4. Correspondence

The correspondence folder will be circulated.

5. Other Business

Next Meeting:

DATE: Wednesday, September 17, 2008
TIME: 5:30 p.m.
Location: Strathcona Room, Subground, City Hall

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Supports Item 1
BAC Agenda
July 21, 2008

BUNT & ASSOCIATES



Bike Centre PC Feasibility Study

Draft Report
6 June 2008

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1.0 INTRODUCTION

1.1 Study Background

Although the recent impetus of bicycle planning in Vancouver has focused primarily on developing an extensive cycling network, bicycle parking facilities have also been considered an integral part of further encouraging cycling as an attractive transportation mode within the City.

Bicycle parking and end-of-trip requirements were introduced as part of a revision to the City's parking bylaw in November 1997. The opportunity to explore a more extensive bike-service facility has been considered previously, in particular a 200 space "bikeade" (i.e. a bike parkade) was investigated at a site in downtown Vancouver in 1991. In this case, the collapse of the office market did not make this a viable facility at the time. The Pacific Centre's recently approved rezoning application has sparked a new impetus to study the feasibility of a comprehensive "bike centre" in Downtown Vancouver.

The bike centre concept, also known as bike stations or bike depots, is based on similar facilities in Europe, Asia, and the United States. Bike centres are attended, centralized locations used for secure short- and long-term bicycle parking that usually also feature an extensive range of bike-related services including: bike retail, rentals, repairs, accessory sales, food vending, shower and change facilities, and travel information.

Bike centres are generally implemented in locations where they will facilitate intermodal connections and/or access to areas with a high concentration of workplaces (21).

1.1.1 Project Background

Bunt & Associates was retained by Cadillac Fairview, the owners and operators of the Pacific Centre mall in downtown Vancouver to conduct this feasibility study. The project team would like to acknowledge the contribution of others to the preparation of this report.

- City of Vancouver
- Capital Bike & Walk (John Luton)
- Vancouver Area Cycling Coalition
- Easy Park
- Bikestation

1.1.2 Study Objectives

The objectives of this study are to investigate the spatial and financial feasibility of constructing a bike centre at the Pacific Centre (refered to herein as Bike Centre PC). There are numerous considerations, a task made more difficult by the lack of established Canadian case studies. This also provides an excellent opportunity to establish the benchmark. The following questions have been formulated to provide a focal point for this study:

- Why is constructing a bike centre (or a future network of bike centres) a good idea?
- How many parking spaces and what additional services are required?
- How much space is required and where should it be located?
- Is a bike centre financially sustainable?

1.1.3 Scope of Work

The scope of work for this project was prepared in consultation with Cadillac Fairview and the City of Vancouver as a comprehensive review of issues related to bike centres and specifically how these relate to the Pacific Centre site.

Firstly, the case for a bike centre in Downtown Vancouver will be presented along with a review of previous experience with bike centres in Vancouver and internationally.

Why is constructing a bike centre a good idea?

How many parking spaces and what additional services are required?

How much space is needed and where should it be located?

Is a bike centre financially sustainable?

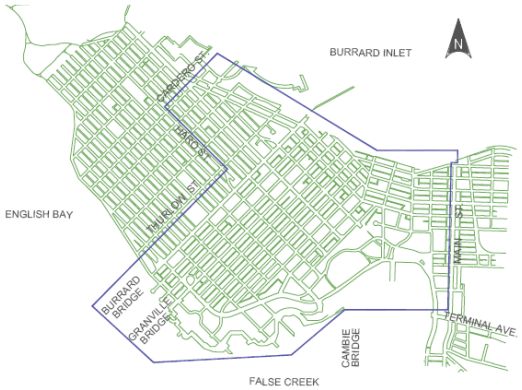
A "space feasibility" analysis will then identify the number of bicycle parking spaces, anticipated usage, and potential ancilliary facilities that could be included in the bike centre. An estimate of the size of the facility will be calculated. This component of the study will also investigate the most appropriate location for the facility and the impacts of a bike centre on the Pacific Centre, in particular the possible impact on vehicle parking supply, circulation, and revenue.

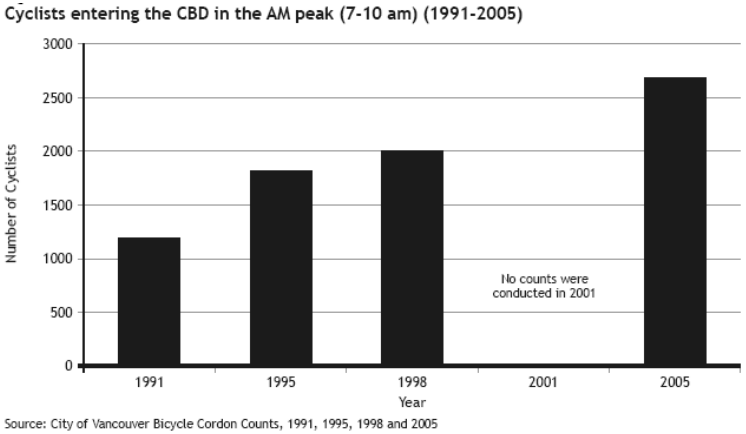
The third component of the study will be an "economic feasibility" to determine if a bike centre is financially sustainable. This component will investigate capital and operating costs, potential revenue streams, and funding opportunities and in particular, identify which costs are critical to the viability of a bike centre. It is not the purpose of this report to develop a specific business model, however a range of possible models will be investigated.

1.2 The Case for a Bike Centre

Cycling is a rapidly growing mode of transportation in Vancouver with over 50,000 daily cycling trips recorded in 2001 (6) and a doubling of downtown cycling trips expected between 1999 and 2021 (2).

The 1999 TransLink *Trip Diary Surveys* estimated that up to 8,000 cycling trips entered downtown Vancovuer during the AM peak on a typical weekday (7). Counts of the Central Business District (CBD) cordon conducted in June 2005 showed that approximately 2,700 cyclists entered the CBD between 7-10 a.m. (17) representing a cycling mode share of 2.1%, a 50% increase from 1991. It is uncertain how many of these cyclists are destined for the CBD (i.e. not through trips).





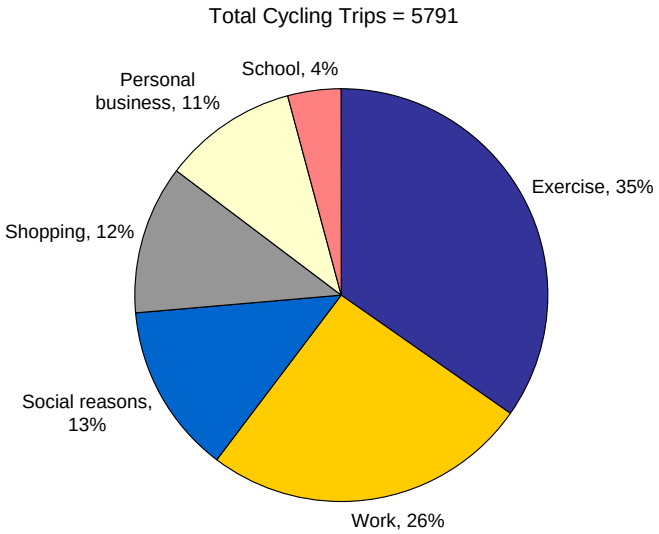
Source: City of Vancouver Bicycle Cordon Counts, 1991, 1995, 1998 and 2005

A survey conducted in 2007 by TransLink of 2,149 Greater Vancouver residents (22) classified cyclists into "waves" based on their level of cycling activity. Characteristics of these waves are identified in Table 1.1.

Table 1.1: Characteristics of Cycling Waves in Greater Vancouver (22)

	Potential Cyclists	Non-Regular Cyclists	Regular Cyclists
Percentage:	20%	58%	22%
Trip purposes:	Health	Health Work	Health Work
Factors that would encourage cycling more often:	Health benefits Better bicycles Safer routes More routes	Safety Improved route network Weather	Improved route network Safety Weather
Route characteristics:	Less traffic Off-street Attractive Short distances	Less traffic Off-street Local street	Less traffic Off-street Local street Bike lanes on busy streets
Inhibitors:	Safety Weather	Safety (volume and speed) Parked vehicles Weather	Extreme weather

Approximately 265 of all cycling trips made by respondents to the TransLink survey, were work-related. An additional 12% were related to shopping. These segments are target groups of Bike Centre PC.



In addition, respondents indicated that they would consider cycling more for work and shopping purposes. By wave, these responses included:

- Regular cyclists: 19% (work), 18% (shopping);
- Non-regular cyclists: 19% (work), 13% (shopping); and
- Potential cyclists: 12% (work), 10% (shopping).

1.2.1 Cycling Benefits and Barriers

There are many well documented benefits of cycling both for individuals and the wider community. Some of these are listed in Table 1.2.

Table 1.2: Cyling Benefits (13, 33)

Individual	Community
Individual health and fitness	Reduced medical costs
Financial savings (gas, parking, insurance, maintenance, etc)	Environmental health
	Equitable transportation
Quality-of-life	Economic vitality

What is often less apparent are "barriers" that discourage cycling as a more attractive transportation mode. The *National Active Transportation Survey* (NATS) (16) (2004) surveyed over 1,600 Canadians to identify attitudes towards bicycling and walking and found a variety of reasons given for not bicycling. These factors are summarized at Figure 1.1 and can be categorized as subjective (e.g. trip distance, safety, convenience, cost) and objective (e.g. weather, environment/topography, infrastructure, accessability) factors.

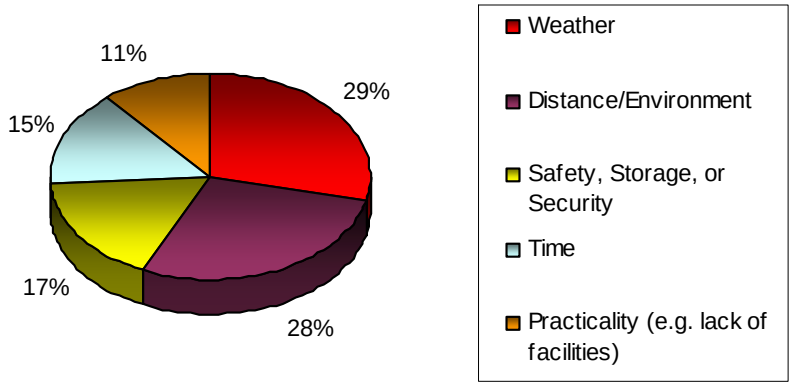


Figure 1.1: Cycling Barriers Identified by Canadians (16)

Factors discouraging already active cyclists from bicycle commuting are far more specific than those influencing bicycling in general.

Approximately 75% of respondents to the active transport survey indicated that they would like to cycle more. Factors that would encourage more cycling were recognized in both the National Active Transportation Survey (in terms of cycling to work) and TransLink's GVRD Travel Survey (in terms of cycling in general). These responses are summarized in Table 1.3.

The TransLink survey of the GVRD also identified that 66% of respondents would be influenced to cycling more often with additional investment into improved cycling facilities, such as cycling routes and bike parking (22).

Table 1.3: Improvements to Facilitate Cyling in Canada (16, 21)

Improvement	Percentage of Respondents Indicating Improvement Would Encourage Them to Cycle	
	NATS (cycling to work)	TransLink Survey (cycling in general)
Better weather	70%	14%
Improved safety	69%	18%
Better health	68%	14%
Dedicated routes	61%	19%
Safe bicycle storage at work	49%	7%*
Tax incentives	48%	
Safe bicycle storage at transit	32%	
Increased bicycle information	31%	
End-of-trip facilities	24%	

Notes:
NATS: National Active Transportation Survey (16)
* Response varied amongst waves – regular cyclists indicated 11%, non-regular 7%, and potential cyclists 2%.

A 1992 survey of bicyclist attitudes in the United States (14, 15) identified trip distance, safety, lack of facilities, the need for a vehicle at work, convenience, and weather as the major discouraging factors for automobile drivers switching to cycling. Approached from a different angle, illustrated at Figure 1.2, existing auto-commuters identified safer bike facilities, financial incentives, showers, and storage, and a rise in gas prices as changes that would encourage them to switch to cycling as a commuter mode.

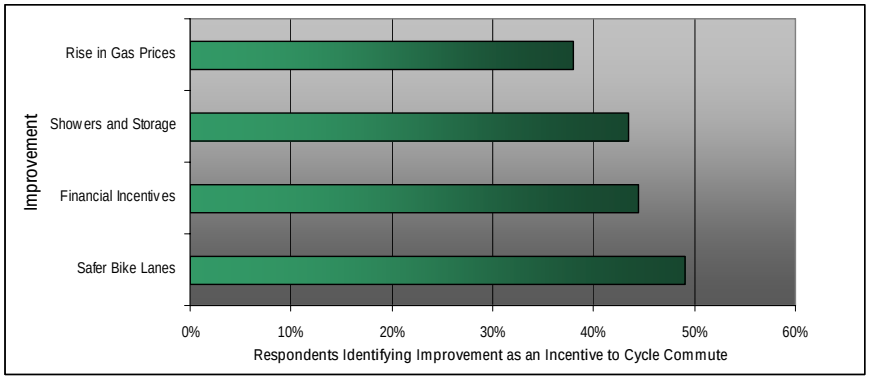


Figure 1.2: Factors Driving a Switch to Cycling (14, 15)

In summary, Table 1.4 identifies current barriers towards cycling as a transportation mode and the facilities that could be offered as part of a bike centre to address these.

