Could Park-and-Ride Become Bike-and-Ride?

Assessing the potential for bike cages at Metro Vancouver's park-and-ride lots

Debra Rolfe

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COULD PARK-AND-RIDE BECOME BIKE-AND-RIDE? ASSESSING THE POTENTIAL FOR BIKE CAGES AT METRO VANCOUVER'S PARK-AND-RIDE LOTS

by

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Executive Summary

This report examines which of TransLink's nineteen park-and-ride lots would be the best locations to install secure bike parking cages. Building upon TransLink's cycling objectives, this report examines existing academic and professional literature about why people cycle, why people park their bikes at transit, and why people use park-and-ride lots. This background research informs the development of a multi-criteria assessment process that provides a method for prioritizing the park-and-ride lots for investment in bike parking facilities. Site assessments at nine of the lots and interviews with planners for the municipalities where the lots are located provide the basis for selecting five lots as potential sites for bike parking cages. This report also develops a business case in support of bike parking cages throughout TransLink's system.

Enhancing the bike parking options at TransLink's park-and-ride lots fits with strategies outlined in its recent regional cycling strategy and responds to the challenges facing its park-and-ride lots. TransLink's (2011a) regional cycling strategy, *Cycling for Everyone*, calls for more and safer cycling by 2040. Its proposals for achieving this include: increasing opportunities for bike-transit integration and improving parking and end-of-trip facilities. At the same time, TransLink is in the process of developing a comprehensive park-and-ride policy. This has been precipitated by uneven use of TransLink's park-and-ride lots, with some being under-utilized while others are frequently over capacity. Increasing bike parking can increase access to transit without the need to construct costly car parking spaces.

This study reviews literature about both cycling and park-and-ride lots. There is a rapidly growing collection of academic and professional literature about why people cycle and a smaller but growing collection of literature about why people cycle to transit stations. Much of the research that looks at why people cycle has focused on built environment factors such as bike lanes and paths, population density, land use mix, and street connectivity. The few studies that have examined bike access to transit have found that the built environment, the design and security of bike parking, and trip-related factors appear to influence the choice to access transit by bike. Trip-related factors include: the mode of transit a cyclist is accessing, where the station or interchange is located in the metropolitan region, and the trip purpose. There has been very little research about park-and-ride lots. Much of the existing literature on park-and-ride lots focuses on their design and use or argues for whether or not they encourage transit use.

This study used a mixed methods approach that included a multi-criteria assessment, site assessments, and interviews with professionals. Multi-criteria assessment is a method designed to help guide decision making processes. The multi-criteria assessment process combined both quantitative and qualitative data to select a shortlist of nine lots. The criteria evaluated in the multi-criteria assessment are outlined in Table 1. Site assessments were conducted at these lots. The final list of lots where bike

cages are recommended was selected using data from the multi-criteria assessment, site assessments, and interviews with municipal planners. The business case development incorporated the above data, plus case study data about bike cages at transit systems in Melbourne; Boston; the San Francisco Bay Area; and Portland, Oregon.

Table 1: Criteria evaluated in the multi-criteria assessment

Assessment Criteria Group	**Criteria**
Install bike parking at park-and-ride lots with a demonstrated need for bike parking	Percentage of surrounding area population commuting by cycling or walking
	Number of bike parking spaces
	Percentage of bike lockers rented
Install bike parking at lots that are supported by transit	Percentage of surrounding area population commuting by transit
	Number of peak-hour transit services
Install bike parking at lots that reduces stress on current car parking facilities	Number of car parking spaces
	Percentage of car parking spaces occupied
	Percentage of surrounding area population with a household income of $20,000 per year or less
Install bike parking at lots in neighbourhoods with the greatest potential for increased bike use	Walkability index
	Bikeability features
	Micro-scale urban design features

This study's most important recommendations apply across the lots. Crucially, TransLink should collect data about how people get to transit stations or exchanges, as well as evaluating cycling levels both before and after bike facilities are installed. Not having this information makes it difficult to accurately predict the need for cycling facilities at transit. In addition, the site assessments found that the cycling facilities at almost all the park-and-ride lots would benefit from improvements, including cycling specific wayfinding features and making sure the bike parking is visible from the transit access point itself. Providing a mix of bike parking options, including covered racks, is another inexpensive way of ensuring that the park-and-ride lots accommodate the greatest variety of cyclists. When bike cages are implemented, design guidelines and promotional programs should be developed to make sure that the bike cages attract the highest number of cyclists. Finally, to reinforce the role of bike parking, TransLink should make sure that car parking is always priced higher than bike parking.

This study found that bike cages should be implemented at three stations and considered at two others. Bike cages are strongly recommended for King George Station in Surrey, Brighouse (or potentially Bridgeport) Station in Richmond, and Coquitlam Station. All of these stations already have enough demand for bike parking to justify a bike parking cage. Plus, both King George and Brighouse Stations have built environments that are relatively supportive for cycling, with bike paths and lanes, some existing walkable developments, and indications that development patterns in these areas are becoming more walkable. Brighouse Station is three stops from Bridgeport Station in Richmond city centre, and it may be most beneficial to provide a bike parking cage there instead, although Brighouse Station is better connected to bike routes and is served by a greater number of transit services than Bridgeport. Further research would help determine which of these stations would be a better location for a bike

cage. Coquitlam Station has a relatively high demand for bike parking currently, although the cycling conditions surrounding the station are poor. However, the construction of the Evergreen Line in the next few years will bring major changes to the area, which will create opportunities to implement planned improvements to bike access to Coquitlam Station.

Bike cages should be considered for Port Moody and Port Coquitlam Stations. Neither of these stations currently have enough demand for bike parking to fill a bike cage, but both have relatively supportive land uses and street networks in their surrounding areas. However, neither station has high quality cycling infrastructure connecting it to nearby residential areas. Previous research about bike cages and how the built environment affects cycling levels suggests that it may be possible to encourage cycling to these stations through a joint effort of improving the bike infrastructure in the surrounding areas and constructing secure bike parking cages at the stations.

The other four stations visited as part of the site assessments are unlikely to support bike cages in the near future. Although demand for bike parking at Scott Road Station in Surrey currently is similar to Port Moody and Port Coquitlam Stations, the auto-dominant built environment surrounding the station and the design of the station itself will likely make it difficult to increase bike access to this station in the future. Currently, there is little demand for bike parking at Ladner Exchange or Phibbs Exchange, and the built environments surrounding the exchanges are only moderately supportive of cycling. Bike cages at these stations could be considered in the future if significant changes to the local built environments or cycling levels occur. Finally, TransLink requested that South Surrey Park-and-Ride be included in the site assessments in order to find a solution to the current excess demand for car parking at that lot. The auto-dominant built environment and the isolated location surrounding the lot make widespread bike access unlikely without very significant investment in cycling infrastructure or changes to the road design and land use patterns surrounding the exchange.

Research limitations included the lack of available data for use in the multi-criteria assessment, especially data about the modes that people used to get to transit and the detailed design features of the lots themselves. Further, the multi-criteria assessment process has not been validated in the field, so it is possible that the method may need additional refinement. Site assessments verified the detailed design features of some of the lots. However, the research process would have been stronger if site assessments could have been performed at all the lots, and the data from the site assessments included in the multi-criteria assessment. Finally, the ultimate selection of the lots where bike cages were recommended was largely a qualitative process based on the judgement of the lead researcher.

This study provides a multi-faceted approach to prioritizing which of TransLink's park-and-ride lots would be the best locations for secure bike cages. Ultimately, it argues that increasing evidence finds that cycling facilities are both the result and the motivation for increased cycling levels. Further, compared to other forms of transportation infrastructure, bike parking is relatively low cost and low risk. These factors support the need for TransLink to expand its bike parking options at its park-and-ride lots, and installing bike cages at selected lots is a strong start.

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Figure 1.1: Bike parking, Osaka, Japan.

I. Introduction

Secure and easy to use bike parking at park-and-ride lots has the potential to increase cycling and boost transit ridership (Transportation Research Board [TRB], 2005). Providing high quality facilities that help cyclists access transit is an important way to increase the convenience and speed of these multi-modal journeys, making them competitive with driving (Keijer & Rietveld, 2000; Martens, 2004). Cycling to transit also costs less than driving, provides exercise, and can be more enjoyable (Pucher & Buehler, 2009; Sherwin & Parkhurst, 2010). This report creates a framework for assessing the bike parking potential at Metro Vancouver's park-and-ride lots, provides recommendations for improving the cycling conditions at a subset of the park-and-ride lots, and develops a business case for providing secure bike parking cages at the lots with the highest potential.

Since the 1930s, transit agencies throughout North America and Europe have used park-and-ride lots in order to expand catchment areas and make transit viable in lower density areas, but there has been growing discussion about the need to rethink this perspective (Burgess, 2008; Meek, Ison, & Enoch, 2008). In theory, park-and-rides can reduce congestion, vehicle kilometres travelled, and increase transit ridership (Turnball, Evans, & Levinson, 2004). However, park-and-rides have rarely been systematically assessed and an increasing number of researchers and transit agencies are questioning whether park-and-ride lots achieve their stated benefits, or if they actually increase congestion, air pollution, and car dependency, while decreasing transit use (Meek et al., 2008; Parkhurst, 1995; Parkhurst, 1996). In the Lower Mainland, TransLink operates or has operation agreements in place for nineteen park-and-ride lots, and is currently reviewing the management of these park-and-ride lots as part of a multi-modal plan addressing how people get to transit.

Cycling is undergoing a renaissance in North America, with increases in cycling for transportation in most of the continent's big cities (Pucher, Buehler, & Seinen, 2011). Vancouver has had a relatively high rate of bike commuting for years and has long been recognized as a North American leader in bike-transit integration (Pucher & Buehler, 2009). For the past twenty years, cyclists in the region have been able to take their bikes on buses, SkyTrain, SeaBus, and West Coast Express. Currently, bikes are allowed on all services at all times, with the exception that bikes are banned on the SkyTrain in peak-directions during peak-hours. Bike racks and lockers have also been available at most stations and interchanges since the mid-1990s (Pucher & Buehler, 2009).

TransLink's (2011a) regional cycling strategy, *Cycling for Everyone*, calls for more and safer cycling by 2040 as its two overarching goals. The strategies for achieving these two interrelated goals include:

1. increasing opportunities for bike-transit integration, and
2. improving bike parking and end-of-trip facilities.

Since TransLink already provides bike parking at many stations and allows bikes onboard most of its services, these strategies must focus on filling in the gaps and improving the quality of bike-transit integration. TransLink recently undertook a survey of bike parking at SkyTrain stations in order to better understand how this parking is used, and where more and better parking might be needed (TransLink, 2011b). But, up to this point, TransLink has paid little attention to the potential for bike access to replace car access to park-and-ride lots. The relatively high capital and operating costs of park-and-ride lots (Burgess, 2008) and the overwhelming demand for some of TransLink's lots suggest that increasing bike access to them could not only increase cycling, but could also decrease costs for TransLink and improve the customer experience.

This report analyzes which of Metro Vancouver's park-and-ride lots would be the most appropriate places to install secure bike cages. Bike cages are keycard-activated steel cages that can hold between 32 and 100 bikes depending on the size and type of rack installed within them (Urban Racks, 2011). Bike cages have been installed at over 50 railway stations in Melbourne, Australia since 2008, where they have been very successful in encouraging customers to bike-and-ride (Bicycle Network Victoria, 2012). This project addresses the potential to emulate this success with bike cages at TransLink's park-and-rides.

The report combines a multi-criteria assessment of available data with site assessments of TransLink's park-and-ride lots to recommend bike cages at three park-and-ride lots in the short-term, and to recommend considering bike cages at two additional park-and-ride lots in the medium-term. The multi-criteria assessment uses data about local travel behaviour, cycling facilities, demand for bike and car parking at the lots, and characteristics of the surrounding built environment. The outcome of the multi-criteria assessment combined with data gathered from the site assessments provides the basis for selecting the recommended lots. The report provides detailed recommendations for how to improve bike access conditions at the nine lots visited for the site assessments. For the five most promising lots, the report presents a business case for why bike secure bike cages would benefit both riders and TransLink.

This project builds upon previous research about bike-transit integration as well as multi-modal transit access plans (Bay Area Rapid Transit [BART], 2002; Hagelin, 2002; Krizek & Stonebraker, 2010; Martens, 2004; Martens, 2007). Unlike previous work in these areas, this report uses objective GIS-based measures of the built environment, providing a fine-grained analysis of a significant factor related to active transportation (Frank, Andreson, & Schmid, 2004; Frank et al., 2007). This work helps to fill the gap in knowledge about park-and-ride lots, as well as expanding the discussion about multi-modal transportation networks. For too long, park-and-ride lots have been developed without any real consideration of other options. This project argues that, with careful research and planning, bike access to transit can be competitive with driving, even in some lower-density suburban areas. Further, it proposes a method for making it so.

2. Background

2.1 Cycling in Metro Vancouver

Just 1.7% of the trips in Metro Vancouver's 24 municipalities are by bike (TransLink, 2009). This figure has been stable since the mid-1990s, although during this time bike trips have increased in Vancouver and decreased in many other parts of the region (TransLink, 2011a). In Vancouver, 3.6% of commuters travel by bike, with up to 12% of commuters cycling in some central neighbourhoods (TransLink, 2011a). Cycling rates are much lower outside of Vancouver, with most suburban areas having cycling mode shares of less than 2% and all having cycling mode shares under 4% (TransLink, 2011a). The suburban areas with the highest cycling mode shares include parts of Richmond, the City of North Vancouver, Port Moody, Port Coquitlam, and Langley City (TransLink, 2011a).

As in many North American cities, over the past twenty years TransLink, its predecessor BC Transit, and Metro Vancouver's local authorities have focused their bike planning activities on developing a comprehensive network of bike routes. Today Metro Vancouver has over 1,600 km of designated bike routes, composed primarily of neighbourhood bikeways, off-street multi-use paths, and marked bike lanes (TransLink, 2011a). TransLink has worked with municipalities throughout the region to build bike routes that connect destinations with transit, including the Central Valley Greenway multi-use path that runs under a portion of the Millennium SkyTrain line.

TransLink encourages bike-transit integration by allowing bikes to be carried on transit vehicles and by providing bike parking opportunities at stations and exchanges. As is common in North America, TransLink allows limited numbers of bikes on 100% of its bus fleet, its SeaBus ferry, and its West Coast Express commuter rail. Bikes are also permitted onboard its SkyTrain heavy rail system, except during peak times in peak directions (TransLink, 2012a). Carrying bikes on transit vehicles allows only a few cyclists to travel on each vehicle and cyclists are banned entirely from some SkyTrain services. To address this, TransLink offers racks and lockers at most of its stations and bus exchanges (TransLink, 2012a). Unlike a growing number of transit agencies and municipalities worldwide, TransLink does not offer a bike station, bike cage, electronic bike lockers, or other type of flexible secure bike parking on its system. Transit users who wish to park their bike at a transit station or exchange must rent a locker by the month (with a three month minimum rental) or use a public rack. Increasing both the quantity and quality of secure bike parking at TransLink's stations and bus exchanges could encourage more people to access transit by bike.

TransLink's recent regional cycling strategy, *Cycling for Everyone,* calls for more and safer cycling by 2040. The document includes detailed plans to improve the region's cycling network, parking and end-of-trip facilities, and opportunities for bike-transit integration. In addition, it calls for enhanced cycling

education, marketing, incentives and changes to enforcement and legislation. Two strategies in *Cycling for Everyone* relate specifically to bike parking or to cyclists navigating transit stations and interchanges. Table 2.1 outlines these strategies and their supporting actions.

Table 2.1: Strategies and applicable supporting actions from TransLink's regional cycling strategy, Cycling for Everyone

Strategy	**Action**
2.1: Provide sufficient parking and end-of-trip facilities	2.1.1: Make early investments to install a **sufficient amount** of the **right mix** of bicycle parking facilities to meet anticipated future demand, particularly at transit stations, Park-and-Ride lots and other transportation exchanges.
	2.1.2: Actively **monitor parking utilization** in private and public bicycle parking facilities in order to effectively manage supply and optimize resources.
	2.1.4: Ensure that any publicly accessible secure bicycle parking facility can provide **on-demand access** and is seamlessly integrated with the **electronic smart card**.
3.1: Make it easy to combine cycling and transit trips	3.1.3: Ensure that transit facilities offer sufficient amounts and the right mix of **bicycle parking** including secure on-demand parking at every rapid transit station and major bus exchange and covered racks at major transit stops.
	3.1.4: Ensure **transit stations** and exchanges clearly indicate desired bicycle circulation in these more complex operating environments.

This project responds to these strategies by proposing bike parking at park-and-ride lots that is well-designed, safe, and easy for cyclists to access. It encourages monitoring of parking utilization and proposes a system that can be integrated with TransLink's forthcoming electronic smart card, the Compass Card.

2.2 Park-and-Ride Lots in Metro Vancouver

TransLink owns or operates eighteen park-and-ride lots in twelve of Metro Vancouver's 24 municipalities and one park-and-ride lot outside of the region, serving bus, SkyTrain, and West Coast Express commuter rail. These include a lot as far north as Lion's Bay, three lots in West Vancouver, and one in North Vancouver. To the south, Richmond and Delta each have two lots, Surrey has four, and Langley has one. Many of the municipalities along the West Coast Express commuter rail running east from Vancouver have park-and-ride lots, including: Port Moody, Coquitlam, Port Coquitlam, Pitt Meadows, Maple Ridge and even Mission, located outside the region and 70 km east of downtown Vancouver. The lots vary in size from just nine spaces at Lion's Bay to over 1,500 spaces at Surrey's Scott Road SkyTrain Station, with a median of just over 250 spaces and a mean of 350 spaces. By North American standards, most of TransLink's lots are relatively small in size (Turnball et al., 2004). Table 2.2 lists the names, locations, sizes, and types of transit available at all of TransLink's park-and-ride lots.

TransLink currently is working on a strategic plan to guide the future management and development of its park-and-ride lots. This has been prompted by observations of uneven lot usage. Some of the lots are regularly less than half full, including Lion's Bay, Sexsmith, and Westmount. Others are regularly full or nearly full, including Phibbs Exchange, Port Moody, Port Coquitlam, South Surrey, and King George, leading to customer complaints and illegal parking (TransLink, 2012b). This unevenness of use demonstrates that a clear policy framework is needed to guide the management of the lots, including developing strategies for managing their capacity and use, as well as potentially considering other uses for some of the lots. Providing high quality bike parking can help respond to the short-term capacity problems at some the lots, and will likely play a role in a long-term solution at many of the lots.

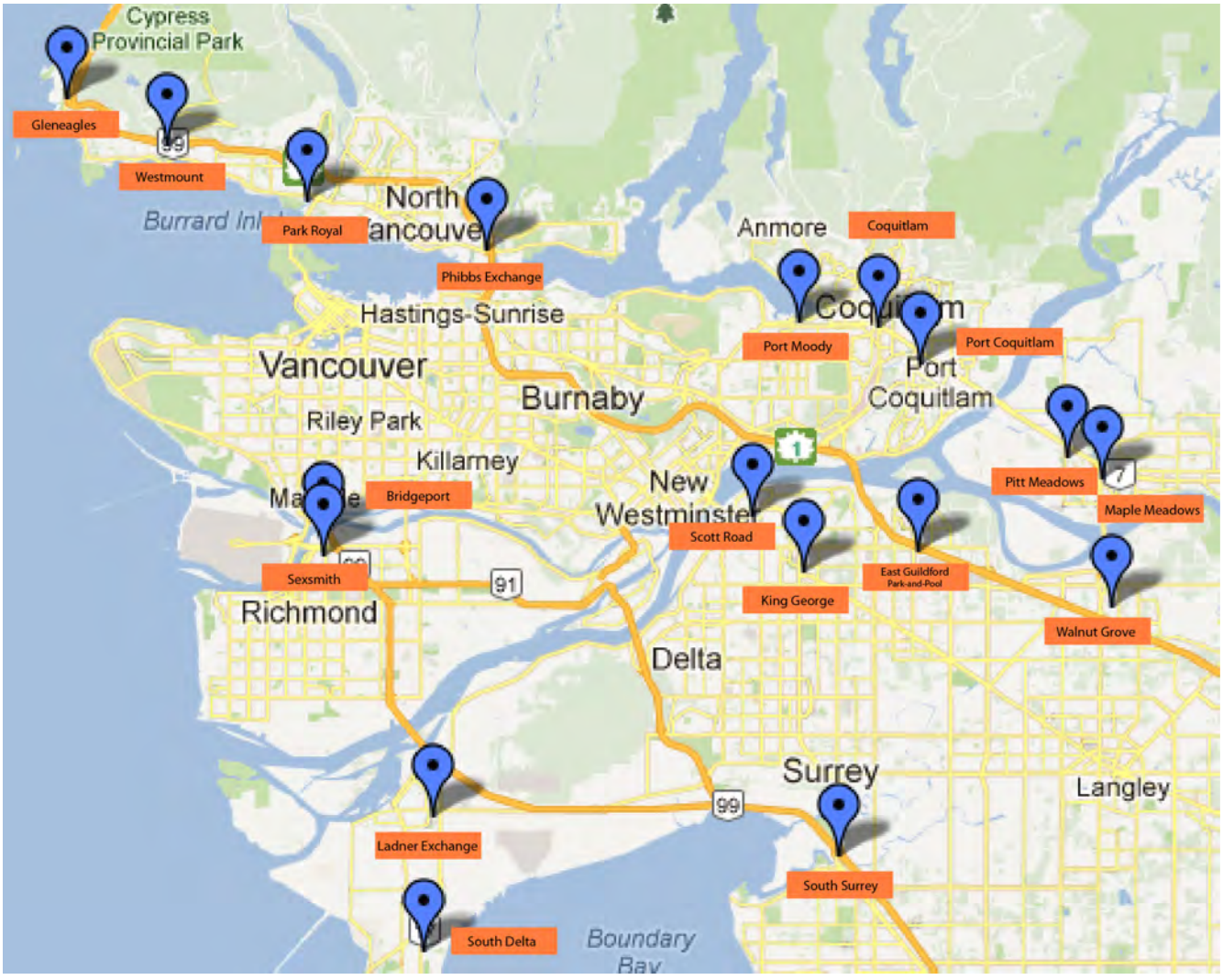


Figure 2.1: Map of Metro Vancouver with park-and-ride lots marked (Mission and Lion's Bay not pictured).

