

VANCOUVER, BRITISH COLUMBIA

TRANSLINK #98 AND #99, B LINES

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VANCOUVER, BRITISH COLUMBIA

TransLink #98 and #99, B-Lines

SUMMARY

Vancouver has two “rapid” bus lines that represent prototypes for future expansion of bus rapid transit (BRT) service to other corridors. The 27-km (17-mile), 14-stop, #99 B-Line (Broadway-Lougheed) Rapid Bus, which opened in September 1996, was the most significant new transit service since the automated SkyTrain was introduced a decade earlier. The line reduced travel times by 5 to 15 minutes and carried more than 20,000 riders daily. Specially designed low-floor standard and articulated buses, and a B-Line logo applied to bus stops and route maps, give the service a distinctive image. Costs for the dedicated fleet of articulated vehicles were estimated at \$13 million Canadian (CAN), which works out to about \$8 million in U.S. currency.

The 15.8-kilometer (10-mile) #98 B-Line (Richmond-Vancouver) was placed in service in August 2001. The line includes suitably sized, well-lit, distinctive shelters; provisions for future on-street ticketing; real-time electronic bus information displays at stations; low-floor vehicles for easy boarding; on-board visual and audio stop announcements; and distinctive vehicle interior and exterior design. Weekday ridership approximates 14,000 passengers. The total capital cost was estimated at \$44 million (CAN) in 2000, about \$2.8 million (CAN) per kilometer.

CITY CONTEXT

The Greater Vancouver Area has a population of approximately 2.1 million people. Its Central Business District (CBD), located between Burrard Inlet and False Creek in the northwestern most part of the city, has an employment of 130,000 – about 16 percent of the region’s total. During the morning peak hour, about 46 percent of all CBD employees arrive by public transport. Annual ridership on the region’s bus, SkyTrain, and commuter rail service totals 129 million; it ranks third in overall ridership in Canada (next to Toronto and Montreal). Service is provided by 950 diesel buses (standard and articulated vehicles), 244 electric trolley buses, 210 automated light rail cars, 34 commuter rail cars, and 2 passenger ferries, all part of a totally integrated regional transit system.

Transit service in Greater Vancouver is planned and provided by TransLink (The marketing name of the Greater Vancouver Transportation Authority), which took over from BC Transit, a provincial crown corporation, on April 1, 1999. In addition to transit, TransLink has responsibility for a 2,100 lane-kilometer (1,300-mile) regional road network, transportation demand management (TDM), and air emissions vehicle testing (Air Care).

Legislation establishing the new Greater Vancouver Transportation Authority requires TransLink to develop transportation plans and services that support the regional growth

management strategy developed by the Greater Vancouver Regional District (GVRD), a regional federation of 21 municipalities. A 15-member board oversees the Greater Vancouver Transportation Authority, including 12 locally elected mayors and councilors appointed by the GVRD and three provincial members of the legislature representing Greater Vancouver ridings.

TransLink is a “steering” organization, responsible for planning, policy, and funding of transportation services and facilities in the region. A subsidiary company, Coast Mountain Bus Company; a contracted municipal operator; and two private contractors deliver bus services. SkyTrain is operated by BC Rapid Transit Company, a TransLink subsidiary, and commuter rail service is operated by CP Rail for West Coast Express, another TransLink subsidiary. Coast Mountain Bus Company also operates SeaBus.

Services are funded by user fees (fares) and a number of dedicated taxes including a \$0.11 per liter tax on gasoline, which raises over \$220 million (CAN) per year for regional transportation services. Transit services on average recover 56 percent of operating costs.⁽¹⁾⁽²⁾

Bus transportation is the mainstay of the region’s public transit system, but is viewed by the public as unreliable, unattractive, and slow. SkyTrain, an advanced light rail transit system, was introduced in 1986, followed by the West Coast Express in 1995, a commuter rail line. Both are ranked consistently higher than the conventional buses in the system. Customers like Sky Train’s speed and frequency of service, comfortable ride, and ease of use. Others like the West Coast Express for its speed, reliability, and comfort. The BRT services in the Broadway-Lougheed and Richmond-Vancouver corridors share some of these same qualities.

Like other North American cities, Vancouver depends upon the automobile as the primary form of transport. However, the Vancouver area has very limited freeway facilities, and none are within the city limits.

PLANNING AND IMPLEMENTATION BACKGROUND

The integration of land use and transportation has been a cornerstone of regional planning policy since the later 1960s when the region rejected a freeway network plan. Through the adoption of a “transit oriented transportation system,” the region has developed a rich mix of automated rapid transit, commuter rail, passenger ferries, bus rapid transit, local buses, express coaches, and community minibuses.

The Greater Vancouver Regional District (GVRD) sets land use and transportation policy. It is a working partnership among 21 municipalities that maintain the quality of life in the Vancouver region. Its “Livable Region Strategy” lays out a blueprint for future development of the region. The strategy creates more compact communities that are anchored by regional and municipal town centers and are supported by high-quality transit links. Under this strategy, over 70 percent of the future population growth is in areas designated for intensive transit development.

GVRD goals include the following:

- Improving transportation choices,
- Building complete communities,
- Achieving a compact metropolitan region, and
- Protecting the green zone.

Transportation investment is seen as a tool for encouraging desired land use patterns. The strategy identifies five corridors for new Intermediate Capacity Transit System (ICTS) lines to be developed over the next 25 years. More intensive urban development in these key growth corridors will support the region's land use vision. BRT is viewed as a stepping stone to a full ICTS, which is defined as segregated busway, light rail transit, or Automated Rapid Transit that can carry 10,000 passengers per hour per direction.

Vancouver is looking at BRT in medium density corridors where investment in ICTS is not warranted because of costs and ridership. BRT is targeted at corridors that typically carry between 1,000 and 3,000 passengers per hour per direction. However, rail transit comes with disproportionately higher costs per passenger. From an economic standpoint, carrying passengers on ICTS is at least four to five times more expensive than BRT. Also, few corridors in the Vancouver region have or will have the densities and ridership potential to support heavy investment in ICTS development.

Bus rapid transit was developed in three corridors as an early-action means of improving service. The #99 B-Line (Broadway-Lougheed) bus service between the University of British Columbia and New Westminster began service in 1996. BRT service in the corridor between downtown Vancouver and Richmond, the #98 B-Line, started in August 2001. Bus rapid transit in the Coquitam-Lougheed corridor opened in 2002. These services are an outgrowth of more than three decades of rapid transit planning.

