Action 2:
Fast and Frequent Rapid Transit That's a Competitive Choice for Most Longer Trips

Phase 2
ENGAGEMENT BACKGROUNDER

TRANSPORT 2050 | TRANSLINK

This backgrounder expands on information in the Transport 2050 Phase 2 Discussion Guide.

Overview

Through Transport 2050, we are proposing actions to serve the needs of people who live, work, and play in Metro Vancouver.

During Phase 1 engagement, Metro Vancouverites said their number one priority was transit expansion and improvement. People also said they want the future transportation system to be cost-effective and efficient.

In response, one transformative action that we are exploring and seeking your feedback about is to *build a fast and frequent rapid transit system that's a competitive choice for most longer trips for most people in the region*.

What is our opportunity and our challenge?

Our region already enjoys one of the greatest public transit systems in North America, with ridership levels that are exceeded only by the transit systems in New York, Toronto and Montreal. Still, many who may want to take transit don't for different reasons: perhaps they can't easily reach transit access close to their home, the trip takes too long compared to driving, or they can't rely on transit to get them where they want to go on time.

Over the next 30 years, in order to ensure that everyone can conveniently and reliably get around by transit, we plan to make substantial and ongoing investments to increase service and improve frequency in all layers of the transit network. These layers include:

- Para-transit service like HandyDART;
- Local service primarily focusing on fixed-route but with some on-demand service where appropriate;
- Express service including services that better connect our region with our neighbours in the Fraser Valley and up the Sea-to-Sky highway; and
- A proposed Major Transit Network, made up of fast, frequent, reliable and high-capacity rapid transit services completely separated from traffic.

We'll also keep up with new technologies such as electrification and automation to make sure that transit remains a competitive and affordable travel choice that also contributes to our Provincial and regional climate action targets.

The focus of the transformative action we are discussing in Phase 2 is specifically on *rapid transit*.

Today, across our region, some people have great access to fast, frequent, and reliable transit service through our existing rapid transit network—the Expo, Millennium, and Canada Lines—and our frequent transit network, where service runs at least every 15 minutes in both directions during the day and into the evening, every day of the week.

What is rapid transit?

Rapid transit refers to fast, frequent, reliable and high-capacity public transit.

Many different kinds of technology can deliver this level of service, whether on rubber tires or rails.

It is the full separation from road traffic that makes rapid transit fast and reliable and able to move large volumes of people.

But some people don't have easy access to the rapid transit network because it is not close to where they live or work. For many people, relying on local transit service running in mixed traffic, they often find themselves stuck in congestion, resulting in unreliable travel times.

Through Phase 2 engagement, we want your input about two approaches to how we could expand the rapid transit network. To improve access to fast, frequent and reliable traffic-separated rapid transit by extending the network and bringing it closer to more people across the region.

What considerations are there as we plan for our future rapid transit network?

Population and job growth drive ridership forecasts

Some of the key drivers of transit ridership forecasts are anticipated population growth and job growth, and the location of that growth. The land around this region's rapid transit stations has proven to be very attractive for both residential and commercial development as shown in Figure 1.

Figure 1 illustrates existing population and employment density with dark blue areas focused especially around rapid transit. In its 2050 growth scenario, shown in Figure 2, Metro Vancouver anticipates that the greatest concentration of new residents and jobs is expected to be along the existing rapid transit network. The location of this new anticipated growth is easiest to visualize in Figure 3, which removes existing population and jobs and illustrates just the anticipated difference between today and 2050.