Base map copyright Google 2012. Labels added.

Table 2.2: Summary descriptions of TransLink's park-and-ride lots

Park-and-Ride Lot Name	Municipality	Location	Number of Spaces	Type of Transit Access
Coquitlam Station	Coquitlam	2920 Barnet Highway	614	West Coast Express, bus
Ladner Exchange	Delta	Clarence Taylor Crescent and Harvest Drive	200	Bus
South Delta	Delta	South Delta Recreation Centre: 56th Street at 18th Avenue	75	Bus
Walnut Grove	Langley	SportsPlex Parkade: 91A Avenue at 202nd Street	186	Bus
Lion's Bay	Lion's Bay	Isleview Place	9	Bus
Maple Meadows Station	Maple Ridge	20010 Dunn Avenue	467	West Coast Express, bus
Mission City Station	Mission	South Railway Avenue	254	West Coast Express
Phibbs Exchange	District of North Vancouver	Oxford Street at the Highway 1 off-ramp	40	Bus
Pitt Meadows Station	Pitt Meadows	12280 Harris Road	140	West Coast Express, bus

Port Moody Station	Port Moody	65 Williams Street	300	West Coast Express, bus
Port Coquitlam Station	Port Coquitlam	2125 Kingsway Avenue	280	West Coast Express, bus
Bridgeport	Richmond	8888 River Road	580	Canada Line, bus
Sexsmith	Richmond	Capstan Way between Sexsmith Road and Garden City Road	400	Bus
King George Station	Surrey	King George Boulevard, between 98th and 100th Avenue	815	SkyTrain, bus
Scott Road Station	Surrey	110th Avenue at Scott Road	1,563	SkyTrain, bus
South Surrey	Surrey	King George Boulevard at Highway 99	425	Bus
Gleneagles	West Vancouver	6200 block of Marine Drive	120	Bus
Park Royal	West Vancouver	Southeast side on the mall rooftop	166	Bus
Westmount	West Vancouver	3700 block of Westridge Avenue	30	Bus

Figures 2.2-2.7: Page 14: Scott Road Station park-and-ride, Bridgeport Station bike parking, Ladner Exchange bike lockers. Page 15: King George Station entrance, Coquitlam Station entrance, bicycle sensor pavement marking near Bridgeport Station.

Figure 3.1: Cyclists on a normal street in Groningen, Netherlands, illustrating some of the built environment factors that encourage cycling.

3. Literature Review

To date, few if any studies have looked specifically at bike access to park-and-ride lots. In the past decade, several North American transit agencies have produced multi-modal or bicycle transit access plans that have included both cycling and park-and-ride lots, but this has by no means been widespread (BART, 2002; BART, 2012; Hagelin, 2002). Even the underlying issues of bike-transit integration and bike parking design for transit stations are under-studied and poorly understood. But, research about cycling has increased significantly in the past decade, and research about bike-transit integration appears to be following. This section explores previous research about why people cycle, why people cycle to access transit, bike parking design at transit stations, and why people use park-and-ride lots.

3.1 Encouraging Cycling

In order for people to cycle to transit, they first have to be able and willing to cycle at all. There is a vast and expanding body of research that looks at what motivates and deters people from travelling by bike. It addresses factors as diverse as infrastructure, cycle training, promotional campaigns, demographics, and personal attitudes and beliefs. The findings on demographics and personal attitudes and beliefs vary widely across studies, and also across countries and cultures (Pucher, Dill, & Handy, 2010). They are also difficult to address from a planning and policy framework. Similarly, two recent research reviews found that programs aimed at increasing cycling had mixed results that were difficult to disentangle from other investments (Forsyth & Krizek, 2010; Pucher, Dill, & Handy, 2010). As a result, these areas are not discussed here. The following paragraphs review the importance of actual and perceived safety, built environment solutions, and bike parking in encouraging cycling.

3.1.1 Actual and Perceived Safety

The actual and perceived safety of cycling is increasingly recognized as one of the most important factors both encouraging and discouraging the use of bicycles for transportation (Parkin, Wardman, & Page, 2007). In an influential study, Jacobsen (2003) compared walking and cycling rates to cyclist and pedestrian injury rates using both cross-sectional and time-series data, finding that cycling is safer when there are more cyclists in a given area. Three potential reasons for this are that motorists become more adept at driving around cyclists, more motorists are likely to be cyclists themselves, and greater political will to improve cycling conditions develops (Pucher & Buehler, 2010). Even under current conditions, medical evidence suggests that the health benefits of cycling far outweigh the injury risks (British Medical Association, 1992; de Hartog et al., 2010). Yet the problem remains that many people perceive cycling as dangerous because they dislike sharing space with much larger and faster moving cars.

3.1.2 Addressing the Built Environment

Figure 3.2: Cyclists in a Dutch residential area.

Many researchers and professionals see the built environment as a significant opportunity for encouraging cycling by improving both real and perceived safety. In North America, interventions intended to address the built environment's effects on cycling frequently take the form of bike routes that are physically separated from car traffic or separated by painted markings on the road. When surveyed about bike route design, cyclists themselves often request routes separated from traffic (Winters et al., 2010b). However, a review of the effects of off-road bike paths found that they generally do not lead to significant increases in cycling (Fraser & Lock, 2010). On-street bike lanes and physically separated cycletracks have fared far better in the research. Several revealed preference studies have found that areas with lots of bike lanes have higher levels of cycling (Dill & Carr, 2003; Krizek, Barnes, & Thompson, 2009; Pucher & Buehler, 2012). Pucher and Buehler's (2012) study found that this was the case even after controlling for land use, climate, socioeconomic factors, gas prices, availability of transit, and cycling safety.

Other built environment factors that may affect cycling mode shares include population density, land uses, and micro-scale urban design features. In a GIS-based analysis of revealed preference data, Winters et al. (2010a) found that higher population density; more neighbourhood commercial, educational and industrial land uses; greater land use mix; fewer freeways and arterials; and greater street connectivity were associated with higher cycling rates. Another study used the walkability index developed by Frank et al. (2005) to measure the relationship of built environment features to cycling. Frank et al.'s index is a GIS-based measure of the walkability of local areas based on net population density, land use mix, street connectivity, and retail floor area ratio (FAR). Owen et al.'s (2011) study found that areas in Adelaide, Australia and Ghent, Belgium with high walkability had higher cycling rates. Further, Pucher and Buehler (2010) have conducted extensive case study research on Northern European countries with high rates of cycling, finding micro-scale urban design features that calm traffic in residential neighbourhoods and land use strategies that prioritize small-scale neighbourhood shopping are likely to be prevalent in places with high rates of bike use. This suggests that encouraging cycling takes more than the installation of a few bike lanes and paths. Rather, systematic planning from large-scale land use policies to micro-scale traffic calming and design strategies are necessary (Pucher, Dill, & Handy, 2010).

3.1.3 The Effect of Bike Parking on Cycling Levels

As discussed in Pucher, Dill, and Handy (2010), only a handful of studies have looked at the effect

of bike parking on cycling levels, perhaps because the idea that bike parking encourages cycling is so intuitive that it has been overlooked by many researchers. A study in the mid-1990s concluded that people with secure bike parking at work are significantly more likely to perceive that cycling is convenient than those without (Noland & Kunreuther, 1995). A more recent study found that secure workplace bike parking encourages cycling as much as 26.5 minutes of travel time savings (Hunt & Abraham, 2007). In Wardman, Tight, and Page's (2007) study, bike parking and end-of-trip facilities significantly raised the percentage of commuters cycling, although the increase was only equivalent to 4.3 minutes of travel time savings for bike parking alone and 6 minutes for parking and showers (Wardman et al., 2007). The few studies that have reviewed the effect of bike parking on bike commuting levels have all found statistically significant correlations between the presence of secure bike parking and increased likelihood of cycling.

Figure 3.3: A Dutch bus stop with bike lockers and covered bike racks.

3.2 Bike-Transit Integration

Only a few studies have attempted to identify the range of factors that make bike-transit integration successful. Bike-transit integration includes: taking your bike onboard with you, parking your bike at the transit access point, using a public bike and leaving it at the transit access point, and using your own bike or a public bike at the destination end of your journey (Krizek & Stonebraker, 2010; Pucher & Buehler, 2009). Research about bike-transit integration has been limited by the tendency of governments and transit agencies to collect data only on primary travel modes, leaving data about how people travel to their primary mode (transit) difficult to find (Martens, 2004; Krizek & Stonebraker, 2010). Despite these limitations, this research has been valuable in identifying the benefits of bike-transit integration and proposing a series of factors that likely encourage or discourage it.

Bike-transit integration benefits transit agencies, individual transit users, and society in general. For transit agencies, it can increase the catchment area of transit by up to ten times that of walking, reduce the need for feeder bus services, and costs considerably less than providing car parking facilities (Krizek & Stonebraker, 2010; TRB, 2005). Riders benefit from transit access that is faster than walking, less expensive than driving, and which provides greater flexibility than relying on feeder bus services (Martens, 2004; Pucher & Buehler, 2009). These benefits can increase the attractiveness of journeys combining cycling and transit relative to driving the whole way, potentially leading to lower car use and associated widespread environmental, social, and economic benefits (Martens, 2004).

3.2.1 Trip-Related Factors

Trip-related factors that likely encourage bike-transit integration include: the type of transit a cyclist is accessing, the location of the access stop or station within the urban region, the size of the destination

catchment area, and the trip purpose (Krizek & Stonebraker, 2010; Martens, 2004). Using data from the Netherlands, Germany, and the UK, Martens (2004) found that people were more likely to cycle to faster modes of transit with fewer stops, such as commuter rail, than to cycle to slower modes, such as local buses. People accessing transit in suburban environments were more likely to bike than people in urban areas, likely due to the longer distances and the lack of feeder bus services in lower-density suburban areas (Martens, 2004). The same study observed that the distance that people have to travel on the destination end of their journeys influences their likelihood of accessing transit by bike, with shorter distances being correlated with greater probability of bike access (Martens, 2004). In addition, most bike-transit journeys are trips either to work or to education (Hagelin, 2002; Martens, 2004).

3.2.2 Built Environment Factors

Most of the studies that have looked at the factors influencing whether or not people cycle to transit have included some measure of the local built environment. This is unsurprising, given the significant emphasis on the built environment in research that seeks to understand why people cycle in general (Forsyth & Krizek, 2010; Pucher, Dill, & Handy, 2010). Most studies and plans recognize the need for streets surrounding stations and stops to have bike routes and pleasant conditions for cycling (BART, 2002; BART, 2012; Krizek et al., 2011; Pucher and Buehler, 2009; TransLink, 2010a). A few studies have examined population, employment, or commercial density (BART, 2002; BART, 2012; Krizek et al., 2011; TransLink, 2010a). However, the previous research on the built environment effects of bike-transit integration lacks precisely defined and measured descriptions of the built environment.

3.3 Bike Parking at Transit Facilities

Practical guidance aimed at helping planners and transit agencies better integrate cycling with transit has tended to focus on the specific design of bike parking at transit stations and interchanges. To an even greater extent than with the research on bike-transit integration, there is little data persuading transit agencies to provide bike parking at transit facilities, and many of the suggested approaches are based purely on observations or predictions. Nevertheless, research from the Netherlands and the UK has found that providing secure bike parking at transit has generally increased the number of people cycling to transit (Martens, 2004; Martens, 2007; Rietveld, 2000). A survey of Vancouver area locker renters found that before renting a bike locker 43% drove and 31% took transit the entire way (TransLink, 2010c). This finding suggests that providing secure, high quality bike parking at park-and-ride lots in Metro Vancouver could encourage both existing and new riders to access transit by bike.

3.3.1 A Hierarchy of Bike Parking Facilities

There are a number of options for providing bike parking at transit, but by far the most common in North America are racks and lockers (TRB, 2005). Racks provide easy, albeit less secure, bike parking with low barriers to entry. Lockers, which frequently are rented by the month, the quarter, or the year are more secure, but lack flexibility, are aesthetically unattractive, and may pose a security risk. Numerous guidelines exist for both types of bike parking which address issues such as how to select bike racks that allow users to lock the frame and both wheels, or which types of locking mechanisms on lockers are most tamper-resistant (Association of Pedestrian and Bicycle Professionals [APBP], 2002; City of Portland, 2012; TransLink, 2010b; US Department of Transportation [US DOT], 2007).

Figure 3.4: Floating, multi-story bike parcade at Amsterdam Central Station.

Although many European and Asian cities have long had much more diverse bike parking options (CROW, 2007; Design Against Crime, 2008), only in recent years have North American transit agencies begun to install bike parking facilities that address some of the shortcomings of the traditional racks and lockers. Within the past decade, both BART and the Chicago Transit Authority have installed racks inside fare gates and near station agent's booths to provide an enhanced level of security with the flexibility and low-cost of racks alone (BART, 2012; Pucher & Buehler, 2009). BART and the Bay Area's Caltrain commuter rail have also both installed electronic lockers that do not require reservations and are paid for by the hour (BART, 2012; Caltrain, 2008). Bicycle cages - unguarded cages containing bike racks which require keycard access - are a more recent innovation in secure bike parking. Bike cages offer greater security than racks, but require far less space than lockers, and have been successful additions to transit networks in the Bay Area; Portland, Oregon; Boston; and Melbourne, Australia (BART, 2012; Caltrain, 2008; Martin & den Hollander, 2009; MBTA, 2012; TriMet, 2012). Finally, European-inspired bicycle stations provide perhaps the most sophisticated improvements over traditional bike parking at stations. In these facilities, comprehensive bicycle services are offered, including guarded bike parking, showers, lockers, and bicycle repair shops (TransLink, 2010c). Bike stations offer a high degree of amenity, but they clearly require a high level of use to make them viable (TransLink, 2010b). Bike stations operate in North American cities as diverse as Washington, DC; San Francisco, Berkeley and Long Beach, California (Pucher & Buehler, 2009; Bikestation, 2012).

Figure 3.5: Racks inside the fare gates at the Midway L Station, Chicago, Illinois.

Figure 3.6: Modern bike lockers at Langara Station, Vancouver.

Figure 3.7: Bike cage in Melbourne, Australia.

Figure 3.8: Bike station at Caltrain's 4th and King Station, San Francisco, California.

3.3.1 Design Considerations for Bike Parking

The safety and security of bike parking are clearly important. Secure bike parking ensures that bikes are not stolen and that the bike parking is not used in a way that may endanger others. This means that bike racks and lockers should be in visible and well-lit locations with nearby foot traffic (BART, 2002; Martens, 2007). Ideally, bike parking should be covered and under camera surveillance (City of Portland, 2012). Similarly, bike lockers can have transparent sections to discourage improper use (Hagelin, 2002). To create safe bike parking, transit stations and interchanges should include clear wayfinding materials to guide cyclists to the bike parking and then to the platforms or bus stops without conflicts with pedestrians or motorists (BART, 2002). The bike parking should be as close as possible to the transit access point, and reachable by a direct and unobstructed route. What constitutes a reasonable distance is not universally agreed upon, but most put the maximum distance that people are willing to walk between 60 and 150 metres, or about 0.5 to 1.5 blocks (CROW, 2007; Martens, 2007; City of Portland, 2012; TransLink, 2011b). Roadway entrances and exits to transit stations and interchanges should be clearly marked and should include designated space for bikes if needed (BART, 2002).

3.3.2 Determining the Quantity and Type of Bike Parking Facilities at Transit

Another important and underdeveloped area of research looks at methods for determining how much bike parking transit agencies should provide, and of what types. Several agencies, including TransLink (2010a) and BART (2012), have developed tools for answering these questions.

As part of the preparatory work for its recent regional cycling strategy, TransLink (2010a) commissioned several studies on the potential for bike stations or bike cages at 150 locations throughout Metro Vancouver. This report found that the locations with the highest potential were in the City of Vancouver or suburban town centres. Of the seventeen shortlisted sites identified in the report, only King George Station (number seventeen) has a park-and-ride lot. However, the report assessed locations based jointly on their potential for attracting riders accessing transit and for attracting riders cycling directly to the bike cage. This heavy weighting of journeys ending at the bike cage assured that urban locations were more attractive. Despite this shortcoming, the 'Bike to Transit' half of the demand equation provides a useful departure point for assessing the potential need for bike parking at park-and-ride lots. Its inputs are: number of bikes presently parked each day, estimates for 2011 transit boardings, a qualitative assessment of bike accessibility, and the local bike mode share for journeys under 5 km.

Another issue with this model is that it uses a subjective and largely unexplained measure of the built environment. It also fails to account for increased demand for bike facilities created by the availability of secure bike parking (BART, 2012; Martin & den Hollander, 2009). More significantly, the report documenting this method does not provide a clear explanation of how the model produced the number of spaces needed to meet each demand level. The inputs and the outputs are presented, but the process of getting between the two is opaque.

BART (2002) suggests a simple method for calculating current bike parking demand, current occupancy plus 10%, plus a multi-criteria assessment for prioritizing future bike parking investments. The multi-

criteria assessment has been updated for the 2012 version of the plan which now includes a modelling tool for determining the quantity and type of bike parking. The inputs for this tool include: local population numbers, local job numbers, amount of car parking, amount of bike parking, the security and lighting of the bike parking, how BART's varied peak-hour bicycle restrictions affect the station, and the station typology (BART, 2012). BART's station typology is a qualitative assessment of the built environment surrounding the station which categorizes the stations as: urban, urban with parking, balanced intermodal, intermodal – auto reliant, and auto dependent. These five typologies are somewhat coarse-grained and the criteria for assessing station typologies are not clear. The modelling tool also fails to account for the quality of bike access routes to the station, and although it includes population and job numbers, it does not assess how many people in the surrounding area cycle or are likely to cycle.

All of these assessment strategies for determining the type and quantity of bike parking at transit have positive and negative features. This is still a new field, which the most recent iteration of the BART (2012) plan acknowledges when it encourages other transit agencies to use its new modelling tool and provide feedback. A weakness in each of these studies is the failure to conclusively take into account built environment factors. Of all three methods, the BART (2012) plan most effectively incorporates built environment characteristics, but it still depends on imprecise station typologies. These tools for planning bike parking at transit stations acknowledge the complexity of planning bike parking, and reiterate that there are a significant number of factors, some of which are very difficult to measure, that affect the utilization of bike parking at transit.