BRT FEATURES

The BRT routes are designed to provide customers with fast, frequent, reliable, and simple service, much like rapid transit. BRT brings together vehicles, facilities, transit priority, technology, and customer-focused service design under a strong brand identity, which ties the various elements together.

CUSTOMER-FOCUSED SERVICE DESIGN

Quality transit requires frequent, reliable service to minimize waiting times. High service frequency allows customers the freedom to use the service when they want to, as opposed to planning their travel around a timetable. As a service standard, BRT routes provide a minimum 10-minute frequency during the daytime and 15-minute frequency during the evening.

BRT routes and schedules are also designed for simplicity. Branches are not permitted, and short turns are minimized. Operating hours are consistent, with over 20 hours per

day, 7 days per week. Routes are direct to minimize delays and assist understanding by infrequent riders. Stop spacing ranges from 500 meters to 1.5 kilometers (0.3 to 0.9 miles). Within downtown Vancouver and regional town centers, stop spacing may be less than 500 meters, whereas on other parts of the routes, stops are more widely spaced. This ensures a high level of accessibility in the dense urban centers while maintaining attractive travel times for customers.

VEHICLES

Articulated low-floor buses are used for BRT service. The articulated bus has a “novelty factor” and enhances BRT’s image and identity. Each bus has capacity for about 100 passengers. Low-floor buses speed up loading and unloading by removing the steps for passengers. All buses assigned to BRT routes are painted in the B-Line livery to distinguish them from other brands of service. Route maps showing stops and stations are provided inside buses as they are in rapid transit cars.

FACILITIES

To provide a more recognizable and permanent transit presence, bus stops and shelters have been given special treatment. Shelters provide customers not only with protection from the weather, but also, through careful design, they provide an identity. In this, they are similar to easily recognizable rapid transit stations. The location of the stop is placed on the shelter to ensure visibility for customers from inside buses as well as customers approaching the bus stop on the street. Improved signage enhances identity as well as providing customer information. Route maps and fare information are placed at each stop.

TECHNOLOGY

Technology is also used to enhance bus operations and improve customer service. The introduction of automated vehicle location (AVL) technology using a global positioning system to track the location of the vehicles can improve on-time performance of the bus service. Transit controllers can monitor on-time performance, and interval-based scheduling can replace timetables during peak traffic time periods.

BUS PRIORITY

To improve reliability and travel times, bus priority is an important element. BRT in Vancouver uses low-cost treatments in congested areas such as short queue jumper lanes and bus pre-emption signals to allow buses to bypass queues of traffic at bridgeheads and major intersections. Exclusive curbside and median busway lanes are also provided where traffic volumes warrant them.

THE B-LINE SYSTEM

Salient characteristics of Vancouver’s three bus rapid transit lines are given in [Table 1](#). A further discussion of the #99 B-Line (Broadway-Lougheed), #98 B-Line (Vancouver-Richmond), and #97 B-Line to Coquitam Center follows.

THE #99 B-LINE (BROADWAY-LOUGHEED)

The #99 B-Line (Broadway-Lougheed) is one of the heaviest bus routes in Vancouver and complements the Route 9 Trolley Bus that operates east/west along Broadway as a cross-town route. The #99 B-Line, the first Rapid Bus service in Vancouver, provides an “overlay” service that only serves major destination points along a 27-km (17-mile) BRT route; it has 14 stops – one every 1.9 km (0.8 miles). This stop spacing is about three times the spacing provided on the existing route. The route and stops are shown in [Figure 1](#).

Service Patterns

The #99 B-Line traverses the busy Broadway-Lougheed corridor that connects the Lougheed and Brentwood town centers, the Vancouver Central Business District, and the University of British Columbia. Service operates every 4 minutes in the peak, every 7 to 8 minutes at midday, and every 15 minutes in the evenings. The route parallels several pre-existing local bus services, including Route #9, a trolley bus route with 45,000 riders per day, which was the heaviest ridership route in the system and previously had crowding problems.

Marketing, Image, and Fleet

A special B-Line logo was applied to route maps, timetables, bus stop signs, and information pieces to provide a distinct image of the service to customers. For the first two years of operation, a mixture of standard and articulated buses displaying the system-wide paint scheme was used. In September 1998, a new fleet of 21 low-floor articulated buses with a distinctive B-Line paint scheme was deployed. Following this change, ridership increased 20 percent over 1997 levels. Five more articulated buses were subsequently added.

Travel Times

Travel times were reduced 5 to 15 minutes (20 percent to 40 percent) as compared with local service. Peak speeds average 23 kph (14 mph).

Ridership

Ridership on the #99 B-Line increased from 8,000 per day at the start of the service to 20,000 per day by 1999 and to 26,000 by 2002. Buses are crowded during peak and midday periods.

A telephone interview survey conducted in 1997 indicated that 18 percent of customers previously drove before switching to the B-Line, and 74 percent previously used another transit route. The survey indicated that 31 percent of former automobile users were more satisfied with the B-Line, than their previous mode.⁽³⁾ Among those who previously took a bus to the same destination, 79 percent were more satisfied with the B-Line, and 17 percent were equally satisfied. Overall, two thirds of customers were more satisfied with the B-Line than their previous mode of transportation, 25 percent were equally satisfied, and only 3 percent were less satisfied.

(With the opening of the Millennium ICTS Line in September 2002, the eastern half of the route will be discontinued and replaced by the SkyTrain. The western half of the line will be upgraded with a 20 percent increase in the level of service.)

Financial Performance

The B-Line service is well utilized, averaging 79 passengers per bus hour. TransLink estimates that route revenue covers 96 percent of operating costs. Fares cover more than half of full costs (including annualized capital costs), which is more than the system average of 32 percent. The dedicated fleet of vehicles cost \$13 million (CAN). At an exchange rate of \$0.68 U.S. dollars to the Canadian dollar, this is a capital cost of \$8.8 million, or \$421,000 per bus.

THE #98 B-LINE (RICHMOND)

The Richmond-Vancouver corridor includes downtown Vancouver, Richmond City Center, and Vancouver International Airport. Growth in these areas, located to the south of the downtown, has surpassed initial projections. Employment for the airport area has already met 2021 levels, while residential development in downtown Vancouver has exceeded expectations. Job and residential growth are strong in Richmond; its city center has a population of 27,000 and employment of 32,000. Congestion along local arteries continues to worsen as traffic volumes increase in the corridor.

