. Many early efforts to improve road conditions were sponsored by organizations such as the League of American Bicyclists. But when automobiles emerged, the situation changed rapidly. Unlike Europe, where motoring superseded cycling gradually, North American cyclists had less of a chance to coexist with motorists. The bicycle's status has fluctuated through the years, and has been more often considered a child's toy than a valid mode of transportation.

In the sixties, bicycling made a comeback as people turned to bicycles for transportation and recreation, but many inexperienced riders feared motor vehicles. This viewpoint led to the bike path trend of the 1970's. Paths attempted to separate the two vehicle types to reduce conflicts. Keeping cyclists off the road with paths was not the total answer – paths function well in some areas and poorly in others.

Current thinking suggests that cyclists and motorists should share the road. That the two modes can be integrated by improving roadways to accommodate cyclists, thereby conserving funds and uniting users under one set of rules for better cooperation and safer operation.

1.3 Rationale for Public Bike Systems

One of the common rationales cited by bike share programs is that they provide an effective substitute for at least some of the large number of short distance trips made by cars in urban areas, often with only one person in the car. In most major cities short automobile trips create much of the

congestion on urban arterials, contribute disproportionately to urban air pollution due to cold starts, and are involved in automobile accidents. To date the mode shift from car trips to public bike has been relatively small at 5 – 8% however when compared to North American transit mode shares in the low teens these numbers are significant. Even in Europe cars are still used for 30% of trips less than 2km[1]. Other reasons why PBS are a good idea include:

PBS Characteristics
Accessibility
Availability
Reliability
Affordability
Safety
Travel time

1. Positive customer satisfaction numbers from existing systems
2. Subscription rates [Paris 15% residents]
3. Average use per bike
4. Expanded cycling base - number of people cycling = health benefits to general population
5. Increased mobility choices
6. Effective 'last mile' for transit - promotes multi-modal trips
7. Potential to increase transit ridership [extends reach of transit network]
8. Improves livability of city
9. Can trigger a blue box phenomena [and now seen with cloth grocery bags] a manageable action and start of behaviour change for average citizen
10. Shifts thinking about the use/allocation of road space
11. Supports pedestrian and transit modes
12. Zero emission
13. Cost effective
14. Increases number of social interactions - connects community
15. Increases private bike use
16. Increases local retail utilization
17. Creates good 'green collar' jobs
18. Makes cycling safer for all cyclists [increases visibility, awareness & understanding of behaviour]
19. Some green house gas savings - with potential to be greater
20. Positive public image for city and region

Public bikes as a solution to the 'last mile' problem is being tested at the University of Washington where more than three-quarters of the campus population commutes in some way other than driving alone, nearly 40 percent use public transit and 8 percent ride their bikes to and from campus. A fleet of 40 electric bikes will be available on campus in fall 2008.

The German Call a Bike system is another example of last mile service and is part of DB's strategy to provide value added mobility services to its customers apart from pure rail transport and to enable door-to-door mobility chains.

[1] ECMT, National Policies to Promote Cycling 2004

2 System Objectives

PBS objectives typically speak to the opportunity to increase mobility choices, improve air quality and reduce congestion.

Table 2.1 Public Bike Systems Objectives

System	Objectives
Lyon, France	This project will help create a more sustainable transportation system in the region by launching a public bicycle system that provides a new mainstream mobility option for short trips in urban settings. Successful implementation of the public bicycle system will help achieve transport and land use planning objectives including pollution emission reductions, reduced traffic congestion, road and parking cost savings, consumer cost savings, energy conservation, reduced crash risks, improved public health, and support for smart growth land use development. The system will be safe, easy to use and cost effective. It will integrate with other regional transportation services and planning activities.
Paris, France	▪ Act on air quality and public health ▪ Improve mobility for all ▪ Render the city a more beautiful and agreeable place in which to live ▪ Encourage economic vitality ▪ Reinforce regional solidarity
Barcelona, Spain	An initiative to improve intermodalism between the different modes of transport, and to promote sustainable travel within the central city area. Specific objectives: ▪ Create a new individual public transport system to facilitate bike use for citizens' habitual travel needs ▪ Implement a sustainable, health inducing service fully-integrated with the city's public transport system, facilitating intermodal travel with other public transport modes ▪ Promote the bike as a usual means of transport ▪ Improve quality of life, reducing air and noise pollution
London, England	The main objective of the early systems was to supply an increased choice in mode of transport travelling around Hammersmith and Fulham. London has recently announced a major infrastructure plan to create twelve super bike networks in and around the city. Planners hope the changes will encourage a "critical mass" of cyclists to use the routes, creating a safe and accessible environment as well as cutting congestion and pollution across London. The stated goal is to make cycling part of public transport and shift 5% of people out of their cars, off the tubes and buses and on to bikes. This mode shift would translate into1.7m cycle trips in London every day
Washington, DC	To provide as many transportation options as possible and to reduce the level of congestion, especially downtown.
Philadelphia	Reduce the city's carbon footprint and create a Public Use Bicycle System as an additional method of urban transportation to enhance the personal mobility of Philadelphia residents and workers.
Portland, Oregon	A transportation system where walking and bicycling are safe and convenient transportation modes for urban trips
Göteborg, Sweden	Bike sharing is one of the concrete actions that will raise the status of cycling, will promote using bicycles for short distance trips and points out the advantages of using different modes of transportation in different situations.
Montreal, Canada	To encourage Montrealers and tourists to use the public bicycles instead of cars for short, inner-city trips

3 Types of Public Bike Systems

Bike systems have been characterized as 1st, 2nd and 3rd generation based on their network configurations and payment systems. The first generation systems featured the random placement of donated bikes around the city and allowed free use, with the idea the bike would be left for the next user. The best known of these systems is the white bikes of Amsterdam, but it has been tried in a number of cities including San Francisco. Unfortunately most of these initiatives failed as the bikes were regularly vandalized or stolen.

The next generation featured bikes stored in designated locked racks so people knew where to locate them. Such programs can be found in Copenhagen and Helsinki, where users pay a minimal deposit when they pick up the bikes and get the deposits back when they return them - much like the system some grocery stores use for their carts.

The third generation of bike-sharing programs is high-tech, with electronic payment, tracking and locking systems. The first 3rd generation system was launched by Clear Channel in Rennes, France in 1998. The system began with 200 bikes and 25 stations and was operated 24/7 year round.

An examination of the 100+ cities with current or planned systems suggests another way to characterize bike systems is by user type. Typically the systems are implemented to meet the needs of one of the following groups:

3.1 Mainstream

Mainstream systems are likely to be configured as public transportation systems. They may be designed to provide the first and/or last trip in a linked bike/public transit/bike trip, to replace short public transit trips or to provide a complete network of service for trips less than 5km. In Barcelona they were careful to specify that Bicing did not want to compete with bicycle rental companies and at start up the system was only accessible to Barcelona residents, however within six months they introduced a weekly pass aimed at casual users. While the Vélib system in Paris accommodates tourists, in the last half of 2007 Vélib was one of the most visited "Paris monuments", it is predominantly intended for use by local residents. See Section 4 for a summary of Mainstream Systems.

3.2 Tourism

Some of the systems were introduced specifically with the objective of increasing tourist mobility or as a tourist attraction. The Copenhagen bike program Bycyklen was first introduced in 1996 and was actively marketed as a tourism feature. The 2000 bikes are restricted to use in the city centre and are coin operated.

Employer program in Goteborg

3.3 Employer Programs

Employer programs are typically aimed at encouraging a change in commuter mode.
The employer program in Goteborg, Sweden was introduced in 2006. In the first year 60 companies joined the pilot system. The service began with 125 bicycles, 11 bike stations and 300 registered users. Users pay an annual administration fee but the majority of costs are funded through advertising revenues. The stations are open from 06.00 – 24.00 and bikes can be used a maximum of 4 hours per trip. Access is by smart card with the cards issued to the employer, not the individual

user. The system is closed December – March. Average trip length in the first year was 43 minutes, suggesting users are using the system as a commute method.

Humana, one of the largest publicly traded health care providers with corporate headquarters in Louisville, Kentucky operates an employee bike share program called Freewheelin'. To date, 2,400 of the 8,500 employees that work at its downtown offices have signed up to use the bikes. Maintenance for the 100 bike fleet is provided by a local bike shop.

Humana employees use a magnetic access card to check out the bikes and a helmet. The card tracks every time a bike is checked out to collect data such as distance travelled per trip, how long the bike was checked out, what it was used for and the demographics of the rider. Some usage findings from the system are:

- 12 percent of those who participated said it was their first time on a bike
- 50 percent said they want to introduce activity into their work day
- 76 percent of rides are taken during a work break
- 40 percent of bikes are taken home during the weekend

3.4 Campus or Community Program

University campuses are frequently communities unto themselves with all of the attendant issues of traffic congestion, parking management and emissions concerns. Like an employer, they have precise information about their population base which can facilitate implementation of a registration system. Grass roots programs such as the AMS Bike Co-op at UBC often lack the funding to incorporate the technology solutions the mainstream operators are using to mitigate theft and vandalism. The 50 bike Purple and Yellow fleet was introduced to make UBC a better place for cyclists and their bikes. The system which used a keyed master lock and ad hoc locking has been debilitated by theft.

State mandated trip reduction plans provide impetus for campus programs in United States

State mandated trip reduction plans provided significant impetus for campuses in the United States to develop multi-modal plans that included cycling components. The University of Washington [U of W] first addressed the issue of bicycle theft with the introduction of secured bike lockers starting back in 1984. Today there are more than 580 bicycle lockers across the campus and bike trips account for 8% of total trips to the campus.

U of W has recently announced a shared electric bike system for the Seattle campus. The campus network of self-rental electric bicycles, supplied by The Intrago Corporation and funded by the Washington State Department of Transportation will enhance mobility for students, faculty and staff that arrive to campus using alternative transportation and aims to reduce the number of automobile commute trips in the region.

The shared bike program is intended to respond to the unmet need for clean, on-demand personal mobility. The electric bicycles provide some riders the extra assist they may need to make it up hills or travel longer distances while sharing the benefits of exercise and a non-polluting vehicle. The system, with 40 bikes and 10 stations, is expected to be in operation in fall 2008.

4 Public Bike Systems

Although there are more than 100 cities with some form of public bicycle system in operation, the majority of these are small – with less than 100 bikes. In order to fully realize the environmental and sustainability benefits of cycling as a transportation mode the system must attract a broad base of mainstream users.

Function follows form and the system envisioned for Metro Vancouver is a 3rd generation mainstream mobility alternative. As such the most meaningful systems for comparison and analysis are those with fleets or 500 or more bikes – and a ratio of less than 1000 citizens per bike. There are currently 21 public bike systems in operation who meet these two criteria. The systems in Paris, Barcelona, Frankfurt and Lyon, and the system under development in Montreal, demonstrate three different approaches to network configuration, access platforms, funding models and operating models. Lyon is worth additional consideration both for the length of time it has been in operation and for the success of the system, and as the size and topography of the city most closely resembles Vancouver.

Table 4.1 A Comparison of 3rd Generation Mainstream Systems

	Paris	**Barcelona**	**Lyon**	**Frankfurt**	**Montreal**	***Vancouver***
Operator	JCDecaux	Clear Channel	JCDecaux	DBRent	Stationnement Montreal	*TBD*
Population	2,153,600	1,605,600	466,400	652,600	1,039,500	*578,000*
# Bikes	20,600	3000*	3000**	720	2400	*3800*
# Residents/ Bike	104	535	155	906	433	*152*
Technology	Smart card	Smart card	Smart card	Mobile Phone	TBD	*TBD*
Business Model	For Profit	Local Government	For Profit	Local Government	Local Government	*TBD*
Funding	Subscriptions & Outdoor Advertising	Subscriptions & Parking Revenues	Subscriptions & Outdoor Advertising	Subscriptions & General Revenues	Subscriptions & Parking Revenues	*TBD*

* increasing to 6000 in 2008
** increasing to 4000 in 2008

4.1 Mainstream Systems

4.1.1 Paris

By far the largest bike-share program to-date, Paris plans to have 20,600 bikes in operation in 2008. Mayor Bertrand Delanoe launched the Vélib network as part of a wide-reaching program to green Paris and reduce vehicular traffic in the central city. There are more than 230 miles of cycling lanes in Paris, many shared with buses.

At build out users will pick up and leave the bikes at one of 1425 automated, self-service bike stations. Customers can verify the availability of bikes or empty docking spaces at any given station, over the internet. To help riders navigate the streets, maps and safety manuals in several languages are available at every station.

Annual registered members use a smart card and swipe in to access the bike at its parking stand. Terminals at each station allow the purchase of a short term subscription with a credit card, which

gives the customer a subscriber number and a password. The customer enters the number into the terminal and selects a bike stand number to unlock the bike.

Users can either have an annual membership or pay for short term subscriptions for daily or weekly usage. A one-day subscription costs 1 Euro, a weekly subscription costs 5 Euros and an annual membership costs 29 Euros. In addition to paying the subscription fee, short term users must pay a security deposit of 150 Euros, which is pre-authorized on their credit card to help guarantee the return of the bikes. This cuts back dramatically on theft.

For the first 30 minutes, the bicycle is free to use. After that, usage costs are incurred. This system, including the pricing system, is designed for short range, individual trips. As a result, in the first two months of operation, 92 percent of the trips lasted less than 30 minutes.

Name: Vélib
Launched: July, 2007
Bicycles: 20,600
Stations: 1425
City population: 2.15 million
Number of citizens per bike: 104
Availability: Year-round
Price structure: Riders can select a one day card for €1, a weekly card for €5 or an annual card for €29. First half-hour is free. Additional half-hours are priced at €1, €2 and €4.
Technology: Smartcard
Operating company: JCDecaux
Financing model: Outdoor Advertising Contract plus user fees

4.1.2 Barcelona

Launched in May 2007 with 750 bikes and 50 stations primarily near Metro Stations and major parking lots, by the end of 2007 the system included 3000 bikes and 194 stations. Bicing is planned to grow to 6,000 bikes and 400 stations in 2008.

The system is managed by B:SM, a municipal service company and was intended to encourage residents to make short trips by bike. In July 2007 a weekly subscription offer was introduced for tourists. The bike stations are located next to underground stations and parking lots to promote Intermodality; and next to major destination points (municipal buildings, universities, hospitals, etc). The station locations are designed to provide citizens with access to a public bike at a distance of less than 300m. 22kms of new lanes have been designed to link the bike stations with the city's strategic cycle routes network (currently extending some 128kms). These lanes are also combined with a network of 30 km/h zones.

The first bikes were operational in Barcelona in March 2007, just two months after the contract was signed, and demand immediately exceeded initial forecasts. More than 100,000 subscribers – ten percent of the adult population – have signed up, and more than 3 million trips have been made across the City.

Like many bike-share programs, Bicing offers its users system information on the internet, with the number of available bikes at every station updated in real-time.

The System is funded with revenues from The Green Area Integral Parking scheme. There is now no free daytime parking whatsoever in central Barcelona, although, city parking is free between the hours of 8pm and 8am. Vehicle parking in the city centre now falls into three categories:

- 'Green zones' reserved for local residents, who pay one euro a week
- 'Other green zones' limited to a one or two-hour stay, available to all, but where locals enjoy a fixed-price discount; and
- 'Blue zones', the parking meter areas of old

Name: Bicing
Launched: March, 2007
Bicycles: 3000
Stations: 212
City population: 1.5 million
Number of citizens per bike: 500
Availability: Year-round, 5am to midnight, 24 hours a day on Friday and Saturday.
Price structure: Riders must apply via mail for a swipe card and purchase an annual subscription for €24. First half-hour is free. Additional half-hours are priced at €.30, with a maximum rental time of two hours.
Technology: Smartcard, and optional credit card.
Operating company: Clear Channel Adshel
Financing Model: User fees and Green Area Parking Revenues

4.1.3 Frankfurt

Call a bike is a commercial public bicycle service that is offered by DB Rent, which is a subsidiary company of Deutsche Bahn (DB, German Rail). The service started in October 2001 in Munich. Meanwhile, it has been expanded to other German cities and is now also available in Berlin, Cologne, Frankfurt and Stuttgart. 4,200 specially designed bicycles are available for rent in these cities from spring to fall.