3.4 Park-and-Ride Access to Transit

Park-and-ride lots are a ubiquitous, but in some ways invisible, part of urban transportation systems. They likely started haphazardly in the US in the 1930s, as motorists took to parking in empty lots and fields near railway stations (Noel, 1988 cited in Burgess, 2008). The first known official park-and-ride lot was built by the Long Island Rail Road in 1939 on a site formerly used by the World's Fair held earlier that year (Frost, 1974 cited in Burgess, 2008). But, it was not until the 1960s that park-and-ride lots began to spread to other parts of the developed world, at the same time as the Federal Highway Act of 1968 greatly increased funding for park-and-ride lots in the US (Burgess, 2008; Dijk & Montalvo, 2011). Many transit agencies throughout the world invested heavily in building park-and-ride lots up through the 1990s, but little has been written about their successes or failures. (Burgess, 2008; Meek et al., 2008; Parkhurst, 1996). The almost total lack of research about park-and-ride lots in Canada reflects the general paucity of research on the topic. The history and cultural context of park-and-rides in Canada can be assumed to follow the trajectory of so many other relatively wealthy countries that invested heavily in a car-dominated transportation network during the twentieth century.

Today many practitioners and researchers consider park-and-ride lots to be important pieces of transit systems that expand catchment areas, reduce congestion and pollution, encourage travel to city centres, and reduce valuable city centre land used for parking (Turnball et al., 2004). In a recent study that interviewed a number of European planning professionals about their attitudes towards park-and-ride lots, Dijk and Montalvo (2011) found that the planners and engineers were almost universally enthusiastic about them. Dijk and Montalvo (2011) argue that these reactions aren't based on evidence, but rather depend on perceptions of demand for car travel to city centres, unfounded beliefs

about the economic benefits of park-and-ride, and what they call 'organizational learning capabilities', or ideas that are passed through organizations as fact. Although only one study, Dijk and Montalvo (2011) reveal the tendency for park-and-ride lots to be poorly assessed or understood.

The criticisms of park-and-ride have become increasingly widespread in recent years, and they centre on the claims that park-and-ride lots achieve only a fraction of their stated benefits or that they are far too expensive for the limited benefits they deliver. Critics argue that park-and-ride lots do not reduce energy use or pollution because people switch from taking transit for their entire journey to driving for part of it (Meek et al., 2008; Parkhurst, 1996). Furthermore, people may drive as close to the city centre as they can to reduce their transit fares while paying the same, or similar amounts for parking as they would at a peripheral park-and-ride lot, thus having a negligible effect on vehicle kilometres travelled and congestion while reducing revenue for the transit agency (Parkhurst, 1996). Even if park-and-ride lots reduce the distance that people drive to access transit, the vast majority of pollutants are emitted from vehicle cold starts, meaning that park-and-ride lots have a negligible effect on pollution emissions (Burgess, 2008). Park-and-rides may also encourage sprawl and reinforce car-dependency (Parkhurst, 1996). Adding to these criticisms, park-and-ride lots are expensive for transit operators to run, and these costs are frequently not be offset by the revenue collected from the lots (Burgess, 2008). They may also use land that could be used more effectively for transit-oriented development (TOD) (Burgess, 2008).

Despite the controversy surrounding park-and-rides, there have been relatively few studies of this phenomenon. Generally, the research that looks at park-and-rides focuses on design and siting issues (Burgess, 2008) or on why people use park-and-ride lots (Shirgaokar & Deakin, 2005; Turnball et al., 2004). Few, if any, have attempted to assess empirically whether or not park-and-ride is effective, and in what situations. There simply is not enough evidence to support the idea that park-and-ride lots are necessarily integral parts of transportation systems. Transportation planners must begin to seriously consider other options, and increasing bike access can be a relatively easy, low-cost, and quick solution.

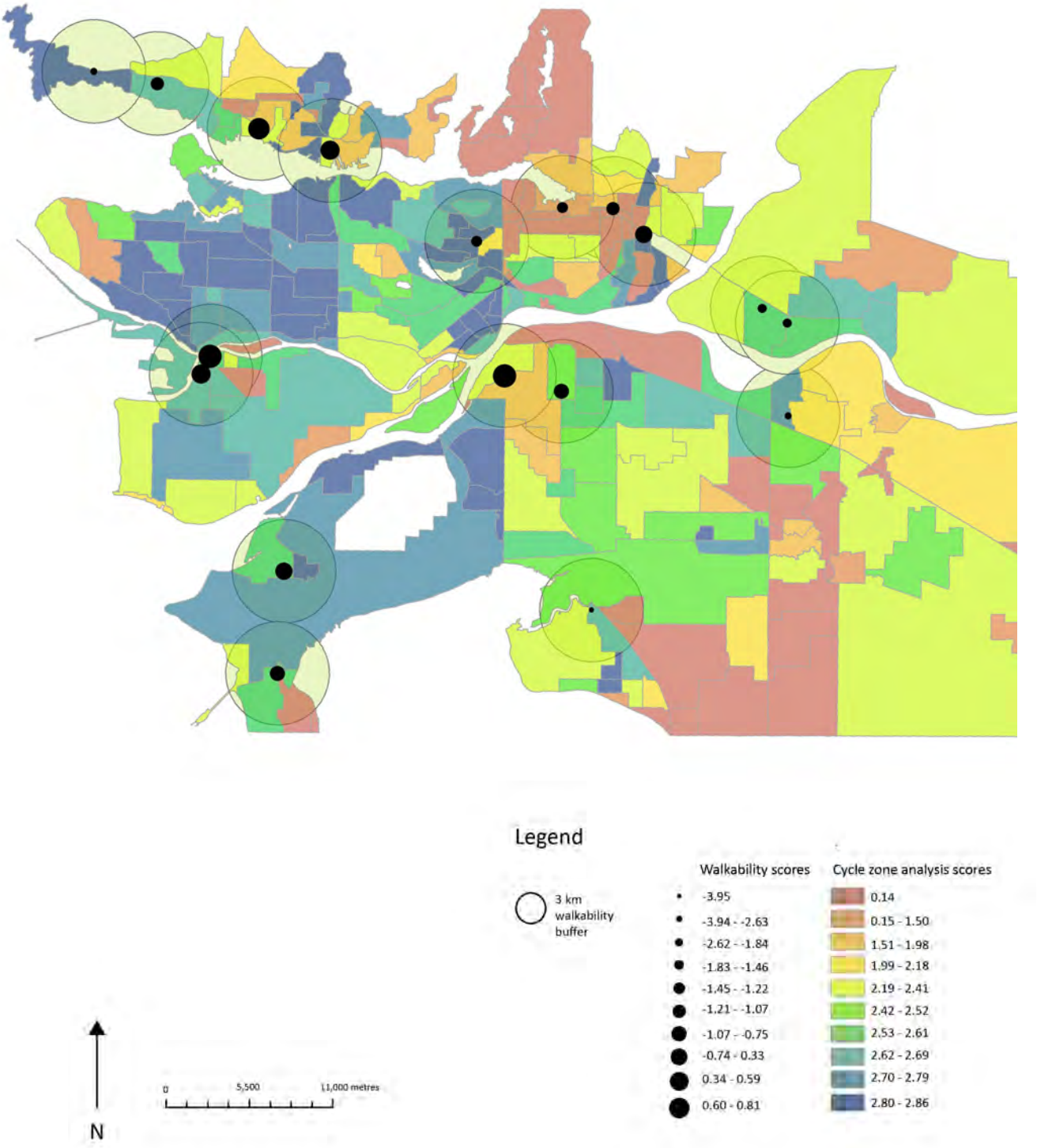


Figure 4.1: Map of Metro Vancouver park-and-ride lots showing the walkability and cycle zone analysis scores.

4. Methods

This study used a mix of methods to evaluate the potential for bike cages at park-and-ride lots and to build a business case for this intervention at the lots with the highest potential. An initial multi-criteria assessment (MCA) was used to select the eight most promising park-and-ride lots. Then, site assessments were conducted at these eight lots, plus a ninth lot identified by TransLink as having significant car parking capacity issues. After this, the municipal planners responsible for cycling at each of these nine lots were contacted for their professional opinions on improving the bike parking at the lots. Data from the MCA, the site assessments, and the municipal planners' local knowledge were assessed together and the final short-list of five park-and-ride lots was developed. Then, planners in Melbourne; Boston; Portland, Oregon; and the San Francisco Bay Area were contacted and their experiences with and assessments of bike cages were incorporated into the business case development.

4.1 Multi-Criteria Assessment

The multi-criteria assessment (MCA) portion of the study follows the process outlined in *Multi-criteria Analysis: A manual*, published by the United Kingdom's Department for Communities and Local Government (2009).

The assessment criteria included a number of factors related to the likelihood of people cycling to access transit. These were grouped into four thematic areas that addressed the importance of installing bike parking at park-and-ride lots that:

- Have a demonstrated need for bike parking
- Are supported by the existing transit services
- Will reduce stress on current car parking facilities
- Are in neighbourhoods with the highest potential for increased bike use

4.1.1 Install Bike Parking at Park-and-Ride Lots that Have a Demonstrated Need for Bike Parking

This group of criteria assessed the potential for increased bike parking demand based on how much people already use active transportation in the areas around the park-and-ride lots, how many bike parking spaces are available at the lots, and whether people are using these bike parking spaces currently. This group of criteria builds upon a frequently used method for determining the provision of bike parking at transit stations and interchanges, where future parking is based entirely on current

utilization numbers plus an overflow margin, which is usually between 10% and 20% (BART, 2002; Caltrain, 2008; CROW, 2007). In this case, the active transportation mode share, or the combined cycling and walking to work mode share, was used instead of just the cycling mode share because the cycling mode shares were all below 2%.

Table 4.1: Criteria used to assess which park-and-ride lots have a demonstrated need for bike parking

Criteria	Source	Justification
Percentage of the population commuting by cycling or walking (at the census tract level)	2006 census	Measures how common it is to travel to work by active transportation in the local area.
Number of bike parking spaces available	2012 TransLink Park-and-Ride Survey	Measures the existing provision of bike parking at the park-and-ride lot. This acts as a proxy variable for the size of the cycling population that is potentially able to access the lot.
Percentage of bike lockers rented in September 2011	September 2011 TransLink bike locker rental statistics; 2009 TransLink Park-and-Ride Survey (West Coast Express locker rental rates)	Measures the existing demand for bike parking at the park-and-ride lot. September was used because it was the last warm month for which data was available.

4.1.2 Install Bike Parking at Park-and-Ride Lots that are Supported by Transit Services

This pair or criteria assessed the role that the availability and utilization of transit services play in encouraging people to access transit by bike. Including this as a criteria group is supported by previous European research that has found that the quality of transit services being accessed affects decisions about what modes to use to get to transit, with people most likely to cycle to faster and more frequent services (Martens, 2004; Martens, 2007).

The first criterion was the percentage of commuters using transit in the census tract in which each lot was located. The second criterion was the availability of peak-hour transit services. This data was derived from a spatial file obtained from TransLink that showed the number of buses per peak hour (7.30-8.30 am) per park-and-ride lot. SkyTrain service numbers were calculated according to TransLink data that the average peak-hour headways on that service are two to three minutes. West Coast Express commuter rail runs three trains per hour at peak times. These three trains were weighted as the equivalent of twelve transit services because they provide very fast connections to Downtown Vancouver.

Table 4.2: Criteria used to assess which park-and-ride lots are supported by transit services

Criteria	Source	Justification
Percentage of the population commuting by transit (at the census tract level)	2006 census	Measures the willingness of the local population to use transit.
Availability of peak-hour (7.30-8.30 am, M – F) transit services	2012 TransLink spatial data	Measures the frequency and convenience of transit at the park-and-ride lot.

4.1.3 Install Bike Parking at Park-and-Ride Lots that Reduces Stress on Current Car-Parking Facilities

Some of the park-and-ride lots in TransLink's system are regularly at or over capacity, whereas others are little used (TransLink, 2012b). The criteria in this group measured the role that stress on car parking facilities plays in inspiring passengers to access transit by bike. Similar to the assessment that looked at demand for cycling facilities, it measured the number of car parking spaces provided at each lot and the percentage of spaces occupied. This group of criteria also included the percentage of the population with a very low household income ($20,000 per year or less) as a proxy variable for car ownership or access, since car ownership data was not available at a scale useful for this project.

Table 4.3: Criteria used to assess which park-and-ride have car parking facilities that are under stress

Criteria	Source	Justification
Number of car parking spaces available	2012 TransLink Park-and-Ride Survey	Measures the size of the lot, which provides a sense of the potential number of people able to switch from driving to cycling to the lot.
Percentage of car parking spaces occupied	2012 TransLink Park-and-Ride Survey	Measures the existing demand for car parking.
Percentage of the population with a household income of less than $20,000 per year (at the census tract level)	2006 census	Measures the percentage of the population with very low household income. Acts as a proxy variable for car access.

4.1.4 Install Bike Parking at Park-and-Ride Lots in Neighbourhoods with the Greatest Potential for Increased Bike Use

This study used two GIS data sets to assess the built environment: the walkability index developed by Dr Lawrence Frank at the University of British Columbia and the cycle zone analysis developed by Alta Planning + Design and applied to Vancouver as part of the background work for TransLink's (2011a) regional cycling strategy, *Cycling for Everyone.*

The walkability index measures how well the built environment supports walking. It is an objective GIS-based tool that includes measures of net residential density, land use mix, retail floor area ratio (FAR), and street connectivity (as measured by the number of intersections per square kilometre). These built environment features are applicable to environments that foster cycling as well as walking (Forsyth & Krizek, 2010; Owen et al., 2010). Walkability can be measured for any size buffer based on a postal code centre point. Many studies that have used the walkability index have measured one kilometre buffers (Frank et al., 2005; Shigematsu et al., 2009). Initially, three kilometre buffers were used in this study to reflect the longer distances that cyclists usually travel to get to transit (Martens, 2004; Rietveld, 2000). However, after a close examination of the findings, the walkability scores for one kilometre buffers around each lot were found to provide an important measure of the areas around the lots that cyclists had to travel through in order to reach the transit services. The final assessment averaged the scores for the one kilometre and three kilometre buffers, in order to provide a more accurate picture of the walkability around each of the park-and-ride lots.

Cyclists frequently are concerned with cycling-specific aspects of their environments (Forsyth & Krizek, 2010; Winters et al, 2010b). The cycle zone analysis addresses this by measuring bikeability through measures of bike route connectivity, bike route density, bike route quality, intersection quality, and hilliness within a zone defined through a structured decision making process. For the purpose of this assessment, each of the above five factors was weighted evenly and an average score produced. Although the cycle zone analysis provides a good assessment of some of the factors that affect bike friendliness, it does not provide the full picture. The zones it uses are large, which means that they lose detail. They also fail to take unofficial cycling routes into account, which may be very important in suburban areas with few official routes.

To address the micro-scale urban design features not captured by the walkability index or cycle zone analysis, a qualitative assessment of the built environments around the lots was conducted using Google Streetview. The perceived bike-friendliness of the streets leading to the lots was assessed, as was the quality of any bike routes, the existence of major barriers such as highways or water bodies, and the perceived size of the neighbourhoods within easy bike access to the stations or stops.

Table 4.4: Criteria used to assess which park-and-ride lots are in built environments with the greatest potential for increased bike use

Criteria	Source	Justification
Walkability index: 4 measure index of the built environment including: net residential density, land use mix, retail floor area ratio, and street connectivity	Walkability index developed by Dr Lawrence Frank at the University of British Columbia (Frank et al, 2004; Frank et al, 2005; Frank et al, 2007)	Measures the macro-scale friendliness of the built environment for cyclists and pedestrians.
Bikeability features: bike route density, bike route connectivity, bike route quality, intersection quality, overall slope of the cycle analysis zone	Cycle zone analysis data developed by Alta Planning + Design for TransLink (TransLink, 2009)	Measures cycling-specific features of the macro-scale built environment. Also measures hilliness.
Micro-scale assessment: Subjective assessment of the bike-friendliness of the area surrounding each of the park-and-ride lots	Conducted using Google Streetview	Provides a measurement of the micro-scale features that neither the walkability index or bikeability features captures.

4.1.5 Scoring and Weighting the Criteria

Each of the lots was assessed against each of the criteria on a scale of 0 at the lowest to 100 at the highest. The assigned scores are presented in the Findings section.

Since not all of the criteria have an equal effect on encouraging cycling to the park-and-ride lots, each of the criteria was weighted and the scores adjusted according to the criteria's weight. The walkability index was felt to be the most important variable, so it received a weight of 100, and was multiplied by one to produce the final score. Each of the other variables was then weighted according to its impact in relation to the walkability index. The scores were multiplied by the percentage of 100 that their weight comprised - e.g. scores for a criterion that was weighted 70 were multiplied by 0.70 to produce the final weighted scores. The weighted scores were sensitivity tested to determine the correct weighting.

The weight-adjusted scores were added together to produce the overall weighted scores of the lots. The weights assigned to the criteria are outlined in Table 4.5. The weighted scores are presented in the Findings section.

Table 4.5: Weights assigned to each criteria

Criteria	Sub-criteria	Weight
Install bike parking at park-and-ride lots with a demonstrated need for bike parking	Cycling and walking to work mode share	60
	Bike parking available	40
	Bike parking used	65
Install bike parking at park-and-ride lots where transit service supports it	Transit to work mode share	60
	Availability of transit services	70
Install bike parking at park-and-ride lots that relieves stress on existing car parking facilities	Percentage of the area population with a low household income	25
	Car parking available	50
	Car parking used	65
Install bike parking at park-and-ride lots where the built environment supports it	Walkability index	100
	Bikeability score	90
	Micro-scale urban design features	75
Total		700

4.2 Site Assessments

The MCA proved to be a useful tool for shortening the list of nineteen park-and-ride lots. But, there were some significant gaps in the available data, specifically information about the micro-scale design features of the lots themselves. This included the quality and location of the bike racks and lockers, availability of wayfinding materials, the presence of locations where cyclists might experience conflicts with cars or pedestrians due to the design of the lots, and fine grained urban design features in the areas surrounding the lots.

In order to make the final decisions about where bike cages should be installed at the lots, the eight lots identified as the most likely to benefit from improved bike parking were visited and site assessments conducted. South Surrey Park-and-Ride was also visited because TransLink had previously identified it as having excess demand for car parking. The site assessments examined:

- The quantity and quality of existing bike parking
- The numbers and locations of bikes locked to racks or street furniture
- Whether the bike parking was visible and near the transit access point
- If there were bike-specific wayfinding features at the lot
- The existence and design of safe routes for cyclists in and around the lot
- The bike-friendliness of the surrounding built environment

Appendix A contains the site assessment form with the complete list of criteria used to assess each of the lots.

4.3 Gathering Information from the Municipalities

After the site assessments were conducted, the relevant bike and transportation plans were reviewed for each of the municipalities where the park-and-ride lots were located. Then, the planners responsible for cycling at each of the municipalities were contacted by email and asked to provide their professional opinion about the benefits and challenges of increasing bike parking at their respective lots, as well as about their knowledge of future planned developments and changes to the bike network. This information helped identify non-park-and-ride transit access points that may compete with the park-and-ride lots for bike access. Appendix B contains the list of questions for the municipalities.

4.4 Business Case Development

A business case was developed for installing bike parking cages at selected park-and-ride lots. Case study data about bike cages in Melbourne; Boston; Portland, Oregon; and the San Francisco Bay Area gathered from publicly available information and informal discussions with planners in those cities was used to support the business case.

4.5 Creating the List of Recommended lots

The final short-list of recommended lots was created based on the current demand for bike parking and the built environment surrounding the lots. Current demand for bike parking was measured as the number of bike locker rentals and the numbers of bikes locked to the racks.

If the current demand for bike parking plus 20% was greater than 20 bikes, a bike cage holding at least 32 bikes was recommended. This created space for current cyclists to park their bikes and anticipated an increase in demand for bike parking created by the availability of a secure bike cage. If the current demand plus 20% for bike parking was less than 20 bikes, but the built environment supported cycling, a bike cage was recommended. Determining if the built environment was supportive involved examining the data from the multi-criteria assessment, site assessments, and reviewing the information provided by the planners about: the presence of high quality existing and planned bike routes leading to the park-and-ride lots, the general built environment around the lots, and whether or not there were alternative stations or exchanges where cyclists could access transit.

5. Findings

5.1 Findings from the Multi-Criteria Assessment

Each of the criteria was scored, and then the scores from the criteria were weighted. Table 5.1 presents the raw scores for each of the criteria, and Table 5.2 presents the weighted scores. The final weighted scores for the lots occurred in several groups, with King George and Bridgeport scoring the highest at 482 and 468 points respectively. Port Coquitlam and Port Moody scored in the 450s and 440s. Coquitlam, Phibbs Exchange, and Scott Road scored between 390 and 370 points. A large group of park-and-ride lots scored between 350 and 330 points: Ladner Exchange, Maple Meadows, Park Royal, Pitt Meadows, Mission City, and Sexsmith. South Delta scored 296 points. South Surrey, Walnut Grove, and Gleneagles scored between 230 and 200 points, and Westmount and Lion's Bay scored below that.