The significant growth in downtown Vancouver, Richmond, and, in particular, the Vancouver International Airport, placed increased emphasis on a rapid transit line connecting these regional destinations. A rapid transit link between Richmond and Vancouver has been part of regional planning policy since the 1970s. A light rail line along the former British Columbia Electric's Arbutus right-of-way between downtown and Richmond was studied in the 1970s. The corridor has been identified for ICTS (i.e., SkyBus) since the mid-1970s.

Bus rapid transit was perceived as a way of meeting the demands in the corridor because it replicates many features of ICTS. The public's popularity and positive response to the #99 B-Line service gave further impetus for BRT development.

Overview

The #98 B-Line route between Richmond and Vancouver is a key component of Vancouver's TransLink Strategic Transportation Plan. The line opened on August 7, 2001, after a 4 1/2 month transit strike. It replaced a confusing array of bus routes with a simple, direct, and frequent service. It combines limited-stop, high-frequency articulated bus service with several transit priority measures including dedicated curbside and median bus lanes, queue jumpers, and transit signal priority. In addition, the route uses an automated vehicle location system with real-time bus information provided at bus stops along the route.

The key features that distinguish the #98 B-Line from a typical bus line include the following:

- Suitable-sized, well-lit distinctive shelters;
- Provisions for future on-street ticketing;
- Real-time electronic bus information displays at stations;
- Customer information signage at stations;
- Low-floor vehicles for easy boarding;
- On-board visual and audio stop announcements; and
- Distinctive vehicle interior and exterior design.

Many #98 B-Line stops feature raised platforms. All are fully sheltered, lit, and equipped with static and real-time electronic customer information. The system utilizes an automated vehicle location technology that tracks the positions of buses and their adherence to schedules. The computerized signal system gives the late running buses some priority at traffic signals to help maintain reliability of service. The digital signs at the bus stops provide real-time information to customers on the arrival of the next two buses. A dedicated fleet of 28 new, low-floor, 60-foot articulated buses seats (per bus) 54 passengers with standing capacity for another 46. Each vehicle has two wheelchair spots as well as exterior bike racks.

[Figure 2](#) shows the route and stations, and [Figure 3](#) shows the key activities, transfer connections, and running way features for each section of routes. [Table 2](#) sets forth key factors pertaining to route length, bus fleet, service frequency, costs, and priority measures. [Figure 4](#) shows a typical articulated bus at a station.

Route Description and Service

The 15.8-km (9-mile) route connects downtown Vancouver, Vancouver International Airport and Richmond Center. It replaces an array of bus lines, and other lines were rerouted to improve service to surrounding neighborhoods. The #100 and #404 shuttle bus at Sea Island Way provide quick connections to the main airport terminal.

The 38 stations provide transfer connections with SeaBus, West Coast Express commuter rail, SkyTrain, the #99 B-Line, the airport shuttle, and the Sexmith Park-and-Ride shuttle. Buses operate every 4 to 6 minutes during peak periods, every 7 to 8 minutes during off-peak daytime periods, every 10 to 15 minutes in the evening, and every 30 minutes in the very early morning periods. Eight stations serve downtown Vancouver including Waterfront, Granville, and Burrard Stations, where connections are provided to SkyTrain and West Coast Express. During the peak period, 23 buses operate with an average speed of 22 kilometers per hour (14 mph).

In Richmond, the #98 B-Line operates along the Number 3 Road from Granville Avenue to Sea Island Way, much of it along dedicated median bus lanes. It then crosses into

Vancouver over the Moray Channel and Arthur Laing Bridges and follows along Granville Street with stops at all major transit crossings before entering the downtown core. In downtown Vancouver, routing is via Seymour to Cordova and then returns southbound to Granville Street via Burrard, Nelson, and Howe. New curbside bus lanes have been added to the most congested parts of Granville, Seymour, and Howe Streets with queue jumper lanes at the approaches to the Arthur Laing and Moray Channel Bridges. Peak travel times with these traffic priority measures are 40 minutes.

Median Busway

A key improvement along the line is the 25-km (15-mile) median busway in the Number 3 Road, the main commercial street through the Richmond town center. It is the first in Canada, and one of the few in North America. (There is an existing busway along Canal Street in New Orleans that replaced a streetcar line, and median busways are planned in Cleveland and Eugene.)

The median busway was necessary because buses took up to 10 minutes to traverse the 2.5-km commercial stretch on busy weekend shopping days. Moreover, traffic studies indicated that traditional curb bus lanes would not provide sufficient reliability or time savings because of conflicts with driveways and right turns at intersections. ⁽²⁾

The busway costs \$12.4 million (CAN) including \$4.2 million (CAN) for property acquisition. Small property takings were required from 25 businesses along the route. Most properties were acquired through a “friendly” expropriation. In addition, the City of Richmond contributed \$2.2 million (CAN) for landscaping the medians that separate the busway from the general-purpose lanes.

Figure 5 gives a typical view of the busway and Figure 6 shows a typical cross section. Two 3.5-meter (11.5-ft) bus lanes were provided by eliminating the dual left turn lanes, narrowing the general-purpose lanes from 4 to 3.5 meters, and narrowing the opposing left turn lanes to 3.0 meters (9.8 ft). Medians generally separate the busway from the adjacent travel lanes.

Five stations are located in the median at signalized intersections at 300 to 400 meter intervals (about 1,800 to 2,000 ft). The stations look similar to many light rail stations. Each (see Figure 7) can accommodate two articulated buses. Pedestrian access is by means of signalized crosswalks.

During the planning phase, a number of concerns were raised over potential business dislocation as a result of the property takes and the reduction in access to some businesses caused by the elimination of dual left turn lanes. TransLink and the City of Richmond dealt with these issues through one-on-one meetings with property owners, block meetings, and public open houses to explain the scheme and try to provide answers to the many questions regarding compensation. One interesting suggestion that has been implemented is providing for U-turns at signalized intersections to maintain access to businesses. U-turns are now permitted on the separate left turn phases.

