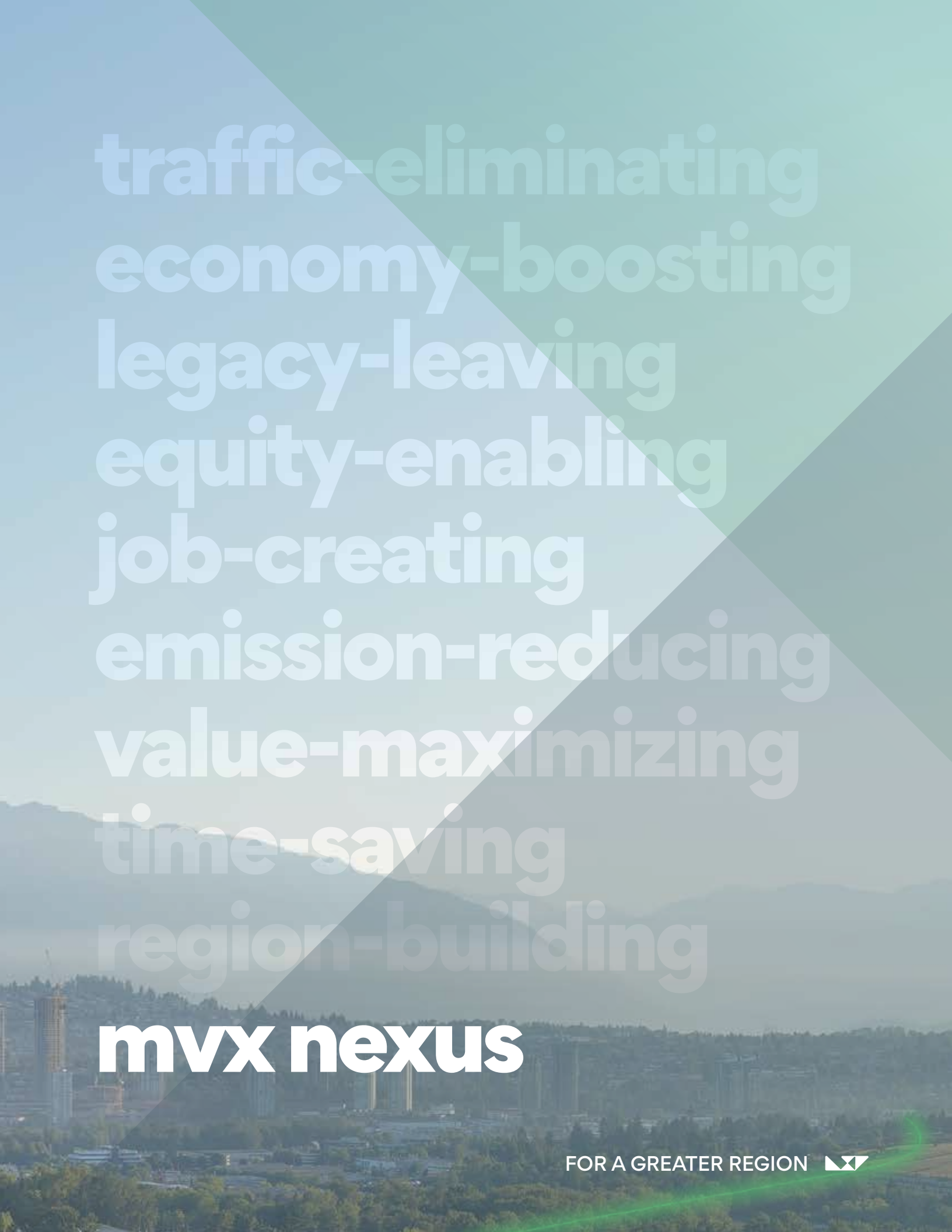

traffic-eliminating
economy-boosting
legacy-leaving
equity-enabling
job-creating
emission-reducing
value-maximizing
time-saving
region-building
mvx nexus
FOR A GREATER REGION

# Land Acknowledgement

The Mountain Valley Express Collective Society wishes to respectfully acknowledge the unceded territory of the South Coast. These lands include (but are not limited to) the Squamish, Tsleil Waututh, Musqueam, Stó:lō, Tsawwassen, Lil'wat, Kwantlen, and Semiahmoo First Nations.

We further wish to acknowledge the unfair treatment that the constitution affords to rail and the way it dispossessed many nations' lands and starved indigenous peoples. As a society, we solemnly reflect and strive to better understand the atrocities of Canada's railway legacy.

In the spirit of reconciliation, we hope that MVX Nexus can serve as a platform for reframing rail as a tool for Nations to harness their economic development potential while building an equitable and sustainable future for connecting all South Coast Nations and all people that call the South Coast home.

# We know how to build a greater region. MVX Nexus is a movement to accelerate it.

There has been long standing interest to better connect the South Coast with its neighbouring cities and surrounding communities for economic, social and environmental reasons. Connecting the seven million inhabitants of the Cascadia region with fast, reliable regional rail is supported by governments on both sides of the border and is now being seriously studied. In addition, South Coast residents have long dreamed about communities like Abbotsford and Chilliwack as well as tourist destinations such as Whistler being conveniently connected by rail.

There are also local demands to connect the region better internally through better public transit. In Transport 2050, TransLink identifies several rapid transit corridors it would like to develop in the coming decades, most notably lines that connect the North Shore with the Burrard Peninsula. These projects, if realized, promise to make living in on the South Coast more affordable and sustainable.

However, what has been so far lacking is a vision that combines both interregional and intercity projects so that the potential of both are maximized. A lack of such a plan could result in wasted and ill-coordinated investments, poor network connectivity and ultimately reduced societal and economic benefits.

This plan aims to address the challenges posed by Metro Vancouver's geography and proposes a regional rail vision that maximizes convenience, value for money, connectivity and infrastructure utility.

# Executive Summary

MVX Nexus is a fresh take on mobility on the South Coast. It is a **350-km** regional rail network that connects Metro Vancouver with the mountains and the valley with connections to ferries and is future-proofed for eventual transborder high-speed rail.

MVX Nexus includes a network of **35 stations** that will act as community nodes and catalyze the growth of sustainable, vibrant centres.