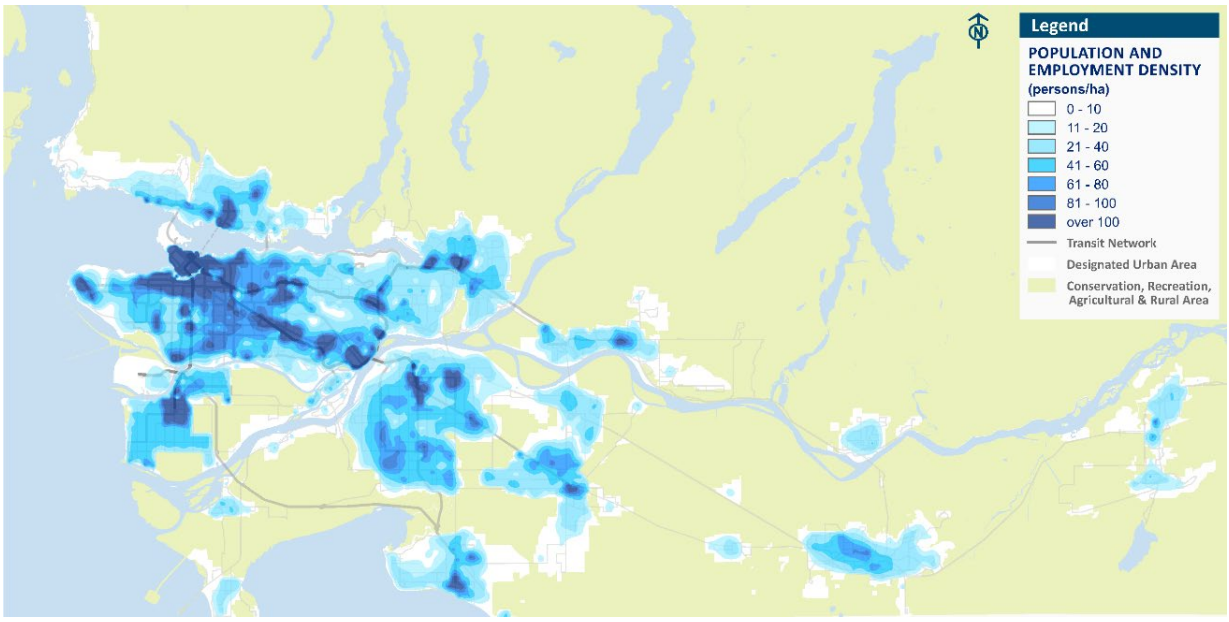


Figure 1 - 2016 Population and Employment Density (Source: Metro Vancouver base 2016 population and employment).

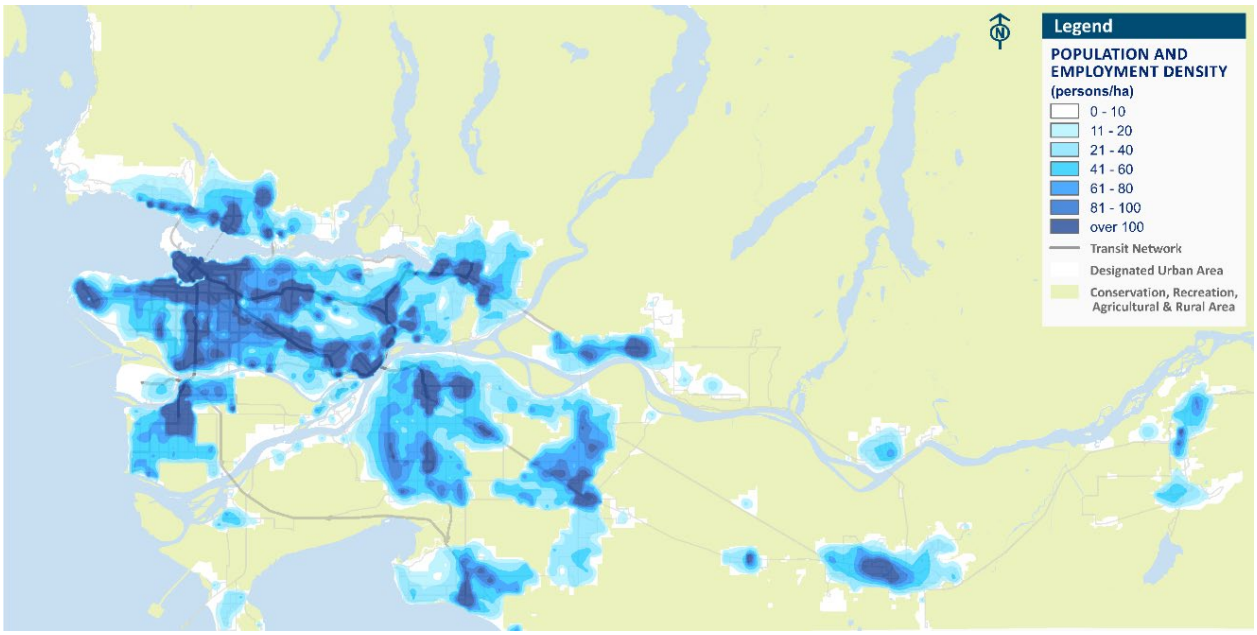


Figure 2 – 2050 Population and Employment Density (Source: Metro Vancouver 2050 Metro Growth Scenario)

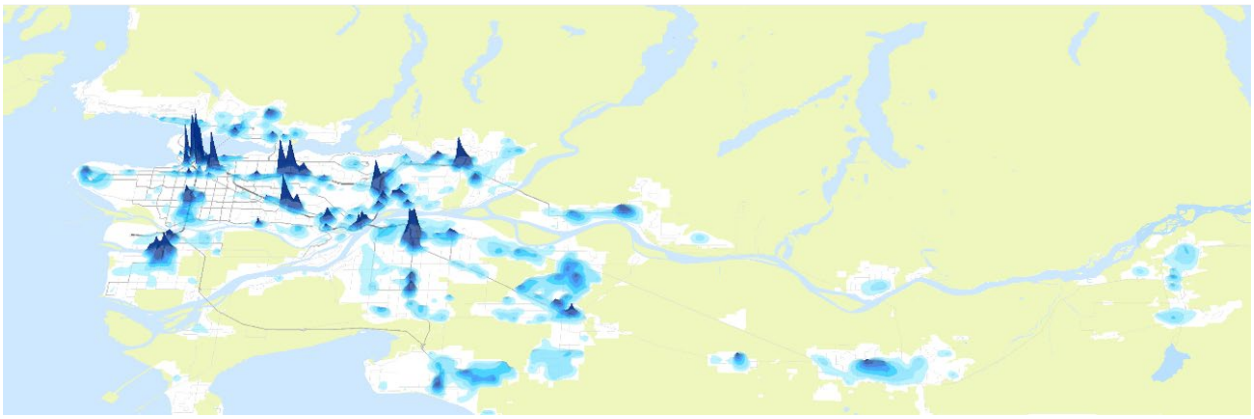


Figure 3 - Locations where growth is expected to occur (difference between 2016 and 2050 Population and Employment Density)