In the first 6 months of operation, motor vehicle accident rates on the section of road with the busway declined by 19 percent, from 70 percent in 1999 to 57 percent in 2001. The decline is attributed to the elimination of the dual left turn lane and the restriction of left turns to signalized intersections. There have been seven accidents involving buses on the busway over the same 6-month period in 2002. Six accidents involved left turn automobiles advancing on the through bus signal phase and hitting the right side of the bus. The other bus accident involved a pedestrian. A common complaint involves the number of signal heads and in particular the presence of the bus signals positioned to the left of the left turn signals. To address the problem, a recommendation was made to retrofit the signal heads with hoods that make it very difficult for automobiles waiting to make the left turn to see the median lane through bus signals. The test intersection has already been outfitted, and the remaining nine intersections will soon be completed.

Modeled after Curitiba and the Trans-val-de-Marne busway in suburban Paris, the system required many years of planning with the local government and businesses to come to fruition. The City's interest was improving the appearance of the main street while providing a significant transit presence. As the City's long-term interest calls for surface light rail transit, the median busway was seen as having a good fit in the short to medium term by reserving a right-of-way. For businesses, the primary concern was loss of business both during construction and following removal of the dual left turns. Therefore, construction impacts were minimized by avoiding major shopping time periods (e.g., Christmas) and by working closely with businesses to ensure that construction schedules were updated on a regular basis. The provision of U-turns was seen as a significant enhancement for maintaining access. In addition, several new signalized intersections were also created to shorten blackfaces and therefore provide for alternative circulation after eliminating the dual left turn lanes.

Curbside Bus Priority

New queue jumper lanes were added at the Fraser River Bridge crossing. The queue jumps were created through widening of the shoulders, allowing buses to bypass the traffic queues for the bridge in the a.m. and p.m. peaks.

Access to downtown Vancouver is provided along six-lane arterial street, Granville Street. The street travels through two busy commercial areas as well as a relatively affluent residential area in the middle. Initially the BC Transit (the predecessor to TransLink) proposed curbside bus lanes along the full length of the street during peak and mid-day time periods. These measures were met with very strong business and resident opposition.

Discussions between the agency and community groups took 6 months before a revised scheme was adopted. The revised plan reduced the number of bus lanes, preserving on-street parking spaces in the reverse peak direction in the commercial areas. To compensate for the loss, the City agreed to introduce several left turn restrictions along the corridor, which speeded up both bus and general-purpose traffic. Within downtown Vancouver, the #98 B-Line uses curbside bus lanes on parallel one-way streets.

Bus Shelters

Architecturally designed bus stops and shelters were seen as the front door to the BRT system. Architects had many factors to consider when designing the shelters including balancing the needs of key stakeholders and site conditions with the driving forces of economics, longevity, and maintainability. Businesses along the route wanted the shelters to be transparent so they didn't obscure storefronts. Residential owners asked that lighting not be intrusive. Customers looked for accessible, easily identifiable shelters that provided protection in a rainy climate, and the cities of Vancouver and Richmond wanted a look that fit neighborhoods in the city. TransLink wanted an identity that conveyed a modern, high-tech system to enhance the brand's image.

The modular design adopted allows for shelters to be constructed from common segments to meet space and ridership requirements and to provide a simple, distinctive look common to all shelters along the route. Structural design provides protection from the elements and is easily adaptable to meet varied environments. Specially engineered lighting enhances personal safety. The shelters also house the real-time information digital signs at either end of the shelter, as well as information panels. To minimize vandalism, vandal shields have been installed. The shields go around all the glass to provide for easy cleaning and easy repair. [Figure 8](#) gives a sketch of a typical shelter, and [Figure 9](#) gives a side view.

There are six sizes of shelters ranging from 5 meters to 17 meters in length (about 5 to 17 ft), each constructed from similar modules. The average cost for the 38 shelters is \$74,500 (CAN).

The shelters, which do not have advertising, have become targets for criticism. The cost and design of the shelters were seen as excessive, and customers complained that under driving rain conditions the shelters provided poor protection. TransLink is re-examining how advertising panels may be installed. However, under current agreements, the cities would derive the revenue benefits because the shelters are on city streets; a revenue sharing agreement is a possibility.

ITS Technology

The #98 B-Line uses automated vehicle location (AVL) technology, enabling the operating company to identify the precise location of buses at any point in time using a Global Positioning System (GPS). This was the first application within Vancouver. Once the computer on board the bus calculates where the bus is, the information is then sent electronically to the transit control center, where the exact location of the bus is mapped. The AVL technology is accurate within 3 meters (10 ft) when a bus is stopped and within a city block when the bus is moving.

In the transit control center, signals are transmitted and received by the central computer from each on-board computer on the #98 B-Line fleet. These signals, in the form of flags on a screen, alert a transit control coordinator when a bus is running late or early. The coordinator can advise operators of the status to maintain the scheduled interval between buses and improve reliability. AVL has also been installed on two on-road supervisor

automobiles, so the transit control center knows where the supervisors are in relation to buses that may need their assistance. The on-road supervisor also has the capability of seeing when a bus is to arrive and where the bus is.

The AVL system knows when buses are running on time or late. If a bus is running late, the system automatically links that message to either the traffic signal controls in the City of Vancouver or those in the City of Richmond. The signal system then grants priority to extend or advance the green time at intersections based on a hierarchy predetermined by the municipalities (e.g., emergency vehicles requesting signal priority are given priority over transit buses). A total of 65 intersections along the route are being outfitted with transit signal priority. To date, the introduction of signal priority has proved to be difficult because of jurisdictional issues. Signal controllers are the responsibility of three different jurisdictions. Although TransLink is paying the cost of the changes, the cities and the Ministry of Transportation are responsible for carrying out the work.

On board buses, speakers provide an audio message, and digital displays indicate the next approaching bus stop. At each stop, an outside-the-bus speaker announces the route number and destination of the bus for audio-impaired customers. Bus drivers can use a mobile data terminal (MDT) to provide select or unique messages to customers about route or schedule adjustments. The MDT also facilitates voice and data communications with the transit control center, which can also use the MDT to communicate simultaneously with multiple buses equipped with this technology.

In addition to on-board announcements, the system uses a real-time information system. Light emitting diode (LED) signs are installed inside the shelters at each bus stop along the route. The countdown system is intended to provide customers with information on the arrival of the next two buses, removing some of the uncertainty around the schedules of buses in mixed traffic.

The real-time information system has not proved accurate enough for regular use. The algorithms are being updated and are anticipated to be fully operational during 2002. The delays in implementing the transit signal priority and the real-time information systems have resulted in a service that has not delivered on what was originally promised.