To obtain access to the call a bike service, users have to register once and need to provide their credit card information or give a direct debit authorization. After registration, the public bicycles can be unlocked by using a code that the user receives via cell phone. DB rent charges 8 Cents per minute, holders of a Bahn Card (which offers discounts on rail trips) or a yearly public transport pass pay 6 Cents a minute and 24 hours cost 15 €. Currently the call a bike service is not financially self sustaining. However, it is not the goal of DB to make a profit on the service. It is rather aimed at a break-even and at attracting rail customers that will use the call a bike service in a trip chain. Call a bike also provides positive publicity for German Rail.

Name: CallBike
Launched: 2003
Bicycles: 720
Stations: 66
City population: 650,000
Number of citizens per bike: 900
Price structure: 8 cents per minute, with a maximum of €15 per day, and €60 per week.
Technology: Mobile phone
Operating company: Deutsche Bahn
Financing Model: User fees, government funding

4.1.4 Lyon

In Lyon, Vélo'v bicycles are parked in 300 bike stations across town. To discourage theft, users need to submit their credit card details when registering, and pay a deposit. Just three months after it got started, the program had signed up 15,000 subscribers, who mainly use the bikes to commute from public transport hubs to work. On average, the city's 2,000 Vélo'v bicycles are 'checked out' 6.5 times a day. A microchip in the bike registers when it's taken from a rack, and when it's returned. Every time a bike is parked in a rack, its tire pressure, lights, brakes and gears are tested. Malfunctioning cycles are blocked from being rented. Pricing is approximately EUR 1 per hour, but the first half hour is free. Since 90% of trips are shorter than 30 minutes, the majority are free. Vélo'v is funded by JCDecaux, the outdoor advertising company, which is operating the bicycle scheme in return for the right to sell advertising space on Lyon's bus and tram shelters.

Lyon intends to expand its fleet by an additional 1,000 bikes by the end of 2007, with the goal of having stations within 300 meters of every point in the city. JCDecaux absorbed all set-up and operating costs in exchange for the bus-shelter advertising contract. Bike traffic is up 80% in 2.5 years since Vélo'v was launched and 25% of this increase is from bike-sharing. The remainder of the increase is from an increase in the use of private bikes.

Name: Vélo'v
Launched: 2005
Bicycles: 4,000
Stations: 340
City population: 450,000
Number of citizens per bike: 116
Availability: Year-round
Price structure: Rider must purchase either a long-term or short-term subscription card. First half-hour is free. Pricing then varies for each additional hour.
Technology: Smartcard
Operating company: JCDecaux
Financing Model: Outdoor advertising Revenues

4.2 Other Systems

At least 8 major cities in North America are in the discussion or planning stages for PBS. New York City conducted a trial programme earlier this year, and one is about to launch in Louisville, Kentucky. Chicago, Philadelphia, Portland, and Tulsa are also considering programmes

4.2.1 Washington DC

About 120 bicycles will be deployed in the first phase of the Washington program at 10 locations around the city with a subsequent build out to 2500 bikes. The system to be known as SmartBike DC will be accessible by online subscription – users will be issued a personalized user card. Details such as costs for usage and membership have yet to be announced. The first phase is expected to open in the first half of 2008. The system operator is Clear Channel.

4.2.2 Seville, Spain

The model for Seville is based on Lyon's service, to be called Sevici, it will feature 2,500 bikes and 250 parking stations distributed across city districts, managed by JCDecaux. The cost will be 10 EUR/year or 5 EUR/week, with the 30 first minutes of rental for free (1/2 EUR for each additional

half-hour). Currently, only two stations are working for free demonstrations in the city center but the complete deployment is expected for mid-2008.

4.2.3 Copenhagen

In operation since 1996 Bycyklen bikes were designed to be simple (they are single-speed), durable and adjustable. They are also conspicuous. The program is supported in part by advertising placed on each of the bike wheels. Currently operating with 2000 bikes Copenhagen has announced the goal of increasing to 5,000 bikes and enlarging the designated use boundaries. The program includes a bike repair shop that aside from fixing bicycles provides an employment training scheme that has resulted in 80% of participants later securing a job.

4.2.4 Stockholm

In 2006 Stockholm launched a congestion pricing program to charge motorists to enter the city center. It has since been recognized as one of the world's most successful, and Sweden's parliament voted in June, 2007, to make the charge permanent. Stockholm's bike-share program has been lauded as a complimentary effort to attract those who might otherwise travel inside the city center by car. The Stockholm system has 2500 bikes and 200 stations.

Oslo Citybike

4.2.5 Oslo

Clear Channel Adshel has installed Citybikes in four Norwegian cities: Trondheim, Drammen, Bergen and Oslo. Citybike is fully funded by Clear Channel Adshel in exchange for street-furniture advertising contracts. The Oslo system is 1200 bikes and 100 stations

4.2.6 Brussels

Brussels is a city of nearly one million inhabitants. In 1997, the number of journeys made by bicycle was less than 1%. Cyclocity was launched in 2006 with 250 bicycles available at 23 Cyclocity stations located in various parts of Brussels. The system, developed and operated by the JCDecaux Belgium Company, is funded by the City of Brussels. To date system uptake has been disappointing. Suggested reasons for this include: a lack of commitment on the part of Brussels and JCDecaux (the advertiser and sponsor). There are very few (20) stations set up around town. There are also very few bikes provided: 250 for a million inhabitants, compared with 26,000 bicycles for two million Parisians. There is no link or co-operation with the 19 suburban areas because they have their own system set up with a competing advertiser, Clear Channel.

There is a charge for the first twenty minutes of the ride in Brussels, as compared to Lyons and Paris where it is free--this is seen as an important factor in the success of their systems. In addition, the bicycles themselves are much heavier than the French ones and only have three speeds; which is problematic in a hilly city like Brussels.

4.2.7 Pamplona

Nbici is the newest addition to Europe's bike share network, having launched in early July. It is also Cemusa's first foray into bike-sharing. Like most European bike-share programs, Nbici is funded through an advertising contract. The City of Pamplona offered Cemusa control over 50 advertising panels, 40 clocks, 50 advertising fences and 29 posters in exchange for funding Nbici in its entirety.

4.2.8 London

OYBike London

OYBike London was launched in June 2004 by OY Bike in the inner London borough of Hammersmith and Fulham]. The system currently has100 bikes and 57 stations. The OYBike network is designed to work with other modes of transport and is available at tube stations, public buildings, key transport interchanges and car parks. OYBike uses mobile phone technology for bike access and return. The bikes are secured to their bike stands using cables that are attached to the bicycle and which double as security locking cables when the bicycles are on hire. Each bike stand is equipped with a specially developed electronic lock operated through a keyboard and LCD display. This lock holds the cable secure until that bicycle is rented out. An OYBike registered user selects an available bicycle, contacts OYBike and receives a one time key code sent as a text message to release the bicycle. When returning the bicycle to the system (by inserting the locking cable into the lock port), a code number is again displayed within the lock display, this unique number is sent to OYBike by phone to end the hire.

Users must pre-register with an initial usage credit of £10. Optional theft insurance is available at additional cost. Cost is GBP 0.30 per 15 minutes, and no more than GBP 8 per 24 hours.

4.2.9 Chalon-sur-Saone [Southeast of Paris]

Launched 15 December 2007, with 50 bikes (to increase to 200 by March). Based on a city population of 120,000 this is provides a ratio of one bike per 600 citizens. The AlloCyclo system uses mobile phone technology adapted from the German transport Call-A-Bike service, to provide user access to the bikes. The bike stations can have any number of bikes at a time, and the bikes may be used within a limited perimeter. The service is being operated by the local transport company Transdev – a subsidiary of the state owned Caisse des Dépôts Group. Transdev is a provider of public transport systems with annual revenues of close to $2 billion. One of the authority's main priorities is the integration of different transport modes, offering passengers tailor-made solutions. All combinations are possible: tram and bicycle, train and coach, car and bus.

4.2.10 Beijing

Bike rental service offered by private sector Company, The Beijing Bicycle Rental Company has 31 stations and 500 bikes. The company hopes to have 200 stations and 50,000 bikes by the end of 2008. Company's rental stations are staffed – customers leave a 400 Yuan ($53) credit-card deposit but may return the bike to any station. The service costs 5 Yuan ($0.66) an hour, 20 Yuan ($2.66) a day, or 100 Yuan ($13.33) for a year-long VIP card. [Note Beijing as described here is a bike rental system – not a public bike system but has been included as it is being cited in reference to the 2008 Olympics]

5 Current PBS Procurements

5.1 Portland

Portland issued a Request for Proposal in late 2007 for a company that could manage the "delivery and operation of a bicycle fleet [numbering 500 bikes] for rent to the general public and stationed in the public right of way to further promote the City's use of a multi-modal public transportation system with a focus on the City's core area."

If a successful and reasonable proposal is received, the City plans to execute a single contract that may include but not be limited to the following services:

- automated rental kiosks AND/OR a telephone rental system;
- bicycles;
- complete backroom operations including billing, communications and information technology services;
- maintenance and cleaning of facilities and equipment; and,
- regular monthly reporting on provision of contract, revenue, costs and usage

The successful Contractor will enter into a "not-to-exceed" Services Contract with the City. The RFP closed in October, 2007 and three proposals were received. To date no contract award has been made. The proposers were:
Clear Channel – an outdoor advertising companies that has the contract for much of the outdoor advertising space in Portland and is the operator of the bicing system in Barcelona.
Library Bikes – a nonprofit bike collective has proposed a system that works more like a library. It builds staffed -- not automated -- branches and requires customers to carry checkout cards.
Portland Bike Company – a joint venture of Alta Planning + Design, local bike shops and nonprofits, and Lamar Advertising, the Louisiana-based company that handles TriMet transit advertising

North American cities contemplating or introducing PBS include: Montreal, Vancouver, Portland, Seattle, Chicago, San Francisco and Washington DC

5.2 King County – Seattle

King County issued an Expression of Interest in late 2007 for a bike share program modeled after the systems in Paris, Barcelona and Lyon, featuring self-serve rental stations. The agency envisions a program with 250 – 300 bikes and 25-30 stations at the end of the first year, increasing to 500+ bikes by the end of the second year. A target neighbourhood – Southlake Union area - with 21 potential station locations was identified for a pilot program to launch in 2008.

King County has clearly identified this as a pilot program intended to demonstrate demand and proof of concept (financially and operationally sound). They have further stipulated that the system operate independent of long term public investment and have requested an exploration of revenue sources including advertising, user fees and corporate sponsorship. Secondary objectives of the system are to facilitate access to public transportation and to link with the bike trail network.

Four customer segments have been identified for the King County system:

- Residents making trips for shopping, business, recreation and personal errands
- Businesses using the bicycles for deliveries and other business-related trips
- Employees making short trips during the workday for business or personal use
- Tourists

The King County EOI attracted responses from the same three companies who had previously responded to Portland's RFP – Clear Channel, Portland Bike company (Lamar Advertising) and Library Bikes

5.3 San Francisco

San Francisco included an option to negotiate an exclusive bike sharing program in its recent RFP for transit shelter advertising. Clear Channel was the successful proponent and will enter into a 15 year contract with the city for sale of advertising space on transit shelters. The city can exercise the Option on completion of the city's Bicycle plan and the parties will have 180 days to negotiate an agreement. If no agreement is reached the city will have the ability to seek new proposals elsewhere.

The Option clearly sets out that the bike share system will not be funded by the outdoor advertising revenues and directs contractor to implement a program to make bicycles available at selected transit stops through a pre-paid option similar to car-sharing business models. Such a bicycle-sharing program shall not have the effect of reducing any of the payments due to the SFMTA under the advertising agreement.

5.4 Montreal

The Montréal system is of particular interest as the city's parking authority Stationnement de Montréal [SM] has been named as the operator. The core competency that the authority brings to the venture is a demonstrated ability to handle real-time wireless transactions and manage logistics with sophisticated parking technology. A pilot project will be launched in 2008, allowing Montrealers to test out this new system with the first stations and the first bicycles. By 2009 the fleet will consist of 2,400 bikes and 300 stations. The final location of the stations will be determined by population density and an analysis of trip generators. The system will not operate during the winter.

SM is in the process of issuing three separate Request for Proposals:

1. Software System Integration
2. Bicycle & Stall Provision
3. Marketing Plan (Including where to site stations)

! Montreal plans for 2400 bikes and 300 Stations – system to be operated by municipal parking authority

Start up costs are estimated at $15 million, but the system is eventually expected to pay for itself. Pricing will be about $1 per half-hour – with no free period announced as yet. The bikes, to be made in Saguenay, Quebec, will be aluminum and will be lighter than the Paris fleet. Maintenance will be subcontracted to a social enterprise which is being set up for this purpose, thereby generating additional sustainability benefits.

Stationnement de Montréal has already had some experience with cycle facilities, having previously installed one thousand bike rings on its sign posts and has plans to install another thousand before year end. The steel rings are positioned to facilitate the locking of bike frames and front wheels to the posts, and each one is large enough to keep two bikes in an upright position.

5.5 Chicago

Chicago is studying two proposals, one from France-based JCDecaux -- which operates the Paris system -- and one from London-based OYBike.

5.6 Tel Aviv

Tel Aviv plans to issue an international tender in early 2008 for the establishment, operation and maintenance of a bicycle rental system, similar to that operating in other major cities in Europe.

The plan calls for 1,500 to 2,000 bicycles in about 100 parking stations throughout the city (a ratio of 190 – 250 residents per bike). The bicycles would be available for use by subscribers and casual users, residents and visitors. The cost of a yearly subscription will likely be $32.50 with the use of a bicycle for the first half-hour free for subscribers, and somewhere in the range of $1.35 to $2.70 for every additional hour. Casual users will pay a one-time fee of $2.75, and $1.35 to $2.70 per hour, according to the plan taking shape. Payment will be made by credit card, to make sure that people returning the bikes beyond the deadline actually pay the fine.

The parking stations will be located at a distance of about 500 meters from one another. The franchisee will be responsible for monitoring and regulation of the bicycles between stations, to avoid shortages of bicycles or parking spaces.

The franchise will be operated for a period of five years, with an option for five more. The winner of the tender will have to undertake to install a payment and control system in three languages, and to establish at least one manned call center for public access.

The tender winner will also be responsible for routine maintenance of the bicycles and operation, which constitutes the bulk of the project investment.

The tender will include an auction for the grant that the franchisee will receive from the municipality. The annual cost of establishing and operating such a system is estimated at about $2.8 million to $4 million.

In order to maintain control over flexible pricing of the service the Tel Aviv municipality has decided not to undertake a B.O.T. (build, operate, transfer) tender - where the winner establishes and operates the system in exchange for royalties from public fees. Revenues from the rental service will go to municipal coffers.

Tel Aviv to seek amendment to helmet laws for PBS customers

International companies experienced in the area are expected to compete for the tender, but these may well cooperate with local businesses. The municipality is also hoping for an amendment to the helmet law in the near future, which will require the use of helmets only when using sports bicycles off urban roads.

