2023 Bus Speed and Reliability Report

July 2023

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TRANSLINK

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Executive Messages

A Message from the CEO of TransLink

Every day, customers rely on buses to get them to the people and places that matter most—from work and school to healthcare appointments, and everywhere in between. Representing almost two-thirds of our daily boardings, customers take more than half a million bus trips every day. As ridership continued to recover from the pandemic in 2022, bus ridership consistently rebounded faster than any other transit mode. Buses are the backbone of our transit system, and as we look to the future, they will continue to play a key role in how we move around this region.

The 10-Year Priorities of our regional transportation strategy, Transport 2050, envisions a bold "bus-first" approach. Priority investments include doubling bus service, 11 new RapidBus routes, seven new Express bus lines, and up to nine new Bus Rapid Transit corridors. Since 2019, TransLink's Bus Speed & Reliability (BSR) Municipal Funding Program has awarded almost $15 million in funding to more than 100 studies and projects. While this is encouraging progress, there is still much work to be done so we can achieve the future we envision for our bus system. We will continue to work with the TransLink Board of Directors and the Mayors' Council on Regional Transportation to secure funds for this program because investing in bus priority measures will directly help us achieve our future goals: to make transportation more convenient, reliable, safe and comfortable, affordable, and carbon-free.

With opportunities to prioritize more road space for transit through bus lanes, queue jumps, bus bulbs, and signal improvements, we can clear the way for faster, more reliable, and more efficient bus service, ultimately reducing delays and helping our customers get to where they need to go.

The humble bus is the future of mass transit. In planning for this future, this Bus Speed & Reliability Report serves as a call to action. Working with our customers, local and regional government, Indigenous Nations, and partners, now is the time to make it happen.

Kevin Quinn
Chief Executive Officer
TransLink

A Message from the President and General Manager of Coast Mountain Bus Company

Across CMBC, our employees—from Transit Operators to Mechanics, Schedulers and many more—work hard every day to provide the high-quality bus service that our customers expect, all while interacting with millions of other road users. However, increasing roadway traffic slows down our buses.

Operating alongside mixed traffic such as private cars, freight trucks, and other vehicles presents both daily and long-term challenges. Despite a temporary respite during the pandemic, traffic is anticipated to continue growing. This means we need to increase the number of buses and Transit Operators on the road, and the number of people working behind the scenes, to maintain our status quo. Just because of traffic, our operational budget must grow $2–$7 million every year, and the cost continues to accumulate. This report estimates the total cost of delay in 2021 was more than $80 million.

Bus priority measures such as bus lanes, queue jumps, bus bulbs, and signal improvements can help. These efficiency improvements allow us to provide additional service at the same cost and help us save for the future. When buses are protected from rising congestion, we can make more durable improvements in bus service, and most importantly, ensure that employees and customers have more certainty in knowing how long each transit journey will take.

This report has a hopeful outlook, highlighting both the problem of bus delay and its potential solutions. By identifying key locations for future bus priority investments, it provides an overview of 20 corridors that most warrant our attention, illustrating where we need to focus our work. Coast Mountain Bus Company service has a big impact on the region, and we'll need help from all our partners to maintain the excellent transit experience our customers expect and deserve.

Michael McDaniel
President & General Manager
Coast Mountain Bus Company

Part 1: Introduction

Bus delay due to congestion is a significant, but solvable, regional problem

Transit service is critical to access and mobility in Metro Vancouver. People in Metro Vancouver board transit to get to their destinations more than 800,000 times every weekday. Before the COVID-19 pandemic, transit ridership was increasing faster in Metro Vancouver than any other region in Canada and the US; and since the pandemic, ridership has recovered faster than most other metropolitan areas in North America.

Buses are the workhorses of the transit system. Most of TransLink's riders take the bus, and buses carry a substantial share of all people traveling on some streets. Bus ridership grew faster prior to the pandemic and recovered more quickly than other transit modes. And continued expansions in bus service are central to TransLink's regional transportation strategy (Transport 2050).

Fast, reliable bus service makes transit an attractive and healthy travel choice and increases access to opportunity. Frequent and reliable bus service allows Metro Vancouver residents to plan their travel around their lives, rather than plan their lives around their travel.

TransLink and Coast Mountain Bus Company work hard to provide frequent and reliable service, including: adding service to reduce passenger wait times and crowding, adjusting schedules to improve accuracy, and launching new frequent-service routes, such as the five RapidBus lines launched in 2020.

However, traffic worsens customer experience and increases operating costs. Traffic-related delays means passengers must add extra travel time to their plans, or risk being late for work or appointments. Delays also require TransLink to either put more buses on the street to maintain the same frequency, or else accept reduced service levels.

These are solvable problems. The early months of the pandemic helped us see where buses freed from congestion can run faster and more reliably. And there are many tools to make these improvements more permanent. These rely on strong partnerships between TransLink, municipalities, and the BC Ministry of Transportation and Infrastructure (BC MOTI).

TransLink will be investing to keep our buses reliable as our region grows. The Bus Speed and Reliability (BSR) Program is focused on making improvements to our network where they are most needed. These investments will be complemented by the service enhancements and new RapidBus and Bus Rapid Transit (BRT) corridors than are central to the regions' plans for growth.

WHY ARE WE UPDATING THIS DOCUMENT?

TransLink's first Bus Speed & Reliability Report, published in 2019, highlighted the issue of bus-delay in Metro Vancouver, its impacts on customers, and its operational costs. The Report also identified corridors for future bus priority investment, establishing a foundation for the new Bus Speed & Reliability Municipal Funding Program ("BSR Program").

The 2023 Bus Speed & Reliability Report serves several purposes. It is an opportunity to:

- Refresh data about bus speed and reliability to create a solid basis for future reporting.
- Identify lessons learned about bus performance during the low-traffic period of the COVID-19 pandemic.
- Report on performance of bus priority projects delivered since 2019, including lessons learned about the priority measures that were most effective.
- Support a growing municipal funding program to improve bus speed and reliability. The BSR Program will grow approximately 35%, from $5.25 million (2022) to over $8 million (2023). This complements the region's ambitious plans to improve bus service with new RapidBus and Bus Rapid Transit routes.

This example of a commercial street with offset bus lanes, cycling facilities, and on-street parking would work well for people riding transit, walking, and biking as well as business interests. It includes bus and pedestrian bulb-outs and right-turn pockets, along with possible restrictions on some left-turns.

HOW TO USE THIS DOCUMENT

This report informs the public, elected leaders, and municipal staff about where delays have the greatest impact on bus service and what to do about it

The 2023 BSR Report explores:

1. The causes and effects of delay on buses and people in our region.
2. The strategies available to TransLink, municipalities, and the BC Ministry of Transportation Infrastructure ("BC MOTI") to improve bus speed and reliability.
3. Specific, actionable, and effective improvements that TransLink can help fund through the Bus Speed and Reliability Program.

The report begins by establishing the context for bus speed and reliability, describing the importance of fast, reliable bus service to Metro Vancouver. It also describes the current state of bus speed and reliability, and how delay impacts people in our region. It examines travel time and ridership data before, during, and after the COVID-19 pandemic to draw conclusions about the essential nature of bus service and the benefits of protecting buses from traffic congestion.

The report describes how TransLink, municipalities and BC MOTI partner to deliver bus priority projects, along with some common challenges. It summarizes our approach to identifying needs, including potential equity considerations. It emphasizes the partnerships needed to implement bus priority improvements, and identifies 20 Profile Areas as focal points for future bus priority investments.

The report evaluates bus priority measures built in the region. It provides an inventory of existing bus priority measures constructed since the launch of TransLink's BSR Program and highlights bus priority project examples to help us understand the measures that have been most effective and how to apply what we have learned to make future projects better.

The report then highlights needs for future investments. It identifies gaps between current bus priority measures and areas of highest need along the Frequent Transit Network (FTN). It also highlights areas of opportunity for bus priority measures within the 20 Profile Areas.

The Appendix provides more detail on areas of interest including detailed maps and statistics about delay.

- **Subregional Profiles:** The location and magnitude of delay in each subregion as well as location and types of existing bus priority.
- **Profile Areas:** The location, magnitude, and causes of delay on selected major corridors.

GLOSSARY

Term	Definition
Boarding	Every time a passenger enters a bus, train or SeaBus. Transfers are counted as additional boardings.
Bus Rapid Transit (BRT)	Bus service that is fast, frequent and high-capacity, typically via dedicated, fully traffic-separated lanes, with signal priority at intersections.
Bus Speed & Reliability Municipal Funding Program (BSR Program)	A TransLink cost-share funding program to support municipalities in planning, designing, and constructing bus priority projects.
Delay	Excess time spent traveling between bus stops, defined in this report as the difference between the “average” and “best case” conditions. (See "Our Approach to Identifying Needs" on page 23.)
Frequent Transit Network (FTN)	TransLink’s network of corridors where transit service runs at least every 15 minutes in both directions throughout the day and into the evening, every day of the week. It is the focus of the BSR Program.
Dwell	Time spent at a bus stop to allow customers to get on and off.
Journey	A complete transit trip, regardless of the number of transfers.
On-time Performance	The percent of trips that arrive at their destination at the time scheduled.
Passenger Load	The number of people on a bus at any given time.
Person-hours of Delay	The total amount of excess time spent in transit for all passengers on the bus.
RapidBus	A TransLink brand of bus service operating at least every 10 minutes at peak times, with bus priority, limited stopping, and enhanced passenger amenities.
Ridership	The total number of people who use transit, typically reported for an average weekday or entire year.
Speed	The rate at which something moves, generally expressed in kilometres per hour. Speed is a useful metric for comparing the performance of buses traveling different distances.
Travel Time	Time spent traveling between locations (e.g., stops or termini). Most bus riders think about their experience on transit in terms of travel time (rather than speed).
Variability	The range of travel times observed for a given route, direction, segment, and time of day—in this report defined as the range between 80th and 20th percentile travel times, by hour of the day. Variability is used as the primary measure of reliability in this report. (See "Our Approach to Identifying Needs" on page 23.)

Part 2: Context

IMPORTANCE OF TRANSIT SERVICE

Transit service is critical to access and mobility in Metro Vancouver

Transit helps people in Metro Vancouver reach the things that are most important to life and liveliness: work, school, shopping, services, cultural centres, and social gatherings. Travelling by transit is more affordable than driving and is often the only option for people who don't drive, including those who are too young to have a driver's license, older adults, people with disabilities, and low-income populations. People may choose to take transit because it is convenient, sustainable, or safer, such as returning home after a night out. Good transit service also complements active modes of transportation—filling in gaps in the walking or cycling network, and extending the range of people who use a different mode for the first-mile or last-mile of their trip.

2.2M

Unique customers

In fall 2021, TransLink served nearly 2.2 million unique customers—that's equivalent to 84% of the Metro Vancouver population.[1]

850K

Weekday boardings

People in Metro Vancouver boarded transit nearly 850,000 times every weekday in fall 2021.[2]

>60%

Person throughput

Buses carry over 60% of travelers on some streets, and ridership was increasing prior to the pandemic.[3]

>75%

Pre-COVID ridership

By fall 2022, ridership had recovered to above 75% of its pre-pandemic levels, which is higher than other metropolitan areas in Canada and the US.[4]

Buses are the workhorses of the transit system.

Buses serve a significant majority of all transit users. In fall of 2021, almost two-thirds of transit journeys (63%) were by bus—a share that increased from about 61% in 2018.[5] And almost three-quarters of transit journeys included a bus for at least a portion of the trip.[6] On an average weekday in fall 2021, there were more than 530,000 boardings of a TransLink bus.[7]

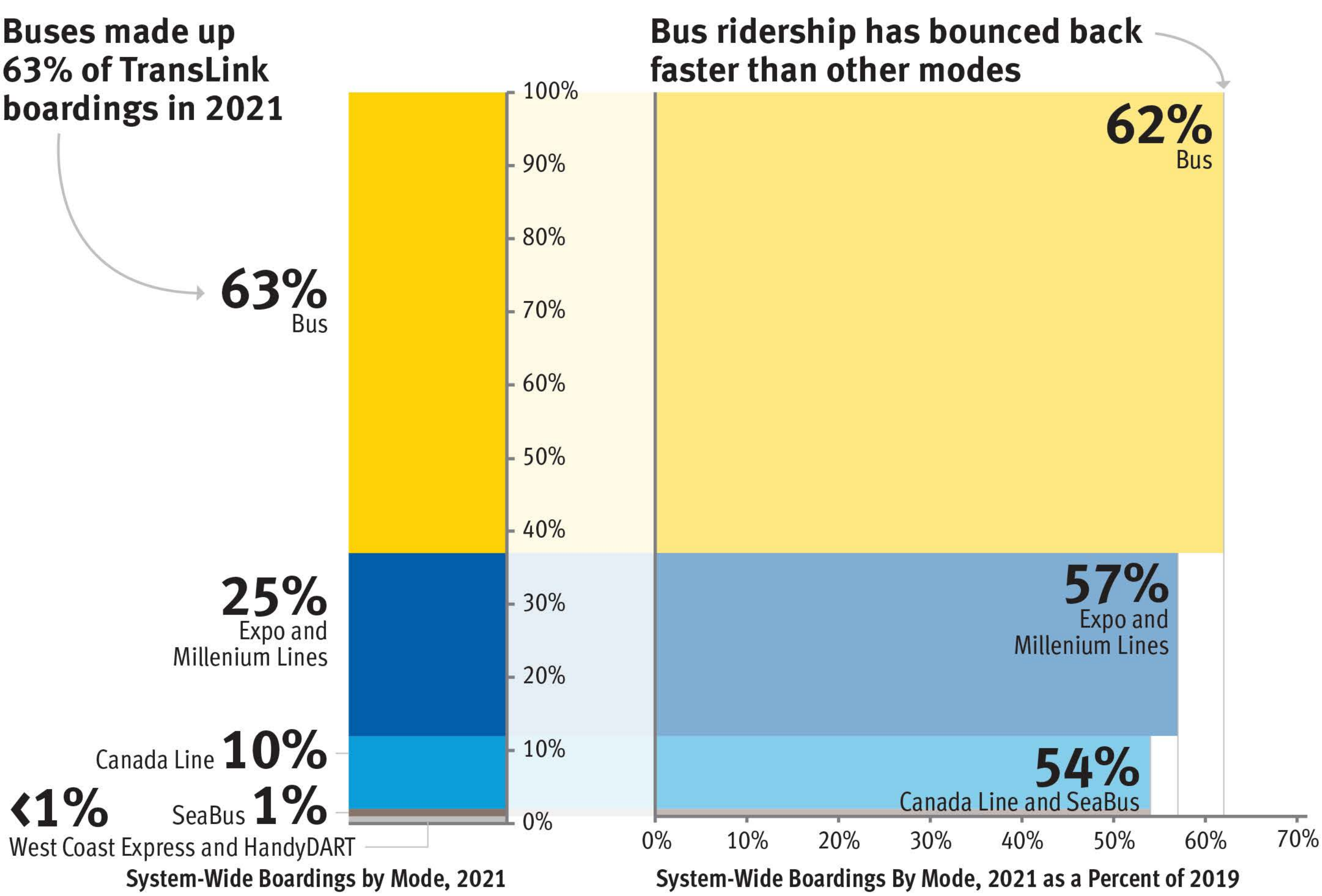
Bus riders are a significant share of road users in many places. (See map of mode-share below.) In others, buses still play a vital role providing access for all. Metro Vancouver has an extensive bus network that reaches communities across the region and runs from early morning to late evening.

Throughout the peaks of the pandemic, TransLink maintained high-frequency bus service on many routes in order to serve essential trips. It also continued to fund and construct new bus priority measures to make service faster and more reliable over the long term.

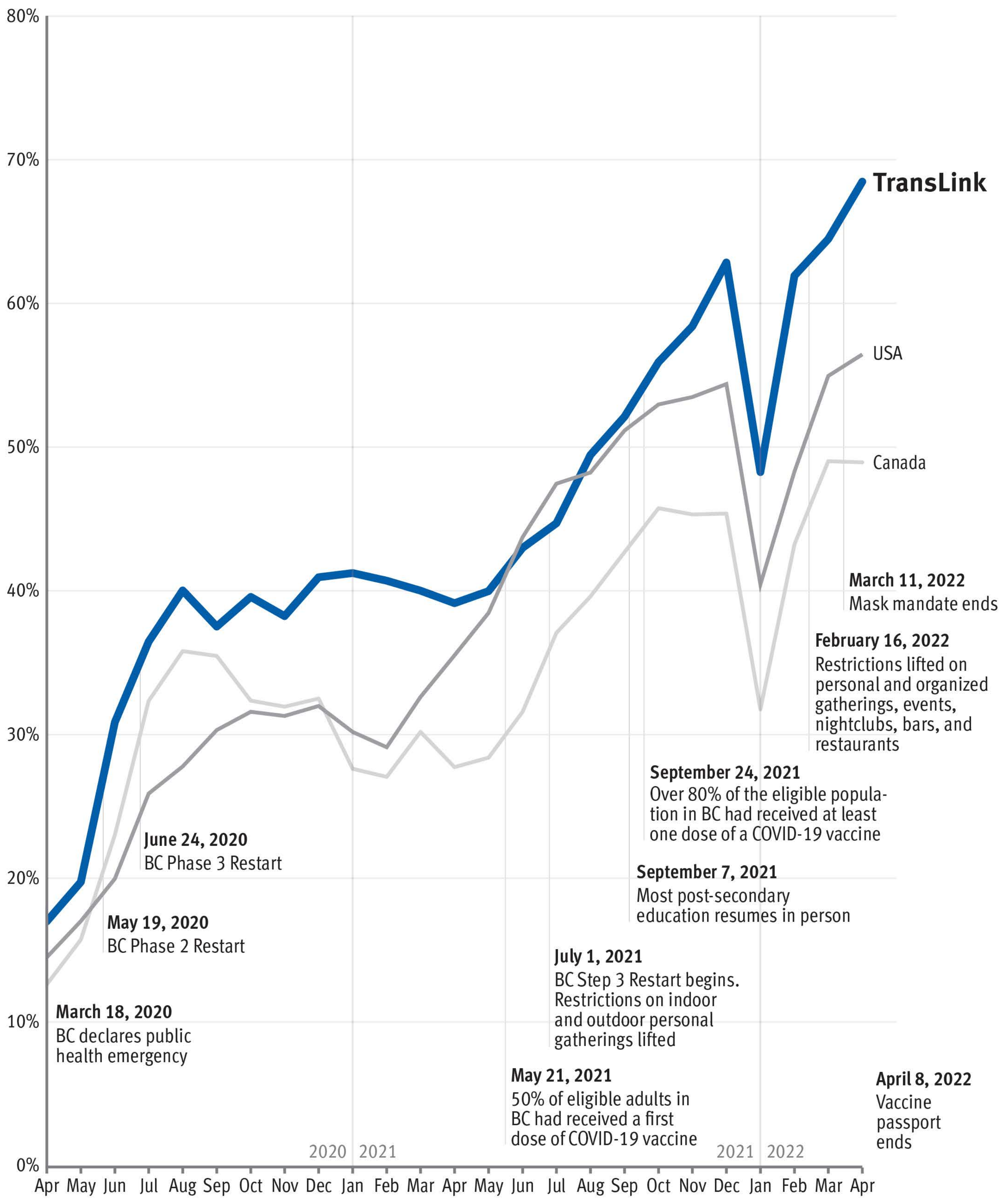
Ridership continues to recover from the pandemic.

In Metro Vancouver and elsewhere, transit ridership dropped steeply during the start of the pandemic in spring 2020. But as daily life outside the home resumed, riders returned. By fall 2021, TransLink's overall ridership levels were 59% of those in 2019. Bus ridership recovery was at 62%—more than the SkyTrain, SeaBus, West Coast Express, and the HandyDART.[8] By fall of 2022, ridership recovery rates had reached above 80%.

Distribution of Total System-Wide Boardings by Mode and Ridership Recovery, Fall 2021



Source: 2021 Transit Service Performance Review



Transit Ridership Recovery Compared to February 2020

Data Sources: 2021 Transit Service Performance Review, page 17.
Estimated based on data sourced from the International Association of Public Transport.

Bus riders are a significant share of road users.

Buses can carry more people than cars—a reality that sometimes obscures their important role. In many areas of Metro Vancouver, buses carry more than 60% of travellers at peak times.[10]

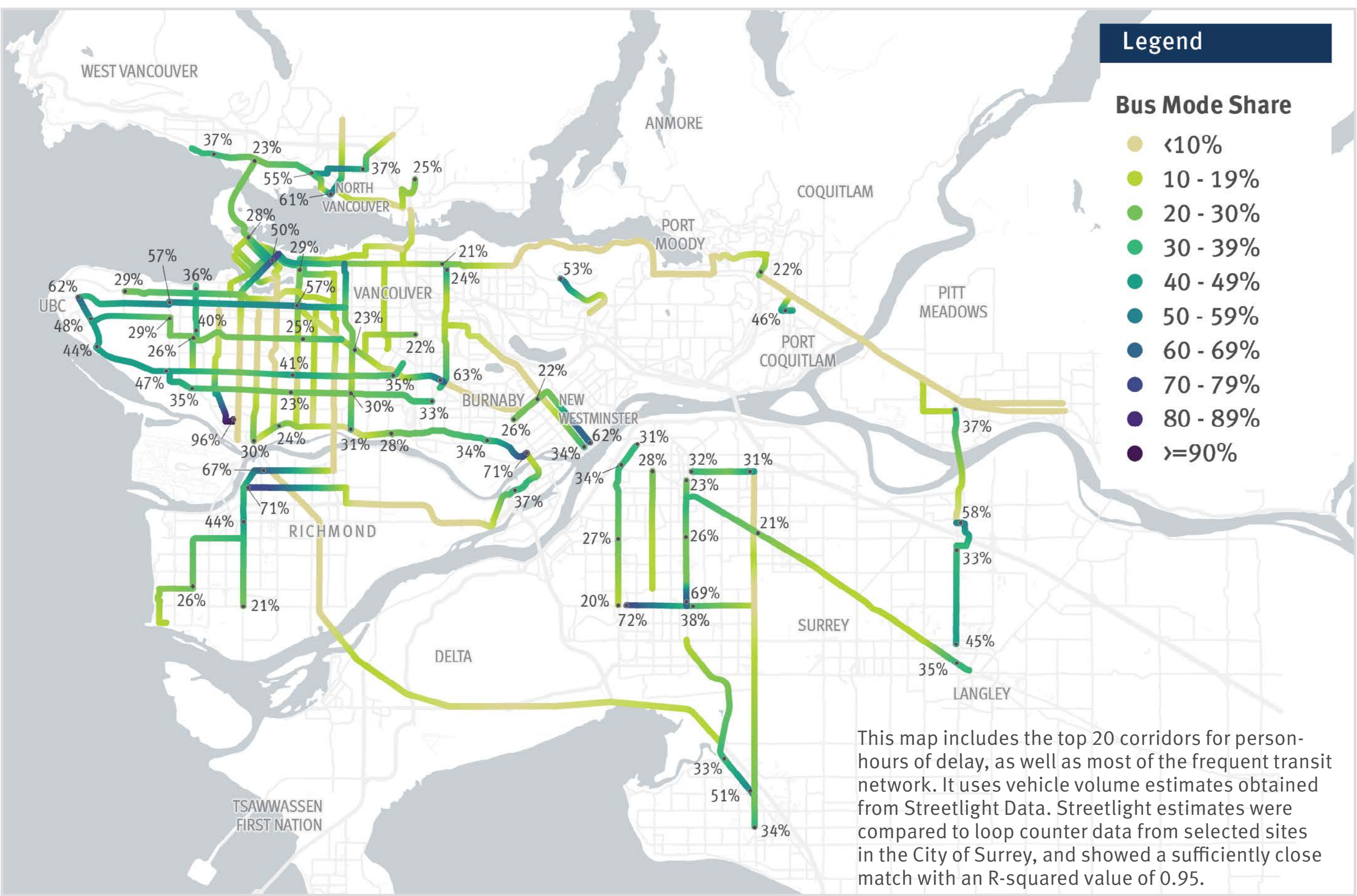
- Transit mode share in the AM Peak ranges from 30% to 50% or more on many corridors (see map below).
- The highest mode share corridors include: Broadway, Wesbrook Mall, North Granville, 41st Ave, Marine Dr/15th St, No 3 Rd, and Edmonds/6th St. Transit mode share across the day exceeds 30% to 40% on these corridors.

New rapid and reliable bus service is integral to our growing transit network.

TransLink's regional transportation strategy documents—Transport 2050, and its related "10-Year Priorities" are "bus-first" plans for growth, guided by goals to make transit convenient, reliable, affordable, safe and comfortable, and carbon-free.

Building on the 2020 launch of "RapidBus"—a new brand of faster, more frequent and reliable service supported by extensive bus priority measures—these future plans will expand RapidBus service further while also building new Bus Rapid Transit routes, which will benefit from even more comprehensive bus priority. (See "Regional Investments in Bus Priority" on page 33.)

Bus Mode Share, 2021, AM Peak



This map includes the top 20 corridors for person-hours of delay, as well as most of the frequent transit network. It uses vehicle volume estimates obtained from Streetlight Data. Streetlight estimates were compared to loop counter data from selected sites in the City of Surrey, and showed a sufficiently close match with an R-squared value of 0.95.

Data Source: TransLink (buses), Streetlight (vehicles)

IMPORTANCE OF BUS SPEED AND RELIABILITY

Fast, reliable service makes transit an attractive alternative to driving

Traffic congestion affects our health, safety, and quality of life.

More cars on the road mean more air pollution and more opportunities for collisions with other vehicles, cyclists, and pedestrians. Congestion also means people must spend more of their valuable time sitting in traffic, reducing time for the rest of life's activities.

Fast and reliable bus service provides a better alternative, alleviating congestion, and complementing healthy active transportation such as walking and biking. Transit customers have the freedom to take their eyes off the road, and not worry about driving safely, or finding a parking spot.

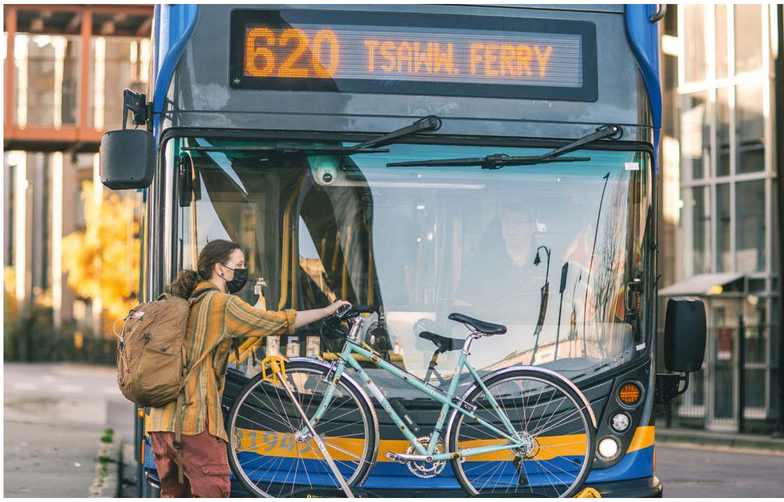
Fast, reliable bus service increases access to opportunity.

Good transit expands people's access to jobs, schools, and social activities—especially people who cannot afford to live in urban centres. When service is reliable and frequent, people feel more confident taking longer transit trips or trips that require transfers. They may also opt to take trips they previously wouldn't have attempted, increasing their freedom to live life fully.

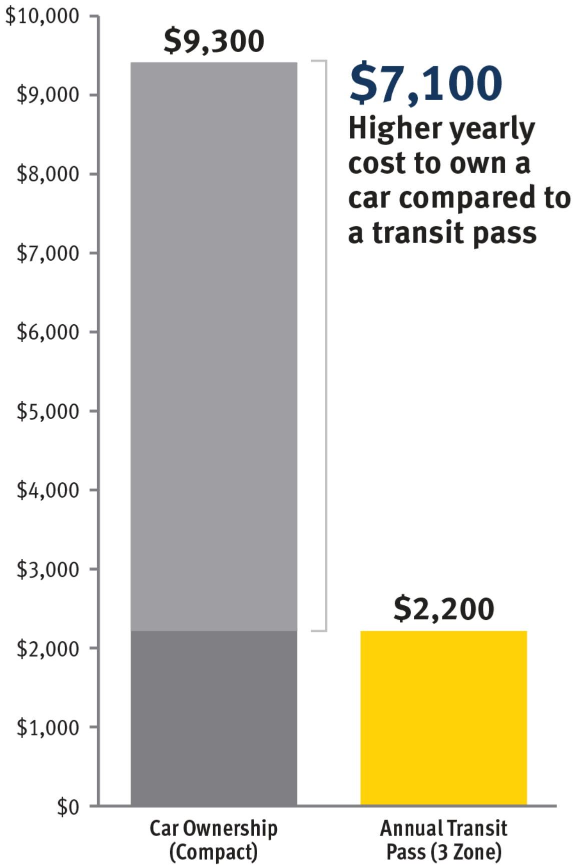
Enabling people to use transit for more trips makes transportation more affordable.

Owning and driving a car is more expensive than taking transit, which does not entail expenses such as gas, insurance, and maintenance. Fast and reliable transit enables more people to forego car ownership, something that could save them thousands of dollars a year.[11]

On average, people living in the Vancouver metro region spend 40% to 49% of their income on housing and transportation.[12] Making transit more convenient will help to achieve the Transport 2050 goal so that no one in the region needs to spend more than 45%.



Annual Cost of Owning a Car vs. Transit Pass [13]

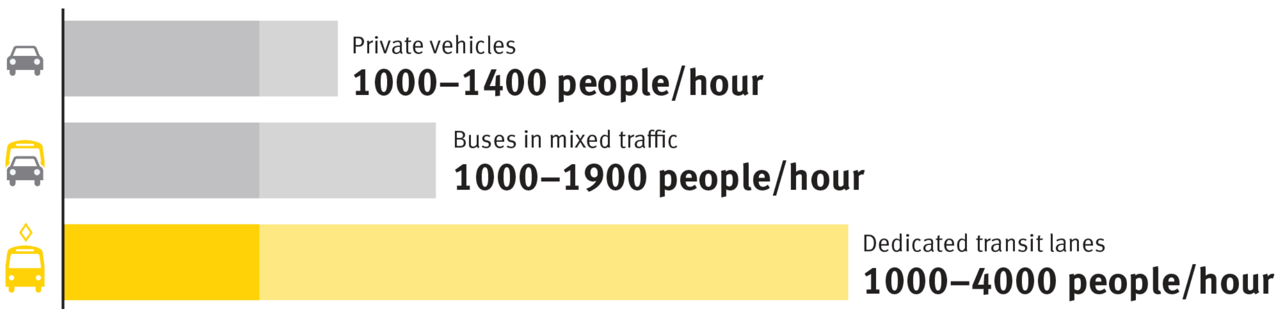


Bus service is also among the most efficient and effective uses of limited resources.

Buses are an efficient way to move people. Unlike trains, they do not require the construction of tracks, and can use existing rights of way. Buses can also hold a lot more people than a car, using the road space more efficiently.

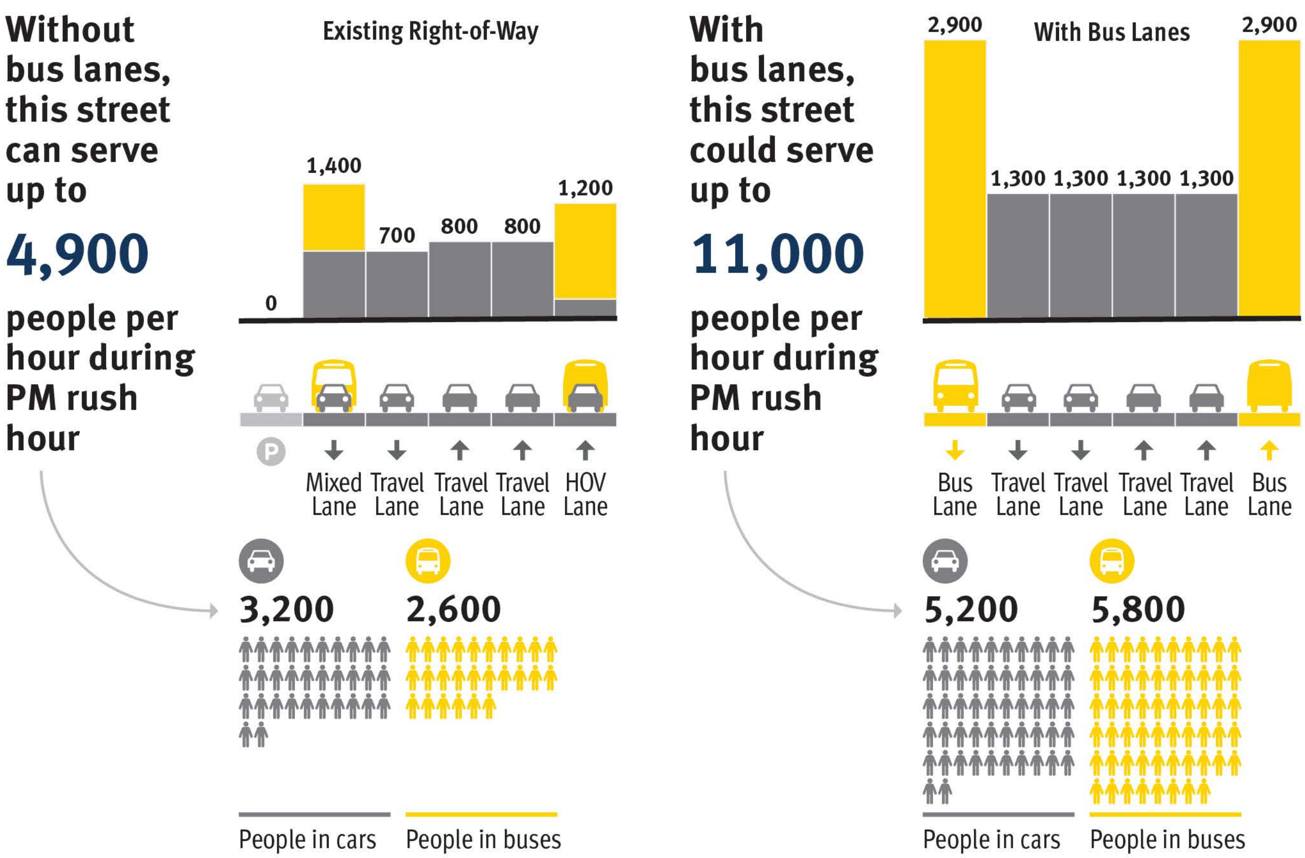
Faster and more reliable bus service can attract new riders. It can also allow TransLink to run more frequent service, further attracting riders. By moving people from cars into buses, the person-moving capacity of the road can be increased, without spending money on widening a road.

How Many People Can Move in Cars Versus a Bus Lane



Source: Based on typical capacities for vehicles and buses traveling in different types of travel lanes.[14]

People Carried by Mode



Existing: Based on vehicle and transit volumes on Hastings Street at Gilmore Avenue in Fall 2019.[15]

Conceptual with bus lanes: Based on assumed capacity for vehicles and buses.[16]

Myth: The bus lanes are empty.

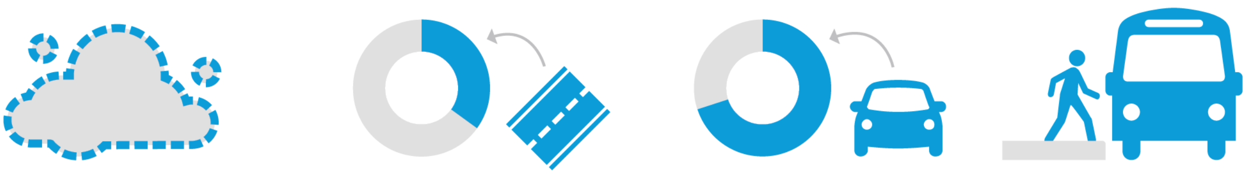
Fact: On Hastings Street, one of our RapidBus corridors, buses carry up to a third of the 5,000 people moving through Burnaby Heights in the PM Peak, with only 3% of total vehicles.[22]

Good bus service helps reduce carbon emissions and slow climate change.

Transportation generates over a third of the region's "on-road" greenhouse gas emissions.[17] Light-duty vehicles are the primary contributors (84%).[18] A key strategy of Metro Vancouver's Climate 2050 Transportation Roadmap is therefore to shift trips from passenger vehicles to public transit. Today, 70% of all trips in the region are made by car.[19] Every time a resident takes the bus instead of driving a gas-powered car for a typical trip they're avoiding about 2.3 kg of carbon emissions.[20] Fast and reliable bus service makes this choice easier.

Even as drivers increasingly use electric cars, TransLink's buses will still be a lower carbon option. There are still greenhouse gas emissions associated with manufacturing batteries, and these are more efficiently used by a bus moving many passengers. In addition, TransLink already has a large fleet of buses that are powered by overhead wire. These not only don't require a big new battery, but also weigh less, making them even more efficient.[21]

Transportation's Role in Greenhouse Gas Emissions and Meeting Our Climate Goals



2050
The greater Vancouver region aims to be carbon neutral by 2050

35%
On-road transportation generates 35% of the region's carbon emissions, mostly from light-duy vehicles (cars and trucks)

70%
Currently, 70% of all trips in the region are made by car

2.3kg
Taking the bus instead of a gas-powered car for a single trip avoids roughly 2.3kg of carbon emissions for an average trip

Data Sources: TransLink Climate Action Strategy (2022) and Climate 2050 Roadmap: Transportation (2021)

TransLink and Coast Mountain Bus Company work hard to provide frequent and reliable service.

High quality bus service allows Metro Vancouver residents to plan their travel around their lives, rather than plan their lives around their travel. TransLink and CMBC work hard to make this possible.

TransLink plans service increases, to both support existing ridership and to shape future ridership growth. For example, the new RapidBus routes launched in 2020 increased the frequency, as well as reliability, of buses along some of the most important transit corridors in the region. During the pandemic, other adjustments were important—including focusing service toward areas where ridership remained high, by making small reductions on frequent bus routes with extra capacity.

TransLink can also work with local partners to invest in bus priority measures. Under the BSR Program, almost $15 million has been allocated for measures such as bus bulbs, queue jumps, transit lanes, and re-balancing bus stops. (See "Multi-agency partnerships are required for progress on bus priority." on page 20.)

CMBC adjusts schedules, ensuring that transit customers have accurate expectations when they plan their trips. This is based on measures of on-time performance (the percent of buses arriving at their destinations on time). As traffic conditions change, CMBC staff change their predictions of how long the bus will take to travel from one stop to the next.

CMBC also manages the complex implementation of service plans—ensuring that enough buses and operators are ready to go, and that routine problems on the ground are resolved quickly—in order to deliver frequent and reliable service on a day-to-day basis.

COSTS OF DELAY

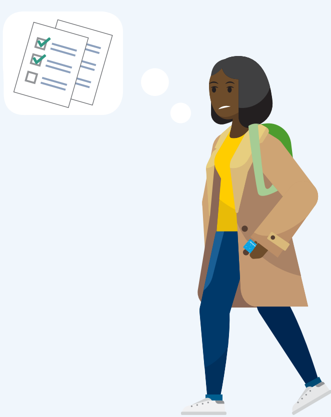
Traffic greatly affects customer experience and operating costs

Delay has direct impacts on peoples' lives.

Bus delays have real impacts on the lives of people who rely on transit. As they sit in traffic or wait to transfer, transit riders face a time penalty—which can be particularly steep for those who cannot afford to live in an urban core. This reduces people's confidence in riding the bus, pushing them toward driving a car instead, a choice that not only costs more for an individual, but also adds further to the road congestion everyone must deal with.

Highly-variable, or inconsistent, bus service means people must include more travel time in their plans to ensure they're not late. Buses may not come on schedule, especially at peak times. Inconsistent service means longer waits, and increased overcrowding when more than one bus arrives at once. And being late for an appointment, childcare pick-up, or exam can be more than an inconvenience. It can mean paying a late fee, waiting until the next slot, or failing a course. Being late for a job can mean losing it.

If I'm late for work one more time, I might lose my job.



I can't be late for my exam!

I have to pay a fee if I'm late picking up my child.

If this bus is late, I'll miss my transfer and my time will be wasted waiting for the next one.

The doctor's office charges a fee if I'm late for my medical appointment.

If I don't get to the grocery store before it closes, I can't pick up food for my family.

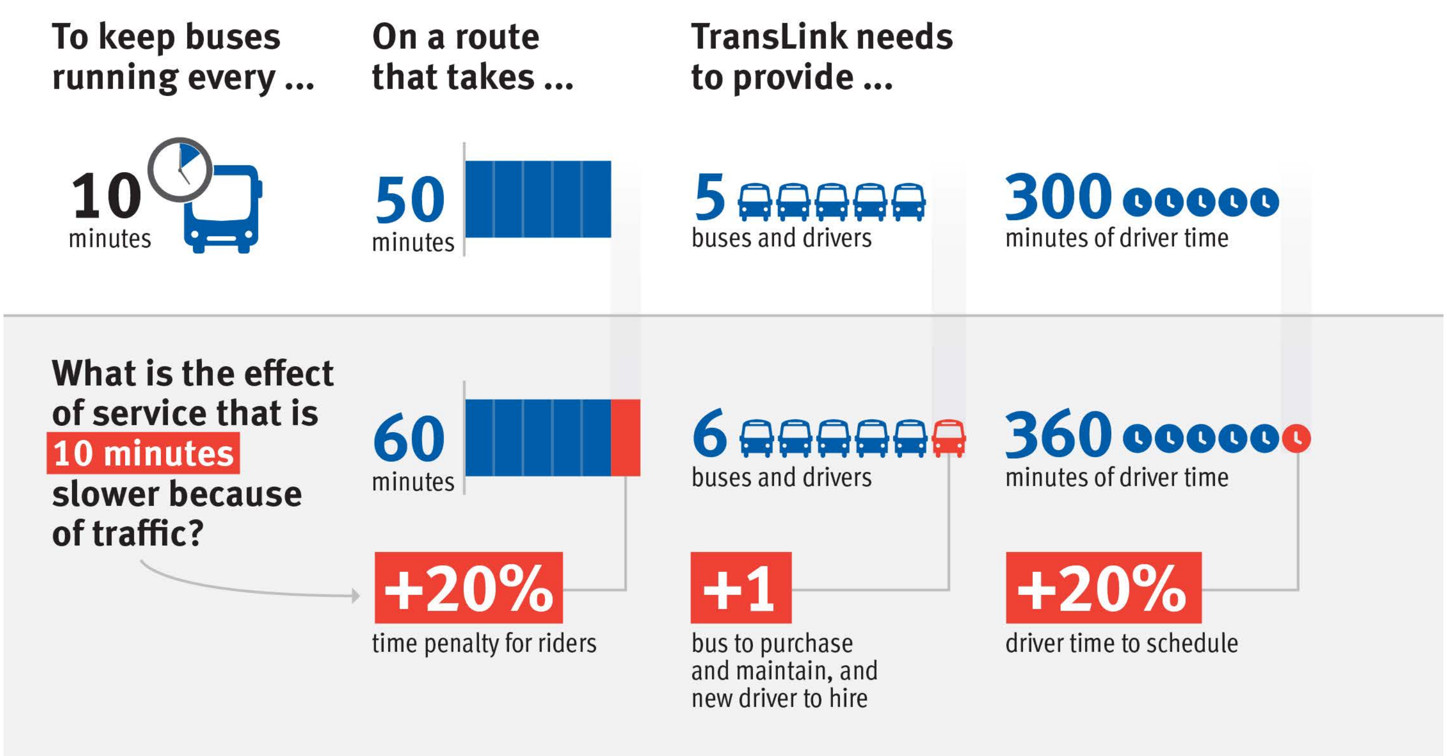
Delay affects our ability to provide great service.