Table 1.4: Addressing Cycling Barriers

Bike Centre Service	Barrier Addressed
Parking, showers, lockers	End-of-trip facilities
Integration with transit and bike-share	Trip distance
Integration with car- and bike-share	Need for a vehicle at work
Bicycle retail and bike-share	Accessibility
Bicycle instruction and tours	Safety
Bicycle bus/group commuting	Safety

1.2.2 Bicycle Parking Types

Bicycle parking can generally be broken into two types: short- and long-term. Short-term parking is usually defined as 2-hours or less and is generally accommodated through bicycle racks within close proximity (less than 20m) to intended destinations and located in active, visble locations.

Long-term parking covers durations of several hours, all-day, and multi-day parking. Long-duration bicycle parking should be provided a much greater level of security than short-term parking. Other desirable features of long-term parking include protection from the elements and end-of-trip facilities. Long-term parking options are generally considered to include enclosed bicycle lockers, a continuously monitored facility, or a restricted access facility.

"Whether short-term or long-term, bicycle parking needs to be visible, accessible, easy to use, convenient, and plentiful"

A bike centre is a more extensive facility than typical end-of-trip bicyle parking. It offers a variety of bike-related services that directly target a number of the barriers holding back potential commuter and discriminatry cyclists and increases the visibility of the mode.

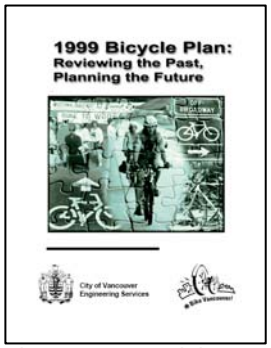
An example of the success of bike centres in "converting" former automobile travelers are the Bikestations in the United States, which have recorded 25 - 30% of use from persons who would have otherwise driven a car (11, 24).

1.3 Transportation Policy Review

The City of Vancouver has made a concerted effort towards cycle planning over the last decade with the development of the City of Vancouver Bicycle Plan in 1999, the Vancouver Transportation Plan in 1997, and the Downtown Transportation Plan in 2005. The overall objective of these plans is to make cycling a more "attractive, safe, and comfortable" mode of transportation. A review of how a downtown bike centre fits with the intent of these documents is included below.

1999 City of Vancouver Bicycle Plan

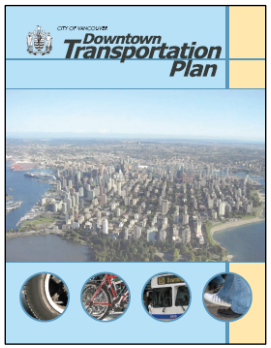
The focus of this study was to build on early bicycle planning initiatives by reviewing the state of cycling infrastructure in the City of Vancouver and formulating strategies that would "educate, enforce, and encourage" cycling as a viable transportation option. Strategies focused primarily on the development of a more extensive bike route network throughout the City including the downtown.



A strategy for increasing short-term bicycle parking in busy commercial areas was developed through the creation of a "bike rack program" and a funding partnership with Cycling BC and the provincial government.

Downtown Transportation Plan (2005)

This study is an extension of the Vancouver Transportation Plan that focuses on land use and transportation planning in the downtown peninsula. The overall objective of the plan is to identify strategies that encourage all modes of transport to accomodate future trip growth without requiring significant expansion of road network capacity.



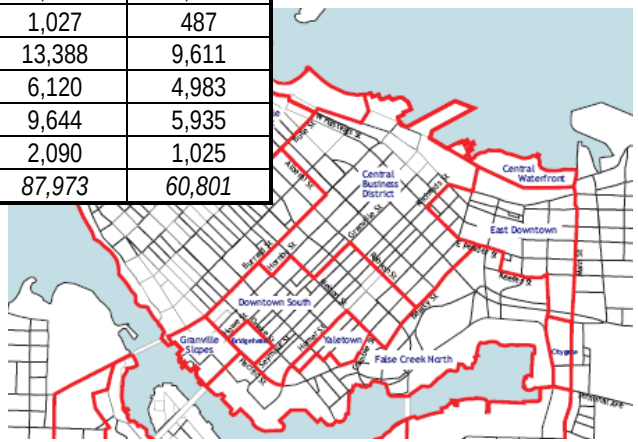
Employment projections for downtown Vancouver anticipate a growth in employment from 143,000 jobs in 2001 to 174,000 jobs in 2021, the majority within the CBD (i.e the area encompassing the Pacific Centre).

Downtown Vancouver is not only a major employment centre. The number of people living on the peninsula has increased significantly over the last decade and is projected to increase from 73,000 residents in 2001 to 100,000 by 2021 primarily in False Creek and Coal Harbour.

The population of the downtown peninsula at 2006 was in the order of 88,000 people and is summarized by area in Table 1.5.

Table 1.5: Downtown Population in 2006 (22)

Area	Population	Dwellings
West End	41,624	29,512
Triangle-West	5,562	3,642
Coal Harbour	3,676	2,333
Granville Slopes	1,750	1,207
CBD	2,741	1,858
Yaletown	1,027	487
Downtown South	13,388	9,611
East Downtown	6,120	4,983
False Creek North	9,644	5,935
Citygate	2,090	1,025
Total	*87,973*	*60,801*

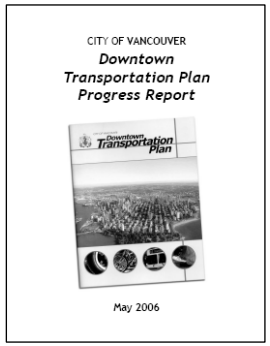


Cycling initiatives proposed as part of the DTP are focused on making biking more "attractive, safe, and comfortable" for riders and include:

- expanding existing bike lanes and bikeways to "provide direct connections to key destinations in and around downtown";
- Providing bike racks on buses and SkyTrain to give cyclists more commuting options;
- Increasing access to storage lockers to provide increased bicycle security; and
- Developing way-finding signage specifically designed for cyclists to make it easy for them to find the safest way to their destination."

A further recommendation of the DTP was to provide related bike facilities to encourage and make bicycling safer (e.g. bike parking facilities, way-finding/ destination signage, education). A bike centre would address a number of these objective directly.

Downtown Transportation Plan Progress Report (2006):



This report provides an update on the status of transportation initiatives identified in the Downtown Transportation Plan Implementation Program.

In terms of cycling, the Implementation Program focused on the creation of an extensive network of downtown bike lanes and bikeways. The city of Vancouver has shown its commitment to cycling by completing many of these projects ahead of schedule and initiating almost all identified projects.

The existing downtown bicycle network is illustrated at Figure 1.3.

1.4 Commuter Cyclist Improvements

An important source of trip-making to Bike Centre PC will come from commuter cyclists (i.e. cyclists who use cycling as the primary mode for their trip). These trips can be short (e.g. originating within the downtown) or long (e.g. originating more regionally).

There are a number of regional projects that have been initiated or completed that will encourage commuter cycling trips to downtown Vancouver including:

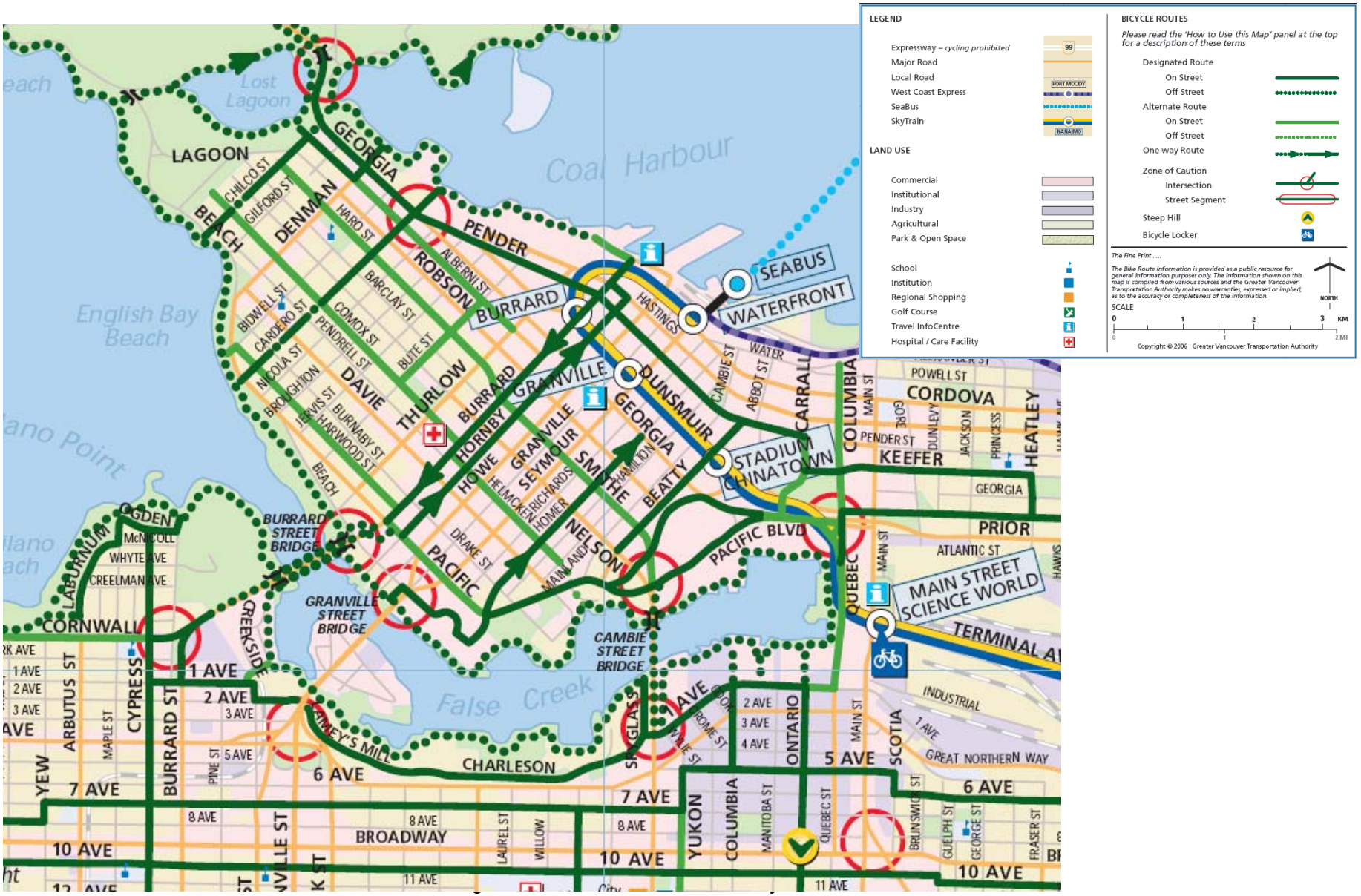
- Upgrade and completion of the regional and downtown bicycle networks including investigation of opportunities for bike facilities on the Georgia and Dunsmuir viaducts, Robson Street east of Richards Street, and longer term along Helmeken/Comox Streets;
- Proposed widening of the pedestrian and bicycle paths on the Burrard Bridge and other False Creek bridges;
- Proposed construction of the Trans-Canada Trail through the eastside of Vancouver; and
- Construction of the Central Valley Greenway, which will link the cities of Vancouver, Burnaby, and New Westminster to the downtown bicycle network.

There is also an opportunity to integrate the facility with any future public bike-share scheme implemented in Downtown Vancouver. The feasibility of a bike share program is currently being investigated by TransLink.

Bike Centre Opportunity Statement

Cyling is a rapidly growing mode of transport used to access downtown Vancouver. A bike centre would serve to add to the amenities provided for cyclists in downtown Vancouver, break down existing barriers to cycling, and encourage cycling as a more viable transportation mode. Specific objectives of the bike centre are to:

- Promote Bicycle Usage
- Facilitate Multi-Modal Integration
- Operate with Financial Sustainability
- Encourage Community Development



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2.0 PACIFIC CENTRE REDEVELOPMENT

A rezoning application for expansion of the Pacific Centre was approved in October 2006. This feasibility study has been borne from the conditions of that approval and provides an opportunity to add a valuable community asset to the complex.

2.1 Existing and Future Land Use

The Pacific Centre is a mixed use development that includes the largest of Vancouver's downtown shopping malls, office towers, and a 376 room hotel. Its location within the downtown peninsula is illustrated at Figure 2.1.

Figure 2.1: Locality Map

The rezoning application approved in 2006 included provision for an additional 6,503m^2 of retail space to be added to the existing site, which would increase the overall development to a total of 315,013m^2. Existing and proposed land use is summarized in Table 2.1.

Table 2.1: Pacific Centre Land Use Summary

	Existing	Proposed Additional
Hotel	35,511 m^2 (376 rooms)	-
Office	165,842 m^2	-
Retail	107,157 m^2	6,503 m^2
Total	308,510 m^2	315,013 m^2

2.2 Existing Cycling Facilities

The Pacific Centre was constructed prior to the establishment of the City's bicycle parking bylaw. Application for redevelopment of the site may require bicycle parking to be provided in line with this bylaw (see Section 4.3.1).

An inventory of bicycle parking facilities currently provided at and nearby the Pacific Centre is illustrated at Figure 2.2 and include:

- Approximately 31 short-term bike racks provided on sidewalks and other public areas at a number of the site frontages with accomodation for approximately 130 – 260 bicycles. Examples of street-level bicycle parking at the Pacific Centre are included at Figure 2.3
- A bike room at the 32 block that accomodates approximately 64 bikes in 4 bicycle racks with approximately 50 lockers. The room is accessible via the parkade entrance on Howe Street south of Pender Street using a swipe card. There are no showers or washrooms associated with the bike room. Figure 2.4 shows the layout of the bike room.