To date the municipality has paved 74 kilometers out of the 100 total kilometers of bike paths planned in the city by 2009. A survey conducted by the municipality in 2004 showed that 5% of the city's residents go to work on bicycles, arriving within 16 minutes.

6 Mode Splits - Cycling Market Share

In Canada, cycling represents about 2% of urban transportation trips[2] and about 8% of the urban population report cycling in a typical week[3]. In Austria, Switzerland, Sweden and Germany, about 10% of urban trips are made by bicycle. In Denmark and the Netherlands, cycling represents 20% and 28% of urban trips, respectively, and the large majority of the population cycles on a regular basis.

Experience in North America and Europe has demonstrated that the addition of cycling infrastructure and the introduction of public bike systems have a dramatic and sustained impact on bicycle mode share. Experience at the University of Washington campus in Seattle reported cycling mode share rose to 8% with the expansion of on-campus bike racks and lockers and the campus will pilot a shared bike service in the fall of 2008 using electric assist bikes in the fall of 2008.

In early 2001, bicycling represented about one percent of the 10.6 million trips made daily in Paris. Following the introduction of the Vélib system, cycling mode share increased 118% - from 1.6 to 3.6 percent in the span of a few months. Bike-sharing has become so popular in Paris that when all 20,600 bikes are available, it will carry as many customers as Paris's tramway system.

In Barcelona the cycling share rose from 1% from 2% to the first four months of operation. 10% of Bicing users report their bike trip has replaced a car trip. Lyon increased from less than 1% to 5% in the 2 ½ years the system has been operating, and estimates that 7% of Vélo'v trips replace a car trip. Munich share was 8% prior to implementation of their system and Copenhagen was already at 22% when they launched – now 36%. Experience from Lyon suggests that a significant increase in private cycling trips [up to 50%] is likely to occur as the public bicycle system acts as a "door opener" to increase the acceptance of cycling as an urban transport mode.

Cycling mode share in the Greater Vancouver region is less than 2% however, in some neighbourhoods i.e. Kitsilano it can reach 14%. Transit share into the downtown core is 50%. The current bike commute mode share in Washington DC is 1.75%, Seattle is 1.5% and San Francisco 0.95%.

According to estimates published by the Dutch Ministry of Transport, Public Works and Water Management in 2007, cycling accounts for 27 per cent of all trips taking place in the country on any given day. There are a reported 600,000 bicycles in the Netherlands.

6.1 System Users

The proportion of the Canadian urban population reporting bicycling in a typical week was 8% (12% in Vancouver), with students cycling more than non-students (17% vs. 6%). In the general population, older age, female gender, lower education, and higher income were associated with lower likelihood of cycling[4].

[2] Pucher and Dijkstra 2003
[3] Winters et al. 2007
[4] Winters et al 2007

I finally got my 'bicing' card and can't even tell you how cool it is. I've never been the biking type either but I literally use it to go everywhere.
Blog entry on www.current.com

Research in Portland Oregon found that younger adults and men were more likely to be regular and utilitarian cyclists. A significant drop off in regular and utilitarian cycling among respondents occurred at age 55 and above. The differences between adults 18-34 years and 35-54 years old were not significant. There was no clear relationship between categories of cyclists and self-reported health status. The vast majority of respondents had a driver's license. Respondents with the highest incomes ($100,000 and above) were most likely to be regular cyclists, but not more likely to ride for utilitarian purposes[5].

Most of the European systems have a minimum age requirement of 14 years, and many state that users must be in a suitably fit condition and possess a third part insurance policy as a condition of use. Users must also commit to safeguard bikes from theft and damage and to follow all applicable laws.

A review of subscribers to the Barcelona system shows an equal split between men and women [50/50], 51% of the users are between 25 and 35 years and the majority are local residents. Most subscribers state they are using Bicing for travel to work and do not combine it with another mode of transportation.

Table 6.1 User Profile Barcelona Bicing by Profession

Profession	%
Student	13
Administrator	11
Engineer	7
Public Administrator	6
Freelancer	4
Artist	4
Doctor	3
Architect	3
Manager/Director	3
Teacher	2

Source - "L'Ajuntament amplia el servei de Bicing" Ajuntament de Barcelona. 2007

[5] Dill, Voros 2007

7 Uptake Findings

Table 7.1 Registered Users on Selected Systems

Location	# city residents per bike	# of users registered in system	% of city residents who are users
Barcelona	535	100,000	10%
Lyon	156	60,000	13%
Paris	105	166,000	8%
Rennes	1,060	4,002	2%

7.1 Rentals per Bike

Average bike rentals per day per bike in the large systems are running at 10 to 12, while smaller systems are reporting averages of 6 – 8.

Figure 7.1 Average Bike Rentals per Day

Source - Clear Channel Press Kit September 2007

7.2 Trip Replacement

While half or more of PBS users report that they would have made the trip previously by another public transit mode [bus or metro] up to 10% report the bike trip has replaced a car trip. To put the value of even a 5% mode shift from car to bike in context, consider that the BC Government recently announced a $11 billion infrastructure program to double the regions transit share by 2025. For North American cities where transit share can be 10% or less this is a noteworthy target.

Table 7.2 Mainstream Systems - Trip Type Replaced

Type of Trip Replaced	Vélib Paris	Bicing Barcelona
Bus or Metro	65 %	51%
Car or motorcycle	8 %	10%
Taxi	5 %	NA
Walk	20 %	26%

Source - www.velib-pourri.com online survey March 2008; www.elPeriodico.com October 2007

7.3 Factors in System Use

Even in countries with high bicycle use, it appears that promotional campaigns can make a difference: the Netherlands has the highest rate of bicycle use in Europe (close to 30% of all trips); yet the city of Groningen has promoted bicycle use to an impressive 50% of all trips in combination with restrictions for car traffic in the city centre as well as traffic-reducing land-use planning.

Internal factors that may influence system use are:

- Hours of operation
- Number and location of stations
- Density of stations [and link to origin/destination requirements]
- The quality of the bikes and the bike stations
- Cost to use [including to be identified] compared to other modes of transport
- Availability of multi-modal fare integration

External factors that may influence use include the following:

- Climate and topography
- Major events or service strikes
- Existing attitudes to bikes
- Need for citizens to use bikes for travel
- Personal security [from crime] while riding the bike and at stations

The number of number of rentals may be further affected by the following internal factors

- Number of users
- Pricing
- Service quality
    - Bikes in good condition available at Origin
    - Open spaces available at Destination
    - Integrity of information system – that updates in real time
- Club Effect
    - When there is a critical mass of users in system they in fact support each others use [make space in a station, relocate a bike to a different station etc.]
    - With more users you will get more infrastructure – which will attract more users again

And the following external factors

- Existing level of cycling before startup
- Day of the week – typical activities
- School holidays
- Seasonal and regular events
- Weather conditions – temperature, wind, snow, rain
- Attitude to public assets – level of vandalism

Vélib Station

Thirty percent of Bicing patrons in Barcelona say they use the system because it is faster than other means of transport. Thirty-seven percent value the exercise and 22% say they use it because it is environmentally friendly. The major difficulty with the system is the frequent lack of bikes, or space to return a bike. Users report this occurs as often as 3xs per week. Approximately 44% will look for another station but 40% will chose another form of transport. Less than 16% of them will wait for a bike to be returned.

In 6 months (July 15, 2007 - January 15, 2008) there were 13.4 million trips or about 75,000 trips per day on Vélib in Paris. Trips are highly weather-dependent. When the weather is cold and wet ridership averages 30,000 trips per day, however, when the weather is nice this can increase up to 80,000 [140,000 trips per day during the recent transit strike]. A large percentage of the overall trips are for commuting purposes with an average of 25% of trips occurring between 9PM and 3AM. (Other transit modes run less frequently during these hours, so more reliance is placed on Vélib.) The average trip length is 20 minutes.

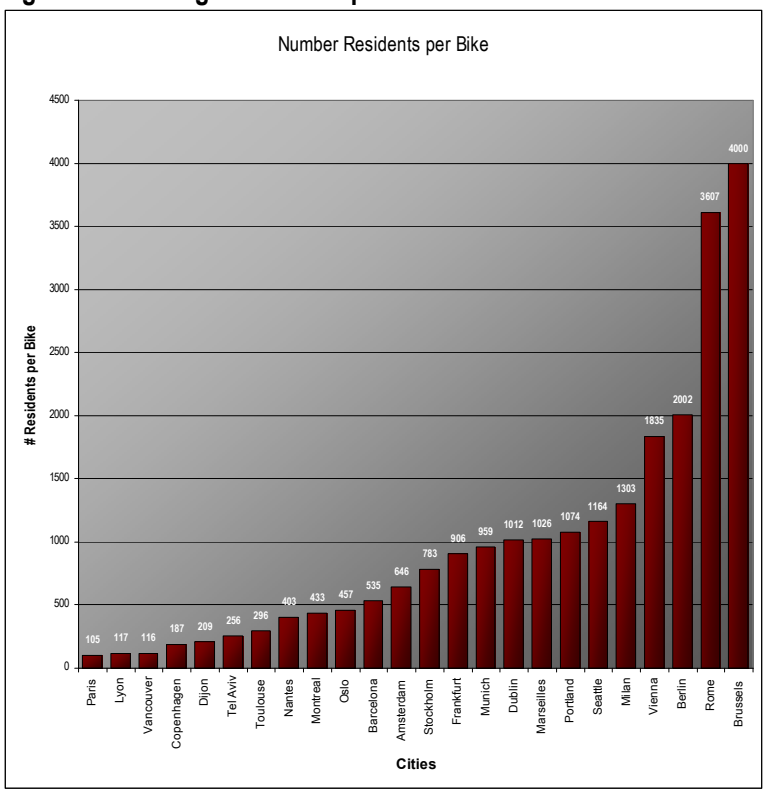
8 Success Factors

8.1 System Configuration

Mainstream public bike systems create a demand for system reliability and functionality on par with other public transport modes. And this is at the centre of the cost structure for third generation systems. The stations, locking devices, information systems and the bikes themselves must be suitable for high volume public self service use. In the same manner that transit planners evaluate walking distances to bus stops and calculate the impact of headways on ridership – so the mainstream system must provide a level of service that will encourage and retain bike ridership. Findings from Paris and Barcelona suggest an average distance between stations of 300m is optimum; anecdotal information from users is an expectation that there will always be a bike available for use – and an empty slot for returns. The use of fixed stations rather than adhoc return sites [in the German CallBike systems bikes can be 'returned' by locking them to any structure, except a traffic light, within a designated perimeter] is considered advantageous for this reason. If the bikes are not fixed, the time to find a bike can increase greatly. The asymmetrical demand for bikes experienced in most venues also creates the requirement for some form of bike re-distribution. See Section 14.

Figure 8.1 Average Residents per Bike

! Systems with an average of 200 residents or less per bike are stimulating mode shares of up to 4%



The system should be designed to attract as wide an audience and as broad a demographic as possible, including gender, age and profession. This translates into elements as diverse as bikes with adjustable seats to a network of cycling infrastructure appropriate to the comfort level of a

person who hasn't ridden a bicycle since childhood. And logically the stations should be situated in high density locations preferably with a mix of activities including residential, employment and retail that favour a sustained demand for short trips in all directions throughout all day parts. With an average of less than 200 bikes per resident the large systems are stimulating mode shares of up to 4%.

Best and highest use of the system is achieved when the bikes are shared by as many users as possible per day, the current benchmark is an average of ten-twelve per day per bike, and is one of the key reasons for the 30 minute free period most of the new systems have adopted. The other rationale for this pricing strategy is obviously to encourage use of the mode in support of reductions in congestion and emissions.

8.2 Risk Areas

There are five key areas of risk in the introduction of public bike system including: hazards (property and liability), financial, operations, data privacy and reputation. When the bike systems are associated with large public sector agencies, for example DB in Germany, they are such small components of mass transportation systems that the liability and insurance issues are easily handled. However, this can be a more problematic issue for privately owned and financed systems. Given the financing models of most of the current systems the majority of financial risk will be in the areas of maintenance, theft and technology. Paris reported more than 250 bikes were stolen in the first year of service and Barcelona is experiencing a higher than anticipated level of flat tires – although they report that theft has been minimal due to the systems ability to link individual bikes with individual users. The back end systems which register users and track system utilization in real time are 'mission critical' to these self serve systems – demanding robust platforms and system redundancies to keep system outages at levels similar to automated rapid transit systems i.e. 99.9% system availability. Bike re-distribution is another critical issue. In the first six months of operation more than a third of Barcelona bicing customers reported that no bike or no parking space was available on arrival at a station. The registration system for subscribers creates a fourth risk area of particular note in Canada where new privacy laws are increasingly explicit and encompassing – for example data on Canadian residents cannot be held in a database in the United States or other jurisdiction not in conformance with Canadian law. And finally the political risk of installing an unsuccessful system can not be taken lightly.

Bike Redistribution in Barcelona

The urban design of western North American cities in particular, cities designed for automobile travel, has inadvertently created another perceptual barrier to establishing cycling as a main stream transportation mode. The length of the typical commute, and the challenges of cycling in fast moving traffic, has associated the practice of bicycle commuting with the super fit and the fearless.

Table 8.1 Success Factors – Public Bike Systems

Factor	Description	Importance
Cycling infrastructure	Quality and quantity of designated cycling space – dedicated bike lanes, intersection facilities, slow streets	√√√
Public Attitudes to Cycling	Perception of mode Willingness to 'share the road' Willingness to utilize mode	√√
Weather & Topography	Amount of Precipitation, Hills	√√
Quality of Public Transit Service	Capacity to motivate residents to forgo auto trips to CBD	√√
System Availability	Hours of Service	√√
System Accessibility	Cost of use including monetary and convenience costs	√√√
Density and Trip Demand	Demand for one way trips in multiple directions and at all dayparts	√√√
Network Configuration	Location specific network design based on system objectives and travel demand	√√√
Technology Platform	Speed of access, real time information, privacy and security of data	√√
Bikes & Terminals	Bike specifications respond to user demographics and operating conditions; Terminals are visible and user interface is good	√√
Maintenance	Bikes and access terminals in good operating condition	√√√
Bike Re-distribution	Mechanism to address asymmetrical demand for bikes by location	√√√
Safety & Security	Terminals and cycling facilities are well lit and patrolled as necessary	√√

The League of American Bicyclists recognizes bike friendly communities in the United States using a detailed audit of engineering, education, encouragement, enforcement and evaluation efforts. Communities are awarded platinum, gold, silver or bronze based on measures including amount and quality of cycling infrastructure, supporting policies and actual levels of cycling. To date Davis, California is the only community to achieve platinum however, Portland and San Francisco are two of the large cities which have achieved gold status.

9 Barriers and Motivators to Use

By their very nature as a public asset intended for short distance travel, PBS do not have to contend with a number of the barriers to longer distance commuter cycling i.e. bicycle theft and increasing travel distances; however they share the issues of vulnerability in accidents with motorized traffic, weather and topology.

Cycle Infrastructure is number one motivator for increased use

According to the Cycling in Cities report[6] the three top discouraging factors to cycling are traffic, poor weather and safety concerns. In Vancouver, the top three areas where bicycle facilities should be provided are the downtown core, on all bridges, and Burrard Street. In addition, 69% of respondents indicated that Vancouver's bicycle network has had at least some influence on the amount they cycled.

The report also found that cycling infrastructure was the number one ranked factor in influencing greater levels of cycling amongst lower mainland residents. 66% of respondents said the presence of more infrastructure would encourage them to cycle more often. Also in the top five were factors were related to information about cycling and improved relations between cyclists and motorists.