Based on the above land use assumptions, using the Regional Transportation Model, we developed a fictitious scenario that connects every urban centre in the region with rapid transit in order to observe the potential transit ridership demand on different corridors. The output of that assessment is shown in Figure 4 on page 5, which shows peak hour demand, a key determinant of peak capacity need. According to this particular model run, corridors that are not showing as yellow, orange or red would not likely require traffic-separated rapid transit to meet forecast ridership volumes over the next 30 years. Corridors showing in red or orange would warrant consideration for above or below street level rapid transit to meet forecast capacity needs. Providing fast, frequent, reliable traffic-separated transit service may still be warranted in some of the blue corridors in order to achieve other policy objectives, such as influencing land use.

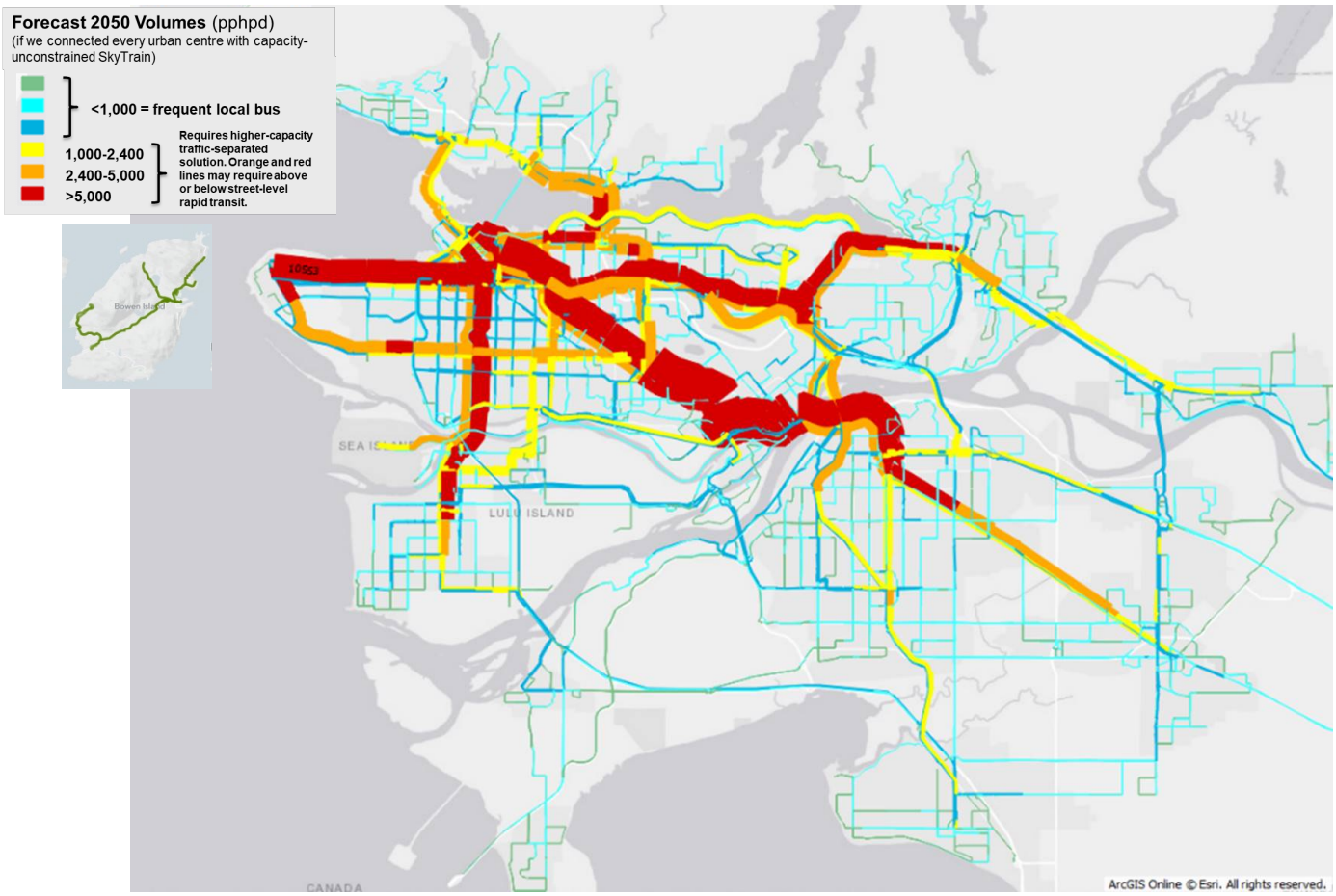


Figure 4 - Forecast 2050 transit ridership volumes in passengers per hour per peak direction (pphpd)

Business-As-Usual won't be enough by 2050

While COVID-19 will delay our ridership growth expectations by a few years, we expect long-term ridership to continue to grow with population, employment and increasing urbanization.

Based on a "Business As Usual" (BAU) approach in which future transit expansion is limited to modest annual increases to local bus service and already-committed rapid transit projects (Broadway Subway from VCC-Clark to Arbutus Street and Surrey-Langley SkyTrain extension), our modelling confirms that, by 2050, demand on the Expo and Canada Lines will exceed capacity even with completion of upgrades to their ultimate design capacity.