Travel Times

Travel times average 40 minutes northbound in the A.M. peak hour and 46 minutes southbound in the P.M. peak. Previous peak-hour travel times were up to 50 minutes.

Ridership

Weekday ridership was initially estimated at 22,000. Annual ridership in 2001 to 2002 totaled 4.2 million, and weekday ridership approximated 14,000.

Rider Characteristics and Attitudes

On-board surveys of 639 riders were conducted between March 18 and March 28, 2002 during the morning and evening rush, midday, and evening periods. ⁽⁴⁾ Key findings are as follows.

Key Markets. About 65 percent of the riders made trips between Richmond and Vancouver, 17 percent within Vancouver, 17 percent to or from the airport, and 1 percent within Richmond.

Trip Purpose. The main trip purposes were work (29 percent), home (18 percent) and personal business (25 percent). The remaining trips were for school, shopping, or entertainment.

Access to Bus Stop. About 5 percent walked, 33 percent came by another bus, 9 percent came by other transit, and 7 percent came by automobile.

Mode Shift. Use of the #98 B-Line resulted in an overall 17 percent mode shift from single occupant automobiles and a 6 percent mode shift from car van pools.

Service Satisfaction. Passengers were positive about the bus route, giving it an average rating of 8. The *highest average* ratings were given to feeling safe from crime on-board and at the station/stop (8.9); comfortable seating with enough leg room (8.5), and on-board announcements of stops. The *lowest* average ratings were given to not being overcrowded (6.9), availability of transit information on-board (7.2), and adequate storage for luggage and packages (7.3). Sixteen percent of passengers were dissatisfied with the location of the busway in the middle of Number 3 Road because of difficult and sometimes hazardous crossing of heavy traffic and/or waiting for traffic signals to cross the street and missing the bus.

Costs

The total capital cost was \$44.2 million (CAN) of which \$26.3 million was for infrastructure and \$18 million for the dedicated fleet of 28 low-floor articulated buses.

Future Conversion to Rapid Transit

There continues to be strong interest in developing a rail rapid transit service in the corridor, given the growth rates and the long lead time required to develop, finance, and construct such a system. Accordingly, the Richmond/Airport – Vancouver Rapid Transit Study was set up as a joint planning process for a rapid transit link connecting Richmond City Center and the airport to downtown Vancouver; it is composed of a team including a Project Director, a Technical Manager, an Environmental and Transportation Planner, and support staff. The study is overseen and evaluated by a partnership composed of eight government agencies. Transport Canada and the Vancouver International Airport provide funding for the study phase. In the interim, the #98 B-Line BRT line provides rapid transit in the corridor.

#97 B-LINE – COQUITAM CENTER.

The #97 B-Line, which became operational in 2002, is a bus-based, on-road extension to Coquitam Center from the new SkyTrain. Extension of the Millennium SkyTrain Line to Coquitam City Center is a long-term priority because its \$730 million (CAN) cost precludes it in the near to medium term. The proposed BRT line will provide the interim access until the rail line is built.

TransLink is examining new ways in which priority may be introduced into the corridor. These include transit signal priority and sections of dedicated curbside bus lanes or median busway. The more suburban setting of this route suggests that curb lanes may be more practical than in the urban areas where development is more mature, and bus lanes are difficult to accommodate without impacting local businesses.

The 10-km (6-mile) route has 18 stops. Service frequency is set at 10 minutes during peaks and midday and 15 minutes during the evening. Weekday ridership is estimated at 6,000, and fare box cost recovery at 56 percent.

ASSESSMENT

Bus rapid transit provides important service in Vancouver. Designed to be frequent, reliable, and easy to use, BRT has improved service for existing bus customers while attracting new riders from single occupant vehicles. Capital costs are low compared to rail-based systems. BRT is being used in corridors proposed for ICTS or in medium-density corridors where ICTS may not be justified. Investment in BRT allows the establishment of patterns of movement early on that will build ridership for conversion to ICTS in the future. The success of the BRT has helped revitalize bus services and has fostered improved customer loyalty and employee pride.

The Broadway and Richmond-Vancouver “B” lines represent cost-effective, environmentally responsive, early action approaches to improved transit services in heavily traveled corridors. As in Los Angeles, these BRT lines mainly rely on longer stop spacing and traffic signal priorities to improve bus speeds in mixed traffic environments. Distinctive low-floor vehicles and improved passenger shelters and information systems enhance their identity, as well as clean simple route structure. Both routes are well used, and both reduce passenger journey times.

LESSONS LEARNED

Much has been learned, including the need to communicate early before positions become fixed, and constructive dialogue becomes impossible. Development of the #98 B-Line clearly demonstrated the need for close working relationships with the business community where changes in curb parking are anticipated.

The opposition to parking removal and other transit priority measures along Granville Street was a setback for the project and brought home the challenge of implementing

curbside bus lanes on urban arterials. Although polling indicated there was significant support for giving buses priority at a regional level, this support was dramatically reduced when communities were confronted with having to accommodate dedicated bus lanes at the expense of curbside parking. The introduction of the curbside bus lanes revealed another weakness – the lack of a political champion. BC Transit, a provincial crown corporation, did not have a political champion that could take the project and steer it through the debate at the local level. This fell to officials who were much less effective in dealing with the difficult political choices that confronted the local council.⁽³⁾

Another important lesson was that well-designed median busways do work and can have the added benefit of helping to enhance the surrounding environment.

RAPID BUS POLICY

Success of the B-Line services has prompted TransLink to develop a Rapid Bus policy. Features of this policy will eventually include the following:

- Minimum headways of 10 minutes daytime and 15 minutes nights;
- Bus stop spacing of 1.0 to 1.5 km (0.6 to 0.9 mile), with stops closer in CBD areas;
- Use of transit priority techniques such as queue jumpers at bridges and major intersections; peak period, peak direction bus lanes; and signal priority that extends the green time for late buses;
- Stops with shelters, route maps, fare information, and signage promoting the identity of the Rapid Bus route;
- Displays at stations showing next bus arrival times using AVL data;
- On-board automated stop announcements and route maps;
- Low-floor articulated vehicles; and
- Proof-of-payment fare collections.

APPLICABILITY

The features of the three B-Line services have application in many U.S. and Canadian cities.

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ACKNOWLEDGEMENTS

Much of the data and analyses were drawn from Glen Leicester's various studies and reports. His cooperation is fully acknowledged.