Table 9.1 Impact of Strategies to Influence Increased Cycling

Factor	% much more likely to cycle
Investment in improved cycling facilities, such as cycling routes, bike parking	66
Information about existing cycling facilities, such as cycling routes, bike parking	47
Law enforcement aimed at drivers	45
A campaign to promote good relations between cyclists & motorists	29
Information about how to use cycling routes safely	28
Information to educate cyclists & motorists about how to interact.	26
Law enforcement aimed at cyclists	26
Cycling skills courses for adults	20
Cycling events	18

Source - Cycling in Cities Report 2007

The importance of infrastructure and protection from high speed motorized traffic was likewise identified as priority in the 2006 study completed by Dill and Voros

Table 9.2 Barriers to Biking and Biking More

Do any of the following environmental barriers keep you from biking or biking more?	% of respondents
Too much traffic	56%
No bike lanes or bike trails	37%
No safe places to bike nearby	33%
Too many hills	30%
Distances to places are too great	28%
Poorly maintained streets or rough surfaces	23%

Source - Dill, Voros 2006

[6] Cycling in Cities Report 2007

More days of precipitation per year and more days of freezing temperatures per year were both associated with lower levels of utilitarian cycling. There was less variation in the proportion of students who cycled by age and income, and only the number of days with freezing temperatures influenced bicycling[7].

Experience in Paris in the first half of 2007 showed that good weather can increase system usage by more than 4 times. Ridership on cold, wet days averaged 30,000 trips/day vs. up to 140,000 trips/day on nice weather days.

Reasons not to use a bicycle may be categorized as either subjective or objective. Subjective reasons have less to do with measureable conditions than with personal perception and interpretation of one's own needs. Objective, physical factors exist for everyone though they may not be weighed equally by everyone.

Subjective factors include distance, traffic safety, convenience, cost, valuation of time, valuation of exercise, physical condition, family circumstances, habits, attitudes and values and peer group acceptance. Objective factors include climate, topography, presence of bicycle facilities and traffic conditions, access and linkage and transportation alternatives. Pucher identified eight factors that affect the level of cycling in North America[8]

1. Public attitude and cultural differences
2. Public image
3. City size and density
4. Cost of car use and public transport
5. Income
6. Climate
7. Danger
8. Cycling Infrastructure

Heavy rain can reduce cycle use by 50%

9.1 Rainfall

Unfavourable weather conditions such as particularly high or low temperatures and frequent rainfall can be perceived as a deterrent to cycle use. Finland points out, however, that rather harsh and severe winter conditions are not a barrier for promoting cycling in Finland. For example, in Oulu, a city of about 120 000 inhabitants situated close to the Arctic Circle, cycling still has about 25 % of the modal share for daily trips.

Wilde (2000) surveyed Canterbury University students and staff and found that they were roughly three times more likely to cycle on a "warm and dry" day, than a "cold and wet" day (with staff slightly higher than students). Separating out the individual effects, it seemed that cold weather caused about a 20% reduction in use, while rain resulted in a ~60% reduction.

Nankervis (1999) also considered this question in more detail, using commuter cyclists in Melbourne. Over the year, stated cycling use per month dropped in winter to ~50% of summer levels. In a similar study of Melbourne students, the drop had not been quite so dramatic, falling to

[7] Winters et al 2007

[8] Dill and Carr 2007

about 70% in winter. When questioned about their commuting behaviour under various circumstances, the following stated actions were given:

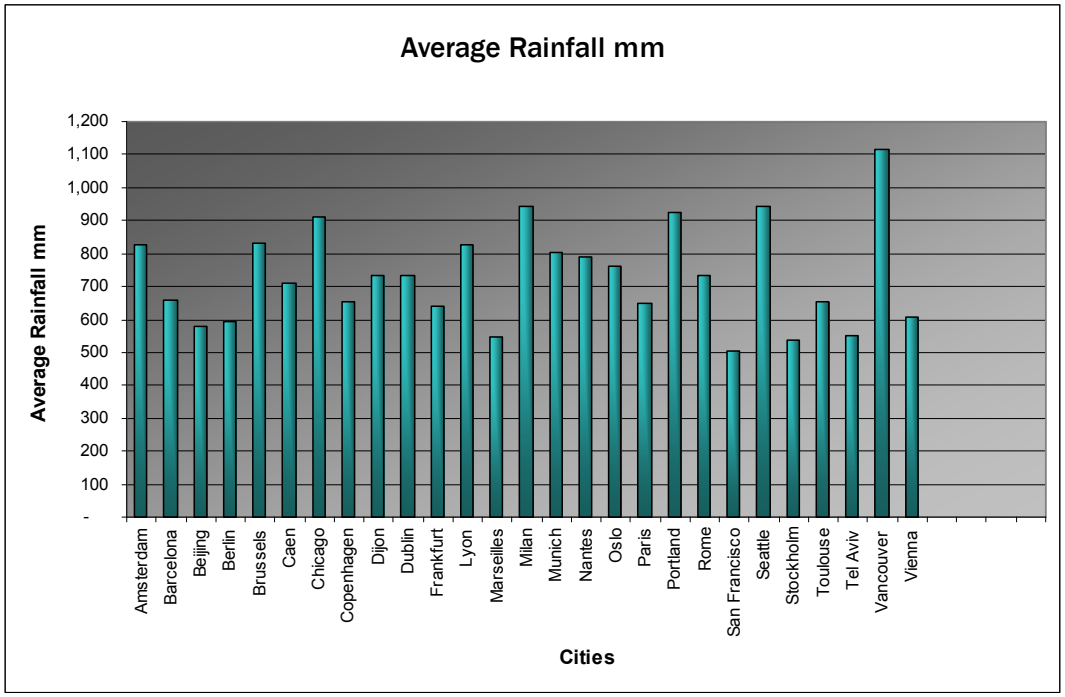
Table 9.3 Climate Impact on Cycle Behaviour

Action taken	No change	Change clothes	Alternative mode	Don't go / other
Heavy Rain	13%	20%	61%	6%
Light rain	17%	61%	17%	4%
High temp (>30deg)	78%	17%	4 %	0%
Low temp (<10deg)	33%	59%	4%	2%
High wind (>15km/h)	72%	9%	17%	2%

Data from special automated cycle count sites in five UK towns was compared against rainfall and temperature data and found that a 1°C rise in the maximum daily temperature gave an approximately 3% rise in daily cycle flows. Meanwhile the incidence of any rainfall during the day saw an 11-15% reduction in cycle numbers[9].

Similar research on five bike routes in Washington state found that average cycle counts were largely consistent until daily rainfall got above ~0.3 inches (8mm) of rain, then dropped away. Increasing average daily temperatures meanwhile caused cycle numbers to increase rather exponentially, with about three times the cycle volumes at 70°F (21°C) than at 50°F (10°C) or below[10].

Figure 9.1 Average Rainfall



[9] Emmerson et al 1998
[10] Niemeier 1996

Overall, it appears that the likelihood of cyclists returning to their cars and buses when the weather turns bad is rather dependent on what type of cyclists they are. Commuting cyclists are more likely to battle on than casual/recreational ("discretionary") cyclists, and more experienced cyclists are also likely to be less affected in their cycling use by weather [11] Recent experience in Paris appears to confirm this finding where use of the Vélib system increases as much as 4 times on clear days as rainy days.

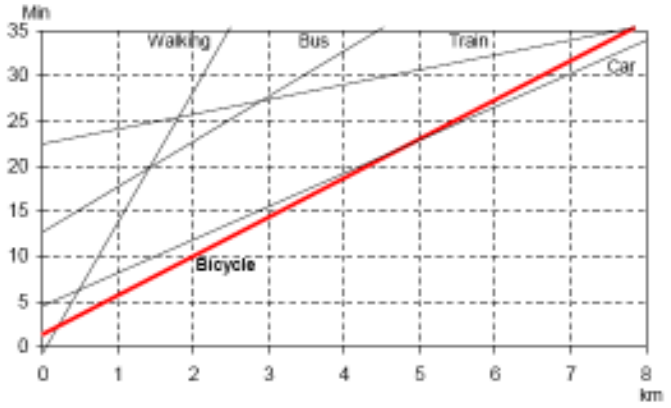
9.2 Trip Speed

30% of Bicing users say they use the bikes because it is faster than other modes

Trip speed can be a motivator in support of public bike use as highlighted in the chart below, and based on the finding from Barcelona where 30% of users report they use the system because it is faster than other modes.

Figure 9.2 Journey Speeds

Figure 1.4. Comparative table of journey speeds in the urban environment



Source: Cycling: the way ahead for towns and cities, 2000, EC, Directorate-General for the Environment.

9.3 Trip Length

In North America in particular, average commuting distances to urban work sites make cycling a mode choice for an extremely limited segment of the suburban population. Even with improved cycling infrastructure and end of trip facilities the barriers to replacing a vehicle trip with a bicycle trip are overwhelming for many. However, some portion of these car or transit commuters may be willing and able to complete some or all of their mid day trips with a cycling link. This level of willingness can be further strengthened by making the cycling option more attractive through the ease of access, quality of infrastructure and low or no cost of a public bike system.

[11] Bruce 2000

9.4 Image of Cycling

The European Commissioner for the Environment has said that the worst enemies of the bicycle in urban areas are not cars, but long-held prejudices[1]. A number of bicycle user organizations indicate that cycling is often, though not always, regarded as a leisure/sport activity or a travel mode for those of modest means or children – not as a "normal" mode of travel. As previously noted, this may be further exacerbated in North America by the perception that cycling has been captured by the 'left'.

9.5 Exposure to Cyclists

Respondents to a study in Portland stated that those who saw adults cycling on their street once a week or more (compared to never or less than once a week) were more likely to be regular cyclists[12].

10 System Size & Density

There is general agreement that a critical mass of bikes and stations (in the case of fixed station systems) is necessary to trigger a significant mode shift.

[12] Dill, Voros 2007

11 System Access / Registration

Vélib terminal accepts smart cards and credit cards

There are two major technology platforms currently in use in public bike systems, smart card systems and mobile phone systems, each associated with a different station strategy. In the smart card systems users swipe their credit card or system issued card at the station terminal or on the bike stand itself to release the bike. Mobile phone systems require users to call a number posted on the bikes lock and are given a pin code which they enter into the lock to release the bike. The mobile phone platform thus permits an adhoc return mechanism – bikes can be locked to any available bike lock or other secure pole without the requirement to locate a dedicated station. To date the majority of the French systems have adopted the smart card platform while Germany and the UK have implemented mobile phone systems.

From a users perspective the smart card system may provide slightly faster time to access or return a bike [fewer steps] however the mobile phone system provides greater flexibility in returning a bike – the bike is considered to be returned once it is locked and the return pin code entered. It is unclear how the mobile phone systems regulate return of bikes left at distant locations, however as the majority of these systems appear to have been designed to address the last mile of public transit it may be that most bikes on the mobile phone platforms are used two ways by the same user. In the Brussels system users must flash their subscription card in front of an optical reader at the station terminal or insert a short duration ticket and enter a personal access code to release a bike.

It would appear that the mobile phone systems are less infrastructure dependent, typically the fixed station systems provide a ratio of 1.75 spaces for every bike in the system, however the individual bike locks are more expensive than a regular bike lock and conventional bike racks are provided at major transit hubs.

Stationnement de Montreal, the city's parking authority, will be using the same technology for the new Montreal bike system as the wireless parking stations they introduced in the summer of 2007. The parking system assigns each pay parking spot in the city with a unique identify number – and drivers can renew a spot from any kiosk in the network. Currently drivers have to walk to the nearest wireless pay station to pay with cash or credit card for parking however the system has the capability to take payments through a cell phone, handheld device or any computer connected to the Internet. 500 kiosks have replaced 6,000 coin-operated sidewalk meters.

12 Pricing

Pricing in the major shared bike systems varies significantly between the general mobility systems and the 'last mile' systems. Typically the general mobility systems are appreciably less expensive with the cost per minute of rental an average of 80% less. On the Paris and UK systems bike rental is free for the first 30 minutes, which accounts for 80 percent of all rides, and increase sharply thereafter.

Table 12.1 A Comparison of costs for Registered Users in London, Lyon, Paris, Barcelona and Frankfurt

	London	Lyon	Paris	Barcelona	Frankfurt
Registration	$19.60*	$7.30	$47.00	$35.00	$7.30
1st 30 minutes	Free	Free	Free	Free	$3.50***
2nd 30 minutes	$3.92	.73	1.60	.44	$3.50
Next hour	$7.84		9.64	.44	$7.00
Full day	$15.68	$34.38	$46.25	$96.58**	$21.92
Average Annual Income	$39,000	$32,000	$32,000	$31,800	$54,100
1 zone transit fare	3.05	2.40	1.76	1.70	3.53
Card Issuer	Mobile Phone System	Personal or System Card	Personal or System Card	System Card	Mobile Phone System

* London registration fee is a credit against future rental
** Barcelona - the bike must be brought back after 2 hours – penalty for non return is $4.39 per hour
*** Stuttgart is the only CallBike city where the first hour is free; Rail customers get a 25% discount on minutes

One OYBike customer calculated that most London commuters can cut around 1 hour per day from their time spent travelling to and from work by having a bike at each end of their rail journey, save £500 a year by not needing a London Central Zones supplement, and possibly the same again by not needing to pay for car parking - and ultimately not needing a car to drive to a station to be parked for 8–10 hours per day, potentially saving a total of £3,000–£6,000 a year. Corporate customers can negotiate a fixed fee for any number of staff to use the scheme. An optional Damage waiver scheme against theft or damage of the bike is available at a cost of £10.00 per annum. This does not cover personal injury insurance.

13 Bikes

13.1 Popular Configurations

In general the bikes used by the public bike systems are heavier than a typical personal bike – ranging from 16kg to 22kg. Most are three speed bikes with mud guards, lights, bell, kickstand, portable lock, baskets and air filled tires. All operators agree that it is preferable to have an easily distinguished fleet. This achieved though use of a single standardized design, consistent livery [colour and distinctive logo] and a distinctive look. Broad awareness of the characteristics of a public bike increases security.

JCDecaux Cyclocity Bike

JCDecaux employs a team of 50 engineers who are constantly refining the Cyclocity bike, stations and terminals. The bikes come with a metal basket on the handlebars and are heavier than standard bicycles, built to withstand heavy use. In line with the program's green image, Vélib' maintenance staff get around town on 130 electrically assisted bicycles. A barge with 12 stops along the Seine picks up bikes in need of major repairs. Cleaning staff drive electric vehicles and use rain collected on the roofs of JCDecaux offices.

JCDecaux Vélib

Particular attention was given to a bike design that would blend elegantly in the Paris landscape. At 22 kilos (compared to about 18 kilos for a standard commercial bike), the three-speed bike is not designed for speed, but to be substantial, sturdy, and to handle approximately 18,000 kilometers a year. Particular attention was given to prevent taking on passengers. Thus, there is no back rack, no horizontal frame bar, and no child seat option.

The shifting, dynamo and break system are all located inside wheel hubs. Control chips inside the bikes report on their condition, as well as on tire pressure and on the bright LED lights, directly to the central computer via the docking stand. If a bike is defective, it remains automatically locked on its stand (a red light appears) until the mechanic clears it. Bikes returned to the stand for less than a minute stay locked for inspection as well. The bike comes with its own lock for intermediate stops. The bikes are 3 speed "roadster"-type bikes.