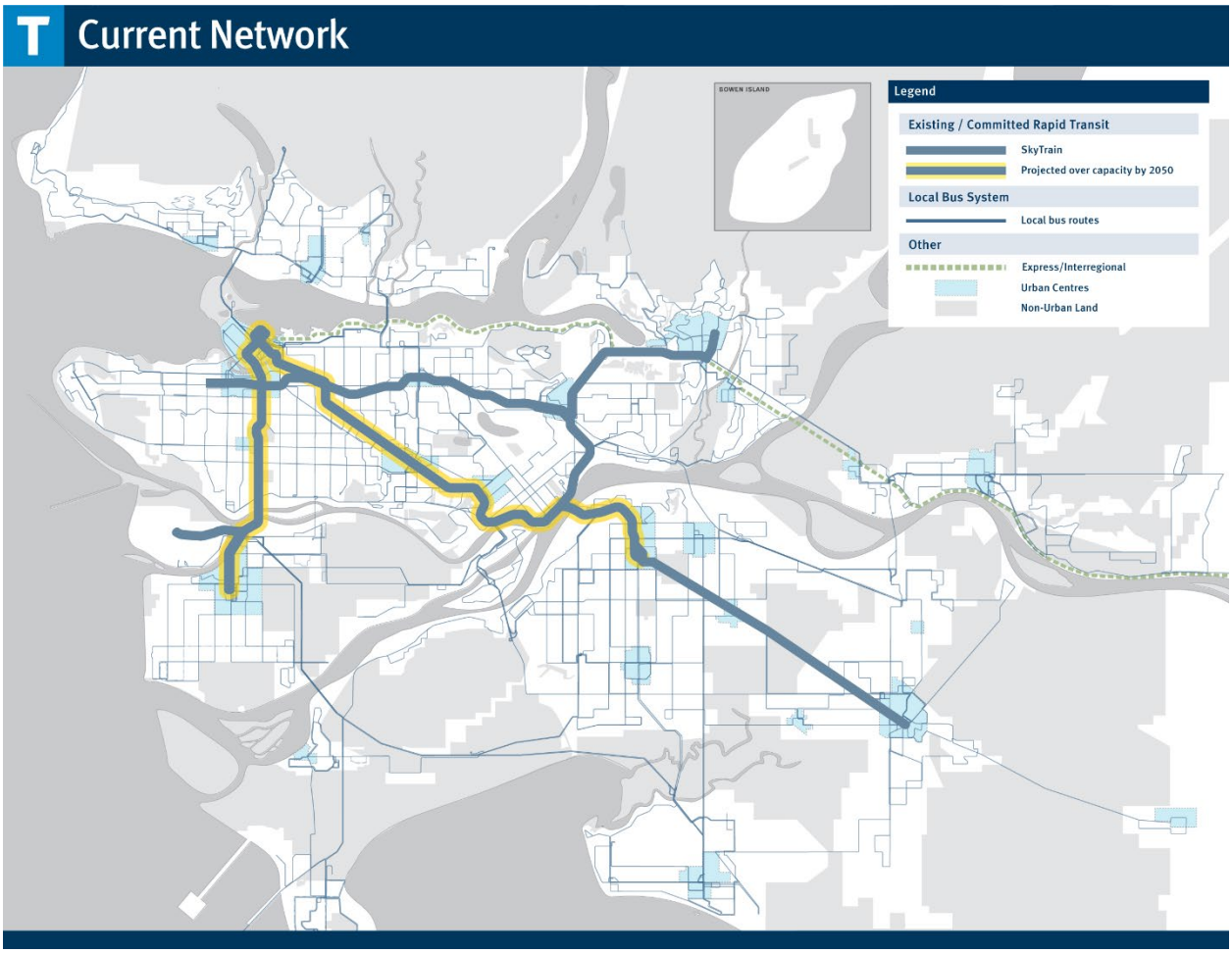


Figure 5 - Current Transit Network (2021), highlighting rapid transit lines projected to be over capacity by 2050

Rapid Transit Line	Ultimate Capacity (pphpd)	2018 Demand/Capacity	2050 Base Demand/Capacity
Canada Line	8,600[1]	75%	112%
Millennium Line	14,500	29%	70%
Expo Line	22,450	70%	101%

Figure 6 - Rapid Transit Demand and Capacity (2018 and 2050)

[1] Assumes 2-car trains. 3-car trains could further increase capacity by 25-50%

The region must begin planning for relief solutions for the existing rapid transit system, concurrently planning for expansion of rapid transit to new parts of the region. The preferred solutions to existing capacity challenges on each of these lines is still to be determined and could include reliance on regional passenger rail running parallel high-capacity express service, twinning of existing rapid transit lines, or building of parallel rapid transit lines to spread out the ridership, or some combination of the above.

The ultimate solutions will require significant technical assessment and decision-maker discussion that will take place in the form of more detailed corridor studies following the finalization of Transport 2050. However, the necessity of these investments should be assumed in any Transport 2050 network concept.