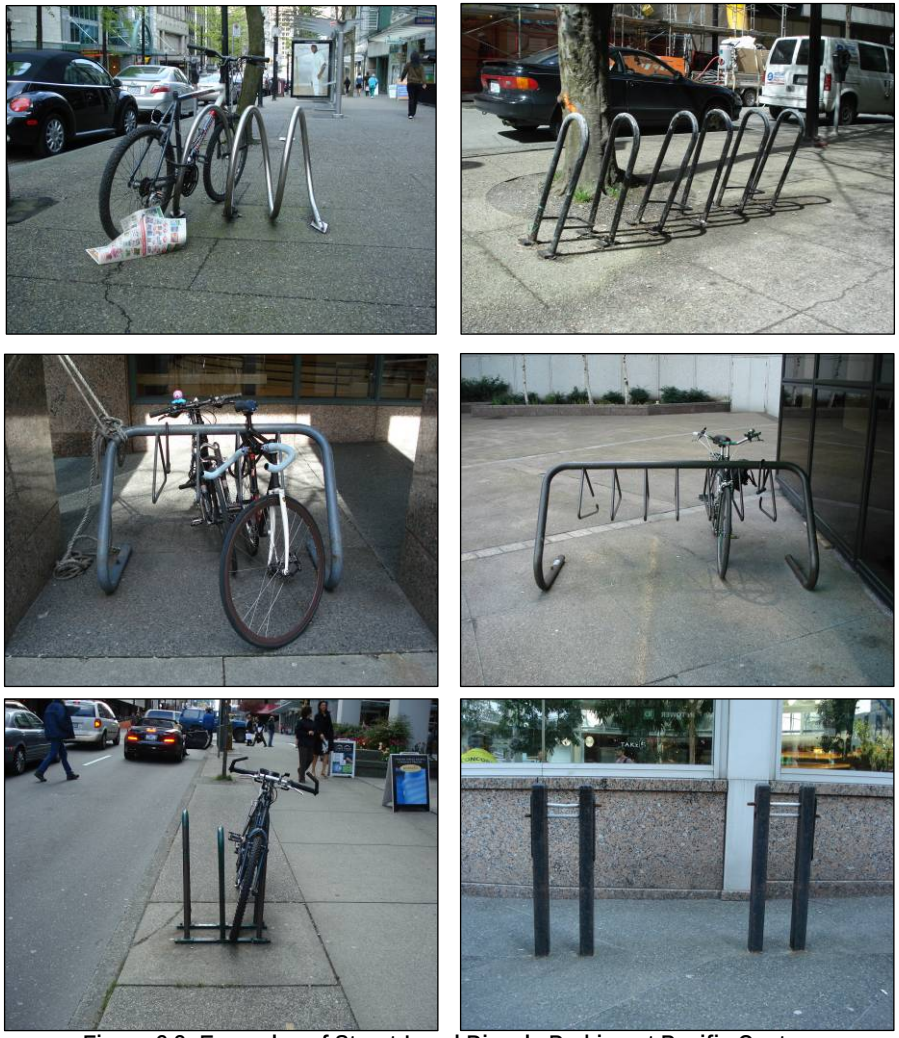


Figure 2.3: Examples of Street-Level Bicycle Parking at Pacific Centre

Figure 2.4: Block 32 Bike Room

2.3 Vehicle Parking and Access

The Pacific Centre vehicle parkade includes 1,528 vehicle parking spaces summarized by type in Table 2.2.

Table 2.2: Pacific Centre Parking Supply

	Transient Anytime	24 Hour Reserved	Reserved to 6pm	Accessible	Car Share	Total
Stalls	1,328	161	20	17	2	1,528

Parking demand surveys were conducted at the Pacific Centre parkade as part of the *Downtown Parking Strategy* conducted by Bunt & Associates on behalf of Easy Park. Surveys were conducted for the mid-day (Monday January 14, 2008 between 9:00 – 15:00), evening (Wednesday January 23, 2008 between 20:00 – 22:00), and weekend (Saturday January 26, 2008 between 13:00 – 15:00) peak periods. The results are summarized in Table 2.3.

Table 2.3: Pacific Centre Parking Demand

Time Period	Occupied	Supply	Rate
Mid-day (9:00 – 15:00)	948	1,528	71%
Evening (20:00 – 22:00)	356	1,528	26%
Saturday (13:00 – 15:00)	978	1,528	73%

Figure 2.2 illustrates the approximate location of vehicle and pedestrian entrances/exits to the Pacific Centre parkade and the mall. The parkade is accessed via Robson Street and two entrances on Howe Street. Egress is via Smithe Street, Howe Street, and Dunsmuir Street.

In general, the vehicle parkades entrances are only wide enough to fit a vehicle and are generally steep with sharp turns into the parking area. An example of the Howe Street entrance and exit (which was considered as a possible access to an underground "bikeade") are shown at Figures 2.5 and 2.6. These ramps are not attractive or conducive to safe cycling. Further, they are located some distance from the preferred location for the bike centre (near the new Canada Line Station). This issues are discussed further as part of Section 6.2.

Figure 2.5: Howe Street Entrance to Pacific Centre Parkade

Figure 2.6: Howe Street Egress from Pacific Centre Parkade

An example of vehicles entering the Robson Street parkade entrance are shown in Figure 2.7. These ramps are too narrow and too steep to safely accommodate vehicles and cyclists.

Figure 2.7: Views of Robson Street Entrance

2.4 Existing and Future Transit

The Pacific Centre, and Granville Street in particular, serves as a key transit hub for the central business district. Existing transit stops, bus routes, and rapid transit routes are illustrated at Figure 2.8.

SkyTrain, a light-rail transit service serving the cities of Vancouver, Burnaby, New Westminster, and Surrey, provides service to the area via Granville Station. Service frequency is summarized in Table 2.4 and is generally every 2 to 3 minutes during peak hours.

Table 2.4: SkyTrain Frequency

Time of Day	Expo and Millenium Lines
Peak Hours	Every 2-3 min.
Mid-day and evenings	Every 3 min.
Late night	Every 4 min.
Saturday & Sunday	Every 3-4 min.

The SkyTrain system will soon be supplemented with the addition of the Canada Line, which is anticipated to be completed in the fall of 2009 and will provide service every six mintues during peak hours and midday between downtown Vancouver and the Vancouver International Airport and Richmond (20).

This service will replace the existing 98 B-Line bus service currently operating on the Granville corridor. A Canada Line station is proposed on Granville Street, with an elevator access on the south-east corner of the Georgia Street/Granville Street intersection.

To date, integration of the station elevator with a bike centre provided in the existing vehicle parkade has formed the preliminary option for development of Bike Centre PC. This option will be assessed further as part of this study.

3.0 BIKE CENTRE EVOLUTION

A review of available bike centre literature has been prepared to provide an understanding of the context of bike centres that have been investigated or implemented locally and internationally.

3.1 Bike Parking Facilities

3.1.1 Downtown Vancouver

The investigation of a bike centre is not completely new for the City of Vancouver. A 200 space "bikade" that would have included bicycle parking, lockers, showers, bike-related retail, and repairs in a sub-teranean parking level was investigated in 1991 as part of a redevelopment application at the corner of Granville Street and Robson Street. In that case, the shift in development away from a predominately office land use did not make a bike centre feasible.

3.1.2 United States

Bike centres are a relatively recent feature of the transportation spectrum in the United States and are generally referred to as bike stations or bike depots. By far the most widespread are the facilities developed and/or oprerated by the Bikestation organization.

A quick survey of U.S. bike station locations and conversations with some operators indicate that the key to ensuring access to sufficient numbers of cyclists to sustain operations is providing access to or being in close proximity to major transit hubs.

Most US bike stations are "transit-oriented" in that they provide patrons a place to park their bike before taking transit to complete their journey, e.g. Bikestation Palo Alto, etc. This is different to the likely market of Bike Centre PC, which will be made up primarily of commuters. There are a number of "commuter-oriented" bike stations in the US including the 300-space Chicago Millenium Park bike station, understood to be the largest in the United States.

3.1.3 Japan

In contrast to North America, Japan has over 8,000 bike centres (21), a number employing advanced stacking and parking technologies to minimize space requirements.

Japanese national and local laws require bicycle parking facilities to be provided near rail stops. These range from single racks to fully automatic bicycle parking garages, some holding more than a thousand bicycles.

3.1.4 Europe

There are over 3,000 bike centres in Europe including over 80 in the Netherlands ranging in size from 1,150 to 4,000 bicycles (21).

The most familiar application is the large bicycle parking garage at the Dutch National Railway station in Amsterdam. Typical of most Dutch applications, this station caters to parking transit-linked bicycle trips (i.e. persons cycling to the station to park and then ride transit). In the Netherlands, national policy requires that bicycle parking be made available at every Dutch National Railway station.

Virtually all German cities have been expanding bicycle parking facilities through incentive programs, particularly in city centers and at transit stops. The City of Bremen established the country's first bike centre. In addition, Muenster's major train station has a bicycle service station.

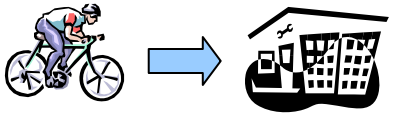
4.0 MARKETS AND DEMAND

The development of a bike centre has numerous considerations - who will use the facility? How much demand will there be for it? How much space is required? These and other planning-level considerations are addressed below.

4.1 Target Markets

Bike centres attract two major cycling trips, inter-modal trips linked to transit and those that are an independent transportation mode. There are also likely to be demands from special events, tourism, long-term parkers, and recreational sources. Considering this, Bike Centre PC could expect to serve three major segments:

1. Commuter: cyclists that have a destination (e.g. work, shopping, etc.) within the catchment area and cycle to park at Bike Centre PC.



2. Transit Linked Trips - Bike Park-and-Ride: cyclists that cycle to Bike Centre PC to park and then ride transit.

3. Transit Linked Trips - Bike Ride-and-Park: cyclists that cycle to a transit stop, carry their bike on the bus or train and then park their bike at Bike Station PC at the end of their journey.

4.1.1 Commuter Cyclists

This group includes cyclists that commute either short or long distances to the bike centre and then walk to their destination within the surrounding catchment area. This group would be expected to make up the single largest market share of Bike Centre PC users and have the largest potential for mode shifting from automobiles.

The Portland Bicycle Parking Facilities Guideline (12) suggests that long-term parkers would be willing to walk 250m to/from their destination if parking is secure. In fact, experience at California Bikestations has shown that 50% of trips ended within a 10-minute walk (700m) of the bike station (9).

Given the concentration of land use in the area, Bike Centre PC could be expected to draw a significant amount of use from the Pacific Centre and the immediate 2 - 3 block radius (approximately 250m), but will also attract some commuters that are prepared to walk up to 10 minutes (approximately 700m) to their destination.

4.1.2 Bike Park-and Ride

These are transit-linked trips originating in the downtown. The majority of existing bike centres in Europe, Asia, and the United States have been developed as bike-transit centres with their major market share being travelers who ride to the transit station, park their bike, and then use transit to continue their journey.

At Bike Centre PC, this market share is expected to be second to the commuter cyclist and will consist of patrons who live downtown biking to the bike centre to park. The catchment for this mode would likely be persons living outside of a reasonable walking distance (750m) but within the downtown peninsula, e.g. a person who lives in the West End and works at Metrotown may ride to Bike Centre PC, park, and take SkyTrain to Metrotown.

4.1.3 Bike Ride-and-Park

These are transit-linked trips that originate from outside of Downtown. This market share is expected to be small but could consist of:

- patrons carrying their bikes onto transit to park at the bike centre;
- patrons taking transit to the downtown where they park a bike at the bike centre permanently for use within the downtown area; and
- patrons taking transit to the downtown and using the services provided by the bike centre such as bike rentals, shared bikes, etc.

4.1.4 Other Users

In addition to the major market shares, the bike centre could also see demands from:

- Special event patrons for downtown sporting events, Canada Day celebrations, the Festival of Light, etc.
- Recreational patrons and tourists within and traveling to the Downtown e.g. visitors and day-trippers wanting to make use of Downtown recreational activitites as well as the services offered by the bike centre.
- Owners of high end race and mountain bikes living in small condos/apartments downtown. The bike centre offers an opportunity for conveniently located, secure storage as well as other services (e.g. repairs) that reduce in-unit requirements to store this equipment.

4.2 Number of Spaces

Determining the number of spaces that should be provided is not an exact science. A number of methodologies have been employed to forcast low- to high-range demands for the user groups identified above.

4.2.1 Bicycle Parking Bylaw

A review of Section 6 of the City of Vancouver's Parking Bylaw relating to bicycle parking requirements is summarized in Table 4.1. Approximately 387 Class A (long-term) and 18 (minimum) Class B (short-term) bicycle parking spaces would be required with the redevelopment of the Pacific Centre.

End-of-trip facilities such as clothing lockers and showers would also need to be provided under this bylaw as per Table 4.2.

Table 4.1: Calculation of Bylaw Bicycle Requirements

Use	Size	Bylaw Rate		Bylaw Parking Spaces	
		Class A	Class B	Class A	Class B
Hotel	376 rooms	1 / 30 units	6 (min.)	13	6
Office	165,842 m^2	1 / 750 m^2	6 (min.)	222	6
Retail	113,660 m^2	1 / 750 m^2	6 (min.)	152	6
Total				387	18

Class A: bicycle parking spaces designed primarily to provide long-term parking for employees of the building.
Class B: bicycle parking spaces designed primarily to provide short-term transient parking.