Clear Channel SmartBike

The new public bikes carry a significantly higher price point than the tourism systems like Copenhagen with bikes made in Taiwan at an average cost of $230. The bikes used in Paris cost around $2,000 apiece. They're embedded with electronic tracking devices, and a computerized system monitors the inventory at each station. Popular commuter bikes retail for between $500 and $1000 in North America.

Table 13.1 Comparison of Bike Weights

System	Weight
Lyon	25.2 kg
Paris	22 kg
Barcelona	16.8 kg
Standard commercial	18 kg

The City Council in Barcelona collaborated with B:SM on the design for the Barcelona bikes. The bikes are amongst the lightest in use (they only weigh 16.8 kg) and incorporate a wide, ergonomic

handlebar. The bikes have three speed gears, a bike stand, anti-slip pedals, a lighting system and both front and back brakes. They are made from steel and aluminium for durability.

Clear Channel is currently in the sixth evolution of their SmartBike in ten years. The bike is the lightest on the market, weighing only 16 kilos. Weight is one of the main concerns of users as a lighter bike improves accessibility for everybody as it requires less effort to pedal. The bike seats are adjustable to accommodate riders of different heights. Other special features include a small front wheel that makes it more manoeuvrable, but is also quirky enough to discourage theft. The bikes also have automatic lighting for night riding.

Barcelona has recently introduced the next generation of bikes which feature a new more robust gear shift and have replaced the front brake with a drum brake. Drum brakes work better in the rain, don't need as many adjustments and are less likely to be stolen than brake pads.

13.2 Automatic Bike Gears

Automatic bicycles have been in the pipeline for many years, but have only recently become commercially available. First steps toward the development of an automatic gear system for bikes were taken in the 1970s, when American manufacturer Browning released details of a unique shifting mechanism incorporating a hinged sprocket. Until that time, this Seattle-based company was most famous for building machine guns. Browning initially employed its system on BMX bikes and then in the late 90s, began successfully integrating it into comfort and mountain frames. Today there are several types of automated gearing systems to choose from. Although moving a lever isn't exactly hard work, finding the ideal gear can be tricky and even experienced cyclists tend to undershift or overshift from time-to-time. An automated system takes the guesswork out of which gear to choose and the resulting changes are surprisingly smooth rather than clunky.

Major bicycle makers including Giant, Raleigh and Trek have all introduced hybrid models in North America that incorporate a simplified three-speed multi-mode version of the Shimano automatic system. Most automatic systems either use batteries or rely on a front hub generator to provide power, and can be overridden by dialling in a manual mode if the rider wants to take control of the shifting. Auto transmissions add weight to a bicycle compared to standard derailleurs and are best suited to commuting or recreational riding.

13.3 Electric bikes

Intrago Electric Bikes

Beginning next fall, the University of Washington will partner with private sector company Intrago to provide electric bikes for students and faculty members across campus. Forty Intrago bikes — which can be pedalled or ridden as electric scooters — will be spread across campus and available to be checked out. Each bike can go 25 miles on a charged battery, more if it's pedalled. And the bikes will not be restricted to use on campus.

Under the plan, there will be four stations spread across campus where the bikes can be charged, 10 at each station. The program is being partially funded by a $200,000 grant from the state Department of Transportation as part of a $1 million trip-reduction program.

The UW has made efforts to persuade students and faculty not to drive to campus, and the majority of the university community uses an alternative to driving alone: 23 percent walk, 21 percent take the bus, 10 percent use a car pool or van pool, 8 percent bike, and only 33 percent drive alone during peak commuting time.

In 1990, the UW issued 6,440 single-occupancy parking permits; last year that number dropped to 3,794. In that same period, the price of parking has risen from $72 per term to $254 for a term pass.

The difficulty has always been that "last-mile" service, getting students and faculty from the bus stop, or the car-pool drop-off, to their ultimate destination.

Under the UW plan, which is still in the works, the users, who would pay a yet-to-be-established fee, would go to a bike station, present a key and enter a PIN to unlock a bike. When the ride is over, the bike could be returned to a docking station.

UW wants to build upon the success of a robust transportation-management program. People will know they have a local vehicle once they get [to campus].

The electric bikes could cost from $1,000 to $6,000.

14 Stations

14.1 Locations

When stations are visible it increases the number of users. When they are placed on the road side or in proximity to public transit hubs or major destinations it increases the likelihood they will be seen and the service tried. Many of the stations in Paris are near historical landmarks and required approvals from the Department of Architecture and Heritage and most of them are located on converted parking spaces. About 15 to 25 meters long, each station displaces three to five parking spaces – or roughly 6,000 parking spaces in total. There is a bike station located close to each Metro station in Barcelona with a 20 bike capacity. In high traffic areas two or even three, 20-bike stations are grouped together.

Bicing Terminal

In the German cities with CallBike systems and in the UK OYBike systems there are some larger bike stations at major transit hubs – some with spaces for up to 200 bikes. This difference in station location strategy conforms to the differences in system objectives – the German and UK systems are first extensions of the public transit system and second intra city mobility, while the French systems are intended to support general mobility between high trip volume origins and destinations within the city centre.

A station may also be used to indicate the start of a cycling lane. Proximity to bike lanes or roads that are cycle friendly is also a factor in reducing overall trip time for cyclists.

User suggestions from Barcelona include linear station design (like grocery carts or airport luggage carts) where the bikes lock to each other thereby permitting a station to grow in numbers based on actual demand.

14.2 Network Configuration

The 300 meter rule seems to have gained some traction in shared bike system network design. Vélib opened in July with 10,648 bicycles and 750 stations; by December of 2008, the system will have 20,600 bicycles and 1,451 stations – or one every 300 meters in central Paris.

A user in Barcelona notes that the uniform distribution of 20 bike stations across the city does not always correspond to demand patterns by location. For example Barceloneta beach may need not twice as many stations but ten times as many [space for 200 bikes vs. the current 40]. Stations on the borders should have more bikes – and the network should differentiate better between residential and office zones. A node to node system based on actual origin-destination would be a more effective way to design the system.

The London OYBike system is based on the availability of rental bicycles at key locations:

- Tube stations
- Public buildings
- Key transport interchanges
- Car Parks

It is based on a smaller, low-cost station design with typically 1-2 bicycles per station.

14.3 Bike Re-distribution

Although the Paris system was planned with about 70 percent more parking stands than bikes in operation, the even distribution of bikes and open stands at stations remains the main challenge of the system. Optimizing station sizes and locations presents an interesting challenge to system planners. In Paris, the plan was done by the Atelier Parisien d'Urbanisme (APUR). Because it was difficult to predict where pick ups and drop offs would concentrate, the system operator has staff with 20 compressed natural gas (CNG) vehicles dedicated to shifting bikes from full to empty stations. The average truck makes a dozen or so trips per day.

An optimized network needs more than large numbers of conveniently located stations; it must also anticipate the asymmetric travel demands of most large cities. Not surprisingly stations located at the top of hills are chronically empty of bikes – as the customers ride down the hill but do not wish to make the return trip up hill. Bikes also tend to collect in stations in the city centres and stay there. Ideas for re-balancing the system, other than a dedicated team with a vehicle, can include a premium to return bikes at a lower elevation or conversely a credit for each bike returned to a higher elevation. Vélib introduced such a program in early 2008.

Vélib bike redistribution

Trondheim, a university town and also Norway's third largest city, has more cycling traffic than all the other Norwegian cities. 90% of the 30,000 students use their bicycles as their main source of transportation. This fact is slightly surprising because the city's geography is anything but flat. In an effort to promote cycling, the city has invested roughly NOK 20 million ($3.2 million) over the past 20 years to create a cohesive network of bicycle infrastructure in the city.

One of the most important - and unusual - infrastructure elements is the bicycle lift 'Trampe'. 'Trampe' works much like a ski lift except that it is integrated into the bike path. To use it one needs a key card which can be obtained from the nearby bicycle repair shop. At the bottom of the steep 130 meter long hill cyclists place their right foot on the lift and receive a push which transports them upwards at a comfortable speed of 2 meters per second. Since its introduction in 1993, 'Trampe' has assisted more than 220,000 cyclists. According to a recent survey, 41% of the lift users claim they're using the bicycle more often because of 'Trampe'.

Other alternatives might be to include electric assisted bikes in stations adjacent to hilly areas or to increase the capacity for transit vehicles on parallel routes to carry public bikes and their riders at no additional charge.

15 System Information

15.1 Hours of Availability

The general mobility systems typically offer 24/7 service while the last mile systems may operate on modified business hours.

15.2 Bike and docking availability

All of the major systems provide real time information on available bikes and empty stands by terminal over the internet. Most also include maps with bike lanes marked, and some provide weather updates.

In Paris if a station has no empty stand, 15 minutes of free time can be added in order to reach the next station by swiping the smartcard or logging into the terminal. The terminal also shows the status of nearby stations and their current number of empty slots. Paris planned for 70% more stands than bikes.

16 Cycling Infrastructure

Surveys indicate that providing bicycle lanes and paths may encourage more people to commute by bicycle. The presence of a striped lane or separated path can increase a cyclist's perception of safety. With growing concerns over traffic congestion and vehicle pollution, public policy makers are increasingly promoting bicycling as an alternative for commuting and other utilitarian trip purposes. States and local spending on bicycle facilities has increased significantly over the past decade. Previous studies have linked higher levels of bicycle commuting to various demographic and geographic variables. At least one analysis showed that cities with higher levels of bicycle infrastructure (lanes and paths) also saw higher levels of bicycle commuting. This research affirms that finding by analyzing data from 35 large cities across the U.S. This cross-sectional analysis improves on previous research by including a larger sample of cities, not including predominantly 'college towns,' and using consistent data from the Census 2000 Supplemental Survey. While the analysis has limitations, it does support the assertion that new bicycle lanes in large cities will be used by commuters[13].

London announces plan to spend £400,000 to stimulate 400% increase in cycling

Based on the experience in Barcelona it is not necessary to have extensive dedicated infrastructure in place prior to launching a mainstream shared bike system, but it is probably preferable. In the months following system start up there were reports of frequent issues with cyclists using the sidewalks, creating hazards and stress for pedestrians. Increased policing and enforcement helped, but the lack of facilities remains a user complaint. In 2006, 35,000 bike trips were registered, of which 88% were internal (start and finish in Barcelona). The city has 128 kilometres of bike lanes in its urban network. An additional 22 kilometres are planned to be installed for the year 2008. Of interest is the fact that 53% of Barcelona's road network is car-free.

Nearly all communities with high levels of bicycle transportation have extensive path and bike lane networks. One study found that each mile of bikeway per 100,000 residents increases bicycle commuting 0.075 percent[14]. Investment in improved cycling facilities is consistently ranked as the number one factor in increasing cycling. In [city] bicycle commute mode share is 2% in areas with cycling facilities vs. 0.2% elsewhere in the region[15].

16.1 Europe

Research undertaken by the Dutch Social and Cultural Planning Office (2006) indicates that municipalities boasting good cycling infrastructure and a well-developed cycling culture have a larger number of cyclists than other places. In the Netherlands, cycling is one of the most popular forms of transport. In the capital, Amsterdam, 40 per cent of all traffic movements are by bicycle, bike rental is available throughout the city and the bike parking ramp at Central Station accommodates about 7000 bikes. Bike lanes and paths often have their own traffic signals.

By 2010 Lyon will have increased its cycle network from 300 to 500 km. They have added 500 additional bike parking spaces since 2004 bringing the total number of spaces to 2700.

[13] Dill, Vorov 2007
[14] Nelson, Allen 1997
[15] Barnes, Thompson, Krizek 2005

30 km/hour 'slow streets' an important component of bike networks

The Vélib revolution began with doubling the amount of cycleways in Paris, making a fairly coherent and continuous network. To slow traffic, street directions were revised to carefully eliminate all through-routes, making vehicles exit back onto the avenue from which they entered. The legal speed limit was lowered to 30 km/h from 50 km/h. On most of these slow speed one-way streets, cyclists are allowed to use the road in both directions. A network of pedestrian-priority shared streets was also created, where the legal traffic speed was lowered to 15 km/h. Free parking was eliminated altogether.

Under the program, 24 million Euros were invested (about 260 Euros per square meter) into widening sidewalks from 4 to 8 meters, planting trees, and building bikeways. Granite separators were put in to protect a new dedicated bus lane. To accommodate deliveries, 30 minute truck parking spaces were placed on the curb-side of the bus lane. Intersections were made safer with secured crosswalks, widened median refuge islands and extended crossing phases for pedestrians. New pavement, landscaping, and street furniture were added to sidewalks and plazas. Businesses signed "charters of quality," harmonizing displays and signs, and promoting good public space practices.

Some German cities such as Münster and Saarbrücken have a dense network of on- or off-street bicycle lanes on all main streets. In these cities, making one-way streets for cars accessible for cycling in both directions offers cyclists shorter journeys without detours. Modification to the German road traffic code in 1998 officially permitted use of this measure.

In Finland, the Ministry of Transport and Communications has developed a Cycling Policy Programme which gives priority to the development of a cycling network, particularly in urban areas, and aims to promote cycling and increase its modal share. The Ministry allocates funds to the Road Administration and Road Enterprise for this purpose.

Policy in Norway focuses on constructing continuous cycling networks in cities. For the period 2002-2005 the plan is to build 230 km of cycle and foot lanes. Norway also plans to allow cyclists to ride both ways on one-way streets for a test period of one year in some cities. After the test period, the results will be evaluated to determine whether it should be made a permanent arrangement.

In February 2008 officials in London England announced a £400m cycling infrastructure program intended to stimulate a 400% increase in the number of people cycling in London by 2025. Twelve special networks will link residential areas to schools, train and bus stations, parks and shops and to the city centre.The routes will have continuous, wide cycle lanes, dedicated junctions and clear signs. Local authorities will also be asked to introduce 20mph speed limits and remove all road humps so motorists and cyclists are travelling at roughly the same speed. It is hoped the first of the cycleways and suburban networks will be complete by 2010, with another five ready for the start of the Olympics in 2012.

16.2 North America

Many aspects of Portland encourage bicycle use including bike lanes, bike traffic signals, and route markings. Portland's current bikeway network consists of 185 miles (existing 150 miles – planned and funded 30 miles) of bicycle lanes, bicycle boulevards, and off-street paths. 69% of streets today have appropriate bikeway facility - facilities that are appropriate to the street classifications, traffic volume and speed on all rights-of-way. The numbers of riders in the city has quadrupled since the early 1990s. Bridge counts show that bicycle trips represented just 2% of all vehicle traffic on the

bridges in 1991, and now represent approximately 10% of all vehicle trips. Bicycle use on these four bridges has grown 322% since 1991, while automotive trips have not increased at all.

Philadelphia has 225 miles of bike lanes and 99 percent of transit buses have bike racks. Biking has increased six percent in the last 17 years and cyclists in Philadelphia travel 260,000 miles on a daily basis.

Green bicycle lane in Chicago

The City of Chicago began construction in early 2008 of more than 70 miles of new bikeways, helping to implement the City's vision to make bicycling an even safer and more convenient form of transportation. The city currently has more than 110 miles of designated bike lanes and 21 miles of shared lanes.

Four types of bikeways will be installed:

- Colored Bike Lanes--Green bike lanes will be established at eight locations for the first time in Chicago. Colored bike lanes alert motorists and bicyclists of conflict areas assigning the right-of-way to bicyclists. Increasing the visibility of bicyclists helps to reduce the number and severity of conflicts between motor vehicles and bicyclists.
- Bike lanes--4.5 miles of new bike lanes will be installed bringing Chicago's total bike lane network to 113 miles. Bike lanes provide bicyclists with five to six feet of dedicated space on the roadway for safe bicycling.
- Marked shared lanes--eight miles of new marked shared lanes will be installed bringing Chicago's total marked shared lane network to 19 miles. Shared lane markings, installed on roads too narrow for bike lanes, identify wide curb lanes for bicyclists and motorized vehicles to share.
- Signed bike routes--60 miles of new signed bike routes will help identify the best streets for bicycling, providing distance and directional information to major destinations. These new signed routes will increase Chicago's existing network of signed bike routes to over 225 miles.