Separating transit from other traffic: the key to speed and reliability

The key to fast and reliable rapid transit is separating it from traffic. There are generally two ways to achieve this, both of which could be part of our rapid transit network in 2050:

Above or below street level	**Street level in dedicated lanes**
SkyTrain or similar services running on elevated guideways or in tunnels   *Image: https://commons.wikimedia.org/wiki/File:R211_Open_House_%2838033469354%29.jpg*	Bus-rapid transit (BRT), light-rail transit (LRT), and other emerging forms of automated, electrified transit   *Image: https://commons.wikimedia.org/wiki/File:R1-tram.jpg*

Each of these ways of providing rapid transit has advantages and disadvantages, and both will be important in our expanded rapid transit network. In the next section, we explore these trade-offs in more depth. It's important to note that although we are seeking your input on these two different approaches to expanding the rapid transit network, multiple possible hybrid approaches are also possible. The intent of the current discussion is to assess and get feedback on these two broad approaches which we will then refine into a preferred approach that we will bring back for engagement in Phase 3.

The evolution of a rapid transit route

As an example of how a transit route can evolve from local bus service and through various forms of rapid transit over time, let's look at what is now the 99 B-Line along the Broadway Corridor.

In 1996, we introduced the B-Line to replace local bus service along the corridor between Lougheed Mall in Burnaby and UBC's Vancouver Campus. The route was immediately one of our busiest shortly after it opened, leading to additional investments of buses and more frequent service.

In 2002, the opening of the Millennium Line SkyTrain replaced the portion of the route from Lougheed Mall to what is now Commercial-Broadway station.

Fast forward to 2019, when the 99 B-Line between Commercial-Broadway and UBC saw up to 60,000 daily trips on articulated buses running every two to three minutes at peak times. It remains one of the busiest and consistently overcrowded bus routes on our region's network.

The Broadway Subway Project, now under construction, will extend the Millennium Line from VCC-Clark to Arbutus Street, replacing a portion of the 99 B-Line.

When the Broadway Subway Project opens in 2025, we expect that the remaining B-Line from Arbutus to UBC will be at capacity in the peak hour. That's why we're currently studying a potential extension of SkyTrain to UBC.

This corridor provides a blueprint for how other routes in our region may evolve over time.

For more information and to provide feedback on our current work to explore a potential Millennium Line UBC Extension, please visit translink.ca/ubcextension.

Two Potential Approaches to Expanding the Rapid Transit Network: At-a-Glance

Approach	Network A	Network B
What's the idea?	This approach to expanding the rapid transit network looks a lot like what we know today. It would rely primarily on SkyTrain, built above and below street level.	This approach would rely primarily on road-based rapid transit. The vehicles would run in dedicated lanes at street level.
What are the trade-offs?	Building SkyTrain involves tunneling and constructing rail guideways above ground. This makes it relatively expensive and slower to build compared to other systems.	A more street-level rapid transit would require dedicating some road space, currently used for automobiles, towards rapid transit.
Advantages	Network A shines when it comes to moving people between town centres as quickly as possible – given the greater emphasis on complete separation from street vehicles. It can also move a lot of people during peak periods, such as when people commute to and from work.	Because a more street-level network puts a greater emphasis on using existing road space, each kilometre would be less costly to build. For the same investment, we could have a network several times larger than SkyTrain-only. Opening up rapid transit for more people. This system excels serving people throughout all times of the day and for sub-regional travel.
Current network	**100 kilometres** Length of the current SkyTrain network, with Broadway Subway (VCC-Clark to Arbutus) and Surrey-Langley extensions	
Network expansion	**200 more kilometres than today** **SkyTrain**: 100 kms **BRT and LRT**: 100 kms	**400 more kilometres than today** **SkyTrain**: 50 kms **BRT and LRT**: 350 kms
Cost	Both networks would cost about the same. While the scale of expansion would be ambitious, both networks are within the realm of what we could expect to fund. In either case, senior governments would be important partners.	