Table 4.2: Bicycle End-of-Trip Facilities

	Rate (per sex)	Requirement (per sex)*
Clothing Lockers	0.7 / Class A space	270 lockers
Toilets	6 + 1/30 Class A spaces over 194	13 toilets
Wash Basins	3 + 1/30 Class A spaces over 194	10 wash basins
Showers	6 + 1/30 Class A spaces over 194	13 showers

* based on number of spaces required under the bylaw as identified in Table 4.1.

The 300-space Chicago Millenium Park Bike Station accommodates a total of 340 lockers and 8 showers. Annecdotally, the number of showers is not sufficient to accommodate peak hour demands (18).

Nonetheless, the City of Vancouver's bylaw requirements for end-of-trip facilities may be high when applied to large bicycle parking settings. Economy of scale will likely apply and it may be prudent to implement a portion of the facilities with room for expansion into the future.

4.2.2 Commuter Demands

Commuter cyclists will represent the largest component of Bike Centre PC use. As described in Section 1.2 and illustrated at Figure 4.1, cyclists currently represent 2.1% of all trips destined to the CBD during the weekday morning (17). This represents a total of 2,700 trips between 7 – 10 a.m.

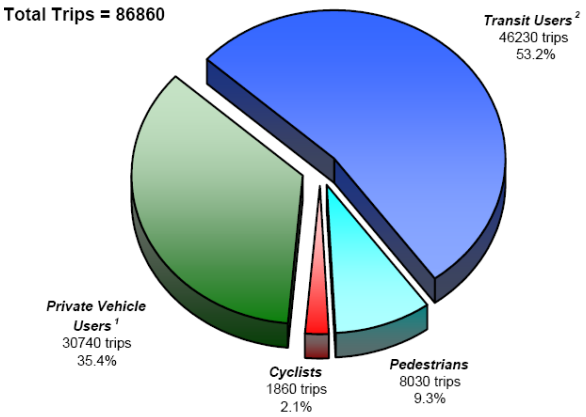


Figure 4.1: Vancouver Central Business District Mode Share (2005) (17)

Interogation of the 2004 TransLink Trip Diary database was conducted to estimate a profile of cycling trips arriving at the CBD across the day and to determine the purpose of these trips. Figure 4.2 summarizes the estimated daily profile of cycling arrivals, calculated by pro-rating the City of Vancouver survey number by the relative percentage of cyclists observed at each period of the day in the TranLink survey. Figure 4.3 shows a breakdown of expected cycling trip purposes across the day.

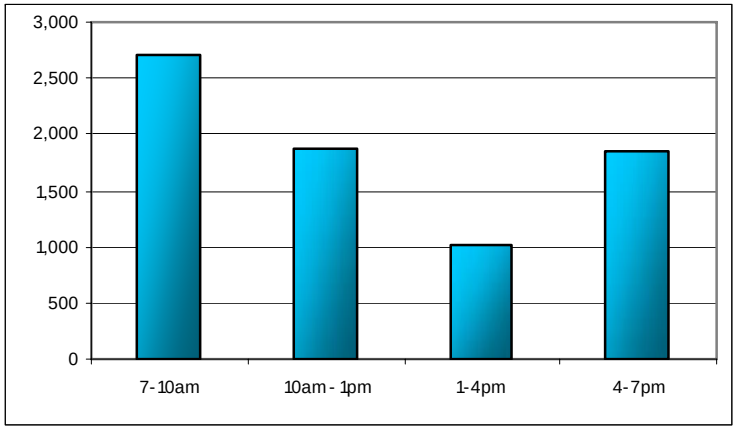


Figure 4.2: Estimated Profile of Downtown Cycling Trips Across the Day.

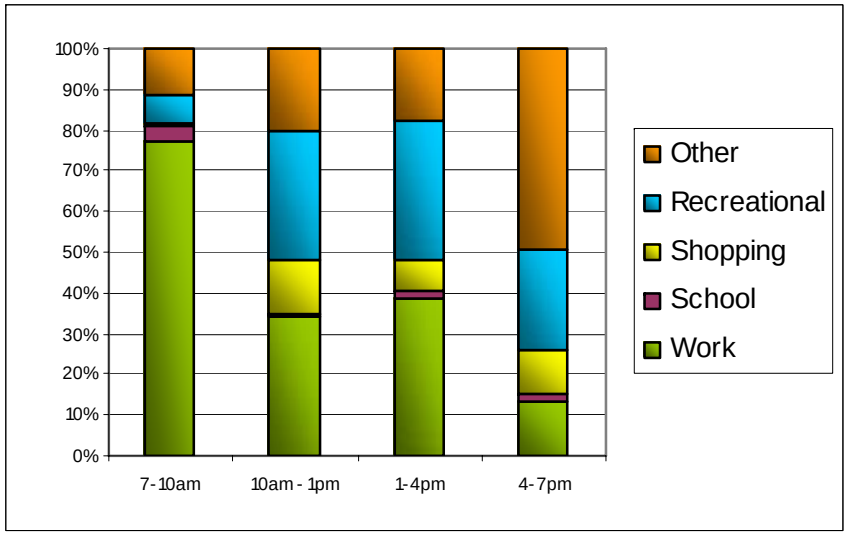


Figure 4.3: Estimated Cycling Trip Purposes Across the Day.

A percentage of cycling trips destined to the CBD will be attracted to Bike Centre PC. This percentage depends on the trip purpose, the final destination being within a reasonable walk of the bike centre, and the attractiveness of the bike centre (e.g. if an office building already has free, secure parking and end-of-trip facilities – cyclists may choose to use this rather than the bike centre).

The primary catchment of the bike centre is expected to be within a 250m radius, or a 3 - 4 minute walk (see Figure 4.4). The percentage of commuter cyclist trips destined for the catchment area has been estimated from the percentage of CBD office floor area within the catchement. Similarly, the percentage of shopping cyclist trips destined for the catchment area has been estimated from retail and commercial floor area.

Approximately 42% of office and 33% of commercial/retail floor area in the CBD falls within the Bike Centre PC catchment.

The attractiveness of a bike centre (compared to other bicycle parking options) is difficult to determine. Use of the facility will be elastic depending on price, security, services provided, availability of other parking, etc. A survey conducted by Bikestation in Long Beach, California indicated that 20% of current bicycle commuters would prefer a Bikestation over other cycle parking facilities (8). To be conservative, a range of low and high "attraction indices" have been applied depending on the trip purpose as shown in Table 4.3.

Table 4.3: Attraction Indices by Trip Purpose

Trip Purpose	Low	High	Explanation
Work	10%	20%	Possibility of secure long-term parking at destination building.
School	5%	10%	Less concern about security, propensity to use short-term racks
Shopping	5%	10%	Cost decision between short- and long-term parking options.
Recreational	1%	5%	Lower parking propensity

Scaling the number of commuter cyclists destined for the catchment by the attraction indices results in a profile of existing cyclists that would be likely to use Bike Station PC. However, there will also be a component of users who start to bicycle to work or shop as a result of the facility (known as latent demand). Surveys conducted by Bikestation in the United States suggest that approximately 30% of Bikestation users are new to bicycle commuting (11, 24). Including latent demand results in the low- and high-range forecasts shown at Figures 4.5 and 4.6 respectively. In total, it is expected the centre will achieve somewhere between 340 to 681 commuter cyclist uses on a peak day.

Assuming durations of approximately 8 hours for work trips, 4 – 6 hours for school trips, 2 – 3 hours for shopping trips, and 1 – 2 hours for recreational trips, the profiles in Figures 4.5 and 4.6 result in a maximum accumulation of approximately 320 – 625 bicycles requiring parking.

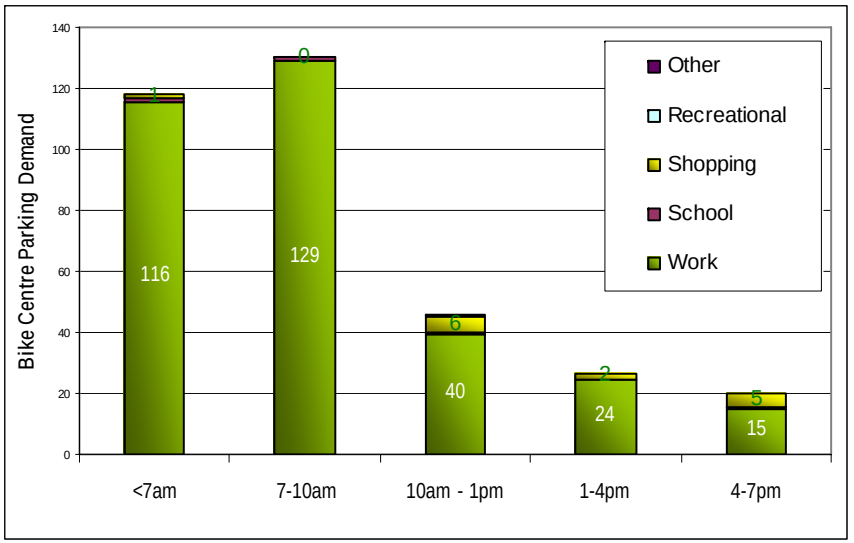


Figure 4.5: Anticipated Low-Range Usage Forecast.

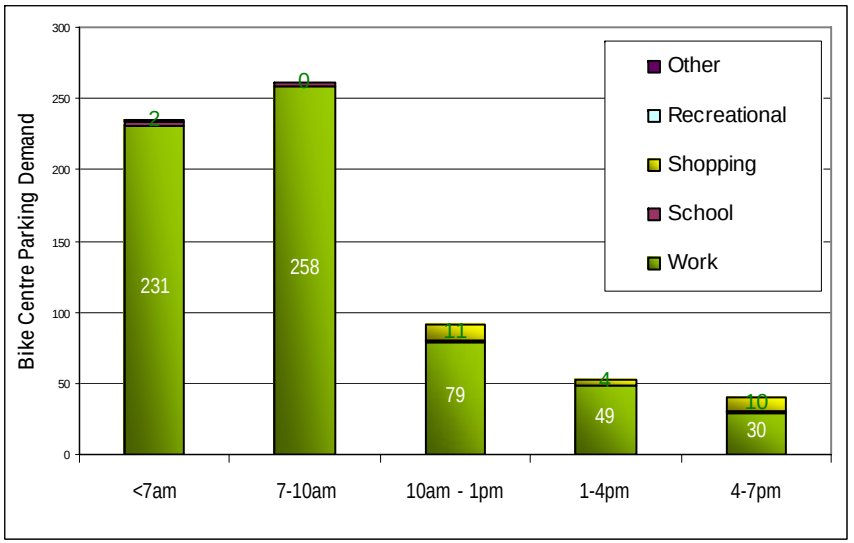


Figure 4.6: Anticipated High-Range Usage Forecast.

4.2.3 Transit-Related Demands

Apart from commuter cyclists, the other significant trip type attracted to the facility will be transit-linked trips. There are two types to consider:

1. Bike park-and-ride
2. Bike ride-and-park

There are expected to be very few bike ride-and-park trips during peak hours given the restriction of taking bikes onto SkyTrain. There may however be some demand of carrying bikes on buses and the SeaBus. A negligible amount of this use has been assumed.

Bike park-and-ride trips are those originating in areas of the Downtown (e.g. West End) that ride to the bike centre prior to taking transit to a regional destination. This is a particularly difficult demand to estimate as it is based purely on latent demand.

Daily departures from the Granville SkyTrain station are in the order of 15,500 trips per day. Based on the TransLink trip diaries, approximately 18% of trips from downtown Vancouver originate from home. Approximately 70% of residential housing downtown is further than 10 minutes or 750m walk from Bike Station PC. If only 2% of these trips were by bike using Bike Station PC, this would result in a demand of approximately 40 bike spaces. This could be more if bus and future Canada Line transit trips are also considered.

Combining commuter and transit-linked demand results in an expected demand between 360 and 665 bicycle parking spaces. The City of Vancouver's bicycle parking bylaw requirements fall within this range and would be a good starting point for the number of spaces to be provided at Bike Centre PC.

4.2.4 Special Event Demands

Special events held in Downtown Vancouver such as Canucks hockey, BC Lions, Canada Day celebrations, Festival of Light, etc could positively effect demand projections at the bike centre.

Surveys of the Celebration of Light (19) have shown that approximately 80,000 persons attend the event at English Bay. Given the price and limited availability of vehicle parking downtown, cycling could become a viable transportation alternative.

If even 5% of event attendees cycle (i.e. approximately double the 2.7% that currently cycle to the event) and 10% of these use the bike centre, demand would exceed 400 spaces. Parking supply at Bike Centre PC could be supplemented through additional racks and/or the bike centre operating a temporary bicycle valet service close to the venue as an additional revenue source.

4.2.5 Factors Influencing Demand

Apart from the elasticity factors and the attractiveness of the facility as previously discussed, a significant issue that faces bike centre usage is the seasonality of cycling as a transportation mode. Based on research conducted at a number of Bikestations in the United States, this is due not only to rainfall, but the availability of daylight. A profile of usage at a number of Bikestations, included at Figure 4.7, shows that even in California use drops off in October and picks back up in April (10).