16.3 Bicycle facilities

Findings from Oregon DOT suggest that effective walkway and bikeway networks are best achieved by modifying the existing street system, rather than trying to create a separate network, for several reasons:

- **The street system already exists:** most streets have been in place since before the wide-spread use of the automobile. Many resources have been dedicated to creating this system. Creating a totally new infrastructure for pedestrians and bicyclists is not financially or physically feasible;
- **Streets take people where they want to go:** virtually all destinations are located on a street, such as homes, businesses, shops and schools. People walking or bicycling need access to these same destinations; and
- **Streets can be made safer:** most bicycle crashes are not a result of collisions with motor vehicles; bicyclists riding responsibly with traffic are at relatively low risk. Pedestrians are safer and more secure when they are on sidewalks and visible.

16.3.1 Intersection Facilities

Perth incorporates three types of facility at intersections that make travel easier for cyclists:

1. Bicycle-crossing lights

These work in the same way as pedestrian lights, but have a red and green bicycle symbol instead of a human figure – when the bicycle symbol is green, cyclists are permitted to ride across the intersection. If a crossing does not have lights with bicycle symbols, the rider must dismount and walk across.

Perth bike crossing lights

2. Detection points

Traffic lights have loops of electrical wire embedded in the road surface that act like metal detectors and inform the signalling equipment when a vehicle is waiting. Because bicycles contain much less metal than cars or motorcycles, in order to be detected, they must be situated directly over the area of maximum sensitivity, which usually occurs along the centre line of each lane. This area of maximum sensitivity is shown at most traffic signals by a row of white painted diamonds and a small bicycle symbol.

3. Head Start Advanced Stop Line

Consisting of a green-painted shoulder lane leading into a green-painted stopping zone at the traffic signal, it provides some dedicated space for cyclists in front of motor vehicles, where they can wait while the light is red. This facility makes riders more visible to drivers, and when the appropriate light or arrow becomes green, it gives them a head start to turn right. The head start facility may also include a special push-button to enable cyclists to activate a green turn arrow if no other vehicles are present.

16.3.2 Types of bike lanes

Copenhagen-style bike lane

Named after the lanes pioneered in the Danish capital, the bike lane runs alongside the footpath, placing parked cars between the cycle lane and traffic.

Contraflow bike lanes

While bike lanes should normally carry bicyclists in the direction of traffic, there are some locations where there is a strong demand for bicyclists to travel against the normal flow of traffic, or to travel in both directions on a one-way street. For example, University Avenue in Madison, Wis., runs through the heart of the University of Wisconsin campus and carries heavy flows of bicyclists and other road users. Because of the high demand for bicycle travel in both directions, several years ago the road was rebuilt with a bus lane, bike lane and three travel lanes in one direction and a bike lane only (separated by a raised median) in the other direction.

A number of communities have created short segments of contraflow bike lanes in order to provide bicyclists unique access to residential streets. For example, the cities of Madison and Portland have both used this technique to open up a network of routes on residential streets that are not accessible in both directions to motor vehicles-essentially creating a very short stretch of roadway that is two-way for bikes but only one-way for cars.

Colored bike lanes

Colored bike lanes have been a feature of bicycle infrastructure in the Netherlands (red), Denmark (blue), France (green) and many other countries for many years. In the United Kingdom, both red

Bike lanes in Denmark

and green pigments are used to delineate bike lanes and bike boxes. The most extensive trial of this design took place in Portland, Ore., where a number of critical intersections had blue bike lanes marked through them.

Shared bike and bus lanes

A growing number of communities are using shared bus and bike lanes to give preferential treatment to both bikes and public transport. Examples currently include Tucson, AZ; Madison, WI; Toronto, Ontario; Vancouver, BC; and Philadelphia, PA. Often the lanes are also able to be used by taxis and right-turning vehicles. Because buses and bikes will pass each other in these lanes, lane width is an important issue. The city of Madison likes to use 16 foot lanes to allow a clear three feet of separation between the bicyclist and a passing bus, but if either bus or bike traffic is light and space is limited, the width of a shared lane might be 14 feet or even less[16].

16.4 Trade-offs

Developing urban bicycle lanes often involves a trade-off with on-street parking. There are three justifications for choosing bicycle lanes over automobile parking in such situations:

1. *Equity.* Local roads are funded through local taxes that residents pay regardless of their travel patterns. It is only fair that bicyclists receive a share of road space and funds.
2. *Priority.* Mobility is the primary function of public roads, and is the justification for devoting public land and financial resources to them. Vehicle storage (i.e., on-street parking) can be considered a less important function than traffic movement, since off-street parking can be supplied by private firms. Since bicycle lanes can improve traffic flow for both bicyclists and motor vehicles, such facilities deserve higher priority than on-street parking
3. *Parking efficiency.* Reduced automobile parking capacity that results when on-street parking spaces are converted to bike lanes can be offset if the bike lanes result in reduced automobile trips. For example, if 80 automobile parking spaces are converted to bike lanes which results in an average daily shift of 100 commute trips from automobile to bicycle, there would be a net *gain* of 20 parking spaces[17].

[16] Pedestrian and Bicycling Info Center
[17] Litman 2005

17 Costs

17.1 Capital Costs

Beyond the infrastructure costs for bike lanes, signals or cycle paths, which can be significant but are typically funded by the sponsoring municipality, the majority of capital costs for PBS implementations are in the bike stations and kiosks associated with a fixed terminal system. As most of the stations are located on public lands, property acquisition costs are limited to the maintenance facilities. Non-fixed systems such as the cellular phone activated OYBike [UK] and CallBike [Germany] avoids the bulk of station and terminal costs as each bike carries its own access technology and locking device and can be locked to any appropriate structure. However, fixed stations are emerging as the preferred configuration as they guarantee users can locate bikes or stands as needed.

JCDecaux reports that the Paris installation of the first 750 stations required 150 installation teams working in parallel and management of 20 civil engineering subcontractors with the installation completed in 4 ½ months. 1,000 terminals and 35,000 bicycle stands were produced.

Table 17.1 A Comparison of Capital Cost by System

	Paris	Tel Aviv	Barcelona	Montreal
Bikes	20600	2000	3000	2400
Stations	1451	100	194	300
Access System	Smart card	Smart Card	Mobile phone	TBD
Capital Cost	$130 million	$4 million	NA	$15 million
Average Cost/Station with Bikes	$90,000	$40,000	NA	$50,000

Table 17.2 A Comparison of Operating & Financing Structures

	Advantages	Disadvantages	Example
DBOMF Public Private Partnership Design, Build, Operate, Maintain, Finance	All logistics handled by the private sector partner Partial control by public owner during some phases of project Relieved of operating detail and performance risk	Loss of revenues from advertising Risk of public backlash to increased levels of outdoor advertising Difficult to enforce performance standards	Paris
DBOM Design, Build, Operate, Maintain	Partial control by public owner during some phases of project Retain control of public spaces Relieved of operating detail	Competition for public funds Difficult to assure performance standards	Barcelona
Design Build	Complete control through all phases of the project. Retain control of public spaces Complete control over network configuration, performance, pricing and marketing details	Competition for public funds Assume all Operating Risk	Munich, Berlin, Frankfurt

17.2 Operating Costs

Maintenance costs in Lyon's bike-share program are reportedly about $1400 per bike per year. DB Rent estimates their maintenance costs at $868 per bike per year. See Volume 3 – Business Strategy for complete business model and assumptions.

18 Financing Models

Most systems are subsidized, with the shortfall between user fees and total costs made up through general revenues, advertising revenues, parking revenues, government grants or sponsorship.

18.1 User Fees - Subscriptions

Subscription and rental fees from system users are collected by all the major shared bike systems. The revenue directly generated by Vélib subscription and rental fees is expected to be in excess of $44 million a year. In Barcelona 100,000 subscriber registration fees alone will generate $3.5 million in revenues while in Lyon 15,000 subscribers will provide $100,000 in registration revenue.

18.2 General Revenues

Transit agency funding is a likely source of mainstream PBS operating funds. In Barcelona the city pays $6.6 million per year for its 3,000 bike program. MN: B:SM is the public company in charge of administration. A large part of the financing comes from the surplus of the *Área Verde*, or Green Area (road side parking revenues). Another part comes from subscriptions. German Rail also supports their public bike systems through a combination of general revenues and user fees.

18.3 Outdoor Advertising Rights

Clear Channel pioneered the concept of providing bike systems in return for advertising rights with the introduction of the Velo a la carte system in Rennes France ten years ago. Velo was implemented as a partnership between the commercial company Clear Channel Adshell and the City of Rennes with the goal of providing a sustainable form of urban transport. The system began with 200 bicycles and 25 docking stations in the city centre. Many of the bicycles loaned are located at a bus interchange point following a park and ride pattern and 69% of users are using the bicycles along with other means of transport.

The other major player in the 'bikes for ads space' is JCDecaux who currently operate 15 public bike systems in Europe. In Paris the Vélib system is privately operated by SOMUPI, a joint venture owned by JCDecaux, an outdoor advertising and street-furniture multinational, and Publicis, a large advertising and communications corporation. Most profits are derived from billboard advertising. SOMUPI is responsible for covering the entire cost of implementing and managing Vélib, as well as any additional fees. In return, it receives exclusive rights to provide and operate the bus shelters, public announcement boards, and other street furniture, which then serve as the physical support for 1,628 advertising boards – placed on sidewalks. The consortium also has to pay for the billboards, street furniture, and up to 32 million in space rental fees to the City. Decaux separately said that they expected the 1,628 billboards to earn 60 million Euros per year for SOMUPI
If SOMUPI meets all contractual standards of good operation of the system, it is entitled to revenue sharing of 12 percent of Vélib revenues plus payment by the city of an amount equal to 12 percent of advertisement sales, i.e. about 10 million Euros.

Oregon Share the Road License Plate

18.4 New dedicated revenue sources

Oregon has recently introduced an optional License Plate surcharge with a portion of the proceeds to cycling. The 2007 Legislature approved a Share the Road license plate, which just became available. Available for the regular vehicle registration fees, plus a $10 premium, proceeds are split between the Bicycle Transportation Alliance and Cycle Oregon. The money is to be used on bicyclist education.

19 Funding Options

Most current government funding for non-motorized transportation is oriented toward:

- Infrastructure investments
- Walking/cycling encouragement
- Safety programs

Public bike share services do not quite fit into any of these categories, although program start-up may be considered comparable to a facility investment, and program operation can be considered comparable to an encouragement program.

19.1 Green Municipal Fund

The Federation of Canadian Municipalities offers low-interest loans combined with grants to support municipal governments in developing communities that are more environmentally, socially and economically sustainable. Cycling infrastructure might qualify for funds under this program. The RFP for Transportation sector projects will be released in August 2008.

19.2 Urban Transportation Showcase Program (UTSP)

The Transport Canada *Urban Transportation Showcase Program* has provided match funding for programs that demonstrate sustainable urban transportation leadership and innovation. These are selected to:

- Support the development and integration of strategies, transportation planning tools and best practices so as to reduce GHG emissions.
- Demonstrate, measure, and monitor the effectiveness of a range of integrated urban GHG strategies.
- Evaluate the effects of these strategies for other important policy objectives to build strong cities (smog reduction, congestion relief, improved public transit infrastructure).
- Establish a comprehensive and pro-active national network for the dissemination of information on successful GHG reduction strategies for sustainable urban transportation.

PBS projects may qualify for Sustainability Funding

Some UTSP projects encourage active (non-motorized) transportation (including the Toronto Community Bikeshare Network. However, there does not appear to be any current funding.

19.3 BC Cycling Infrastructure Partnerships Program (CIPP)

The BC Ministry of Transportation and Highway's *Cycling Infrastructure Partnerships Program* provides provincial funding to local governments for the construction of new transportation cycling infrastructure that reduces automobile travel. Funding appears to be limited to trails and paths that are part of the provincial cycling network. Parking and other end-of-trip facilities are specifically excluded.

19.4 TransLink Bicycle Infrastructure Capital Cost Sharing Program (BICCSP)

TransLink's Bicycle Infrastructure Capital Cost Sharing Program gives priority to utilitarian transportation, as described below. Public bike services seem to meet that objective. TransLink can provide as much as 50% of project funds.

"TransLink is focused on facilities that connect specific land uses to enable utilitarian trips by bicycle such as commuting to work, shopping, and personal errands. Each municipality develops a network of bicycle routes, designated streets, connecting paths etc. In respect of this, TransLink has tied funding eligibility to a target market of utilitarian cycling rather than to a specific engineering solution such as bike lanes. The funding criteria exclude recreational facilities, meaning pathways or road space that does not connect (or will not form part of a connection) to/from the land uses specified below." (*Bicycle Infrastructure Capital Cost Sharing Program Funding Guidelines & Project Evaluation Criteria*, 2002)

The list of eligible costs excludes street furniture and vehicles (which probably includes bicycles), but does not specifically exclude bicycle racks. Table 19.1 discusses how public bike services might be rated according to TransLink bicycle project evaluation criteria.

Table 19.1 TransLink Bicycle Project Evaluation Applied to PBS

Criteria	Public Bike Service
Opportunity: *Preference will be given to projects that arise as a time limited opportunity owing to the timely initiation and completion of another project.*	In general this does not apply, but it may if a particular public bike project has a deadline.
Term of Project: *Projects that will result in the completion of a route will be given preference over projects in the same municipality that require several years further development*	Probably does not apply.
Directness & Travel Time: *Preference to projects that provide direct connections to schools, shopping, employment, community centres*	This might apply, since public bikes do tend to provide utilitarian transportation to such destinations.
Barrier Removal and Connectivity: *Preference given to projects that fill gaps, overcome barriers on a high demand travel corridor*	This might apply, since public bike programs do fill gaps (people want to bicycle but lack a bike) and serve high demand travel corridors.
Intermodal: *Preference given to bike routes that connect with transit*	This certainly applies, since public bikes tend to integrate well with public transit.
Safety: *Improvements that address significant safety concerns will be considered higher priority.*	This probably does not apply.
Value: *Preference for projects that offer high benefit at modest cost*	This may apply, depending on the analysis. Public bike programs may be considered cost effective if government costs are modest and if the analysis considers all the benefits of shifting travel from driving to alternative modes.

19.5 2010 Legacies Now

Dedicated to strengthening arts, literacy, sport and recreation, physical activity and volunteerism in communities throughout BC leading up to and beyond the 2010 Olympic and Paralympic Winter Games. PBS funding could be considered in conjunction with programs such as the 20% challenge.

19.6 BC Innovative Clean Energy Fund

The mandate of the Innovative Clean Energy (ICE) Fund is to accelerate the development of new energy technologies that have the potential to solve real, everyday energy and environmental

issues and create significant socio-economic benefits for all British Columbians. While the base technology of a PBS is not new per se, the mass deployment of a 3rd generation PBS could be interpreted to fall within the category of Energy Use. ICE funds directed to this area are intended to help improve the ways energy is used in BC communities.

19.7 ACT Now

ACT Now is led by the Ministry of Health and involves all provincial ministries as well as key external partners, including 2010 Legacies Now, the Union of BC Municipalities, the BC Recreation and Parks Association, and the BC Healthy Living Alliance.