It is estimated that MVX Nexus will take **$9.6 Billion** to build. By sharing infrastructure with rapid transit projects, this cost can be reduced to $7.8 Billion. Through smart design and the use of best project management and tendering practices, we believe this is readily attainable. With considerable benefits to the regional economy and environment, MVX Nexus is a can't miss investment opportunity for both the public and private sectors. The economic and quality of life value that regional rail would deliver is undeniable.

We are also presented with unique challenges.

1. Climate change urgently necessitates a transition to a zero-carbon transportation that is fast and congestion-free
2. Current arrangements have fallen short on delivering transportation with the exit of private coach providers. Disjointed public operators and fare interoperability between BC Transit and TransLink makes interregional transit complex.
3. Rail service provided by West Coast Express and VIA are insufficient to attract ridership and spur mode shift. Existing service does not provide a competitive option to car travel.
4. The cost of housing remains out of reach for many working professionals and young families within a reasonable commute of regional nodes, thus requiring access to a car which is increasingly cost prohibitive for stagnating middle-class wages.
5. The economic potential and attractiveness of surrounding regions is hampered by substandard transportation connections and long commute times.

We’re in urgent need of solutions beyond express buses and SkyTrain.

Our region has expanded beyond the Metro Boundary and in order to adequately serve a growing population on the South Coast, we need to consider this.

MVX Nexus proposes a long-term network vision with five main rail axes which can be delivered in several phases depending on delivery priority. These axes are the South Fraser Axis, North Fraser Axis, Sea-to-Sky Axis, Tsawwassen Axis, and Cascadia High-speed Rail.

Delivery models and funding solutions exist and could materialize in one or a combination of several ways including via land value capture mechanisms, direct development, financing tools from the Federal Government, and/or private operation and delivery models.

Southwestern BC competes on the world stage for immigration, talent, and investment. Other world-class cities are making waves to remain relevant. Paris is reinventing itself around bikes; Toronto has 94km of LRT and Subway projects in progress and a electrified regional rail network in delivery; Stockholm has a similar population and a 241km electrified regional rail network with a 160 km/h top speed; Brisbane boasts a 689 km regional rail network.

Our competition is fierce and if we want to remain relevant globally, we need to invest in our future beyond highway expansion and express buses. When using innovative construction methods, project management and tendering best practices, a network link MVX Nexus, and a greater region, is within reach.

# Mountain Valley Express Collective Society Board of Directors

**Bert Chen** BSocSc, MBA, PMP
infrastructure developer

**Alex Gaio** BURPl, MSc
transportation planner

**Lee Haber** BEng, MA
civil engineer

**Michael Pratt** BComm
municipal councillor

## STRATEGIC ADVISORY PANEL

In addition to our elected board members, the MVX Collective Society also retains the expertise of a strategic advisory panel and works closely with members of the Transit Costs Project.

# Contents

# Key understandings we considered in our rationale.

The cost of inaction is rising

Climate change necessitates change

Inflation and household costs are rising

Housing in the metro core is finite and unaffordable

Private vehicles have major environmental and capacity limitations

Cycling and rail is a winning combination

International flagship events are coming to our region

Innovative construction lessens capital expenditure

Expanding roadways leads to more traffic congestion

Population and travel demand is growing

# Challenges

Building a comprehensive regional rail network in Metro Vancouver comes with several challenges. However, these can all be overcome with creativity and foresight.

These challenges include:

## GEOGRAPHIC BOTTLENECKS

The Metro Vancouver region is divided by two major bodies of water: Burrard Inlet and the Fraser River. Existing crossings are either busy, old or both. Building new crossings over or under these bodies will likely prove expensive. In addition, the mountainous North Shore means an efficient rail corridor will likely require tunneling as well.

## FEW SUITABLE EXISTING RAIL CORRIDORS

Metro Vancouver has few rail corridors that connect major population centres. The CP Rail Corridor on the south shore of Burrard Inlet (that the West Coast Express currently uses) has high levels of freight traffic and would be costly to widen. The existing Amtrak line takes a long, circuitous route around South Surrey. Efficient service will require new, more direct rail corridors.

## POORLY LOCATED TERMINAL STATIONS

Although Pacific Central Station (currently used by Amtrak) is located next to a Skytrain Station, it is not located at a regional hub, meaning it is inconvenient to get to from all parts of the region. Some high-speed rail proposals have proposed a new station at Surrey Centre Skytrain Station, though none currently exists.

## FINANCING

Building this regional rail and rapid transit infrastructure will cost billions of dollars. Ensuring a well-connected design will likely be more costly (though will also offer greater benefits). New sources of funding will need to be found for this project.

# Planning Principles

Building a comprehensive regional rail plan in Metro Vancouver poses significant challenges, however these can be overcome by adhering to sensible principles.

Project Nexus was developed with the following principles in mind in order to maximize its benefits and enhance its feasibility:

## MAXIMIZE MAJOR INFRASTRUCTURE PROJECTS

New bridges and tunnels will be the most capital-intensive projects. Wherever possible, they should accommodate both regional rail and local rapid transit. This can be done with a four-track, 12 m tunnel bore. Dig once, benefit twice.

## MAXIMIZE CONNECTIVITY

Better connectivity means greater convenience, meaning more people will use the system instead of driving. The network needs to minimize passenger backtracking and minimize the number or transfers passengers need to make to reach important regional destinations such as Vancouver International Airport and regional ferry terminals. When it is not feasible for a station to be located next to a destination to a destination, convenient last-mile connections must be built.

## ALLOW FOR INCREMENTAL IMPLEMENTATION

Building in phases not only makes the project more manageable, it also allows residents to experience the benefits of the project far sooner, making it more likely that they will support future phases of the project.