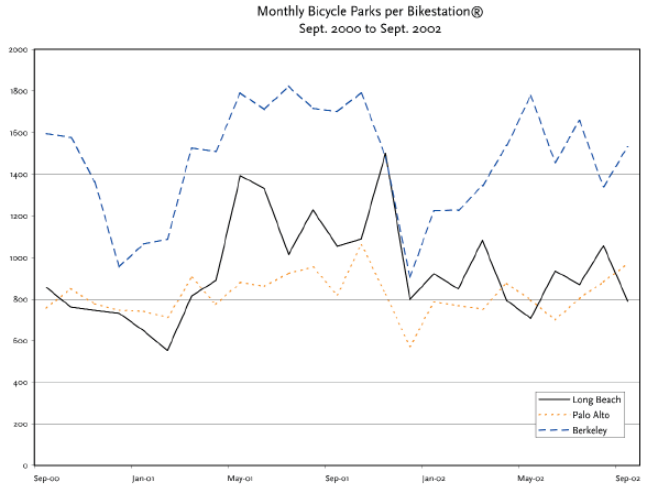


Figure 4.7: Seasonal Use of Bikestations in California.

Figures 4.8 – 4.10 illustrate the average monthly rainfall, hours of sunshine and hours of daylight for Vancouver.

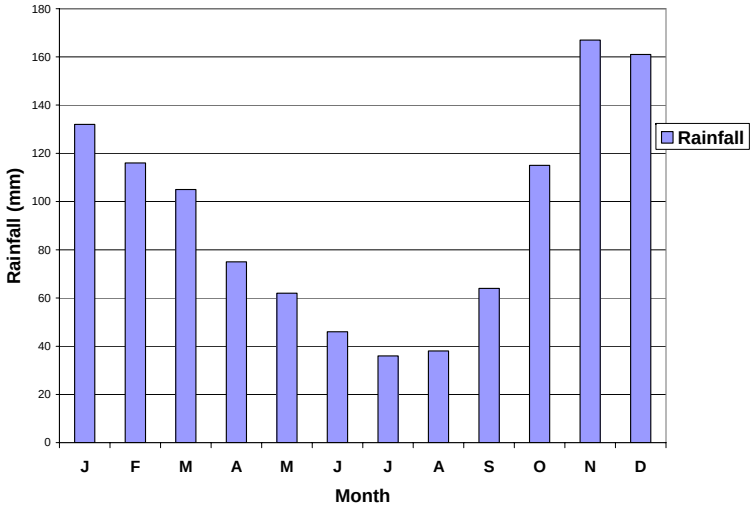


Figure 4.8: Average Monthly Rainfall in Vancouver (25)

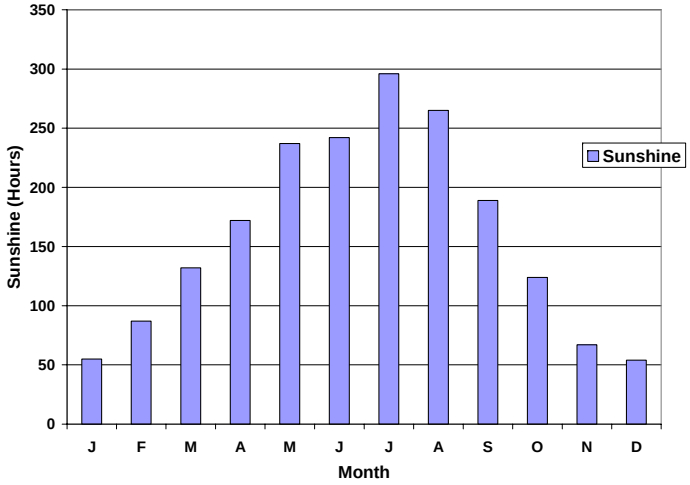


Figure 4.9: Average Monthly Sunshine in Vancouver (25)

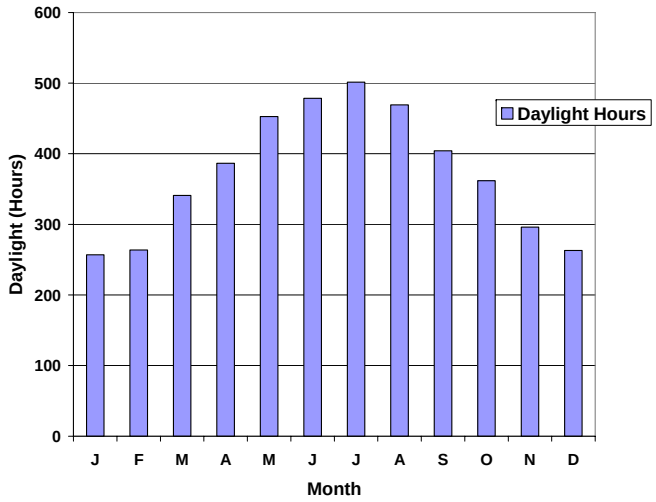


Figure 4.10: Average Monthly Daylight Hours in Vancouver (25)

Demands will also be impacted by design issues including accessability to the bike centre, personal security, activity, and visibility. These items are addressed in more detail in Section 6.

4.3 Bike Centre Services

A bike centre can be generally described as having three service components:

1. Bicycle parking;
2. End-of-trip facilities; and
3. Bike-related services.

4.3.1 Bicycle Parking

Bicycle parking is the primary reason for the bike centre and should provide safe, secure, and convenient bicycle parking. For most bike centres, this is the most spatially efficient component of the facility. There are a number of different parking types that can be employed. In increasing order of spatial efficiency these are generally:

- Single-level bicycle lockers;
- Single-level bicycle racks;
- Dual or multi-level bicycle racks;
- Attended or valet bicycle parking.

Figure 4.11: Dual-Level Bicycle Racks (35)

4.3.2 End of Trip Facilities

End-of-trip facilities refer to facilities cyclists use to clean-up following their journey. These include clothing lockers, showers, washrooms, towel and laundry services.

Interestingly, very few of the US Bikestations provide these facilities, most likely because they cater to transit-linked trips (i.e. biking is not the final leg of the journey) and/or rely on destination buildings (e.g. office towers) to provide these services (e.g. Seattle Bikestation, which is located in public space).

4.3.3 Bike-Related Services

There are a number of complimentary land uses and services that can be offered as part of the bike centre to improve its desirability, convenience, and revenue-generating potential. These can range from information services to retail uses. Land uses that are complimentary to the bike station are listed below (this list is not considered to be comprehensive):

- Air and water;
- Transportation information;
- Bicycle library;
- Internet kiosk;
- Bicycle retail: bikes, parts, and accessories;
- Bicycle repairs;
- Bicycle rentals;
- Bicycle tours;
- Snacks/vending machines;
- Retail:
    - Café, deli, juice bar;
    - Health and fitness studio;
    - Dry-cleaner;
    - Flower or newspaper stand;
    - Sporting goods rental or retailer;
    - Bicycle courier service;
- Car-share;
- Cycling group offices;
- Cycling seminars and workshops;
- Bicycle liscencing program;
- Sports cycling displays e.g. cycling hall-of-fame, local or international team shirts, memorabilia, and promotion of local cycling events (e.g. Tour de Gastown).

Figure 4.12 summarizes the services offered at existing Bikestations in the United States.

	Attended Bicycle Parking	24-Hour Bicycle Parking	Bicycle Repairs	Parts & Accessories	Air	Snack Bar/Café	Retail Sales	Rentals	Showers/Locker Room	Change & Rest Rooms	Information	Bike-Sharing	Car-Sharing	Bike Library	Parking Spaces	Floor Area (sq.ft)
Berkeley	✓		✓				✓				✓				77	1,000
Embercadero	✓	✓	✓				✓				✓				142	1,200
Long Beach	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓		78	1,200
Palo Alto		✓	✓	✓	✓						✓				94	2,000
Santa Barbara		✓	✓	✓	✓				✓	✓	✓	✓			78	1,360
Seattle	✓	✓	✓					✓					✓	✓	67	2,100
Chicago	✓	✓	✓			✓		✓	✓	✓					300	12,000

Figure 4.12: Matrix of Bikestation Services (Source: Bikestation).

4.4 Integration with Other Services

4.4.1 Transit

As previously identified (see Section 4.1), the majority of use at Bike Centre PC is expected to come from bicycle commuters. Only a small percentage of users are expected to take their bike on transit and park at Bike Centre PC, however there is likely to be some use of the facility from residents of the downtown that park their bike at Bike Centre PC before riding transit.

For the latter, it is important that the facility be integrated in some way with transit. It is noted that at other locations where bike centres are being considered, the importance of linking transit trips may be more critical (as is the case for many of the US Bikestations).

Despite the small expectation for transit-linked patronage, visibly linking the facility to transit is still important to further emphasize the location as a transport hub and to make use of high-activity areas to promote the facility.

Another way that the facility should be linked with transit is through an extension of the integrated ticketing system. For example, a valid transit ticket for that day may enable the holder to park at the bike station.

4.4.2 Car-Sharing

Along with transit, car-sharing is expected to be highly compatible with a bike centre in broadening people's travel choices. Integrating a car share program with the bike centre directly addresses potential cyclist's concerns of needing a vehicle during the day for meetings, errands, etc. It is important that these synergies are exploited to enhance travel choice.

In Metro Vancouver, there are two current operators of car-share programs, the Cooperative Auto Network and Zipcar, both operating a network of vehicles which people can access through becoming members. Car sharing membership levels are increasing exponentially in Canada and similar patterns are being observed in the Metro Vancouver area.

Cooperative Auto Network has a number of complementary benefits to its members, including a 15% reduction in the cost of transit passes and a discount on car rentals. Given the synergy with cycling, there may be opportunities to extend these benefits to cover the bike centre through discounts, joint memberships, etc. These options should be explored with both operators through the system design and financial planning so as to maximize benefits and integration between both systems.

4.4.3 Policy Changes

Current transportation policy within the City of Vancouver and the region include a number of initiatives to encourage cycling. A high profile facility such as Bike Centre PC represents an opportunity to revisit and enhance these policies to further support cycling. Policy initiatives should focus on matters such as:

- Measures to improve the bicycling environment to and from the bike centre in response to significant increases in bicycling activity, e.g. separated cycle lanes;
- Incentives such as reduced vehicle parking requirements for developers who contribute to this and similar facilities;
- Seeking further investment, sponsorship, and government funding into this and other facilities;
- Reducing traffic volumes and speeds; and
- Improving signage and way-finding.

Together, well founded transportation policies and increased cycling use present a strong combination in influencing priorities for walking, bicycling and transit use.

4.4.4 Bike Share

TransLink recently commissioned a study to investigate the feasibility of introducing a public bicycle system (PBS) to Vancouver. Integration of the bike centre with a PBS station (i.e. where public bikes are housed and parked) would enhance the centre as a node of cycling activity, although shared use between the two may be limited.

4.4.5 Local Cycling Groups

Local cycling groups including the Vancouver Area Cycling Coalition (VACC) and the British Columbia Cycling Coalition (BCCC) are volunteer-run non-profit organizations, whose members work to improve conditions for cycling in the Lower Mainland.

The VACC operates at a number of levels to support cycling in the Lower Mainland through training, improving parking facilities and design of the cycle network. Its overall mission is: "making cycling an integral part of the transportation culture".

The BCCC operates at a provincial level to “represent the interests of cyclists” and “secure their recognition in policy and programs affecting transportation cycling”. The BCCC is also involved in cyclist education through the national CAN-BIKE education program and the Bike Smarts program.

It is important that the experience and skills of advocacy groups such as these are used to the full extent in the development and promotion of a bike centre. In other locations, bike centres have been operated on a voluntary or minimal fee basis by these groups.

4.4.6 Reward Points

To encourage use, the bike centre could be integrated into a “rewards points” scheme. Any future network of bike centres should encourage a network-wide scheme where points are redeemable at any location.

Further, “reward shopper” points systems offered by Cadillac Fairview could include points or discounts for using the bike centre.

Lastly, if a transit “rewards” program is ever established, e.g. earn points towards a free transit ticket by riding transit, it should include the bike centre as part of the system.

4.5 Reduced Emissions

An estimate of the reduction in greenhouse gas emissions on a typical day as a result of Bike Centre PC has been calculated using industry-standard emission multipliers (ie. kg/CO_2 per vehicle km traveled) to calculate the amount of CO_2 that could be removed. These calculations consider only those users switching from a vehicle to a bicycle trip and assume that a mid-sized vehicle represents a "typical vehicle" size (ie. a fuel consumpation of 8.9L/100km) (36)

Vehicle Emmissions Balance Sheet

Vehicles removed (per workday)	100 - 200	vehicles/day
Vehicle trips removed (x 2)	200 – 400	vehicle trips/day
Average commuter cycle distance (24)	5	km
Vehicle-kilometers removed	1,000 – 2,000	veh-km/day
CO_2/veh-km (35)	0.2243	kg/veh-km
CO_2 removed	225 – 450	kg/day

5.0 SPACE REQUIREMENTS

5.1 Survey of Existing Facilities

The floor area/bicycle parking ratio for existing and proposed Bikestations in the United States has been reviewed in Table 5.1 to provide an estimate of the floor space required to accommodate the proposed bicycle parking spaces.

Floor space ratios range from approximately 9 sq.ft/space to 40 sq.ft/space, however on average approximately 18 square feet is required per bicycle space. It is noted that there is a distinct difference between transit-oriented and commuter-oriented Bikestations. Transit-oriented Bikestations require less floor area (approximately 14 sq.ft/space on average) as most of them do not provide significant end-of-trip facilities or many ancilliary services. Commuter-oriented Bikestations, such as in Seattle and Chicago, provide full service and average approximately 35 sq.ft/space.