As congestion slows buses down, TransLink must either put more buses on the street—to maintain the same frequency of service—or else accept a reduction in service—requiring customers to wait longer for the next bus. (See diagram below.) When service is inconsistent, it can also be hard to provide an accurate schedule, unless this is based on the slowest days, which guarantees slow service even on good days.

Service that is unreliable or slow reduces the overall attractiveness of transit as a mode choice, reducing fare revenues. In turn, less revenue reduces TransLink's ability to maintain high quality service. This can lead to a downward spiral of declining ridership and lower service levels—a situation experienced by many transit agencies in North America.

Conversely, when buses get faster and more reliable, TransLink can either provide the same level of service with fewer buses or increase frequency with no additional cost.

This graphic shows the additional buses needed to maintain the same frequency of service when a bus runs more slowly.

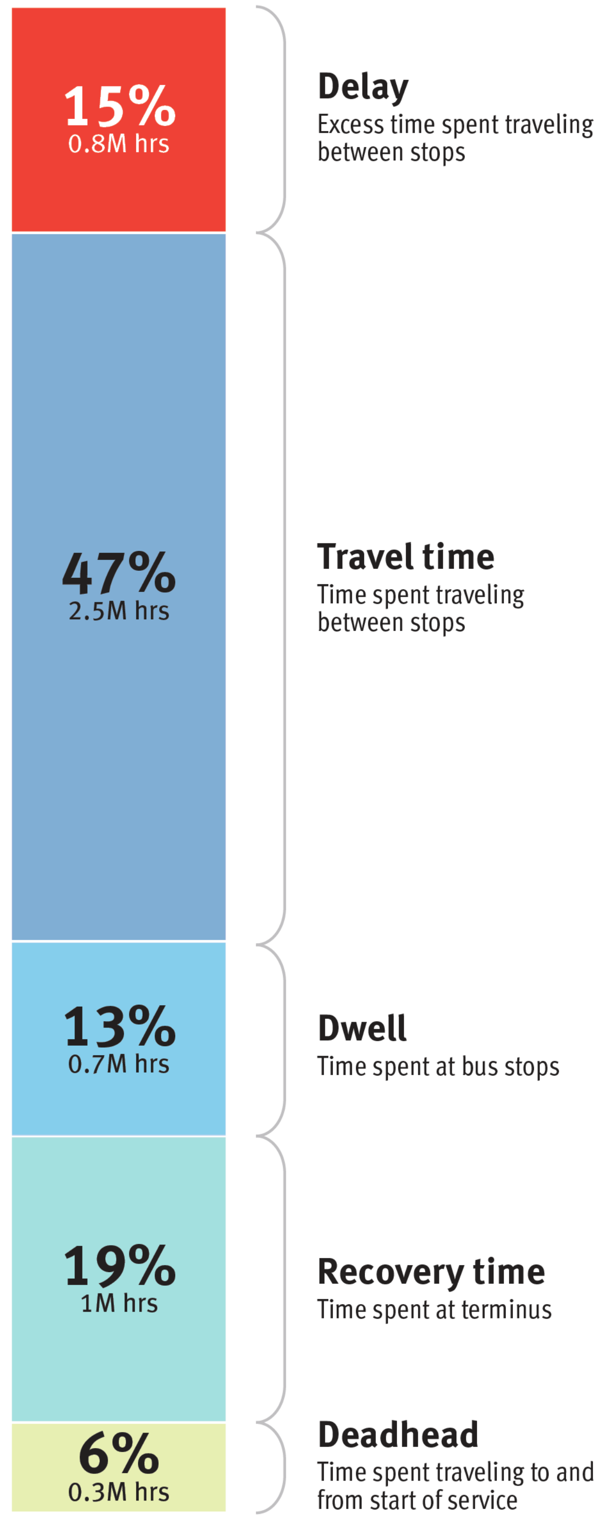


Roadway delay is responsible for approximately 15% of CMBC bus operating costs.

We estimate that over $80 million per year (800,000 annual service hours), or **15%** of CMBC total bus operating costs, are attributable to roadway delay.

A further **19%** of CMBC's operating cost is attributed to recovery time spent at termini. While this provides important break time for operators, some of it is also necessary as a buffer against unreliable bus trips. This buffer is not defined as "delay" in this report, but when bus travel times become longer and more irregular, recovery time must also be increased to ensure on-time departures. It adds further to the costs of delay.

Breakdown of Annual Scheduled Service Hours, 2021



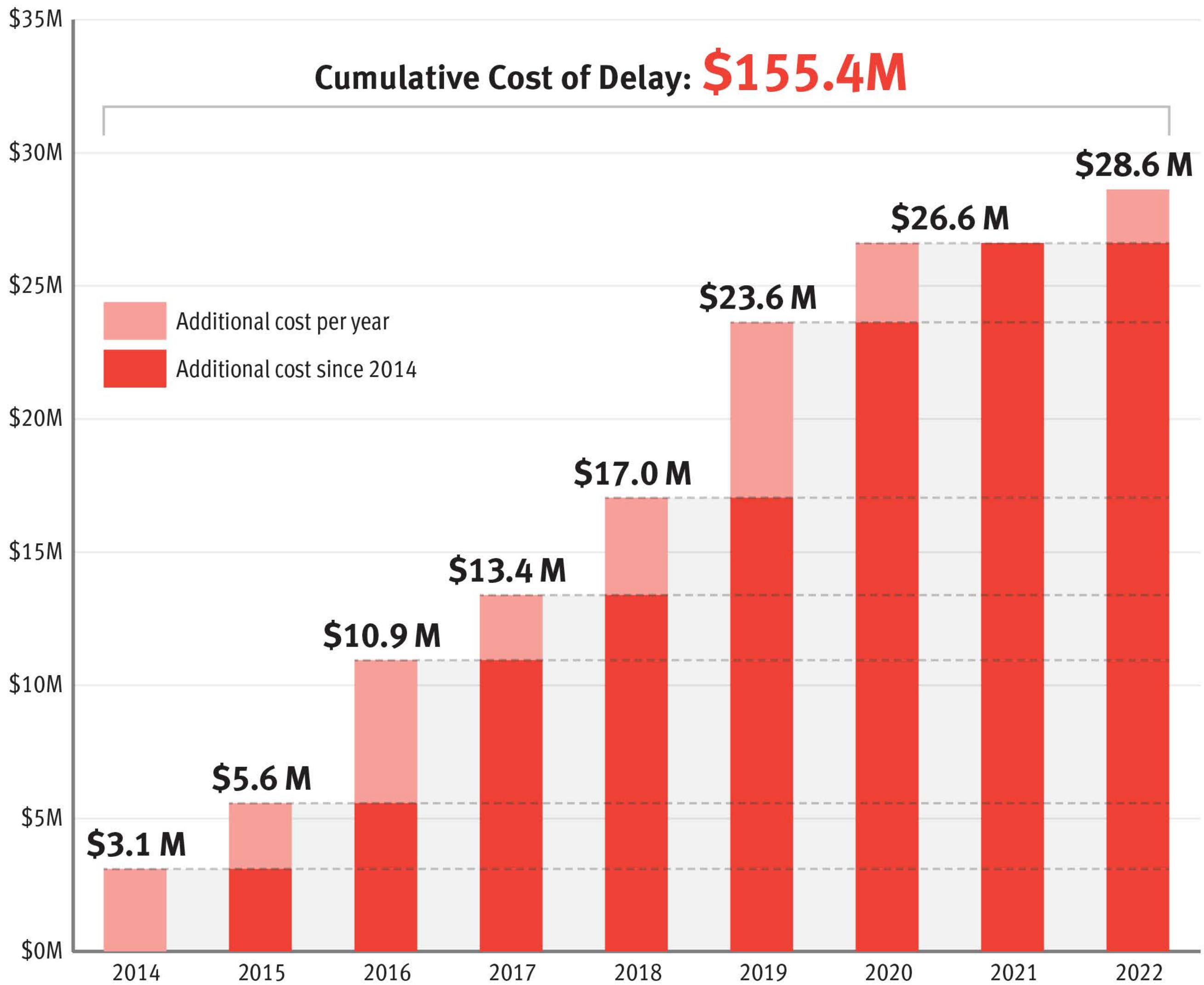
Each year, TransLink adds over $2M of service to offset the impacts of traffic.

In the face of growing roadway congestion, CMBC has endeavored to maintain service levels and on-time performance by increasing the number of buses on the road. Except for one year during the pandemic, these adjustments have added $2M–$7M each year in operating costs in recent years. That's comparable to the operational cost of introducing a new RapidBus route every two years. In 2022, it cost $28.6 million to counter delays from increased traffic relative to 2014 levels. The cumulative cost from 2014 to 2022 is $155.4 million.

Bus delay is back to the same levels as before the pandemic.

Although pandemic restrictions and remote working policies have shifted travel patterns, overall bus-delay is at the same levels, or worse than before COVID-19. Buses did run faster for a brief period in Metro Vancouver in the spring of 2020 (see "Buses freed from congestion are faster and more reliable." on page 26). But by fall 2021, the total hours of bus-delay on weekdays were the same as those just before the pandemic (in fall 2019), and exceeded those in fall 2018 by about 3%.

Change in Annual Operating Costs due to Schedule Maintenance, 2014–2022



Note: Costs due to bus delay increased in all years except 2021, during the pandemic.

Part 3: Planning and Delivering Projects

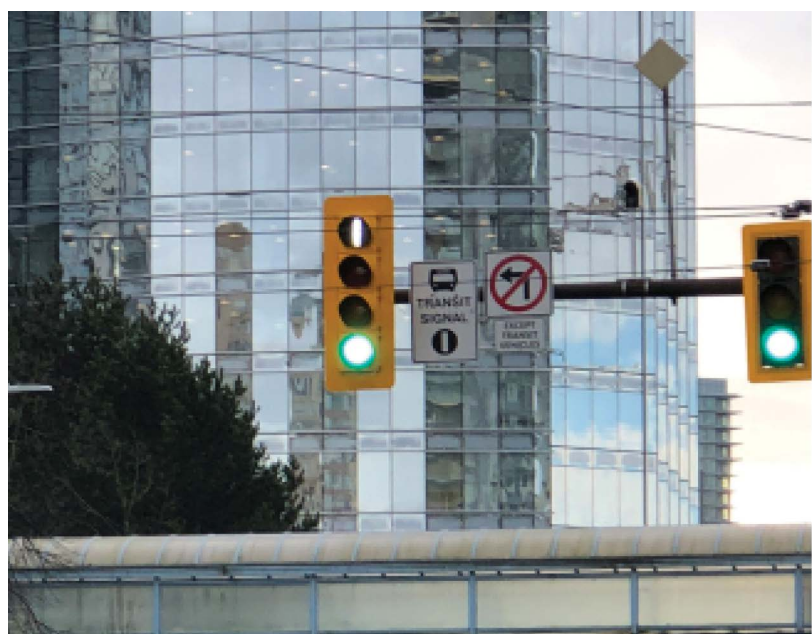
High quality transit takes a regional effort

There are many tools to improve the speed and reliability of bus service.

These interventions range from dedicated bus-only lanes that separate buses from congestion, to fare-payment policies that allow customers to board and alight more quickly. Transit approach lanes and queue jumps allow buses by bypass congested intersections. Turn pockets can move private vehicles out of the bus's path. Bus stops can be removed, or shifted out from the curb, in order to reduce the time buses spend merging; and traffic signals can be designed to recognize and prioritize bus movements. (See the "Bus Priority Infrastructure" portion of this report, starting on page 43, for more discussion about these bus priority measures.)

TransLink has developed a Transit Priority Toolkit (see next page) that provides examples of bus priority measures and the challenges they address. These tools vary in terms of cost, effectiveness, complexity, and visibility.

Bus lane on Georgia Street.



Bus-only signal at Metrotown.

TransLink Transit Priority Toolkit

STRATEGY	CONGESTION		DELAY			OPERATIONS				SAFETY			COST/COORDINATION	
	SPECIFIC CHALLENGES													
	INTERSECTION	ROADWAY	SIGNAL	RIGHT TURN	LEFT TURN	ACCESS TO BUS STOP	LEAVING BUS STOP	DWELL TIME	INSUFFICIENT RUNNING TIME	PEDESTRIANS	CYCLISTS	MOTORISTS		
A. Bus Stop and Curb Management														
A1. Bus Stop Placement	★		★			★★★	★★	★	★	★★	★★		$–$$	Medium/ High
A2. Curb Management		★				★★	★	★		★	★	★	$–$$	Medium
B. Traffic Regulations														
B1. Movement Restrictions	★★★		★	★★★	★★★		★★		★★	★	★	★★	$–$$$$	Medium/ High
C. Street Design														
C1. Bus Stop Infrastucture						★★	★★	★★★		★★★	★★★		$–$$$	Low
C2. Turn Pockets	★		★★	★	★							★★	$–$$	Medium
C3. Vertical Control Devices		★★★				★★	★		★★	★★★	★★★	★	$	Medium
C4. Queue Jumps	★★★		★★★						★★				$–$$	Medium
C5. Transit Approach Lane	★★★		★★★						★★				$	Medium
C6. Peak-Hour Bus Lane	★★	★★		★★	★★	★★	★★	★★	★★★		★	★★	$$–$$$$	High
C7. Dedicated Bus Lane	★★★	★★★		★★★	★★★	★★★	★★★	★★★	★★★		★	★★	$$–$$$$	High
D. Signal Priority														
D1. Passive Signal Priority	★★	★	★★						★★	★	★	★★	$–$$	Medium
D2. Transit Signal Priority (Active)	★★★		★★★	★★★	★★★				★★★				$$–$$$$	High
E. TransLink Practices and Policy														
E1. All-Door Boarding								★★★	★★	★				Low
E2. Schedule/Operator Recovery									★★★					Low

Cost legend:
- $ UNDER $50K
- $$ $50,000 - $100K
- $$$ $100,000 - $250K
- $$$$ OVER $250K

Benefits: ★ LOW ★★ MEDIUM ★★★ HIGH

The tools for improving bus speed & reliability are controlled by different authorities.

In Metro Vancouver, no single entity controls all the interventions that improve bus performance. Making transit better therefore is a shared responsibility between TransLink, CMBC, municipalities, and the BC Ministry of Transportation and Infrastructure (BC MOTI).

TransLink has control or direct influence over operating considerations such boarding and fare payment policies, route design, and service frequency. Coast Mountain Bus Company (CMBC), a subsidiary of TransLink, operates the bus fleet and manages the schedules.

Municipalities and BC MOTI own the roadway and control traffic signals. This means they have ultimate authority over changes to the right of way, such as the addition of bus lanes, the management of parking, and the programming of traffic signals.

TransLink, the municipalities, and BC MOTI share responsibility for many interventions. For example, if TransLink wishes to move a bus stop—or modify its design—municipalities must approve the change, which occurs on their property.

Private property owners and municipalities also share control over parts of the roadway. These include street patios, the addition of which can impact bus operations.

The table below illustrates what TransLink has control over in the right-of-way and what is controlled by municipalities, MOTI, and private property owners—or is a shared responsibility.

TransLink Control	TransLink and Municipality Control	Municipality and MOTI Control		Municipality and Property Owner Control
Operations	**Bus Stops**	**Travel Lanes**	**Intersections**	**Public Realm**
Boarding policy (e.g., all-door boarding)	Stop relocation or consolidation	Bus lanes	Turn and movement restrictions	Street patios
Route design	Bus platform design	Transit approach lane	Transit signal priority	Connecting shuttles or bike share
Bus fleet size and type	Bus bulbs	Queue jump	Turn lanes and pockets	
Frequency and hours of service	Boarding islands	Roadway channelization		
		Parking restrictions		

Multi-agency partnerships are required for progress on bus priority.

Although bus priority improvement projects can be done cost-effectively and quickly, they are not always easy to accomplish, in part due to their multiagency nature. No agency can successfully deliver these projects alone. In additional to having different authorities over road-space, each offers unique skills, perspectives, and resources.

TransLink has staff with expertise in transit operations and design. They can identify causes of delay and propose potential solutions. TransLink also provides funding resources to municipalities to design and deliver projects.

Municipalities and BC MOTI have staff with expertise in transportation engineering and traffic signal operation and design. They can also identify causes of delay and potential solutions. But they also bring local knowledge of conditions, including previous and planned initiatives, and they have the ability to integrate bus priority elements into already-planned roadway maintenance and upgrade projects.

In recent years TransLink, BC MOTI, and some Metro Vancouver municipalities have ramped up their efforts to improve bus performance, in support of regional and provincial goals. That collaboration has been aided by the launch of the RapidBus brand of service, which focused new transit priority measures along some of the highest ridership corridors in the region. In parallel TransLink has also dedicated funding for the BSR Program—nearly $15 million between 2019 and 2022. (See "Regional Investments in Bus Priority" on page 33.) This has been supported by the development of new data analytics and visualizations that support analysis of existing bus delay.

A recent collaborative speed & reliabilty project on Edmonds at Kingsway in Burnaby.

The launch of new RapidBus routes requires close coordination between TransLink, municipalities, and BC MOTI.

OVERCOMING COMMON CHALLENGES TO FAST, RELIABLE BUS SERVICE

Most municipalities and BC MOTI face similar challenges to providing fast, reliable bus service.

Although each city has unique characteristics, they all must balance competing demands on public roadways and sidewalks. In addition to transit vehicles, roads must also accommodate personal cars, taxis, goods movement and delivery trucks, emergency services, bicycles, and pedestrians. Similarly regional authorities like BC MOTI must balance competing demands for the space on provincially managed highways.

Sometimes bus priority improvements have benefits to other users of the roadway, such as widening projects that add bus or HOV lanes. But, in general, the most impactful and inexpensive interventions are the most politically sensitive—because they require an explicit trade-off between users of the roadway. For example, converting general travel lanes or parking lanes into bus lanes is a fast, effective, and low-cost way to improve bus service. However, it can be challenging to reallocate space—or time in the traffic signal cycle—from one user to another, especially when changes are subject to public comment or approval from the City Council.

In particular, major corridors often serve many different modes of travel at once, notably buses, cycling, and goods movement. Along these, multiple goals must be balanced, and the impact on overall people-moving capacity of the road should be considered.

Many cities have been successful at providing fast, reliable bus service.

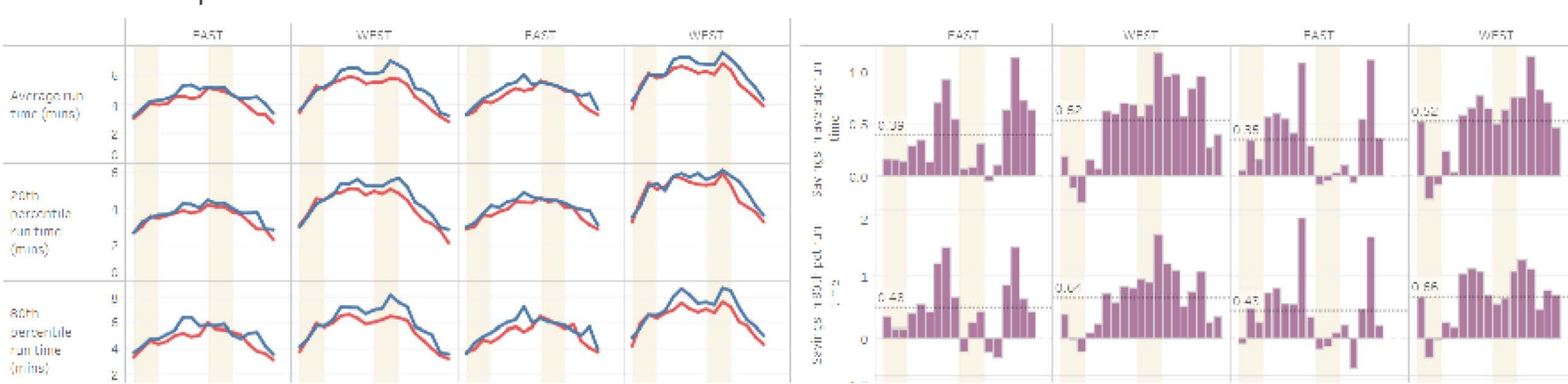
Fortunately many cities across the globe, including several in Metro Vancouver, have successfully reallocated road space. Many of these efforts were accelerated during the pandemic, when very low levels of traffic prompted a unique opportunity to rethink priorities.

Road reallocations to support transit are often done in recognition of the fact that transit riders already make up a major share of the people moving through major corridors. But many cities have made changes to encourage mode shifts in the future. For example, most cities have some experience reallocating road space to provide safer facilities for cycling or walking. The same can be done to protect people on transit from congestion.

Data helps leaders make more informed decisions about trade-offs.

As the manager of Metro Vancouver's integrated regional transit network, TransLink has enormous amounts of data to identify where, when, and by how much buses are slowed down. In tandem, municipal and provincial agencies have information about traffic volumes, and other roadway activity such as parking usage. Using this data to develop analytics and visualizations on bus delays, traffic conditions, and parking have helped municipal and provincial leaders make informed decisions and balance competing needs.

Example of TransLink Data Used to Make Informed Decisions



It is possible to achieve shared goals with businesses.

Improving and promoting transit supports local businesses. Locations with convenient access to good public transport are more valuable,[23] and improving transit access to business districts increases the customer base.[24] Notably, employees who commute by transit are also interested in shopping without going home to get their car, and tourists and visitors often don't have one at all.

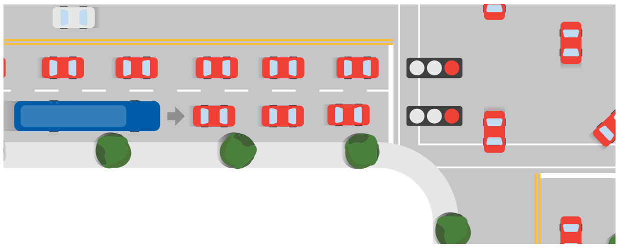
Examples from several Canadian and US cities found that transit brings new and existing customers, who then spend more time in shops and businesses.

- **Toronto, ON:** 76% of people surveyed felt that "complete street" installations that supported bus access in Summer 2021 helped local businesses, and 31% of respondents visited the area more often.[25]
- **San Francisco, CA:** An intercept survey on Mission Street showed that 60% of people arrived by transit. Transit riders also spent more than those who arrived by other modes such as walking, biking, driving, or ride share.[26]
- **Seattle, WA:** An intercept survey in downtown Seattle found that workers who take transit are also much more likely to spend more time in the neighbourhood to shop or eat, spending more than triple that of car commuters.[27]

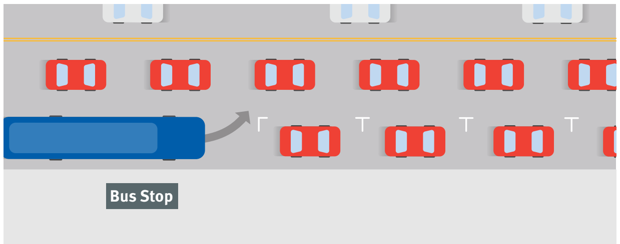
OUR APPROACH TO IDENTIFYING NEEDS

What causes delay?

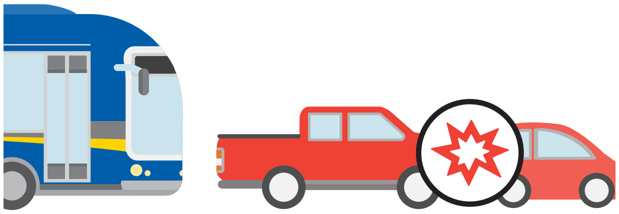
Traffic congestion delays all road users. Buses and cars alike are stuck in traffic. Some of this time is built into bus schedules.



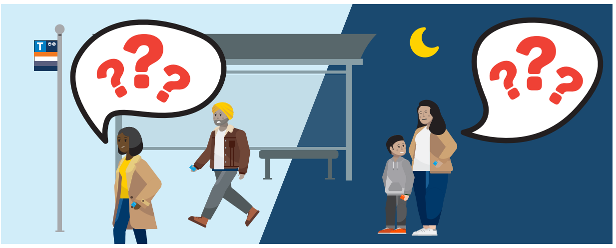
As traffic congestion increases, buses spend more time moving and waiting at red lights. It takes longer for people on the bus to get where they want to go.



Buses must slow down and speed up for each stop, and on some streets, merge back into traffic. Buses also take longer to accelerate and decelerate than cars. When bus stops are too close together, it makes the bus slower.



When traffic is heavy it can be more difficult for bus operators to find safe gaps to change lanes. Incidents like crashes or construction can also cause heavier than normal traffic but can be hard to plan for.



When congestion varies from day to day or from one time of day to another, it makes taking the bus unpredictable.

Data from TransLink buses are used to quantify delay across the region.

This report uses TransLink's bus performance and passenger delay data from across the region to aid the discussion within municipal and provincial agencies and with the public about where bus priority improvements may be most beneficial.

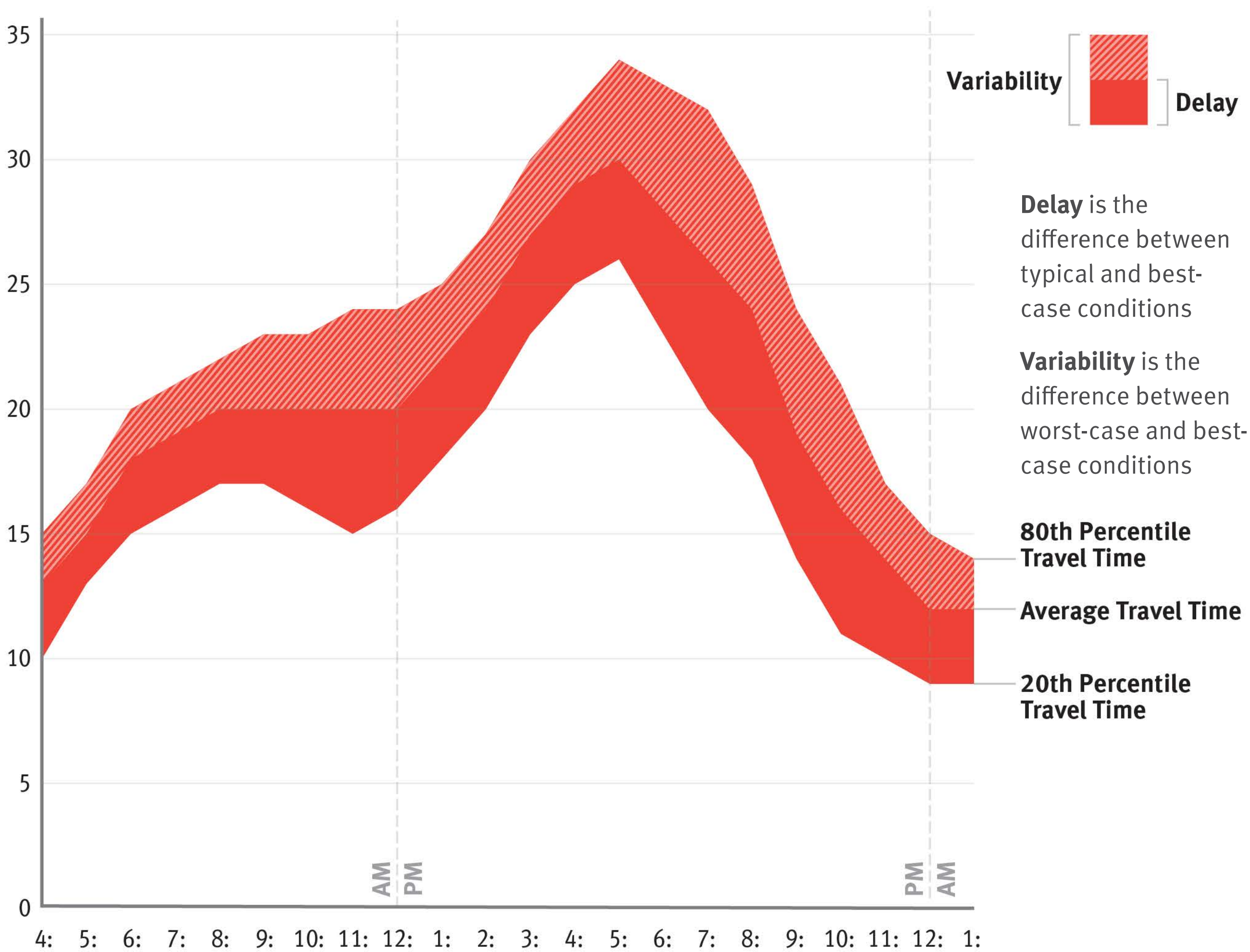
TransLink collects multiple sources of data from buses, from GPS units that track their movement to automated passenger counters (APCs) and Compass card readers that track passenger activity. From these data sources we calculate measures of bus performance due to road congestion.

This report generally focuses on the time buses spend traveling between bus stops. This is approximately 80-85% of the time between the start and the end of a route. Importantly, it excludes the time spent picking up and dropping off passengers, which can be affected by ridership levels.

"Delay" is the key metric for this report. It's defined as the difference between an average and optimal (fastest 20%) trip on the bus. It can be seen as the additional time it takes the bus to make a trip on a typical day, compared to the best day of the week.

"Variability" is another useful metric, to evaluate the reliability of bus service. It's defined as the difference between the worst case (slowest 20%) and optimal (fastest 20%) trips. This can be seen as amount of additional travel time a transit customer must plan into their schedule, due to road congestion.

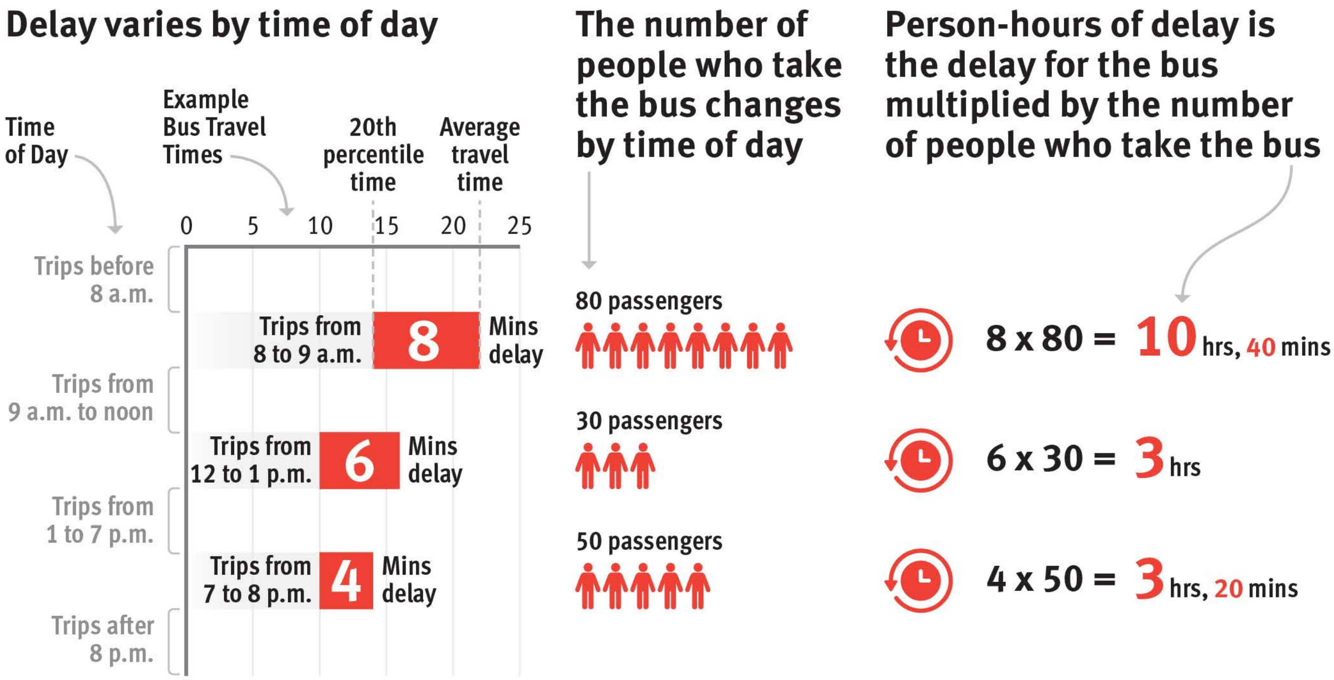
Conceptual Illustration of Delay and Variability



Customer-focused metrics like "person-hours of delay" identify areas of greatest need.

TransLink can calculate the amount of time our customers spend delayed by traffic. This highlights parts of the bus network where delay is impacting the most riders, helping to prioritize investments in bus priority where they will benefit the greatest number of people.

Calculation of Person-Hours of Delay



Note: Person-delay is calculated for each bus trip in a service period based on the number of people on board. Data are summarized by hour and totaled for the full day.

Measures of "bus delay" help to evaluate trends.

Measures of bus performance that are not weighted by passenger loads are still useful. These highlight areas where road congestion is incurring the greatest costs on TransLink's operations. They also help to reveal trends across the region and over time, independent of differences in ridership. This is particularly useful after the COVID-19 pandemic, which has had significant impacts on ridership.

Lessons from the Pandemic

Buses freed from congestion are faster and more reliable.

In the early days of the COVID-19 pandemic—when lockdown orders were most stringent—general purpose traffic fell significantly. This period provides a glimpse of how much faster and more reliable buses can be when they're not stuck in traffic.

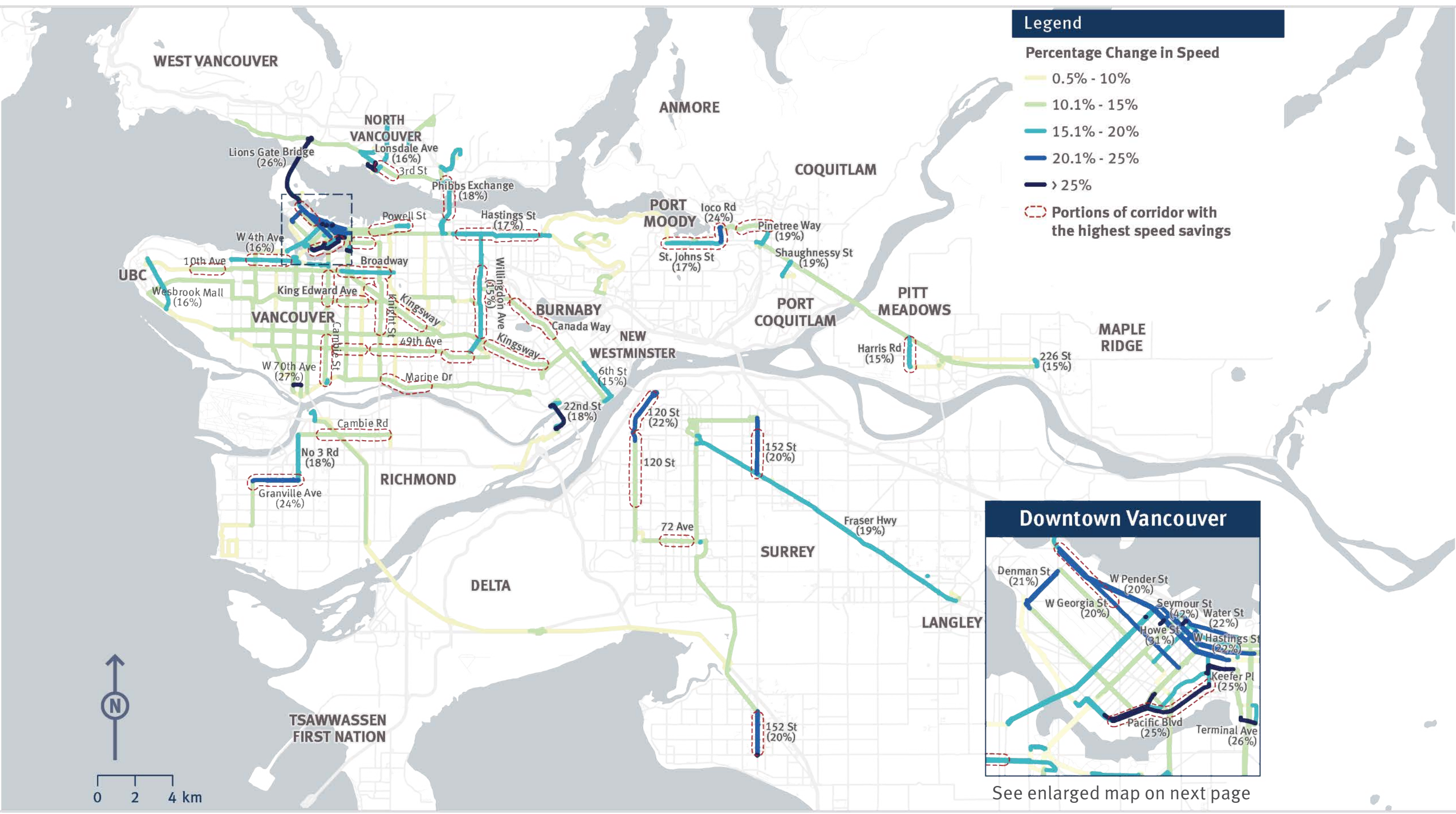
Between February 2020 and April 2020, bus performance improved as follows:

- 14% faster system-wide speed, on average. Some routes saw 15% to 20% increases in end-to-end speed, with some sections increasing more than 25%.
- 34% reduction in system-wide delay, with some routes experiencing 50% to 75% reductions.

For example, a trip from Metrotown Station to UBC using 49th Avenue was both faster and more reliable (less variable). A trip that had taken between 36 and 62 minutes during the PM peak, was taking 32 and 50 minutes when buses could move more freely.[28] An average trip increased from 25 km/hour to 30 km/hour, and weekday delay fell from 13 minutes to 9 minutes.

The following map highlights where bus service improved the most during the early months of the pandemic.[29] Over 90% of the Frequent Transit Network saw an increase in speed between the two months; 35% of the Frequent Transit Network saw an increase in 5 km/hour or more, much of it happening along major corridors.

Change in Bus Speed for Frequent Network, February to April, 2020



See enlarged map on next page

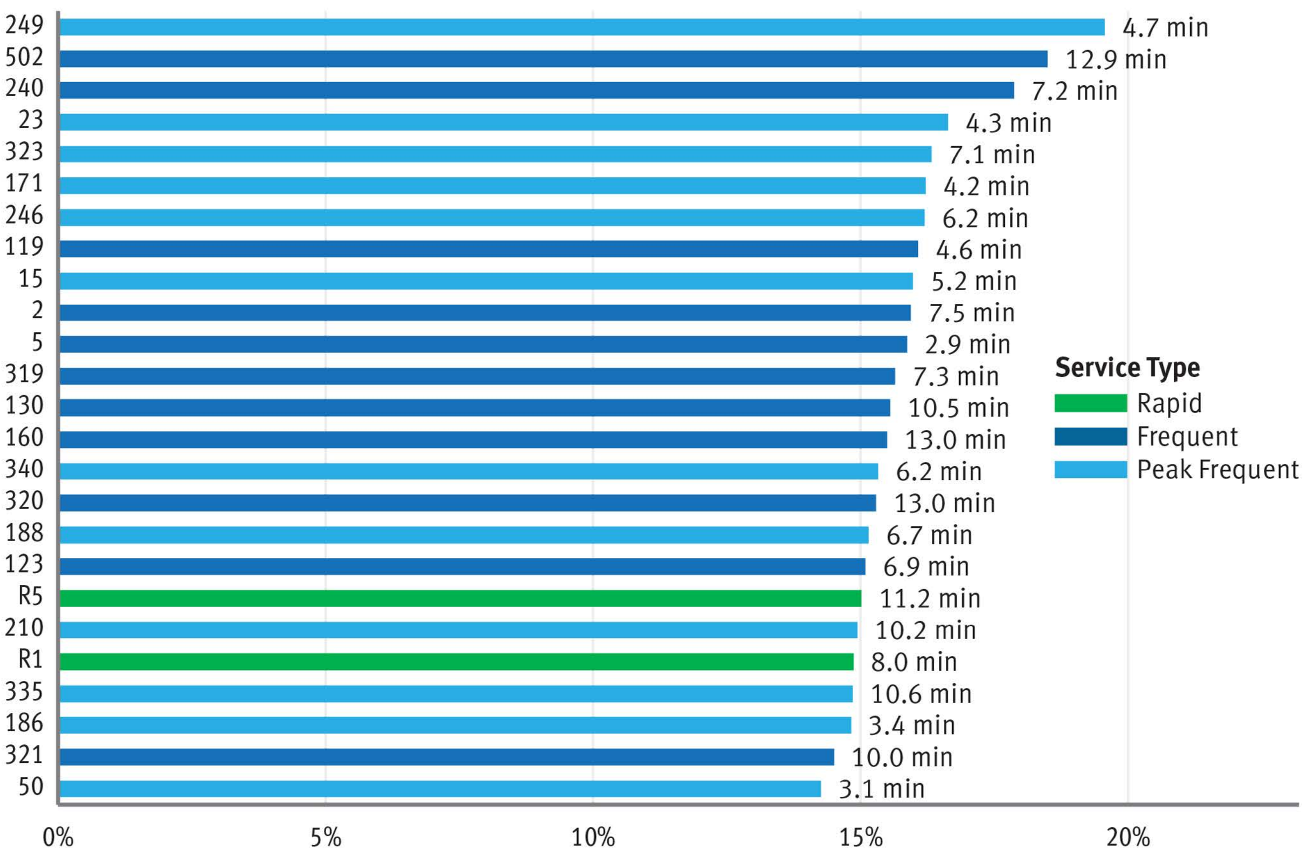
As a percentage, buses improved the most in downtown areas—especially downtown Vancouver—which are also destinations for the kind of work commutes and shopping trips that were most impacted by early pandemic restrictions. In absolute terms, sections of major arterials such as Lions Gate Bridge, Trans-Canada Hwy, Hwy 99, Fraser Hwy, and Lougheed Hwy and streets such as Hastings St., Kingsway, SE Marine Dr., Granville Ave., and Scott Rd., increased in speed by over 10 km/hour. Likewise, these are key corridors for work commutes and shopping trips.