5.2 Findings from the Site Assessments

Site assessments were conducted at nine park-and-ride lots from April 17th to 24th, 2012. The eight highest scoring park-and-ride lots were visited based on the strength of their performance in the multi-criteria assessment. The decision to conduct the site assessments at eight lots was made in consultation with TransLink, and was based on practical knowledge of the lots as well as the resources available for the site assessments. South Surrey, the fifth lowest scoring park-and-ride lot, was assessed on the request of TransLink because its car parking is frequently over capacity.

The weather during all the site visits was cool and cloudy, with patches of sun and occasional light rain. The results of the site assessments are summarized below in Table 5.3, and the notes from the complete process are available in Appendix C. The Discussion and Recommendations section provides further detail on the findings from the site assessments.

5.3 Findings from the Discussion with the Municipalities

With the exception of Port Coquitlam, all of the contacted municipalities responded to the request for information. None of the municipalities provided information that significantly altered the outcome, but all the planners provided information about planned bike routes and developments around the lots that informed the ultimate conclusions.

Table 5.1: Summary of the multi-criteria assessment scores (each criteria was scored from 0 to 100)

Park-and-ride lot	Bike and walk mode-share	Bike parking available	Bike parking used	Transit modeshare	Availability of transit services	Income	Car parking available	Car parking used	Walkability	Bikeability	Micro scale features
King George	25	100	63	100	62	72	53	70	60	81	80
Bridgeport	27	42	70	30	81	100	78	56	75	96	70
Port Coquitlam	25	24	100	49	47	64	18	95	75	78	90
Port Moody	22	24	63	55	41	59	20	100	100	65	90
Coquitlam	52	60	100	37	100	88	40	84	55	0	30
Phibbs Exchange	25	56	19	40	66	61	3	93	70	74	60
Scott Road	8	36	30	62	51	81	100	84	50	66	40
Ladner Exchange	28	44	13	25	32	59	13	85	60	81	70
Maple Meadows	19	26	70	27	22	65	30	89	45	86	40
Park Royal	100	0	0	56	49	63	11	63	60	66	40
Pitt Meadows	16	24	50	47	27	62	9	88	45	97	40
Mission City	15	24	100	18	10	83	17	81	60	50	60
Sexsmith	26	18	0	30	11	99	26	32	80	100	60
South Delta	26	0	0	40	12	93	5	73	75	78	40
South Surrey	19	32	25	21	22	57	31	92	0	71	20
Walnut Grove	14	0	0	13	17	59	12	57	30	86	40
Gleneagles	25	0	0	29	1	47	8	90	40	55	20
Westmount	9	0	0	32	1	50	2	40	20	50	10
Lion's Bay	13	0	0	32	0	50	1	11	0	50	0

Table 5.2: Summary of the multi-criteria assessment weighted scores

Park-and-ride lot	Bike and walk mode-share	Bike parking available	Bike parking used	Transit modeshare	Availability of transit services	Income	Car parking available	Car parking used	Walkability	Bikeability	Micro scale features	TOTAL
King George	15.0	40.0	41.0	60.0	43.4	18.0	26.5	45.5	60.0	72.9	60.0	482.3
Bridgeport	16.2	16.8	45.5	18.0	56.7	25.0	39.0	36.4	75.0	86.4	52.5	467.5
Port Coquitlam	15.0	9.6	65.0	29.4	32.9	16.0	9.0	61.8	75.0	70.2	67.5	451.4
Port Moody	13.2	9.6	41.0	33.0	28.7	14.8	10.0	65.0	100.0	58.5	67.5	441.2
Coquitlam	31.2	24.0	65.0	22.2	70.0	22.0	20.0	54.6	55.0	0.0	22.5	386.1
Phibbs Exchange	15.0	22.4	11.7	24.0	46.2	15.3	1.5	60.5	70.0	66.6	45.0	378.1
Scott Road	4.8	14.4	19.5	37.2	35.7	20.3	50.0	54.6	50.0	59.4	30.0	375.9
Ladner Exchange	16.8	17.6	8.45	15.0	22.4	14.8	6.5	55.3	60.0	72.9	52.5	342.2
Maple Meadows	11.4	10.4	45.5	16.2	15.4	16.3	15.0	57.9	45.0	77.4	30.0	340.9
Park Royal	60.0	0.0	0.0	33.6	34.3	15.8	5.5	41.0	60.0	59.4	30.0	339.5
Pitt Meadows	9.6	9.6	32.5	28.2	18.9	15.5	4.5	57.2	45.0	87.3	30.0	338.3
Mission City	9.0	9.6	65.0	10.8	7.0	20.8	8.5	52.7	60.0	45.0	45.0	333.3
Sexsmith	15.6	7.2	0.0	18.0	7.7	24.8	13.0	20.8	80.0	90.0	45.0	332.1
South Delta	15.6	0.0	0.0	24.0	8.4	23.3	2.5	47.5	75.0	70.2	30.0	296.4
South Surrey	11.4	12.8	16.3	12.6	8.4	14.3	15.5	59.8	0.0	63.9	15.0	229.9
Walnut Grove	8.4	0.0	0.0	7.8	11.9	14.8	6.0	37.1	30.0	77.4	30.0	223.3
Gleneagles	15.0	0.0	0.0	17.4	0.7	11.8	4.0	58.5	40.0	49.5	15.0	211.9
Westmount	5.4	0.0	0.0	19.2	0.7	12.5	1.0	26.0	20.0	45.0	7.5	137.3
Lion's Bay	7.8	0.0	0.0	19.2	0.0	12.5	0.5	7.2	0.0	45.0	0.0	92.2

5.4 Findings from the Business Case Development

A business case was developed for TransLink which assessed using bike cages as opposed to other options for increasing access to transit, such as providing additional bike lockers or car parking spaces. The business case development found that bike parking is more cost effective than car parking in facilitating increased station access. It also found that bike cages provide benefits over the currently used bike lockers to customers in that they are more cost-effective, more convenient, more flexible, and more secure. They provide benefits to TransLink in that they are easier and less expensive to manage and maintain, produce higher incremental revenues, have smaller footprints, and data from Melbourne shows that they appear to encourage mode shift. The full business case is available in Appendix D.

Table 5.3: Summary of site assessment data

	Number of bikes locked up	Bike racks covered	Bike parking visible from transit access	Bike parking within 60 m of transit access	Bike wayfinding materials at lot	Quality of bike routes near lot	Bikeability of local streets	Supportive mix of land uses surrounding lot	Cost of car parking
King George	3	Yes	Yes	Yes	No	Medium	Medium	High	$6/12 hours
Bridgeport	7	Yes	Some	Yes	No	Medium	Medium	High	$2.50 per day
Port Coquitlam	1	No	No	Yes	No	N/A	High	High	$3 per day
Port Moody	3	No	Yes	Yes	No	Medium - High	Medium – High	High	$3 per day
Coquitlam	5	No	Some	Some	No	Low	Low	Medium	$3 per day
Phibbs Exchange	0	No	Yes	Yes	No	Medium	Medium	Medium	Free
Scott Road	2	Some	No	Yes	No	Low	Low	Low	$3 per day
Ladner Exchange	2	No	Some	Yes	Yes	Low	Medium	High	Free
South Surrey	0	No	Yes	Yes	No	Very low	Very low	Very low	Free

5.5 Findings from Developing the List of Recommended Lots

The process of producing the final short list of recommended lots used data about the built environments surrounding the park-and-ride lots combined with the observed demand for bike parking to develop a short-list of the five lots most likely to benefit from secure bike parking cages. The final prioritization of the lots alongside the recommendations for each of the lots is detailed in the Discussion and Recommendations section below.

Table 5.4: Findings relevant to the process of producing the final list of recommended lots

	Number of lockers rented[a]	Number of bikes locked to racks or street furniture[b]	Current demand for bike parking + 20%[c]	Existing and planned bike-ability of surrounding streets[d]	Existing and planned built environment features around the lots[e]	Uniqueness of park-and-ride lot as a transit access point for the area[f]
King George	50	3	64	High	High	High
Bridgeport	7	7	17	Med	Med – High	Med
Coquitlam	12	5	20	Low	Med	High
Port Moody	5	3	10	High	High	High
Port Coquitlam	8	1	11	High	High	High

a: Source: TransLink locker rental statistics, September 2011.

b: Source: Site assessments.

c: Calculation based on data in a and b.

d: Source: Multi-criteria assessment, site assesssments, and interviews with the municipal planners. Takes into account the availability and quality of existing and planned bike routes, intersection designs, hilliness of the surrounding area, existence of arterials and other barriers, and overall road network connectivity.

e: Source: Multi-criteria assessment, site assesssments, and interviews with municipal planners. Takes into account land use mix, density, and urban design characteristics.

f: Source: interviews with planners. Takes into account the existence of other stations and exchanges in the nearby area.

6. Discussion and Recommendations

This project identified the five park-and-ride lots most likely to benefit from enhanced secure bike parking in the form of bike cages, but it also identified wider issues with data collection and planning for cyclists across all of the park-and-ride lots. This section first presents general recommendations for all of the park-and-ride lots. After this, it discusses the findings from the site assessments and provides recommendations specific to individual lots.

6.1 Recommendations for All Lots

1. Collect station access mode share data, particularly *before and after* implementing bike parking improvements.

One of the most difficult parts of undertaking this project was the lack of data about how people get to the stations and interchanges. Better data collection about how people access stations is necessary for accurately understanding how much and what types of bike parking should be provided and where.

Having station access mode share data is particularly important for monitoring the effectiveness of future investments in bike facilities. A good example of how multi-modal station access data can be collected in North America is BART's (2008) *Station Profile Study*. TransLink should begin periodically undertaking surveys to collect station and park-and-ride access data.

2. Develop comprehensive design and location guidelines for bike cages.

Many transit agencies, municipalities, and organizations have developed bike parking design guidelines. Usually, these cover design and location best practices for racks and lockers. Few, if any, have produced guidelines for bike cages. By developing comprehensive design and location guidelines for bike cages, TransLink can ensure that future bike cages are designed and sited in order to attract the greatest number of cyclists.

3. Include bike maps and bike-specific wayfinding features at stations and exchanges, especially signs directing customers to the bike parking and bike maps of the surrounding areas.

Very few of the park-and-ride lots visited had high quality wayfinding materials pointing cyclists

and potential cyclists to the bike parking and to the bike-friendly routes available to them in the surrounding neighbourhoods. People who may wish to cycle to transit may not feel comfortable doing so because they simply do not know where to go. Improving wayfinding is crucial for helping people get to the park-and-ride lots by bike, and helping them navigate the lots once they're there.

4. Make sure that secure bike parking is visible from the station entrance or the exchange bus loop. If there is more than one entrance and only one bike cage, use signage to direct cyclists to the secure bike parking.

Just as wayfinding is important, making bike parking visible is perhaps the easiest and least expensive form of advertising. Highly visible bike parking also improves security by providing 'eyes on the street'.

5. Make sure that some lockers and free bike racks remain, and provide cover for bike racks if not already covered.

Not all cyclists are willing or able to pay for secure parking, so it is important that high quality, free bike parking is available for a range of cyclists. Similarly, some cyclists may prefer storing their bike inside a locker. Providing a mix of parking options is likely to attract the most cyclists.

6. Work with HUB – Your Cycling Connection (the organization formerly known as the Vancouver Area Cycling Coalition), municipalities, and other partners to promote and encourage the use of bike cages and other parking facilities.

As the experiences of cities such as Melbourne and Boston have shown, working with municipalities and cycling advocates can be a powerful way to manage and promote bike cages. Bicycle Network Victoria, the advocacy organization that manages the bike lockers in Melbourne regularly runs activities to promote their use.

7. Price car parking to make cycling more attractive.

In order to increase the likelihood of the bike cages at TransLink's park-and-ride lots being successful, it is crucial that the cost of bike parking be significantly less than the cost of car parking. Currently, TransLink's bike lockers cost $10 per month. Amongst the nine lots where site assessments were conducted, Phibbs Exchange, Ladner Exchange, and South Surrey all offer free car parking. Bridgeport, Scott Road, Port Moody, Coquitlam, and Port Coquitlam offer car parking for $3 per day or less. King George alone charges $6 per day. Increasing car parking costs is always a sensitive issue, but it may make the difference between choosing to drive or cycle. Making bike parking free in places where car parking is free is another potential solution.

6.2 Recommendations for the Individual Lots

The discussion and recommendations for individual park-and-ride lots are ranked in order from most likely to support a bike cage to least likely. To help further refine these recommendations, the bike cages should be implemented one by one, with each cage monitored.

Figure 6.1: Aerial view of King George Station.

1. King George Station

Installing a bike cage at King George Station should be a priority. Consider a large bike cage with capacity for 60 or more bikes.

King George Station is at the end of the Expo SkyTrain line. As a result, bikes are banned entirely from trains serving the station during commute times. It is located in an area that is rapidly growing and densifying, and which is fairly well connected to other residential areas by quiet neighbourhood street bike routes. These factors contribute to over 60 people per day parking their bikes at King George.

Although the City of Surrey plans to improve the bike routes around King George Station, many of the existing routes do not connect to it. Working with Surrey to provide these clear and direct cycling connections in the future will be crucial. In addition, currently the east entrance to the station involves cycling down a long narrow driveway shared with the kiss-and-ride. This may lead to conflicts between cyclists and cars, so upgrading this entrance or creating a separate bike entrance could increase the attractiveness of cycling to King George.

Recommendations

1. Make this station the top priority for piloting a bike cage. Monitor bike parking utilization before and after the cage's installation.
2. Work with the City of Surrey to continue improving bike routes around the station, and provide clear signage at the station to nearby bike routes.
3. Consider improving the bike entrance to the station. Currently, cyclists enter either from the sidewalk (west side) or the kiss-and-ride (east side). In particular, the kiss-and-ride driveway could be widened and/or a separate bike entrance could be built to reduce conflicts between cyclists and motorists.
4. Investigate the feasibility of removing the barrier on King George Boulevard on the west side of the station and constructing a mid-block pedestrian and cyclist crossing. This would create a direct connection between the station, the bike route through Holland Park, and the stop for southbound buses. The large blocks in this area justify a mid-block crossing, as the current design requires that cyclists and pedestrians detour 265 metres to get from one side of the street to the other.

Figure 6.2: Banks of bike lockers at King George Station.

Figure 6.3: The east entrance to King George Station is through the kiss-and-ride, potentially creating conflict with between cyclists and motorists.

Figure 6.4: Bike lanes on Fraser Highway near King George Station.

Figure 6.5: Off-road bike path near King George Station.

Figure 6.6: Aerial view of Bridgeport Station.

Legend

Entrance

Bike lockers

Bike racks

2. Bridgeport

Install a bike cage at either Bridgeport Station or Brighouse Station.

Bridgeport Station is a busy interchange between the Canada Line and a number of buses connecting Richmond, Delta, Surrey, and White Rock to Vancouver. It is the northernmost Canada Line Station in Richmond, and it is three stops up the line from Richmond city centre's Brighouse Station, which like King George is the end of the line. Ideally, Brighouse and Bridgeport Stations would have been assessed against each other as part of this study, but Brighouse does not have a park-and-ride lot. The stations have similar levels of observed bike locker rentals, with nine lockers rented at Brighouse and seven lockers rented at Bridgeport in September 2011. Brighouse is closer to the town centre and to the neighbourhoods where many people live, but Bridgeport is better connected to high quality bike routes and is served by twice as many trains as Brighouse. There are positive and negative aspects of installing bike parking at both stations, and it will take additional research to determine which would be the best location for a bike cage.

Figures 6.7 and 6.8: left: overview of the south end of Bridgeport Station. Note that the bike racks are lightly filled, right: bike locked to a fence at the north end of the station, where the bike racks are overflowing (see page 14 for an image).

As a new station, Bridgeport is fairly well-designed and has better cycling connections leading to it than many of the other park-and-ride lots. However, the existing wayfinding signage around the lot does not provide a clear and unobstructed route to the quiet Charles Street station entrance. Without this, it is too easy for cyclists to end up at the busy Great Canadian Way entrance, having to compete with buses and pedestrians to enter the station. The signage within the station could also be improved. The bike parking is located in the bus loop beneath the station platform, but the train's concrete supports and a service building block the lines of sight across the bus loop. On the afternoon of the site assessment, a bike was locked to a fence because the rack nearest it was full while a rack on the other end of the bus loop was empty. Improved wayfinding does not guarantee that cyclists will travel across the station, but it at least informs them that the option is available. Finally, TransLink recently commissioned consultants to assess car parking conditions at the park-and-ride lots, and they noted that free informal car parking was available at a nearby gravel lot (TransLink, 2012b). This free parking reduces the effectiveness of the $2.50 per day charge for the park-and-ride lot.

Figures 6.9 and 6.10: left: Bridgeport Station's Charles Street entrance, right: Bridgeport Station's Great Canadian Way entrance.

Recommendations

1. Improve signage around the lot, particularly by providing signs identifying the location of the bike parking.
2. Work with the City of Richmond to improve signage leading to the lot - especially pointing to the Charles Street station entrance.
3. Enforce payment for informal parking in the gravel lot near the station (it is $2.50 per day in the official lot).

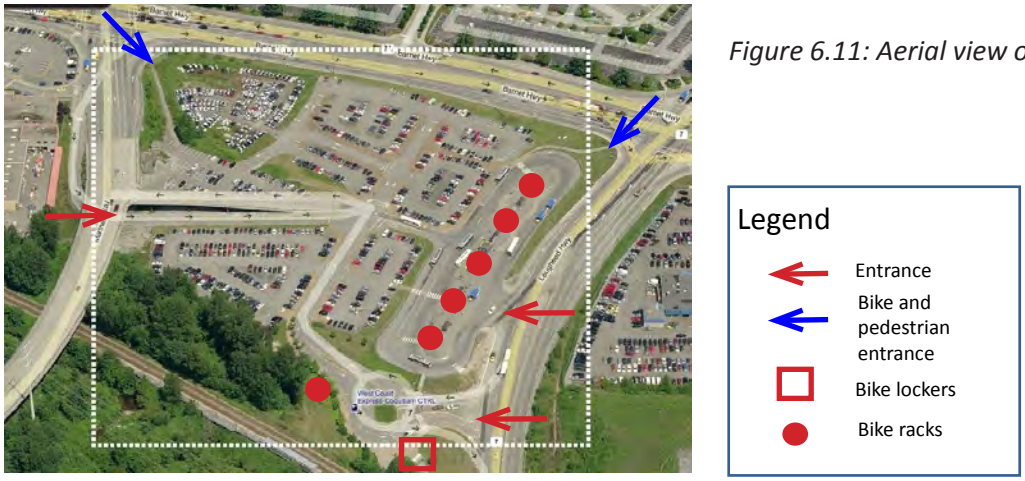


Figure 6.11: Aerial view of Coquitlam Station.

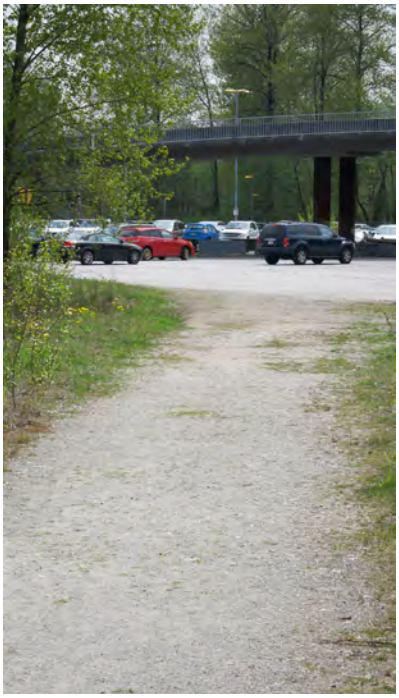
3. Coquitlam Station

Consider a bike cage, particularly at the new Evergreen Line station.

Coquitlam Station is located at the junction of Barnet Highway and Lougheed Highway, so initially it might not appear that it would support a bike cage. But, the park-and-ride lot has good transit service, heavily used car parking, and its surrounding neighbourhood has a relatively high non-motorized mode share. At twenty spaces, it also has the second highest existing daily demand for bike parking. Staff at the West Coast Express who manage the bike lockers at Coquitlam Station report having waiting lists for the twelve lockers in the summer.

The built environment around Coquitlam Station does not support cycling, with many busy roads and poor junctions. Working with the City of Coquitlam to improve these and create other bike routes could play an important role in improving safety for cyclists who are already accessing the lot, as well as encouraging new people to try cycling to this station. The City of Coquitlam's recent *Strategic Transportation Plan Update* calls for new facilities on Barnet Highway and Johnson Street, and a multi-use path on Pinetree Way to Douglas College is currently being planned. Additionally, the future construction of the Evergreen Line will likely provide the opportunity for further significant changes to the station and its surrounding area.