It is a cross-government health promotion initiative that seeks to improve the health of British Columbians by taking steps to address common risk factors and reduce chronic disease. ActNow BC supports schools, employers, local governments and communities to develop and promote programs that make healthy choices the easy choices for all British Columbians.

ActNow BC's goals by 2010 that could be supported by a public bike system include:

- increase the percentage of the B.C. population that is physically active by 20 per cent;
- reduce the percentage of B.C. adults who are overweight or obese by 20 per cent

Cycling is a health benefit at any age

Other potential funding sources include:

19.8 Carbon Credits

In step with the dramatic rise in C02 emissions and other pollutants in recent years, a variety of new financial markets have emerged, offering businesses key incentives — aside from taxes and other punitive measures — to slow down overall emissions growth and, ideally, global warming itself.

A key feature of these markets is emissions trading, or cap-and-trade schemes, which allow companies to buy or sell "credits" that collectively bind all participating companies to an overall emissions limit. While markets operate for specific pollutants such as greenhouse gases and acid rain, by far the biggest emissions market is for carbon. In 2007, the trade market for C02 credits hit $60 billion worldwide — almost double the amount from 2006.

VANOC is talking about purchasing carbon offsets at an estimated cost of $4.9 million. Based on figures provided by JCDecaux the average CO2 saving per bicycle trip is 200 gm less CO2 per km travelled. If emission credits were to reach $30 per tonne this would represent about 7.2¢ per liter gasoline. Assuming that under urban conditions vehicles consume about 14 liters per 100 kms this equals about 1¢ per motor-vehicle-mile reduced, or about 15¢ per day per public bike if ridden 15 kilometers per day and each bike-kilometre substitutes for a automobile-kilometre.

20 Operating Models

There are numerous ways to administer a shared bike program. It can be operated by a government agency at the municipal or regional level (as in the case of Germanys national rail company), by a for-profit company (like JCDecaux is doing in France), or by a non-profit organization (as in the case of the City Bike Foundation of Copenhagen).

The system in Copenhagen is run by the nonprofit City Bike Foundation. The city provided 115 public spaces for the bike stands and advertising billboards at each station. In a ten year deal signed by JCDecaux in 2002 for rights to the advertising space, the foundation receives a guaranteed payment of $400,000 per year. New bike purchases are partially funded by sponsorship at an annual rate of $345 - $510 per bike. The Danish government and a number of public sector companies have joined the sponsorship program however they have had difficulty attracting private sector sponsors. The Foundation pays Reva, another social agency $100,000 a year for maintenance.

DB Rent, a subsidiary of the national rail company Deutsche Bahn operates the CallBike systems across Germany in cooperation with each city. While start up costs are approximately $1520 per bike, annual maintenance is fixed at $1,520,622 or about $866 per bike. This puts the total cost of operation in the first year at about $2390 per bike.

Lyon has a 13 year contract with JCDecaux (2005-2018) for the design, build, operation and maintenance of the Lyon public bike system. Lyon estimates the value of the public advertising rights at $27.8 million a year. Start up costs for the system were an estimated at $4.6 to $9.2 million or $2300 – $4600 per bike and annual maintenance at 9.2 million ($4600 per bike)

As PBS gain acceptance as a legitimate component of an overall public transit system there are compelling reasons to retain control for operations within the local transit or transportation agency [although this does not preclude contracting out the operations functions]. In addition, if regions are to optimize the utility of this micro travel mode at both origin and destination points on commuter lines then it is equally important that the agency with overall responsibility be at the regional, and not the municipal level. This issue is currently playing out in Paris and its surrounding suburbs. The implication for Metro Vancouver is to suggest that PBS service be added to the current line-up of TransLink services, and deployed in the regions municipalities on the basis of agreed to neighbourhood characteristics. See Volume 2 – Local Context Analysis

21 Safety Issues

21.1 Injury through accident

The risk of injury through accident is a major concern for cyclists traveling with or adjacent to vehicular traffic and one of the most frequently cited deterrents to commuter cycling. Research completed in Vancouver in 2006 put the following four factors among the top 6 deterrents: the risk of injury from car-bike collisions; the risk from motorists who don't know how to drive safely near bicycles; vehicles driving faster than 50 km/hr; and streets with a lot of car, bus, & truck traffic[18].

Studies of patterns of injuries and ridership in California, Australia, and Europe, between cities, within cities, and over time consistently support the principle of safety in numbers: both traumatic death rates and injury rates are lower where cycling modal shares are higher[19]. North America-wide data found that lower cycling fatality rates were associated with higher cycling modal share in comparisons across 59 Canadian provinces and American states[20].

The principle of safety in numbers is consistently supported

Cycling infrastructure in Canada and the United States varies between and within cities, but commuter cycling generally follows a strong pattern of being on road, beside both moving and parked motor vehicles. In contrast, northern European cities offer more dedicated cycling infrastructure alongside roads, but separated from motorized traffic (e.g., with medians, curbs, or other barriers). The relative merits of these two styles of infrastructure from a safety perspective are the subject of a great deal of debate. As an example, a California transportation engineer, John Forester, has advocated cycling on roads in vehicle lanes with cars as the safest mode of travel ("vehicular cycling"). His thinking has been integrated in part into North American transportation planning.

Statistics are not readily available for the incidence of car-cyclist or cyclist-pedestrian accidents in Paris or Barcelona since the opening of their systems, but anecdotal evidence supports the findings of the commuter cycling studies discussed above, i.e. increasing the number of cyclists reduces the accident rate overall. Alex Doty, the executive director of the Bicycle Coalition of Greater Philadelphia, believes that bike sharing makes biking in general safer. "If you double the number of bikers on a street, crash risk falls for each bicyclist by 33 percent," he said.

The first fatality involving a Vélib bicycle occurred on 18 October in the 13th arrondissement. The cyclist was struck by a truck near the corner of Boulevard de la Bastille and quai de la Rapée. The accident was caused when the driver of the truck could not see the bicyclist due to the "blind spot".

While the majority of Paris bike lanes are dedicated to bikes, there remain many that are shared between bikes, taxis, and buses. According to users riding in these shared lanes is tricky and cyclists have to compete for space with very large vehicles that do not always see the bike riders well if at all.

[18] Winters et al 2007
[19] Leden et al. 2000 and Jacobsen 2003
[20] Pucher and Buehler 2006

21.2 Personal Safety and Security

Similar to public parking lots, 24/7 public bike systems also raise issues of personal safety and security particularly when accessing the system in the evening or in less affluent areas (criminals may target sites). And like a pedestrian, a cyclist may be more vulnerable to the threat of physical attack than a mass transit customer or vehicle passenger. The incorporation of sufficient lighting and emergency call buttons into the bike stations can provide added security and act as a deterrent to would-be attackers.

21.3 Helmets

Bike helmets are not an issue in the European context as there use is not mandatory, however it is emerging as a serious question in North America and Australia where mandatory bike helmets laws have been in effect for some time. There is a considerable body of research which appears to find both in favour of and against bike helmets, with a reported 31 papers in favour of helmet wearing or legislation, compared with 32 against[21] ; but little of which specifically addresses the requirement in the context of a mainstream public bike system with appropriate levels of cycle infrastructure and driver awareness and education.

Ordinary cycling is not demonstrably more dangerous than walking or driving[22] yet no country promotes helmets for either of these modes (although there was an experiment in Japan with walking helmets for children, which demonstrated no measurable benefit[23]). Analysis of hospital admissions data also fails to support the idea that cycling is unusually dangerous: a study of hospital admissions in the UK found that the proportion of cyclist injuries which are head injuries is essentially the same as the proportion for pedestrians at 30.0% vs. 30.1% [24].

The issue of bicycle helmets has been under discussion for about 20 years. Many aspects are involved - safety, health, environment, human rights, enforcement and costs. Some believe that enforced helmet laws have discouraged cycling and the health benefits of cycling are considered to outweigh the risks. With fewer cyclists due to legislation a key question is whether society benefits from such measures.

Australia led the way in 1990 with bicycle helmet legislation in the state of Victoria. Enforcement of the legislation resulted in a drop of 36% in the numbers cycling in Melbourne, where 42% wore helmets before legislation[25]. In 1991, bicycle helmets were made compulsory in Australia and New Zealand. Dorothy L. Robinson of the University of New England analysed the effects of the law and concluded that 30-40% of cyclists gave up cycling as a direct result. What is more, Robinson found there was only a small drop in the number of serious head injuries, even though more people were wearing helmets than before.

During the same period, the number of head injuries to pedestrians, who were not required to wear a helmet, fell by 30%. The most likely cause was a highly effective national campaign against drink-driving and speeding. Fatality data also indicates a significant proportion of cyclists sustain serious injuries to other parts of the body than the head. For example, 63% sustain chest injuries. According to information from the John Hopkins Injury Prevention Centre, motor vehicles are involved in 90 to

[21] Towner et al 2002
[22] Wardlaw 2003
[23] Yamanaka, Ogihara 1996
[24] UK Dept of Health
[25] Finch, Heiman, Neiger 1993

92 percent of bicyclist deaths[26] however, the vast majority of bicycle crashes do not involve a motor vehicle; rather, 65 to 85 percent of all bicycle crashes involve falls or collisions with stationary objects, other cyclists, or pedestrians.

Data compiled in British Columbia noted most collisions happened at intersections, where there were no traffic controls, and in residential areas. The most common error among cyclists was to ride without due care. Among motorists the most frequent fault was failure to yield right-of-way.

Table 21.1 Analysis of Cyclist / Car Collisions

Fault	Cyclists	Car drivers
Operating vehicle without due care	23%	14%
Failure to yield right of way	13%	27%
Using the wrong side of the road	10%	0%

Source - Hamilton and Associates1997

Several other studies in North America have found that the primary fault in bicycle/motor vehicle collisions is approximately equally shared between cyclists and drivers. These studies also found that the single most common bicycle accident was falling without any other vehicle being involved.

According to records from the Oregon Department of Transportation the main causes of bicycle crashes are:

- Motorists or bicyclists failing to yield at an intersection (30 percent and 23 percent, respectively).
- Crashes at intersections are typically caused by one or both parties disregarding a sign or signal or failing to yield right-of-way.
- Bicyclists traveling against the flow of traffic (11 percent). Wrong-way riding involves adult and youth cyclists in similar proportions.
- Bicyclists or motorists entering or leaving mid-block (12 percent and 9 percent, respectively).
- Those injured in this type of crash are primarily young bicyclists (67 percent under the age 16) who are most often responsible for crashes due to disregard or ignorance of the law.

Safety for cyclists relates strongly to the number of people cycling and the expectation of motorists encountering cyclists. The likelihood that a given person walking or bicycling will be struck by a motorist varies inversely with the amount of walking or bicycling. This pattern is consistent across communities of varying size, from specific intersections to cities and countries, and across time periods.[27]

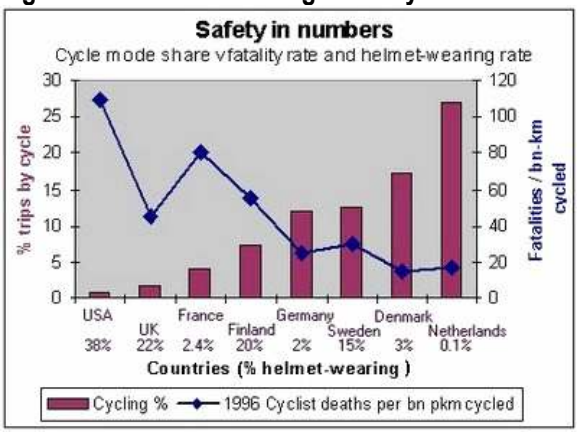
The European Cyclists' Federation believes that, instead of making it compulsory for cyclists to wear helmets, the authorities should concentrate on preventing accidents. Promoting the wearing of helmets by cyclists is not an effective way of improving safety for cyclists. Their conclusion: Road safety for cyclists can only be improved by removing the danger at its source: by calming the traffic

The Netherlands has adopted a similar approach to cyclist safety - its approach is to segregate cyclists from fast-moving and dense motor traffic. Where this is either impossible or not desirable, motor speeds will be limited to 30 kph. The Dutch already have a good record for improving safety:

[26] Johns Hopkins Center for Injury Research and Policy
[27] Jacobsen 2003

cyclist fatalities fell more than half in the 26 years to 1996, while both bicycle and car use grew - and the number of cyclists wearing helmets is still close to zero.

Figure 21.1 Helmet Wearing & Safety



Source - Pascal van den Noort 2008

Prior to introducing legislation in Australia, cycling was reported to be growing by as much as 10% per year in some areas. After legislation, surveys showed a 36% drop in the numbers riding. This effectively reduces safety for the majority of those still cycling. If cycling had continued to grow at only 5% per year over the past 15 years, the numbers riding would have doubled.

Recommendations to increase cycling safety from The European Cyclists' Federation include:

- reducing the speed and volume of motorized transport,
- supporting all measures which promote cycling,
- creating road conditions which minimize the risk of fatal collisions between motorists and cyclists,
- segregating cyclists where traffic flows or speeds are high, but lowering speeds and limiting traffic flows where segregation is either not desirable or not possible,
- avoiding complex and incomprehensible situations for cyclists at junctions

The laws that govern cyclists in the province of British Columbia are contained in the BC Motor Vehicle Act [RSBC 1996] Chapter 318 Part 3

The regulation concerning helmets is the following:
184 (1) A person commits an offence if that person operates or rides as a passenger on a cycle on a highway and is not properly wearing a bicycle safety helmet that
(a) is designated as an approved bicycle safety helmet under subsection (4) (a), or
(b) meets the standards and specifications prescribed under subsection (4) (b).

In 1996 an exemption was granted to the operator of, and each passenger carried by, a pedicab or quadricycle [need more detail on grounds for this exemption]. The City of Vancouver currently issues 30 licenses for pedicabs that operate on designated streets in the downtown business district. In the past 12 years there have been no reported head injuries by operators or passengers.

There is at least one folding bike helmet on the market. The Stashkit is one that is marketed in Europe and when folded takes up about 40% less volume than a conventional helmet would. When collapsed the helmet's crescent shape makes it easier to inside a bag, backpack or briefcase. The helmets exceed safety requirements in Europe but are not approved for sale in North America.

21.4 Awareness & Training

Most cities with formal bicycle plans have highlighted the importance of driver and cyclist awareness and training programs. Motorist behaviours that commonly endanger bicyclists include failure to yield to bicyclists, speeding, passing too closely, and opening car doors into a bicyclist's path. Cyclist behaviours that endanger themselves and others include disregarding traffic laws, speeding, failure to stop at red lights, and riding against traffic on busy streets. Typically, the goal in educating cyclists is to clarify their rights and responsibilities, teach them existing traffic law and promote safe cycling practices. For motorists it is to foster an awareness and respect for bicycling and to increase understanding about typical cyclist behaviour.

Most cities with formal bicycle plans have highlighted the importance of driver and cyclist awareness and training programs

The Chicago 2015 Plan identifies seven key objectives for the Education portion of their plan:

- Educate motorists and bicyclists to share the road.
- Deliver bicycle education programs and campaigns to target audiences.
- Establish partnerships to deliver bicycle information more effectively and at a lower cost.
- Train city staff and consultants to implement the Bike 2015 Plan.
- Produce and distribute bicycle education material.
- Reduce the incidence of bicycle theft through education and enforcement.
- Determine the effectiveness of the education and marketing initiatives in this plan.