The chart below shows the savings for the routes that improved the most.

If these temporary improvements were made permanent via bus priority measures, TransLink could save over 500 hours per weekday and reduce the number of buses needed to run frequent routes by more than 60.[30]

Change in Bus Speed in Downtown Vancouver, February to April, 2020

Travel Time Savings for the Routes that Saved the Most Time, April vs February 2020 (Top 25 based on Percent Savings)

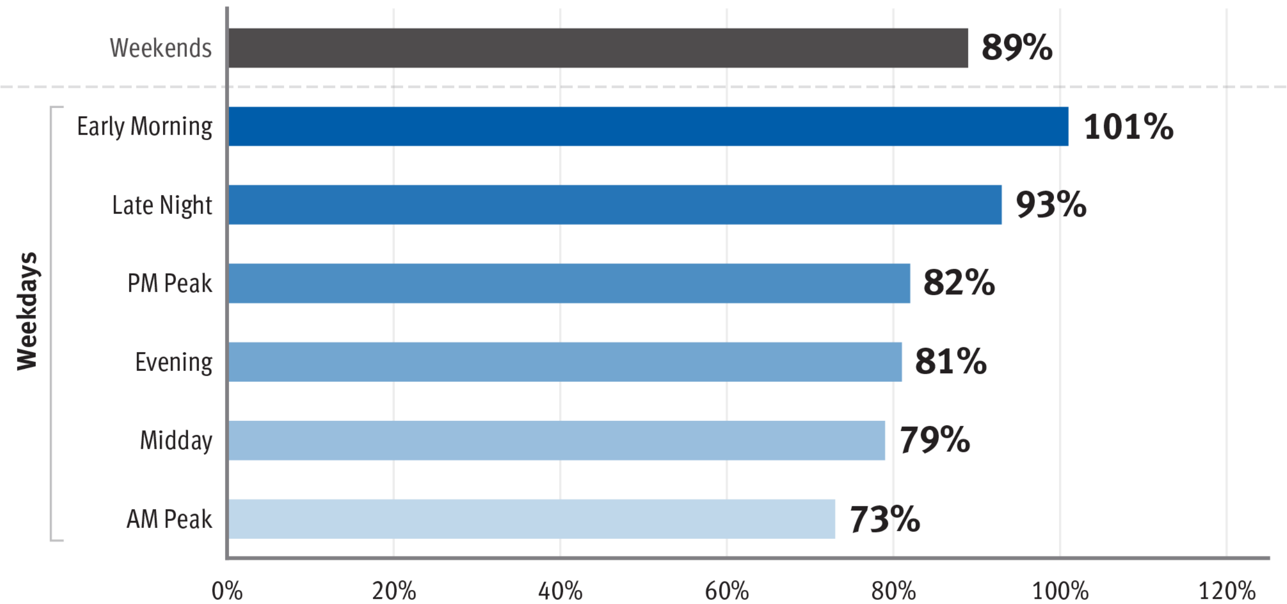


Off-peak person-delay has become relatively more important.

As ridership has returned from pandemic-lows, it is still highest at weekday rush hour peaks—a similar pattern as before.[31] However, ridership has not returned evenly throughout the week, increasing relatively more on the weekends, early mornings, and late nights. As a result person-delay is also relatively more important during these "off-peak" times.

This may be because work-from-home policies have reduced the number of traditional commute trips, while errands and off-peak commutes have still continued. Regardless, this trend suggests that peak-only transit priority measures (such as AM peak-hour bus lanes) have also become relatively less valuable than all-day or 24-7 measures.

Percent Recovery in Person-Hours of Delay, November 2022 vs November 2019



Addressing Social Equity

There are different frameworks for addressing social equity, an increasingly important consideration.

Unfortunately the pandemic worsened, and brought new attention to, many social inequities—due to both lingering historical injustices and rising economic inequality.

Public transportation has an important role to play in mitigating these inequities. It provides affordable access to all, including those who are unable to drive due to age, disability, or limited resources. And bus service in particular—which extends more broadly throughout the region than ferries or rail lines – can provide access for historically disadvantaged ethnic groups and neighbourhoods.

Improvements to bus speed and reliability can therefore bring improvements in access for equity-seeking groups. There are many different "equity lens" that could be adopted to prioritize projects, but three are discussed here:

- **"Transit need"**
- **"Essential trips"**
- **"Location-based demographics"** such as neighbourhoods with relatively higher low-income and visible-minority populations

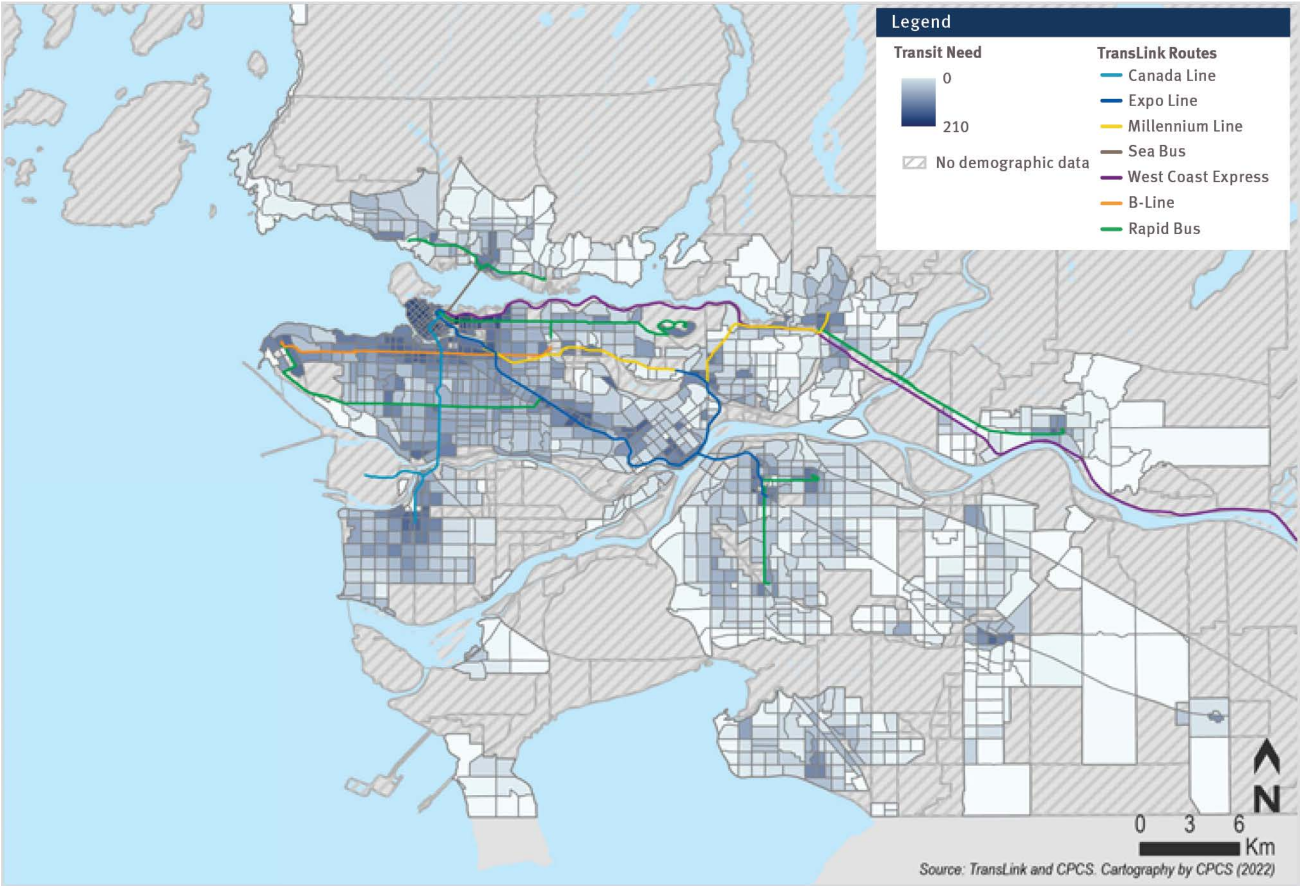
Transit Need

It is possible to identify areas where people are most likely to be reliant on transit. The map below illustrates "transit need" based on a combination of:

- Overall population density
- Percentage of the population that is low-income
- Percentage of households who do not own a car

Although this is not a precise indicator, places where a large number of people cannot afford a car are impacted more by bus delay.

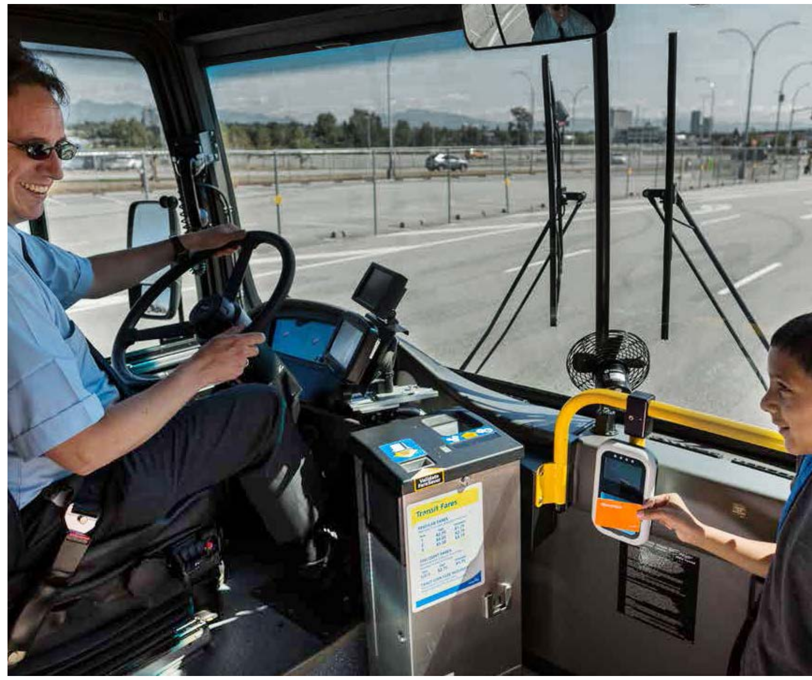
Index of Transit Need by Traffic Analysis Zone (TAZ), 2017



Source: TransLink and CPCS

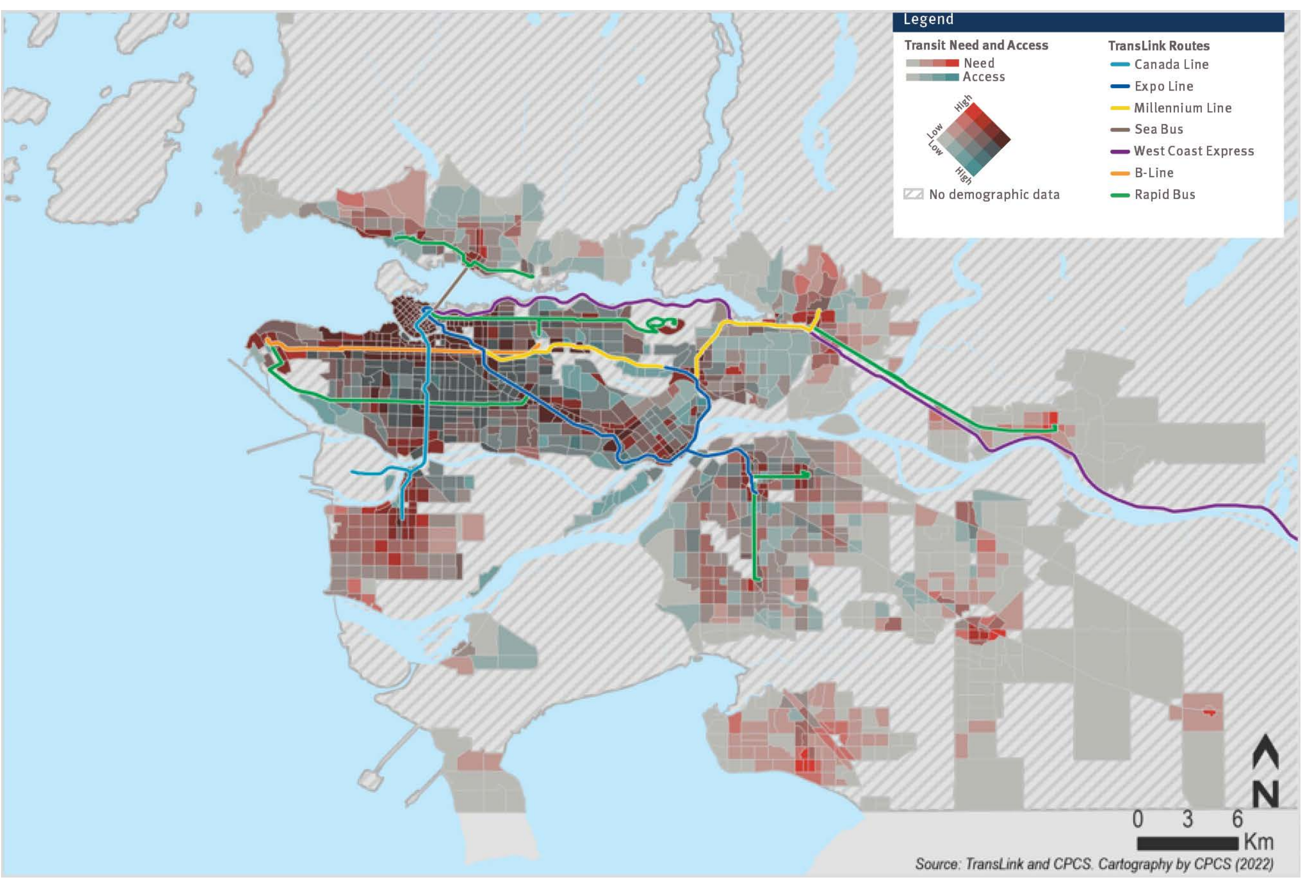
Transit Need and Access

Locations with high transit need—and where transit service is also limited—should be particularly important targets for new investments in transit. The map below overlays the data from the first map with an analysis of "transit access" to jobs and other destinations. This is based on the number of destinations people can reach in a given time, based on TransLink's regional transportation model. Areas with high need and low access (coloured bright red) are where people are more likely to both rely on transit, and to be poorly served by it.



These areas will most benefit from investments in new transit lines or increases in the frequency of existing service—to make transit more useful. However, improving the speed & reliability of bus routes can also play a role, by allowing customers to access more destinations in the same amount of time.

Index of Transit Need and Access by Traffic Analysis Zone (TAZ), 2017



Source: TransLink and CPCS

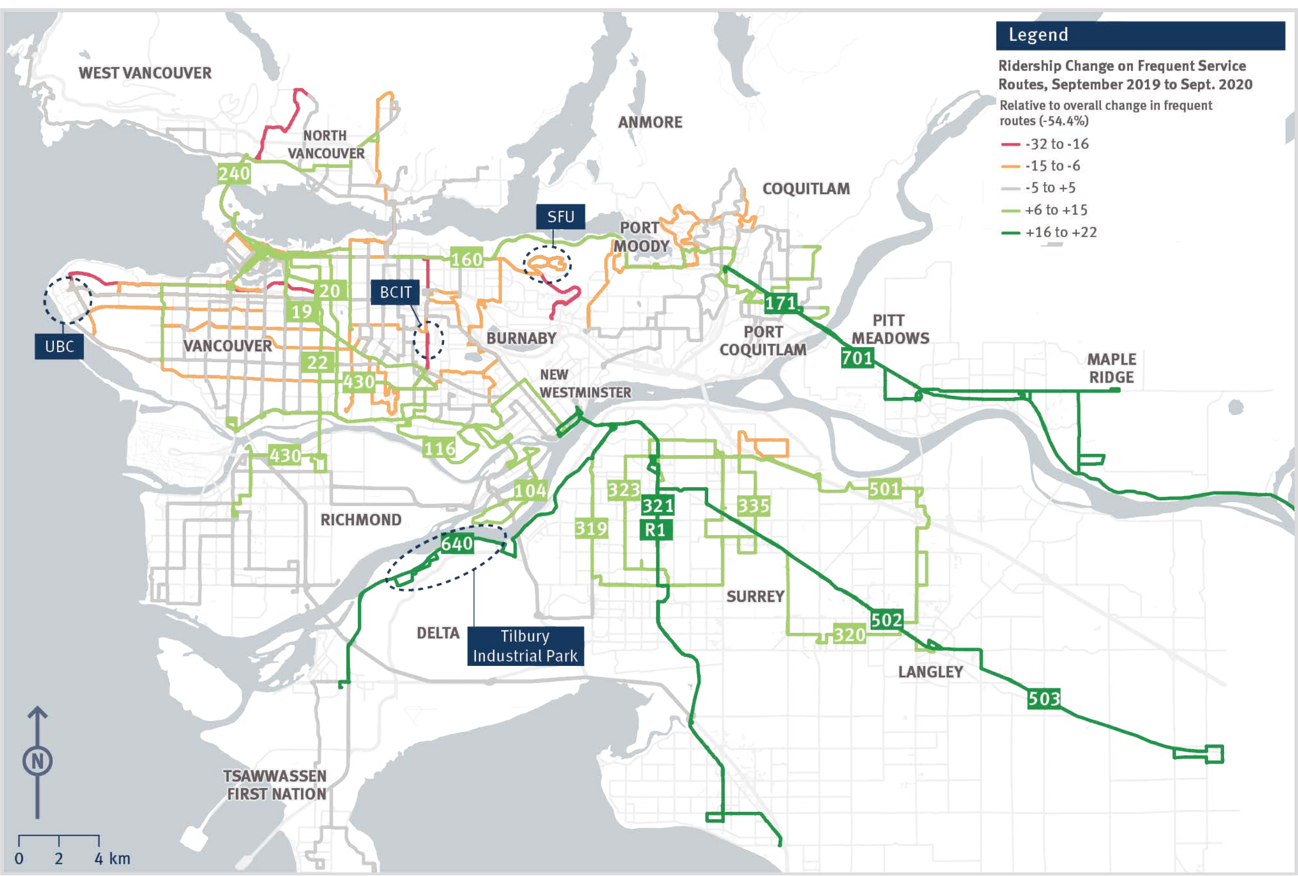
Essential Trips

The pandemic provided another way to identify where Metro Vancouver residents are most reliant on transit service. When stay-at-home orders were issued in the spring of 2020, ridership dropped sharply—by nearly 55%.[32] Those who continued to ride were largely making essential trips, to get to work, to take care of relatives, or to access healthcare and other services. Corridors where bus ridership fell the least can be seen as areas where investments in bus speed & reliability would improve access for people with the fewest alternatives, reducing transportation inequities.

Comparing September 2019—before the pandemic—with September 2020, ridership on TransLink's frequent routes dropped by approximately 54% on weekdays. The map below shows that all lines lost ridership, but the changes were not consistent.

- Ridership increased or stayed the same in areas outside the regional core of Vancouver and Burnaby, notably south of the Fraser River (in Surrey, Delta, and Langley), and east of Port Coquitlam. While some of this ridership retention can be attributed to the introduction of new service, it still reveals how many people relied on bus service during the pandemic.
- Industrial areas—important locations for warehousing and freight distribution—also saw relatively higher ridership. These jobs remained important during the pandemic, but they are less amenable to working-from-home. The southeast industrial, warehouse, and distribution sectors stand out relative to the region.

Change in Bus Ridership on Frequent Routes, September 2019 to September 2020



Demographics

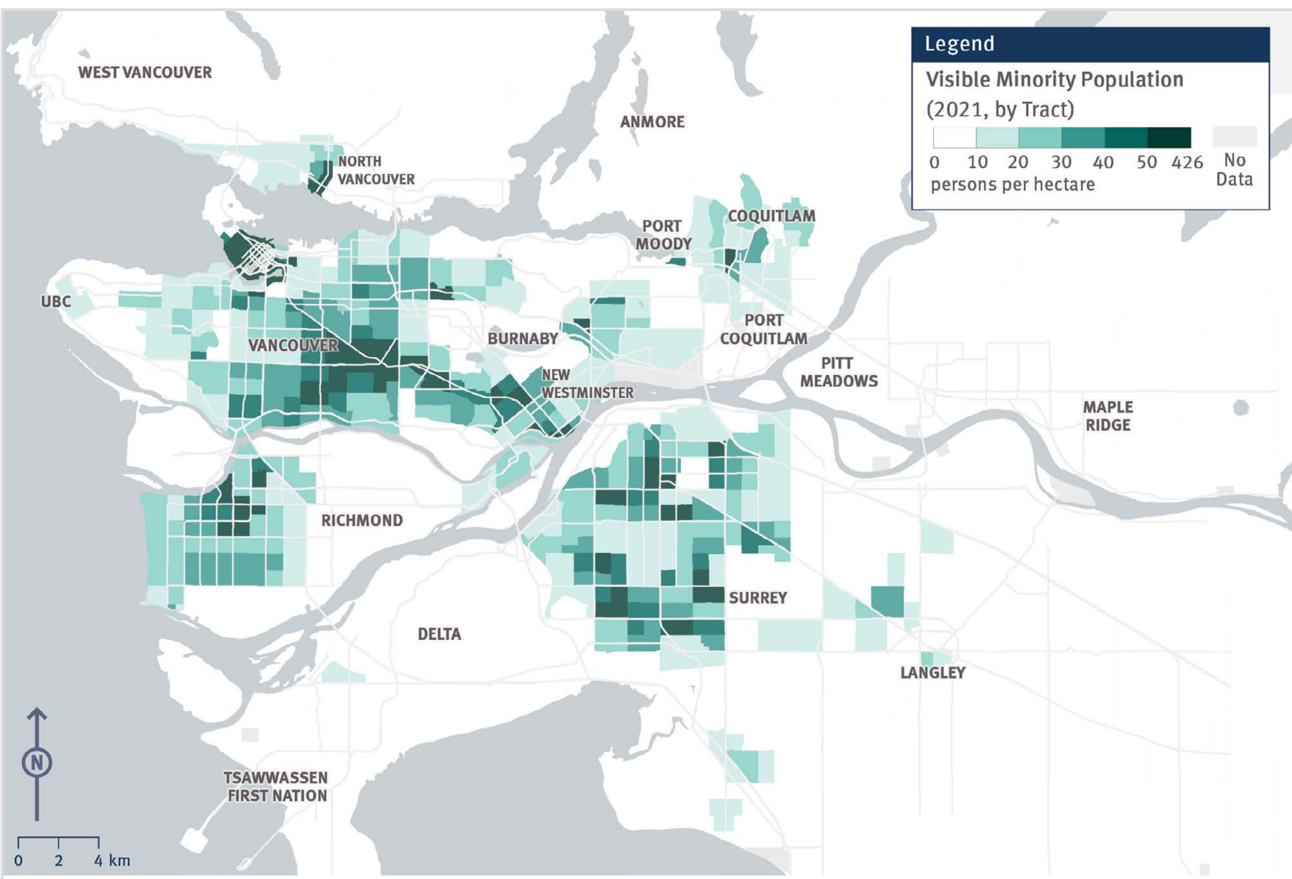
A range of other demographic characteristics can also be used to indicate where to target inequity-reducing transit investments. People who are too young or old to drive, for example, need transit to ensure their access to the region; and neighbourhoods with a high concentration of minority ethnicities may have historically received less public investment—either because of overt racial prejudice or because they have not been included in political processes. People who do not speak English, for example, may not be heard by decision makers. In the United States, Title VI of the Civil Rights Act requires transit agencies to demonstrate that any major changes in service do not discriminate based on race, colour, or national origin.

An "intersectional" approach tries to account for the exacerbated inequity faced by people in multiple disadvantaged groups. The following is a list of these groups, for which there is Canadian Census data available, and which the City of Vancouver has included in developing a metric for Disproportionately Impacted Communities:

- Seniors (people aged 65+)
- Indigenous people
- Visible minorities
- Single-parent households
- People with limited knowledge of English
- Rent-burdened households (30%+ of income)
- Median household income
- Recent immigrants
- Youth under 14

Unfortunately, there is complexity in ensuring that demographic data is intersected in a meaningful way, and that each factor is appropriately weighted. The following map shows just one of these demographic characteristics, which was not included in the "transit need" analysis above: the share of visible minorities by census tract.

Visible Minority Population (Census Tract), 2021



Data Source: Statistics Canada (via CensusMapper.ca)

REGIONAL INVESTMENTS IN BUS PRIORITY

Faster and more reliable bus service is a keystone of the region's growth.

Metro Vancouver's regional transportation strategy—Transport 2050—aims to put transit within a short walk of most homes and jobs. This goal is to be achieved by quadrupling the size of the rapid transit network from 100 to 400 kilometres—relying in large part on buses. Enhancements to the bus network can be quicker and more cost-effective than other approaches, and these investments will build on TransLink's previous efforts to provide high quality bus service across the region.

The RapidBus Program is a new brand of faster and more reliable service.

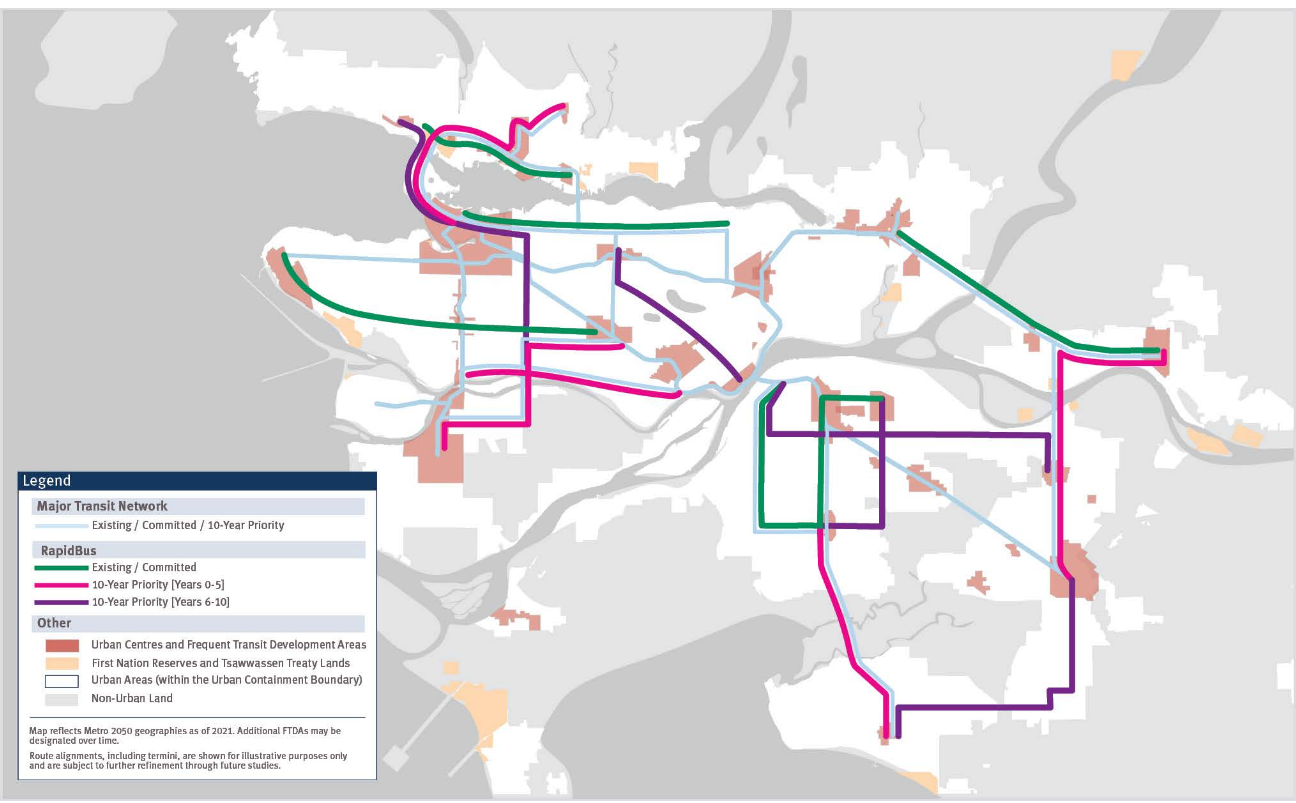
In 2020, TransLink launched a new brand of service—"RapidBus"—along five corridors. RapidBus aims to be 20% faster than local buses—via fewer stops, all-door boarding, and extensive bus priority. All five of the new RapidBus lines have achieved the program's goal of having bus priority measures such as bus lanes, transit approach lanes, and queue jumps on at least one-third of each corridor.

Upcoming expansions to RapidBus service are already planned:

- The **6th RapidBus (R6)** is on track to launch in 2023, with bus priority measures on approximately 36% of the 72 Ave/Scott Road corridor.
- A **further 11 new RapidBus lines** are prioritized for the first 10 years of Transport 2050, with five lines proposed in the next five years.[33]

An additional **7 new Express bus routes** are prioritized as well. Also supported by extensive transit priority, these will provide connections over longer distances.

Existing (and Planned) RapidBus Routes



Source: Transport 2050: 10-Year Priorities (RapidBus)

Bus Rapid Transit corridors will become increasingly important.

Building on the success of RapidBus, Bus Rapid Transit corridors will provide even faster and more reliable service along key corridors. BRT runs along dedicated, fully traffic-separated lanes, with signal priority at intersections. While BRT requires reallocating traffic lanes to dedicated rapid transit running ways, its lower cost means that the region can bring fast, frequent, and reliable rapid transit service more quickly and affordably and to more areas than would otherwise be possible with a rail-only approach.

Up to **nine** new Bus Rapid Transit routes are prioritized for the first 10 years of Transport 2050, including several corridors also identified as future RapidBus routes. The phased implementation of these routes will be determined via a BRT Action Plan.

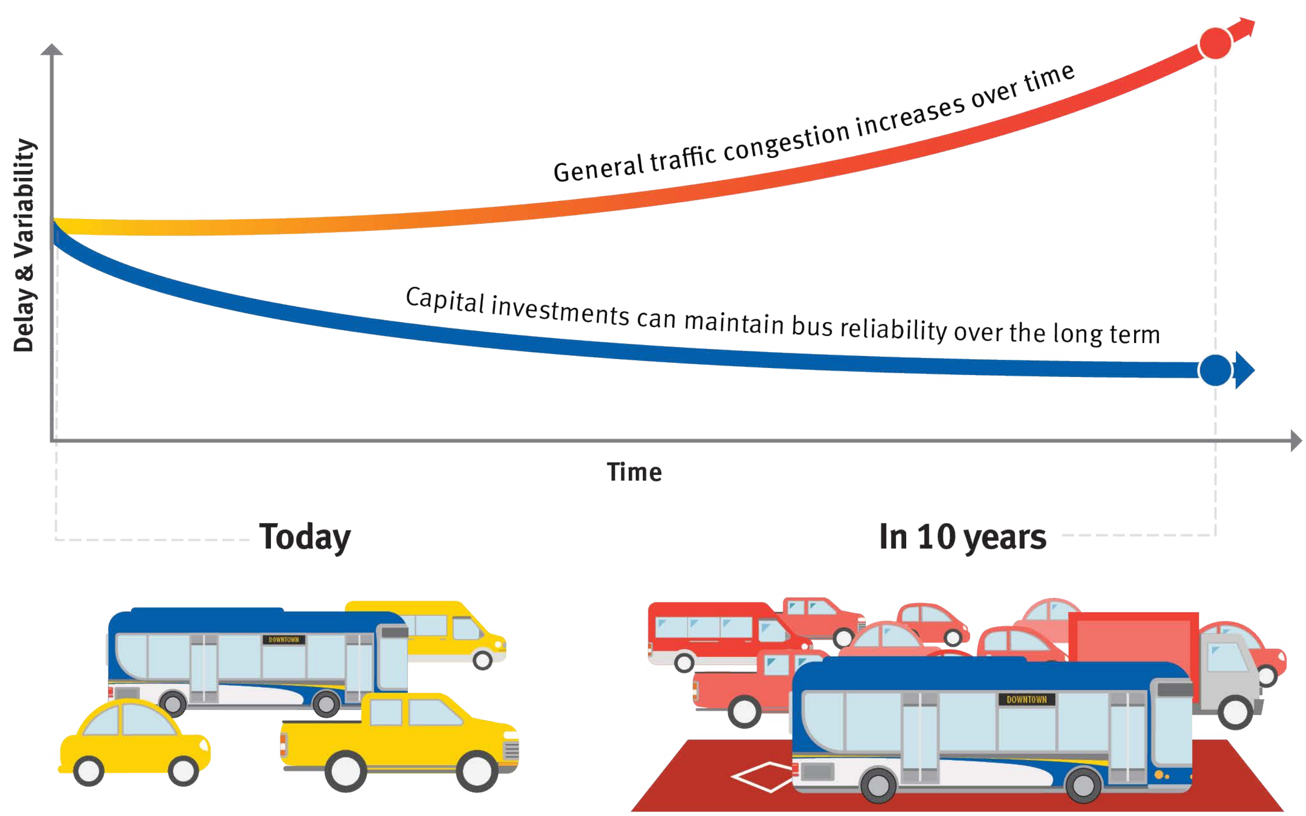
The Bus Speed & Reliability Program makes investments across the network.

TransLink's BSR Program helps improve bus performance along parts of the network that carry the most riders and experience the highest delay —regardless of whether they are future RapidBus or BRT corridors. Bus priority interventions at high delay locations can reduce travel times by 5% to 10%. These minutes add up and help improve the access available by transit.

Between 2019–2022, TransLink has worked with municipalities to identify and fund 103 bus priority projects, totaling almost $15 million. TransLink aims to expand bus priority measures to the entirety of the existing frequent bus network and up to 25% of an expanded frequent bus network.[34]

These projects will not only improve the speed and reliability of the buses running today. By investing now, we can ensure bus service remains reliable, even if traffic congestion increases in the future.

Conceptual Illustration of the Long-Term Impact of Speed and Reliability Improvements



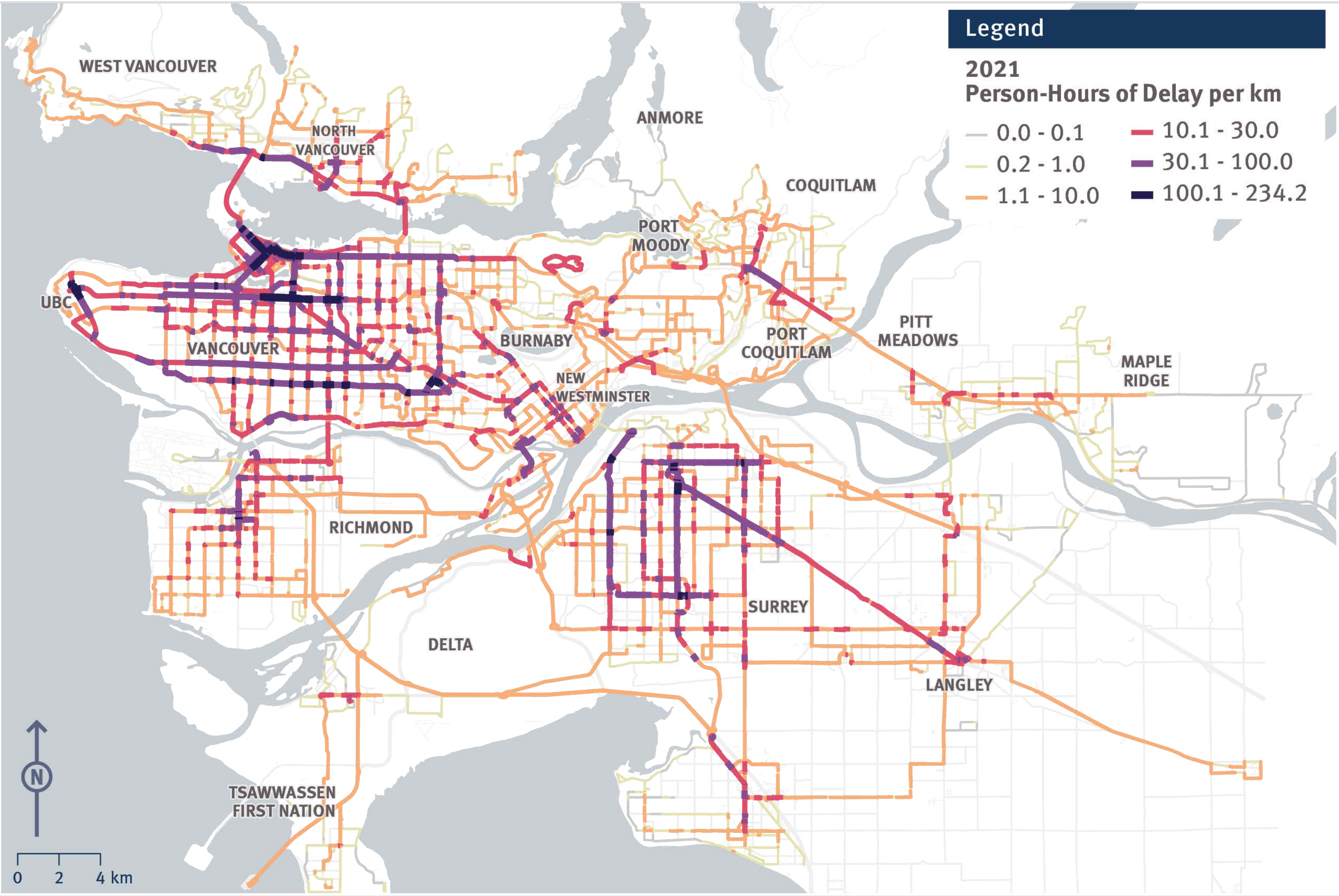
RANKED PRIORITIES

Delay exists across the region.

Despite active efforts to reduce delay for our buses, there are many locations throughout the network where bus priority solutions can be beneficial. The total amounts of delay are significant. Buses experience more than 2,400 hours of delay each weekday. Collectively, people on those buses are delayed by over 28,000 hours.

The map below shows the distribution of delay.

Person-Hours of Delay in the Region, Fall 2021

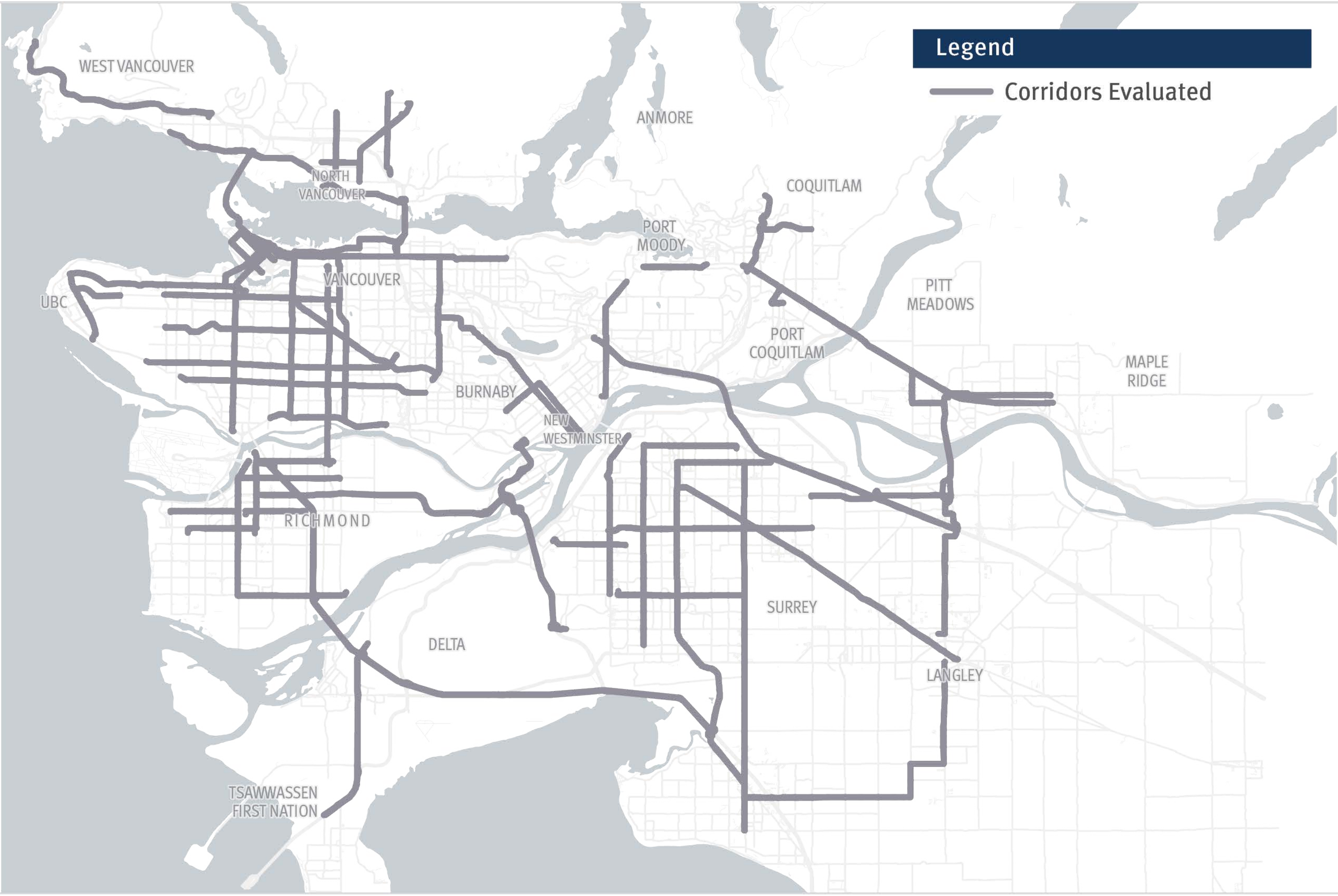


Delay is concentrated along the most congested and well-used transit corridors.

TransLink has identified over 60 corridors that are served by many of the most frequent and highest ridership routes. Nearly 60% of the person-delay in the system in fall 2021 was concentrated on these corridors, which make up only 30% of the transit network (by kilometres). Over 40% of the person-delay is concentrated on less than 10% of the network.

The map below shows the corridors identified by TransLink for further evaluation.

Map of Corridors Evaluated



The table below provides statistics for each of the corridors evaluated, which are ranked by person-delay per kilometre.