Figures 6.12 and 6.13: left: entrance to Coquitlam West Coast Express Station, right overview: Coquitlam Station entrance from Lougheed Highway.



Figures 6.14 and 6.15: top: bike route sign without any accompanying infrastrutcture on Mariner Way adjacent to Coquitlam Station, bottom: gravel path connecting Coquitlam Station parking lot to the bike route above.

Even if a bike cage is not installed, wayfinding signage at the station could be improved easily and inexpensively. This is particularly important at Coquitlam Station, as the West Coast Express Station and the bus loop are physically separated by a large grade change, leaving bus loop users unlikely to know that secure bike parking is available at the railway station. Improving the West Coast Express platform so that it provides greater weather protection could make the train more attractive to people without cars to wait in. The shelters at the bus loop provide wind blocks on three sides, and the West Coast Express portion of the station should include shelters that offer at least as much weather protection. The quality of bike parking could also be improved, with the West Coast Express bike racks being moved closer to the station and covered. The bike lockers should also be labelled as such so that potential cyclists know what they are.

Recommendations

1. Install signage telling potential cyclists about the available bike parking. This signage can be especially helpful for informing cyclists using the bus loop about the lockers currently available at the West Coast Express Station, as well as the bike cage available in the future.
2. Work with the City of Coquitlam to make changes to the surrounding built environment that would improve cycling conditions.
3. Move the bike racks at the West Coast Express station closer to the platform, and label the bike lockers as such. Provide more bike lockers until a bike cage can be installed.
4. Improve the quality of the West Coast Express waiting area by installing weather breaks and more comprehensive awnings. A waiting area enclosed on three sides should be available.

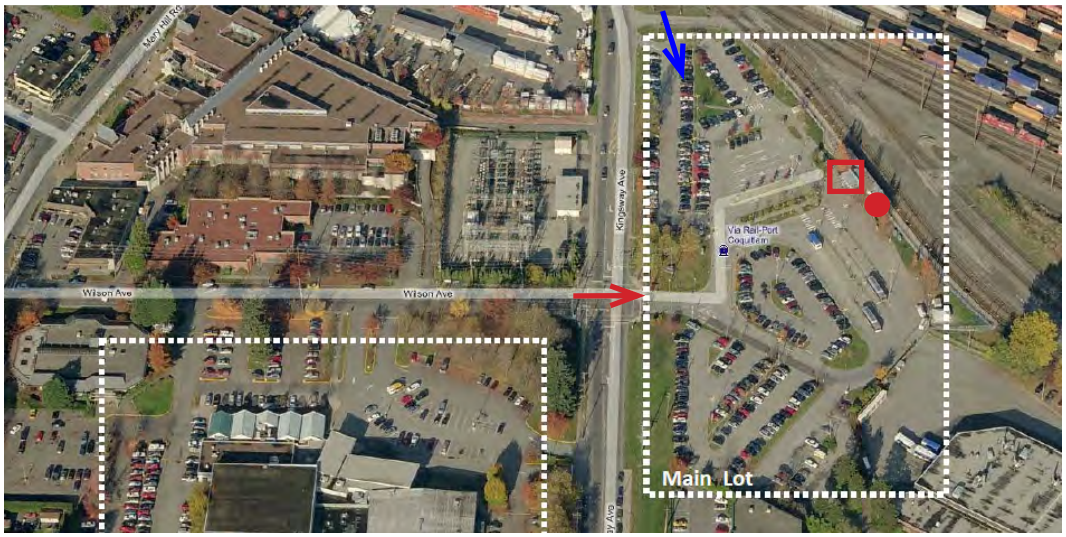


Figure 6.16: Aerial view of Port Moody Station.

4. Port Moody

Consider a bike cage. Improve the cage's chances of success by implementing the following recommendations before the cage is installed.

Port Moody's West Coast Express station does not have enough demand for bike parking to support a bike cage at present, but the built environment around the station has significant potential. Currently, the demand for bike parking is only about ten spaces per day, but Port Moody Station is two kilometres from the city's Newport Village, which has densified in recent years and more new residential developments are planned. The two kilometres from Newport Village to the station are too far to walk conveniently. But, it is a perfect distance for cycling, especially as most of it is along a paved off-road path that runs through a park. With support and encouragement, people living in Newport Village could easily use bikes as their primary means of accessing Port Moody Station. Port Moody Station is also slated to be reconfigured with the construction of the Evergreen Line, providing an opportunity for improving bike facilities in and around the station.

Figure 6.17: Port Moody Station's poor weather protection and infrequent benches in the waiting area.

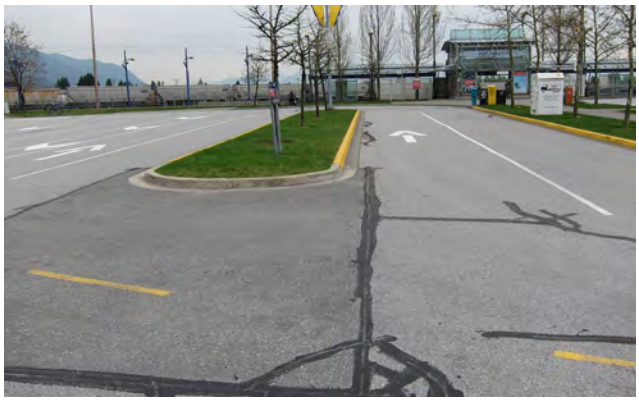
The major challenges that the station faces currently in attracting cyclists are: there are breaks in the bike network as it approaches the station, the routes for cyclists through the station are unclear, and wayfinding materials for cyclists in and around the station are poor. Most importantly, the bike route connecting Newport Village to the station ends at a narrow bridge that goes over the railway tracks on Moody Street. Not only is the bridge uncomfortable for cyclists, reaching the station requires negotiating a steep embankment (with steps, but no ramp) and riding through the entire 300 space parking lot. Each of these issues must be addressed. In

Figures 6.18 and 6.19: left: unofficial bike entrance to Port Moody Station, right: bike lockers at Port Moody Station have no signs identifying them as bike lockers and have been vandalized.

addition, providing a waiting area with better weather protection, covering the bike racks, labelling the bike lockers, and charging more for car parking could help make cycling to the lot a more attractive option.

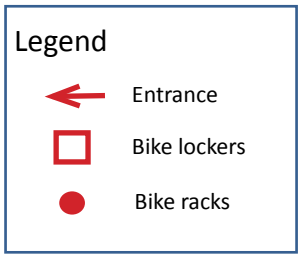
Recommendations

1. Create designated bike routes through the station. This is very important, as it appears that many cyclists access the station from the back of the parking lot, potentially creating conflicts with motorists and pedestrians as they travel to the front of the lot where the platform is located.
2. Install a ramp leading from the bridge on Moody Street down to the parking lot. Tracks in the grass show that cyclists are already riding up and down the short but very steep rise. Installing a ramp also increases accessibility to the station for people who cannot climb stairs.
3. Cover the bike racks and label the bike lockers as such.
4. Improve the quality of the waiting area by installing weather breaks and more comprehensive awnings. A waiting area enclosed on three sides should be available.
5. Work with the City of Port Moody to implement their planned bike route improvements in the area as soon as possible, particularly the proposed changes to the bridge over the railway tracks on Moody Street.
6. Work with the City of Port Moody to promote cycling to the station.
7. Consider raising car parking charges to address parking lot capacity issues and encourage cycling.



Figures 6.20 and 6.21: left: entrance to Port Coquitlam Station. Note the complex road layout. Right: Downtown Port Coquitlam. There are no official bike routes, but the built environment is walkable and bikeable.

Figure 6.22: Aerial view of Port Coquitlam Station.



5. Port Coquitlam

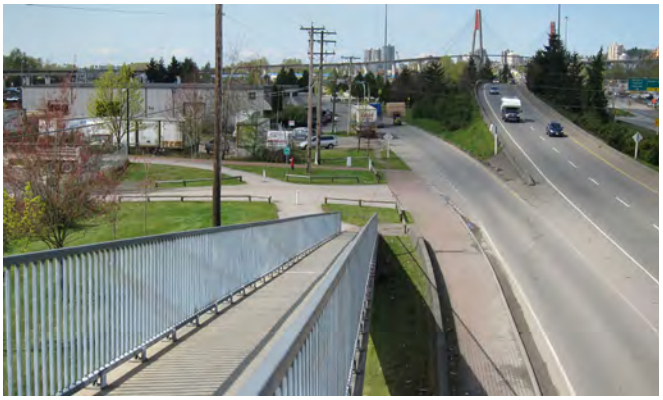
Consider a bike cage. Improve the cage's chances of success by implementing the following recommendations before the cage is installed.

Like Port Moody Station, Port Coquitlam's current demand for bike parking is not enough to support a bike cage. But, its West Coast Express Station and park-and-ride lot are located immediately adjacent to its walkable downtown. It is ranked lower than Port Moody because its walkable downtown is almost too close. At less than one kilometre from the station, it could be just as convenient to walk from the downtown to the station as to bike from it.

Despite the natural bikeability of the area around the station, no official bike routes run anywhere near the station. Adding these routes and working with the City of Port Coquitlam to promote cycling to people who live within a three kilometre easy cycling distance of the station are important first steps towards making a bike cage feasible. Other improvements such as labelling the bike lockers, improving the weather protection of the waiting area, and increasing car parking charges are similar to recommendations for other West Coast Express park-and-ride lots. Improving signage throughout the lot is especially important, as it is a long, thin triangular shape and the circulation pattern through it is relatively complicated.

Recommendations

1. Work with the City of Port Coquitlam to identify and mark existing informal bike routes, and to make improvements where needed.
2. Improve signage within the station directing cyclists to the bike parking and making the route around the station more legible for all road users.
3. Cover the bike racks, and label the bike lockers as such.
4. Improve the quality of the waiting area by installing weather breaks and more comprehensive awnings. A waiting area enclosed on three sides should be available.
5. Consider raising car parking charges to address capacity issues.
6. Work with West Coast Express and the City of Port Coquitlam to promote cycling to the station.



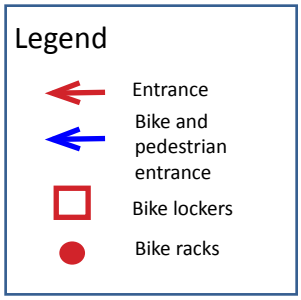
Figures 6.23 and 6.24: left: view from the platform of Scott Road Station, right: BC Parkway bike route leading to the station.

6. Scott Road

Improve existing racks and lockers and monitor bike access.

The demand for bike parking at Scott Road Station is currently about nine bikes per day. In a 1,563 space parking lot, that means that if only 2% of the motorists switched to bike there would be more than enough cyclists to fill a bike cage. But, that calculation ignores two important features of Scott Road Station. First, the built environment around the station does not encourage cycling. Extremely busy roads surround the station and the adjacent portion of the BC Parkway bike route is a poor quality converted sidewalk route. Second, the two sides of Scott Road Station are only connected by the platform, which means that moving from one side of the station to the other with a bike requires taking the elevator up to the platform, walking across the platform, and then taking the elevator or carrying the bike back down to the ground level. This is very inconvenient for cyclists and splits the demand for bike parking across the two sides of the station. For these reasons, the level of bike access to this station is unlikely to justify a bike cage in the near future.

Figure 6.25: Aerial view of Scott Road Station.



Recommendations

1. Install bike lockers on the east side of Scott Road Station. Currently, they are only installed on the west side, but the east side is the side that is easiest to access by bike.
2. Cover the bike racks on both sides of the station.
3. Work with the City of Surrey to implement the planned bike route on 128 Street, as well as potential bike routes on 126A Street and 100 Avenue.
4. Work with the City of Surrey to improve the portion of the BC Parkway bike route that runs alongside the lot.
5. Work with the City of Surrey to provide signage on the existing informal cycling route connecting the Bridgeview neighbourhood to Scott Road Station.
6. Monitor bike rack use and locker rental. If demand exceeds 20 bikes per day on at least one side of the station, consider installing a bike cage.

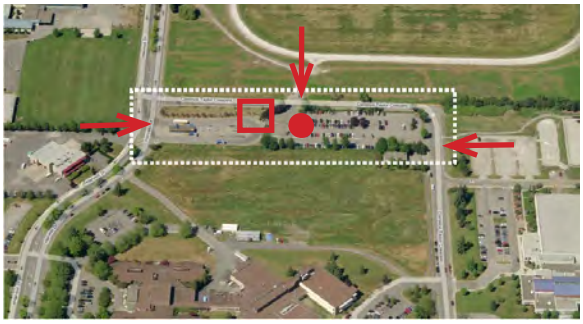


Figure 6.26: Aerial view of Ladner Exchange.

7. Ladner Exchange

Improve existing bike racks and lockers and monitor bike access.

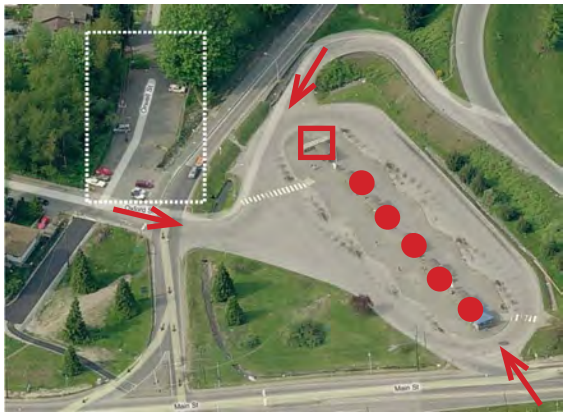
Ladner Exchange is a relatively small 200 space park-and-ride lot, where only about four people per day park their bikes. The Harvest Drive cycling route connects the lot to a residential area to its south, but to the north Harvest Drive is busy and unpleasant for cycling. Near the lot, Ladner Trunk Road and Highway 17 pose significant barriers for cyclists. Creating a full and unobstructed network of bike routes connecting Ladner Exchange with the rest of Ladner could help connect potential cyclists to the lot.

Figures 6.27 and 6.28: left: bike racks located in the middle of the kiss-and-ride at Ladner Exchange, right: mouldy bike lockers at Ladner Exchange.

Ladner Exchange was the only park-and-ride lot assessed that had a bike map posted for customers. But, several other design features of the lot and its maintenance could be improved. The bike lockers are relatively new, but they are under tree cover and have mould growing on them. The bike lockers should be cleaned, and the two bike racks should be covered. In addition, there are three entrances to the interchange, and wayfinding signage marking the entrance closest to the bike racks and lockers would be helpful.

Recommendations

1. Cover the bike racks and clean the mould off the bike lockers.
2. Provide wayfinding signs around the interchange, particularly signage pointing out which entrance to the lot is closest to the bike racks and lockers.
3. Encourage the Corporation of Delta to upgrade all of Harvest Drive so that it provides a high quality bike connection between the exchange and the rest of the city.
4. Monitor bike rack use and locker rental. If demand exceeds 20 bikes per day, consider installing a bike cage.



Figures 6.29: Aerial view of Phibbs Exchange, with the parking lot highlighted.

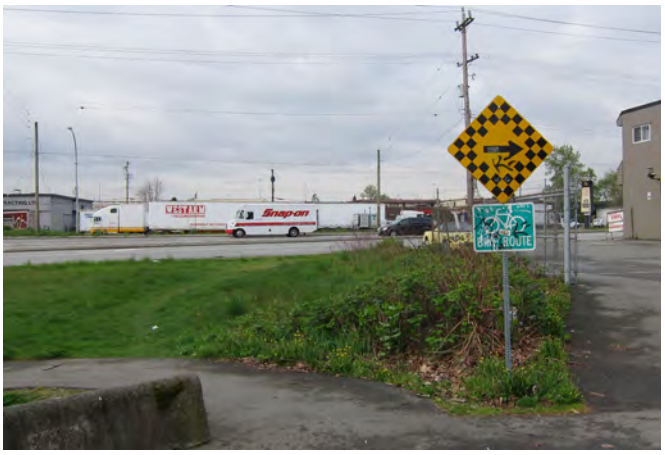
8. Phibbs Exchange

Cover existing bike racks and monitor use.

Currently, only three lockers are rented at Phibbs Exchange and on the day of the site assessment not a single bike was locked at the five racks at the bus loop. Phibbs Exchange is the departure point for a number of buses going to Vancouver, Burnaby, and east to the Tri Cities. It is in a part of North Vancouver that is relatively flat and fairly well connected to the surrounding areas by a network of bike routes. Further, the small (40 space) parking lot is frequently over 90% full.

Although its connection to bike routes is better than many of the park-and-ride lots, there are breaks in the bike network surrounding Phibbs Exchange. In particular, Oxford Street which leads into the lot crosses both Mountain Highway and a Highway 1 off-ramp. Redesigning both of these junctions should be considered to improve perceived safety and ease of accessing Phibbs Exchange by bike. According to the planner at the District of North Vancouver, many local people perceive this neighbourhood as unsafe. There are very bright lights at the lot, but working with the municipality to increase lighting

in the neighbourhood around Phibbs Exchange could help address these perceptions. In addition, surveying customers to find out what mode of transportation they use to get to the lot and what effect better bike parking would have on their travel choices could provide information that would help with developing solutions targeted to address the specific conditions at Phibbs Exchange. Introducing a charge for the currently free lot could help address the problems with car parking overflow, while also encouraging bike parking. The District of North Vancouver has plans to extensively upgrade the bike routes around Phibbs Exchange as part of a significant redevelopment process to create a town centre nearby. This is a perfect opportunity to make the changes necessary to encourage widespread bike access to the lot.



Figures 6.30 and 6.31: left: bike lockers located close to a bus stop at Phibbs Exchange, right: a sign marking a bike route leading to Phibbs Exchange.

Recommendations

1. Cover the existing bike racks and monitor their use.
2. Work with the District of North Vancouver to improve bike access routes to the exchange.
3. Work with the District of North Vancouver to increase lighting in the streets around the exchange.
4. Consider working with other stakeholders to redesign the two Oxford Street crossings leading to the lot.
5. Consider conducting surveys with both transit riders and cyclists to gain insight into why the bike parking is underutilized, and what would encourage greater bike access to the lot.
6. Consider charging for car parking to address lot capacity issues.

9. South Surrey

Institute a car parking charge to address car parking capacity issues, and work with the City of Surrey to improve cycling conditions on King George Boulevard immediately adjacent to the lot.

TransLink requested that South Surrey Park-and-Ride be included in the site assessments because it has significant problems with its car parking reaching capacity, and virtually no opportunity for overflow parking. South Surrey Park-and-Ride is located at the junction of Highway 99 and King George Boulevard, which is almost like a highway in this part of Surrey. The lot itself is surrounded by fields, but there is significant development to the southwest and east. However, the roads leading to these developments are extremely busy. King George Boulevard is an official bike route, but for at least one kilometre on either side of South Surrey Park-and-Ride, there are no painted lanes and no signs demarcating it as such. For this reason, improving the bike parking here is unlikely to attract more cyclists unless Surrey can significantly improve bike facilities on King George Boulevard and connecting arterials.

Recommendations

1. Institute a charge for using the car parking, provide information about transit services to park-and-ride users, and monitor the results.
2. Encourage the City of Surrey to improve King George Boulevard leading to the lot. Currently, it is officially a bike route, but it is hostile to cyclists. Ideally, the upgraded facility would include very wide painted lanes or a separate facility.

Figures 6.32 and 6.33: left: bike racks located in the middle of the bus loop at South Surrey Park-and-Ride (the bike is the author's own), right: the entrance to the lot from King George Boulevard.

7. Conclusions

Secure bike cages would benefit cyclists currently biking to some of TransLink's park-and-ride lots, as well as potentially encouraging a greater number of people to try cycling to several other park-and-ride lots. As demonstrated by the business case development (Appendix D) secure bike cages are also the best option for increasing access to transit at lots that currently have high cycling demand because they are more cost effective than increasing car parking. Bike cages are also easier and more convenient than bike lockers for both cyclists to use and TransLink to maintain and manage.

The lots where bike cages would provide a clear benefit include: King George Station, Bridgeport Station (or nearby Brighouse Station), and Coquitlam Station. The lots where the potential benefit may be high, but where the demand is not currently as clear are: Port Moody Station and Port Coquitlam Station. Small and relatively inexpensive changes to encourage cycling could help increase cycling to all of TransLink's park-and-ride lots, specifically improving wayfinding materials and providing rain cover over the bike racks. In addition, TransLink should develop comprehensive design and location guidelines for bike cages prior to installing them. TransLink should also focus on improving data collection about how people access transit in order to be able to make more rigorous decisions in the future.