Table 1: Summary of Vancouver's B-Line Service and Performance

B-Line Performance			
	#99 B-Line Broadway-Lougheed	#98 B-Line Richmond-Vancouver	Projected #97 B-Line Coquitlam-Lougheed
Route Distance	27 kms	16 kms	10 kms
# of Stops	14	19	18
Average stop spacing	1.9 kms	900 meters	550 meters
Peak travel time	70 minutes	44 minutes	30 minutes
Speed	23 kph	22 kph	20 kph
Peak Vehicles	26	19	7
Fleet	28	28	9
Frequency			
Peak	4 minutes	5 minutes	10 minutes
Mid-day	7.5 minutes	7.5 minutes	10 minutes
Evening	15 minutes	15 minutes	15 minutes
Annual Passengers	7,200,000	4,200,000	1,800,000
Weekday Passengers	26,000	14,000	6,000
Annual Service Hours	91,000	71,000	49,000
Annual Cost	\$7.5 million	\$5.8 million	\$4 million
Annual Revenue	\$7.2 million	\$5.2 million	\$2.2 million
Cost Per Passenger	\$1.04	\$1.38	\$2.22
Passengers per Hour	79	59	37
Cost Recovery	96%	90%	56%

Source: Leicester, Glen. Bus Rapid Transit Development in Vancouver, B.C. Compendium of Technical Papers, 2002 Annual Meeting, Institute of Transportation Engineers Philadelphia, PA, August 4 7, 2002.

Table 2: #98 B-Line Fact Sheet

Route Length	16 kms (10 miles)			
Number of Stops	19 per direction (38 round trips)			
Average Stop Spacing	900 meters (0.55 miles)			
Peak-Hour Travel Time	42 minutes N/B			
	46 minutes S/B – target was 40 minutes (previous times up to 50 minutes)			
Peak-Hour Speed	22 kph (14 mph)			
Peak-Hour vehicles	19			
Fleet	28 (9 spares to be used in future)			
Type of Vehicle	Low floor articulated bus			
Manufacturer	New Flyer Industries Ltd; Winnipeg, Canada			
Seating Capacity	54 passengers			
Frequency	<i>Peak</i>	5 minutes	<i>Saturday</i>	7– 8 minutes
	<i>Mid-day</i>	7–8 minutes	<i>Sunday</i>	10 minutes
	<i>Evening</i>	15 minutes		
Annual Ridership	4,200,000			
Weekday Ridership	14,000 (Forecast 18,000 riders after one year of operation)			
Peak-Hour Max Load	900 peak one hour @ max load point northbound am/ southbound pm			
Annual Service Hours	71,000			
Annual Operating Cost	\$5.8 million (\$82 per hour including overheads)			
Annual Revenue	\$5.2 million			
Average Fare	\$1.24			
Cost per Passenger	\$1.38			
Passengers per Hour	59			
Operating Cost Recovery	90%			
Project Cost	\$44.2 million			
- Design	\$2.2 million			
- Project Administration	\$1.4 million			
- Stations/Shelters	\$3.5 million (average \$80,000 per)			
- Busway	\$14.7 million (including 25 properties [\$4.2 million])			
- AVL, Real Time	\$4.2 million			
- Transit Signal Priority	\$1.6 million			
- Curbside Bus Lanes	\$0.4 million			
- 28 Buses	\$16.2 million			
Project Timing				
Announced	September 1995			
Project Initiated	Early 1997			
Alignment Approval	Fall 1998			
Construction	2000–2001			
Start Up	August 2001 (after 4 ½ month bus strike)			
Priority Measures				
Busway	2.5 kms (first median busway in Canada)			
Curbside Lanes	5 kms (one way)			
Signal Priority	65 intersections for late running buses only			
Signal Pre-emption	3 intersections			
Exclusive On Ramp to Bridge				

Source: TransLink

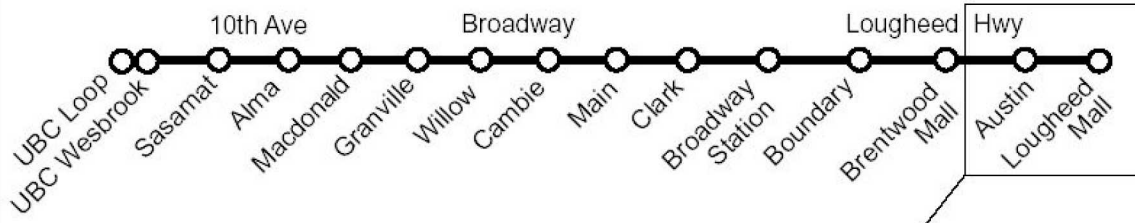
99 B-Line

Lougheed Mall/Brentwood Mall/Broadway Station/Alma/UBC

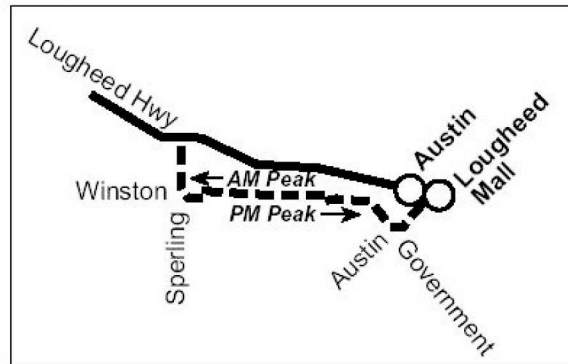


All stops bike-rack accessible

All stops wheelchair accessible



Inset



———— Regular route
 - - - - - Peak period route

Drawn Feb 97/SW	Revised Feb 22/99	Effective: Sept/98/PN
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Figure 1: #99 B-Line