Statistics for Corridors Ranked by Person Delay per Kilometre

Corridor		Sub-Region	Primary Route(s)	Max. Hourly Buses (One Direction) [1]	Daily Person Delay (hours per km)	Rank within Region	Rank within Sub-Region	Daily Person Delay (hours)	Daily Bus Delay (hours)	Daily Person Load (One Direction) [2]	Profile Area?
	System-Wide Total							28.3K	2.4K		
1	Broadway	Vancouver/UBC	9, 99	40	89	1	1	1,500	75	11,700	Yes
2	W Georgia St	Vancouver/UBC	240, 246, 250, 257	44	78	2	2	360	25	7,800	
3	Wesbrook Mall	Vancouver/UBC	49	76	57	3	3	380	21	10,900–13,100	Yes
4	Hastings St	Vancouver/UBC	R5	47	51	4	4	1,200	96	8,000	Yes
5	49 Ave	Vancouver/UBC	49	22	48	5	5	1,140	45	5,600	Yes
6	Scott Rd	Southeast	319	26	46	6	1	770	47	6,000	
7	41 Ave	Vancouver/UBC	41, R4	33	46	7	6	1,130	57	7,300	
8	104 Ave	Southeast	R1, 320, 337	44	44	8	2	400	28	5,700–6,100	Yes
9	Burrard St	Vancouver/UBC	2	38	41	9	7	250	16	5,600	
10	Marine Dr	North Shore	R2	32	40	10	1	570	42	5,600	Yes
11	Granville St	Vancouver/UBC	10	48	36	11	8	700	55	8,400	
12	Willingdon Ave	Burnaby/ New Westminster	130	34	34	12	1	410	29	4,300–4,400	Yes
13	72 Ave	Southeast	301, 319, 322, 335	31	30	13	3	430	29	6,000–7,500	
14	Robson/Denman/ Davie	Vancouver/UBC	5, 6	19	30	14	9	250	21	2,300	
15	Pender/Powell/ Dundas/McGill	Vancouver/UBC	4, 7, 19, 22, 210	57	30	15	10	460	53	4,900	Yes
16	Main St	Vancouver/UBC	3	36	29	16	11	460	34	4,100–4,200	Yes
17	W 4 Ave	Vancouver/UBC	84	33	27	17	12	470	33	5,800–6,000	Yes
18	Kingsway	Vancouver/UBC	19	20	26	18	13	440	29	4,200	Yes
19	Edmonds St	Burnaby/New Westminster	106	16	26	19	2	120	8	3,100	
20	Fraser Hwy	Southeast	502, 503	20	26	20	4	850	58	4,300–4,400	
21	University Boulevard	Vancouver/UBC	4, 9, 14, 99	37	25	21	14	120	8	7,300	
22	No 3 Rd	Southwest	403	49	25	22	1	330	33	4,800–6,000	Yes
23	King George Blvd	Southeast	R1, 321	34	25	23	5	850	45	11,100	Yes
24	Lonsdale Ave	North Shore	229, 230, 232	20	23	24	2	180	18	2,300–2,700	Yes
25	Lions Gate Bridge	North Shore	240, 246, 250, 257	43	22	25	3	210	10	7,000–7,300	
26	SE Marine Dr	Vancouver/UBC	100	17	22	26	15	260	16	3,300	Yes
27	King Edward	Vancouver/UBC	25	17	22	27	16	370	20	3,000	Yes
28	Commercial/Victoria	Vancouver/UBC	20	29	22	28	17	350	21	2,700–8,800	
29	6 St	Burnaby/ New Westminster	106	13	21	29	3	130	11	1,700	
30	Cambie Rd	Southwest	405, 410	13	19	30	2	190	14	2,300	
31	Garden City Way	Southwest	407, 408	57	18	31	3	140	12	6,200–6,700	
32	Queensborough Bridge/Hwy 91A	Burnaby/ New Westminster	104, 340, 388, 410, 418	69	17	32	4	160	9	4,900–13,500	Yes
33	Knight St	Vancouver/UBC	22	16	16	33	18	340	22	2,500	

TRANSLINK

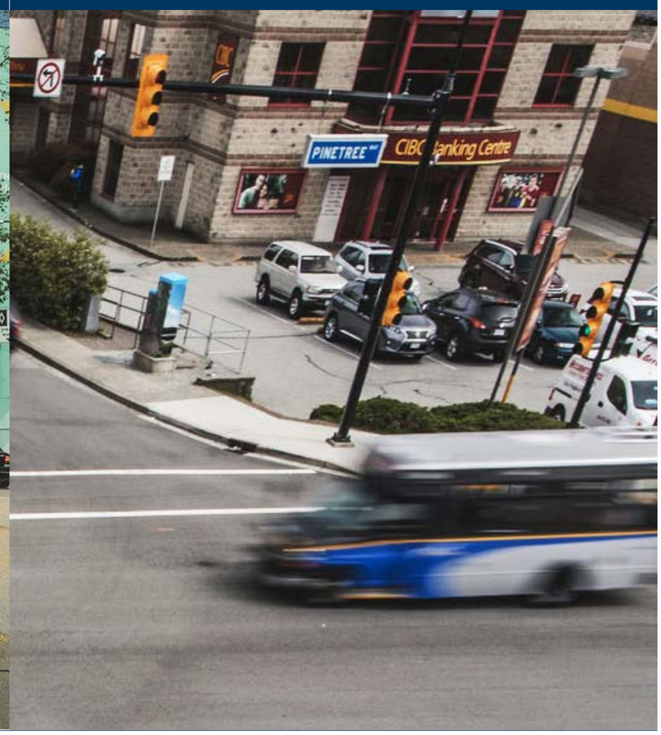
Corridor		Sub-Region	Primary Route(s)	Max. Hourly Buses (One Direction) [1]	Daily Person Delay (hours per km)	Rank within Region	Rank within Sub-Region	Daily Person Delay (hours)	Daily Bus Delay (hours)	Daily Person Load (One Direction) [2]	Profile Area?
34	15 St	North Shore	240, 255	15	15	34	4	60	5	2,000	
35	108 Ave	Southeast	335	14	15	35	6	130	9	2,300	
36	3Rd/Main	North Shore	R2	43	14	36	5	140	13	2,500–3,700	
37	**Canada Way**	**Burnaby/ New Westminster**	**123**	**22**	**14**	**37**	**5**	**260**	**22**	**2,200–2,600**	**Yes**
38	Wilson/Shaugnessy	Northeast	159, 160, 173, 174	35	14	38	1	40	13	1,300	
39	Granville Ave	Southwest	404, 406	9	14	39	4	90	7	1,400–1,500	
40	**Bridgeport Rd**	**Southwest**	**407, 430, all hwy routes**	**39**	**13**	**40**	**5**	**90**	**6**	**4,900**	**Yes**
41	**152 St**	**Southeast**	**375**	**27**	**13**	**41**	**7**	**470**	**39**	**3,200**	**Yes**
42	**128 St**	**Southeast**	**322, 323**	**9**	**11**	**42**	**8**	**220**	**14**	**2,500**	**Yes**
43	Harris Rd	Maple Ridge/ Pitt Meadows	701	12	9	43	1	30	4	900	
44	**Lougheed Hwy**	**Maple Ridge/ Pitt Meadows**	**R3, 701**	**43**	**9**	**44**	**2**	**320**	**40**	**3,000–3,400**	Yes
45	Westminster Hwy	Southwest	401, 405	10	9	45	6	110	8	1,800	
46	Pinetree Way	Northeast	183, 186	20	9	46	2	70	15	1,400	
47	Dewdney Trunk Rd	Maple Ridge/ Pitt Meadows	701	15	8	47	3	90	12	900	
48	**Ironworkers Memorial Bridge**	**North Shore**	**28, 130, 210**	**30**	**8**	**48**	**6**	**70**	**6**	**2,700**	**Yes**
49	Saint Johns St	Northeast	160, 180, 183, 184	25	7	49	3	40	10	1,300–1,400	
50	84 Ave	Southeast	301	6	6	50	9	40	2	1,400	
51	Lynn Valley Rd	North Shore	240, 228, 255	18	6	51	7	50	9	1,100	
52	**200 St Golden Ears**	**Southeast**	**501, 595**	**20**	**6**	**52**	**10**	**150**	**12**	**1,500–2,800**	**Yes**
53	North Rd	Northeast	109, 180	19	5	53	4	60	13	1,100–1,900	
54	Hammond Rd	Maple Ridge/ Pitt Meadows	701	12	5	54	4	20	2	900	
55	David Ave	Northeast	191	11	5	55	5	30	4	1,000	
56	96 Ave	Southeast	501	9	4	56	11	60	4	1,400	
57	Hwy 99	Southwest	351, 601, 620	31	4	57	7	260	16	3,600	
58	Hwy 91	Southwest	301, 410	11	4	58	8	150	8	1,700–2,500	
59	24 Ave/200 St	Southeast	531	10	3	59	12	110	9	900	
60	Mountain Hwy	North Shore	210	20	3	60	8	30	4	600–1,000	
61	88 Ave	Southeast	326, 388	7	3	61	13	60	5	600	
62	Steveston Hwy	Southwest	403	10	3	62	9	30	10	600	
63	Hwy 1 To Carvolth	Southeast	509, 555	13	3	63	14	110	5	2,500	
64	Hwy 17A	Southwest	620	20	2	64	10	40	3	2,200	
65	Hwy 1 To Horseshoe Bay	North Shore	257	5	1	65	9	30	2	1,000	

Notes: 1. Highest number of bus trips per direction within the AM Peak, Midday, and PM Peak time periods. 2. Daily passenger load is reported for the location along the corridor in one direction with the highest number of cumulative passengers on-board the bus throughout the day. For corridors with a range of loads, the lower range represents the maximum daily load, accounting only for routes that have at least 1 km of their alignment along the corridor. The upper range reflects the maximum daily load for all routes, regardless of distance along the corridor.

The most-delayed corridors typically contain retail areas.

Of the most-delayed corridors, 14 of the top 15 have notable retail areas (all but 49 Ave)—which can impact bus operations. “Traditional” retail zones feature on-street parking, frequent deliveries, and rideshare pick-up/drop-off—each of which have potential to interfere with bus movements. Likewise “auto-focused” retail areas have access driveways, which bring turning cars into the buses’ path, and many retail strips have few parallel roads for traffic to divert onto. Both types of retail development may have constrained or non-existent sidewalks, limiting the space available to optimize bus stop locations.

Comparison of Traditional and Auto-Oriented Retail Chacteristics that Affect Bus Operations

Traditional Retail (e.g., on-street parking)	Auto-Focused Retail (e.g., off-street parking)
	
Examples • Hastings St • W 4th Ave • Lonsdale Ave • Robson St	**Examples** • Scott Rd • Lougheed Hwy • No. 3 Rd
Characteristics that affect bus operations • On-street parking • Deliveries • Rideshare pick-up/drop-off • Constrained sidewalks	**Characteristics that affect bus operations** • Driveways • Constrained sidewalks • Lack of parallel roads

Delay remains concentrated in the Vancouver/UBC subregion.

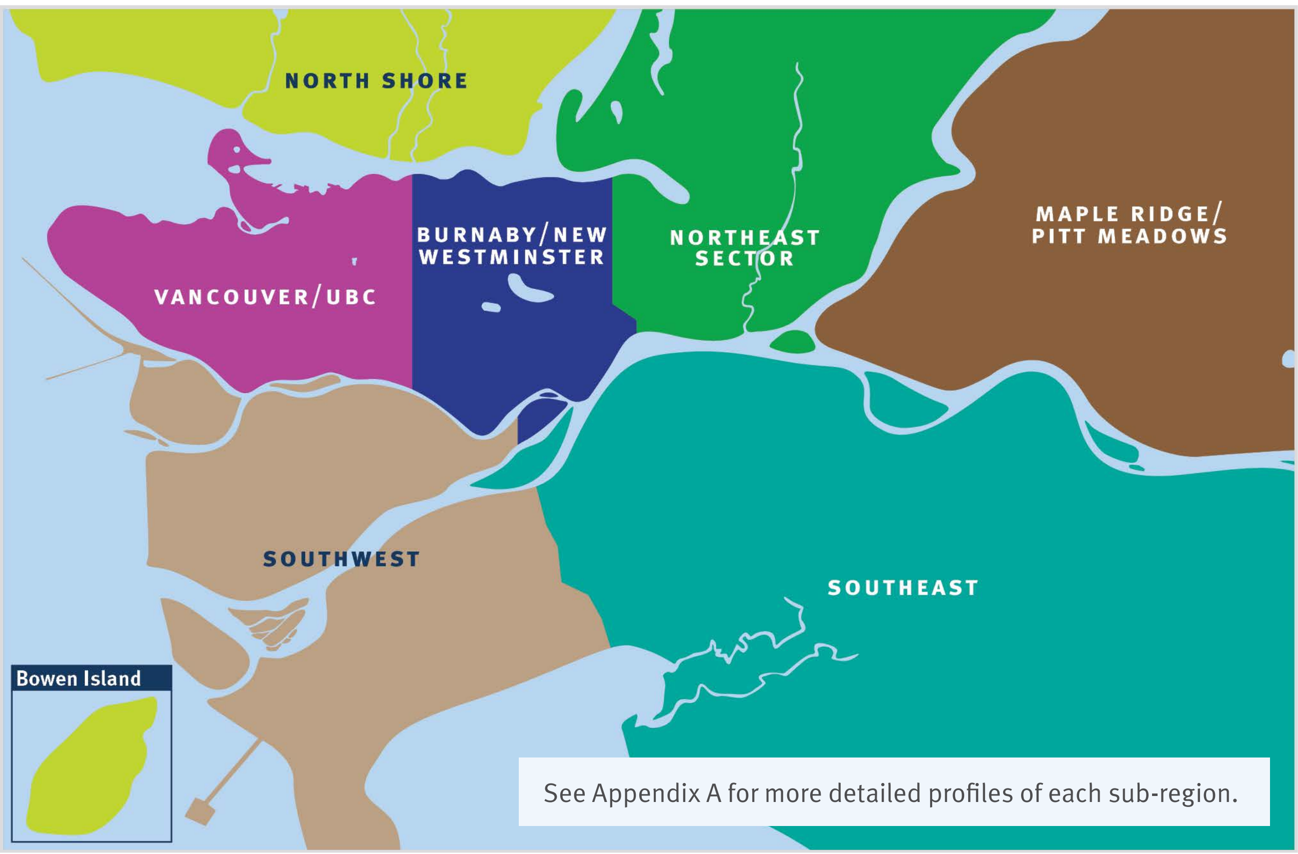
The table below shows total person-hours and bus-hours of delay each day, by sub-region. In 2021, the Vancouver/UBC sub-region had the biggest share, with 45% of the region's person-hours of delay and 37% of the bus-delay. This proportion fell slightly from 2018, in part because bus service was reallocated from Vancouver/UBC to other sub-regions with strong ridership growth, notably the Southeast and Maple Ridge/Pitt Meadows.

Share of Daily Passenger Delay and Bus Delay by Subregion, 2018 and 2021 (ordered by total person-hours of delay)

	Network (% of km)	Daily Bus Trip-KM (% of trip-km)			Daily Person Delay (% of person-hours)			Daily Bus Delay (% of hours)		
Sub Region	2021	2018	2021	Chg*	2018	2021	Chg*	2018	2021	Chg*
Burnaby/New Westminster	12%	14%	13%	-0.4	13%	12%	-0.3	14%	13%	-0.5
Maple Ridge/Pitt Meadows	8%	3%	3%	0.8	1%	1%	0.2	2%	2%	0.8
North Shore	10%	8%	8%	0.2	6%	6%	-0.7	7%	7%	-0.3
Northeast	12%	10%	10%	0.1	4%	4%	0.7	8%	9%	1.4
Southeast	24%	18%	21%	2.3	18%	22%	4.0	17%	20%	3.1
Southwest	18%	15%	15%	0.1	10%	10%	0.3	10%	11%	0.4
Vancouver/UBC	16%	33%	30%	-3.0	49%	45%	-4.2	42%	37%	-4.9

Note: *Change values represent the change in percentage points from 2018 to 2021.

Map of Sub-Regions



See Appendix A for more detailed profiles of each sub-region.

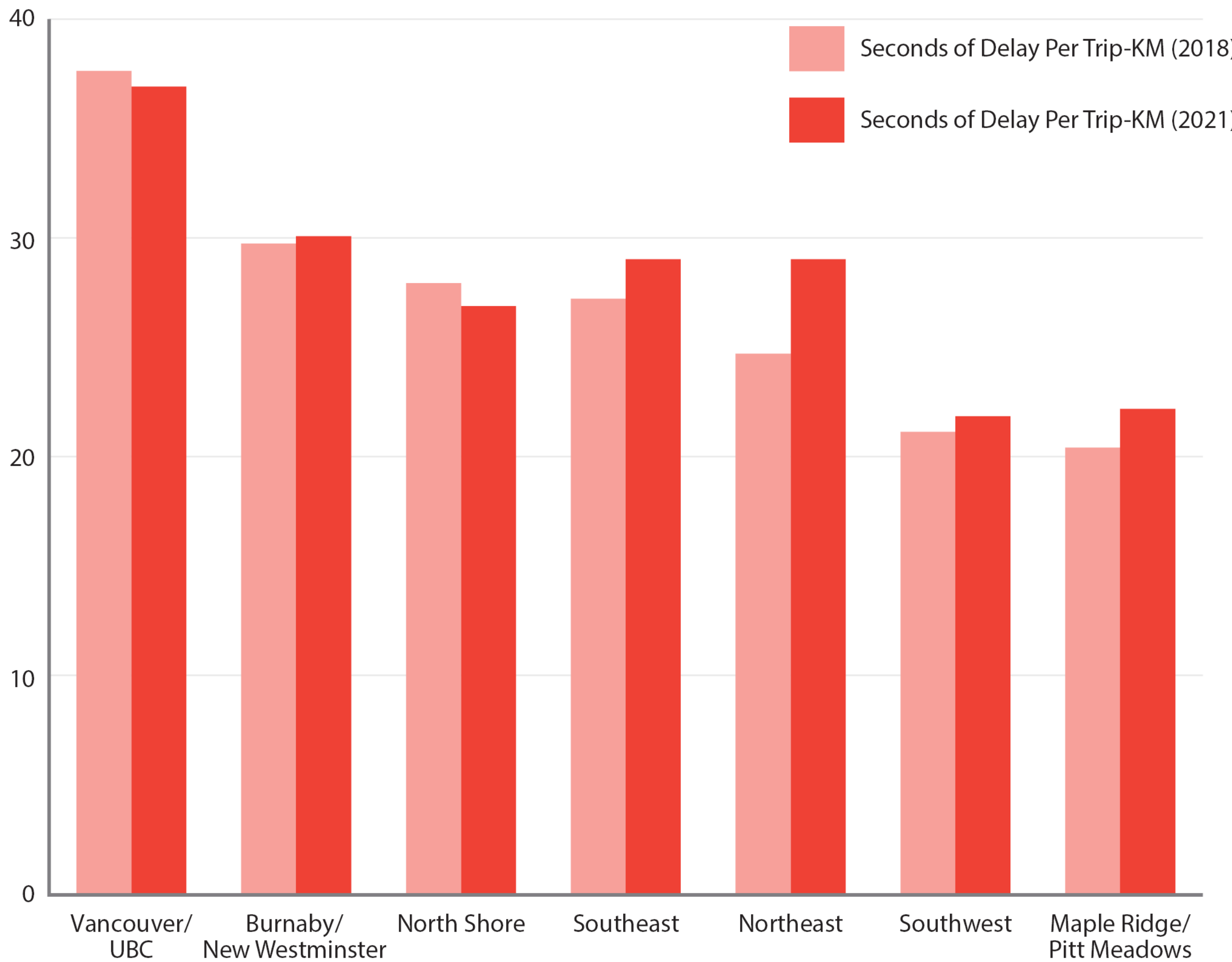
The share of delay outside Vancouver/UBC and Burnaby/New Westminster rose.

Adjusting for changes in bus service, delay per bus kilometre traveled also remains highest in the Vancouver/UBC sub-region. But between 2018 and 2021, it fell slightly in Vancouver/UBC and the North Shore, while rising outside the Burrard peninsula, especially the Southeast and Northeast.

Opportunities to reduce bus delay exist throughout our region.

Even though delay is not distributed evenly, there are corridors that warrant improvement in every sub-region. Profiles of each sub-region (see Appendix A) provide additional statistics and maps highlighting hotspot areas for attention.

Return of Bus Delay by Sub-region, 2018 to 2021



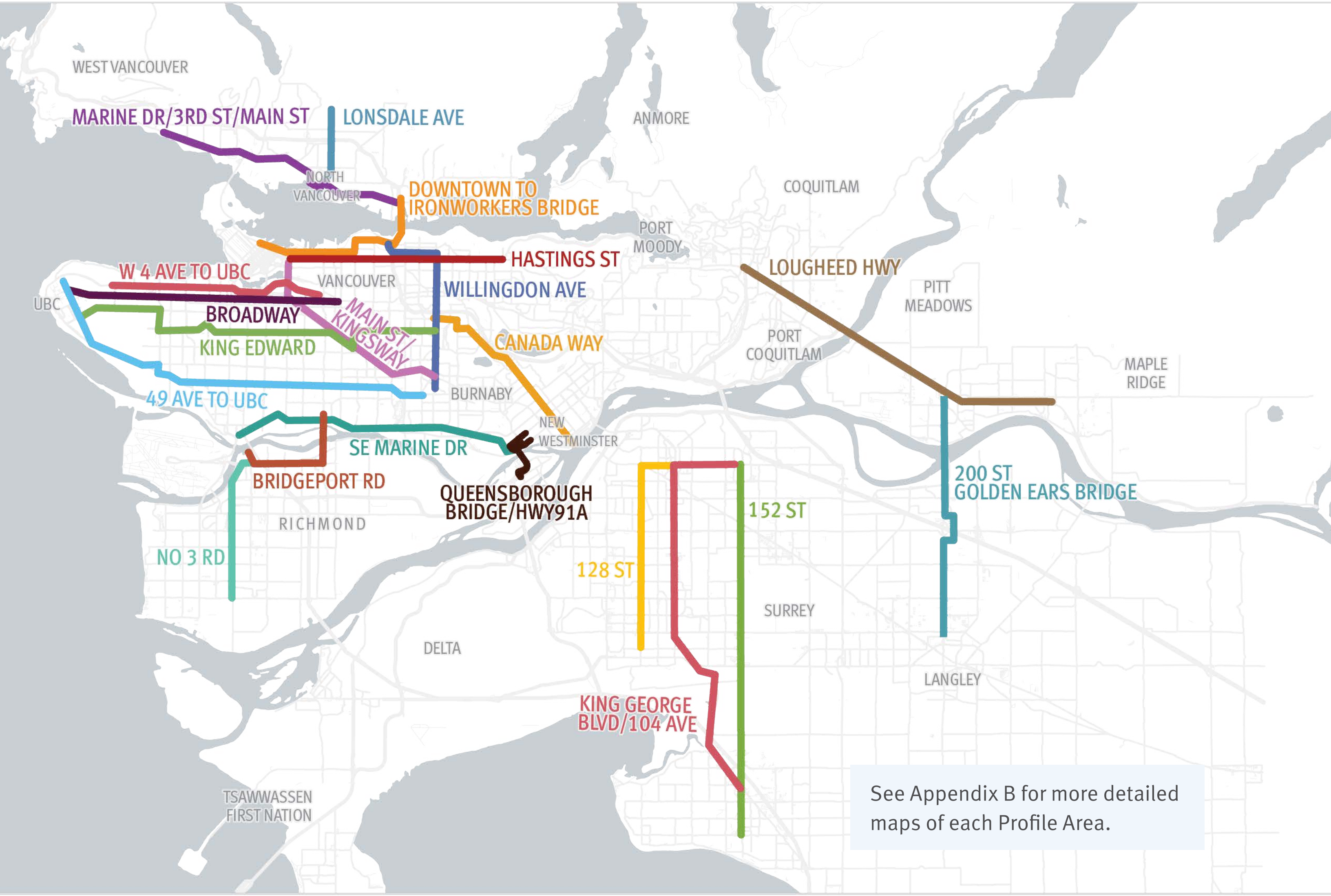
Profile Areas

Bus speed and reliability investments are most impactful when focused where they can benefit the most people. Among the corridors evaluated, TransLink has identified 20 "Profile Areas" to analyze in more detail. These are primarily the corridors with the most person-hours of delay. However, the list excludes those with transit improvements already underway, while corridors identified as near-term RapidBus or Bus Rapid Transit lines are also included. Maps of each are provided in Appendix B.

These Profile Areas differ slightly from the corridors shown on page 36. In order to better align with existing and planned bus routes, some overlap with parts of more than one corridor. Others have been adjusted to focus away from transit investments underway. (The table on page 37 identifies the corridors included in these Profile Areas.)

The 20 profile areas cover less than 15% of the transit network, but represent 35% of total bus-delay and 45% of total person-delay.

Map of Profile Areas



Part 4: Bus Priority Infrastructure

WE ARE MAKING PROGRESS IN REDUCING BUS DELAY

Significant investments in transit priority are working

Bus delay is a problem that can be solved by transit priority measures. To that end, TransLink has invested $40 million over the past four years to support more than 100 studies and projects. This is the greatest expansion of bus priority in the region's recent history.

For the first time, TransLink is reporting the results of the bus priority projects implemented across the region during this period. We are evaluating 35 pilot and capital projects that were completed by fall 2022. This section of the Bus Speed and Reliability Report examines which projects were most effective and what factors led to success.

Overall, we found that:

- **Transit priority improved bus performance.** Bus priority projects improved bus speeds by 5–35% depending on project type, location, and scale.
- **Most projects yield a return-on-investment within 10 years—many within two years.** Expanding bus priority will allow us to make better use of limited resources, now and in the future.
- **RapidBus projects hit targeted 20% travel time savings.** This provides momentum for future RapidBus routes, including the launch of R6 (2024), alignment planning for R7 and the other BRT and RapidBus corridors planned for the region.
- **Transit priority works best at scale.** Customers and TransLink accrue the most benefits when priority measures are focused along a corridor. We can reinvest these savings to expand or enhance service.

Evaluating each bus priority project by type, we are also learning from experience and developing regional knowledge about best practices for future investments. This will inform future work by TransLink and municipalities on bus priority, including future proposals for the Bus Speed and Reliability (BSR) municipal funding program.

IMPLEMENTING BUS PRIORITY

Bus priority projects improve travel time, reliability, customer experience, and safety

Travel Time: Transit service operates at an optimal speed throughout the day, with minimal delay from traffic congestion, and passengers can board and alight efficiently.

Reliability: Transit operates on schedule and is consistent and predictable throughout the day and each day of the week.

Customer Experience: Bus priority projects are an opportunity to improve travel options and enhance stop amenities and pedestrian infrastructure to make transit feel appealing, comfortable, safe, and easy-to-use.

Safety: Transit operates efficiently while supporting the safety of customers, pedestrians, cyclists, or other drivers.

How Speed and Reliability Improvements Benefit our Customers.

When the bus is faster, I have time to do a few errands before dinner.

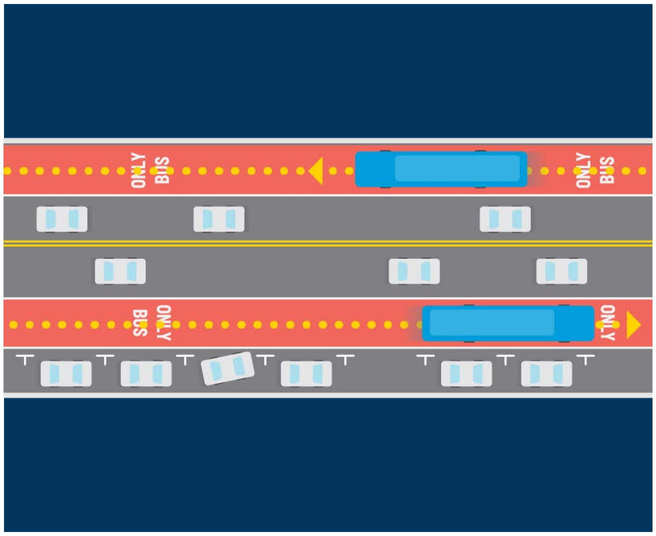
Even if there's traffic, I can count on the bus to get me to school on time.

This bus route is so much better, I don't need to use my car as often.

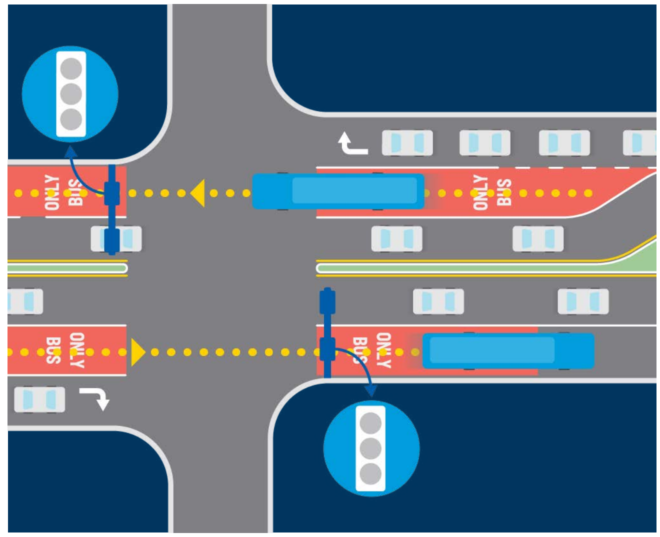
Fewer cars are speeding now that there's a red bus lane.

THERE ARE MANY TYPES OF BUS PRIORITY PROJECTS

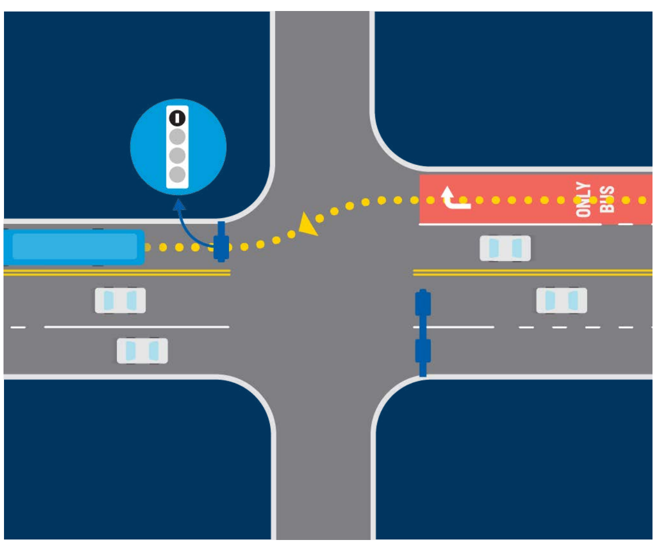
Different bus priority measures address different kinds of delay



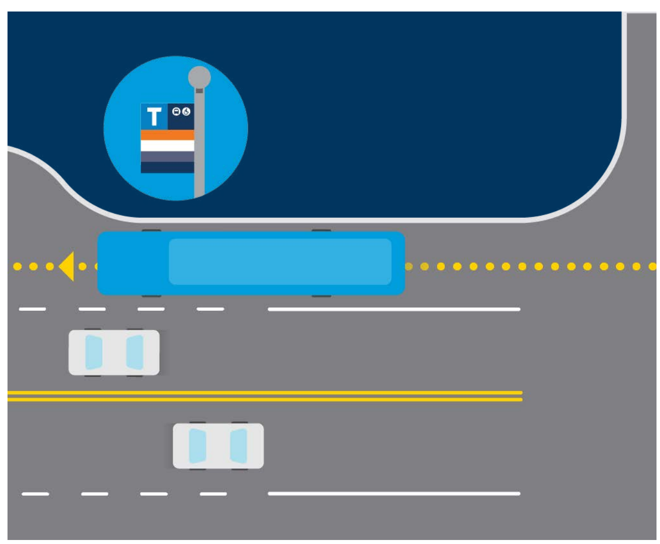
Bus / BAT Lanes: Bus lanes are lanes reserved for the use of buses. Dedicated bus lanes are exclusive to buses at all times, whereas Business Access & Transit (BAT) lanes allow vehicles to make right-turns. Peak-hour bus lanes allow for general use or parking during off-peak times.



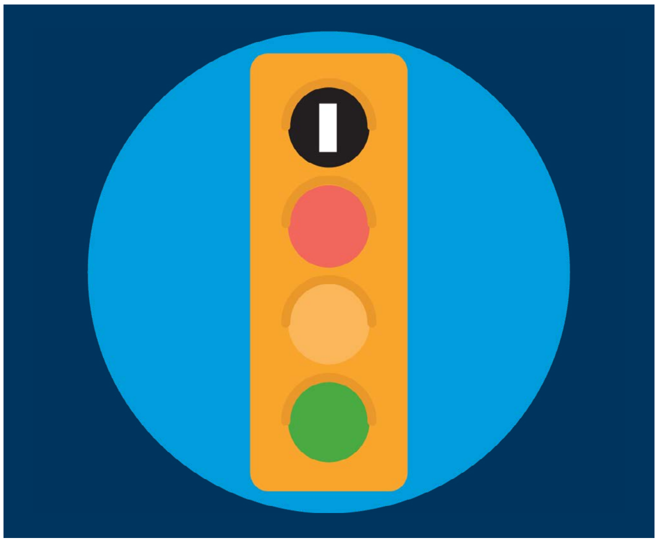
Approach Lanes: Approach lanes are short, dedicated lanes at intersections that separate buses from traffic queues. Approach lanes allow buses to bypass traffic queues and proceed through the intersection on the green light with other motorists.



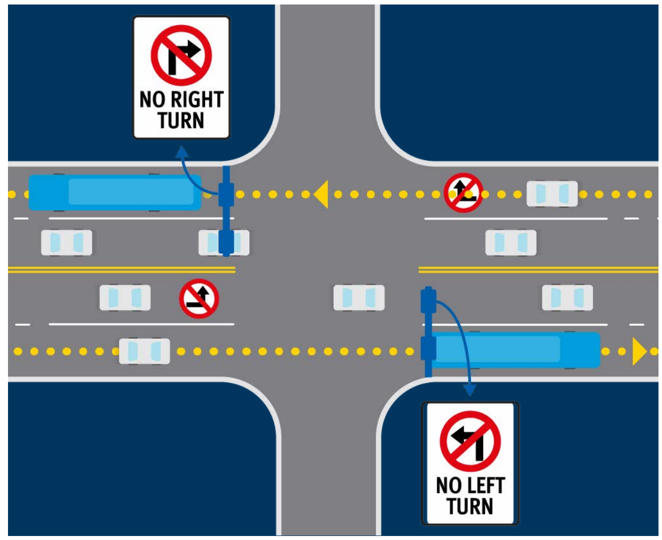
Queue Jumps: Queue jump lanes are short dedicated transit lanes (similar to approach lanes) or a shared turn pocket paired with a transit signal treatment that allows transit vehicles to get ahead of traffic at an intersection.



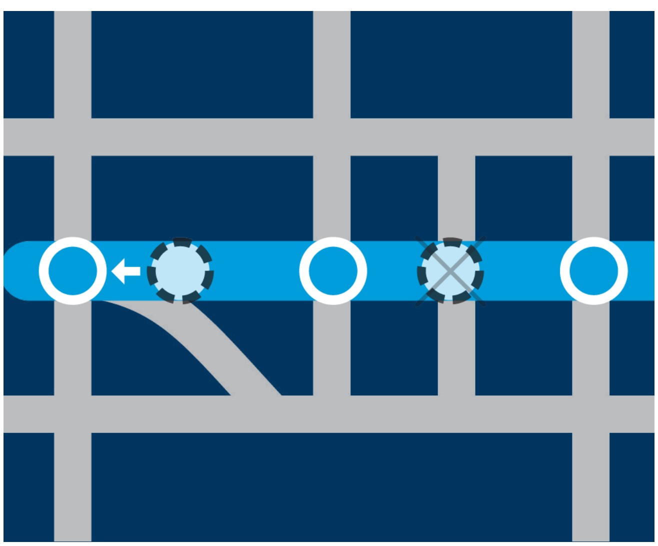
In-Lane Stops (Bus Bulbs / Floating Bus Stop): In-lane bus stops allow buses to stop directly in the travel lane in front of the bus stop. Bus bulbs or island bus stops may be used to create the in-lane stop.



Signal Upgrades: Signal upgrades may add a new traffic signal or signal phase.



Turn Restrictions: Turn restrictions limit left- or right-turns for general traffic to reduce delay for buses and other vehicles traveling along a corridor. Buses may be exempted from the restrictions.



Bus Stop Balancing: Bus stop balancing (also called "bus stop consolidation") includes thoughtful removal and/or relocation of bus stops along a corridor to achieve more consistent spacing, maintain convenient access, and provider faster, more reliable service.

All-Door Boarding: All-door boarding is an operational policy that allows customers to board a bus at any open door.

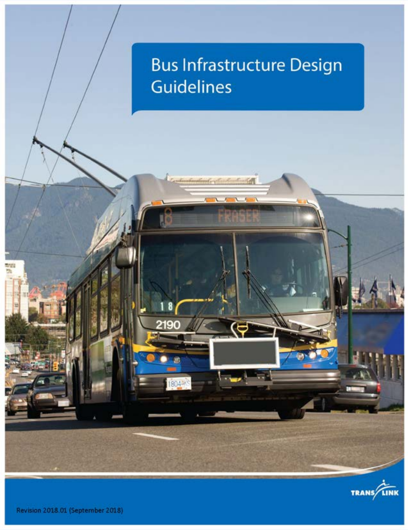
RapidBus

RapidBus is a brand of TransLink bus service that improves customer experience via more widely spaced stops, all-door boarding, and extensive bus priority like queue jumps or bus lanes. RapidBus also runs with high frequency and has additional amenities at bus stops.

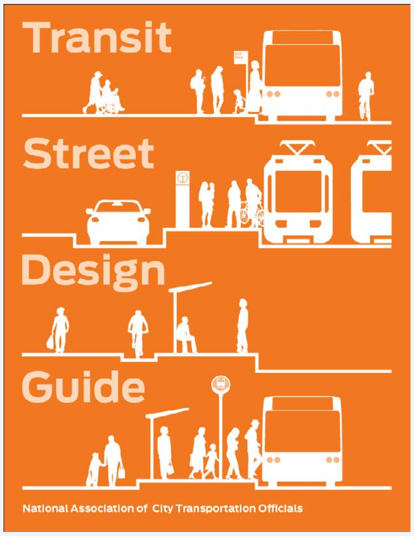
GUIDANCE TRANSLINK AND MUNICIPALITIES USE TO IMPLEMENT BUS PRIORITY

TransLink and municipalities have drawn upon resources developed by TransLink and organizations such as the National Association of City Transportation Officials (NACTO) when implementing bus priority projects. These include the following:

TransLink Transit Priority Toolkit



TransLink Bus Infrastructure Design Guidelines



NACTO Transit Street Design Guide

OUR APPROACH TO MEASURING PROJECT EFFECTIVENESS

We focused where new bus priority measures would have an impact.

We assessed travel time changes only along road sections that benefitted from new bus priority measures. This reduces the noise from elsewhere along the corridor. For most projects, the project area covered a few blocks or less. For RapidBus routes, it was the entire corridor. All the bus routes impacted were included in the analysis.

We typically evaluated just travel time between stops to avoid distortion due to changes in boarding activity. We included dwell time at bus stops for some projects that are meant to reduce time spent at stops (e.g., bus stop balancing and in-lane bus stops).

We used metrics based on customer experience and operating costs.

"Travel time savings" describes the experience of a customer along a typical trip, including all-day average and peak-period. We looked at seconds or minutes saved but used % improvement to compare different scales of projects.

Metrics like "annual bus-hours saved" and "payback period" describe the benefits to operating costs and account for the larger-scale savings of more extensive projects.

We sought clean before-after comparisons.

We generally compared fall 2019 and fall 2021 as "before" and "after." By focusing on fall periods, we accounted for seasonal changes in traffic and ridership patterns. Fall 2019 is just before the pandemic disrupted normal patterns. And by fall 2021 overall traffic had roughly returned to pre-pandemic levels. (See "Bus delay is back to the same levels as before the pandemic" on page 16.)

Where necessary, we adjusted these before-after periods to avoid distortion due to known construction activity, or to accommodate projects completed before fall 2019 or after fall 2021.

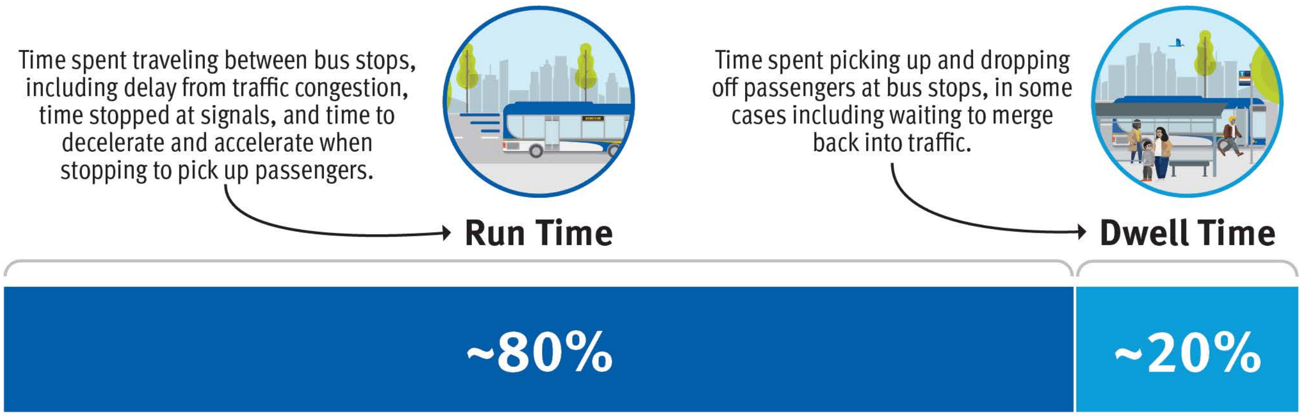
We interpreted results in context.

With a relatively small number of projects to evaluate, we avoided drawing strong conclusions from any individual project, or evaluating project effectiveness by location type or by sub-region. In addition, some projects were implemented quickly using interim materials or reduced scope. The project costs used in the analysis may not reflect actual costs ultimately incurred to municipalities, especially if these projects are made permanent in the future.

Where possible we supplemented analysis with available information on background traffic changes, traffic counts, and on-site observation. Recommendations for future projects are based largely on best industry practice.

What measures did we use?

We evaluated particular types of projects depending on how they improve travel time and reliability for people on buses. The graphic below illustrates the different components of bus travel time—run time and dwell time. We evaluated the change in travel time over the extent of new bus priority that was implemented, including all bus routes that serve the location.



We evaluate each type of bus priority project based on run time, dwell time, or both, depending on the components of bus travel time it addresses.