Table 5.1: Bikestation Parking and Floor Space Survey

Location	Bicycle Parking (spaces)	Floor Area (sq.ft)	Floor Area Ratio (sq.ft/space)	Transit or Commuter Focus
Palo Alto Bikestation	94	2,000	21	Transit
Berkeley Bikestation	77	1,000	13	Transit
Embercado Bikestation	142	1,200	9	Transit
Long Beach Bikestation	78	1,200	15	Transit
Santa Barbara Bikestation	78	1,360	17	Transit
Seattle Bikestation	67	2,100	31	Commuter
Chicago	300	12,000	40	Commuter
Washington*	180	1,750	10	Transit
Fort Collins**	200	2,000	10	Transit
Minimum			*9*	
Average		*All*	*18*	
		Transit	*14*	
		Commuter	*35*	
Maximum			*40*	

* Proposed
** Feasibility study
References: 8, 9, 10, 11, 18, 24

The data included in Table 5.1 has also been graphed at Figure 5.1 and a linear-regression equation developed to estimate the size of the facility based on the number of bike parking spaces. The coefficient of determination of this equation (known as the "r-squared value") is reasonable, but suggests that floor area is based on other factors in concert with the number of spaces (this is logical as end-of-trip facilities, etc take up additional space).

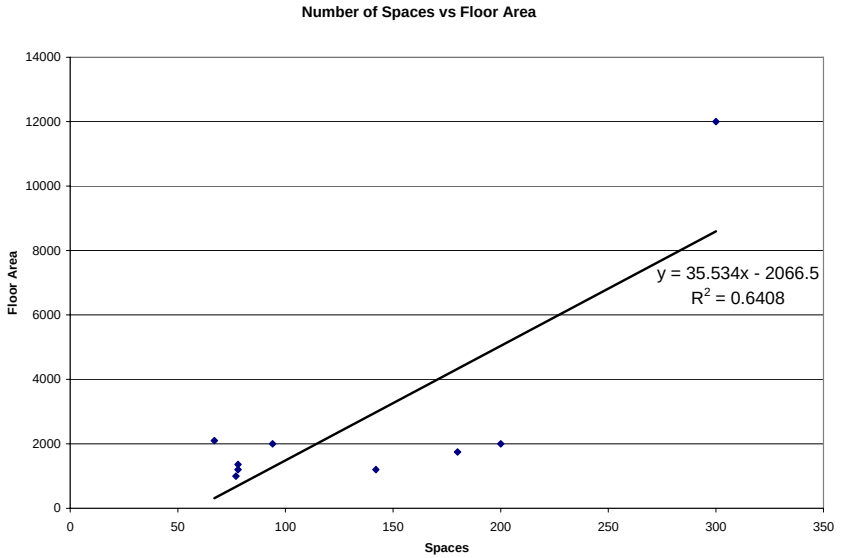


Figure 5.1: Relationship of Floor Area to Bike Parking Spaces.

Based on the commuter-Bikestation average rate in Table 5.1 (35 sq.ft/space) and the regression equation from Figure 5.1, an estimate of floor area requirements (in square feet) has been calculated in Table 5.2 for different numbers of bicycle parking spaces.

Table 5.2: Estimate of Space Requirements

Spaces	Commuter Bikestation Average	Best-Fit Equation
300	10,500 sq.ft	8,600 sq.ft
350	12,250 sq.ft	10,350 sq.ft
400	14,000 sq.ft	12,150 sq.ft
450	15,750 sq.ft	13,900 sq.ft
500	17,500 sq.ft	15,700 sq.ft

As a comparison, the space requirements of only the bicycle parking component, using a number of different configurations, is shown in Table 5.3.

Table 5.3: Space Requirements of Various Parking Arrangements

Spaces	Horizontal Parking (single level)	Horizontal Parking (double level)	Vertical Parking (single level)
300	5,100 sq.ft	2,670 sq.ft	3,900 sq.ft
350	5,950 sq.ft	3,115 sq.ft	4,550 sq.ft
400	6,800 sq.ft	3,560 sq.ft	5,200 sq.ft
450	7,650 sq.ft	4,005 sq.ft	5,850 sq.ft
500	8,500 sq.ft	4,450 sq.ft	6,500 sq.ft

The most efficient parking layout is to use two-tier horizontal racks (used in the majority of Bikestations – refer to Figure 4.11). With this configuration, parking will take up approximately 25% of the anticipated floor area. The remainder of space will be available for end-of-trip facilities and ancilliary services.

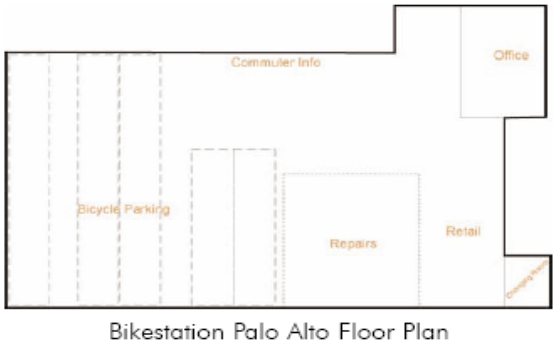
Single-level horizontal racks are the most inefficient parking layout, taking up almost twice the space of two-tier racks. Vertical racks use approximately 1.5 times the space of two-tier horizontal.

5.2 Floor Plans

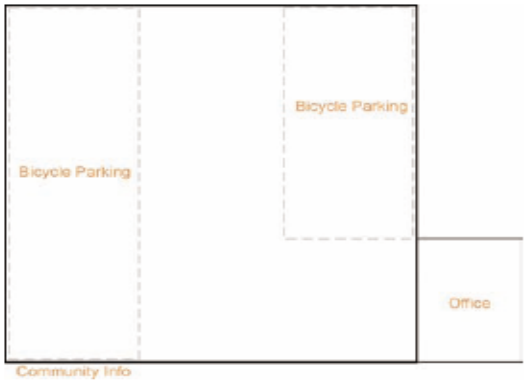
Example floor plans of proposed and existing bike centres have been included below to give a general idea of how space is allocated to the various uses.

Figure 5.2 shows the floor plan of the Palo Alto and Berkeley Bikestations. These facilities are transit oriented and do not provide end-of-trip facilities or extensive ancilliary services. The majority of space is dedicated to parking bikes and operations.

Figure 5.3 shows the floor plan of the Long Beach Bikestation. In this case, bike parking is provided at the back accessed through an entrance past high activity uses including bicycle retail/repairs, café, and outdoor seating. A washroom is provided, but for the most part, end-of-trip facilities are not included in the floor plan.

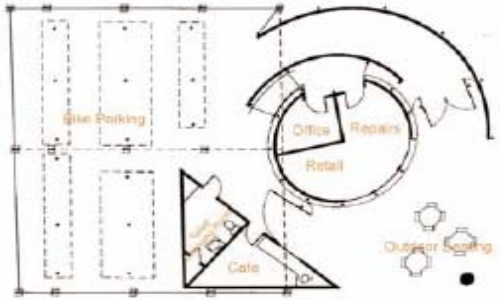


Bikestation Palo Alto Floor Plan



Bikestation Berkeley Floor Plan

Figure 5.2: Bikestation Palo Alto and Berkeley Floor Plans (9).



Bikestation Long Beach Floor Plan

Figure 5.3: Bikestation Long Beach Floor Plan (9).

The floor plan of the proposed downtown Vancouver "bikeade" developed in 1991 by Cycling Dimensions for the Future Shop/Winners site is shown at Figure 5.4. This facility would have had no street presence, however the layout provided full service including a reception lobby, bicycle parking, showers, lockers, towel and laundry service, bike-related retail, and offices. In total, the layout was to provide for 230 parking spaces in an area of 6,000 sq. ft.

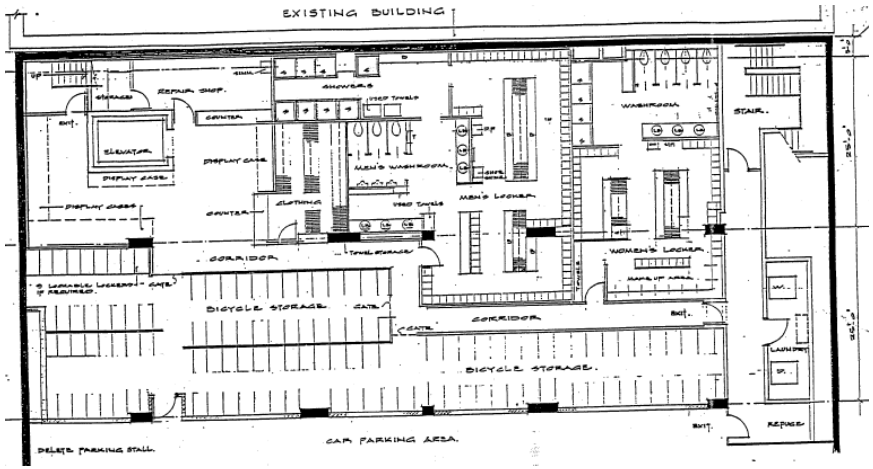


Figure 5.4: Proposed Downtown Vancouver Bikeade Floor Plan
Source: Canwest Cycling Dimensions (1991)

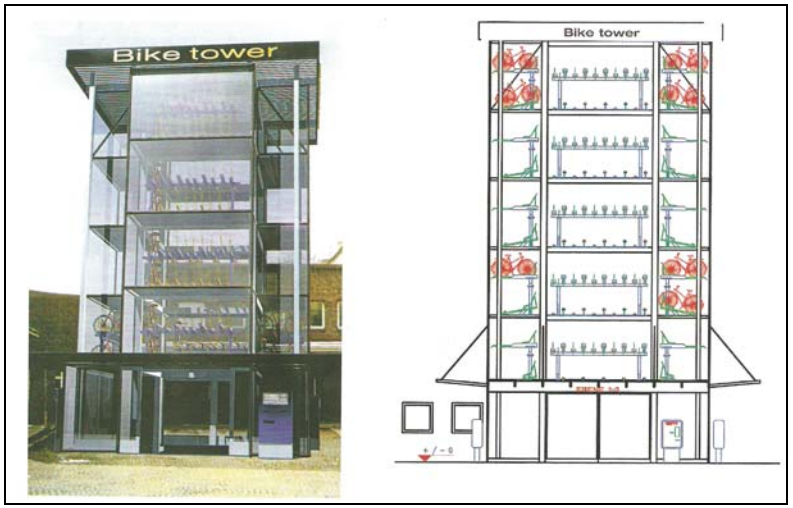
5.3 Storage Technology

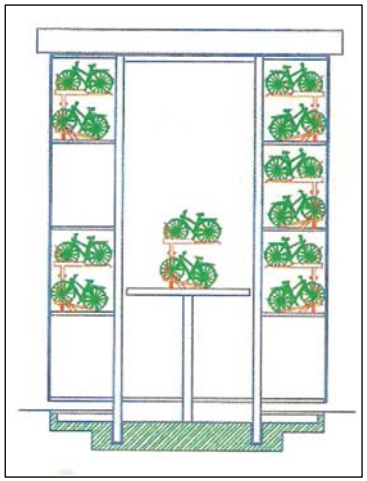
Beyond single- and double-tier, vertical- and horizontal-bicycle racks, there are also a number of other storage technologies that have been applied in other parts of the world that can reduce the footprint of the bicycle parking component of the bike centre. Figure 5.5 shows some examples of bike storage technologies including:

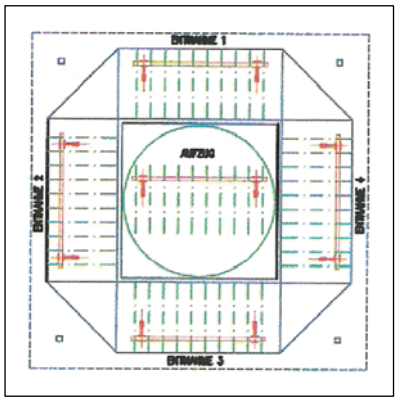
- Bike towers: an automated parking system that stacks bicycles in cubicles in a tower above the ground using a shuffling system. Various models are used in Europe and Japan;
- Biceberg: an automated parking system that stacks bicycles in compartments that form cicular modules underground. Developed in Spain;
- Bike tree: bicycles are elevated off the ground along the "trunk" of the tree, however are not stacked underneath each other. The main role of the bike tree is to enhance bicycle parking security.

Figure 5.5: Examples of Advanced Bike Parking Storage Technology (below):

Bike Tower (35)

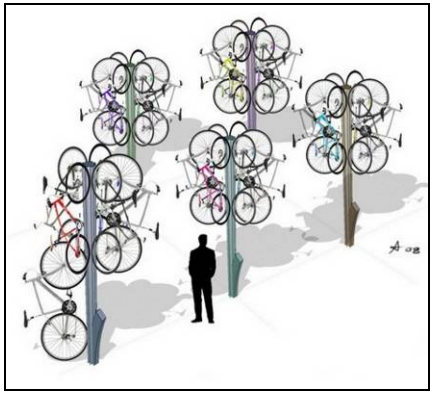






Biceberg (37)

Bike Tree (38)



6.0 COSTS, REVENUE, AND FUNDING

This section reviews costs, revenue potential, and funding opportunities related to Bike Centre PC. It is not intended that an operating budget or a business model be developed as part of this study, however significant costs that could impact the viability of the facility have been identified and a discussion on business model options presented.

6.1 Costs

In general, there are two cost components, capital costs to design and construct the facility and operating costs to maintain it. These are reviewed as part of this section.