## SUPERIOR TO CAR TRAVEL

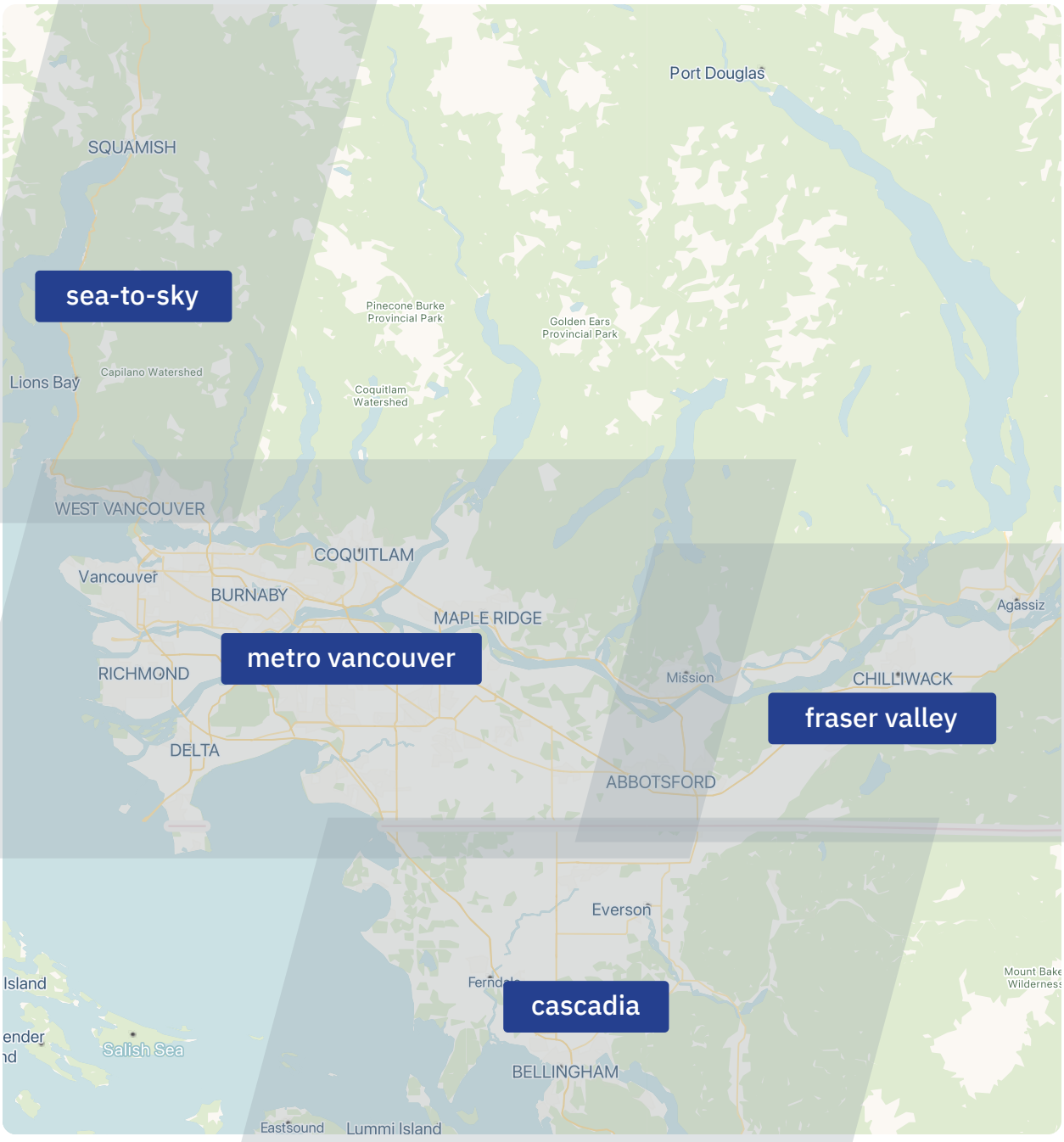
Public transit does not exist in a vacuum; it is competing against other forms of travel. The regional rail system must be designed in a way so that travel times are superior to equivalent car trips.

## COMBINE DEVELOPMENT AND TRANSPORTATION

The utility of this new infrastructure must be maximized by permitting higher levels of development near stations. Transit Improvement districts and new Transit-Oriented greenfield developments could be used to help finance the project.

# Geographical Overview

By land, three regions border on Metro Vancouver: the Sea-to-Sky Region to the north, the Fraser Valley to the east and the American portion of the Cascadia region to the south.



# Axes

MVX Nexus envisions connecting to these regions via five main axes which are listed in priority of construction:

## SOUTH FRASER AXIS

This corridor would extend to Chilliwack and serve the approximately 300,000 people who live in the South Fraser region outside of Metro Vancouver. It would provide rapid connections between Vancouver, Surrey, Langley, Abbotsford and Chilliwack and could enable Abbotsford International Airport to become a secondary aviation hub for the region.

## NORTH FRASER AXIS

This corridor travels along the north shore of the Fraser River from Coquitlam to Mission and is currently served by the West Coast Express. Project Nexus would redesign the Metro Vancouver portion of this corridor, providing better connections with the Skytrain network and enabling faster, more frequent service.