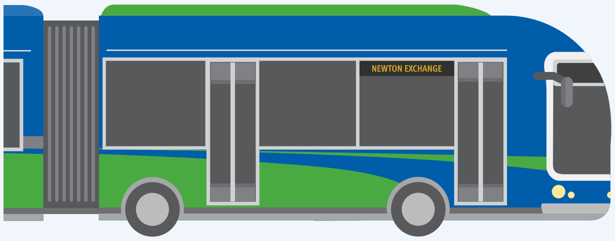
The table below describes the benefits we expect to see from each type of project and whether we evaluated it based on run time, dwell time, or both.

Project Type(s)	Expected Benefits	How can we measure benefits? [1]	
		Run Time	Dwell Time
Queue Jumps and Approach Lanes (Includes Turn Pockets)	Buses move through signalized intersections with less delay	✓	
Bus/BAT Lanes	Buses have priority through a congested area including multiple intersections [1]	✓	
In-Lane Bus Stops	Buses do not have to merge into traffic from a bus stop (reduces wait time)	✓	✓
Signal Upgrades	Buses spend less time waiting for a green light and don't have to wait for multiple signal cycles	✓	
Turning Restrictions for All Traffic	Prevent vehicles from backing up at intersections and delaying buses (and other vehicles)	✓	
Bus Stop Balancing	Avoids overly frequent stops and saves buses time to accelerate, decelerate, and merge back into traffic	✓	✓
RapidBus Route	RapidBus includes multiple types of treatments	✓	✓
All-Door Boarding	Allows passengers get on the bus efficiently using all doors of the bus and reduces dwell time at bus stops		✓

Notes: 1. See page 24 for an illustration of how we measured bus travel time and delay. 2. In cases where bus lanes replace on-street parking, they can also result in more in-lane bus stops, which also reduces dwell time.

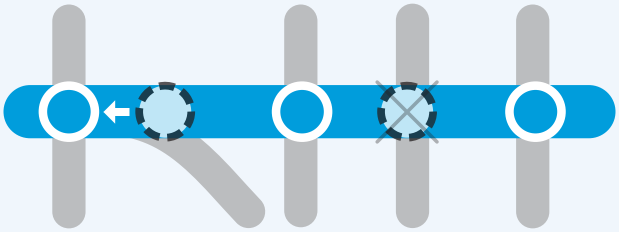
Quantity of Bus Priority Measures Evaluated, by Project Type, 2019–2022

RapidBus



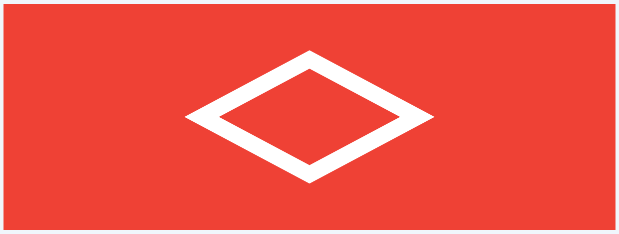
3 RapidBus routes with new transit priority including over 30 km of bus or BAT lanes

Bus stop balancing



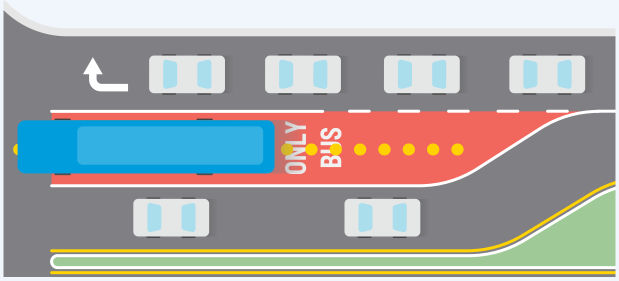
5 routes optimized by consolidating or relocating 86 stops

Bus/BAT lanes



10 projects creating nearly 22 km of bus or BAT lanes [1]

Approach lanes

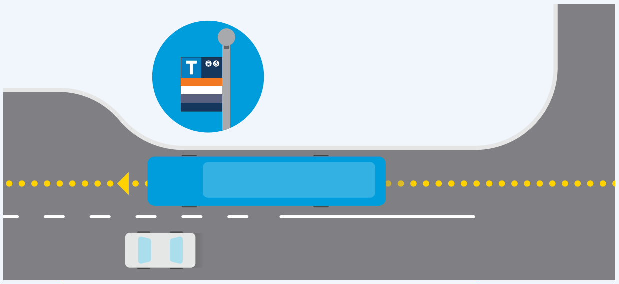


3 projects improving the approach to 5 intersections

Queue jumps

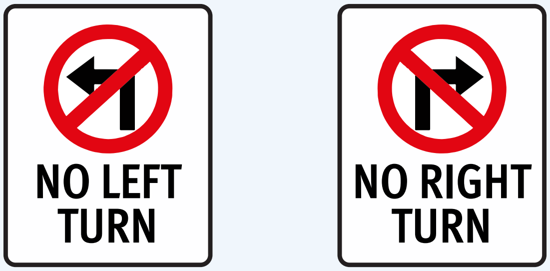
2 projects improving the approach to 3 intersections

In-lane bus stops



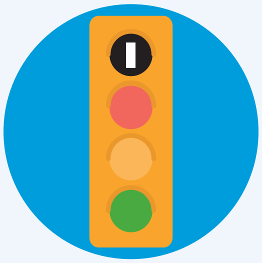
5 projects creating 19 in-lane bus stops

Turn restrictions



1 project optimizing traffic flow at 1 intersection

Signal upgrades



6 projects upgrading 7 signals

BUS PRIORITY PROJECTS COMPLETED SINCE 2019

TransLink has invested $40 million in bus priority since 2019.

Our investments include:

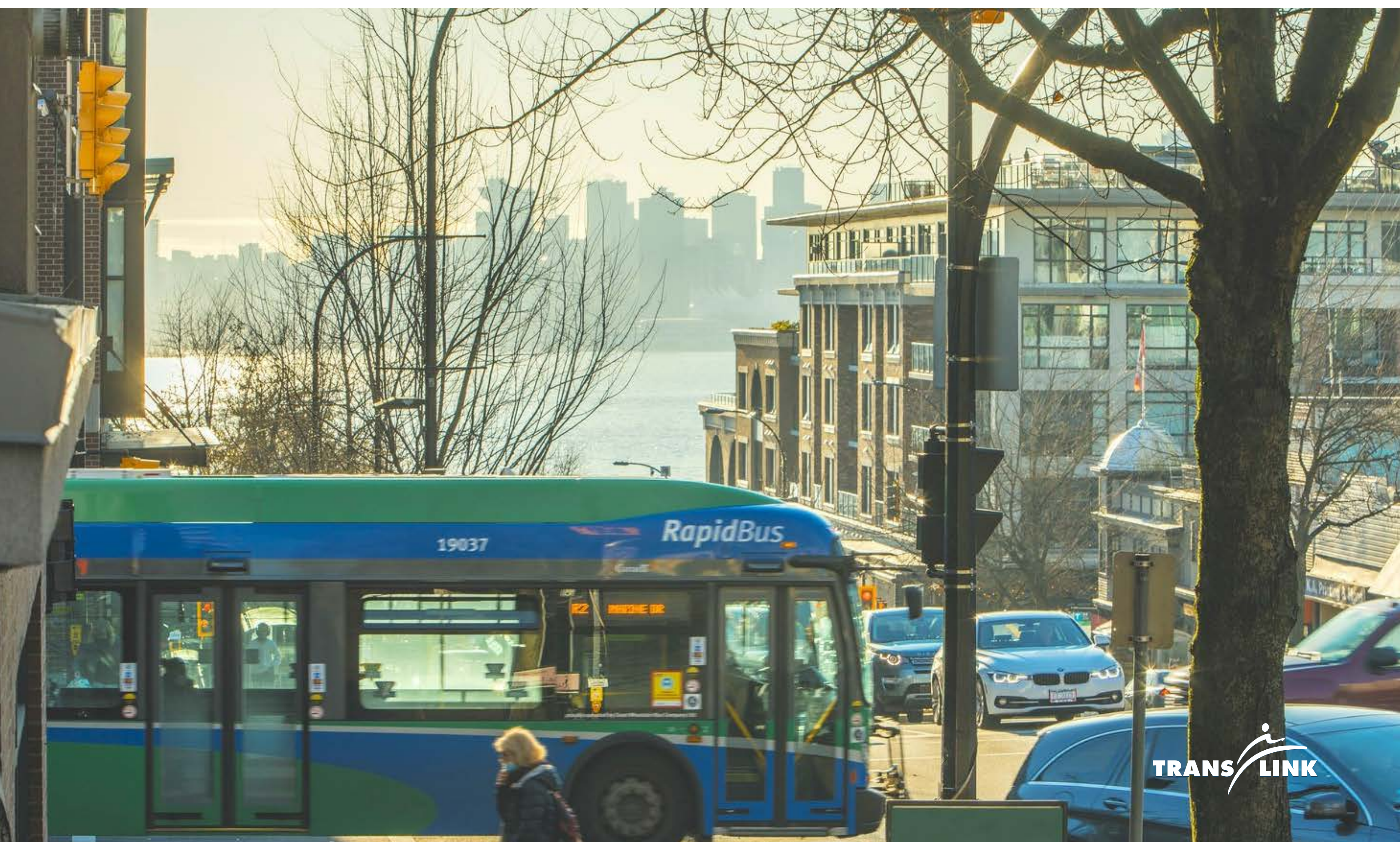
- $24 million for RapidBus bus priority construction, including the R2, R3, and R4 lines.
- $15 million in small- to medium-scale bus priority improvements made possible by the Bus Speed and Reliability (BSR) municipal funding program, including 37 awards for studies, 14 awards for pilots, and 52 awards for capital projects.

This has been a historic expansion of transit priority.

The region has added about 70 km of new bus priority measures, an expansion of nearly 50%. This report is evaluating 35 bus speed and reliability projects including three new RapidBus routes that were completed between 2019 and 2022, across all seven subregions. The number of projects includes some individual projects built as part of RapidBus projects.

These projects:

- Serve over 60 routes that carried over half of TransLink's ridership in fall 2021.[35]
- Address network segments that accounted for over 560 hours of bus delay (nearly a quarter of the systemwide total) and nearly 8,500 hours of person delay (nearly 30% of the systemwide total) per day in 2021.
- Make service faster and more reliable for nearly 190,000 passenger trips that pass through these network segments on an average weekday (2021), which is approximately a third of the total.



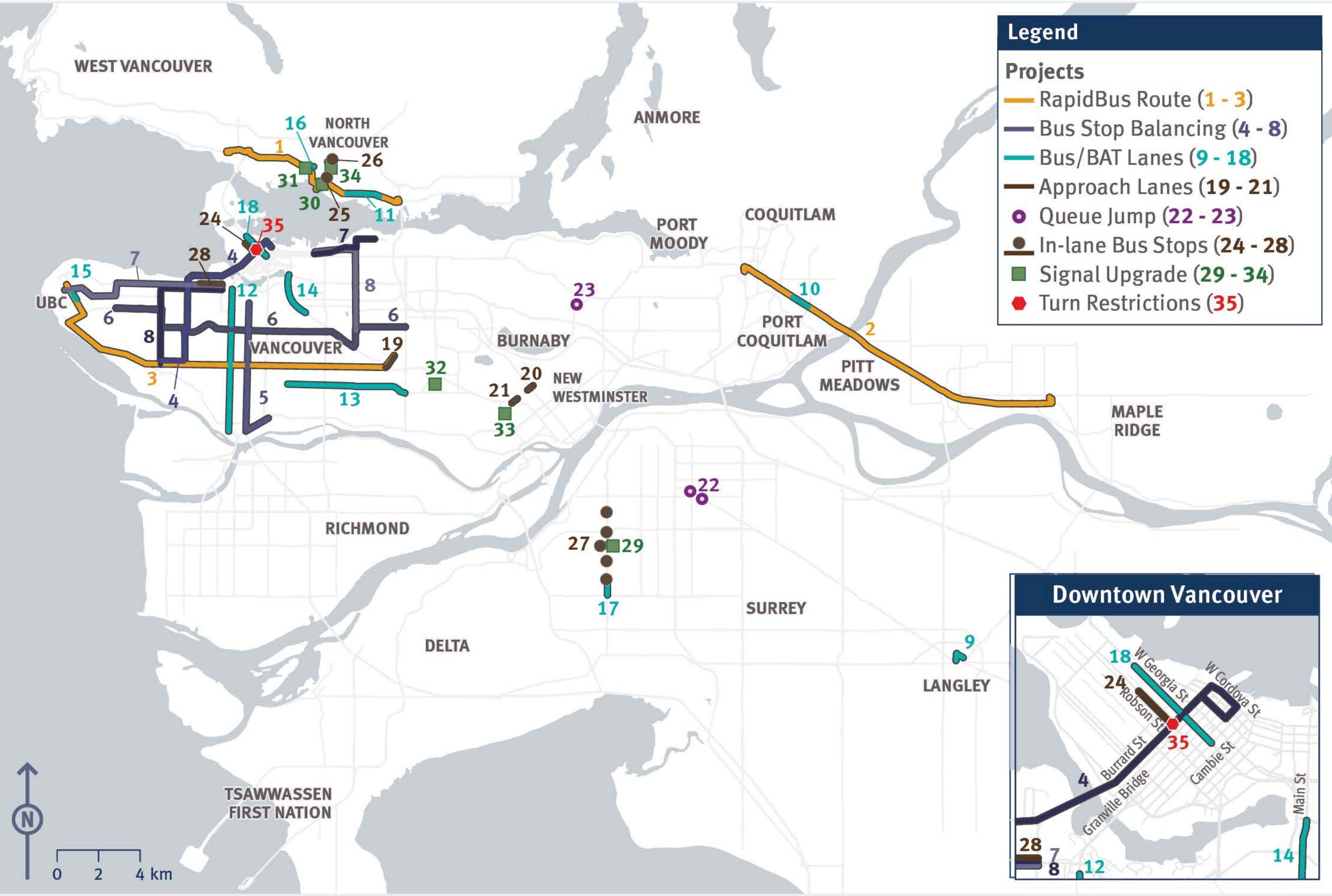
TRANSLINK

MAP AND INVENTORY OF BSR PROJECTS

The map below shows the projects funded by the BSR program over the past four years and evaluated for this report. (Additional bus priority projects completed during this time period, including municipal-led projects and BSR projects completed in late 2022, were not evaluated and are not shown on the map.)

The table on the following page provides a description of each project including the sub-region(s) where it is located; the type of project and the metrics used to evaluate each type of project; time periods used in the evaluation; a summary of travel time savings; and the projected return on investment.

Map of Completed BSR Projects Evaluated in this Report, 2019–2022



Summary of Implemented Projects, 2019–2022, Percent Change in Transit Travel Time, Before and After Implementation, and Projected Return on Investment

				Transit Metrics		Periods Compared		Percent Change in Transit Travel Time (Weekdays) [1]		Return on Investment [2]	
Map	Project Name	Project Type	Sub-Region	Run Time	Dwell	Before	After	Avg Daily (6 a.m. to 10 p.m.)	Avg AM/PM Peak	Cost	Payback Period (Years)
1	R2 Marine Dr: R2 vs 239	RapidBus route	North Shore	X	X	Sep 2018	Sep 2021	**-24%**	**-26%**	$8,096,000	**7.6**
2	R3 Lougheed Highway: R3 vs 701	RapidBus route	Northeast & Maple Ridge/Pitt Meadows	X	X	Sep 2018	Sep 2021	**-35%**	**-35%**	$8,096,000	**5.5**
3	R4 41st Ave: R4 vs Local (41)	RapidBus route	Vancouver/UBC	X	X	Sep 2018	Sep 2021	**-26%**	**-27%**	$7,683,000	**13.8**
4	Route 2 bus stop balancing	Bus Stop Balancing	Vancouver/UBC	X	X	Sep 2019	Sep 2021	**-11%**	**-14%**	$82,000	**0.3**
5	Route 17 bus stop balancing	Bus Stop Balancing	Vancouver/UBC	X	X	Nov 2019	Nov 2021	**-6%**	**-7%**	$142,000	**0.6**
6	Route 25 bus stop balancing	Bus Stop Balancing	Vancouver/UBC & Burnaby/New Westminster	X	X	Nov 2019	Nov 2021	**-6%**	**-6%**	$163,000	**0.4**
7	Route 4 bus stop balancing	Bus Stop Balancing	Vancouver/UBC & Burnaby/New Westminster	X	X	Apr 2019	Apr 2022	**-8%**	**-7%**	NA	**-**
8	Route 7 bus stop balancing	Bus Stop Balancing	Vancouver/UBC	X	X	Apr 2019	Apr 2022	**-7%**	**-4%**	NA	**-**
9	Langley City bus lanes	Bus/BAT lanes	Southeast	X	-	Sep 2018	Sep 2021	**-3%**	**-3%**	$146,000	**7.7**
10	Lougheed Highway bus lane	Bus/BAT lanes	Northeast	X	-	Sep 2018	Sep 2021	**-5%**	**-11%**	NA	**[3]**
11	East 3rd St bus lane	Bus/BAT lanes	North Shore	X	-	Sep 2018	Sep 2021	**-4%**	**-4%**	NA	**[3]**
12	Granville St bus lanes	Bus/BAT lanes	Vancouver/UBC	X	-	Sep 2019	Sep 2021	**-6%**	**-7%**	$171,000	**4.8**
13	49th Ave transit project	Bus/BAT lanes	Vancouver/UBC	X	-	Sep 2019	Sep 2021	**-4%**	**-5%**	$48,000	**0.4**
14	Main St and Kingsway bus lanes	Bus/BAT lanes	Vancouver/UBC	X	-	Sep 2019	Sep 2021	**-4%**	**-4%**	$97,000	**8.3**
15	Wesbrook Mall bus lane	Bus/BAT lanes	Vancouver/UBC	X	-	Sep 2019	Sep 2021	**-15%**	**-13%**	$500,000	**5.7**
16	West Keith Rd transit project	Bus/BAT lanes	North Shore	X	-	Nov 2019	Nov 2021	**-9%**	**-9%**	$108,000	**9.9**
17	Scott Rd / 120 St BAT lane	Bus/BAT lanes	Southwest & Southeast	X	-	Sep 2019	Sep 2022	No Change	No Change	$65,000	**-**
18	W Georgia St bus lane	Bus/BAT lanes	Vancouver/UBC	X	-	Sep 2019	Sep 2022	**-3%**	**5%**	$41,000	**1.5**
19	R4 Joyce Street approach lanes	Approach lanes	Vancouver/UBC	X	-	Sep 2018	Sep 2021	**-34%**	**-33%**	NA	**[3]**
20	Edmonds St approach lanes at Canada Way	Approach lanes	Burnaby/New Westminster	X	-	Sep 2019	Sep 2021	**0%**	**-3%**	$59,000	**› 20**

Map	Project Name	Project Type	Sub-Region	Transit Metrics		Periods Compared		Percent Change in Transit Travel Time (Weekdays) [1]		Return on Investment [2]	
				Run Time	Dwell	Before	After	Avg Daily (6 a.m. to 10 p.m.)	Avg AM/PM Peak	Cost	Payback Period (Years)
21	Edmonds St approach lanes at Kingsway	Approach lanes	Burnaby/New Westminster	X	-	Sep 2019	Sep 2021	**-2%**	**-2%**	$59,000	**› 20**
22	Fraser Highway queue jumps	Queue jump	Southeast	X	-	Jun 2019	Jun 2021	**-15%**	**-21%**	$443,000	**3.3**
23	Broadway and Gaglardi Way queue jump	Queue jump	Burnaby/New Westminster	X	-	Sep 2019	Sep 2021	**-15%**	**-15%**	$52,000	**4.1**
24	Robson St transit project	In-lane bus stops	Vancouver/UBC	X	X	Sep 2019	Sep 2022	**-8%**	**-8%**	$100,000	**1.8**
25	Lonsdale Ave bus bulbs at 4th St and 5th St	In-lane bus stops	North Shore	X	X	Nov 2019	Nov 2021	**-5%**	**-3%**	$395,000	**› 20**
26	Lonsdale Ave bus bulbs at 15th St	In-lane bus stops	North Shore	X	X	Sep 2019	Sep 2021	**-5%**	**0%**	$94,000	**7.5**
27	Bus pullout infills on Scott Rd / 120 St	In-lane bus stops	Southwest & Southeast	X	X	Sep 2018	Sep 2022	**0%**	**-4%**	$427,000	**19.3**
28	West 4th Ave bus bulbs	In-lane bus stops	Vancouver/UBC	X	X	Oct 2019	Oct 2022	**-14%**	**-16%**	$52,000	**0.3**
29	Signal upgrade on Scott Rd at 84 Ave	Signal upgrade	Southeast	X	-	Sep 2018	Sep 2019	**-15%**	**-7%**	$40,000	**16.8**
30	Signal upgrade on Lonsdale Ave at East Esplanade	Signal upgrade	North Shore	X	-	Sep 2020	Sep 2021	**-3%**	**-6%**	$12,000	**1.8**
31	Signal upgrade on Marine Dr at Keith Rd and Bewicke Ave	Signal upgrade	North Shore	X	-	Sep 2019	Sep 2021	**-9%**	**-9%**	$12,000	**0.4**
32	Signal upgrade at Metrotown bus loop	Signal upgrade	Burnaby/New Westminster	X	-	Sep 2019	Sep 2021	**-18%**	**-19%**	$70,000	**1.8**
33	Signal upgrade on 18th Ave at Griffiths Dr	Signal upgrade	Burnaby/New Westminster	X	-	Sep 2019	Sep 2021	**-11%**	**-13%**	$10,000	**0.2**
34	Signal upgrades on 15th St W	Signal upgrade	North Shore	X	-	Sep 2019	Sep 2022	**-2%**	**-2%**	$45,000	**9.8**
35	Turn restriction on Robson St	Turn restrictions	Vancouver/UBC	X	-	Sep 2019	Sep 2022	**-9%**	**-6%**	NA	**[4]**

Notes: 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). RapidBus launch also included significant investments in stop amenities and service increases. The brand is an upgraded service rather than efficiency improvement. Some projects lacked sufficient cost data to estimate a payback period. Some of the projects listed were constructed using temporary/interim measures, while others may be more permanent and have different associated costs. 3. Subset of a project constructed as part of RapidBus implementation. 4. Robson Street turn restrictions project may include some run-time benefits from stop consolidation, implemented concurrently, which could not be isolated as a separate project.

EVALUATING COMPLETED BUS PRIORITY PROJECTS

What did we learn?

- **Transit priority improved bus performance.** Most projects provided the benefits expected, generally ranging from 5–35% reduction in travel time.
- **RapidBus projects exceeded targeted 20% savings.** The three routes with new transit priority achieved significant improvements over the previous local service—each in different contexts.
- **Most projects pay for themselves within 10 years.** Faster and more reliable buses can provide more trips each day. They support more efficient schedules and reduce the need to add resources in the future, due to increasing traffic, ridership, etc.

We quantified the return on investment (ROI) based on operating cost savings that are realized as bus schedules can be adjusted to take advantage of faster and more reliable bus run times and shorter dwell times at stops. Some projects perform even better, with an ROI of only 1–2 years. Even after the payback period, speed and reliability savings continue to accrue. And projects can reduce the need to add buses in the future to maintain frequencies due to increasing traffic.

- **Service levels affect return on investment.** Projects along high-frequency corridors pay back faster because they benefit many trips.

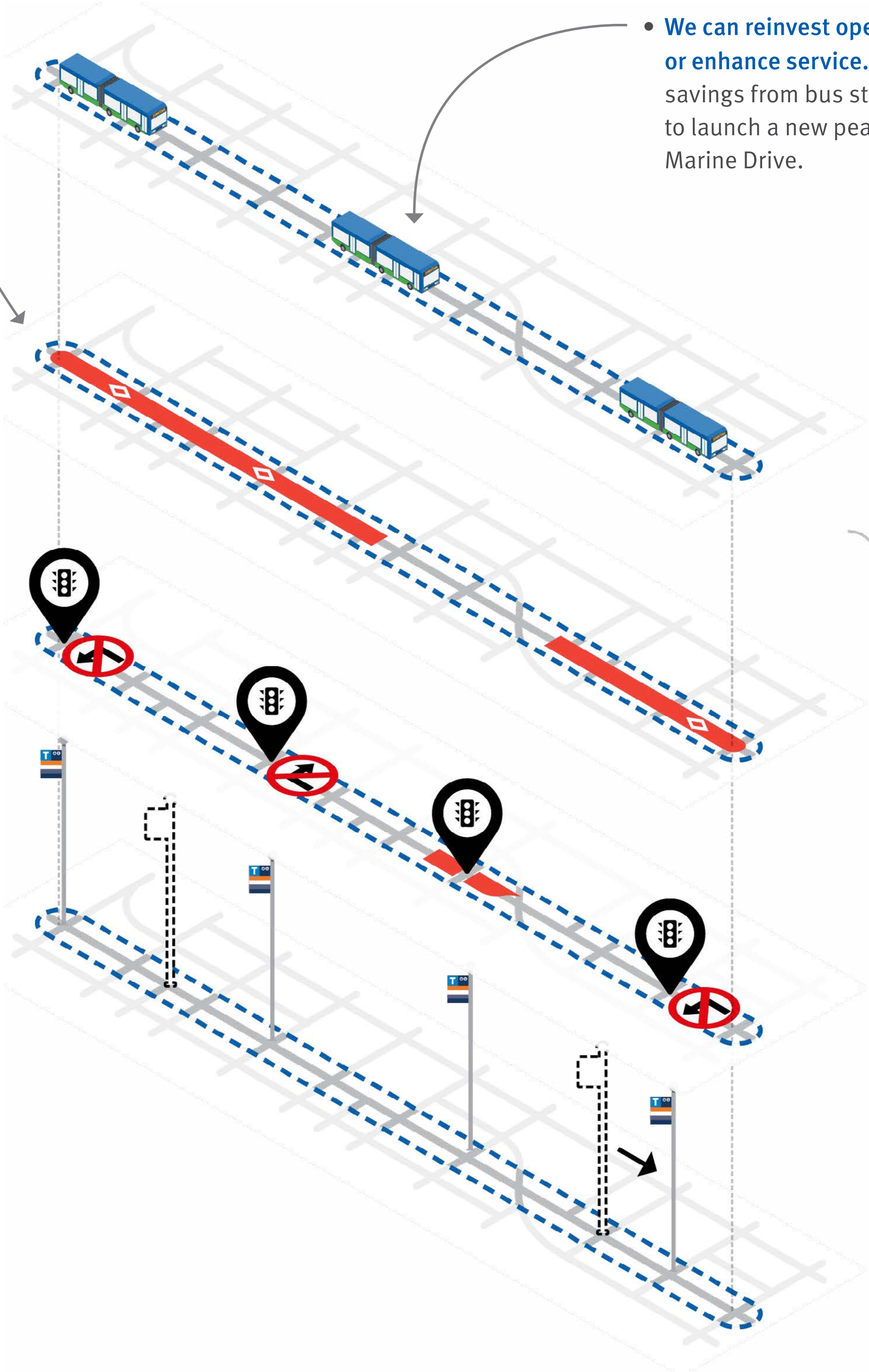
Travel Time and Return on Investment from Bus Priority

Project Type	# of Projects	Travel Time Savings (Weekdays) [2]	Typical Return on Investment [3]
RapidBus route [1]	3	25–35%	N/A [4]
Bus Stop Balancing [1]	5	5–10%	<1 year
Bus/BAT lanes	10	Up to 15%	0-10 years
Approach lanes	3	Up to 35%	N/A [5]
Queue jumps	2	Approx. 15%	<5 years
In-lane bus stops [1]	5	Up to 15%	0–15+ years
Signal upgrades	6	Up to 20%	0–15 years
Turn restrictions	1	Approx. 10%	N/A [5]

Notes: 1. Benefits include both faster travel time between stops AND reduced dwell time at stops. 2. Daily travel time savings between 6 am and 10 pm. 3. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). 4. RapidBus launch also included significant investments in stop amenities and service increases. The brand is an upgraded service rather than efficiency improvement. 5. Insufficient cost data.

- **Transit priority works best at scale.** Customers and TransLink accrue the most benefits when priority measures are focused along a corridor or full route—such as RapidBus and bus stop balancing projects that include bus stop consolidation at a corridor level. Larger-scale projects are more likely to yield schedule changes that result in actual operational savings. (See project highlights from "RapidBus" on p. 57 and "Bus Stop Balancing" on p. 67.)

- **We can reinvest operational savings to expand or enhance service.** For example, we reinvested savings from bus stop balancing into service to launch a new peak-hour bus route along Marine Drive.



Between stops, bus and BAT lanes keep buses moving when streets are congested.

They also make queue jumps, signal priority, and turn restrictions more effective.

At the intersection, queue jumps, signal priority, and turn restrictions help buses get through the lights.

This means they're able to get to stops faster.

At stops, in-lane stops as well as all-door boarding on RapidBus make it faster to pick up passengers.

Bus stop balancing means spacing stops so that buses are faster and more reliable.

BUS PRIORITY PROJECT HIGHLIGHTS

Project Highlights: RapidBus

RapidBus is TransLink's brand of fast and frequent bus service operating along key corridors in the Vancouver region.

Supported by extensive transit priority, all-door-boarding, and limited stopping, RapidBus routes run all-day, every day—at least every 10 minutes during peak times and 15 minutes during off-peak times.

Passengers also benefit from enhanced passenger amenities such as real-time schedule information and accessibility features such audio information and tactile walking surface indicators.

The first five RapidBus routes (R1–R5) launched in 2020, with extensive new transit priority along three of the routes (R2, R3, and R4) as well as enhancements to 116 bus stops and a significant expansion in service levels, via 110 new, articulated buses.

A sixth route, R6, will launch in 2024, and will represent the biggest service expansion since the pandemic.

Map of RapidBus Projects

Overview of RapidBus Performance

Since its launch in 2020, the RapidBus brand set a target of at least 20% faster service compared to previous local buses.

The three RapidBus routes with new transit priority (R2, R3, and R4) achieved 24 to 35% savings in combined run and dwell time on weekdays, compared to comparable local bus routes. This demonstrates success for the RapidBus brand in three different contexts across the region. These savings are due to extensive new transit priority measures as well as shorter dwell times due to bus stop consolidation and all-door boarding onto larger 3-door buses.

- The R2 saved 24% in end-to-end run time all day, between 5 to 12 minutes.
- The R3 saved 35%, with savings ranging from 11 to 28 minutes.
- The R4 lines saved 26% overall, ranging from 11 to 19 minutes during the day.

The two RapidBus routes that were pre-existing routes (R1 and R5) benefitted from improved stop amenities, new buses, all-door-boarding, and greater frequencies.

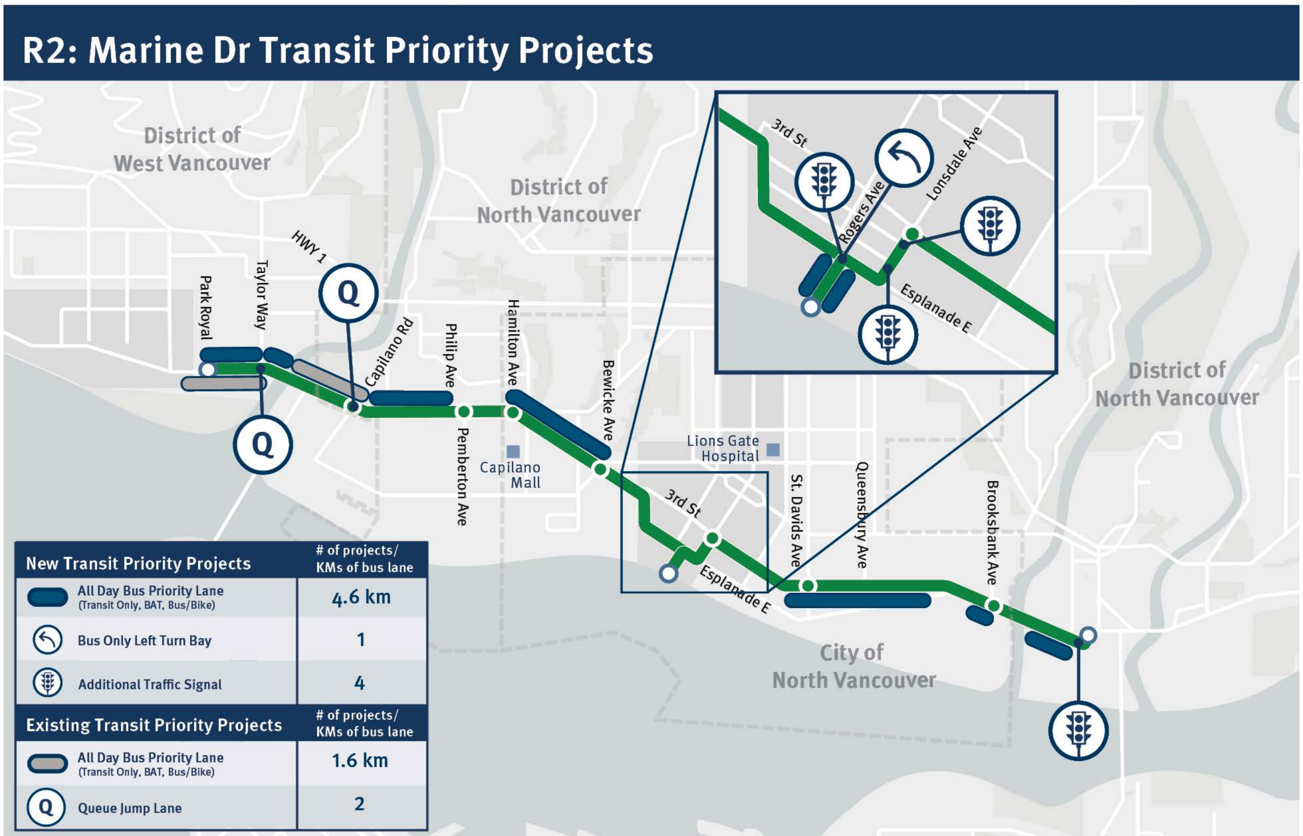
Peer Highlight: In the Seattle (WA) region, King County Metro's RapidRide arterial BRT service has also achieved its goal of up to 20% faster travel time. Ridership increased by 70% on its six lines in service as of 2019, before the pandemic.[36]

RapidBus routes have succeeded in different parts of the region.
Top: R4 at Kingsway.
Middle: R3 at Coast Meridian Rd.
Bottom: R2 at Lonsdale Ave.

R2 RapidBus: Marine Drive

The R2 RapidBus runs between Park Royal, Lonsdale Quay, and Phibbs Exchange via Marine Drive, 3rd Street and Main Street. The R2 RapidBus replaced local bus Route 239 and introduced new transit priority including bus lanes, queue jumps, turn pockets, and transit priority signals along with reducing the number of stops, allowing all-door boarding, and improving bus stops.

Map of R2 RapidBus Transit Priority



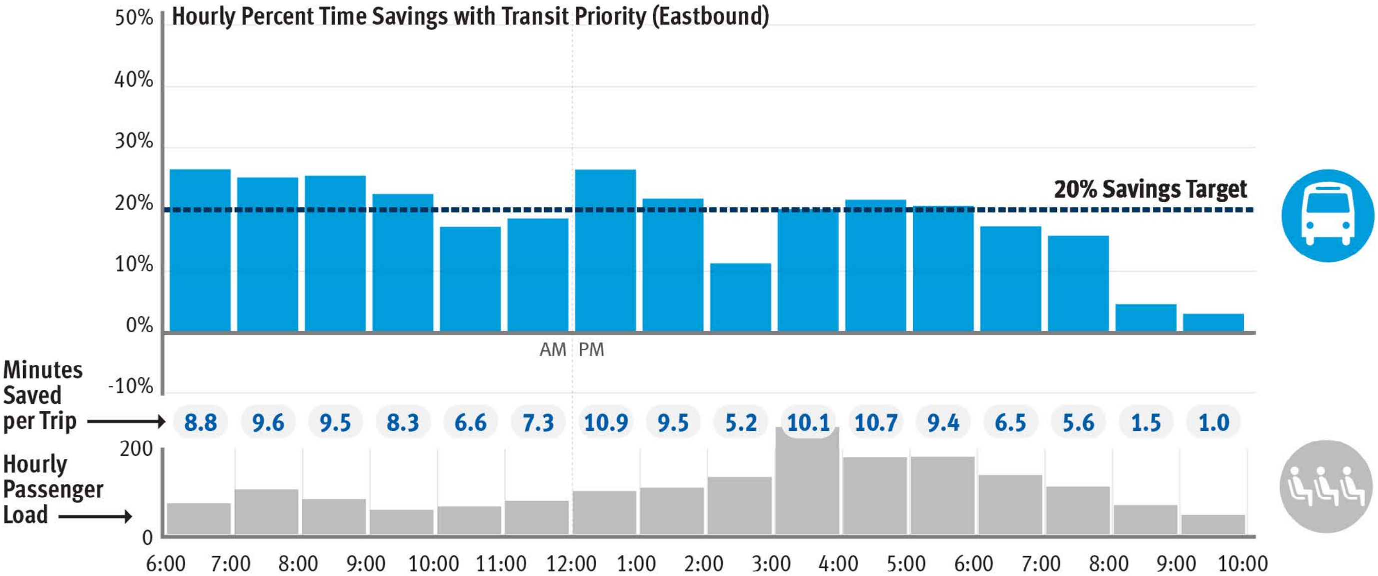
Overview of R2 RapidBus Performance

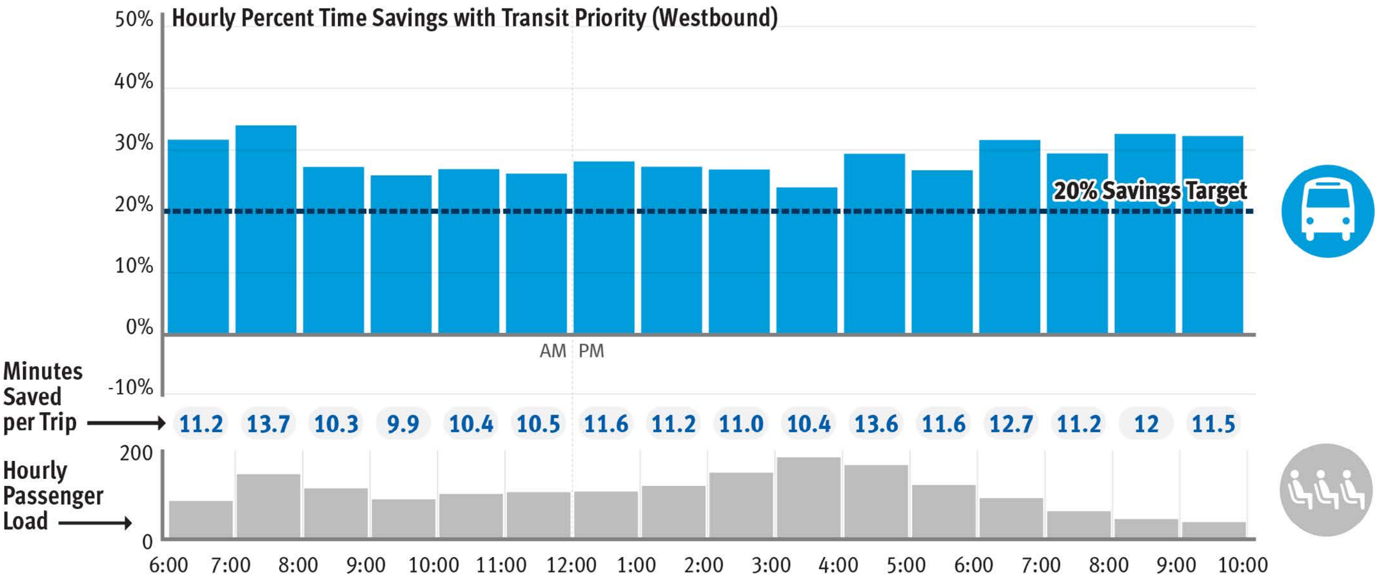
- Compared to Route 239, the R2 RapidBus reduced run time and dwell time by 24% on weekdays between Park Royal and Brooksbank Avenue in the City of North Vancouver.
- Travelling eastbound, the R2 experienced run time savings at all times of the day, with the highest percent savings between 6 a.m.–9 a.m., 12 p.m.–1 p.m., and 3 p.m.–6 p.m.
- The R2 experienced higher and more consistent run time savings travelling westbound, exceeding 20% at all times of the day.

R2 Implementation Challenges

- The western terminus of the proposed route was truncated from Dundarave to Park Royal in response to some community members' concerns about service levels and bus priority measures.
- Travel lanes along Marine Dr, 3rd St, and Main St vary between three and one, so transit priority measures for the R2 are intermittent.
- Construction around the Mosquito Creek Bridge delayed implementation of bus lanes originally planned to support the route at launch.

R2 RapidBus Travel Time Savings by Hour, Weekdays, R2 vs. Route 239, between Park Royal and Brooksbank Ave



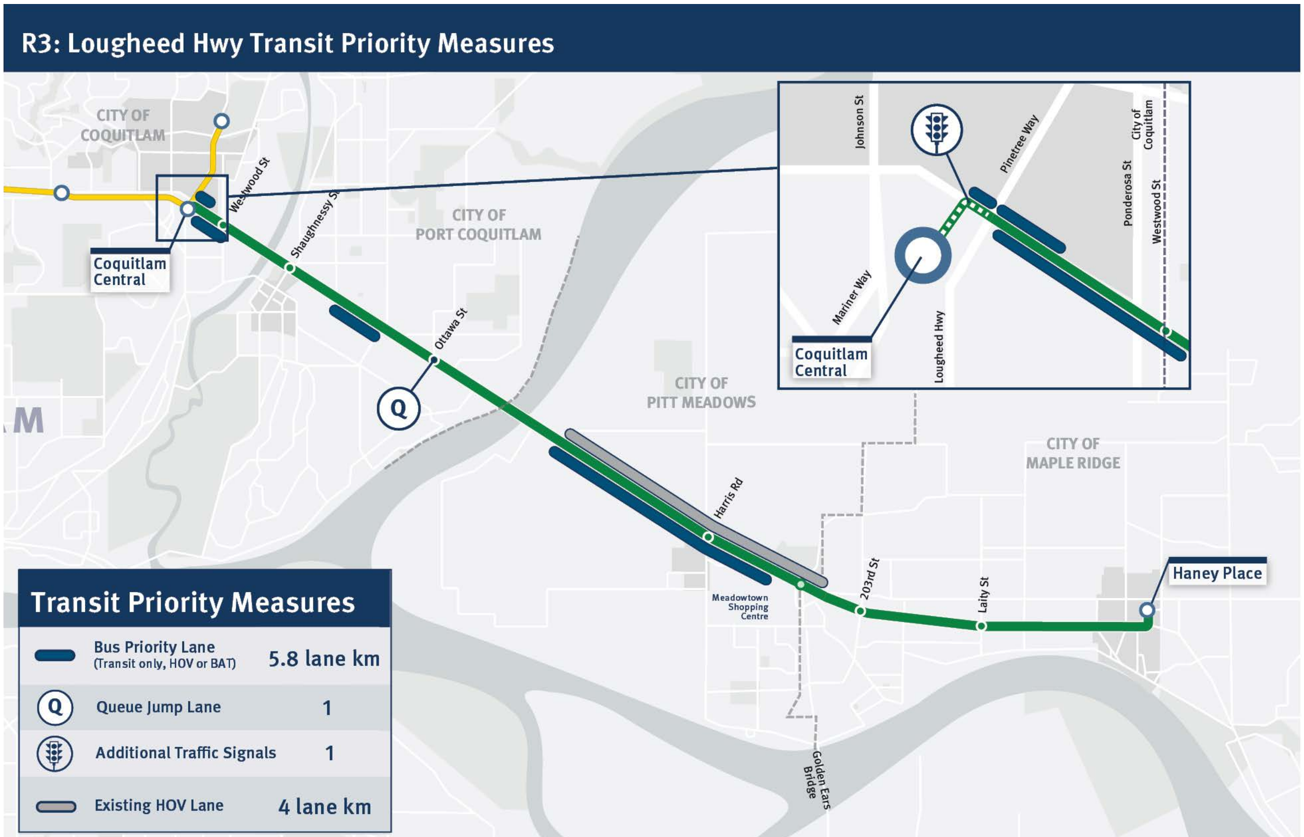


The blue vertical bars (top) show the percentage savings by hour of day, relative to RapidBus' target of 20% faster service compared to previous local buses; the labels below the bars show the average minutes saved per trip. The grey bars (bottom) show the passenger load (number of passengers on board) in each hour.
Note: Based on combined run and dwell time.