6.1.1 Capital Costs

Capital cost is by far the most significant cost for the facility. The magnitude depends largely on the opportunity to retrofit or redevelop sites as well as the architectural desires of the project.

Components of capital cost include:

- Land acquisition;
- Surveys and testing;
- Architecture and engineering;
- Administration;
- City and municipal fees;
- Construction:
    - Building costs;
    - Exterior improvements;
- Public art; and
- Contingencies (at least 10%).

Cost information included in studies conducted in the United States by Bikestation suggest that bike centre capital costs range from US $50,000 to $800,000 for transit-oriented facilities. This represents approximately US $3,000 to $5,000 per space and an average of US $4,200 (10). However, the Chicago Millenium Park facility, an architecturally designed commuter bike centre cost in the order of US $3.1 million. Commuter-oriented facilities cost significantly more due to the addition of end-of-trip facilities and other services.

An analysis of capital cost data for a number of US bike centres including existing and proposed Bikestations and the Chicago Millenium Park Bike Station found that there was some relationship between capital cost and the number of bicycle parking spaces. However, given this variable does not account for the space taken up by ancilliary services associated with commuter-oriented bike centres, the relationship between capital cost and overall floor area, included at Figure 6.1 shows a much stronger relationship. A linear regression equation has been developed from this data.

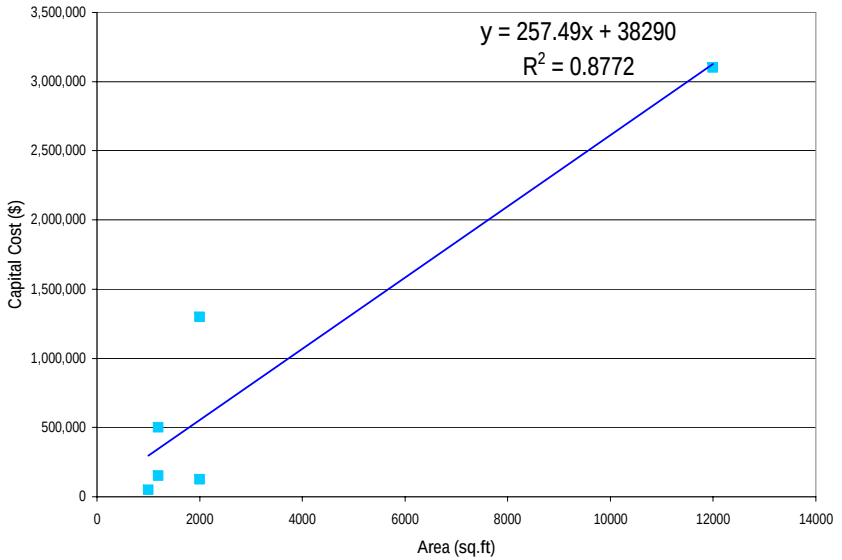


Figure 6.1: Relationship between Capital Cost and Floor Area ($US)
Data includes: California, Seattle, Fort Collins Bikestations and the Chicago Bike Station.
Sources: (8, 9, 10, 11, 18, 24)

An estimate of capital costs for various space arrangements has been calculated in Table 6.1 using the average cost per sq.ft for commuter-oriented bikestations and the regression equation at Figure 6.1.

Table 6.1: Estimated Capital Costs ($US)

Number of Spaces	Space Required (sq.ft)*		Capital Cost ($ million)	
	Commuter Bikestation Average	Best-Fit Graph	Commuter Bikestation Average	Best-Fit Graph**
300	10,500 sq.ft	8,600 sq.ft	$2.75 million	$2.25 million
350	12,250 sq.ft	10,350 sq.ft	$3.20 million	$2.70 million
400	14,000 sq.ft	12,150 sq.ft	$3.65 million	$3.15 million
450	15,750 sq.ft	13,900 sq.ft	$4.10 million	$3.60 million
500	17,500 sq.ft	15,700 sq.ft	$4.55 million	$4.10 million

* from Table 5.2.
** based on Figure 6.1.

The approximately 400 spaces required to meet the bylaw requirements of the City of Vancouver (and supported by usage forecasts) would be expected to cost in the order of US $3.15 to $3.65 million dollars.

6.1.2 Operating Costs

Operating costs fall into five major categories (10): marketing, membership management, facility maintenance, day-to-day operations, and agency interaction. Specific costs may include the following:

- Liability insurance;
- Licenses and permits;
- Marketing;
- Maintenance;
- Payroll/Staffing:
    - Manager: 40 hrs/week and staff: up to 56 hrs/week;
- Professional fees (e.g. accountant);
- Rent;
- Equipment and office supplies;
- Utilities (phone, internet, water);
- Workers compensation; and
- Miscellaneous expenses including postage, delivery, etc.

A literature review suggests that operating costs range from US $30,000 to US $150,000 per year (39) but are often in the order of US $50,000 per year. This will depend on the type of facility (e.g. unattended facilities will cost less to operate). Operating costs for Bike Centre PC will likely be in the order of $150,000.

The operation of the facility could be established as a public agency operation, a private operation, a not-for-profit operation, or a public/private partnership. These are discussed in more detail in Table 6.2.

Table 6.2: Options for Operating Responsibilty

	Advantages	Disadvantages
Public Operation	Can be integrated into an existing public agency department Acknowledgement of the facility's role as a public service and expansion of the transportation system	Multi-department co-operation required
Private Operation	Private sector takes all responsibility Greater operating skills and entrepeneurship	Existing bike centres have proven financially unsustainable Not-for-profit organizations can operate with grant assistance
Not-for-Profit	Objectives are community oriented Eligible for grant funding to cover operating costs	Limited resources Existing bike centres have proven financially unsustainable
Public/ Private Partnership	Cost, risk, and goal sharing Reduced public agency time commitment Private sector operating skills	Competing objectives and expectations

The proposed Bike Centre PC would benefit from the multi-objective approach of a public/private partnership (with either a local private operator or a not-for-profit organization). A local operator would bring the added skills of operation and business savvy to maximize the financial position of the bike centre.

Although existing bike centres in the United States have not achieved financial independence, there is opportunity for a private operator to direct more attention to achieving financial goals. Partnership with a public agency would strengthen that position through additional resources.

6.2 Revenue

There are a number of revenue streams available to the bike centre – parking revenue is only one component. Other revenue sources can come from services offered by the facility. The expectation of these revenues in covering bike centre costs needs to be identified when establishing the business plan.

Is the Bike Station expected to be financially self-sufficent?

The bike station has a number of community-focussed goals, e.g. reducing greenhouse gas emissions and encouraging activity. Considering this, some level of financial support from public sources may be reasonable to expect.

Should parking be free of charge?

In terms of parking revenue, a key consideration is whether parking should be free or charged, and if charged, how much? There are arguments for both free and charged parking.

Free parking encourages use of the facility to achieve the wider community goals of encouraging greater cycling mode share. This increase in activity also enhances the success of associated services.

On the other hand, charged bicycle parking provides an independent revenue stream. In some cases, revenue generated by membership and parking fees can cover up to 40% (Source: Dutch National Railway and anecdotal advice from Bikestation board member) of maintenance and administration costs.

The Bikestation model charges a $20 annual administration fee for users, however parking is provided free during times when the facility is attended. During other times, a membership (offered as annual, monthly, or daily) is required to access the parking area. A summary of Bikestation rates and operating hours is provided in Table 6.3.

Table 6.3: Bikestation Parking Rates

	Annual Fee	Rates	Operator	Hours
Berkeley	Free	Free	Bicycle-Friendly Berkeley Coalition	7am – 9pm Closed weekends and holidays No access when unattended
Embercado	$20	Bikestation Schedule	BART	Attended 7:30-9:30am 3 – 7pm Closed weekends 24hr member access
Long Beach	$20	Bikestation Schedule	Bikestation	Attended Weekdays 7am-6pm Weekends 9am – 5pm 24hr member access
Palo Alto	$20	Bikestation Schedule	Palo Alto Bicycles and City of Palo Alto	Unattended facility 24hr member access
Santa Barbara	$20	Bikestation Schedule		Unattended facility 24hr member access
Seattle	$20	Bikestation Schedule	Bicycle Alliance of Washington	Attended 9am-5pm Closed weekends 24hr member access

Bikestation Schedule: Free during attended times (some facilities are unattended). During unattended times: Annual - $96; Monthly - $12; Daily - $1.

Parking revenue is supplemented by ancilliary services such as:

- Bicycle retail, rentals, repairs, tours, licensing;
- Meeting room hire, educational seminars, etc;
- Associated land uses: café, deli, newspaper stand, sports good retailer/renter, flower shop, dry-cleaners, juice bar, bicycle courier company, etc.

One important feature of the Bikestation model is that 24-hour member access is maintained through key fob or similar technology. Other operational questions that need to be addressed include:

- What hours should be attended? Weekends, holidays, evenings, etc? What happens if a bike is dropped-off during attended hours, but picked-up after attended hours (e.g. a client "got stuck at work")?
- Is parking and non-parking revenue from the bike centre expected to sustain operations and maintenance. What costs should be covered by expected revenue (e.g. operations, maintenance, rent, etc)?
- How are ancilliary service revenues tied (or not tied) to the bike centre, i.e. are bike-related retail spaces sub-leased to independent operators?

Assuming the Bikestation model, and that 75% of patrons using Bike Centre PC chose to be members and 50% of the remainder paid the daily $1 parking fee (during non-attended times), the facility may generate in the order of $20,000 in annual parking revenue.

As an example of the parking charge required to meet financial sustainability, under these conditions, and assuming that operating costs could be limited to $50,000, membership would need to be in the order of $60 annually and daily parking fees $3 for the centre to be financially sustainable (assuming no elasticity in demand).

The Bikestation model is not the only available option. Other models that should be considered include:

(1) Fee per use regardless of duration;
(2) Fee per hour;
(3) Graduated fee based on duration of stay, e.g. first 4 hours free, then fee based on longer stay;
(4) Graduated administration fee based on amount of use (to a maximum);
(5) An established monthly fee used as credit towards parking; and
(6) Validated parking.

An e-card set up that debits fees and charges directly from a credit card would be a beneficial system to facilitate payment, track data, and claim unpaid fees. This system also enables any future incentive or reward schemes.

6.3 Support and Funding

The success of the bike centre will likely depend on the amount and diversity of support that can be gathered from interested sponsors. This support comes in a variety of forms including financial, operating, and promotional support. Interested sponsors may include:

- City of Vancouver;
- TransLink;
- Air Quality agencies (GVRD);
- Cadillac Fairview and other private development interests;
- The Downtown Business Improvement Association;
- Local bicycle retailers;
- Bicycle advocacy groups (often through staffing); and
- CAN and Zipcar car-share programs.

Depending on the revenue set-up and the future success of the facility, funding may be required to cover the capital, operating, and/or maintenance costs.

6.3.1 Funding Sources

As previously discussed, operating expenses can be offset (at least partially) by revenue generated from parking and other services. However, capital cost can be more difficult for an operator to front. It is generally accepted that capital costs are easier to secure than operating costs from most of the available funding sources.

There are a number of local, provincial, federal, and private organizations that offer grants to suitable projects, these are listed and described briefly below.

Local

- Vancity – *Green Building Grant*: a fund that supports the retrofitting of buildings to reduce GHG emissions (30).
- Vancity – *enviroFund*: a fund for air quality improvement and alternative transportation. Previous recipients include the Livable Region Coalition SPEC Enviro Transportation Solutions and the Vancouver Area Cycling Coalition's bike skills courses (30).

- Vancity – *Carbon Offset Program*: invests in local solutions to climate change, builds local knowledge about reducing emissions, and creates local sources of high-quality carbon offsets. Eligible to not-for-profit organizations (31).
- Federation of Canadian Municipalities – *Green Municipal Fund*: offers low-interest loans combined with grants to support municipal governments and their partners in developing communities that are more environmentally, socially, and economically sustainable (28).
- Special Property Taxes: imposed in areas served by transportation programs and services, sometimes called a Local Improvement District or Land Value Capture (32).
- Business or Employee Assessments: special assessments on businesses in an area, based on floor area, revenues, or number of employees (32).

Provincial

- *Built Environment and Active Transportation (BEAT) Initiative*: this Union of British Columbia Municipalities program is available to communities with initiatives for green or active transportation infrastructure such as bicycle storage facilities.
- *Green City Awards*: the British Columbia provincial government provides a contribution towards community greenhouse gas emission reductions.
- *Cycling Infrastructure Partnership Program*: this program offered through the British Columbia Ministry of Transportation focuses mainly on projects involving bicycle network improvements and is likely not available to the bike centre.

Federal

- *Moving on Sustainable Transportation* (MOST): a program funded by Transport Canada for sustainable transportation projects. Previous recipients include the Christian Bike Share Program in Toronto. One outcome of this project was a plan to develop a bike and transit hub service similar to the bike station concept (33).
- Environment Canada – *Eco Action Community Funding Program*: funding for not-for-profit organizations for projects that address Environment Canada's priority issues of clean air and climate change, clean water, and nature. Private and municipal partners are eligible through partnership with non-profit organizations (29).
- Federal gas tax transfers: a portion of fuel tax revenues are dedicated to special transportation programs;

Private

Additional programs are offered through private foundations and philanthropic organizations as well as:

- Bicycle Trade Association of Canada – Grant Program: focused on creating and building on relationships between grassroots projects and local specialty bike retailers. BTAC will fund projects that have significant potential for changing behaviours, and that have measurable success. Past projects include the *After School Bikes Program* in Vancouver (30).