## SEA-TO-SKY AXIS

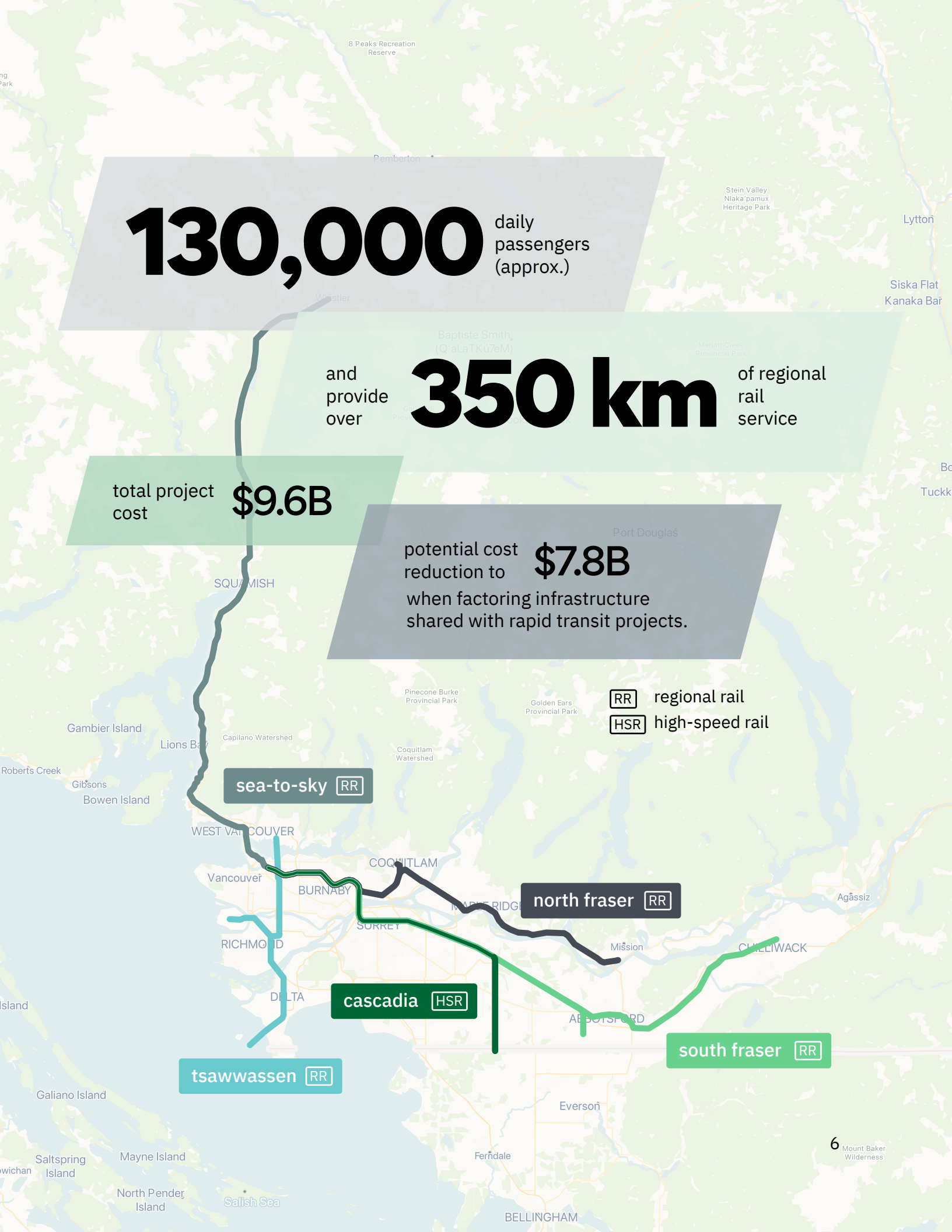
This corridor would extend up Howe Sound up through Squamish up to Whistler. Though the current population of this region is relatively small at around 50,000, millions of tourists frequent its attractions every year. This is expected to grow with the future Garibaldi Ski Resort. Rapid regional rail will help this region reach its economic potential and enable this region to grow in a sustainable manner. Currently, only the Rocky Mountaineer tourist train travels this corridor.

## TSAWWASSEN AXIS

This corridor would connect the North Shore, Vancouver, and Richmond with Delta and the Tsawwassen Ferry Terminal, enabling convenient transit connections to Victoria and Southern Vancouver Island. Around 8.1 million trips were made through the Tsawwassen Ferry Terminal in 2019. It would also provide more convenient connections to Vancouver International Airport for residents who live outside of Vancouver proper. Tunnels connecting with the other axes will allow passengers from the entire region to conveniently access these important destinations.

## CASCADIA HIGH-SPEED RAIL

This corridor would connect Metro Vancouver with around 7 million people living to the south in the Cascadia region. High-speed rail would connect and boost this rapidly growing economic region. It is currently served by the Amtrak Cascades train.


130,000 daily passengers (approx.)
and provide over 350 km of regional rail service
total project cost $9.6B
potential cost reduction to $7.8B when factoring infrastructure shared with rapid transit projects.
RR regional rail
HSR high-speed rail
sea-to-sky RR
north fraser RR
cascadia HSR
south fraser RR
tsawwassen RR
Pemberton
Whistler
Lytton
Siska Flat
Kanaka Bar
SQUAMISH
Gambier Island
Lions Bay
Roberts Creek
Gibsons
Bowen Island
WEST VANCOUVER
Vancouver
BURNABY
COQUITLAM
SURREY
RICHMOND
DELTA
Mission
Agassiz
Galiano Island
Everson
Saltspring Island
Mayne Island
North Pender Island
Salish Sea
Ferndale
BELLINGHAM
Port Douglas
Golden Ears Provincial Park
Pinecone Burke Provincial Park
Coquitlam Watershed
Capilano Watershed
Mount Baker Wilderness

# MVX Nexus Characteristics

## TECHNOLOGY

MVX Nexus uses rail technology that is best suited for each use-case. The overall vision includes sections that are high speed rail (HSR) and regional rail (RR). The characteristics of each of these segment characteristics are described below.

| Spec | | Speed | Trainset | Length |
|---|---|---|---|---|
| RR | regional rail | 160 km/h | 4 cars | 100m |
| HSR | high-speed rail | 350 km/h | 6 cars | 150m |

**Note:** tilting trains will be used on the Sea-to-Sky axis

## TUNNELING METHODS

Throughout this document there are distances reported using different recommended tunneling methods. These methods are described as follows:

**Sequential Excavation Method (SEM)**

Using the geological strength of surrounding rock and soil reinforcing only where necessary. This method is suitable for short tunnels with variable ground conditions.

**Cut and Cover**

Digging a trench and returning the surface to its original state.

**Bored Tube**

Digging a tube using a tunnel boring machine. MVX Nexus primarily employs a 12m wide-bore tube to simplify construction.

## DESIGN STRATEGIES

Several design strategies have been employed to achieve the primary design goal. Some of these strategies overlap with the Design Principles stated in the original Project Nexus document, however, these strategies are more directly relevant to the design process. These strategies include:

**Maximize Major Infrastructure**

New bridges and tunnels will be the most capital-intensive projects. Wherever possible, they should accommodate both regional rail and local rapid transit. This can be done with a four-track, 12m tunnel bore. Dig once, benefit twice.

**Build for Today, Design for Tomorrow**

Future proof within reason. The regional rail network should be designed to accommodate passenger traffic for 30 years without requiring major upgrades. If the traffic growth expected in 30 years does not justify the infrastructure, it should not be built.

**Design for Off-the-Shelf technology as much as possible**

Proprietary technology may make certain infrastructure cheaper but comes at a high-cost long-term. It may cost over two times as much and may become obsolete in the future. In most cases, it is better to invest in the infrastructure that allows for cheaper and more common technology to be used.

**Software before Hardware**

Infrastructure should be used as intelligently and efficiently as possible before more infrastructure is built. This can be done through better signaling and smart scheduling. For instance, shorter trains operating more frequently reduces the cost of station construction.

**Allow for Full Automation**

Full automation will reduce operating costs long term. Design the rail network so that it is as segregated from other passenger and freight rail services as possible, simplifying signaling systems in the process.

**Invest when the Returns are High**

Don’t be afraid to invest when the gains in terms of passenger convenience, comfort and safety are high. This includes interventions such as platform screen doors and rebuilding Commercial-Broadway Station to allow for cross-platform transfers.