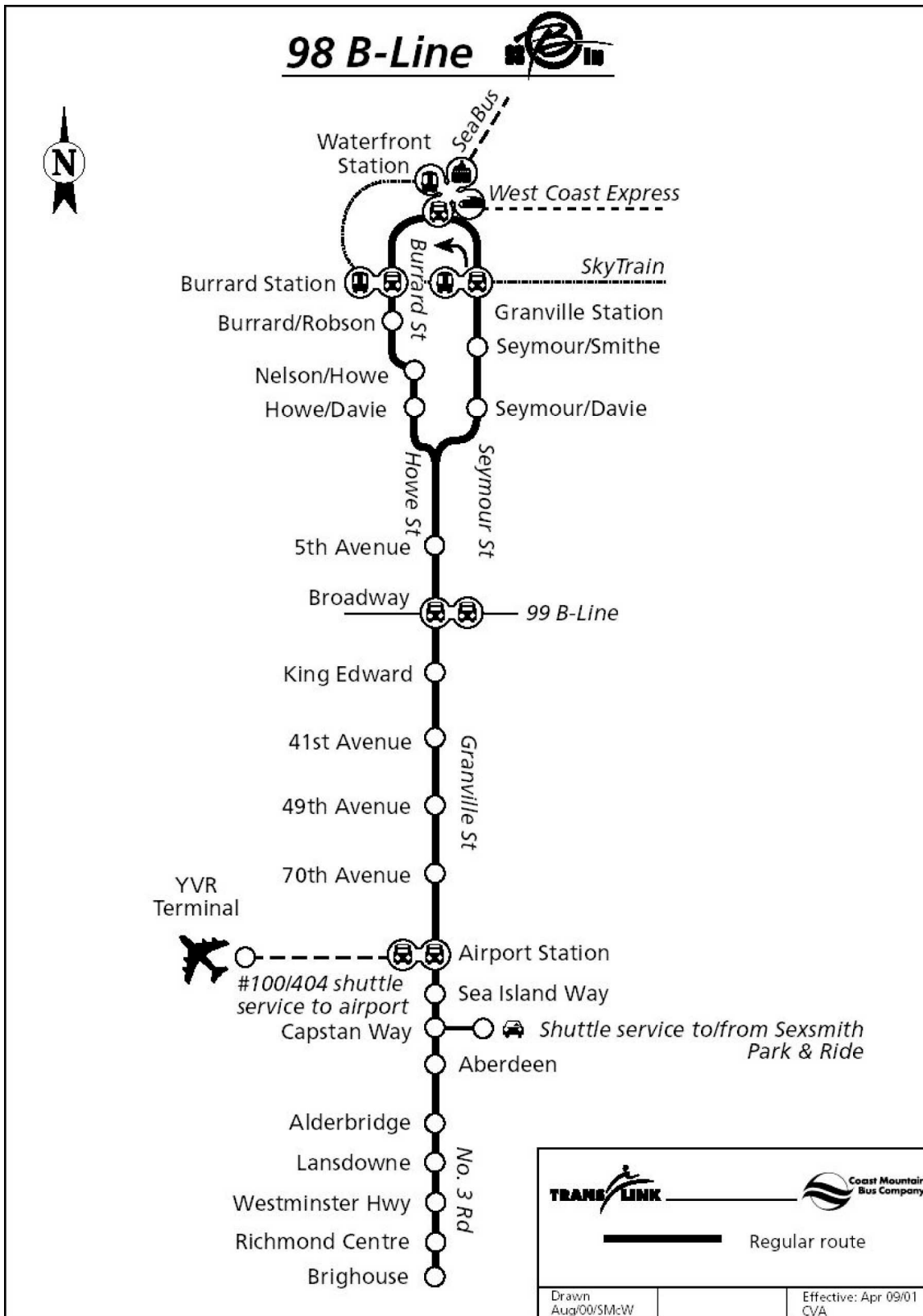


Figure 2: #98 B-Line

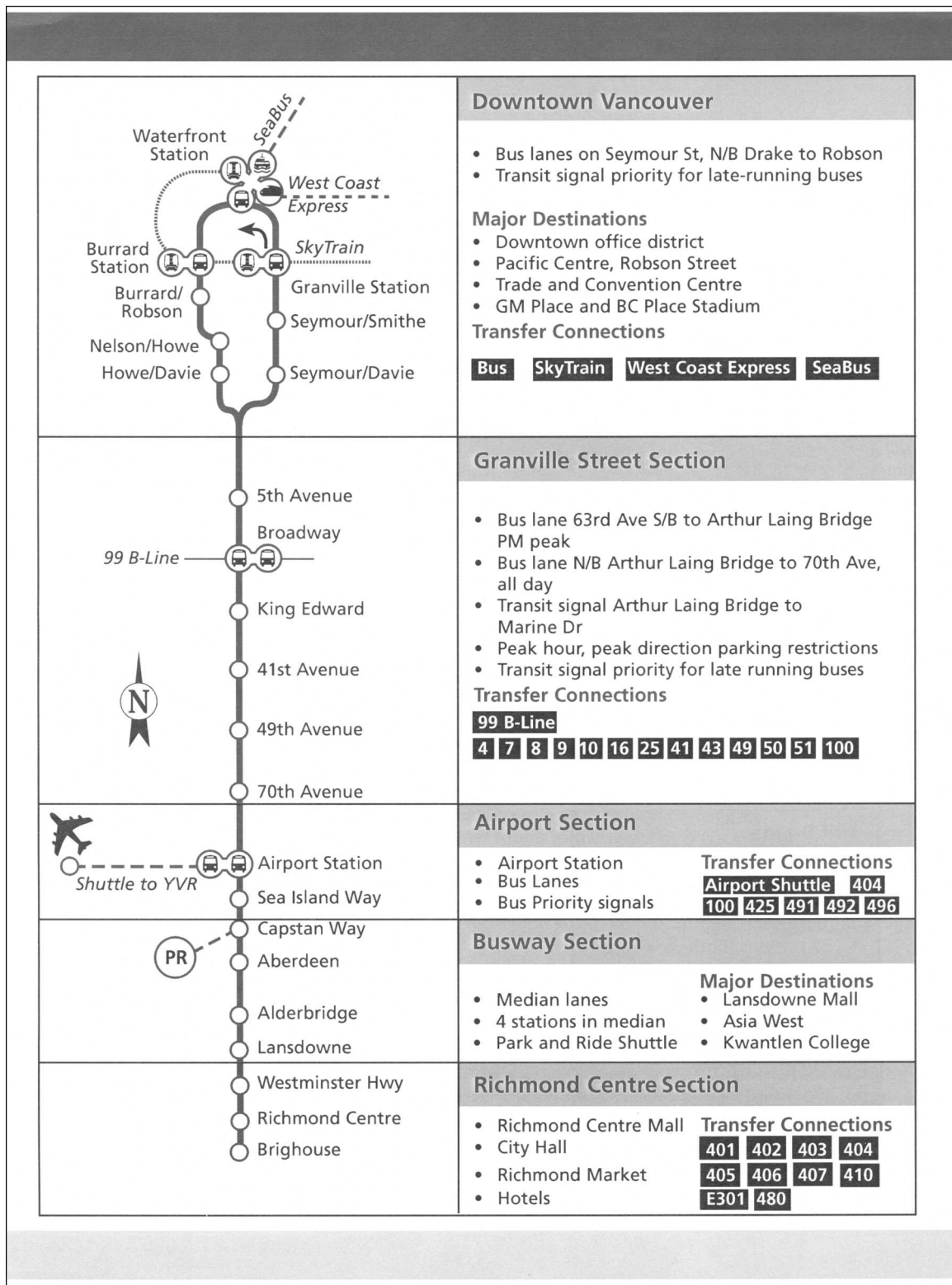


Figure 3: Route, Features, Activities, and Connections – #98 B-Line



Figure 4: Typical Bus



Figure 5: View of Median Busway – Richmond