Other funding partnerships that should be explored as appropriate include:

- Low-interest loans;
- Tax-credit investment;
- Community development grants (must demonstrate improved economic conditions);
- Land-donation or write-down;
- Development fee rebates;
- Tax sharing;
- Public-private signature project (to encourage additional investment);

6.3.2 Funding Case Studies

The following case studies are taken directly from a feasibility study conducted by Bikestation for the City of Fort Collins in Colorado (9). A number of the funding sources mentioned are not available to the Vancouver setting, however a general idea of funding partnerships can be gained from these examples.

Bikestation Long Beach, California

Type: Transit-oriented, some commuter function

Land: Portion of an existing parking lot provided by the Long Beach Redevelopment Agency

Initial Funding:

Year: 1992
Time: 18 months
Amount: $230,000
Agencies: Intermodal Surface Transportation Efficiency Act, Los Angeles Metropolitan Transportation Authority (MTA)

Renewal Funding:

Year: 1997
Time: 30 months
Agencies: City of Long Beach, Los Angeles MTA

Current Funding:

Year: 2000
Time: ongoing
Amount: $4,000 per month
Agency: City of Long Beach

Other Contributors: Local sponsors, Mobile Source Air Pollution Reduction Review Committee, South Coast Air Quality Management District.

Bikestation Palo Alto, California

Type: Transit-oriented

Land: Retrofitted luggage room at Palo Alto Caltrain depot

Initial Funding (retrofit and operations):

Year: 1999
Time: 18 months
Amount: $171,000
Agencies: City of Palo Alto, Bay Area Air Quality Management District

Current Funding:

Year: 2000
Time: ongoing
Amount: $3,500 per month
Purpose: operations and marketing
Agency: City of Palo Alto

Bikestation Berkeley, California

Type: Transit-oriented, unattended

Land: Bicycle "cage" on a subterranean level of the Berkeley BART station

Initial Funding (construction and operations):

Time: 18 months
Amount: $135,000
Agencies: City of Berkeley, BART, Bay Area Air Quality Management District
Other: $20,000 in private donations to assist in operation

Current Funding:

Time: ongoing
Amount: $5,000 per month
Purpose: operations and marketing
Agencies: as above (extension of 18-month demonstration period)

7.0 DESIGN ISSUES

This section establishes criteria that can be used to evaluate a potential bike centre location. These are then applied to a number of arrangements at the Pacific Centre. The preferred arrangements are then described in further detail.

7.1 Location Criteria

International experience in the establishment and success of bike centres has been reviewed through an extensive literature review. Based on this review, a number of key themes continually reappeared and have been collated as a guide to the key considerations in determining a successful bike centre location. These considerations are:

- Accessability: both in terms of the proximity to the local cycling network as well as physical access to bicycle parking areas;
- Visibility: the most important consideration in the longevity of the facility and its ability to attract users. The bike centre must have a presence that acts as "advertsing" to passing cyclists, pedestrians, and most importantly, vehicle drivers and passengers;
- Expandability: the ability of the bike centre (or network of bike centres) to grow as use increases;
- Capital: the costs associated with constructing the facility.
- Revenue: both in terms of the revenue-generating potential of the bike centre and lost revenue from the replacement of other uses that could have occupied that space. At Pacific Centre, the latter manifests as:
    - Lost vehicle parking revenue ($40-50/sq.ft per year); and
    - Loss of high-value leasable space ($200/sq.ft per year).

"Initially, the entire bike station was meant to be underground—it wouldn't be visible from above — but we thought that would be a mistake. It needed a more attractive and official presence so people would know about it. It actually has become somewhat of a landmark for bikers in Chicago." David Steele (Chicago Bike Station Designer). (18)

7.2 Bike Centre Arrangement

A number of different arrangements have been considered at a planning level to determine the most effective arrangement that addresses the above criteria. Options considered include a bike centre:

1. Built into a parkade;
2. Stand-alone above grade structure;
3. At-grade entrance with sub-teranean parking;
4. At-grade entrance with rooftop parking; and
5. Mechanized bike tower.

These options have been evaluated in terms of the location criteria (see Section 7.1) in Table 7.1.

Sub-terranean arrangements (Options 1 and 3) have the advantage of (anticipated) lower capital costs, however are more difficult to access, result in a significant loss of vehicle parking revenue, and have difficulty linking to the street and high-visibility locations.

A completely at-grade structure (Option 2) is the most accessable and visible arrangement for the bike centre, however may reduce the amount of high-value leasable space available within the allowed site density. Some of this lost revenue can be recouped through the creation of bike-related retail.

A rooftop location, linked with an entrance and associated services at street-level (Option 4) limits the loss of parking and high-value leasable area revenues by converting previously unused space (i.e. the rooftop).

A "bike tower" (Option 5) reduces the footprint of the Bike Centre and therefore minimizes the loss of high-value leasable area. However, this is offset by the high cost of construction and limited ability to expand.

Table 7.1: Evaluation of Arrangement Options

Option	Criteria						
	Accessibility		Visibility	Expandability	Capital Cost	Revenue	
	Proximity to Cycle Network	Physical Access				Parking	Leasable Space
1. Built into Parkade	Elevator access from Granville Street. Parkade ramps not linked to cycle network	Canada Line Station elevator Existing vehicle ramps	Limited opportunity to link facility to activity centres	Expandable at the expense of vehicle parking	Costs associated with bringing facility "to code"	Facility built in place of existing parking - lost revenue is substantial	Minimal
2. Stand Alone Above Grade	Dependent on location	Street-level access	Visible to street activity	Requires pre-planning of building size to accommodate future growth	Construction of new building	None	Some loss of rentable space. Introduction of street-level related retail e.g. cafes, etc.
3. Street Level Entrance – Subterranean	Dependent on location	Street-level access Elevator	Entrance and supporting street-level retail provides visible link to facility	Expandable at the expense of vehicle parking	As per 1 and 2 Elevator or cycle ramps to lower levels required.	Facility partly built in place of existing parking - lost revenue	Introduction of street-level retail, e.g. cafés, etc
4. Street Level Entrance – Rooftop	Dependent on location	Street-level access Elevator	Entrance and supporting street-level retail provides visible link to facility	Expandable – limited by the size of the rooftop.	Converts previously unused space Elevator required.	None	Previously unused space Introduction of street-level retail, e.g. cafés, etc
5. Mechanized Bike Tower	Dependent on location	Street-level access	Visible at street-level – height of tower gives visible presence	Expansion requires installation of a another tower.	High cost of technology	None	Small footprint reduces loss of lease-able space

7.3 Pacific Centre Sites

The preferred arrangements, in terms of their ability to provide an accessable and visible location, as well as reduce the financial impact on parking and mall operators are Options 2, 4, and 5. The bike tower (Option 5) is limited by its cost and expandability.

A number of specific locations for a Bike Centre at Pacific Centre have been considered in terms of how they deliver these options with consideration of the key criteria.

7.3.1 Pacific Centre Parkade

Although this is not a "preferred" option given its limited visibility, it has been presented as the initial arrangement considered by the City of Vancouver.

An underground bikeade at the Pacific Centre would be best located in the first underground parking level below grade, integrated with the Canada Line station elevator (to best make use of existing infrastructure and provide a link to transit). It is not desirable to provide additional access to this facility via the vehicle ramps to the parkade given the mix of traffic and design of the ramps (see Section 2.3.

This facility would remove approximately 40 - 45 vehicle parking stalls based on a preliminary size estimate of 12,000 – 14,000 sq.ft. The centre would be difficult to link to the street beyond a ceremonial entrance, which may be overshadowed by the entrance to the Canada Line station. The location may also become too cluttered at the Canada Line entrance with the addition of street-level services related to the bike centre. This option seems to be the least preferred.

7.3.2 Georgia Street/Granville Street Redevelopment

This is the preferred option of Cadillac Fairview as space can be dedicated appropriately as part of the future redevelopment of the Sears site. This would be the best location for the bike centre in terms of visibility and accessibility. The major concern with this option is the timing of the redevelopment of this site and the potential for lost retail revenue. The latter could be relieved through relaxation of the site density for part or all of the bike centre.

7.3.3 Georgia Street/Howe Street Redevelopment

This option provides a less visibile site from the street-front than the Sears site, however has the benefit of the "novelty factor" of being located on the rooftop of a building that could develop this location as a landmark for cyclists in the City. There is also more opportunity to link associated services to the street level. Revenue loss is minimized at this location and it also provides the most expandable location.

Connectivity of this site to the downtown cycle network would need to be addressed as the fronting roads (Georgia Street and Howe Street) are not comfortable for cyclists of all levels. This could be in the form of on-street cycle lanes or separated cycle facilities.

Other concerns with this site include:

- The link to transit, particularly for bike park-and-ride trips that will need to park, walk across Georgia Street and then enter the Canada Line Station.
- Constructability: it has been advised by Cadillac Fairview that the new building will be constructed on existing footings and will push design strengths to their limits and in so doing, will likely not allow roof occupancy of any kind.

With the constructability issues aside, this site may be a good temporary solution prior to the redevelopment of the Sears site, depending on its timing.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This feasibility study has investigated numerous aspects surrounding the construction and operation of a bike centre at the Pacific Centre mall. Recommendations have been framed by answering the questions posed as part of Section 1 of this report.

Why is constructing a bike centre a good idea?

Cyling is a rapidly growing mode of transport used to access downtown Vancouver. A bike centre would serve to add to the amenities provided for cyclists in downtown Vancouver, break down some of the existing barriers to cycling, and encourage cycling as a more viable transportation mode.

Current levels of use of the informal bike room at Pacific Centre and short-term bicycle racks in the immediate vicinity suggest that demand for the bike centre can be met. It is estimated that peak demand for the facility will be between 360 and 665 spaces (depending on the attractiveness of the facility) consisting mainly of commuter and bike park-and-ride cyclists. Other users are expected to include recreational, tourist, and special event cyclists as well as downtown residents using the facility for secure storage of high-end bicycle equipment.

Previous North American bike centre applications have shown a proven reduction in auto use and a reduction in greenhouse gas emissions.

How many parking spaces and what additional services are required?

Bike Centre PC should be constructed with 400 spaces initially. This brings the facility in line with the City of Vancouver's bylaw requirements for the Pacific Centre and is within the expected range of peak demand. Consideration should also be given to providing an expandable facility that could take advantage of its future success.

Bicylcle parking should be provided in a number of forms. The majority of parking should be dual-tiered racks that minimize space requirements, however some lockers may also be desirable to accommodate storage of high-end cycling equipment.

Ancilliary services are essential in providing a functional facility that will become a landmark for cyclists and hopefully act as a catalyst to encourage others to cycle. As a minimum, the bike centre should provide end-of-trip facilities including lockers, showers, and wash facilities as well as air, water, and bicycle/transit information.

To aid the financial viability of the facility, a vendor that provides bicycle retail, repairs, rentals, tours, classes, etc is recommended. Other complimentary land uses including cafes, juice bars, a health and fitness studio, newspaper stands, etc should be considered to transform the location into an active sense of place.

How much space is needed and where should it be located?

A commuter-oriented bike centre of 400 spaces will require in the order of 12,000 to 14,000 sq.ft. to accommodate bicycle parking, end of trip facilities, and some ancilliary services.

The location of Bike Centre PC within the Pacific Centre is crucial to its success. It is important that the site chosen be accessible, visible, and expandable. Given the revenue potential of space at the Pacific Centre (both retail and vehicle parking), it is important that lost-revenue potential be minimized.

The original proposal for an underground "bikeade" does not deliver the accessibility or visibility requirements essential to the success of the facility. The preferred location is an at-grade facility developed as part of a future redevelopment of the Sears building, which will maximize street exposure and interaction and provide the most accessible facility to cycling and transit facilities.

A facility on the rooftop of the proposed redevelopment of the Georgia Street/Howe Street entrance linked to the street by an elevator at street level would be a good interim location that minimizes the potential loss of revenue (as compared to an underground bikeade). However, this location is likely to have constructability issues (limited to no roof occupancy allowed), is less visible, and has some difficulty in connecting to the existing nearby on- and off-street cycling network.

Is a bike centre financially sustainable?

Previous applications of bike centres in North America have proven not to be financially self-sustaining, however many of these have been established with the primary goal of encouraging more cycling activity. Whilst this is still a priority goal of Bike Centre PC, a greater level of importance must also be placed on bridging the gap towards financial sustainability.

The first consideration is who is responsible for providing the space for the facility. If provided by the Pacific Centre, some form of compensation, perhaps in the form of an exclusion from the development assessment should be made.

Almost certainly, the bike centre will require some form of capital funding. A 400-space bike centre is expected to cost in the order of US $3.15 to $3.65 million to construct. There are a number of grants and funding sources available to assist in the initial investment.

It is recommended that a public-private partnership between a public agency invested in providing increased transportation choice and a local business and/or a not-for-profit organization be established to cover ongoing operations and maintenance of the facility. These costs are likely to be in the order of $150,000 per year. A public-private partnership will maintain the multiple goals of the bike centre (including a focus on sustainable transportation and a financially successful facility), introduce the skills of the private sector to the operation and marketing of the facility, and avail a number of different funding opportunities. It is important under this model that each party's role and responsibility be clearly defined and a contingency strategy be clearly understood.

Costs to park at the facility should be further investigated through consultation with a cycling focus group to determine an appropriate fee structure and identify cycle parking elasticities.

Financial sustainability of the bike centre will be greatly improved with the integration of bicycle and other associated retail services to the facility. This will supplement revenue generated by parking.

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