# A Word on Cost Estimation

MVX Nexus is an evolutionary vision and this is an evolving document. Cost plays a significant role in determining feasibility and heavily influences the choices made in this project.

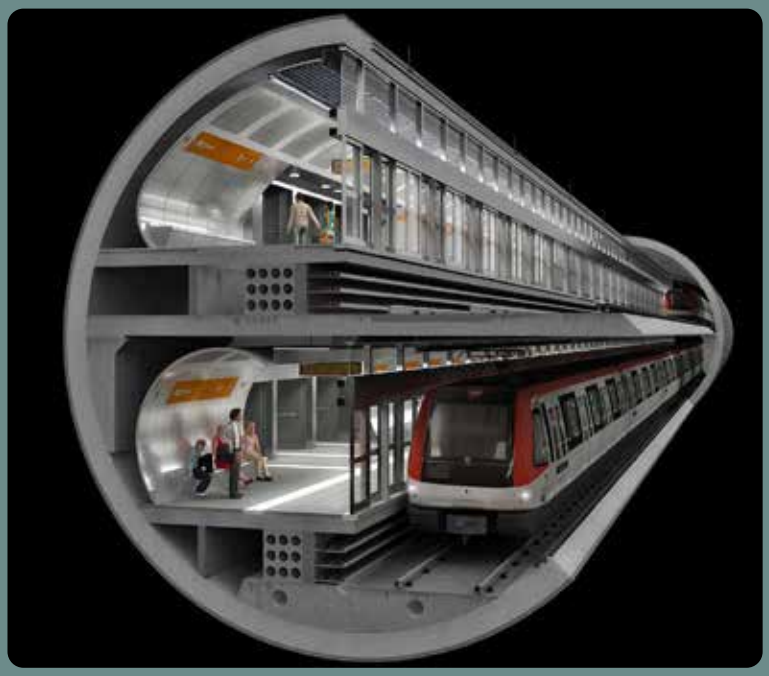
To help readers grasp this project at an early stage, quick-and-dirty cost estimates have been produced. These estimates are shown in the table below.

| Section Type | Cost per KM |
|---|---|
| Tunnel Bored (without stations) | $100 M |
| Single-Track Tunnel Bore | $80 M |
| Cut-and-Cover (without stations) | $55 M |
| Immersed Tunnel (double track) | $200 M |
| Elevated (without stations) | $45 M |
| Elevated (single track) | $25 M |
| At-Grade (double track) | $4.0 M |
| At-Grade (single track) | $2.5 M |
| Electrification (double track) | $2.5 M |
| Electrification (single track) | $2 M |

| Spot Improvement | Cost per unit |
|---|---|
| Grade Separation (overpass/underpass) | $70 M |
| Incorporated Platform Tunnel Station | $70 M |
| Single Side Underground Station | $100 M |
| Mezzanine Cut-and-Cover Station | $200 M |
| Elevated Station | $35 M |

One may observe these estimates and deem them to be exceedingly low. *That's the point*. It should not be assumed that the cost of constructing rail projects in North America is set in stone or justified. There are developed countries in the world that are able to build superior infrastructure at a far lower cost. Cost estimates can be driven further down when factoring in best design and construction management practices.

## Wide-bore Tunneling



The use of wide-bore tunnels is one of the most important measures that will make regional rail in the Lower Mainland viable. Wide-bore tunnels permit multiple transit services to use the same infrastructure, reducing costs and maximizing utility. They can also significantly reduce station construction costs, the largest cost when building underground transit.

# yes, we can build on better value.

1

# network phases

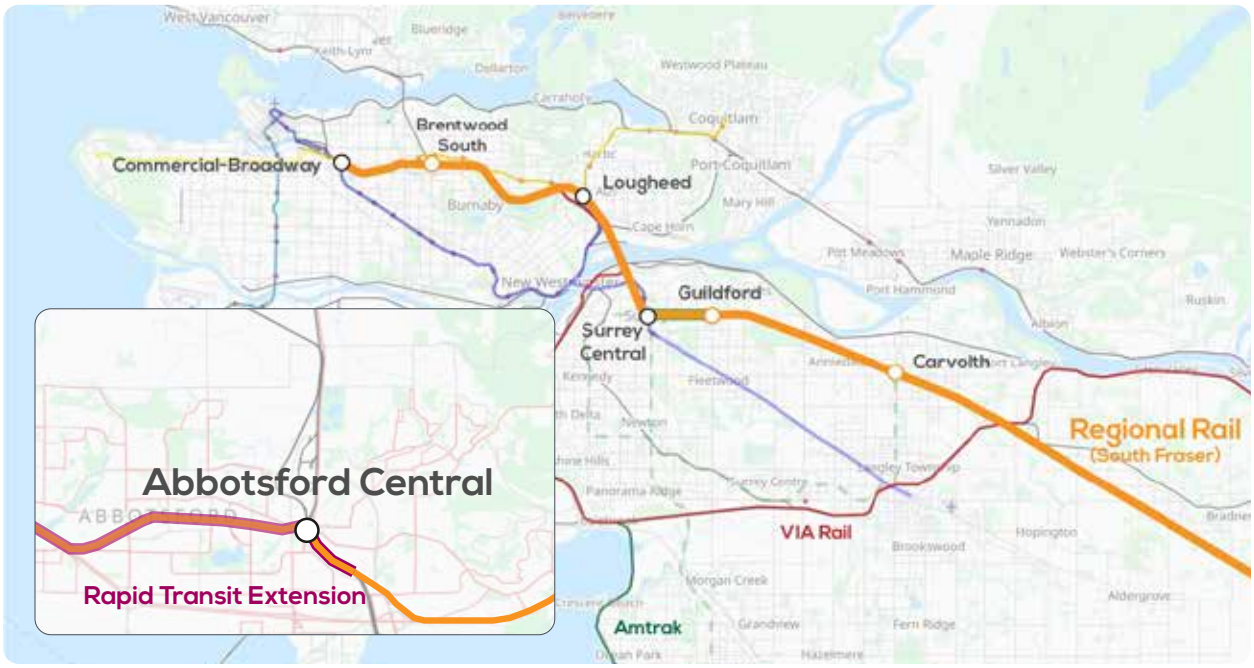
SOUTH FRASER AXIS

# vancouver, surrey, abbotsford line

The Vancouver-Surrey-Abbotsford (VSA) Line is the first project of Project Nexus. It would provide the trunk section off of which future sections of the regional network can be built.