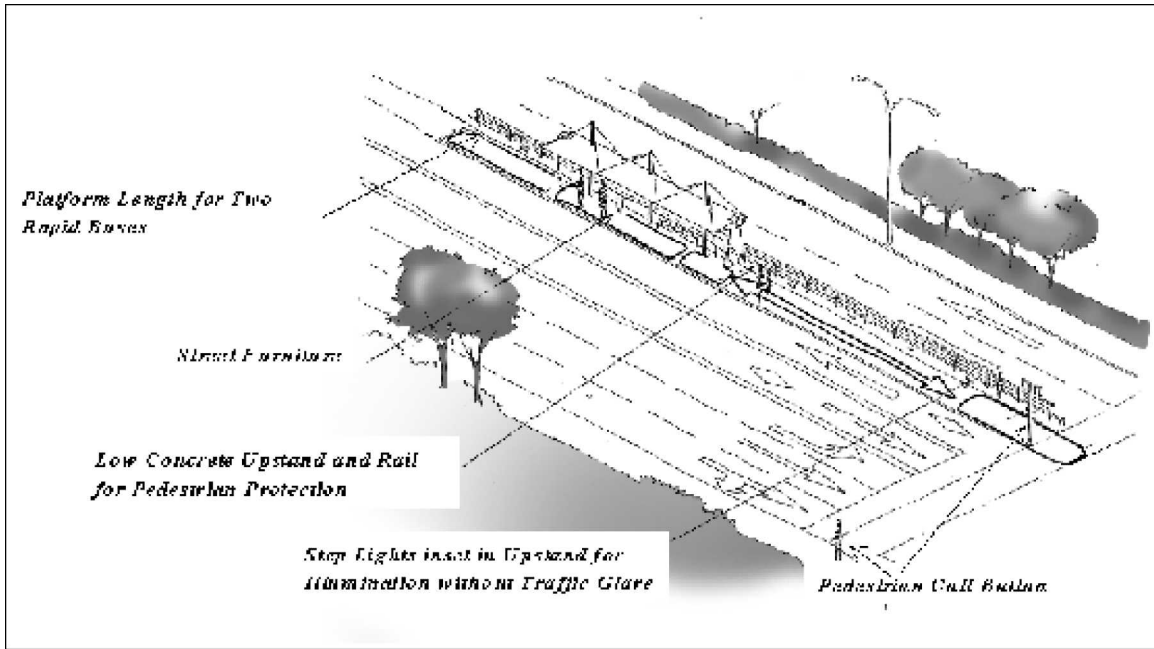


Figure 6: Busway Typical Section



Figure 7: View of Busway Station – Richmond

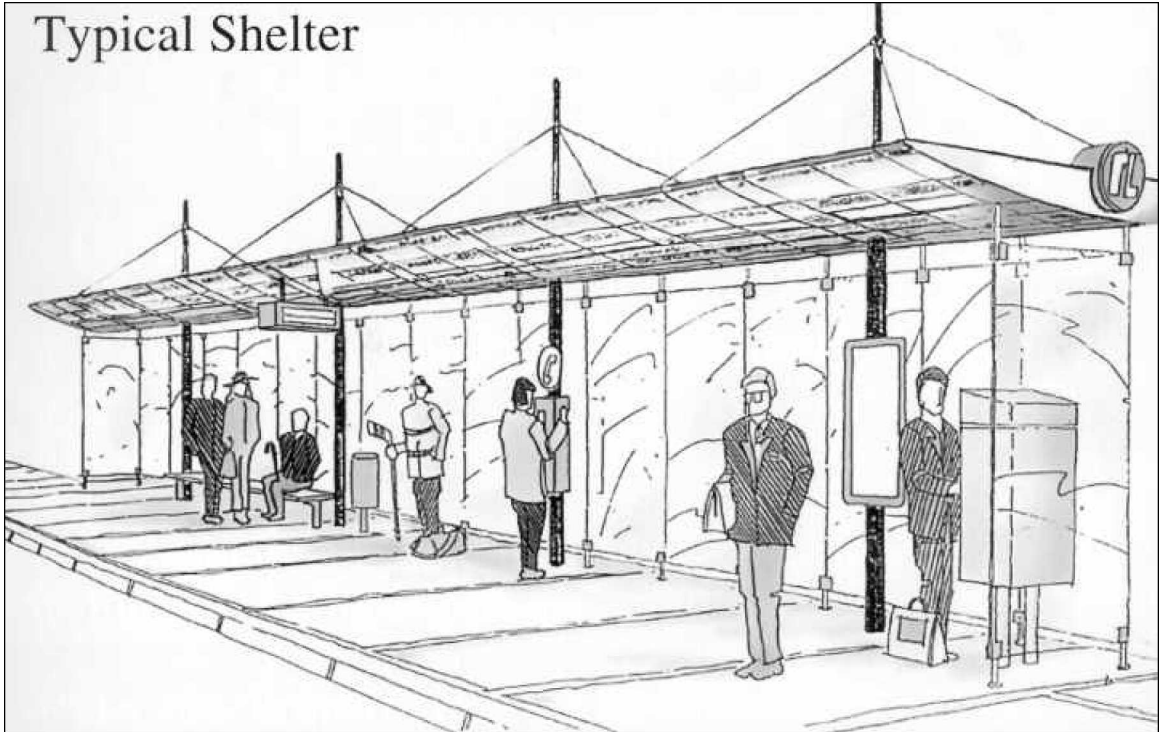


Figure 8: Typical Shelter Sketch



Figure 9: Sideview of #98 Shelter