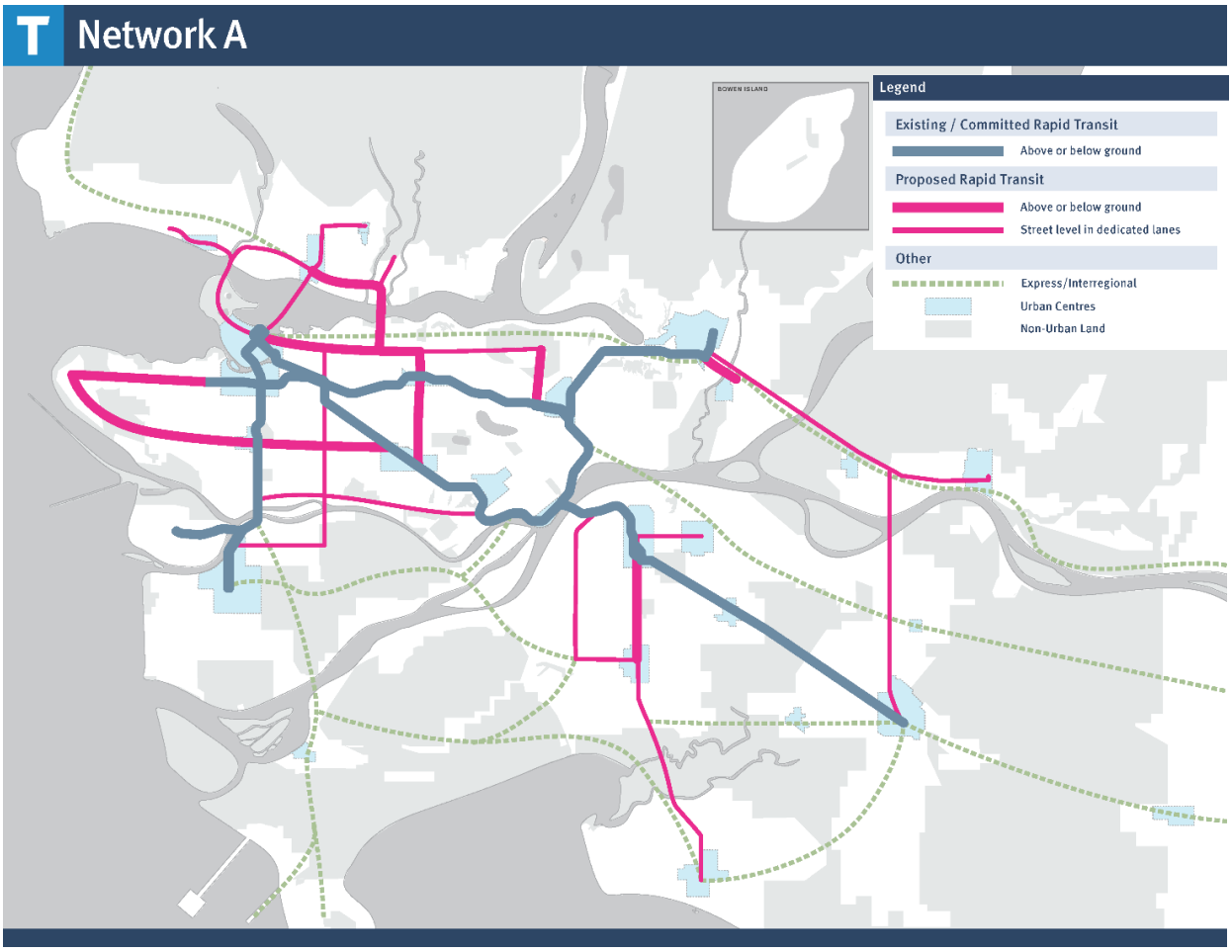
Network A

In the decades since the launch of SkyTrain in 1986, we have expanded the network to include the Millennium Line, Canada Line, Evergreen extension, and soon, the Broadway Subway (VCC-Clark to Arbutus Street) and Surrey-Langley extensions. Once those are complete, we will have 100 kilometres of SkyTrain in the region. This approach has resulted in a high-frequency, high-capacity network that services the region's busiest corridors.

Our current rapid transit network has resulted in well-connected regional town centres. Metro Vancouver has become one of the most livable regions in North America, in large part due to the regional focus on building transit-oriented communities focused around frequent transit – especially at SkyTrain stations. Regional town centres such as Metrotown, Brentwood, Surrey Central, and Coquitlam Central have grown significantly in recent years to meet the high demand to live along a rapid transit corridor.

The Network A approach would add about 200 kilometres of new rapid transit to our rapid transit network. About 100 km would be rapid transit on elevated guideways or in tunnels, and 100 km would be street-level rapid transit in dedicated lanes.

A trade-off to the Network A approach is that investment is focused into fewer but more expensive corridors at a time, meaning that by 2050 some parts of our region would still not have convenient access to rapid transit.