R3 RapidBus: Lougheed Highway

The R3 RapidBus runs between Coquitlam Central SkyTrain Station and Haney Place via Lougheed Highway. The R3 largely runs alongside and complements local Route 701. It added bus priority lanes expanding on an existing HOV lane along with providing a more direct route compared to Route 701.

Map of R3 RapidBus Transit Priority



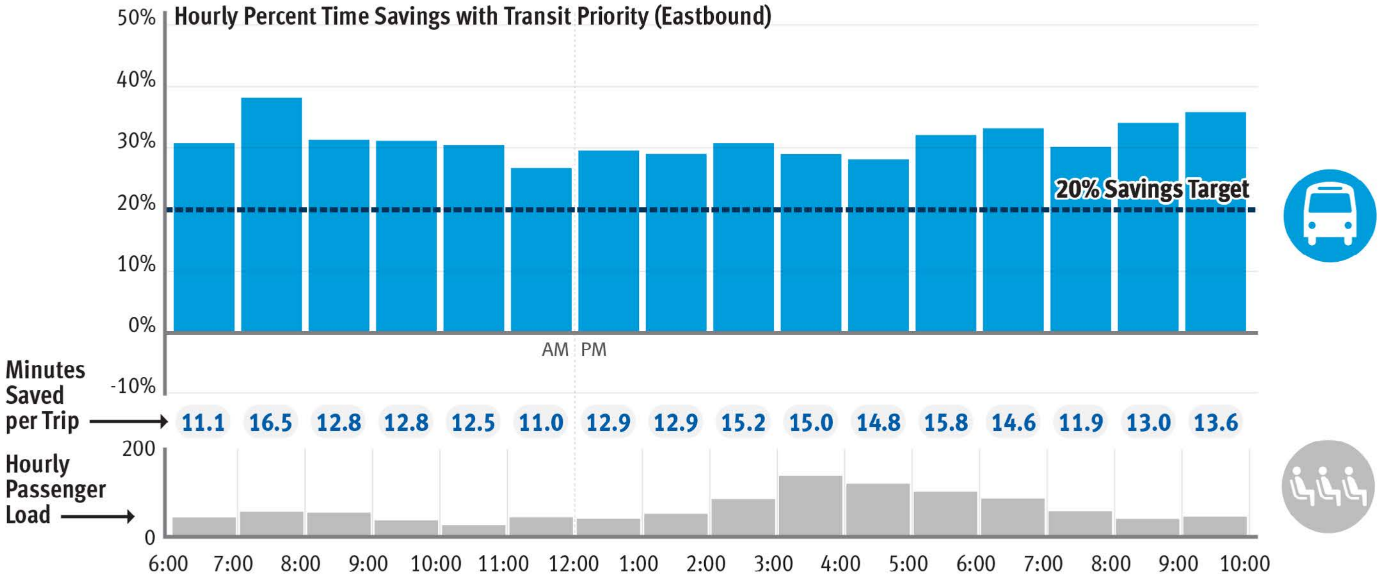
Overview of R3 RapidBus Performance

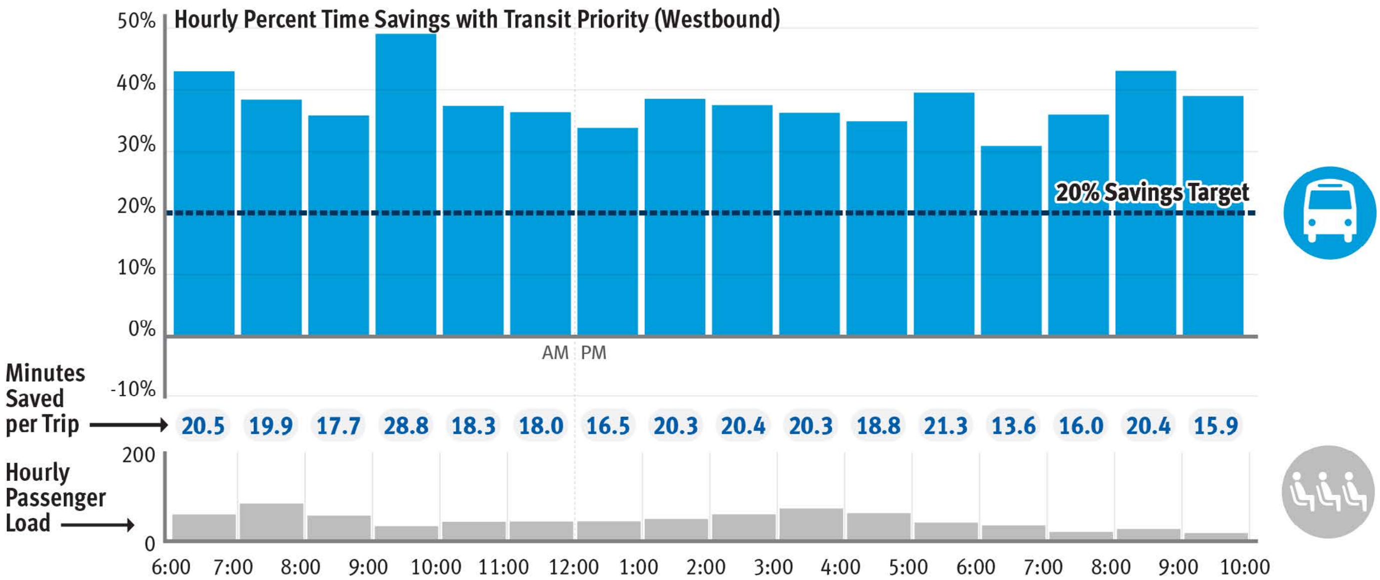
- Travelling both eastbound and westbound, the R3 provided consistent travel time savings at all times of the day, exceeding 30% at all times of the day traveling eastbound.
- This is a significant improvement, providing a much faster transit connection between Maple Ridge and the rest of the region, including a more direct connection to the Millennium Line SkyTrain.
- With average speed (36 km/hr) and stop-spacing (2.45 km) exceeding those of the Canada Line (32 km/hr and 1.22 km), **the new R3 has service attributes comparable to SkyTrain**. This is an example of what can be accomplished with at-grade bus service.
- Largely as a result of the introduction of the R3, ridership in the whole sub-region has been more robust since the COVID-19 pandemic. In fall 2022, Maple Ridge/Pitt Meadows led all sub-regions, with a ridership recovery of 98% since before the pandemic, compared to 79% system-wide.

R3 Implementation Challenges

- The Coquitlam River Bridge is a two-lane bottleneck that is due to be replaced. Implementation of bus priority measures in this area was not possible prior to the launch of R3.

R3 Travel Time Savings by Hour, Weekdays, R3 vs. 701



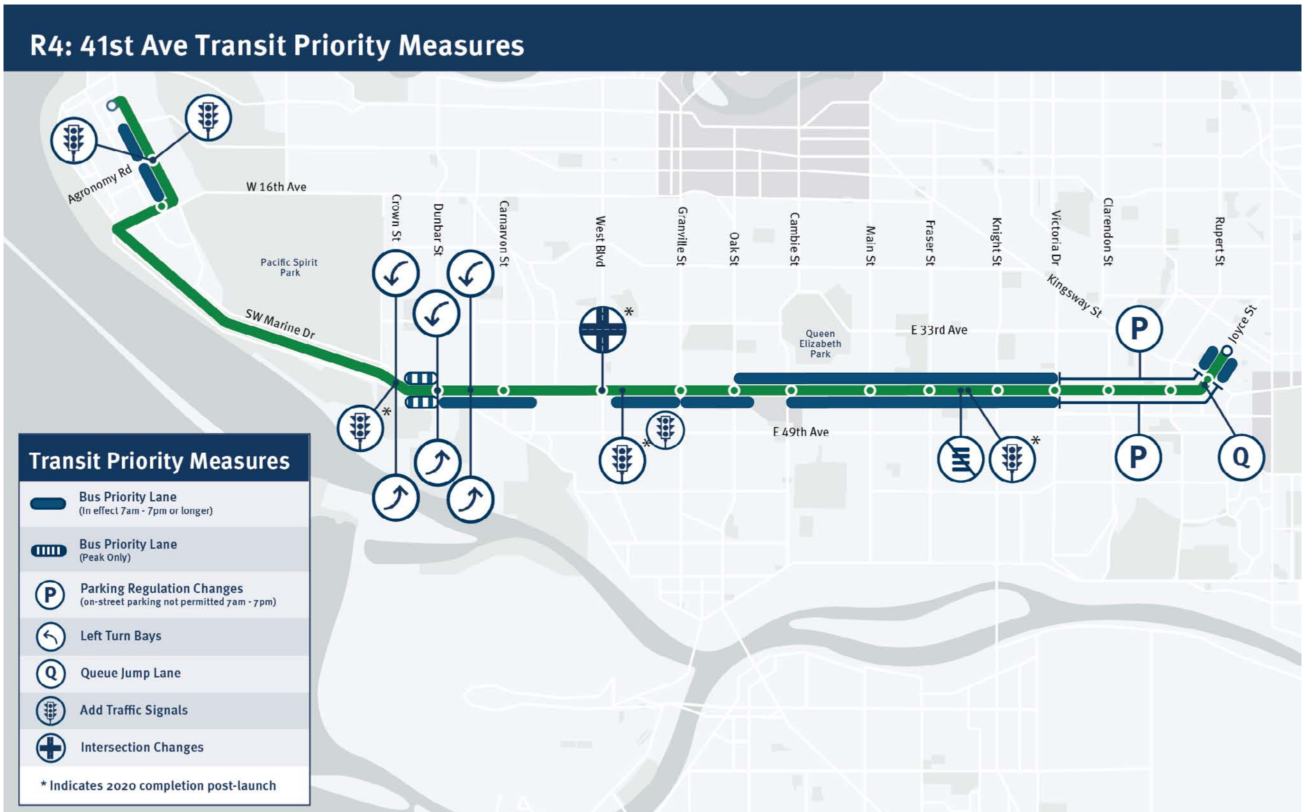


For each direction, the blue vertical bars (top) show the percentage savings by hour of day, relative to RapidBus' target of 20% faster service compared to previous local buses; the labels below the bars show the average minutes saved per trip. The grey bars (bottom) show the passenger load (number of passengers on board) in each hour.
Note: Based on combined run and dwell time.

R4 RapidBus: 41st Ave

The R4 RapidBus runs between UBC to Joyce–Collingwood SkyTrain Station via 41st Ave. The R4 replaced Route 43, the previous weekday-only limited stop service. It also replaced the local Route 41 west of Marine Drive. The RapidBus route added transit priority measures including bus lanes and queue jumps along with turn restrictions and traffic signal changes. The RapidBus launch introduced all-door boarding and provided frequent limited stop service including on weekends.

Map of R4 RapidBus Transit Priority



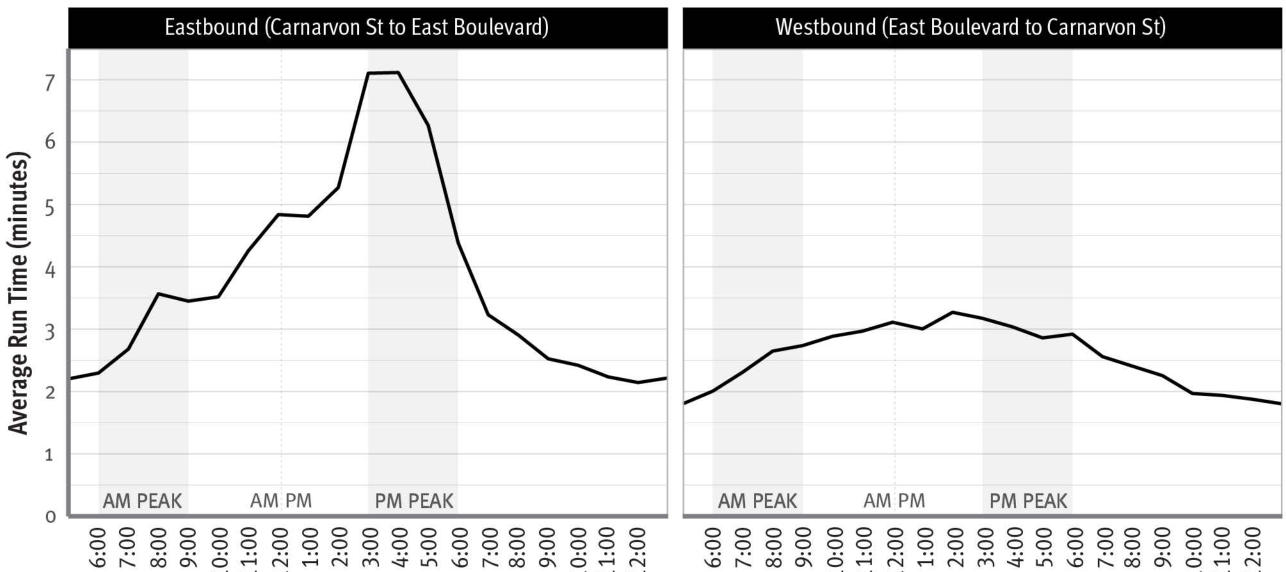
Overview of R4 RapidBus Performance

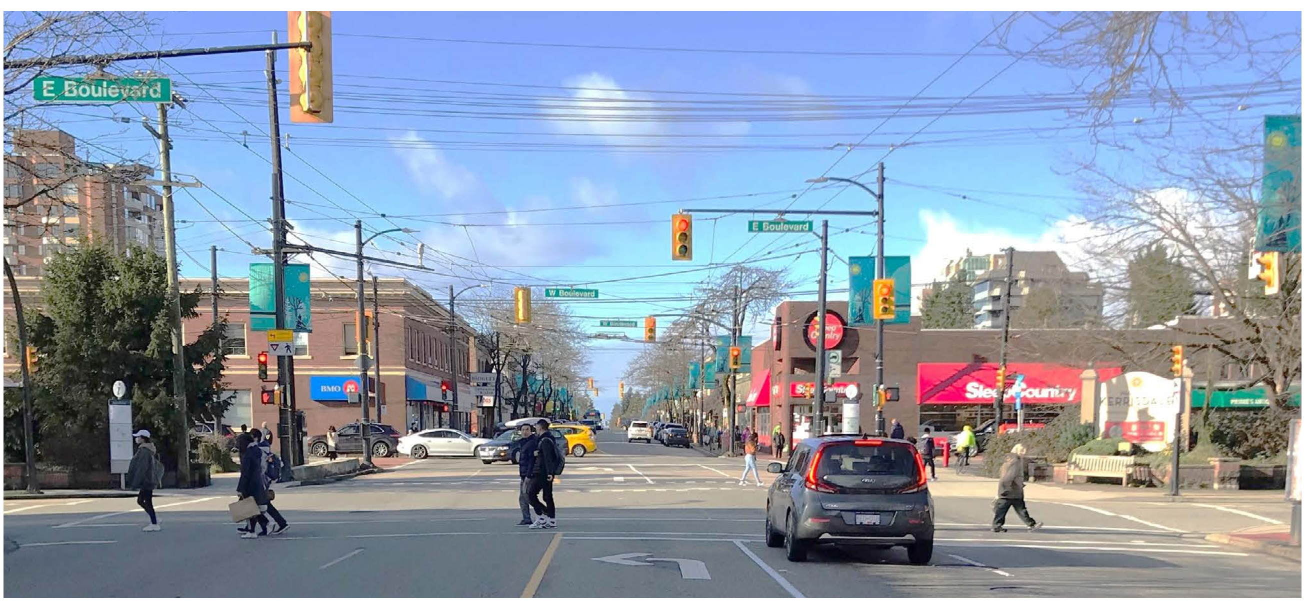
- Comparing the R4 RapidBus with the previous local Route 41, the R4 saw a 26% reduction in run and dwell time between Joyce–Collingwood Station and UBC, and a 29% reduction between Joyce–Collingwood Station and Dunbar St.
- Prior to the implementation of the R4, local Route 41 travelled between UBC and Joyce–Collingwood Station. RapidBus service provided travel time savings of over 20% throughout the day compared to the pre-existing local route, and over 30% at some times of the day.

R4 Implementation Challenges

- Travel lanes along 41st Ave vary between one and two so transit priority measures could not be applied continuously along 41st Ave.
- Along much of the corridor, bus lanes were created by removing on-street parking. This requires additional stakeholder engagement, but expands capacity for both buses and other vehicles.
- Kerrisdale is a retail area that remains a hotspot of congestion along the corridor with delays most evident in the eastbound direction in the afternoon (see charts below). Creative solutions will be required to alleviate this congestion given limited road space and many competing demands—including parking, pick-up/drop-off and pedestrian access.
- Ongoing construction of Oakridge Centre will continue to cause disruptions to bus service until its completion after 2025.

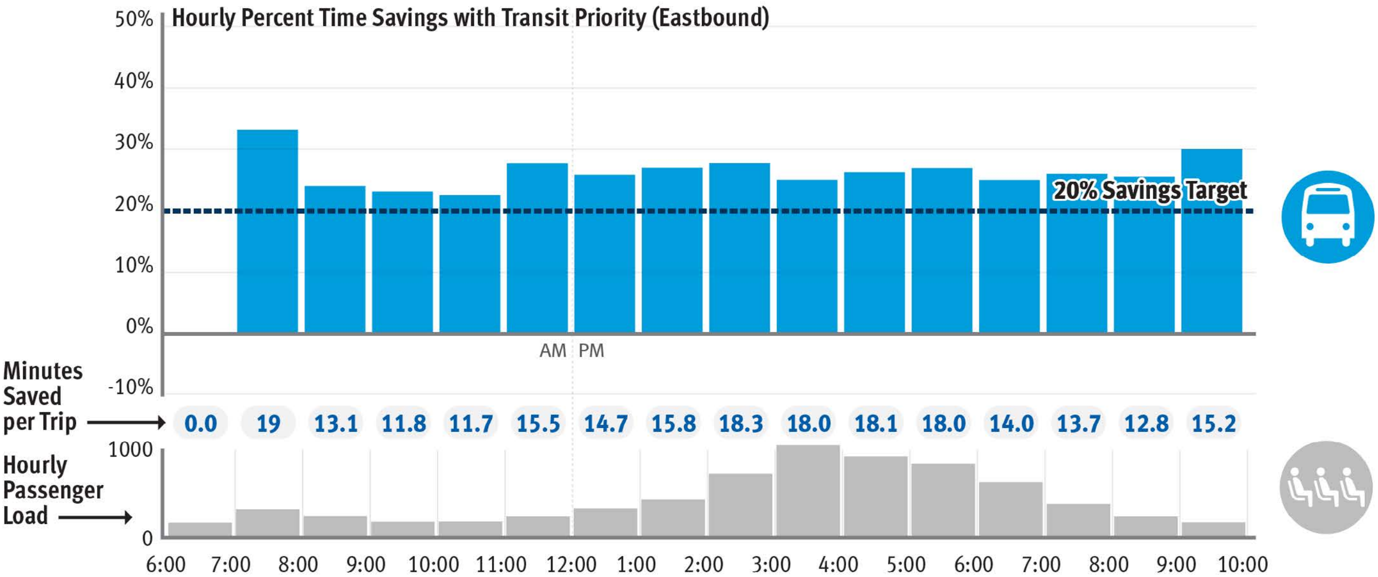
R4 Average Weekday Travel Time by Hour (Excluding Dwell Time) in Kerrisdale between Carnarvon St and East Blvd, Fall 2021

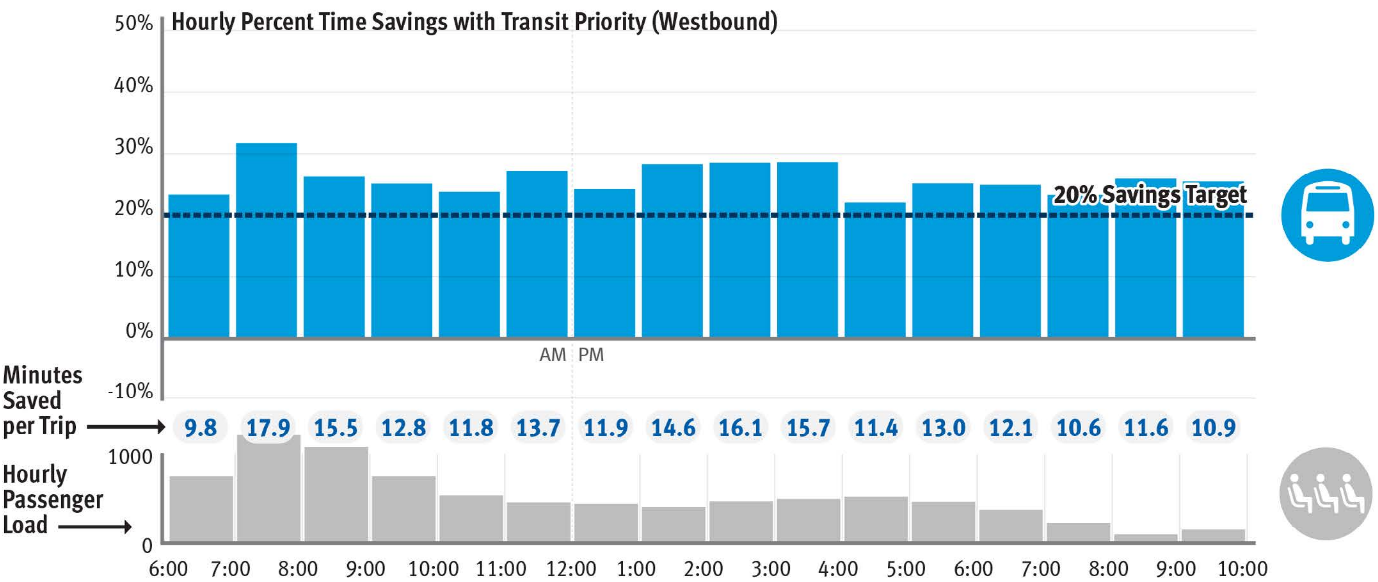




West 41st Ave at East Blvd, facing west.

R4 Travel Time Savings by Hour, Weekdays, R4 vs. 41

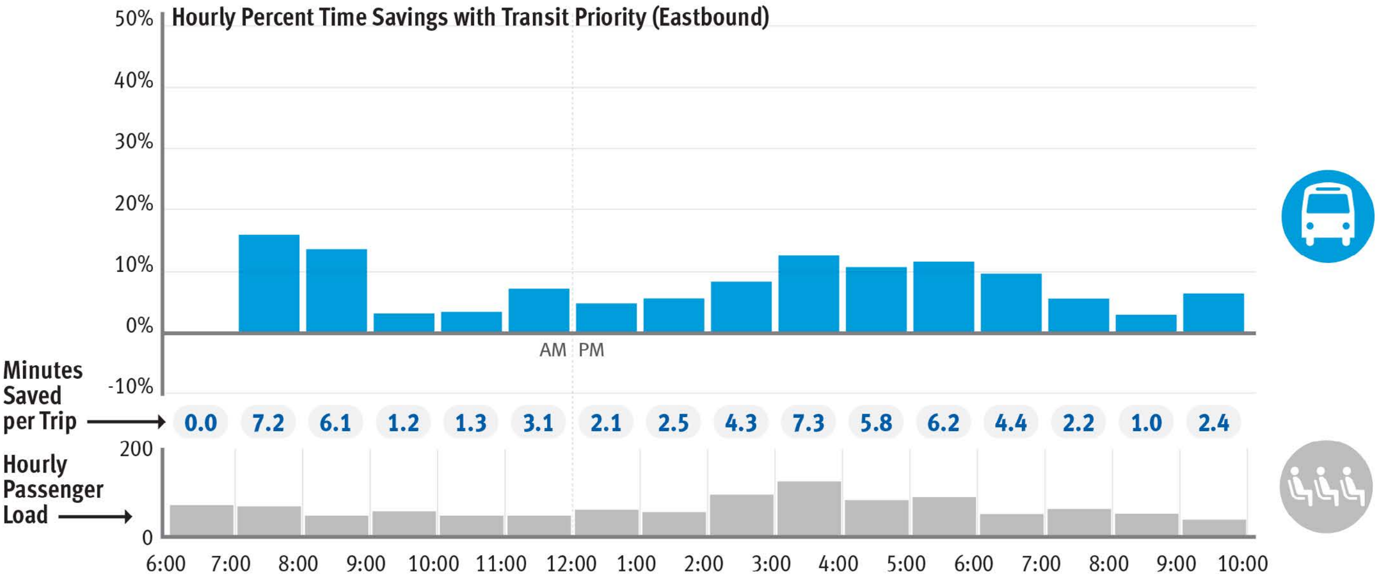


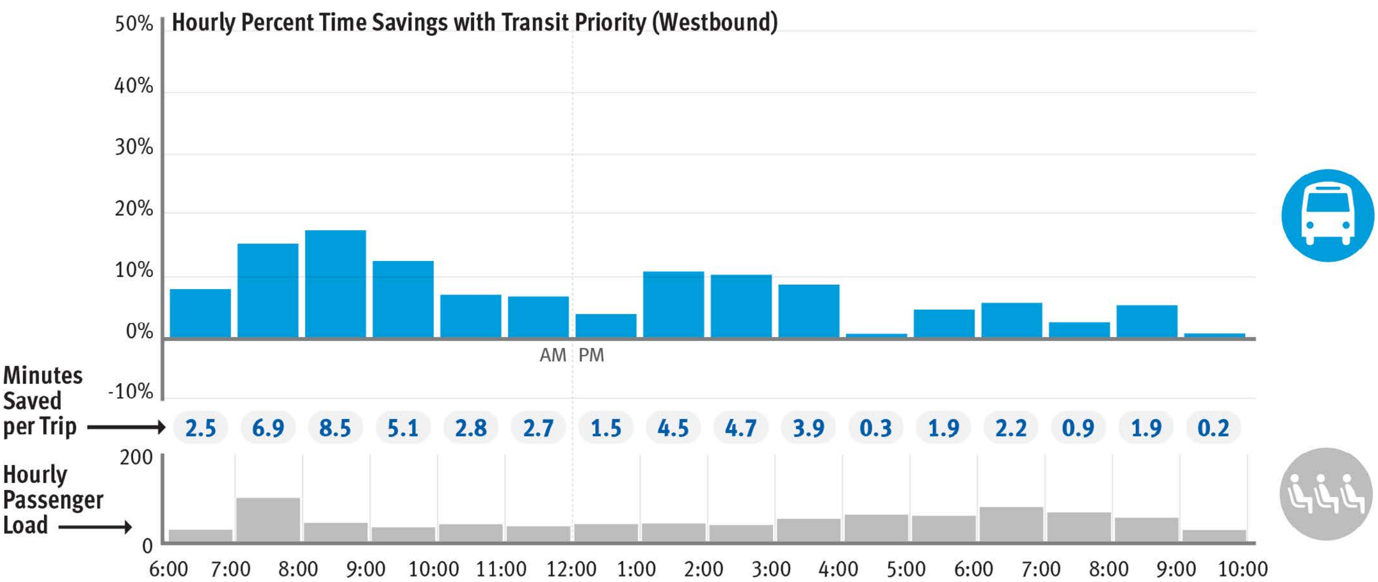


For each direction, the blue vertical bars (top) show the percentage savings by hour of day, relative to RapidBus' target of 20% faster service compared to previous local buses; the labels below the bars show the average minutes saved per trip. The grey bars (bottom) show the passenger load (number of passengers on board) in each hour.
Note: Based on combined run and dwell time.

The local service on Route 41 saw a 9% reduction in run and dwell time, demonstrating transit priority measures benefit all routes that travel on the corridor. Since implementation of the R4, local Route 41 now terminates at Crown Street. The graphic below shows the hourly travel time savings compared to the previous Route 41 between Dunbar Street and Joyce–Collingwood Station. Travel time was lower on Route 41 at all times of the day, exceeding 10% savings during some hours in the morning (both directions), late afternoon (eastbound), and mid-afternoon (westbound).

Local Bus Travel Time Savings by Hour, 41 Before and After, Joyce–Collingwood **Station – Dunbar**





For each direction, the blue vertical bars (top) show the percentage savings by hour of day; the labels below the bars show the average minutes saved per trip. The grey bars (bottom) show the passenger load (number of passengers on board) in each hour.
Note: Based on combined run and dwell time.

TransLink is continuing to improve and expand the RapidBus network.

The existing RapidBus routes remain focus areas for continuing improvements.

- Along the **R2,** new bus lanes continue to be implemented. This includes the "East 3rd St bus lanes" project (evaluated under "Bus/BAT Lanes" in this report). Notably, the necessary road space for this project was created via a transportation-oriented land-use rezoning. Another gap in bus lane is also being filled eastbound between Queensbury and Gladstone (under construction). And new bus lanes around the Lynn Creek Bridge are also planned (though yet to be funded).
- Along the **R4,** the Northbound "Wesbrook Mall Bus Lane" was completed since launch, complementing an upgrade to the bus loop at University of British Columbia. Other spot changes are being completed, including a new bus shelter and permanent bus lanes around Oakridge Centre, once construction is complete.
- The City of Burnaby and TransLink are in the planning stages for a future corridor-level upgrade for the **R5.**

The success of the initial launch of RapidBus routes also provides momentum for an expansion of the RapidBus network, including:

- Launch of the R6 along Scott Road in Surrey and Delta (see map on page 57).
- Alignment planning for the R7 to connect Richmond to the Expo Line SkyTrain.
- Up to 11 future RapidBus corridors highlighted in the region's Transport 2050: 10 Year Priorities (see map in "Regional Investments in Bus Priority"—on page 33).
- Nine new Bus Rapid Transit Routes, including upgrades to existing or proposed future RapidBus routes (see map in "Future Bus Rapid Transit"—on page 94).

Plans are underway to improve the R5 RapidBus corridor in Burnaby.

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Project Highlights: Bus Stop Balancing

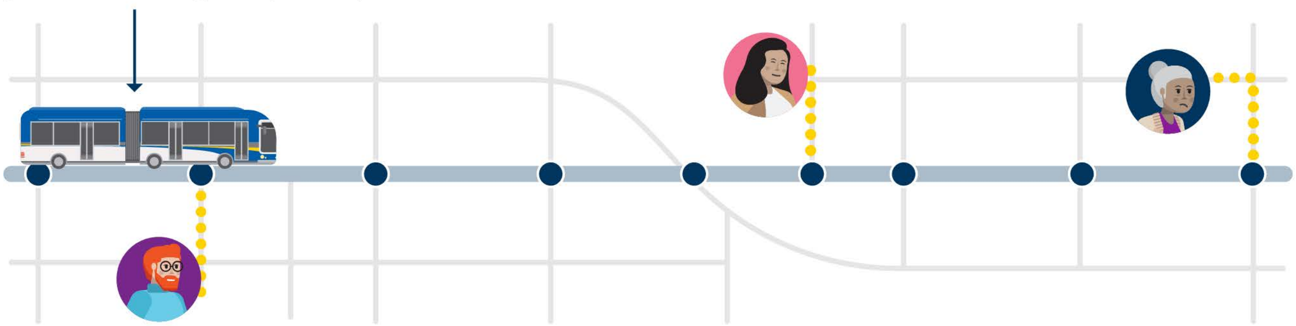
Bus stop balancing projects yield savings at scale.

Bus stop balancing involves carefully consolidating or removing bus stops that are too close together, in order to improve travel times and reliability for bus customers. As the name suggests, it aims for a balance between convenient access and effective service. While bus customers must sometimes walk a little bit further to their stop, their trip on the bus will be much shorter.

Bus Stop Spacing Before and After Balancing

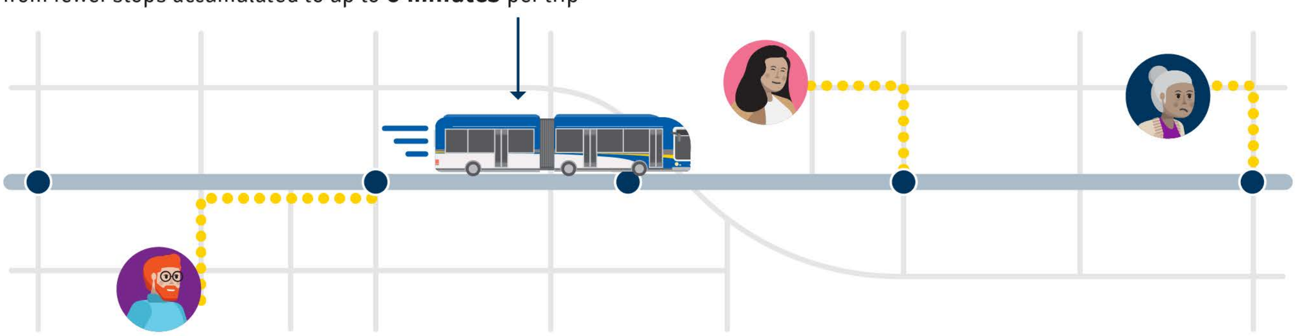
Shorter walk; slower bus

Before bus balancing: up to 75% of stops exceeded spacing guidelines, resulting in frequent stops and slower buses



Slightly longer walk; faster bus

After bus balancing: buses ran **4% to 14% faster**—time savings from fewer stops accumulated to up to **6 minutes** per trip



Map of Bus Stop Balancing Projects (Routes 2, 4, 7, 17, and 25)

Between 2020 and 2022, TransLink and the City of Vancouver worked together on the Bus Stop Balancing project, which focused on five bus routes. Up to 80% of stops on these routes were closer than TransLink's service guidelines (300 m). After consolidating 86 bus stops, the vast majority of customers could still use their original stop, especially those with mobility limitations, and most customers affected were still within a 2- to 3-minute walk of their original stop. But all customers experienced a significant improvement in travel times. These project areas are illustrated in the map above, which shows only the portions of Routes 4 and 7 where stops were balanced; downtown Vancouver stops were not included in the projects.

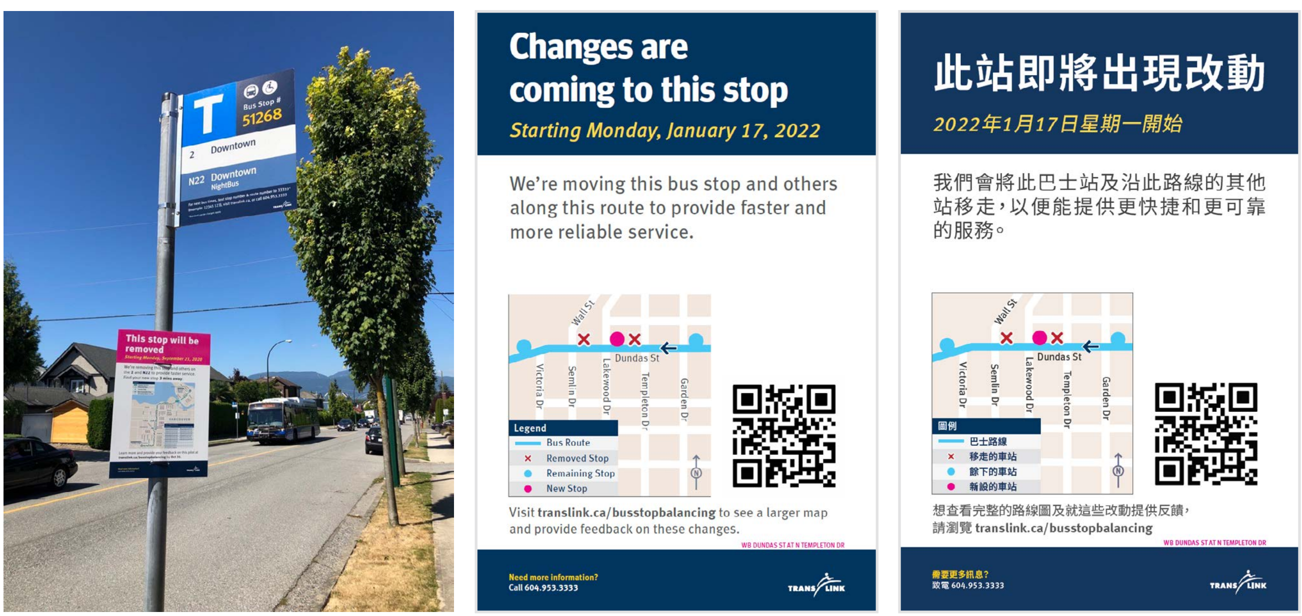
Overview of Bus Stop Balancing Performance

- On the five routes with rebalanced bus stops, travel time savings averaged approximately 4% to 14% (3 to 6 minutes) across the day.
- Reducing the number of stops most clearly improves dwell time, as buses are less often sitting still at a stop. But run-time is also reduced, as buses spend less time decelerating, accelerating, and merging back into traffic.
- Run time savings are most pronounced during weekday peak periods, when buses can experience more delay from accessing bus stops and re-entering traffic.
- Optimizing timing points—a set location along the route where bus operators wait if they are ahead of schedule—can have a major impact on improving speed and reliability. The removal of the timing point in the Route 2 Bus Stop Balancing project accounted for up to one-third of dwell time savings.

Bus Stop Balancing Project Statistics

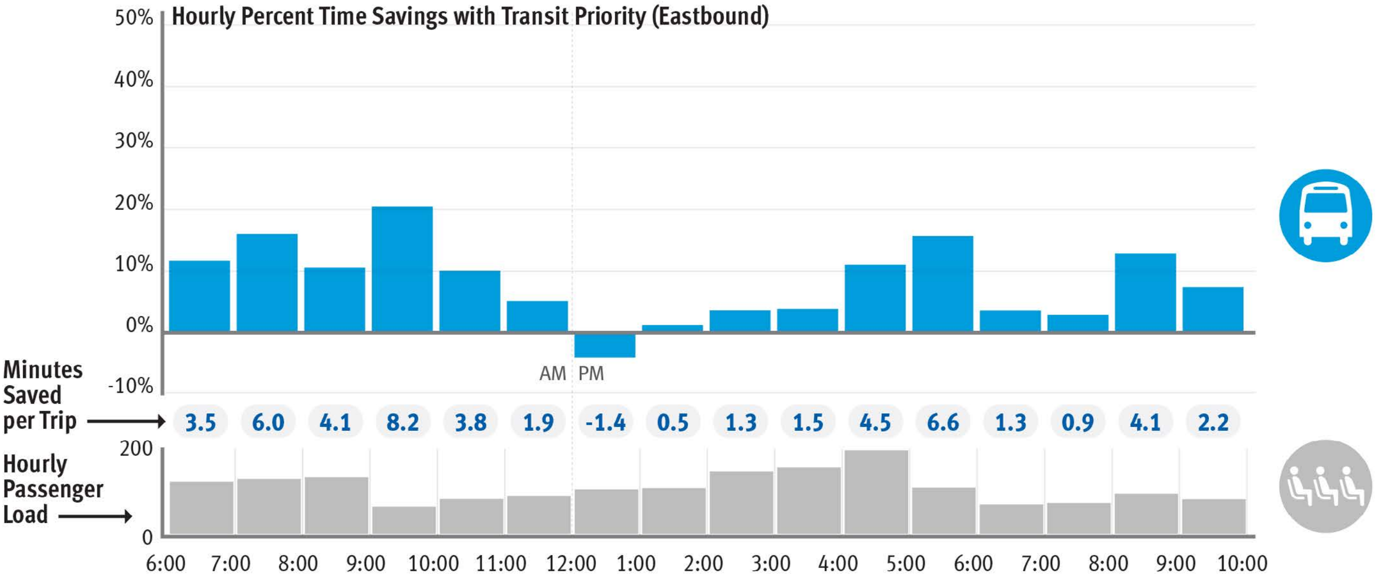
Route	Sub-Region	Closely Spaced Stops [1]		Travel Time Change [2]		Cost/Benefit [3]
		Before	After	Daily	AM/PM Peak	Payback Period
Route 2	Vancouver/UBC	81%	45%	-11%	-14%	0.3
Route 17	Vancouver/UBC	76%	56%	-6%	-7%	0.6
Route 25	Vancouver/UBC & Burnaby/New Westminster	52%	33%	-6%	-6%	0.4
Route 4	Vancouver/UBC & Burnaby/New Westminster	65%	48%	-8%	-7%	-
Route 7	Vancouver/UBC	77%	52%	-7%	-4%	-

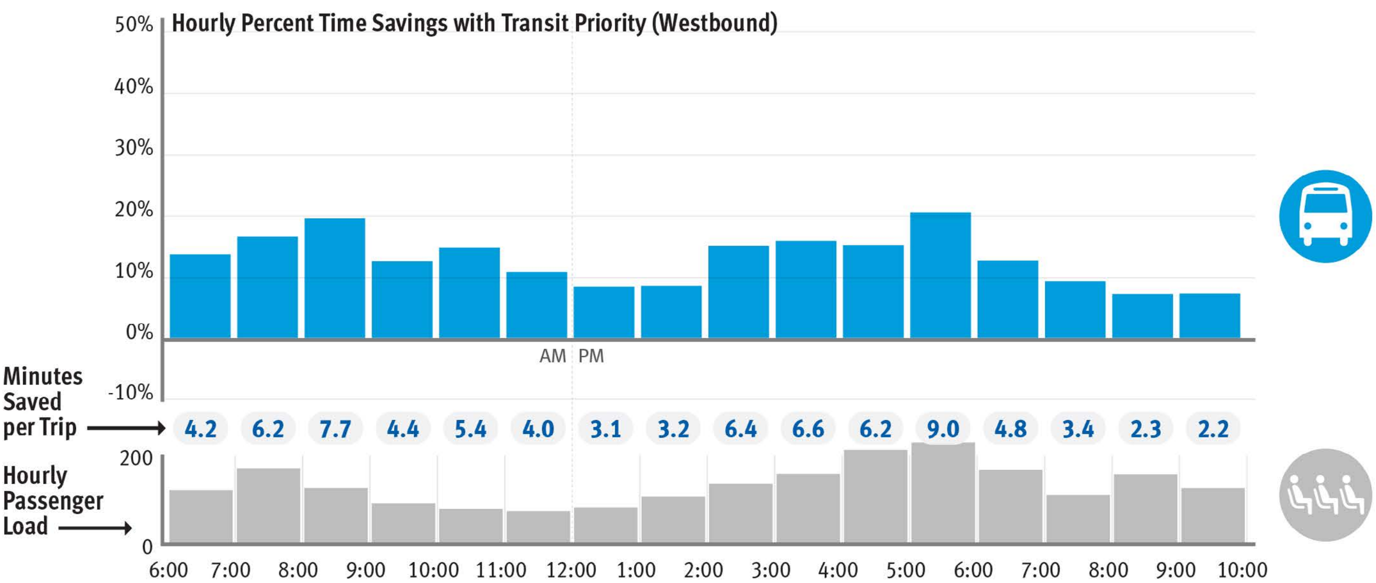
Notes: 1. Closer than the recommended 300m per TransLink's Service Guidelines before implementation. 2. Daily average change per trip, for trips between 6 am and 10 pm, including run time and dwell time. 3. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period.