Starting at Commercial-Broadway Station, the line would serve Burnaby, Coquitlam, Surrey, Langley Township and Abbotsford. It would connect a major transit hub and a growing regional centre in Surrey City Centre with Abbotsford International Airport, making YXX a credible secondary airport.

## Current Recommended Design



# Anticipated Challenges

## FRASER RIVER CROSSING

Amtrak Cascades trains currently use the New Westminster Rail bridge, a heavily-used and aging bridge that is inoperable when a ship requires passage. Frequent and efficient rail service will require a new crossing of the Fraser River.

## BNSF/CN RAIL CORRIDOR

This rail corridor extending from Pacific Central Station to New Westminster is heavily used by freight traffic. However, unlike its CP counterpart to the north, it is straighter with more room for expansion. Faster, more frequent service will also require new grade separations along the corridor.

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench

# Benefits

## TARGET TRAVEL TIMES

| VAN → SEA | VAN → SRY | VAN → LHD | VAN → CBW |
|---|---|---|---|
| **1 hr** | **17 min** | **11 min** | **3 min** |
| vancouver to seattle | vancouver to surrey | vancouver to lougheed | vancouver to commercial-broadway |

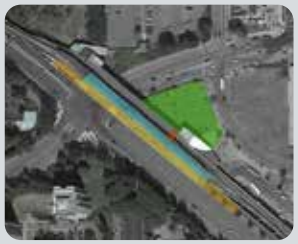
# Specifications

## MEASUREMENTS

| BORED TUBE | CUT-AND-COVER | ELEVATED | AT-GRADE |
|---|---|---|---|
| **9.7 km** | **4.1 km** | **14.8 km** | **42.3 km** |

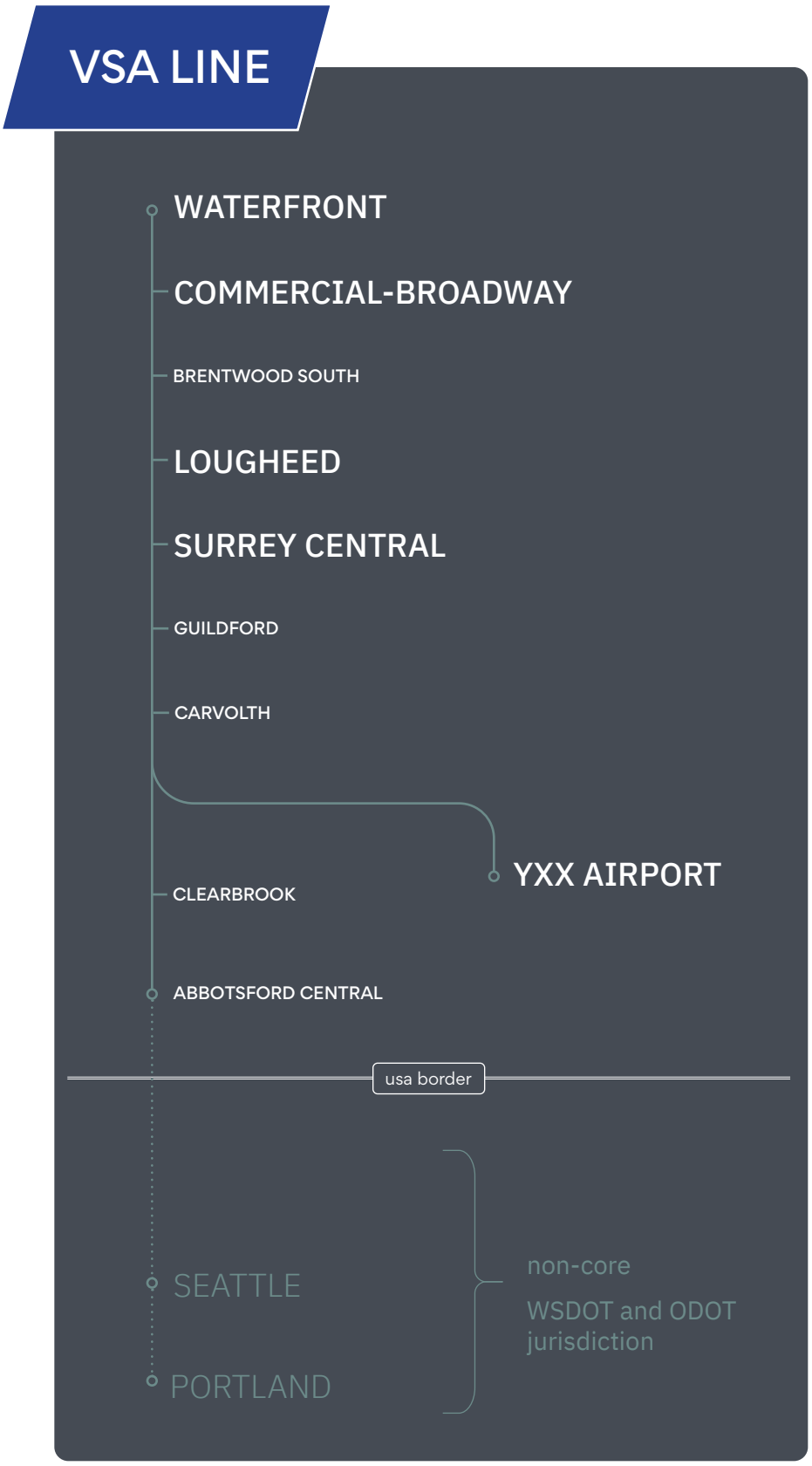
# Key Stations


COMMERCIAL-BROADWAY


LOUGHEED


SURREY CENTRAL


YXX AIRPORT


VSA LINE
WATERFRONT
COMMERCIAL-BROADWAY
BRENTWOOD SOUTH
LOUGHEED
SURREY CENTRAL
GUILDFORD
CARVOLTH
YXX AIRPORT
CLEARBROOK
ABBOTSFORD CENTRAL
usa border
SEATTLE
PORTLAND
non-core
WSDOT and ODOT jurisdiction

# Recommended Alignment Solutions

## BROADWAY TO BRENTWOOD SOUTH

From Commercial-Broadway, the Westbound Regional Rail track will travel north of the freight ROW and the Eastbound Regional Rail track will travel south of the regional rail track. This can facilitate future connections with the Tsawwassen Connector to be built as part of the East Vancouver Access project.