Several limitations with the research process are important to note. First, the multi-criteria assessment was shaped in many ways by the availability of data and the difficulty of measuring many of the potential variables of interest. The criteria and weightings used in this multi-criteria assessment process have not been validated in the field, and may not provide the best framework for evaluating the potential for bike parking use at park-and-ride lots. Further, the scorings of the multi-criteria assessment were performed primarily by one person. Usually multi-criteria assessment is a group process, with the multiple perspectives of the group members creating rigour out of the ultimately subjective nature of decision making.

The site assessments were integral to selecting the short-list of park-and-ride lots. The site assessments were the only source of information about the micro-scale design features of the lots, and cycling through the neighbourhoods around the lots provided the best understanding of local cycling conditions. In addition, quite a few of the suburban areas where the park-and-ride lots are located have seen large amounts of development in recent years, which was not captured by the Google Streetview data that was incorporated into the multi-criteria assessment. Ideally, the site assessments should have been performed for all the lots and the data incorporated in the multi-criteria assessment.

The final selection of lots and the business case development were both ultimately based largely on a qualitative assessment by the lead researcher. This selection incorporated the data gathered throughout the process, but it still ultimately depended on individual judgment.

North America has had nearly a century of car-dominated planning, and only now are we beginning to explore the potential for bicycles in our transportation system. Planners must embrace this change and incorporate cycling into transportation plans and infrastructure, even while we are still developing the evidence base to support specific projects and designs. There is increasing evidence that cycling infrastructure and the programs and policies that support it are both the result of, and the motivation for, increased cycling (Forsyth & Krizek, 2010; Pucher, Dill, & Handy, 2010). Furthermore, implementing bike parking is a relatively low risk, low cost endeavour. For these reasons, bringing bike cages to park-and-ride lots and other transit stations and exchanges in Metro Vancouver is an obvious step in the correct direction.

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Appendix A: Site Assessment Form

Lot name/location:

Day and time visited:

Weather and light conditions at visit:

Existing bike parking

____ Number of racks. Specify type: _____

Other notes:

____ Number of lockers. Specify type: _____

Other notes:

____ Number of bikes locked up. Observations about locked bikes (e.g. bike quality, lock quality, any bikes that are clearly abandoned, racks broken or in disrepair, racks that are empty or overfilled, bikes locked to objects other than racks, etc). Do the racks move when pushed?

Is the bicycle parking high quality?

- Are racks covered?
- Is the area around the bike parking well lit?
- Are the racks clearly visible (and not obscured by landscaping, etc)?
- Is the area around the bike parking clean and free of debris?

Does the station/interchange accommodate cyclists?

- Are there signs directing cyclists to and around the interchange?
- Is the entrance wide enough for a car to safely overtake a cyclist?
- Is the bike parking within 60 m of the transit access?
- Are there safe paths from the bike parking to the transit access?
- Are there maps of the surrounding area at the station/interchange? What type of maps (pedestrian, cyclist, transit)?
- Are there other amenities that would be useful for cyclists (e.g. washrooms, vendors, vending machines, ATMs)?

Is the area surrounding the station/interchange supportive for cycling?

- Are there bike routes leading to the station/interchange?
- Are surrounding local streets quiet and supportive of cycling?
- Are there traffic signals so that cyclists can easily get to the station/interchange?
- Is there a mix of land uses in the surrounding area?
- Are there any major barriers to the park-and-ride lot?
- Are there signs in the surrounding area directing cyclists (and others) to the lot?
- What is the potential of the area?

Are the logistics lined up?

- Is there an existing power source? If not, is there a power source that could be easily extended to power the bike cage?
- Is there enough space for a bike cage?

Appendix B: Interview Guide for the Municipalities

1. Do you have any plans to enhance the bike network around the park-and-ride?

2. Do you see any potential problems related to increasing bike journeys to this lot?

3. Do you see any potential benefits from increasing bike journeys to this lot?

4. Where do you think would be the best areas to improve bike access to this lot – e.g. where would you put bike routes and what types of bike routes, or where would you add a new traffic signal?

5. Do you have any suggestions for improvements to the lot itself that could attract cyclists – e.g. better racks, more lockers, a bike cage, etc?

6. Do you know of any plans for new developments in this area?

7. Do you have any plans to do repaving or other road works near the lot?

8. What would encourage you to make improvements to the cycling infrastructure near the lot?

9. How does this park-and-ride lot fit into your plans and priorities for future bike improvements?

10. Do you think this lot is the best place for cyclists to access transit in the area, or are there other stations or exchanges where you think cyclists would be more likely to access transit? Why?

Appendix C: Site Assessment Notes

Ladner Exchange

Day and time visited: Tuesday, April 17th, 14.30

Weather and light conditions: cool, cloudly and overcast. Started drizzling part of the way through the site visit.

Bike parking: 2 hanging loop racks (both with 7 loops).

Number of lockers: 10 green plastic Cycle-safe lockers. They appear mouldy.

Number of bikes locked up: 2. Both bikes are old and very poor quality with completely rusted chains. But I don't think they're abandoned because one has new tires and the other has a blanket wrapped around the saddle (presumably to protect it from the weather).

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? Sort of. In general, lot is well lit, with lamps every 10-15 m, but there is a break right around where the bike parking is situated due to the bike parking being situated between the kiss-and-ride and the park-and-ride.
3. Are the racks clearly visible? Yes, both the racks and the lockers are visible from the bus loop. The lockers are located on a green area at the end of the bus loop. The racks are located on a traffic island between the kiss-and-ride and the car parking, which is directly behind the bus loop.
4. Is the area around the bike parking clean and free of debris? Yes, but why on earth is there a garbage can right between the bike racks? There are quite a few garbage cans throughout the transit interchange.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No, and this would be particularly useful because there are three entrances to the lot.
2. Is the entrance wide enough for a car to safely overtake a cyclist? No, although there are 3 entrances to the lot, which helps a little. One entrance is for the buses, and there are two entrances into the car parking – including one right next to the bike parking (and the kiss-and-ride).
3. Is the bike parking within 60 m of transit access? Yes.
4. Are there safe paths from the bike parking to the transit access? Yes, crosswalks.
5. Are there maps of the surrounding area at the station/interchange? Yes, transit and bike maps!
6. Are there other amenities that cyclists would find useful? The waiting area at the front of the lot is surrounded on three sides.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Yes, sharrows on Harvest Drive leading to the lot *from the south only*.
2. Are the surrounding streets quiet and supportive of cycling? Some – there are a fair number of relatively

grid-planned residential streets, but there is a general problem with arterial streets being difficult to traverse by bike – this is particularly a problem with Ladner Trunk Road and Highway 17, which are very near the lot and cut it off from much of the surrounding community.

3. Are there traffic signals so that cyclists can easily get to the station/interchange? No. There should be one at Harvest Drive and Clarence Taylor Crescent.

4. Are there a mix of land uses in the surrounding area? Yes – I observed residential, commercial, and institutional land uses.

5. Are there any major barriers to the park-and-ride lot? As mentioned, Ladner Trunk Road and Highway 17.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No. There is one big sign for the lot at the corner of Harvest Drive and Clarence Taylor Crescent, but it doesn't point to how to get into the park-and-ride lot.

7. What is the potential of the area? It's very flat, which is good. It's also relatively small, which is also good. But, it's also really suburban and somewhat isolated.

Are the logistics at the lot lined up?

1. Is there an existing power source? Probably. Although there might be problems due to the break in the street lights right next to the bike racks – there may be two banks of lights, without the power connected across them. But, the current location of the bike racks is too small for a cage.

2. Is there enough space for a bike cage? Not in the current racks location. And the lockers have trees overhanging them, which makes replacing the lockers with a cage not possible. But, the location of the bike racks and the kiss-and-ride shelter could be swapped to make space for a bike cage, although that might block the 'eyes on the street' effect from the bus loop to the KNR.

Recommendations

1. Provide cover for the bike racks.

2. Provide wayfinding signs around the station (especially a sign that shows cyclists how to enter it).

3. Encourage the municipality to upgrade all of Harvest Drive so that it provides a high quality bike connection between the exchange and the rest of the city.

4. Monitor bike rack and cage rental. If demand exceeds 20 (currently 4) bikes per day, consider installing a bike parking cage.

5. Consider installing bike lockers at the South Delta Exchange (municipality's request).

Bridgeport

Day and time visited: Tuesday, April 17th, 15.45

Weather and light conditions: cool to cold, cloudy and overcast. Started raining lightly part of the way through the site visit.

Bike parking: 2 hanging loop racks (both with 2 loops). One rack is located behind the entrance to the station, and one rack is located on the other end of the bus loop by the bike lockers.

Number of lockers: 10 tan plastic Cycle-safe lockers.

Number of bikes locked up: 7 overall: 5 bikes locked on the rack by the station entrance, 1 bike locked on the fence by the station entrance, and 1 bike locked on the far end of the bus loop. The locked bikes are of various qualities, and several are clearly well-cared for with helmets hanging off them, which suggests that they are not abandoned.

Is the bicycle parking high quality?

1. Are racks covered? Yes, by the Skytrain tracks.
2. Is the area around the bike parking well lit? Yes, there are lights less than 2 metres from the racks.
3. Are the racks clearly visible? Yes, but only if you are on the rack-side of the station entrance (and you can only see the rack on that side), or if you are on the rack-side of the driver's amenity building. There is a clear lack of visibility from one side of the bus loop to the other, which may explain the varied utilization of the bike parking.
4. Is the area around the bike parking clean and free of debris? Yes.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No.
2. Is the entrance wide enough for a car to safely overtake a cyclist? When I was at Bridgeport, I only noticed the entrance on the Great Canadian Way side of the station, but according to the Richmond bike planner, there is a second entrance on Charles Street. The entrance on Great Canadian Way is really problematic for cyclists because the car parking is in the casino next door, the road entrance is designed to facilitate bus movement, with a series of crosswalks for pedestrian access. This leaves cyclists potentially in conflict with both pedestrians and buses.
3. Is the bike parking within 60 m of transit access? Yes.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on a giant pedestrian island that makes up the bus loop.
5. Are there maps of the surrounding area at the station/interchange? Yes, transit and walking maps, but no bike maps.
6. Are there other amenities that cyclists would find useful? There are supposed to be a number of amenities in the station (see the consultants' survey, which says it has vending machines, vendors and an ATM), but I only saw the vending machines. There's also a casino next door.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Yes, Great Canadian Way has painted bike lanes, there are also a number of side streets that are marked as bike routes, but they all appear to

need upgrading and some effort put into making sure they actually go somewhere.

2. Are the surrounding streets quiet and supportive of cycling? Some. Great Canadian Way is terrible, as is Bridgeport Road and No 3 Road. But, there are also quite a few side streets that are more or less in a grid plan.

3. Are there traffic signals so that cyclists can easily get to the station/interchange? Yes, including a cool bike-activated signal on Great Canadian Way.

4. Is there a mix of land uses in the surrounding area? Yes – I observed residential, commercial, and industrial land uses, although there was very little residential and it was all old, single-family houses near the station – so I don't know what the future of it is.

5. Are there any major barriers to the park-and-ride lot? Well, obviously, the PNR lot is right next to the water, and it looks like there's a rail yard immediately to the northeast of the station. Also, the big busy streets (Great Canadian Way, Bridgeport Road, and No 3 Road) all could probably use a few more traffic lights, especially where there is the opportunity for a neighbourhood street bike route, such as at Sexsmith.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? It looks like there has been quite a bit of effort to put up wayfinding signs leading to the PNR along the nearby side streets, but either I didn't follow them very well or they don't fully deliver, as I didn't see the Charles Street entrance initially.

7. What is the potential of the area? It's very flat, which is good. It's also quite commercial and industrial, which brings up big questions of who uses this station and how/why. It's obviously attractive for PNR users because it's more attractive for them to get as close to their destinations as possible in their cars. But BNR users are much more likely to want to lock their bikes as close to their origins as possible. So, it might make more sense to have a bike cage or cages further down the line.

Are the logistics at the lot lined up?

1. Is there an existing power source? Probably. It's a new station space, and the lights are very close by.

2. Is there enough space for a bike cage? Absolutely, there is tons of space around the bus loop.

Recommendations

1. Improve signage around the lot – especially provide signs identifying where both bike racks (and lockers) are located.

2. Work with the municipality to improve signage leading to the lot - especially pointing to the Charles Street entrance.

3. Consider installing a bike parking cage (current demand: 14 bikes per day) *and/or* at Brighouse.

4. Enforce payment for informal parking in gravel lot near station ($2.50 per day in official lot).

Scott Road

Day and time visited: Friday, April 20th, 11.00

Weather and light conditions: sunny and warm for the season.

Bike parking: 4 hanging loop racks (both with 2 loops). There are 2 racks on both sides of the station.

Number of lockers: 20 green plastic Cycle-safe lockers. Lockers are only located on the west side of the station. The west side of the bank of lockers is a bit mouldy.

Number of bikes locked up: 2 – 1 bike locked up on each side. Both are fairly old, in poor condition, and locked with cable locks.

Is the bicycle parking high quality?

1. Are racks covered?
    a. West: 1 out of 2 racks (covered by SkyTrain tracks, which split here).
    b. East: not covered.
2. Is the area around the bike parking well lit?
    a. West: there are several lights next to the bike parking on the west side, including two lights hanging off the train tracks right near the bikes.
    b. East: not really. There are fewer lights in general than on the west side, and the racks is about 4 m from the nearest light.
3. Are the racks clearly visible? On both sides, the racks are around the corner from the entrance to the stations, so they are not visible from the station entrance. On the west side, they are on the path that people walking from the parking lot must take to access the station, and right next to the parking payment machine. They are also visible from most of the bus loop.
4. Is the area around the bike parking clean and free of debris? Yes.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No, although the station is currently undergoing construction, so the signs could be obscured by the scaffolding, etc.
2. Is the entrance wide enough for a car to safely overtake a cyclist? No. There are about six entrances and exits to the two parking lots, bus loop, etc. But, they almost all lead onto highways, so I would not cycle into the lot from the official entrances. There are other options:
    a. West: a gravel path from the corner of the parking lot leads to a 110 Avenue, which is a major street and has painted bike lanes leading to the Pattullo Bridge (which is probably not a direction that any bike commuters would come from). From this path, you can also get to a crosswalk with a pedestrian warning light; across one highway, and another uncontrolled crossing across a second highway. If you cross both of these, you end up in the parking lot of a mall. Presumably, you can get somewhere else from here.
    b. East: the BC Parkway trail connects to the lot on the east. It runs along the sidewalk upon

exit from the lot.

3. Is the bike parking within 60 m of transit access? Yes.

7. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized area by the station.

8. Are there maps of the surrounding area at the station/interchange? There's a map showing regional transit connections (i.e. SkyTrain and B-lines), but nothing showing local connections. This may be due to the construction work.

9. Are there other amenities that cyclists would find useful? Yes. There station areas are quite sheltered on both sides. There's also a portable building holding a full-sized shop on the west side, and a small kiosk for selling stuff on the east side (currently boarded up).

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange?

    a. West: 101 Avenue has painted lanes and leads to the Pattullo Bridge.

    b. East: BC Parkway runs along the sidewalk of 126a Street and then King George Boulevard farther into Surrey

2. Are the surrounding streets quiet and supportive of cycling? Mostly no. The Bridgeview neighbourhood on the east side of the station is mostly a residential grid plan, and this is largely fine for cycling.

3. Are there traffic signals so that cyclists can easily get to the station/interchange? No, although there is a bridge on the east side of the station that leads to the Bridgeview neighbourhood. The junctions along the BC Parkway are surprisingly scary and not bike friendly.

4. Is there a mix of land uses in the surrounding area? Yes. I observed residential, commercial, and industrial – although the commercial and industrial tended to be in large plots of land that aren't particularly walkable.

5. Are there any major barriers to the park-and-ride lot? Yes, there are far too many busy streets.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.

7. What is the potential of the area?

    a. West: I think the roads surrounding the lot to the west would be terrifying at commute times.

    b. East: the lot is fairly well connected to the Bridgeview neighbourhood. How big is this neighbourhood, and what is the potential to get people cycling to the lot from here? **Are the logistics at the lot lined up?**

1. Is there an existing power source? Yes, both sides.

2. Is there enough space for a bike cage?

    a. West: yes

    b. East: not really

Thoughts/recommendations

1. Provide cover for the bike racks on both sides of the station.

2. Install bike lockers are the east side of the station. (Currently, they are only installed on the west side, but the east side is the side that is easiest to access by bike. Note that the only way to get between each side of the station is to go up on the platform, walk across it, and then carry your bike down.)

3. Work with the municipality to improve signage on the existing safe cycling route connecting the Bridgeview neighbourhood to Scott Road Station.

4. Support the municipality in promoting and marketing cycling to Scott Road Station in the Bridgeview neighbourhood.

King George

Day and time visited: Friday, April 20th, 13.30

Weather and light conditions: bright, sunny, cool, and breezy. Some clouds and overcast moments.

Bike parking: 4 hanging loop racks (both with 2 loops). There are 2 racks on both sides of the station.

Number of lockers: 84 blue and tan plastic Cycle-safe lockers. Lockers are on the south side of the station, by the kiss-and-ride.

Number of bikes locked up: 3: 2 on the north side of the station and 1 to the south. All 3 are fairly old and inexpensive, but 2 are locked with good quality locks and 1 has a helmet locked to it.

Is the bicycle parking high quality?

1. Are racks covered? Yes (all) – by the SkyTrain tracks (double tracking here).
2. Is the area around the bike parking well lit? Yes.
3. Are the racks clearly visible? Yes – they're visible from the station entrances.
4. Is the area around the bike parking clean and free of debris? Yes.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No, but the station as a whole is fairly legible because it is relatively small with two entrances that face each other.
2. Is the entrance wide enough for a car to safely overtake a cyclist? Not really. Its west entrance connects with the sidewalk (making it the most pedestrian-focused PNR I've looked at) – this also creates potential cyclist – pedestrian conflicts. Its east entrance connects to the kiss-and-ride, which is reached by a fairly long and narrow driveway. Interestingly, there is no bus loop (buses just stop on the street in front of the lot), so this cuts down on entrance options, as well as making it so that cyclists don't have to deal with buses to access the lot.
3. Is the bike parking within 60 m of transit access? Yes – it's about 5 m.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized part of the station.
5. Are there maps of the surrounding area at the station/interchange? There are local and regional transit maps, but nothing showing how to get around the area.
6. Are there other amenities that cyclists would find useful? Yes. There is a shop in the station that sells snacks, and a bunch of new (and empty) retail units next door. There's also a strip mall across the parking lot, and this includes even more retail.

Is the area surrounding the station/interchange supportive for cycling?

8. Are there bike routes leading to the station/interchange? Yes.
    a. West: Off-road access through Holland Park, and on-road bike lane access along East Whalley. However, I would think that cyclists would be more likely to keep going and access transit from Surrey Central than to back-track and get on at King George.
    b. East: there are a bunch of options: trails through the Green Timbers Urban Forest, lanes along Fraser Highway, and lots of neighbourhood street options.

9. Are the surrounding streets quiet and supportive of cycling? Not all, but some definitely are.

10. Are there traffic signals so that cyclists can easily get to the station/interchange? Yes.

11. Is there a mix of land uses in the surrounding area? Yes. Lots of land use mix – and lots of neighbourhood-focused retail.

12. Are there any major barriers to the park-and-ride lot? Yes, there are a few very busy streets. King George Highway (with its median divider fence) is a good example of a busy street that acts as a barrier. It would improve the urban design if there was a light and pedestrian/cyclist crossing connecting King George to Holland Park (this would also improve connections for people accessing or exiting from southbound buses).

13. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.

14. What is the potential of the area? It is significantly denser and more mixed-use than the other lots I've looked at. It's also obviously a huge collector for people coming from south of the SkyTrain. These two factors make this the most supportive lot by far.

Are the logistics at the lot lined up?

1. Is there an existing power source? Yes.

2. Is there enough space for a bike cage? Absolutely. The bike lockers take up so much space!

Thoughts/recommendations

1. Install a bike cage here! There are currently around 70 people per day who cycle to King George Station (based on observed number of bikes locked and information about locker rentals). There is more than enough demand (and space behind the station) to install a bike cage, while keeping some of the lockers.

2. Work with the municipality to continue improving bike routes around the station.

3. Consider removing the barrier on King George Highway in front of the station and creating a mid-block pedestrian and cyclist crossing, creating a direction connection between the station, Holland Park, and the stop for southbound buses.