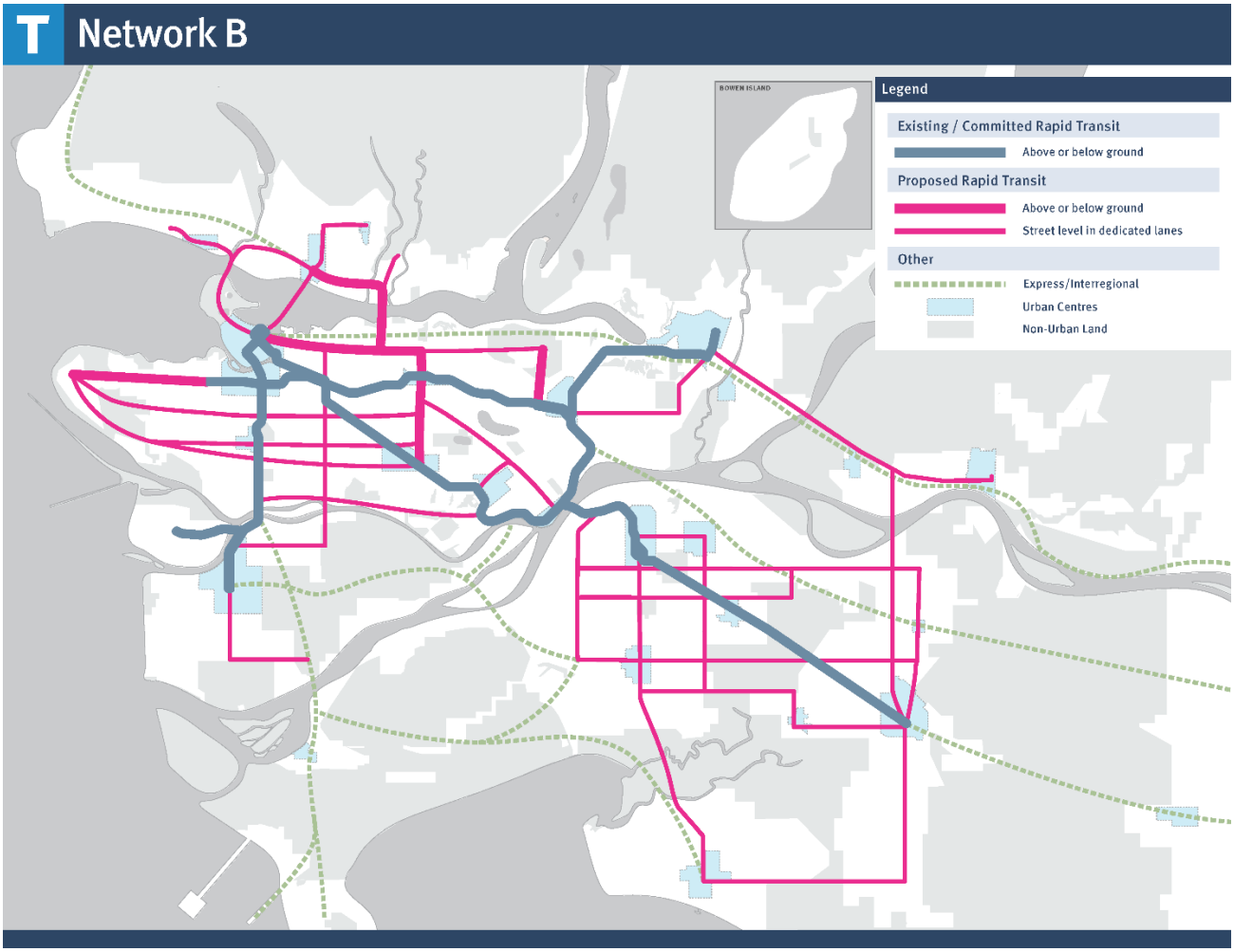
Note: *North Shore crossing alternatives are still under active study and are shown here for illustrative purposes.*

Network B

Street-level rapid transit that makes use of existing road space is much cheaper to build than new guideways and tunnels. Accordingly, the approach illustrated in Network B, which puts more emphasis on street-level rapid transit, would bring more rapid transit to more people in more parts of the region by 2050.

The Network B approach to expanding our rapid transit network would add about 400 more kilometres to our rapid transit network. It would still include about 50 kilometres of new above and below street level rapid transit on those corridors where it is required to meet forecast peak ridership volumes. But, in Network B, the remaining investment would be put towards an additional 350 kilometres of street-level rapid transit.

A trade-off to building more new rapid transit at street-level is a need to change the way our streets are used. While in some cases, new lanes may be able to be added to existing roads to accommodate street-level rapid transit – in most cases it would be achieved through a reduction in general purpose traffic lanes, resulting in less road space for non-transit vehicles. In other cases, it is possible to achieve new transit lanes through a reduction or elimination of curb side parking which could have impacts on local businesses and residents if not managed appropriately.



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How do these two approaches compare?

We have undertaken a preliminary evaluation of how these two approaches to expanding the rapid transit network compare to each other on a series of factors. In addition to analysis for Network A and Network B, we are showing how our current network and a business-as-usual approach compare. Green shading indicates which network approach performs best for each factor.

It should be noted that both the modelling results shown below for Network A and Network B assume a strong foundation of local bus service with frequencies of 15 minutes or better on all routes.

Evaluation Factor	Evaluation Measure	Current	Business-As-Usual	Network A	Network B
Population coverage	Population within walking distance to rapid transit	15%	25%	50%	65%
Employment coverage	Jobs within walking distance to rapid transit	30%	35%	60%	70%
Equitable distribution	Low-income population in areas with low transit access scores	253,000	509,000	83,000	32,000
Flood risk	Kilometres of rapid transit exposed to risk of flooding	15	22	48	72
Service resiliency	Number of high-capacity lines that parallel each other	3	3	17	31
Ridership	Projected passengers per day (million)	1.5	2.4	3.4	3.6
Congestion	Minutes of congested vehicle travel (million)	2,500	8,000	7,200	7,700
Vehicle kilometres of travel	Annual vehicle kilometres of travel from vehicles (million)	13,800	18,500	17,400	17,000
Greenhouse gases from construction	Additional CO_2 emissions from construction of the network (tons)	n/a	n/a	11,690,000	9,540,000
Cost effectiveness	Cost per additional annual boarding	n/a	n/a	$223	$179
	Cost per reduction of vehicle kilometre travelled	n/a	n/a	$54	$40
Accessibility	Jobs accessible within 45 minutes by vehicle vs. transit	6.8:1	6.0:1	4.1:1	3.6:1

Figure 7 - Evaluation results for two different approaches to expanding the rapid transit network

As shown in Figure 7, the Network B approach performs better than the Network A approach on most measures including reaching more people and jobs and making transit a competitive choice for more trips, resulting in higher transit ridership at lower costs and a greater reduction in the amount of driving and hence transportation GHGs. Using less concrete, which is a major global source of GHG emissions, the approach shown in Network B also generates fewer GHGs from construction and materials.