The Eastbound track will travel along the southern edge of the Grandview Cut and transition to a viaduct between Nanaimo and Slocan streets. It will then join the Westbound track between Slocan and Kaslo.

From Kaslo heading west, the Westbound track will cross over the freight track and transition to at-grade between Slocan and Nanaimo. By Nanaimo Street, it will be at the level of the bottm of the cut running north of the freight track.

Heading east, both tracks will travel in a viaduct south of the BNSF/CN ROW from Kaslo to east of Gilmore where it will transition to at-grade. To accommodate the additional tracks, the BNSF/CN tracks will need to be shifted to the north. It is also likely that the hydro corridor that runs along here will need to be relocated to the north.

## BRENTWOOD SOUTH TO LOUGHEED

Most of this section will not necessitate significant change. Most of the corridor has sufficient space to accommodate two freight rail tracks and two regional rail tracks.

An exception is near the Kensington Avenue Overpass where there is insufficient space between the overpass supports to accommodate a fourth track. For this 350 m section, regional rail trains will run in a stacked configuration with eastbound trains running in a cut buried below westbound trains.

## LOUGHEED TO SURREY CENTRAL (FRASER RIVER TUNNEL)

Connecting Lougheed to Surrey Central will require the construction of a new Fraser River rail crossing. The current recommended solution is a tunnel that will travel below the Fraser River.

Additional branch tunnels north and south of the river may be added for intercity passenger train services to exit the tunnel after crossing the river. (This branch tunnel may also facilitate regional rail train access to a possible OMC site).

The recommended tunnel alignment will continue to 104 Avenue where it will then turn east before reaching Surrey Central Station. A cavern will be built just west of the station to facilitate possible future rapid transit service to North Delta along 104 Avenue.

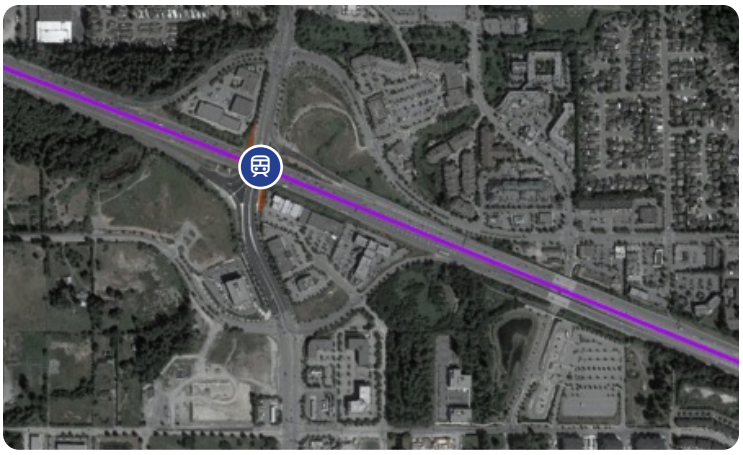
## SURREY CENTRAL TO GUILDFORD


From Surrey Central, the bored tunnel will continue east until 140 Street. This is where the Fraser Tunnel TBM station staging area will be located. Heading east, a cut-and-cover tunnel will be built primarily along the south side of 104 Avenue to Guildford Station.

## GUILDFORD TO CARVOLTH

From Guildford Station heading east, the cut-and-cover tunnel will continue along the south side of 104 Avenue to just east of 158 Street where it will transition to a viaduct. The viaduct will run south of Highway 1 and enter the median of the highway near where the highway meets 102 Avenue. About 150 m west of the pedestrian overpass it will transition to running at grade and continue along the median of Highway 1 running under a rebuilt 176 St. overpass, over Golden Ears Way and under 192 Street.

## CARVOLTH TO CLEARBROOK



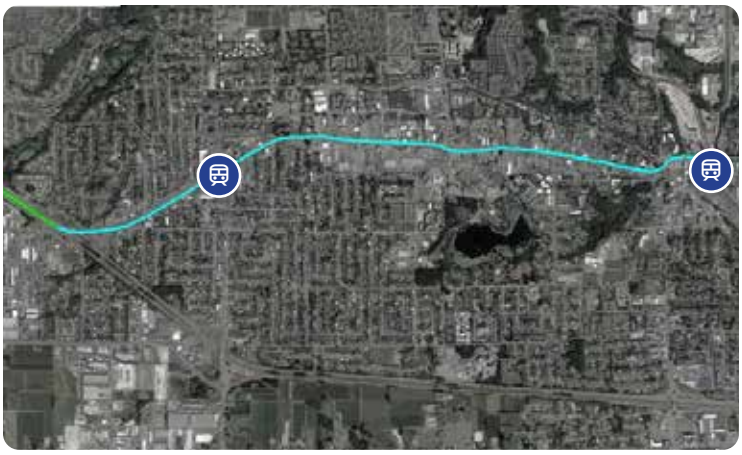
Heading east, the regional rail tracks will transition to a viaduct that will travel above the access ramps to 202 Street, in effect mirroring the highway. It will cross over 202 Street and continue in a viaduct over the ramps until the median widens and continue at grade.

The tracks will continue at grade in the median of Highway 1 until Abbotsford. The CP Rail Overpass will need to be rebuilt to allow trains to pass under it (this may happen with the Highway 1 upgrades currently under construction). If an OMC is built here, a flyover would connect the regional rail alignment with the CP Corridor. (The overhead transmission lines would need to be relocated.)

About 200 m east of the rail overpass, a future flyover for high-speed rail trains will be built. Approximately 1300 m east of the Mt. Lehman Road Overpass, the flyover for the spur to Abbotsford International will be built. The main alignment to Abbotsford will continue in the median of Highway 1 until south of the Peardonville Overpass where it will transition to a viaduct that will cross over westbound Highway 1 traffic (This may change depending on the Highway 1 upgrades design). Heading east, the viaduct will continue on the south side of South Fraser Way and will split just before  Clearbrook Station.

To accommodate the Regional Rail Viaduct, one lane of traffic should be reallocated to the alignment of the viaduct. For example, if the viaduct is located on the south side of South Fraser Way, a lane on the southern side of South Fraser Way should no longer be used for vehicular traffic in order to accommodate the viaduct.