South Surrey

Day and time visited: Friday, April 20th, 15.30

Weather and light conditions: sunny and warm.

Bike parking: 3 hanging loop racks (both with 2 loops).

Number of lockers: 8 tan plastic Cycle-safe lockers.

Number of bikes locked up: Zero.

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? Sort of – there are lights nearby, but I can imagine it gets pretty dark here.
3. Are the racks clearly visible? Yes – they're in the middle of the bus loop island.
4. Is the area around the bike parking clean and free of debris? Yes.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No, although the PNR is really small and the bike racks and lockers are visible from the entrance.
2. Is the entrance wide enough for a car to safely overtake a cyclist? No.
3. Is the bike parking within 60 m of transit access? Yes – it's right next to the bus stops.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized island in the centre of the bus loop.
5. Are there maps of the surrounding area at the station/interchange? Regional transit maps, but nothing local.
6. Are there other amenities that cyclists would find useful? The one amenity is LED 'next bus' signs. Are they real-time? Also, the bus shelters are three sided with floor to ceiling glass.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Technically, yes. King George is technically a bike route, but this part is like a rural highway, and I would definitely not want to ride on it.
2. Are the surrounding streets quiet and supportive of cycling? Not at all – the PNR is at the junction of two rural highways.
3. Are there traffic signals so that cyclists can easily get to the station/interchange? No.
4. Is there a mix of land uses in the surrounding area? No. The PNR is in the middle of fields.
5. Are there any major barriers to the park-and-ride lot? Yes – the highways and the distance to get to any destinations (nearly 1 km).
6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.
7. What is the potential of the area? Not much currently. The lot is at the junction of two rural high-

ways with nothing at all nearby. There's so little around it, and the streets around it are so hostile that I can't believe people cycle here now … but two lockers are rented.

Thoughts/recommendations

1. Institute a charge for using the car parking.
2. In the short term, encouraging drivers to take transit to the lot may be the best option for dealing with its capacity problems. There are very few destinations within cycling distance of it, and the lot's location at the junction of two highways makes it extremely difficult to cycle there.
3. In the long term, a potential solution may include working with the municipality to vastly improve cycling conditions on King George Boulevard. Longer term, working with the municipality and landowners to construct off-road cycling trails that connect the lot to surrounding residential neighbourhoods may be an option.

Port Moody

Day and time visited: Monday, April 23rd, 11.00

Weather and light conditions: Alternating sun and clouds. Warm and breezy.

Bike parking: 1 hanging loop rack (with 6 loops).

Number of lockers: 8 unknown brand white aluminum lockers. Each locker has a different padlock (rather than a key as on the Cycle Safe lockers). There are clear signs of attempted vandalism (evidence of kicking/hitting the side) on locker 1/8.

Number of bikes locked up: 3 – the bikes are slightly higher quality than usual and are clearly not abandoned (2 have plastic bags on the seats, and 1 has a helmet locked to it).

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? Ok – there are walkway and platform lights nearby, but nothing directly over the bike rack.
3. Are the racks clearly visible? Sort of – they're a little way down from the entrance to the station, between the platform and the KNR. But, the rack is also between two trees, which obscure it somewhat if you're looking from the station.
4. Is the area around the bike parking clean and free of debris? Yes. It's worth noting here that the rack has been installed improperly, so that the brick paving beneath it only extends far enough for one side of the rack to be usable (without stepping on the grass/mud). This reduces its capacity.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No.
2. Is the entrance wide enough for a car to safely overtake a cyclist? Yes, the official entrance is wide enough. There is also a pedestrian entrance at the back of the parking lot, which can be used by cyclists (although poorly because it has steps, although there is some evidence that cyclists have been circumnavigating the steps and just riding down the hill).
3. Is the bike parking within 60 m of transit access? Yes.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized part of the station.
5. Are there maps of the surrounding area at the station/interchange? There are regional bus maps, but no local maps.
6. Are there other amenities that cyclists would find useful? No (although there are a few shops along St Johns Street). Also, there is very poor waiting infrastructure at the station – only 4 benches (2 benches on the platform and 2 benches at the bus loop/KNR), plus the wind breaks on the platform have holes in them, and the overhangs on the platform are too short and have breaks in them.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Sort of. There is a really nice off-road path running through Town Centre Park that connects the station with the old part of Newport Village (getting to the new part of Newport Village requires cycling along Murray Street on the sidewalk). This off-road path is somewhat clumsily connected to the station. There is a flight of stairs from the back of the parking

lot leading up a grassy rise to Moody Street. The grassy rise shows signs of people riding up and down it (rather than using the stairs), and then there's a really narrow bridge over the railway tracks with neither the roadway or the sidewalk being ideal for cycling (or marked as such).

2. Are the surrounding streets quiet and supportive of cycling? The Newport Village streets are – but the streets near the station are generally just a little too busy (St Johns Street) or too vertical (anything south of St Johns Street).

3. Are there traffic signals so that cyclists can easily get to the station/interchange? Enough – there tend to be traffic signals at critical junctions and the area is on a grid plan, so the large distances between traffic signals could be easily dealt with if you knew the area.

4. Is there a mix of land uses in the surrounding area? Yes. There's quite a bit of land use mix – and quite a bit of neighbourhood-focused retail.

5. Are there any major barriers to the park-and-ride lot? Yes, there are a few very busy streets surrounding the PNR, and there are some steep rises south of the PNR lot.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.

7. What is the potential of the area? It has good bones and shows a recent commitment to good development. It just needs a little bit more by way of bike infrastructure and legibility (see thoughts/recommendations).

Are the logistics at the lot lined up?

1. Is there an existing power source? Yes, street lights point to power source in green island.

2. Is there enough space for a bike cage? Yes, although it wouldn't fit alongside the station where the bike parking is now). But, there's a green traffic island between the car parking and the bike parking, which could have a bike cage on it.

Thoughts/recommendations

1. Consider installing a bike cage, or increasing the number of bike lockers and covering the existing bike rack.

2. Improve signage within the station directing cyclists to the bike parking.

3. Create designated bike routes through the station. This is very important, as it appears that cyclists may be accessing the station from the back of the parking lot which could create potential conflicts with motorists.

4. Install a ramp leading from the bridge on Moody Street down to the parking lot. Tracks in the grass show that cyclists are already riding up and down the very steep hill. Installing a ramp also increases accessibility to the station for people who cannot climb stairs.

5. Improve the quality of the waiting area by installing weather breaks and more comprehensive awnings. A waiting area enclosed on three sides should be available.

6. Work with the municipality to implement their (draft) planned bike route improvements in the area as soon as possible.

7. Consider raising car parking fees to address capacity issues.

Coquitlam

Day and time visited: Monday, April 23rd, 13.00

Weather and light conditions: Somewhat overcast, with a light breeze. Fairly warm.

Bike parking: 5 hanging loop rack (with 2 loops) at the bus exchange, and 1 hanging loop rack (with 6 loops) at the West Coast Express.

Number of lockers: 12 unknown brand white aluminum lockers. The lockers have padlocks (like Port Moody), but except for one they all have the same lock.

Number of bikes locked up: 5 – 2 at the bus loop, and 3 at the WCE. All are very inexpensive and poorly maintained.

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? Yes – nearby lamps.
3. Are the racks clearly visible?
    a. Bus loop: racks are located across the pedestrianized bus loop area, so they're easy to come across, although service buildings and bus shelters along the bus loop make two of the racks difficult to see. There are no lockers at the bus loop and the bus loop is about 50 m from the station.
    b. WCE: racks are unnecessarily far from the station, but the lockers are right next to the station entrance. The racks are about 60 m from the station entrance, even though there is abundant space closer to the station.
4. Is the area around the bike parking clean and free of debris? Yes. It's worth noting here that the rack has been installed poorly, so that the brick paving beneath it only extends far enough for one side of the rack to be usable (without stepping on the grass/mud).

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No.
2. Is the entrance wide enough for a car to safely overtake a cyclist? Not really (entrance and exit are single narrow lanes with traffic islands) – but if I was cycling here, I would *not* enter from the car entrance, which is off Lougheed Highway. I would enter instead from the sidewalk on the Lougheed Highway or along Barnet Highway.
3. Is the bike parking within 60 m of transit access? Yes – bus loop. No – WCE racks, Yes – WCE lockers.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized part of the station/bus loop.
5. Are there maps of the surrounding area at the station/interchange? There are regional bus maps, but no local maps. The bus loop also has a map of the transit interchange, showing where to catch which buses.
6. Are there other amenities that cyclists would find useful? No (although there are lots of malls and strip malls around here – but getting to them requires crossing really big streets). The bus loop has lots of benches and three-sided bus shelters, but the WCE side has very poor waiting

infrastructure – only 3 benches (2 benches on the platform and 1 bench in front of the station entrance), plus the wind breaks on the platform have holes in them, and the overhangs on the platform are too short and have breaks in them.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Not really. There is a sign up at the junction of Barnet Highway, Mariner Way, and Johnson Street which appears to indicate that all three are bike routes. But, these listed as informal bike routes on the TransLink map, and I would prefer not to cycle there.

2. Are the surrounding streets quiet and supportive of cycling? No - it's the junction of 2 highways. The official (car) entrance to the station is on a dual carriageway.

3. Are there traffic signals so that cyclists can easily get to the station/interchange? Yes, but the streets are really intimidating to cross if you're not in a car.

4. Is there a mix of land uses in the surrounding area? There's quite a bit of retail and other commercial uses right nearby, and some housing within 400 m. But the mix of land uses tends to exist as single-use districts that have to be travelled between on huge arterials.

5. Are there any major barriers to the park-and-ride lot? Yes, there are way too many very busy streets near the PNR lot.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? There's one sign on Pinetree Way that looks a bit ancient that directs people to a 'train station'.

7. What is the potential of the area? There are a lot of new high rises going up not that far away, so there's an increasing population density within biking distance to the station. But the roads are just *so* unfriendly that I don't see there ever being tons of people who would want to bike here without big changes to the road network.

Are the logistics at the lot lined up?

1. Is there an existing power source? Yes.

2. Is there enough space for a bike cage? Yes, in the plaza in front of the station where the bike lockers are currently – maybe move the lockers to where the rack is currently.

Thoughts/recommendations

1. Consider installing a bike cage and promoting it to both WCE and bus loop users. Despite the hostile built environment surrounding the station, there are already 17 people parking their bikes here per day (and the bike lockers are at capacity, so there may be additional demand).

2. If a bike cage is not appropriate right now, cover all the bike racks (WCE and bus loop), and move WCE racks closer to the station entrance.

3. Install signage telling potential cyclists about the bike parking.

4. Provide better weather protection at the WCE station (better awnings and wind breaks).

5. Interview cyclists at the station to find out more about why they bike here, what routes they use, and what they would like to see improved.

6. Work with the municipality to make changes to improve cycling conditions.

Port Coquitlam

Day and time visited: Monday, April 23rd, 14.00

Weather and light conditions: Overcast, warm, and somewhat humid with a light breeze.

Bike parking: 1 hanging loop rack (with 6 loops).

Number of lockers: 8 unknown brand white aluminum lockers.

Number of bikes locked up: 1 – really cheap Raleigh in decent shape with a helmet locked to it.

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? No – the only lights are targeted lights on the platform, with a larger collection of lights 15 m away.
3. Are the racks clearly visible? Sort of – if you look to the right of the station as you're leaving it, you'll see them. If you don't look that way, you won't.
4. Is the area around the bike parking clean and free of debris? Yes. It's worth noting that this is the only WCE rack I've seen that was properly installed so that cyclists could use both sides (without stepping on the grass/in mud).

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No.
2. Is the entrance wide enough for a car to safely overtake a cyclist? Yes, although only if you're willing to go over the lanes painted on the tarmac.
3. Is the bike parking within 60 m of transit access? Yes – about 30 m, but there's enough space next to the station that the bike parking could be right next to it.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized part of the station.
5. Are there maps of the surrounding area at the station/interchange? No.
6. Are there other amenities that cyclists would find useful? No (although there are a few shops along Wilson Avenue). The station has very poor waiting infrastructure – only 4 benches (2 benches on the platform and 2 benches at the KNR by the station entrance), plus the wind breaks on the platform have holes in them, and the overhangs on the platform are too short and have breaks in them.

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? No.
2. Are the surrounding streets quiet and supportive of cycling? Yes. They are generally fairly small (2 lanes), with lots of pedestrian activity.
3. Are there traffic signals so that cyclists can easily get to the station/interchange? Yes.
4. Is there a mix of land uses in the surrounding area? Yes – there's lots of commercial and residential.
5. Are there any major barriers to the park-and-ride lot? Not really, although the railway tracks do form

a barrier.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.

7. What is the potential of the area? High. Of all the PNRs I've looked at, this one has had the best 'bones'. It's about a 3 minute bike ride from the town centre and there appears to be lots of housing around it. The surrounding area is relatively flat.

Are the logistics at the lot lined up?

1. Is there an existing power source? Yes.

2. Is there enough space for a bike cage? Yes, there's lots of space around the station entrance and where the existing bike parking is.

Thoughts/recommendations

1. Consider installing a bike cage, or increasing the number of bike lockers and covering the existing bike rack.

2. Improve signage within the station directing cyclists to the bike parking and making the route around the station more legible for all road users.

3. Improve the quality of the waiting area by installing weather breaks and more comprehensive awnings. A waiting area enclosed on three sides should be available.

4. Work with the municipality to identify and mark existing informal bike routes, and to make improvements where needed.

5. Work with the municipality and WCE to promote cycling to the station.

6. Consider raising car parking charges to address capacity issues.

Phibbs Exchange

Day and time visited: Tuesday, April 24th, 9.30

Weather and light conditions: Cool and cloudy.

Bike parking: 5 hanging loop rack (with 2 loops).

Number of lockers: 16 tan Cycle Safe lockers.

Number of bikes locked up: none.

Is the bicycle parking high quality?

1. Are racks covered? No.
2. Is the area around the bike parking well lit? Probably – none of the racks are under lights, but there are lights up and down the bus loop (and under the shelters).
3. Are the racks clearly visible? Mostly. The racks are installed alongside the bus shelters – so they are blocked a bit by the bus shelters. But it's not a big deal because the bus shelters have transparent sides, and there are a lot of racks.
4. Is the area around the bike parking clean and free of debris? Yes.

Does the station/interchange accommodate cyclists?

1. Are there signs directing cyclists into and around the interchange? No, but it's really small.
2. Is the entrance wide enough for a car to safely overtake a cyclist? Yes, although the entrance that bikes would use (Oxford Street) crosses an offramp for Highway 1 and this is not well marked (plus, I observed several cars come off this really fast).
3. Is the bike parking within 60 m of transit access? Yes – both the racks and the lockers are located on the bus loop island.
4. Are there safe paths from the bike parking to the transit access? Yes, the bike parking is located on the pedestrianized part of the bus loop.
5. Are there maps of the surrounding area at the station/interchange? Yes, there's a regional transit map which contains a blow-up of the various town centres – this is somewhat useful, as the level of detail for North Van is much better than for many other areas.
6. Are there other amenities that cyclists would find useful? No. In addition, the bus shelters are open to the elements on all four sides (they only provide a roof).

Is the area surrounding the station/interchange supportive for cycling?

1. Are there bike routes leading to the station/interchange? Yes – not very good Ironmongers Bridge route, pretty good Main Street (mixed-use path running adjacent to the road) and ok Mountain Highway (which has a bus/bike shared lane).
2. Are the surrounding streets quiet and supportive of cycling? Yes. They are generally fairly small (2 lanes), with lots of pedestrian activity.
3. Are there traffic signals so that cyclists can easily get to the station/interchange? Yes – except there is no traffic signal on the Oxford Street entrance, and this would help make sure that drivers getting off the highway slow down and look for cyclists/pedestrians.

4. Is there a mix of land uses in the surrounding area? Yes – there's lots of residential and some commercial.

5. Are there any major barriers to the park-and-ride lot? Obviously, the highway.

6. Are there signs in the surrounding area directing cyclists (and others) to the lot? No.

7. What is the potential of the area? Fairly high – there seems to be quite a few people who live within biking distance of the lot (plus, this part of North Van is fairly flat), and the streets are not terrible. Also, I'm very curious about the transit access mode share data here – the lot is small, and not that many people appear to be cycling, so are they all walking or taking transit? I saw a great many people when I was here.

Are the logistics at the lot lined up?

1. Is there an existing power source? Yes.

2. Is there enough space for a bike cage? Not in the current lot. Perhaps the KNR could be reconfigured or some of the parking spaces could be switched to bike spaces (although, it is a very small lot, and usually full, so this could be politically difficult). But, I don't think this lot costs anything to use – what if it did?

Thoughts/recommendations

1. Conduct rider surveys to understand why bike parking use is so low at Phibbs Exchange (3 lockers rented, and no bikes locked to the racks).

2. Consider charging for car parking to address capacity issues (over 90% of lot filled).

3. Work with municipality to improve bike access routes to exchange and promote cycling to people in the local area.

Appendix D

Business Case for Bike Cages at TransLink's Transit Stations and Bus Exchanges

1. Request

Installation of secure bike cages at SkyTrain stations and park-and-ride lots where the current demand for bike lockers and racks is at least 20 bikes per day or where the built environment supports the likelihood of future increased demand.

2. Background

Bike access to TransLink's services has a number of benefits for its customers, the transit agency, and wider social and environmental goals. For TransLink, it can increase the catchment area of transit by up to ten times that of walking, reduce the need for feeder bus services, and it is much cheaper than providing car parking (Krizek & Stonebraker, 2010; Pucher & Buehler, 2009). For individuals, cycling to transit can be faster than walking and more flexible than bus services, which may increase the attractiveness of sustainable transportation options relative to driving (Martens, 2004). This can discourage car use, leading to widespread environmental, social, and economic benefits (Martens, 2004).

Currently, TransLink offers bike lockers at almost all of its SkyTrain stations, West Coast Express stations, and bus exchanges. Bike lockers provide secure bike parking and have been widely used at transit stations and exchanges throughout North America over the past 30 years (TRB, 2005). However, bike lockers are also space intensive, frequently sit empty because they can only be rented by one person at a time, and require significant maintenance and management (P. Kinney, personal communication, May 25, 2012; Martin & den Hollander, 2009). Many transit agencies are beginning to find that new secure bike parking technologies such as bike cages, electronic lockers, and bike stations provide more efficient and more widely used bike parking options (BART, 2012; Martin & den Hollander, 2009; TriMet, 2011).

There is a strong business case for TransLink to introduce secure bike cages into their range of bike parking options. In addition to the benefits that bike cages provide over lockers, observational data from other transit agencies has shown that investing in secure bike parking is correlated with increased numbers of people accessing transit by bike (BART, 2012; Martin & den Hollander, 2009).

3. Recommended alternative: Bike cages

It is proposed to install bike cages at selected rapid transit stations and bus exchanges.

An example of the type of bike cage that can be installed is the Parkiteer cage, which is distributed in BC by bike rack manufacturer Urban Racks. It is an aesthetically attractive steel cage containing bike racks that can be secured by a keycard entry system. The basic Parkiteer cage holds 32 bikes, with a footprint of 5 by 7 metres. The basic cage can hold up to 52 bikes with stackable hydraulic lift-assist racks installed inside it. The cages are modular and can be expanded to hold up to 100 bikes. Add-on features such as cameras and a panic button can be installed to further improve security (Martin & den Hollander, 2009; Urban Racks, 2011).

Objectives met:

1. Increase bike access to transit.
2. Increase the convenience, flexibility, and security of TransLink's bike parking.
3. Help meet Regional Cycling Strategy (2011) strategies calling for secure, on-demand bike parking at major transit stations and exchanges that can be integrated with the Compass card.
4. Help address bike carriage capacity issues on some transit services by providing an incentive to park bikes at transit access points rather than taking them onboard.
5. Help address car parking capacity issues at some park-and-ride lots by providing an incentive to cycle to access transit rather than driving.
6. Contribute to wider environmental and social objectives through encouraging active transportation.

Examples of bike cages around the world

In 2008, Melbourne, Australia constructed 23 Parkiteer bike cages at stations on its Metrotrains and Connex rail systems (Martin & den Hollandar, 2009). It has continued to expand its Parkiteer offerings, and now has cages at over 50 metro stations, regional rail stations, and park-and-ride lots (Bicycle Network Victoria, 2012a). Also in 2008, Boston's MBTA opened a bike cage at Alewife Station. MBTA now has two more bike cages in operation and plans to install cages at twelve more stations (MBTA, 2008; MBTA, 2012). Closer to Vancouver, TriMet in Portland, Oregon has installed bike cages at three light-rail stations since 2010 (TriMet, 2011). The BART heavy rail system and Caltrain commuter rail, both in the San Francisco Bay Area, each have three keycard accessible bike parking rooms or cages (BART, 2012; Caltrain, 2008; Caltrain, 2012).