Bus stop balancing projects require thoughtful public outreach to minimize disruption to customers, including multilingual announcements at stops.

Bus Stop Balancing: Example of Travel Time Savings Achieved on Route 2





The blue vertical bars (top) show the percentage savings by hour of day; the labels below the bars show the average minutes saved per trip. The grey bars (bottom) show the passenger load (number of passengers on board) in each hour. After bus stop balancing, eastbound travel on Route 2 saw mostly decreases in travel time, with travel time savings of up to 20% in some hours of the day.

Considerations for Future Projects

- Corridors with very close and busy stops benefit the most. These are often concentrated in downtown areas.
- It is important to avoid increasing walking or rolling distances to bus stops for people with accessibility needs, especially if their new route would involve a steep slope.
- Financial payback is very high, but public outreach requirements are also high. Staff have a limited amount of time, limiting the number of corridors that can be implemented at the same time. Additional effort is also required to decommission bus stops after route adjustments have been made.

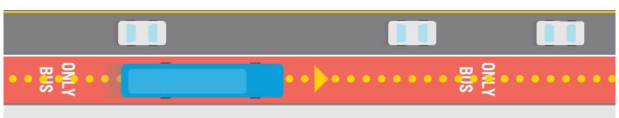
Project Highlights: Bus/BAT Lanes

Bus and BAT lane projects reduced travel times by up to approximately 15%, with payback in less than 10 years.

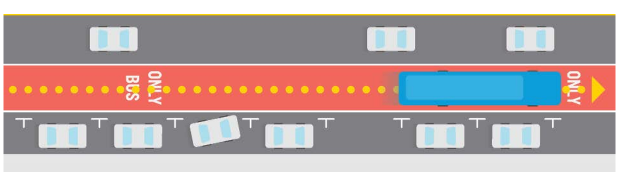
Lanes reserved for buses protect them from congestion. They may operate all-day or only during certain parts of the day, such as peak-only lanes that primarily benefit commuters. Bus lanes can also be bus-only, or they may be shared with "business access" traffic that turns across bus lanes (BAT lanes) or "high-occupancy" vehicles (HOV lanes). Bus/bike lanes are shared with cyclists. Bus lanes are typically demarcated by diamond-shapes or red paint on the road, along with curb-side or overhead signage.

There are two primary types of bus lanes in Metro Vancouver.

Curb-side bus lanes are cost-effective and quick to implement, often with limited impact to traffic if repurposing parking. Tradeoffs include conflicts with right turning motor vehicle traffic. They also require enforcement and curb management to deter prohibited uses such as parking or loading in the bus lane.



Offset bus lanes run between an on-street parking lane and a through-traffic lane and reduce competition with right-turning vehicles as well as delivery and loading vehicles. Offset bus lanes preserve parking and loading along the curb. Tradeoffs include friction between buses and vehicles that are parking or double-parked. Because passengers cannot board directly from the curb, bus bulbs can be provided additional space for passengers at bus stops and improve pedestrian safety (e.g., shorter crossing distances).



Overview of Bus and BAT Lane Project Performance

- Both peak hour and all-day bus lanes were effective at decreasing travel time. These were evaluated only during the hours the lanes were in operation.
- In general, clearly marked, red, bus-only lanes perform the best. These included the two most effective projects—Wesbrook Mall bus lane (a curb-side lane) and West Keith Rd transit project (an offset lane).
- Bus lanes that are shared with business access traffic did not perform as well, especially in areas where buses encounter frequent intersections or queues of right-turning vehicles. This includes the least effective project—the W Georgia St bus lanes. Notably this project also showed a slight worsening at the peak periods. This is due to increased road delay at the PM peak, during which there had previously been a peak-only business-access bus lane.
- The most cost-effective project achieved savings at scale, using low-cost interventions. Although the 49th Ave transit project did not have the highest percentage improvement in travel time, by changing lane markings across a more than 5 km corridor, it achieved greater absolute savings (more than 75 seconds at the AM peak). And, relying primarily on street signage and roadway paint—which are relatively cheap—it achieved a payback period of less than 6 months.

The bus lane along Keith Rd is supported by red paint, a right-turn pocket, and a left-turn restriction at the intersection with Bewicke Ave.

Bus and BAT Lane Project Statistics

Map	Project Name	Sub-Region	Time Restrictions	Travel Time Change [1]		Cost/Benefit [2]
				Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
15	Wesbrook Mall bus lanes	Vancouver/UBC	-	-15%	-13%	5.7
16	West Keith Rd transit project	North Shore	-	-9%	-9%	9.9
12	Granville St bus lanes	Vancouver/UBC	SB: 3–6 p.m. NB: 7–10 a.m.	-6%	-7%	4.8
10	Lougheed Highway bus lanes	Northeast	-	-5%	-11%	-
13	49th Ave transit project	Vancouver/UBC	Various time-restricted segments	-4%	-5%	0.4
11	East 3rd St bus lanes	North Shore	-	-4%	-4%	[3]
14	Main St and Kingsway bus lanes	Vancouver/UBC	SB: 3–6 p.m. NB: 7–10 a.m.; portion 7 a.m.–7 p.m., 7 days/week	-4%	-4%	8.3
9	Fraser Hwy bus lanes	Southeast	-	-3%	-3%	7.7
18	W Georgia St bus lanes	Vancouver/UBC	Extended peak-only lane to 7 a.m.–7 p.m.	-3%	5%	1.5
17	Scott Rd / 120 St BAT lane	Southeast	-	No change	No change	-

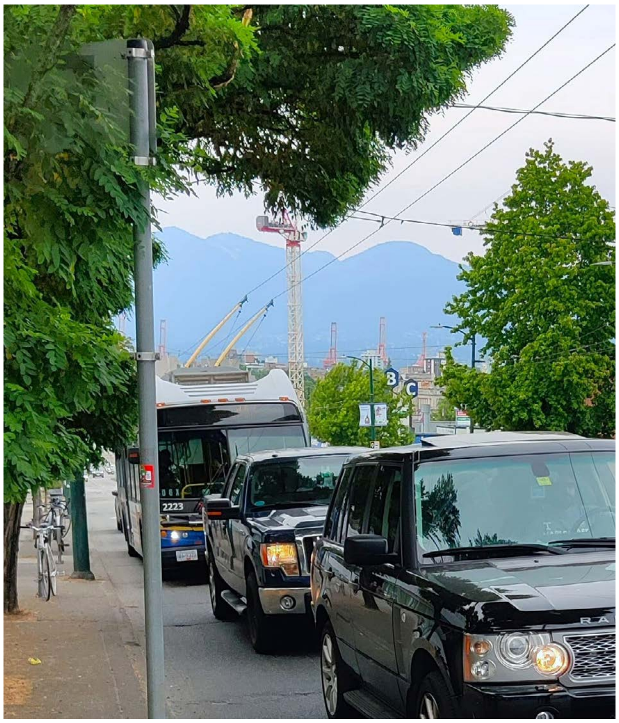
Notes: 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period. Some of the projects listed were constructed using temporary/interim measures, while others may be more permanent and have different associated costs. 3. Subset of a project constructed as part of RapidBus implementation. 4. Table includes projects completed after RapidBus launch in 2021.

The red bus lanes along Wesbrook Mall are clearly demarcated.

Considerations for Future Projects

Bus lanes are complementary with other transit priority treatments.

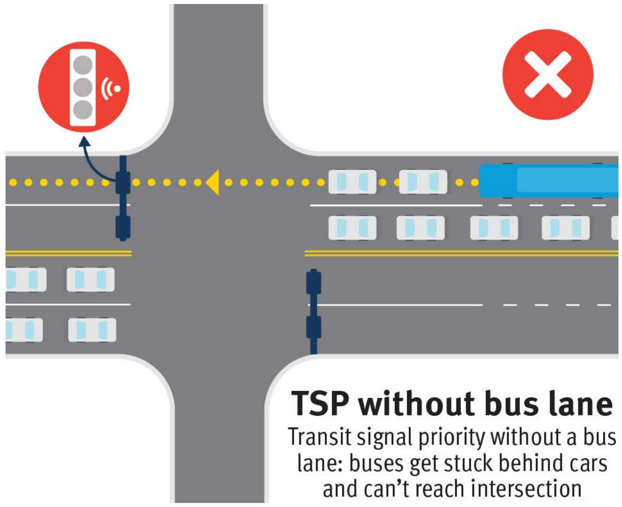
- ***Turn restrictions*** can be used to prevent cars from queuing to turn at intersections, such as where right-turns may block bus lanes. Limiting turn movements at intersections can also prevent traffic from backing up.

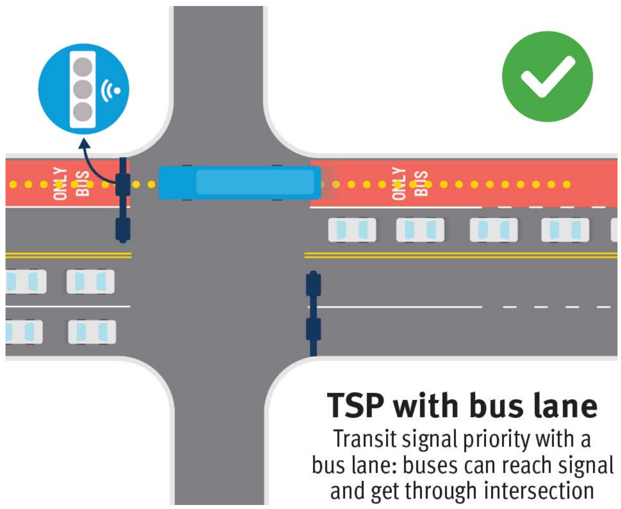


Cars blocking the 7AM-7PM bus-only lane on Main St at 5th Ave.

- ***Right-turn pockets and advanced right-turn signals or phases*** can separate buses from queued vehicles where there are many right turn movements and pedestrian crossings.

- ***Transit signal priority (TSP)*** benefits from bus lanes. TSP may not function effectively if a bus is stuck in traffic and is unable to activate signal priority (top right panel). Bus lanes make transit signal priority systems more effective by allowing buses to be detected reliably and far in advance of the intersection (bottom right panel).





Clearly marked and well-enforced bus lanes work better. Confusing signage and inadequate enforcement of drivers blocking the bus lane reduce their effectiveness. Strategies that other regions have used to keep buses moving smoothly through bus lanes include:

- ***Follow-up on quick build projects with permanent improvements.*** Many bus lane projects implemented in 2020 were installed using side-mounted signage for quicker project delivery. Once improvements are demonstrated to be effective, it is also important to construct permanent and more visible bus lane markings and signage.

- ***Make lanes visible.*** Many cities and transit agencies are using red-coloured pavement treatment to discourage unauthorized vehicles from using transit lanes. A study of red bus lanes in San Francisco found they reduced the number of drivers violating the lanes by approximately 50%.
- ***Increase awareness of bus lane policies and hours*** by ensuring clear and consistent signage. A variety of signs are used in bus and HOV (High-Occupancy Vehicle) lanes in Metro Vancouver.[37] Drivers may not understand that a diamond lane is a bus-only lane. Many people interpret it as an HOV lane (and drivers of electric vehicles interpret it as "EV OK"). Improved overhead signage can communicate when bus lanes can be shared with HOVs or bicycles, and when they are reserved exclusively for bus travel.

Provide consistent reinforcement to deter drivers from stopping in the bus lanes and establish a culture of keeping bus lanes clear. Active enforcement of cars in the bus lane (pick-ups/drop-offs, deliveries, double parking) keeps the bus lane clear and reminds drivers not to stop in the bus lane. Examples of innovative approaches to enforcement include:

- In 2019, the Metropolitan Transportation Authority in New York City introduced automated bus lane enforcement (ABLE) cameras on several of its buses to capture bus lane violations in real-time. Signs posted along the bus route indicate bus lane hours and notify drivers that camera-enforcement is in use. In 2022, 300 ABLE cameras were installed, and 600 more are expected in 2023.[38]
- The City of Seattle is piloting an automated transit lane enforcement system that tracks license plates of all vehicles authorized to use transit lanes and sends out notices to vehicles that are not authorized to use the lanes. The pilot also includes enforcement of markings and signage to prevent drivers from blocking intersections and crosswalks.[39]

Bus lanes benefits are most durable when they are reserved for buses only. As described elsewhere in this report (see "Existing Bus Priority in Metro Vancouver"), much of our existing bus priority lane infrastructure allows high-occupancy vehicles. Benefits from HOV lanes may decline in the future as more vehicles are allowed to use those lanes (see "HOV Lanes and Electric Vehicles" sidebar below).

HOV Lanes and Electric Vehicles

High occupancy vehicle (HOV) lanes are limited to vehicles transporting two or more persons per vehicle. HOV lanes move more people in fewer vehicles, which lowers greenhouse gas emissions and reduces congestion on our roads. In British Columbia, some vehicles are permitted to use HOV lanes regardless of the number of passengers, such as electric vehicles (EVs). EV drivers must display a provincial decal to access HOV lanes in Metro Vancouver and throughout the province. These decals do not provide EV drivers with access to bus lanes reserved exclusively for bus travel.

The number of EVs on our roads is expected to continue to grow and may increase more rapidly in response to actions to reduce transportation emissions. For example, some actions in the CleanBC Roadmap to 2030 include requiring 100% of new light-duty vehicles to be EVs by 2035, and a target of 10,000 public EV charging stations in the province by 2030. More light-duty EVs on the road will decrease emissions, but not congestion.

By 2027, the benefits of HOV lanes in reducing traffic congestion are expected to be diminished due to the volume of EVs expected. These trends would impact buses, since HOV lanes comprise nearly half of our current bus priority.

Source: MOTI, EV HOV Lane Capacity and Utilization, March 2022

Project Highlights: Queue Jumps and Transit Approach Lanes

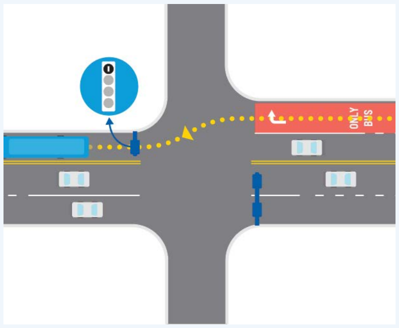
Queue jumps and transit approach lanes improved travel times by up to 35%, with payback often less than five years.

Queue jumps and transit approach lanes allow buses to bypass general traffic at congested intersections, reducing delay at traffic signals.

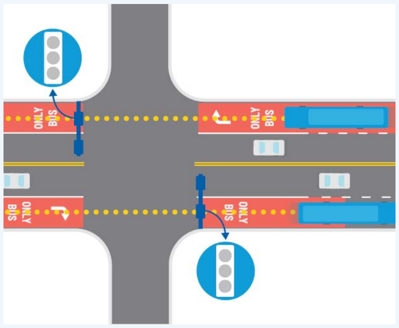
Transit approach lanes are a dedicated bus lane running through an intersection, allowing a bus to bypass congestion at the intersection.

Queue jumps are typically approach lanes that are combined with a specialized transit signal that enables buses to get a head start at the beginning of a new signal cycle. This design is particularly important when there is no receiving bus lane on the far side of the intersection, allowing buses to merge ahead of the traffic. Queue jumps can also be an approach lane with a sensor that recognizes when a bus is at or approaching the intersection, prompting the signal to stay or turn green.

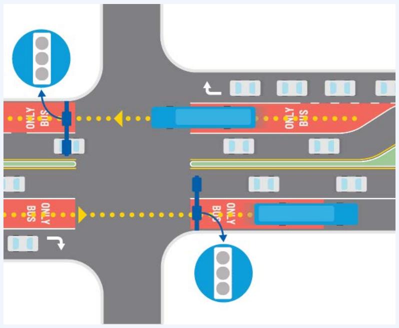
How do queue jumps and approach lanes work?



Queue jump in right-turn lane or BAT lane without a receiving lane. A specialized transit signal and/or phase is required to help the bus transition back into traffic.



Queue jump in right-turn lane or BAT lane. Signal priority is not required but may be complementary.



Dedicated transit approach lane. Signal priority is not required but may be complementary.

Overview of Queue Jump and Approach Lane Project Performance

Travel time savings for the queue jump and transit approach lane projects completed between 2019 and 2022 were evaluated based on improvements to bus run time. Results included:

- Queue jumps on Fraser Highway and at the Broadway and Gaglardi Way intersection reduced bus run times by **13% to 25% during peak periods, and 15% all-day (15 to 65 seconds).**
- Transit approach lanes implemented along Joyce Street as part of the R4 RapidBus project were the most effective, reducing bus run time on weekdays by **34% all-day and up to 40% during the PM peak**—more than a minute per trip.
- The Edmonds Street approach lanes saw more modest benefits (e.g., 6% savings in the PM peak at Canada Way and 8% savings in the AM peak at Kingsway, but were not effective during some hours of the day. This may be due to high right-turn and/or overall traffic volumes preventing buses from reaching the approach lanes. Challenges like these may be addressed via adjustments to lane configuration, on-street parking, and/or stop placement.

Transit Approach Lane Project Statistics

			Percent Change in Transit Travel Time (Weekdays) [1]		Return on Investment [2]
Map	Project Name	Sub-Region	Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
19	R4 Joyce Street approach lanes	Vancouver/UBC	-34%	-33%	[3]
21	Edmonds St approach lanes at Kingsway	Burnaby/New Westminster	-2%	-2%	› 20
20	Edmonds St approach lanes at Canada Way	Burnaby/New Westminster	0%	-3%	› 20

Queue Jump Project Statistics

			Percent Change in Transit Travel Time (Weekdays) [1]		Return on Investment [2]
Map	Project Name	Sub-Region	Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
22	Fraser Highway queue jumps	Southeast	-15%	-21%	3.3
23	Broadway and Gaglardi Way queue jump	Burnaby/New Westminster	-15%	-15%	4.1

Notes (both tables): 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period. 3. Subset of a project constructed as part of RapidBus implementation.

Project Highlight: Queue Jumps on Fraser Hwy at 96 Ave and 140 St

After implementation, buses on Fraser Hwy saw decreased run times of 15% across the day and up to 25% during peak periods at these locations.

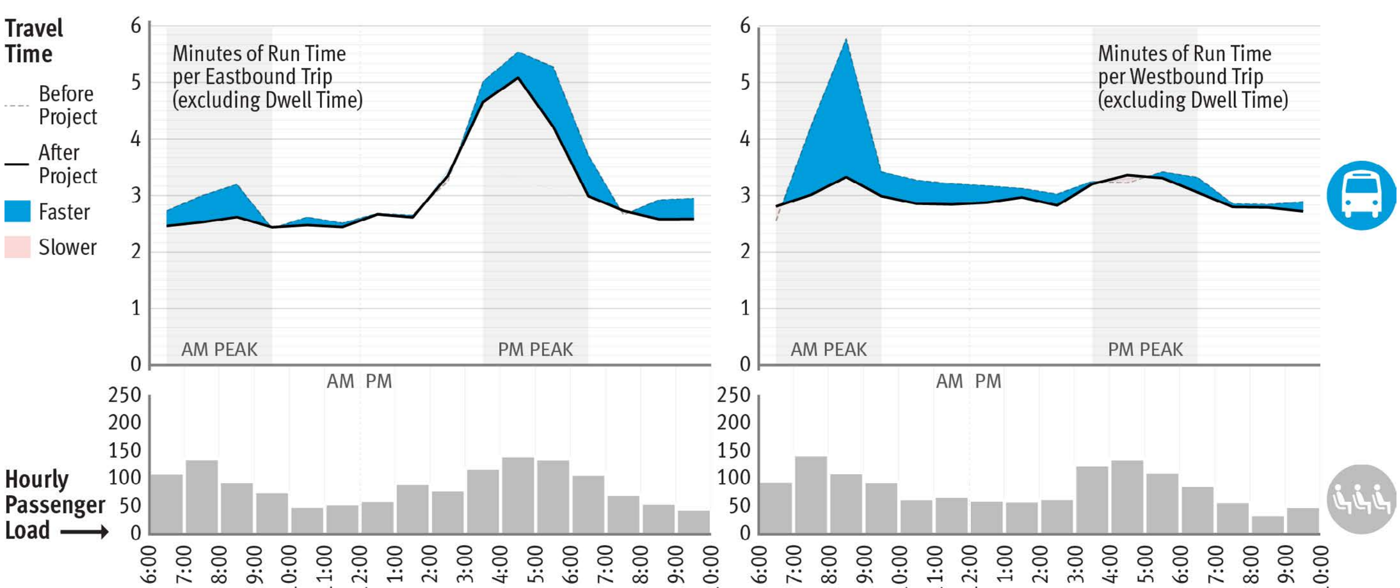
Before:

After:

Travel lanes and wide shoulders were narrowed on Fraser Highway at 96 Ave to create receiving lanes on the far side of the intersections, allowing buses to use right-turn lanes to bypass congestion, before and after. The project also prohibited right turns, which would cross a newly repaved bike lane—benefitting both bus passengers and cyclists (Google Street View). Notes: Photo showing eastbound direction. The queue jumps were removed when Fraser Hwy was widened in June 2022.

The graphs below show that the project created the greatest benefit when bus ridership was highest, particularly westbound in the morning, during which delay was almost eliminated—declining by about two minutes. It reduced but did not eliminate eastbound delay in the afternoon.

Illustration of Travel Time Savings from Fraser Hwy Queue Jumps, Weekdays, Fall 2021 vs. Fall 2019



This graphic illustrates bus run time before implementation (dotted line) compared to after implementation (solid line), by hour. Blue shading highlights the run time improvement. The grey bars below the graphs show the hourly passenger load (number of passengers on-board buses).

Project Highlight: Queue Jumps on Broadway & Gaglardi Way

Implementation of a queue jump with transit signal priority enabled buses to bypass vehicles queued at the signal and get a head start when the light turns green. Along this segment of Route 145 to Simon Fraser University, the improvement saved buses 15% of run time.

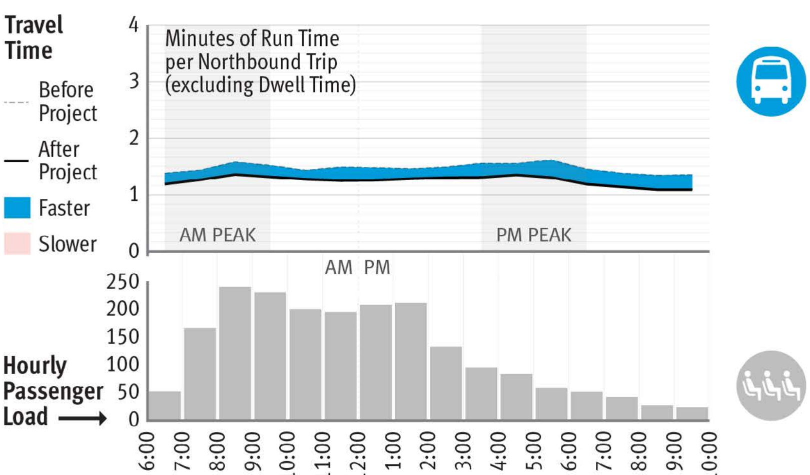
Before:

After:

Before (left) and after (right) showing a bus queue jump lane with transit signal priority that was installed at the intersection of Broadway and Gaglardi Way in late 2020 (Google Street View).

The graph below shows buses consistently saved time throughout the day.

Illustration of Travel Time Savings from Broadway & Gaglardi Way Queue Jump, Weekdays, Fall 2021 vs. Fall 2019



This graphic illustrates bus run time before implementation (dotted line) compared to after implementation (solid line), by hour. Blue shading highlights the run time improvement. The grey bars below the graph shows the hourly passenger load (number of passengers on-board buses).

Project Highlight: Edmonds St Approach Lanes at Canada Way and Kingsway

Southbound transit approach lanes were implemented along Edmonds St at Kingsway and at Canada Way in late 2020. Northbound right-turn except bus lanes were also implemented. Approach lanes are used to allow buses to bypass vehicles that are queued to make right-turns, where right-turn volumes are high.

For Route 106, connecting Edmonds and New Westminster Stations, the improvements saved buses up to nearly 6% of runtime at Canada Way in the PM Peak and up to nearly 8% of run time at Kingsway in the AM Peak, but did not perform consistently across the day, as described in more detail below.

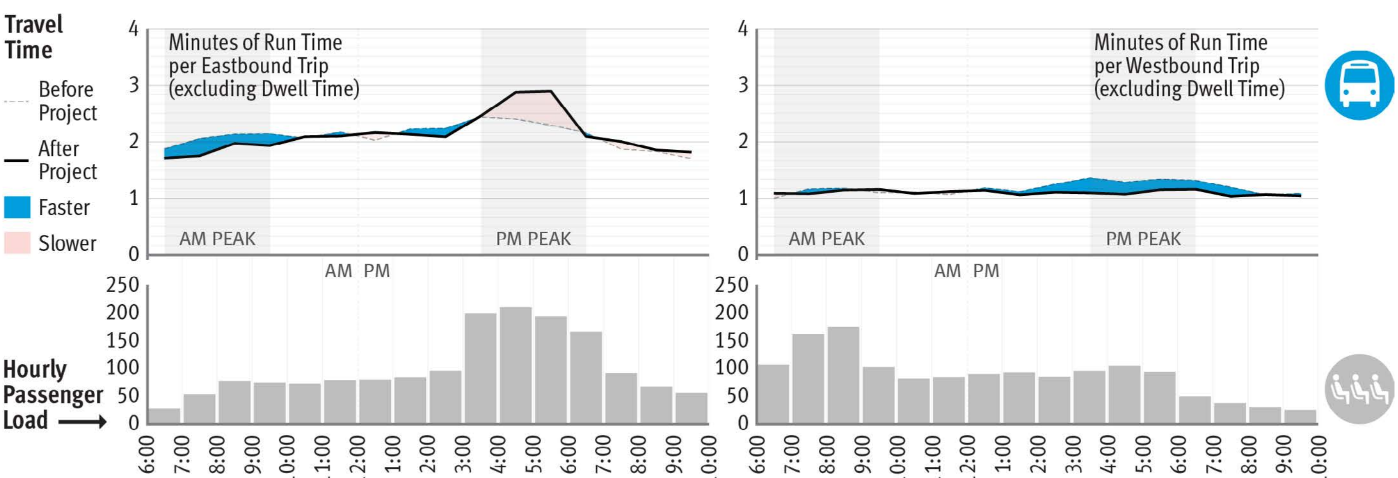
Before:

After:

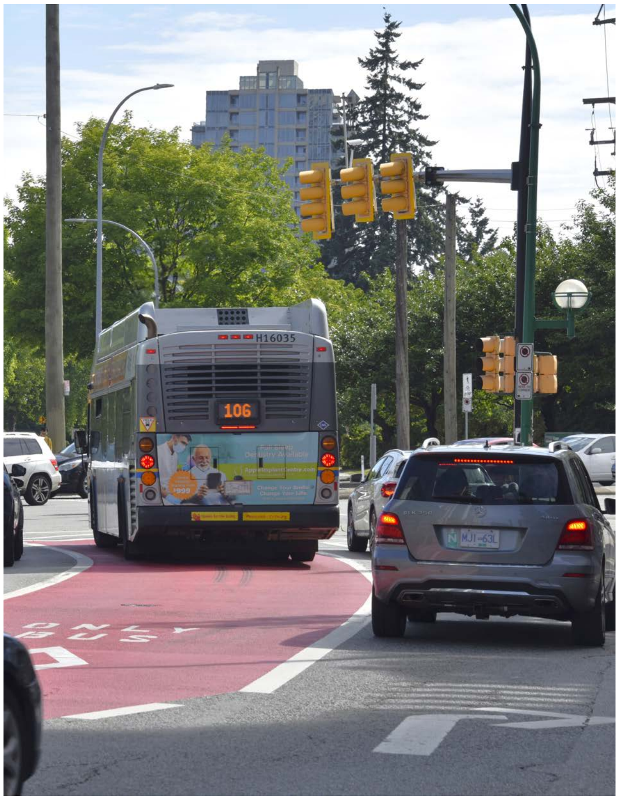
Before (left) and after (right) showing the eastbound right-turn except bus lane that was installed at the intersection of Edmonds St and Kingsway in late 2020 (Google Street View).

The graphs below show that at Kingsway, the eastbound right-turn except bus lane pictured above improved bus run time in the morning, but there was an increase in run time in the afternoon, which can be attributed to high right-turn volumes in the shared lane (see left panel below).[40] The westbound transit approach lane improved travel time for buses in the afternoon (see right panel below).

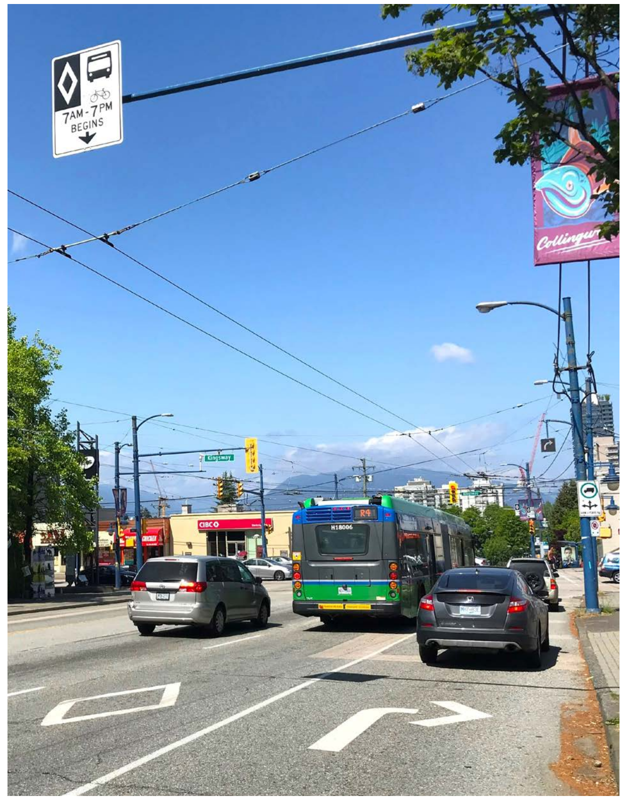
Illustration of Travel Time Change at Eastbound Right-Turn Except Bus Lane and Westbound Transit Approach Lane on Edmonds St at Kingsway, Weekdays, Fall 2021 vs. Fall 2019



This graphic illustrates bus run times before implementation (dotted lines) compared to after implementation (solid lines), by hour. Blue shading highlights the run time improvement, while red shading indicates an increase. The grey bars below the graphs show the hourly passenger load (number of passengers on-board buses).

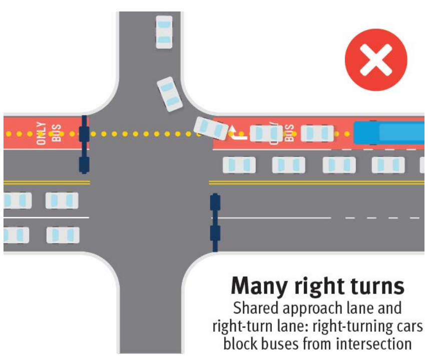


The westbound approach lane on Edmonds St at Kingsway is supported by a right-turn pocket, allowing buses to bypass queues and get through the intersection quickly.

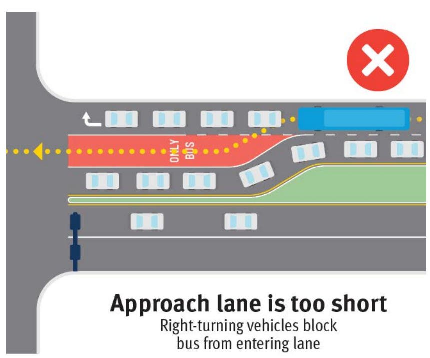


The approach lane on Joyce St at Kingsway is supported by a right-turn pocket. Parking was removed to lengthen this pocket and minimize friction with buses. The project reduced average travel times by more than 30% all day.

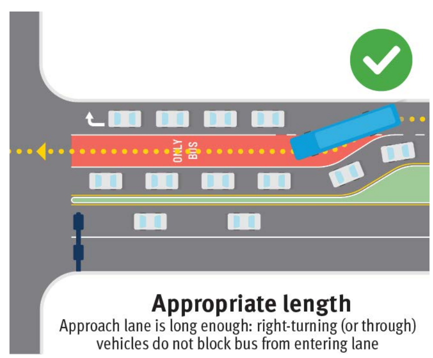
Considerations for Future Projects



Both approach lanes and queue jumps must be long enough for buses to reach them before encountering congestion.



Particularly where there are many right-turning vehicles or pedestrians crossing the street, right-turn lanes can back up and prevent buses from getting to the front of the queue.



Project Highlights: In-Lane Bus Stops

In-lane bus stops improve travel times by up to approximately 15% and can pay back investments quickly.

In-lane stops allow buses to serve customers from the travel lane. They improve travel time and reliability by eliminating delays caused by merging into and out of the travel lane at bus stops. Bus bulbs extend the sidewalk areas out to the travel lane in locations with on-street parking. Travel time reduction may be appear as a reduction in run time or dwell time (waiting time at a stop) depending on bus operator behaviour and whether a bus is registered as at, or nearby, a stop.

Creating bus bulbs or filling in bus pullouts areas can provide more space for passengers waiting for the bus and make stops more accessible, safe, and visible for passengers. For example, along the R6 RapidBus corridor, infilling several bus pullout areas to make in-lane stops was necessary to accommodate a ramp for mobility devices.

Overview of In-Lane Bus Stops Project Performance

Overall, in-lane bus stops and bus bulbs contributed to reduced run time and dwell time along the routes they serve, as shown in the table below. The projects evaluated saved between 5-40 seconds (up to 16%) at different times of day. This is consistent with TransLink's Transit Priority Toolkit, which suggests peak savings of 15-30 seconds as a general rule-of-thumb.

Payback periods were as short as a few months. In general bus bulb cost-effectiveness will vary based on how permanent the construction materials are, and how many buses benefits from the improvement.

In-Lane Bus Stop Project Statistics

Map	Project Name	Sub-Region	Travel Time Change [1]		Cost/Benefit [2]
			Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
28	West 4th Ave bus bulbs	Vancouver/UBC	-14%	-16%	0.3
24	Robson St transit project	Vancouver/UBC	-8%	-8%	1.8
25	Lonsdale Ave bus bulbs at 4th St and 5th St	North Shore	-5%	-3%	› 20
26	Lonsdale Ave bus bulbs at 15th St	North Shore	-5%	0%	7.5
27	Bus pullout infills on 120 St	Southeast	0%	-4%	19.3

Notes: 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period. Some of the projects listed were constructed using temporary/interim measures, while others may be more permanent and have different associated costs.

Project Highlight: West 4th Ave bus bulbs

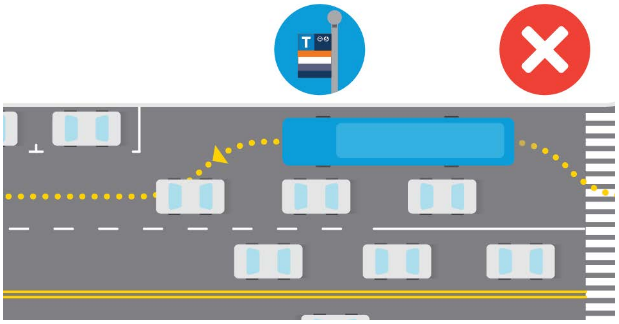
In 2022, TransLink partnered with the City of Vancouver to construct bus bulbs along West 4th Avenue. They reduced total dwell time at stops by 30% and total travel time by 10% to 20%—including both dwell time and run time—saving more than a minute at the weekday PM peak. Extending bus zones to accommodate more than one bus may also have contributed to reduced dwell times.

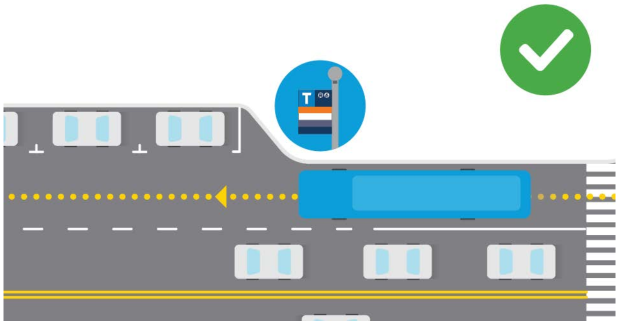
Considerations for Future Projects

- Stops should be fully in-lane to eliminate time lost to bus merging in/out of traffic at stops.
- Bus bulbs preclude peak-hour bus lanes from operating in the parking lane.
- Savings at timing point stops—where bus operators may wait to get back on schedule—may be hard to measure and will rely on schedule tightening.
- Bus priority measures can have "co-benefits" beyond making buses faster and more reliable (see graphic below).
  - Bus bulbs improve safety by shortening pedestrian crossing distances and calming traffic. These should extend fully to the pedestrian crosswalk in order to "neck-down" the intersection.
  - They also support retail areas by expanding room for pedestrian activity, parking, loading and unloading, and landscaping, while acting as a complement to street patios.


Bus bulbs along West 4th Ave.

Bus bulb projects reduce the time buses spend merging into and out of traffic while also providing more room for people on the sidewalk, such as at Lonsdale Ave between 4th and 5th Streets.


Buses can be delayed when they need to pull to the curb to pick up passengers and then find a gap to re-enter traffic.


Bus bulbs not only enable buses to stop in-lane, they can enable other benefits such as improved amenities and safety.

Project Highlights: Signal Upgrades

Signal upgrade projects reduce travel time by up to 20% and typically pay back the investment in less than 5 years.

Upgrading traffic intersections can reduce wait times for buses at what are often hotspots for congestion. Interventions often take the form of left-turn or right-turn pockets that separate through-traffic and turning vehicles. These turn lanes can also be supported by distinct signal phases to clear queues of turning vehicles.

Signal upgrades that support overall flow of traffic, including buses that are turning alongside other vehicles, can improve bus performance. Turn pockets and signal phases can also be bus-only.

In “active” transit signal priority projects, the signal recognizes the presence of a bus, and either extends a green phase or shortens a red phase to support bus movement. In “passive” transit signal priority, multiple intersections along a corridor are timed to turn green at the speed of a typical bus, which also reduces bus wait times at red lights.

Overview of Signal Upgrade Project Performance

Signal upgrade projects decreased run time by up to 20%. The two bus-only signal upgrade projects were among the most effective: The Metrotown signal project reduced run-time by nearly 20% and the 18th Ave at Griffiths Dr project – which serves buses exiting the bus loop – reduced peak run times by 13%. These two projects had a payback period within 1-2 years.

Signal Upgrade Project Statistics

Map #	Project Name	Sub-Region	Travel Time Change [1]		Cost/Benefit [2]
			Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
32	Signal upgrade at Metrotown bus loop	Burnaby/New Westminster	-18%	-19%	1.8
29	Signal upgrade on NB Scott Rd at 84 Ave	Southeast	-15%	-7%	16.8
33	Signal upgrade on 18th Ave at Griffiths Dr	Burnaby/New Westminster	-11%	-13%	0.2
31	Signal upgrade at Marine/Keith/Bewicke	North Shore	-9%	-9%	0.4
30	Signal upgrade on Lonsdale Avenue at East Esplanade	North Shore	-3%	-6%	1.8
34	Signal upgrades on W 15th St	North Shore	-2%	-2%	9.8

Notes: 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period.

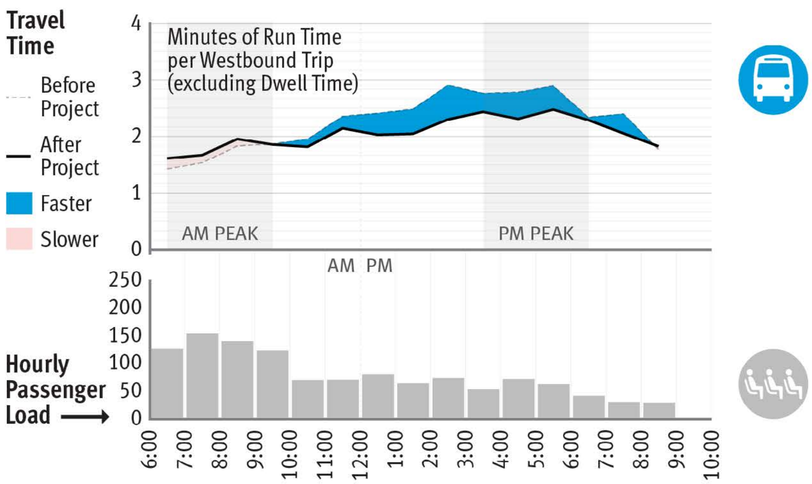
Project Highlight: Signal upgrade on NB Scott Rd at 84 Ave

Upgrading the traffic signal on Scott Road at 84th Ave to provide a northbound left-turn signal saves an average of 25 seconds per trip for Route 301, or 15% of average run time. This route connects Richmond and Surrey, including Kwantlen Polytechnic University.

When the City of Delta first installed the left turn signal in June 2019, transit buses were experiencing waits of up to 4 minutes to make the single left turn. Immediately after the change in signal operation, buses saved almost 2 minutes in travel time.