However, Network B exposes more kilometres of rapid transit to high flood risk in the low-lying parts of the region, which has an impact on operational resiliency and recovery costs in the event of a flooding event.

The other area where Network A performs better than Network B is with respect to time that people spend in traffic congestion. This is discussed in more detail below.

Spotlight on congestion

We forecast that, over the next 30 years, traffic congestion will continue to grow along with growth in population and the economy. The approaches in Network A and Network B (together with increased local transit frequency) would both result in people spending less time stuck in congested conditions as compared to business-as-usual.

However, Network A which puts more of the rapid transit network above or below street level, results in greater overall congestion reduction (-10%) than does Network B (-4%). While Network B results in greater absolute reduction in driving levels, it also relies on reallocating more road lanes to dedicated transit lanes which is why the overall congestion reduction impacts are not as high.

When we focus on congestion experienced by different road users, Network A is more attractive for people using automobiles while Network B is more attractive for people using transit.

As shown in Figure 8, compared to business-as-usual (BAU), Network A would reduce both transit passenger and auto user congestion (-32% and -9%, respectively). Network B would result in substantially more congestion reduction for transit passengers (-50%) with a modest reduction in congestion for auto users (-1%).

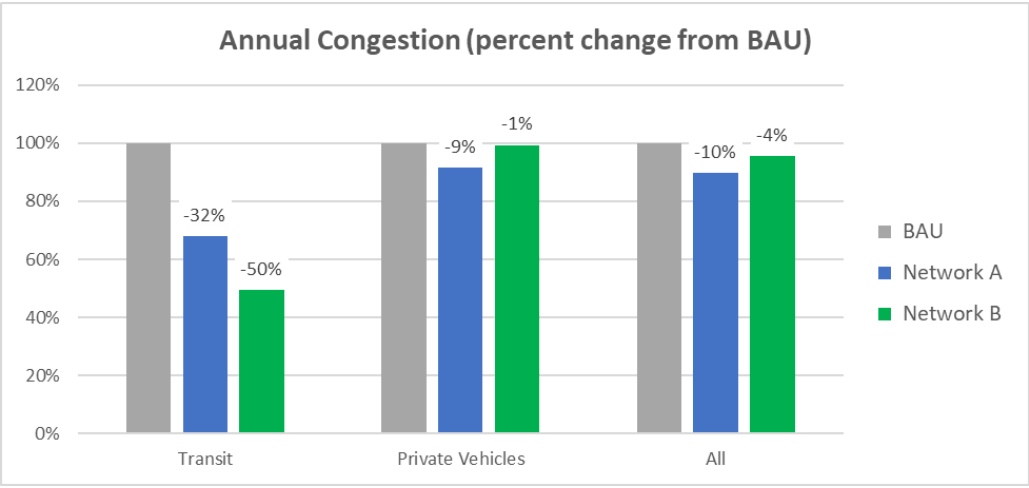

Figure 8 - Annual Congestion (percent change from BAU)

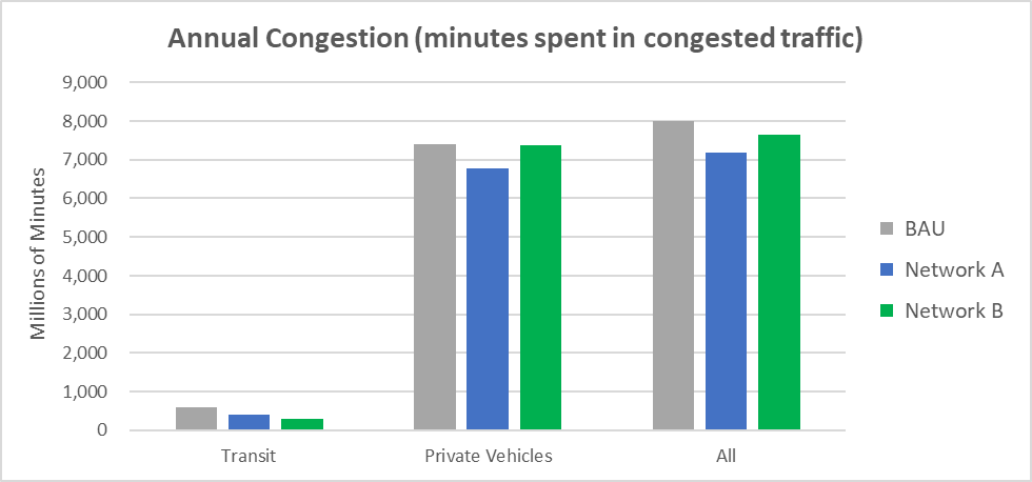

Figure 9 - Annual congestion (minutes spent in congested traffic)

Other traffic reduction and demand management strategies would have the potential to further reduce congestion for both transit and automobiles in relation to business-as-usual.

We need your input

Should we focus on building fewer kilometres of rapid transit but build them with higher levels of traffic separation (above or below street) from the outset? Or should we focus on building as many kilometres of rapid transit as quickly as possible and then upgrade them incrementally over time as additional capacity is needed?

Visit transport2050.ca to take the survey.