The rates of bike cage use have varied enormously across cities, with the highest rates of use at individual cages recorded in Boston and Melbourne. Erik Scheier, Project Director for Operations at Boston's MBTA, estimates that MBTA's three bike cages are usually between 75% and 100% full on weekdays (personal communication, May 30, 2012). Melbourne now has over 50 cages throughout the region, which in May 2012 had rates of use ranging from 1.3% full at Broadmeadows to 142.4% full at Laverton – South (Bicycle Network Victoria, 2012b). Across the Melbourne metro system, the mean cage occupancy is 42.1% and the median cage occupancy is 40.2%. On average, five cages are more than 70% full and fifteen cages are less than 30% full (Bicycle Network Victoria, 2012b). Registrations to use the system and daily use have grown steadily over time, with the number of May 2012 registrations increased by 15.7% and the number of uses increased by 10.5% over May 2011 levels (Bicycle Network Victoria, 2012b).

Bike cages in California's San Francisco Bay Area and Portland, Oregon have generally been less than half full, which likely reflects specific local conditions. Some of the lessons that can be learned from these conditions are outlined below. A recent count of bike parking use on the Bay Area's BART system found that 12% of the spaces at BART's Ashby Station bike cage and 28% of the spaces at Downtown San Francisco's Embarcadero Station bike cage were occupied (BART, 2012). The Bay Area's Caltrain (2008) counted 25 out of 52 (48%) spaces at the Menlo Park Station bike cage filled, and only 11 out of 96 (11%) spaces at the Palo Alto Station bike cage in use. Caltrain's third bike cage, at Mountain View

Station, has opened since the data was collected in 2008. The data from Portland, Oregon's TriMet shows that the use of its suburban bike cages has averaged 7% at Sunset Station, 10% at Gresham Station, and 32% at Beaverton Station (TriMet, 2011). However, Portland's cages are all relatively new, and they have all shown increases in the number of bikes parked there since they were installed (TriMet, 2011).

Lessons from existing bike cages:

1. The location of bike cages within the region is important. Portland's lightly used bike cages have been critiqued for being located in low density suburban areas with built environments that do not encourage cycling (Rose, 2011). Melbourne has also found that local built environment factors affect the rates of use for their bike cages (I. Clarke, personal communication, June 8, 2012).

2. The location of bike cages within the station or exchange is important. Ian Clarke, Melbourne's Parkiteer Program Coordinator, says they have found that the most important factors for cage use are: distance from the platform and whether cyclists can ride directly to the cage rather than having to dismount and walk to access it (personal communication, June 8, 2012).

3. Pricing of bike cages likely affects their use. The low rate of use at Caltrain's Palo Alto Station may be related to the relatively high price of the bike cage ($1 per day or $12 per month) relative to the cost of locker rental ($5.50 per month) (M. Espinosa, personal communication, April 11, 2012). Similarly, the low rate of use at BART's Ashby bike cage may be related to the free, guarded bike parking available at the Downtown Berkeley bike station, which is less than two kilometres from Ashby Station (BART, 2012). Bike cages are free to use in both Melbourne and Boston, which likely encourages both systems' high rates of use (Bicycle Network Victoria, 2012a; MBTA, 2012).

4. Other forms of flexible secure parking may reduce the use of bike cages. BART and Caltrain's low bike cage use numbers may reflect the widespread availability of flexible-use electronic lockers on these two systems (BART, 2012; Caltrain, 2008). Although electronic lockers address the lack of flexibility associated with conventional keyed lockers, they have the same large footprints and intensive maintenance requirements as conventional bike lockers (P. Kinney, personal communication, May 25, 2012).

5. Advertising and promoting bike cages appears to encourage their use. Both Melbourne and Boston have worked with the media and local cycling organizations to promote their bike cages (Bicycle Network Victoria, 2012a; Bicycle Network Victoria, 2012b; MBTA, 2012).

7. Financial analysis

Summary

The complete capital costs of a 52 space bike cage, including the structure and its delivery, preliminary civil works, Compass Card integration, communications, marketing, and interest during construction, will be $186,970.

With an assumed useful life of 20 years, the bike cage will have an internal rate of return of 2.8% and an ultimate net present value (NPV) of -$29,320. Spread over 20 years, this is a loss to TransLink of $1,470

per year, or $28 per space per year. Assuming the cage is 50% full on weekdays and 20% on weekends, it will require a per use subsidy of $0.19.

Capital costs

The cost of a Parkiteer cage with 26 'double stacker' racks installed inside (holding up to 52 bikes) has been quoted as $151,320 from Urban Racks. Including additional installation costs, the complete capital costs of one 52 space Parkiteer cage are $186,970. The full breakdown of capital costs is outlined in Table 1.

*Table 1: Breakdown of capital costs per one bike cage**

Costs	Amount
Structure	$93,200[1]
Construction	$45,000[1]
Shipping	$750[1]
Labour	$1,700[7]
Interest during construction	$1,000[7]
Compass Card integration	$5,000[5]
Communications – signage	$1,000[5]
Marketing	$2,500[5]
Contingency (10%)	$25,600[1]
Total	$187,000

* Note: positive figures indicate net costs, negative figures indicate net revenues.

(Data sources: [1]Urban Racks Customer Quote Prepared for TransLink, n.d.; [5]H. Cook and K. Rao, personal communication, May 14, 2012; P. [7]TransLink pro forma financial analysis spreadsheet.)

Incremental costs and revenues

Incremental costs and revenues associated with the bike cages include: maintenance and management costs, user revenues, and advertising revenues. Table 2 outlines the full breakdown of incremental costs and revenues.

For the purpose of calculating the financial impact of one bike cage, this report assumes a $1 per day user charge from one bike cage space, with a maximum monthly user charge of $10. TransLink's (2010a) Cycling Support Services Strategic Plan published the results of a survey of bike parking users, which found that 80% thought that a $1 charge per day was 'about right' for secure bike parking. But, if someone parks their bike at the bike cage five days per week for a month, with a $1 per day use charge they would have to pay between $20 and $25 per month, at least double the current $10 per month locker rental charge. To keep the bike cages cost competitive with lockers, the payment system could be set up so that the maximum a user could have to pay is $10 per month. To encourage greater use of the Parkiteer cages, the user fees could be set at a lower level, or could even be free.

The user revenue has been calculated with the assumption that on weekdays 50% of the cage will be full, 25% by users paying $10 per month and another 25% by users paying $1 per day. This is a conservative estimate that follows the roughly 50% of Melbourne bike cage spaces that are full (Bicycle

Network Victoria, 2012b). Additionally, the revenue has been calculated assuming that on weekends, 10% of the cage will be occupied by users paying $1 per day. This is based on research from TransLink's recent Park-and-Ride Survey that found that about 20% of park-and-ride lot capacity is occupied on weekends (TransLink, 2012). It assumes that half of the weekend users are regular users paying $10 per month (and have been captured already in the weekday calculations), and the other half are unique weekend users paying $1 per day.

*Table 2: Breakdown of incremental costs and revenues per one bike cage**

Maintenance and management costs	$3,000/year (+2% for each subsequent year) [2,6]
Debt payment costs	$14,700
Rental revenue	-$5,200/year (+2% for each subsequent year) [5,6]
Advertising revenue	-$7,200/year (+2% for each subsequent year) [6]
Total	$5,200

* Note: positive figures indicate net costs, negative figures indicate net revenues.

(Data sources: [2]C-Media Annual Operating Costs; [5]H. Cook and K. Rao, personal communication, May 14, 2012; P. [6]P. Kinney, personal communication, May 25, 2012.)

Overall financial impact

The inputs used to calculate the costs and revenues associated with one bike cage are described below.

The net present value for a bike cage operating over 20 years is -$29,215. That means that TransLink's per year subsidy for one bike cage is $1,466. This produces an internal rate of return of 2.8%. It is also equivalent to a $0.19 subsidy per use.

Table 3 outlines the 20 year financial evaluation, including debt payments. Table 4 shows the calculations behind the estimated $0.19 per use cost to TransLink.

Assumptions and calculations

- The cost calculations are performed for a 52 space bike cage.
- Excluding debt payments, all costs and revenues are increased by 2% each year.
- The capital costs for the cage come from a quote supplied by Urban Racks, distributer of Parkiteer cages in BC. Additional capital cost quotes come from TransLink staff, or are derived from a TransLink pro forma financial analysis spreadsheet.
- C-Media management and maintenance costs for bike cages would be 65% lower than the costs for bike lockers (P. Kinney, personal communication, May 25, 2012). This has been calculated by dividing the current maintenance costs by 434 (the current number of bike lockers), which produces the per space costs. This has then been reduced by 65% and multiplied by 52 to produce the costs for one bike cage.

- Each bike cage would support $600 annually in advertising revenue (P. Kinney, personal communication, May 25, 2012).
- After installing a bike cage, TransLink could sell 60% of the bike lockers, or 32 bike lockers, for $500 each (or $1,000 for a bike locker pod containing two lockers) (H. Cook and K. Rao, personal communication, May 14, 2012).
- To calculate the rental revenue produced by one bike cage, it was assumed that 25% of the cage would be occupied by people paying $10 per month. A further 25% of the cage would bring in $1 per day in revenue. Further, the rental revenue assumed that on weekends 10% of the cage would be occupied by people paying $1 per day (P. Kinney, personal communication, May 25, 2012).

Table 3: Bike cage 20 year financial evaluation

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
User and advertising revenues		$12,444	$12,693	$12,947	$13,206	$13,470	$13,739	$14,014	$14,295	$14,580
Bike locker sales	$16,000	$12,444	$12,693	$12,947	$13,206	$13,470	$13,739	$14,014	$14,295	$14,580
Total Revenues	$16,000	$12,444	$12,693	$12,947	$13,206	$13,470	$13,739	$14,014	$14,295	$14,580
Debt payments	($3,673)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)
Maintenance and management contract		($2,988)	($3,048)	($3,190)	($3,171)	($3,234)	($3,299)	($3,365)	($3,432)	($3,501)
Total Costs	($3,673)	($17,680)	($17,740)	($17,801)	($17,863)	($17,926)	($17,991)	($18,057)	($18,124)	($18,193)
Net Income (Loss)	12,327	($5,236)	($5,047)	($4,854)	($4,657)	($4,456)	($4,251)	($4,043)	($3,830)	($3,612)
Net Present Value	($29,315)									

Table 3 (continued): Bike cage 20 year financial evaluation

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
User and advertising revenues	$14,872	$15,169	$15,473	$15,782	$16,098	$16,420	$16,748	$17,083	$17,425	$18,129
Bike locker sales	$14,872	$15,169	$15,473	$15,782	$16,098	$16,420	$16,748	$17,083	$17,425	$18,129
Total Revenues	$14,872	$15,169	$15,473	$15,782	$16,098	$16,420	$16,748	$17,083	$17,425	$18,129
Debt payments	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)	($14,692)
Maintenance and management contract	(3,571)	($3,642)	($3,715)	($3,789)	($3,865)	($3,943)	($4,021)	($4,102)	($4,184)	($4,353)
Total Costs	($18,263)	($18,334)	($18,407)	($18,481)	($18,557)	($18,635)	($18,713)	($18,794)	($18,876)	($19,045)
Net Income (Loss)	($3,391)	($3,165)	($2,934)	($2,699)	($2,459)	($2,215)	($1,965)	($1,711)	($1,451)	($916)
Net Present Value	($29,315)									

Table 4: Per use subsidy required for one bike cage space

Occupancy (52 spaces)	Day	Week	Month	Year
Weekday (50%) – 5 days	26	130	559	6,708
Weekend (20%) – 2 days	10	20	86	1,032
Total	36	150	645	7,740

The per use cost of a bike cage is derived by dividing the annual net cost ($1,466) by the number of uses (7,344), which produces $0.19 per use.

8. Other alternatives considered

Bike cages present good value for money compared to other alternatives, as well as providing a number of qualitative benefits. Table 4 presents a per space breakdown of costs and revenues associated with bike cages, bike lockers, and car parking.

Table 5: Per space comparison of costs for bike cages, lockers, and car parking

	Capital costs	Year 2 annual operating costs (not including debt servicing)	Year 2 annual revenues
Bike cages (52 spaces)	$3,600 [1]	$60 [2,6]	$290 [5,6]
Keyed bike lockers	$1,000 [5]	$140 [2,3]	$95 [2,3]
Car parking	$10,700 [4]	$320 [4]	$0 [4]

* Note: positive figures indicate net costs, negative figures indicate net revenues.

(Data sources: [1]Urban Racks Customer Quote Prepared for TransLink, n.d.; [2]C-Media Annual Operating Costs; [3]C-Media Monthly Bike Locker Report, December 2011; [4]TransLink, South Surrey Park-and-Ride Business Case, 2005; [5]H. Cook and K. Rao, personal communication, May 14, 2012; P. [6]P. Kinney, personal communication, May 25, 2012.)

Bike cages compared to conventional keyed lockers

Bike cages present a number of benefits over conventional keyed bike lockers in terms of: customer convenience, customer cost, TransLink ease of maintenance and management, footprint size, security, and encouraging active transportation.

Customer convenience

Conventional bike lockers require keys for access, so they can only be used by one person at a time. This means that many lockers may sit empty some, or most, of the time. This occupies valuable space at stations and exchanges that could be put to other uses. Further, market research conducted by TransLink and published in the *Cycling Support Services Strategic Plan* (2010a) found that 22% of cyclists want reserved lockers, whereas 45% want on-demand secure bike parking. This suggests that cyclists prefer

other bike parking options.

Since bike cages are accessible to multiple people at once, they are less likely to sit empty while other cyclists wait for a space to open up. When Melbourne first began its bike cage program, keycards were linked to specific cages. They found that it was possible to give out up to 45 access cards for a single cage, or 1.4 times the occupancy of the 26 space cage. In that case, the waiting list for lockers shrank from 50 people before the bike cage opened down to zero, with 26 people now on a waiting list for the bike cage (Martin & den Hollander, 2009). This evidence from Melbourne strongly suggests that cyclists prefer the flexible solution to bike parking needs that bike cages provide.

The keycard technology enables several other features that improve customer convenience. The keycard technology allows bike cage access to be integrated with transit system smart card (E. Scheier, personal communication, May 30, 2012). Bike cages can also be unlocked remotely, so a customer can still use the facility even if they have left their keycard at home. In Melbourne, the customer simply phones a number listed on the side of the cage to gain access without their keycard (Bicycle Network Victoria, 2012a).

Customer cost

TransLink rents bike lockers at SkyTrain and Canada Line stations and park-and-ride lots for $10 per month, with a minimum three month rental period. Bike lockers at West Coast Express stations are $17 per month. TransLink's rapid transit station and bus exchange lockers work out to about 26 cents per day, and its West Coast Express lockers are about 79 cents per day. Both of these figures are less than the $1 per day that TransLink customers cited as a reasonable cost for bike parking at transit (TransLink, 2010a).

Just as there are a number of different pricing options for bike lockers, there are a number of different pricing options for bike cages. In Melbourne, all bike parking at stations is free. This includes the Parkiteer cages, which require a $50 (AUD) security deposit that is refundable upon the card's return (Bicycle Network Victoria, 2012a). Similarly, the bike cages in Boston are also free (E. Scheier, personal communication, May 30, 2012).

The west coast American systems require a non-refundable $5 (USD) deposit and cost 3 cents per hour, which works out to between 24 and 30 cents for a typical workday plus one hour of commuting time (BikeLink, 2012). TriMet (2012) charges one cent per hour after 8 pm or before 8 am. These systems are lower in price than TransLink's locker rental fees if a commuter uses the bike cage every day. But, a significant benefit of a bike cage is that if a commuter does not use it, they do not pay and their overall costs are reduced.

TransLink cost

This is detailed in the financial analysis in Section 6.

TransLink ease of maintenance and management

Bike cages' open design and lack of blank walls makes them easier to clean and less likely to be vandalized than lockers (P. Kinney, personal conversation, May 2, 2012). This creates significant savings in

maintenance and management costs.

Bike cages also provide a surprisingly high level of flexibility for TransLink. Bike lockers are relatively portable, and can be moved at short notice. However, TransLink's experience shows that the plastic bike locker units generally break after multiple moves, are labour-intensive to clean, and are frequently vandalized (P. Kinney, personal conversation, May 2, 2012). Like lockers, bike cages can be moved. They are also modular, and can be adjusted from 32 to 100 bikes (Urban Racks, 2011).

Footprint

Parkiteer bike cages house 32-52 bikes in a space that is 5 x 7 metres (Urban Racks, 2011). A Cycle-Safe bike locker, such as TransLink uses, houses two bikes in a unit that is 1 x 1.5 metres (CycleSafe, 2012). The bike locker unit is approximately 20% of the size of the bike cage, but it only houses 8% of the bikes. A bike cage is significantly more space-efficient way to hold 32 bikes than a bank of 32 lockers.

Security

Bike lockers are opaque and block sight lines and natural surveillance, whereas bike cages do not (P. Kinney, personal conversation, May 2, 2012). Bike cages also feature keycard access control, which records the identity of anyone who accesses the space (Bicycle Network Victoria, 2012a). Bike cages can have cameras installed to increase security even further (Urban Racks, 2011).

Mode shift

Bike cages appear to increase bike access to transit in both absolute terms and in percentage terms. The installation of bike cages at three Melbourne train stations increased the number of subscribers or people on waiting lists for secure bike parking by between 13% and 26%. When surveyed, between 37% and 45% of the new bike cage users drove to the station previously (Martin & den Hollander, 2009). In the Bay Area, BART has identified that investments in bike parking are correlated with increased bike access mode share, although it has not differentiated between bike rack spaces or more secure bike parking spaces (BART, 2012).

Increasing bike access to transit in conjunction with increasing opportunities to securely park bikes at transit access points can help address capacity issues both with car parking and with bike carriage on transit vehicles.

Other options for increasing access to transit

Other options for increasing access to transit include: other bike parking technologies and providing more car parking.

Other bike parking technologies

Of the new secure bike parking technologies, bike cages are the best option for TransLink. Guarded bike stations are very expensive, with a 2010 estimate for TransLink predicting that a downtown Vancouver bike station would require over $3m in capital costs, and over $130,000 a year in operating costs for 300 bike parking spaces. The operating costs would be recouped through parking charges, and the net

operating revenue would be $49,000 per year or $163 per space (TransLink, 2010b). But, the high capital costs for this option make it only appropriate for some city centre locations with high cycling mode shares.

Electronic lockers address the flexibility and customer cost problems of traditional lockers, but they have the same large footprint, security, and maintenance issues (P. Kinney, personal communication May 2 and 25, 2012). Like bike cages, they may also increase demand for cycling to transit services, but there has not yet been any research about this.

Increasing car parking spaces

Increasing car parking spaces is an incredibly expensive solution to addressing transit access issues, and fails to meet the needs of customers who may not have access to a car or who may prefer to bike to transit. In addition, this may not be feasible for many of TransLink's stations or exchanges due to lack of space and high existing land values.

The current 450 space South Surrey Park-and-Ride lot was constructed in 2005, at a cost of $4.8 million. Its operating costs are $146,000 per year. Parking is free, so there is no revenue from the lot. On a per-space basis, the capital costs were $10,742 and the operating costs are $324 per year (TransLink, South Surrey Park-and-Ride Business Case, 2005).

Table 6: Summary of benefits of alternatives considered by type of intervention

	Customer convenience[a]	Customer price efficiency[b]	TransLink ease of maintenance and management[c]	TransLink cost efficiency[d]	Space efficiency[e]	Security[f]	Mode shift[g]
Bike cages	High	High	High	High	High	High	High
Bike lockers	Medium	High	Low	High	Medium	Medium	Medium
Car parking	High	Low	Low	Low	Low	Medium	Low

a: Ease of using and paying for the parking for the average commuter using transit 3-5 times per week.

b: Cost of using the parking for the average commuter using transit 3-5 times per week.

c: Ease of maintenance and management of the parking for TransLink.

d: Capital and operating costs of the parking.

e: The amount of space it takes to store the transit access mode of one person.

f: The security of the bike or car parking.

g: Evidence that this mode of transit encourages passengers to travel to transit by a sustainable mode.

9. Consequence if not approved

TransLink's relatively limited options for bike parking at transit may suppress demand for bike-transit journeys and encourage driving to park-and-ride lots. Capacity issues caused by bike carriage onboard vehicles may intensify.

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