Although the project has continued to be effective overall, its benefits appear to have diminished by 2021. This may be due to additional vehicles on the road, including more vehicles taking advantage of the new signal—as travel times for general purpose vehicles along Scott Road increased by over 20% throughout the day. Nonetheless, the graphic below shows that bus run time improved for much of the day, especially in the afternoon and evening.

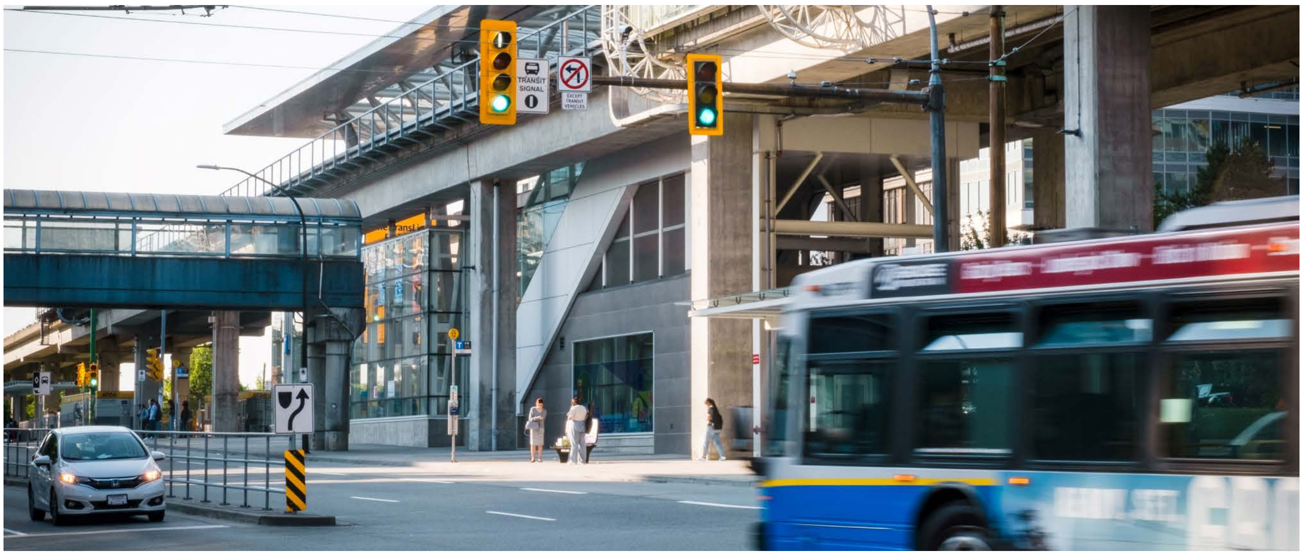
Travel Time Savings from NB Scott Rd & 84 Ave Signal Upgrade, Weekdays, Fall 2021 vs. Fall 2019



This graphic illustrates bus run times before implementation (dotted lines) compared to after implementation (solid lines), by hour. Blue shading highlights the run time improvement, while red shading indicates an increase. The grey bars below the graph show the hourly passenger load (number of passengers on-board buses).

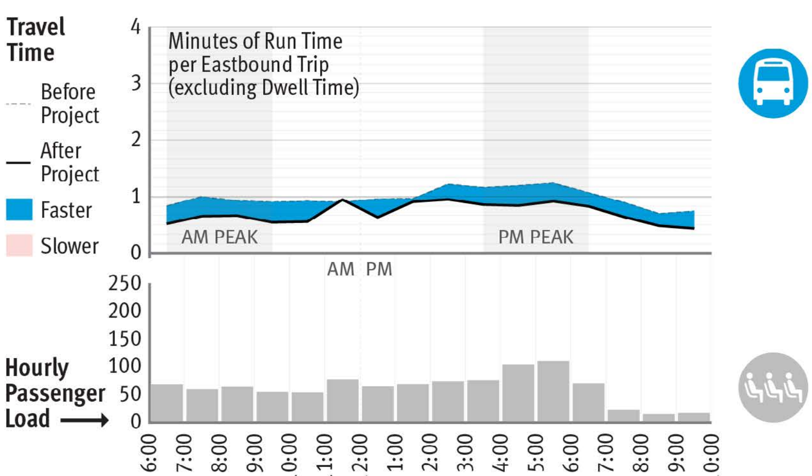
Project Highlight: Signal upgrade at the Metrotown Bus Loop

A bus-only left-turn signal reduced run time by approximately 15% for eastbound buses turning left from Central Boulevard into the Metrotown bus loop, providing a consistent benefit averaging more than 10 seconds for approximately 2,000 bus trips every week. The City of Burnaby installed the signal and has periodically adjusted it to fine-tune the detection of buses, contributing to slightly improved performance over time. The signal also improved travel time for all vehicles by approximately the same amount, since left-turning buses no longer had to wait until the end of the green light to make the turn.



Bus-only left-turn signal into Metrotown bus loop.

Travel Time Savings from Bus-Only Left-Turn Signal at Metrotown Bus Loop, Weekdays, Fall 2021 vs. Fall 2019



This graphic illustrates bus run time before implementation (dotted line) compared to after implementation (solid line), by hour. Blue shading highlights the run time improvement. The grey bars below the graph show the hourly passenger load (number of passengers on-board buses).

Considerations for Future Projects

- Bus-only upgrades that target frequent bus corridors will pay back faster.
- Buses do benefit from intersection improvements that benefit all traffic, but transit-priority signals are more likely to have lasting benefits.
- Left-turn pockets can also improve intersection throughput, reducing delay for buses and other motorists.

Project Highlights: Turn Restrictions

Turn restrictions can improve bus travel times >5% at a low cost.

Turn restrictions, similar to turn pockets, remove locations where vehicles obstruct buses' movements, forcing them to wait or merge. Where there is one through lane, left-turn restrictions may have the most significant benefit for buses as vehicles can wait for an entire signal phase before turning. Right-turn restrictions can support buses when they are travelling in the curb-side lane, especially at locations with heavy pedestrian volumes.

Overview of Turn Restriction Project Performance

Left-turn restrictions on Robson Street contributed to a decrease in run time of nearly 10%—saving up to 16 seconds and complementing bus bulbs on the same corridor.

Signal Upgrade Project Statistics

			Travel Time Change [1]		Cost/Benefit [2]
Map	Project Name	Sub-Region	Daily (6 a.m. to 10 p.m.)	AM/PM Peak	Payback Period (Years)
35	Turn restrictions on Robson St	Vancouver/UBC	-9%	-6%	[3]

Notes: 1. Transit travel time change is a trip-weighted average calculated by hour from TransLink AVL data for the before and after time periods. 2. Costs are based on values provided by municipalities in funding applications, funding reallocations, or submitted invoices (if received). Some projects lacked sufficient cost data to estimate a payback period. 3. Robson Street turn restrictions project may include some run-time benefits from stop consolidation, implemented concurrently, which could not be isolated as a separate project.

Considerations for Future Projects

- Turn restrictions can bring low-cost benefits to both buses and general purpose traffic and complement other transit priority measures along a corridor.
- Each restriction may lead to higher traffic volumes elsewhere. They are best implemented with a corridor perspective, including in tandem with left-turn pockets at nearby intersections.
- All modes of transportation should be considered to identify conflicts.
- Right-turn restrictions in particular can benefit pedestrian and cyclist safety along a roadway, and should be considered at high volume intersections.
- The BSR Program is prepared to fund, and learn from, more projects like these.

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Part 5: Bus Priority Gaps

DESPITE RECENT PROGRESS, THE REGION STILL HAS A LONG WAY TO GO

In order to meet regional goals, we must continue to invest in transit priority

The Vancouver region's Transport 2050: 10-Year Priorities is a "bus-first" plan for growth, guided by goals to make transit convenient, reliable, affordable, safe and comfortable, and carbon-free. Enhancements to the bus network can be quicker and more cost-effective than other approaches, and they enable the region to deliver fast, frequent, and reliable rapid transit service more quickly, affordably, and broadly than would otherwise be possible with a rail-only approach.

Transit priority is essential to this plan, which requires accommodating more bus riders on the existing road network. New RapidBus and Bus Rapid Transit projects, running along existing roads, are a keystone of the vision.

In addition, **the region's 10-Year Priorities Plan aims to expand bus priority measures to the entirety of the existing Frequent Transit Network (FTN)** and up to 25% of an expanded frequent bus network. Bus priority investments along the FTN will improve the trips of a majority of our customers (more than 60% of boardings). And these projects will not only improve the speed and reliability of the buses running today, they can also ensure bus service remains reliable, even if traffic congestion increases in the future.

This report finds that:

- **We have greatly expanded the amount of bus priority in the region in recent years.** Coverage of the FTN has increased from 15% to 22% since the launch of the BSR funding program in 2019.
- **However, buses are rarely fully protected from traffic.** More than 75% of the FTN has no bus priority infrastructure, and more than 90% does not fully protect buses from traffic; buses must still share lanes with other traffic for some or all of the day.
- **Approximately 700 km of the existing FTN remains to be improved,** if we are to achieve full coverage of the FTN with bus priority.

EXISTING BUS PRIORITY IN METRO VANCOUVER

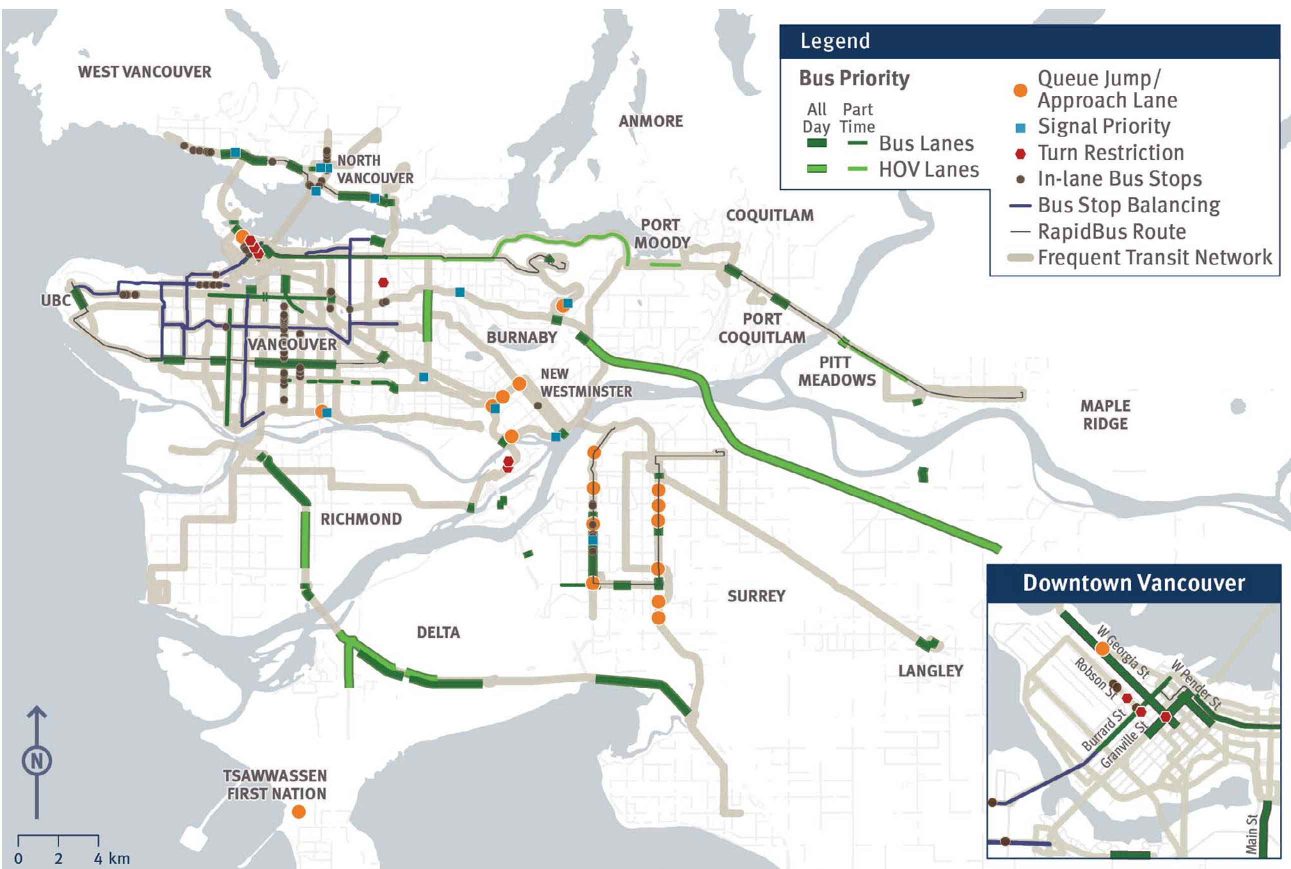
Recent expansions in bus priority have been significant. Since 2019, transit priority on the FTN has increased by 70 km, from 15% to 22%—a big step forward. This is an expansion of nearly 50% over what existed before. And this under-represents projects not measured in kilometres (e.g., bus stop balancing and intersection improvements).

Bus priority makes service faster and more reliable for nearly 280,000 passenger trips on an average weekday. On an average weekday in fall 2021 over 280,000 trips are more reliable as a result of all the transit priority investments that are in place across our region. And nearly 200,000 trips on Saturdays and 150,000 on Sundays.[41]

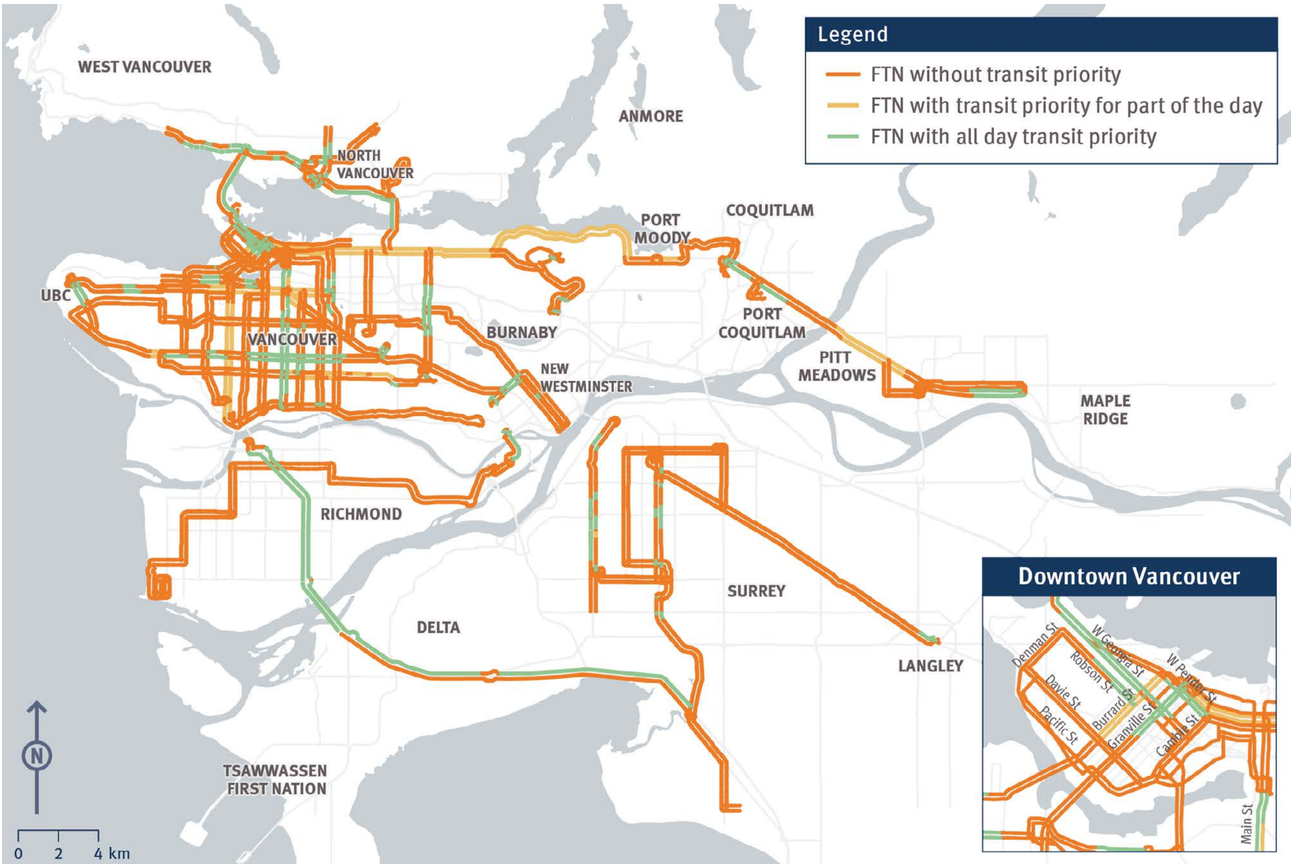
However, buses are still rarely fully protected from traffic. Although much of the growth has been in all-day, bus-only lanes, these are still just 7% of the FTN.

Most of the FTN has limited or no bus priority. Yet even with these and our previous investments, buses are still delayed throughout the region. 75% of the FTN has no bus priority lanes; and along more than 90%, buses must travel in general traffic lanes for some or all of the day. That means that more than 700 km of the existing FTN can be improved for bus service.

Existing Transit Priority, including built before 2019 and Under Construction



Transit Priority Gaps on Frequent Transit Network



Note: Map illustrates each direction separately.

The FTN represents nearly 940 km of our transit network—approximately 30%. The table below shows both how much we have expanded bus priority since before 2019, and also that we have a long way to go to address the needs on the existing FTN.

Bus Priority and Share of FTN with Bus Priority

Type of Bus Priority Infrastructure	Prior to 2019	2019–2022	Including Infrastructure under Construction
All types of bus priority (including HOV and peak only lanes)	138 km (15%)	192 km (20%)	207 km (22%)
All-day / bus only priority	24 km (3%)	51 km (5%)	66 km (7%)

FUTURE BUS RAPID TRANSIT WILL BE A FOCAL POINT FOR NEW TRANSIT PRIORITY

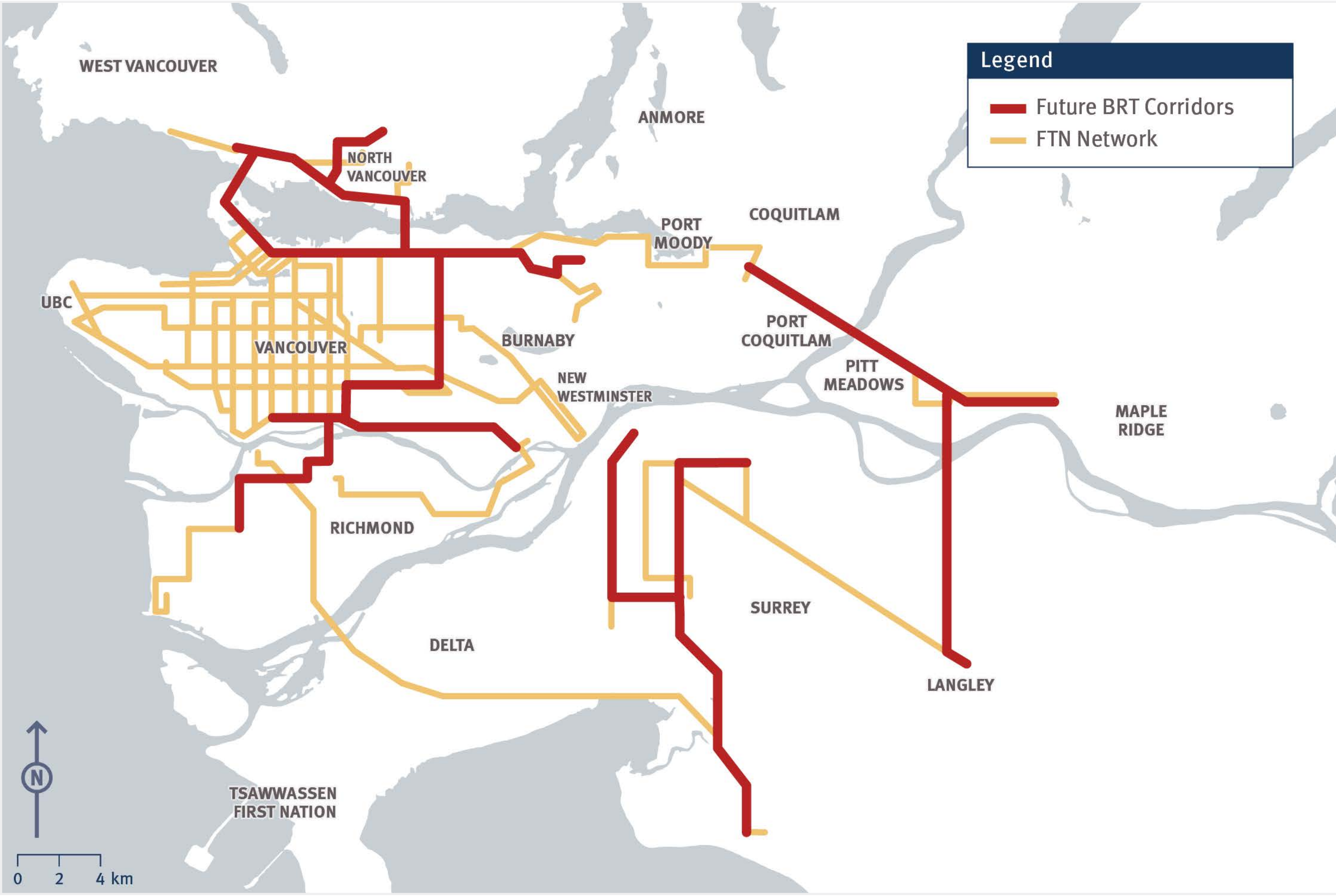
TransLink's BRT Action Plan calls for developing nine new BRT corridors—collectively nearly **150 km**. These corridors would address **almost 30%** of the passenger delay in our bus system. Currently just **11%** of the total length of these corridors has some form of transit priority—and only about **7%** has all-day, bus-only priority.

Future BRT Corridor Statistics

Corridor Name	One-Way Corridor Length (km)	Existing Passenger Delay, Passenger-Hours, Fall 2021		Share with Existing Bus Priority, 2022, Including Under Construction	
		Pax-hours	% of Systemwide Total	All Types of Priority	All-Day, Bus-Only Priority
Metrotown / Richmond (R7)	18.4	1,110	3.9%	6.3%	1.8%
22nd St Station / Marine Dr Stn (Via Marine Way)	13.6	430	1.5%	0.9%	0.7%
Hastings	20.5	1,450	5.2%	28.8%	0.7%
Langley / Haney Place	21.6	290	1.0%	4.7%	4.7%
Lougheed Hwy	17.3	320	1.1%	26.1%	7.6%
Lynn / Downtown	16.3	1,250	4.4%	21.0%	20.2%
Metrotown / Park Royal	22.3	1,460	5.2%	35.1%	24.9%
Scott Road	14.8	1,240	4.4%	25.5%	24.0%
Surrey / White Rock	22.8	1,420	5.0%	5.9%	3.5%
All Corridors	**148.7**	**7,890**	**27.9%**	**11.0%**	**6.5%**

Note: BRT alignments are illustrative and subject to revision during concept planning.

Future BRT Corridors and the FTN



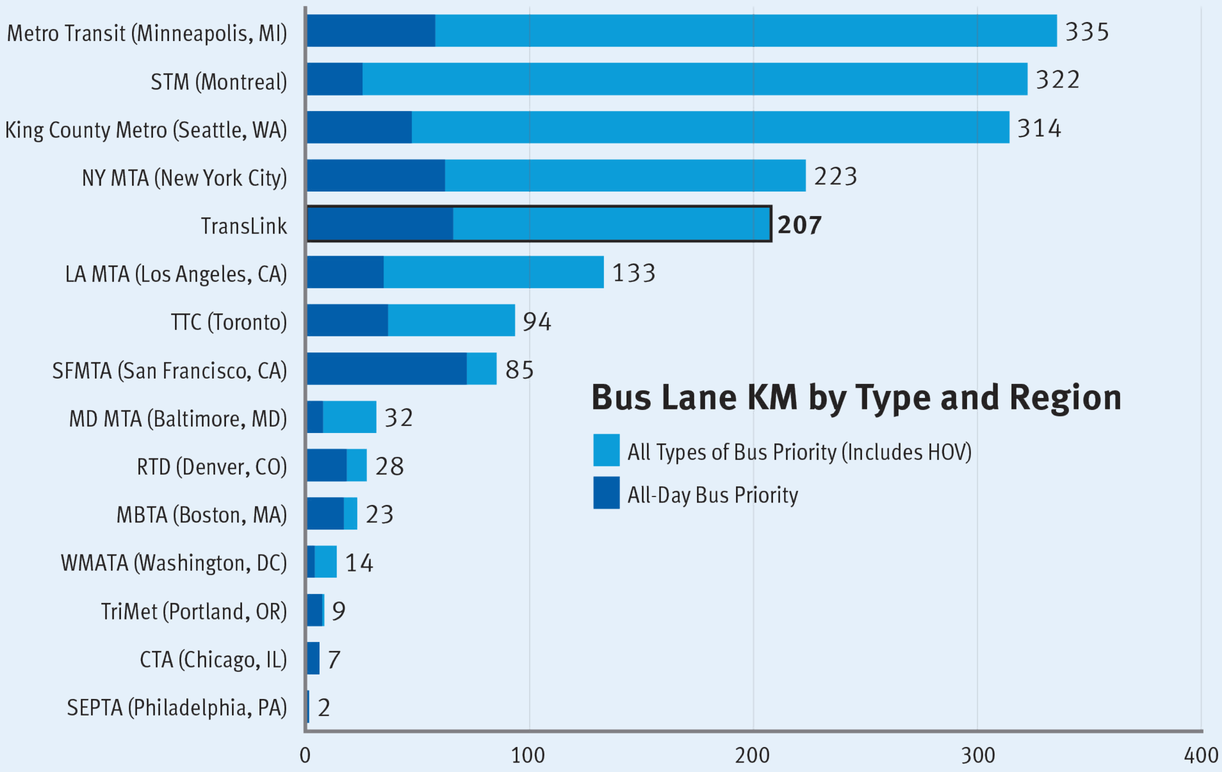
Note: BRT alignments are illustrative and subject to revision during concept planning.

How does bus priority in Metro Vancouver compare to other regions?

The chart below and table on the next page compare bus priority in Metro Vancouver to bus priority in other regions in the US and Canada, including both all types of bus priority and all-day (24-7) bus-only priority. Highlights include:

- **Metro Vancouver has 207 km of total bus priority (including HOV lanes).** This is less than the Minneapolis Twin Cities, Montreal, and Seattle regions (all over 300 km) and the New York region (over 220 km) but more than the Los Angeles, San Francisco, and Toronto regions (close to or exceeding 100 km).
- Comparing based on the number of people in the region and the number of bus passenger-km travelled, **Metro Vancouver has nearly 80 km of bus priority per million people and over 15 km per passenger-km**—third and seventh highest among this set of agencies.
- **Metro Vancouver is among the leaders, with 66 km of all-day bus priority.** This is most comparable to the New York City and Minneapolis Twin Cities regions. The City of San Francisco leads all regions in terms of all-day bus priority km, both total and relative to passenger-km.[42]
- **Metro Vancouver is also a leader in all-day priority relative to population or passenger-km.** Relative to population, Metro Vancouver has the third highest amount of all-day bus lanes per person among the agencies compared, and eighth highest relative to passenger-km.
- **Many regions are implementing ambitious plans to expand bus priority.** For example, San Francisco is continuing to implement and make permanent Temporary Emergency Transit Lanes first rolled out during the pandemic.

Comparison of Bus Priority in Metro Vancouver to Selected US and Canadian Transit Agencies



Comparison of Bus Priority in Metro Vancouver (2023) to Selected US and Canadian Transit Agencies, 2021 or 2022/2023

			All Types of Bus Priority			All-Day Bus-Only Priority		
Region and Agency	**Regional Pop.**	**Bus passenger-km**	**Km**	**Per million people**	**Per 100M annual bus passenger-km**	**Km**	**Per million people**	**Per 100M annual bus passenger-km**
Metro Transit (Minneapolis, MI)	1.7 M	150 M	**335**	**193**	**223**	58	33	39
STM (Montreal)	4.2 M	674 M	322	75	48	26	6	4
King County Metro (Seattle, WA)	2.3 M	303 M	314	137	104	48	21	16
NY MTA (New York City)	8.8 M	1,662 M	223	25	13	62	7	4
TransLink	2.6 M	1,410 M	207	78	15	66	25	5
LA MTA (Los Angeles, CA)	10.5 M	683 M	133	13	19	35	3	5
TTC (Toronto)	6.5 M	869 M	94	15	11	37	6	4
SFMTA (San Francisco, CA)	0.9 M	175 M	85	97	48	**72**	**82**	**41**
MD MTA (Baltimore, MD)	7.8 M	255 M	32	4	13	8	1	3
RTD (Denver, CO)	2.9 M	150 M	28	9	18	19	6	12
MBTA (Boston, MA)	3.1 M	217 M	23	7	11	17	6	8
WMATA (Washington, DC)	4.9 M	251 M	14	3	6	4	1	2
TriMet (Portland, OR)	1.6 M	159 M	9	5	5	8	5	5
CTA (Chicago, IL)	3.2 M	478 M	7	2	1	7	2	1
SEPTA (Philadelphia, PA)	3.4 M	309 M	2	1	1	2	1	1
TransLink Rank	-	-	5	4	7	2	3	8

Source: National Transit Database, 2021; Data for STM and TTC from agency communication (2023); TTC (2022); All-Day Bus-Only Priority for Metro Transit, King County Metro, SFMTA, and RTD from agency communications or data (2023). Data for SFMTA reflects only bus-only lanes within the City of San Francisco.

SUB-REGIONAL BREAKDOWN OF BUS PRIORITY

The share of the FTN where transit priority protects bus speed and reliability varies by sub-region, but at most 16% of the FTN has all-day priority exclusively for buses in any sub-region.

The table below shows the amount of bus priority that exists by sub-region. Considering all types of bus priority including HOV and peak-only lanes, system-wide 15% of the FTN had bus priority prior to 2019, which will grow to 22% of the FTN including facilities that are currently under construction. Within the sub-regions, between 12% and 53% of the FTN will have any type of bus priority.

Considering only facilities that provide all-day bus priority, system-wide 7% of the FTN will have bus priority including facilities that are currently under construction. Among the sub-regions, within the Southwest sub-region 16% of the FTN will have all-day bus priority (18 km of 114 km). Within the Vancouver/UBC sub-region nearly 24 km of the FTN will have all-day bus priority (6% of nearly 400 km).

The map on the following page illustrates the share of all-day bus-only priority in each sub-region.

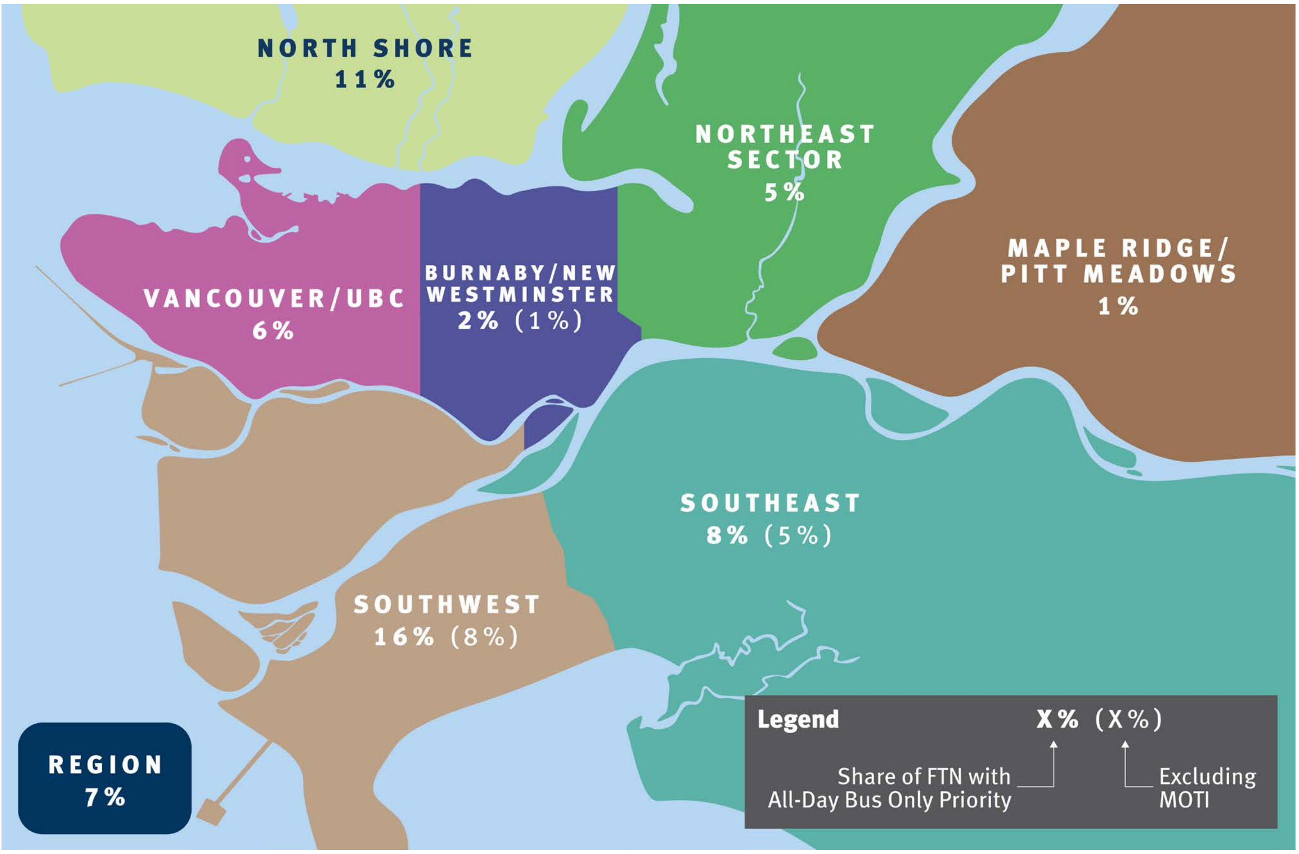
Appendix A includes a map of bus priority measures and the FTN in each subregion.

Bus Priority Measures by Sub-region and Share of FTN

		Prior to 2019				2023 (Including Under Construction)				Recent Expansion (Including Under Construction)	
	FTN	All Types		All-Day, Bus-Only		All Types		All-Day, Bus-Only		All Types	All-Day, Bus-Only
Sub-Region	km	km	% of FTN	km	% of FTN	km	% of FTN	km	% of FTN	km	km
Burnaby / New Westminster	132	27.5	21%	2.1	2%	28.3	21%	3.0	2%	0.8	0.8
Maple Ridge / Pitt Meadows	41	0.2	1%	0.2	1%	7.3	18%	0.2	0.5%	7.1	0.0
North Shore	58	2.8	5%	2.5	4%	6.8	12%	6.5	11%	4.0	4.0
Northeast	41	19.9	48%	0.0	0%	21.8	53%	1.9	5%	1.9	1.9
Southeast	149	40.8	27%	8.2	5%	45.1	30%	12.4	8%	4.3	4.3
Southwest	114	17.9	16%	6.1	5%	29.9	26%	18.1	16%	12.0	12.0
Vancouver / UBC	397	29.3	7%	5.1	1%	68.0	17%	23.7	6%	38.7	18.6
Full Region	**938**	**138**	**15%**	**24**	**3%**	**207**	**22%**	**66**	**7%**	**69**	**42**

Note: FTN km excludes SkyTrain and SeaBus. Approximately 6 km of the FTN are not classified as part of any sub-region. "% MoTI" refers to the share of the FTN that is under jurisdiction of the Ministry of Transportation and Infrastructure. “All-Types” includes HOV and peak-only lanes; excludes full length of RapidBus corridors. “24x7 All-Day” Excluding HOV and peak-only lanes and the full length of RapidBus corridors.

All-Day Bus-Only Priority Measures by Sub-region as Share of FTN



Coming Soon

In late 2023 TransLink will supplement this report with guidance for future investments in transit priority, focusing on key corridors in the region.

Endnotes

1 TransLink, 2021 Transit Service Performance Review, page 15.

2 TransLink, 2021 Transit Service Performance Review, page 16.

3 Bus loads measured by TransLink Automated Passenger counts; Vehicle estimates from StreetLight Data.

4 TransLink Ridership Recovery Update Report, August 30, 2022.

5 TransLink System Analytics, 2018–2021, based on Compass farecard data.

6 TransLink, 2021 Transit Service Performance Review, page 20.

7 TransLink, 2021 Transit Service Performance Review, page 16.

8 TransLink, 2021 Transit Service Performance Review, page 16.

9 https://www.thestar.com/news/canada/2022/05/25/translink-says-ridership-recovery-outpacing-other-north-american-systems.html. SkyTrain lines rebounded by between 54% and 57% over the same period.

10 Bus loads measured by TransLink Automated Passenger counts; Vehicle estimates from StreetLight Data.

11 Metro Vancouver, Housing and Transportation Cost Burden. Data from 2011.

12 A TransLink annual pass saves over 75% of the typical cost of owning a car. Source: Estimated total annual driving costs from https://carcosts.caa.ca/ (British Columbia, Compact). Cost of TransLink Annual Transit Pass from https://www.translink.ca/transit-fares/pricing-and-fare-zones (Compass 3 Zone). The yearly savings is $7,077.

13 Based on data from https://carcosts.caa.ca/ (car) and https://www.translink.ca/transit-fares/pricing-and-fare-zones (bus).

14 Vehicles: Based on up to 800 to 1,100 vehicles per lane per hour, and 1.3 people per vehicle on average. Buses: Based on 95 people per bus, at 75% to 100% of capacity and up to 20 buses per hour per direction in mixed traffic (every 3 minutes) and up to 40 buses per hour per direction in a priority lane (every 1.5 minutes).

15 Existing: Vehicles – Based on existing vehicles per direction along Hastings Street at Gilmore in the PM Peak hour and 10% of vehicles in the HOV lane and 1.3 people per vehicle on average. Buses – Based on existing transit volumes on Hastings at Gilmore (Fall 2019).

16 Conceptual with Bus Lanes: Vehicles – Based on up to 1,000 vehicles per lane per hour, and 1.3 people per vehicle on average. Buses – Based on 95 people per bus, at ~85% of capacity (85 people), and up to 30 buses per hour per direction in a priority lane (every 2 minutes), plus a local bus with 50 people every 10 minutes.

17 TransLink, Climate Action Strategy, January 2022, page 5.

18 Metro Vancouver, Greenhouse Gas Emissions Inventory, 2019.

19 Metro Vancouver, Climate 2050 Roadmap: Transportation, November 2021, page 22-23.

20 TransLink, Climate Action Strategy, January 2022, page 5.

21 TransLink, Low Carbon Fleet Transition Plan, 2020.

22 Hastings Street in Burnaby Heights. The estimate of people traveling through the corridor was based on traffic counts, bus volumes, and bus passenger loads at Gilmore Street in Fall 2019. It assumed each auto carried 1.3 passengers, which is the regional average.

23 The Centre for Active Transportation. Complete Streets in The 15 Minute City, https://www.completestreetsforcanada.ca/wp-content/uploads/2021/02/Complete-Streets-and-the-15-Minute-City.pdf

24 New York City Department of Transportation. The Economic Benefits of Sustainable Streets, https://www.nyc.gov/html/dot/downloads/pdf/dot-economic-benefits-of-sustainable-streets.pdf

25 The City of Toronto. ActiveTO Midtown Complete Street Pilot Public Intercept Survey Evaluation Report, https://www.toronto.ca/wp-content/uploads/2022/03/970b-8705-atm-intercept-studyAODA-Compliant.pdf

26 San Francisco Municipal Transportation Agency. Results of Intercept Survey. https://www.sfmta.com/sites/default/files/projects/2015/14_Survey_Summary.pdf

27 Downtown Seattle Association. Tourists spend $195 a day in downtown Seattle—that's twice as much as local visitors. https://downtownseattle.org/2017/12/tourists-spend-195-day-downtown-seattle-thats-twice-much-local-visitors/

28 Range between 20th and 80th percentile travel times.

29 Data is based on the comparison of bus speeds on weekdays in February 2020 to speeds in April 2020, for AM peak, midday, and PM peak hours. Values exclude dwell time.

30 Data represents savings on Rapid, All-Day Frequent and Peak Frequent routes. Savings on other routes are not included, but would increase these values.

31 See Figure 4 of the 2021 Transit Service Performance Review, page 19, for a chart illustrating boardings by time of day in Fall 2021 compared to Fall 2019.

32 TransLink, 2021 Transit Service Performance Review, page 12.

33 Transport 2050: 10-Year Priorities for TransLink. https://www.translink.ca/-/media/translink/documents/plans-and-projects/regional-transportation-strategy/transport-2050/t2050_10yr-priorities.pdf

34 Transport 2050: 10-Year Priorities for TransLink. https://www.translink.ca/-/media/translink/documents/plans-and-projects/regional-transportation-strategy/transport-2050/t2050_10yr-priorities.pdf

35 The number of routes does not include night bus or the two pre-existing routes that were launched as RapidBus routes.Transport 2050: 10-Year Priorities for TransLink. https://www.translink.ca/-/media/translink/documents/plans-and-projects/regional-transportation-strategy/transport-2050/t2050_10yr-priorities.pdf

36 King County Metro, MetroConnects, p. 22. https://kingcounty.gov/~/media/depts/metro/about/planning/metro-connects/metro-connects-final.pdf

37 https://www2.gov.bc.ca/gov/content/transportation/driving-and-cycling/traveller-information/routes-and-driving-conditions/hov-lanes

38 https://www.nytimes.com/2019/11/20/realestate/14th-street-manhattan-a-congested-thoroughfare-transformed.html; https://www.masstransitmag.com/safety-security/article/21282903/mta-expands-use-of-

automated-bus-lane-enforcement-technology

39 https://www.seattle.gov/police/community-policing/community-programs/transit-only-lane-enforcement; https://sdotblog.seattle.gov/2022/02/16/dont-block-the-box-traffic-cameras/

40 Anecdotally, most of the buses merge out of the bus lane to bypass right-turning cars at this time of day.

41 Based on the number of riders on board buses entering an area with transit priority, plus riders boarding within that area.

42 The Twin Cities region has a wide network of lanes designated all-day busways lanes on freeways and highways (including use of shoulders), making it an outlier among agencies; all-day lanes of freeways and limited access highways were excluded from the comparison of all-day bus lanes. Data for SFMTA reflects only bus-only lanes within the City of San Francisco, and does not include rail-specific transit-lanes in the city.