The Portland Bicycle Master Plan identifies three education components:

- Developing safe cycling skills in children;
- Teaching adult cyclists their rights and responsibilities; and
- Teaching motorists how to more effectively share the road with cyclists

Recent announcements of a major increase in cycling infrastructure in London prompted the Freight Transport Association to call for an expanded education campaign for cyclists so that they obey the rules of the road.

21.4.1 Cycling Education in BC

According to Section 183 of the BC Motor Vehicle Act, "a person operating a cycle on a highway has the same rights and duties as a driver of a vehicle." The provision of practical cycling education is a task that has been taken on by volunteers and by independent cycling instructors across Canada. There are multiple programs for adults and children including workplace -based workshops.

21.4.2 Social Marketing

There are a number of long running social marketing programs that aim to increase the proportion and safety of trips made by bicycle and to reposition cycling in the minds of the public as a legitimate means of transport. Most of these are intended to both encourage and educate cyclists and the general public. Ongoing campaigns include programs like Decide to Ride in Portland, Oregon; and Cycle Instead in Perth, Australia; annual programs like Bike Month and other special events are now held in most major cities.

22 Policy and Legislation

A key difference in policy between Europe and North America appears to be the emphasis of the European policy makers on traffic congestion, parking demand and cycling as a mode for short trips. North American policy by contrast looks at mechanisms to support distance commuter cycling including the provision of end of trip facilities.

22.1 Europe

Cycling policy objectives draw from various sectors including transportation, land-use, safety, environment, and health. Therefore a comprehensive cycling policy and planning process should involve input from a wide range of cycling stakeholders -- governmental bodies at all levels, non-governmental organizations, cycling associations and the bicycle manufacturing industry.

In 2001 the ECMT completed a review of cycling policy in 20 countries and recognized the role of cycling as a means of travel that can contribute to bringing about sustainable urban travel, defined as follows:

"Although definitions of and criteria for sustainability differ among countries and cities, most have common objectives for quality of life in urban areas that include, clean air, quiet neighbourhoods, and economic prosperity without detrimental health and environmental impacts and depletion of finite natural resources."

Improving safety and the environment appear at the top of the list of objectives for cycling policies within Transport Ministries, according to the survey. These key objectives are followed by increasing cycling's modal share, reducing congestion, improving mobility and promoting better physical health.

They concluded that a national cycling policy framework can

- articulate common objectives, goals, and a set of specific, integrated, coordinated actions among the different national Ministries and agencies (horizontally), as well as among national, regional and local authorities (vertically), and in partnership with industry, cycling associations and other stakeholders;
- demonstrate political will and commitment at the national level, thereby pushing cycling policies higher up on the policy agenda;
- raise awareness and "de-marginalize" cycling as a sustainable mode of transport;
- provide a basis for the monitoring and evaluation of cycling policy implementation by national, regional and local authorities.

The average proportion of the total number of journeys made by bicycle in Europe is, according to the ECMT, 5 %. But countries such as Denmark (18 %) and the Netherlands (27 %) prove that a much greater share is possible. Within Europe the Netherlands is regarded as the leading country for cycling and thus as a model for other countries. The Netherlands owes this reputation not just to the highest rate of cycling mobility in Europe, but also to the Bicycle MasterPlan (1990 — 1997). Other European countries have followed the Dutch model and have been persuaded by the Dutch government's attention and commitment (including financial) to a good cycling policy.

22.1.1 Barcelona

Barcelona, like many other European cities, has witnessed a steady increase in the number of cars entering the city centre. In 2005, it was estimated that there were 1,150,000 car trips which involved travel throughout the city centre, and 93% of those were seeking parking spaces. These numbers resulted in severe traffic congestion, and associated negative environmental effects.

Faced with this predicament, a new parking management scheme was introduced. Known as The Green Area Integral Parking the broad aims of the scheme were to:

- Reduce traffic and make the centre less congested, by encouraging the use of alternative means of transport and improving the city's environment
- Facilitate parking for local residents by creating parking places for them (and thus dissuading others from entering the city centre by car)
- Use public spaces in a more orderly fashion and reduce the amount of illegal parking

Revenues from The Green Area Integral Parking are used in part to fund the public bike system.

22.1.2 Paris

Policy support for the Vélib system can be found in the city's 15-year Sustainable Mobility Plan. The 2020 objectives of the plan include:

- Reduce traffic by 40 percent
- Reduce green house gas emissions by 60 percent
- Increase transit capacity by 30 percent; and
- Raise non-automobile transportation mode share from 78 percent to 83 percent.

22.1.3 Copenhagen

The city has adopted a 10-year policy to fully realise the potential of the bike as a commuter vehicle. A key factor is having the infrastructure in place that makes riding a bike safe. Another is the elimination of the 'us and them' mentality that pervades both sides [drivers and cyclists]. In Copenhagen, authorities are looking at ways to change the attitudes of drivers and riders towards each other.

22.2 Canada

22.2.1 Vancouver

The regions livability plan written in 1990, *Creating our Future: Steps to a More Livable Region* was created to maintain Greater Vancouver's livability and advocated a system of regional town centers to combat the issue of urban sprawl. Regional Actions 16 and 17 addressed cycling directly and stated:

> 16. Develop a regional air quality and transportation strategy that identifies priority actions. Reverse transportation priorities so decisions are made to favour walking, cycling, public transit, goods movement and then the automobile.
>
> 17. Double the number of bicycle commuters by 1995 through promoting a regional cycling network in co-operation with municipalities, preparing a regional map of commuter and recreational cycling routes, working with BC Transit to facilitate multimodal travel, and encouraging municipalities to adopt development standards that accommodate the needs of cyclists.

In 2004 the regions Strategic Plan was updated and included the following recommendations:

- Invest $4, 5 and 6 million in funding annually in 2005, 2006 & 2007, respectively;
- Provide majority or 100% GVTA funding for significant regional facilities, such as the BC Parkway or Central Valley Greenway;
- Provide 50% cost-share funding with municipalities on new cycling facilities;
- Build approximately 150 km of new bike facilities;
- Plan and design facilities to overcome major road or natural barriers to cyclists;
- Ensure that all major capital projects funded in whole or in part by the GVTA are reviewed for their potential to facilitate greater cycling, including the provision of cycle paths on the RAV and FRC bridges, as well as other bridge upgrades.
- Increase annual funding for information and education programs to encourage more and safer bicycling among all age groups;
- Implement an interactive web based bicycle route map by 2007;
- Distribute information on safe cycling practices to schools and work places.

Vancouver City Council has set a list of transportation priorities in the following order: pedestrian, bicycle, transit, movement of goods, and private automobile. All existing and new projects in the City are evaluated with these priorities in mind and are developed to accommodate them, wherever possible.

Table 22.1 Comparison of Bicycle Facilities between Vancouver, Seattle and Portland

	Portland, OR	Seattle, WA	Vancouver, BC
Population			
City	480,000	533,000	540,000
Metro Region	1,200,000	3,100,000	1,900,000
Rainfall (mm/yr)	1270	968	1480
Bicycle Use (%)	2%	2%	2%
Bike Lanes (km)	200	24	5
Bicycle Paths (km)	80	144	27
Bikeways (km)	40	45	72
Total (km)	320	213	104
Bikes on Buses	Yes (all)	Yes (all)	Limited Routes

Updated from City of Vancouver 1999 Bicycle Plan

22.3 United States

22.3.1 Chicago

Chicago has recently adopted two cycle friendly policies, they have introduced a bylaw to permit bicycles to use the entire lane [to avoid open car doors etc] and implemented a Complete Streets Policy Statement - "The safety and convenience of all users of the transportation system including pedestrians, bicyclists, transit users, freight, and motor vehicle drivers shall be accommodated and balanced in all types of transportation and development projects and through all phases of a project so that even the most vulnerable – children, elderly, and persons with disabilities – can travel safely within the public right of way."

Reckless drivers who endanger bicycle riders could pay fines of $150 -- $500 if there's a bike crash – under new ordinances proposed in Chicago. Opening car doors into a cyclist travelling on a cycle path, turning left in front of a cyclist and passing within 3 feet are three of the violations targeted by

the new ordinance. It's designed to reduce the number of crashes involving bikes and motor vehicles. There were 6,000 such crashes in Chicago between 2001 and 2005, killing 30 cyclists. The ordinance establishes a fine for double-parking in a marked lane that's supposed to be shared by bikes and vehicles. And it raises the fine for driving, standing and parking in a bicycle-only lane. The city has more than 110 miles of designated bike lanes and 21 miles of shared lanes.

22.3.2 Massachusetts

The Bicyclist's Bill of Rights and Responsibilities (H. 1411) overhauls the rules applying to bicycles. The bill moved through the Public Safety Committee and is now in House Ways and Means. Changes this bill would make include:

- clarify that bicyclists have the same rights and responsibilities as other drivers, rather than merely saying that bicyclists have to follow the traffic rules
- clarify that motorists must wait until it is safe to pass bicyclists, and must not return to the right side until safely passed
- give bicyclists the right to ride side by side, where appropriate
- require people to wait until its safe before opening car doors into traffic
- require training courses on bicycle safety and laws for police officers
- recommend the posting of Share the Road signs where appropriate
- prevent the posting of bicycles prohibited signs, except on Interstate-type highways
- make the ticketing procedure for bicyclists the same as for motorists and increase the maximum fine from $20 to $50
- require motorists to follow existing law when turning right (move as far as practicable to the right before turning), rather than turning across the path of a bicyclist.

22.3.3 Portland

Portland is one of the few cities to reference the issue of trip length in their policy, but this appears to be in response to perceived cyclable trip length rather than as a strategy to reduce parking demand or traffic congestion in the CBD. Nonetheless the Portland policies are amongst the most comprehensive and explicit in the nation.

POLICY 6.12 Bicycle Transportation makes the bicycle an integral part of daily life in Portland, particularly for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer.

22.4 Australia

Nic Low, director of the Australian Centre for Governance and Management of Urban Transport, has a target that by 2030, 30 per cent of all city trips should be made by bicycle. To achieve this target, he has identified eight priority areas. Among these are: sacrificing road space for bikes, including cycling in transport planning, special designs of bike path intersections and bike paths connected to stations and activity centres.

23 Theft and vandalism

Weight, along with the distinctive design of the Paris bikes, was thought to be sufficient to discourage theft. However, this has been only partially successful. As of September 10th, 250 to 300 bikes had been stolen. Some of the bikes have been removed from the stations by sawing through the arm that locks the bike to the rack. In most cases, thieves simply took bikes improperly locked at the stand by their users.

Clear Channel bikes have a unique identifier and use a system of GPS tracking to reduce theft. Even in Copenhagen bikes are regularly the target of vandalism [breakage and graffiti] and new measures have been put in place to address this as it has a direct impact on operating costs and the ability to attract system sponsors.

The OYBike in London has an anti-theft system that uses an algorithm to generate unique codes to open and lock the bikes. A flexible cable with connection points at both ends is mounted in a socket that rotates 360°. This effectively denies a would-be vandal any point of leverage to try and break the locking device.

24 Integration with Public Transit Systems

Measures to improve the interface between cycling and public transport include development of parking facilities at railway stations and bus/tram stops; allowing public transport passengers to board public transport with their bicycles; and renting bicycles at public transport and railway stations. The potential effects of such measures on both cycling and public transport modal share look promising considering that in the Netherlands, for example, 35% of all train users come to the railway station by bicycle.

In most of the major systems public bikes are not permitted on board transit vehicles [even when private bikes are] rather bikes are available for use and return at rail and metro stations.

Many systems offer transit customers a discounted rate on the use of public bikes ie. German CallBike rate per minute is 25% less for DB passholders. Similarly in Lyon, Técély [public transport pass] card holders enjoy a discounted rental rate for use of Vélo'v.

The importance of providing sufficient bike capacity at mass transit stations has been identified in both the UK and France. Dave Holladay, a veteran cycling enthusiast who advises the CTC, the national cycling organization in UK, noted that previous attempts to introduce effective public bike systems had failed due to the opposition of rail companies to provide space for bike racks. And in Paris a lack of docking space at major hubs is deterring many Parisians from picking up Vélib for the ride to work.

UK researchers previously reported that the potential of these public bike systems to enhance existing public transport services lies primarily with the leisure and recreational market and with providing links to public transport stations[28].

[28] Ishaque, Noland 2007

Vélib Maintenance Barge

25 Maintenance

Maintenance and logistics are large operational issues, especially in the largest of bike-sharing programs with the average bike operating up to 180,000 km per year.

Users in Barcelona report that the biggest problem with the bikes is the tires, and that there are typically 2 or 3 bikes with flat tires in every station. In Copenhagen ten to fifteen percent of bikes must be replaced each year. Four mobile units check the fleet daily there. In Paris the Vélib system has a support center on a barge that moves between 12 landing points on the river. It features a shop with 10 mechanics for smaller repairs. The more seriously damaged bikes are transferred daily to a facility outside the city.

26 Operators

26.1 Advertising and Communication Companies

26.1.1 JCDecaux

JCDecaux, the second largest global outdoor advertising company, is the world leader in street furniture advertising in a fast consolidating business environment. In the late 1990s, JCDecaux diversified its activities in reaction to competitor attacks and provides outdoor advertising through billboards, public furniture, and transportation ads. Although growing across the board, JCDecaux's primary market is still Europe (where it is the top outdoor advertising company and #2 worldwide, behind Clear Channel Outdoor Holdings); its biggest gains have been in Asia, the UK, and the US. JCDecaux Holding, an entity owned by the Decaux family, owns 70% of the company, which was established in 1964 by chairman Jean-Claude Decaux. JCDecaux currently operates public bike systems in 15 European cities.

26.1.2 Clear Channel

Ten years ago Clear Channel Outdoor deployed the first ever public bike program in Rennes, France. In 2001, Oslo chose Clear Channel Outdoor to install and operate a 1,200 bike program for the Norwegian capital, and in 2006 Clear Channel Outdoor was also selected by Stockholm to provide 1,000 bikes for the Swedish capital. Drammen and Trondheim in Norway, Gothenburg in Sweden and Washington and San Francisco also have selected Clear Channel Outdoor to provide bike programs for their cities.

Clear Channel Outdoor (NYSE:CCO) is the world's largest outdoor advertising company with over 973,000 displays in more than 60 countries across 6 continents. In the United States, the company operates over 167,000 advertising displays and has a presence in 49 of the top 50 Designated Market Areas. It also operates airport, rail, taxi and mall advertising businesses worldwide. Its Spectacolor (U.S.) and DEFI (international) divisions are the global market leaders in spectacular sign displays, including in New York's Times Square. Clear Channel Adshel is the company's international street furniture division, which operates over 3,500 municipal advertising contracts worldwide.

In May 2007 Clear Channel kicked off design of a bike-rental program in Washington, D.C. Then in June, the company secured exclusive advertising rights to San Francisco's bus shelters and secured the option to provide a public bike system in the city.

26.2 State or Regional Transportation Authorities

Transdev is a subsidiary of the state owned Caisse des Dépôts Group and is operating the new 200 bike system launched in Chalon-Sur-Saone southeast of Paris.

Deutsche Bahn is the German Transport Company that operates the CallBike systems in major German cities.

Arlington, Virginia is considering a model where local government provides the service, like bus service and other mass transit.

26.3 Parking Authorities

Stationnement de Montreal – Montreal Parking Authority
Stationnement de Montréal is responsible for the management of paid on-street parking, a network of some 16,000 paid spaces, and parking lots, some 4,000 off-street spaces, managing all planning, collect, maintenance of equipment, administration, and customer service activities.

Ville de Montréal and the boroughs are responsible for: parking policies, rates, signage, new paid spaces installations, regulations and enforcement.

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