## CLEARBROOK TO ABBOTSFORD CENTRAL



Just west of McCallum Road, the viaduct will turn north off of South Fraser Way towards George Ferguson Way. (The building containing Dollar Tree may need to be demolished). The viaduct will continue along the north side of George Ferguson Way until it turns south, running parallel to the existing railway ROW. A lane of traffic will need to be reallocated to accommodate the viaduct. Just north of the station, the viaduct will split into eastbound and westbound tracks.

## SPUR TO YXX AIRPORT

Heading southeast from the flyover located just west of Fishtrap Creek, the spur to Abbotsford International will run in a viaduct along the Fishtrap Creek Valley until Mt. Lehman Road. It will then continue south parallel to Mt. Lehman Road until Marshall Road, where it will transition to at-grade. It will continue south at grade until where it meets Mt. Lehman Road again. There are several suitable OMC sites along this at-grade section.

In the vicinity of Abbotsford International Airport, the corridor would transition to a viaduct that would traverse Mt. Lehman Road before terminating in front of the airport terminal building.

# Key Decision Points

## CROSS-PLATFORM TRANSFERS AT COMMERCIAL-BROADWAY STATION

Facilitating cross-platform transfers will cost more and involve temporarily disrupting existing Millennium Line service. However, the additional cost is not exorbitant (less than $10 M for new viaduct construction) and the benefits would be significant.

Thousands of passengers are expected to transfer at this station and allowing cross-platform transfers will save passengers over 2 minutes per transfer. This number is only expected to grow with Commercial-Broadway becoming an even important regional rail hub and future segments of the network are completed.

## VIADUCT VS. GRADE SEPARATIONS

A key question is how to build the regional rail line between the Grandview Cut and Willingdon Avenue. There are several level crossings where regional rail service would require a viaduct or new grade separations.

Building new grade separations would benefit the City of Vancouver, the City of Burnaby as well as CN in terms of reducing points of conflict between rail and road traffic. However, neither party seems interested in making these upgrades any time soon. These upgrades also would not be cheap; the six (6) new grade separations could cost over $0.5 B.

In comparison, a viaduct stretching from Gilmore to the Grandview Cut is estimated to cost around $150 M, about ⅓ the cost of grade separations. It would also not be as dependent on the support and contributions of 3rd parties, reducing risk.

## TRACK PLACEMENT ALONG BNSF/CN TRACKS

For a significant portion of its length, the regional rail network will share the BNSF/CN rail corridor. The corridor is much straighter than the CP corridor and most of the corridor easily has room for two (2) additional tracks.

The question is where should the regional rail tracks be located with respect to the freight trail tracks. A few of the goals of this vision is to maximize the utility of the network through higher frequencies and to enable automation. This requires as much of the network as possible to operate under Automatic Train Control (ATC) signalling.

However, this form of signalling requires the regional rail system to be segregated from other freight and passenger rail services (not including rapid transit). Therefore, the regional rail tracks will be located directly south of the freight rail tracks. (This alignment also avoids a potential conflict west of Brentwood South Station).

## SHARING THE FRASER TUNNEL

The Fraser Tunnel could also be used to remove a bottleneck for VIA and Amtrak trains which currently use the crowded New Westminster Rail Bridge. The tunnel diameter would have to be increased slightly to 13 m to be sufficiently wide to allow for regional rail trains to run alongside passenger trains. (The rest of the tunnel alignment can accommodate this). The southern access tunnel could also be used to help regional trains access a potential OMC site in Surrey.

However, allowing additional passenger rail services in the tunnel would come with additional costs such as ventilation costs. If these passenger rail services wished to use the tunnel, they would be expected to pay the additional cost to enable this, as well as the cost of any accessory tunnels.

## OMC SITE SELECTION

There are several possible sites where an OMC could be built. Ideally, an OMC should be located on relatively inexpensive land but be located centrally on the network in order to minimize dead-heading.

An OMC should be built on the Airport Spur for several reasons. First, it would serve the future Abbotsford Rapid Transit network as regional rail and rapid transit trains are intended to be interchangeable. Second, the Airport Spur would serve as a good staging ground for early testing as the rest of the line is built. However, an OMC in Abbotsford would be located far from the centre of the future network. Another facility is needed.

A more central location would be at 232 Street. Regional Rail trains would access this site using the CP rail corridor via a viaduct that would span over Highway 1. The short segment would need to be electrified and the transmission lines would need to be relocated. This site is 20 km west of the Airport OMC site, though still far from the trunk section of the regional rail network.

A previously mentioned site would be located in Surrey at the foot of the Skybridge. Access to this site would be provided using one of the accessory tunnels to the Fraser Tunnel that allow passenger rail services to use the tunnel. In terms of location within the network, this site would be ideal as trains could begin their routes at either Lougheed or Surrey Central, two major hubs. It could also serve as an OMC for a future SNG Line or South Fraser Orbital Line. However, this option would likely be much more expensive as the land is more expensive and building an accessory tunnel would be costly. For this option to make sense, the contributions of partners would be required.

A final option is in North Burnaby where Holdom Avenue meets the BNSF/CN corridor. This site would centrally located and the cost of connecting to it would be minimal as it is right on the corridor. It's location further west means it could also serve as an OMC for the Hastings Rapid Transit line. However, this site would likely be the most expensive in terms of property acquisition. A more in-depth analysis is needed to determine the best OMC arrangement.

## TUNNELING STAGING AND TRANSITION LOCATION IN SURREY

Tunnel staging requires a significant amount of land for launching the TBM as well as supplying the TBM. Two sites in Surrey were examined for staging the 12m diameter TBM for the Fraser Tunnel: Surrey Central and 140 Street.

The Surrey Central option would shorten the length of the TBM section, potentially lowering costs. However, the close proximity of the City Hall parkade likely prevents the staging pit from being located south of 104 Avenue. This means expensive decking of 104 Avenue over the staging site would likely be required.

The 140 Street site allows the tunnel to run south of 104 Avenue allowing for the staging area to be built in the empty site south of 104. There is also plenty of empty land nearby for staging construction equipment and materials, making this an ideal site for TBM staging.

## WESTERN STATION LOCATION IN ABBOTSFORD

Initially, Abbotsford West was seen as the best location for a western station as it would minimize 'backtracking' for passengers transferring from regional rail to rapid transit. However, the station in and of itself would serve few residents and businesses and the bus connections would be fairly limited.

For these reasons, we are now recommending the station serving Western Abbotsford be located at Clearbrook. A station here would serve more residents and businesses and would more easily connect with the Abbotsford bus network. Having a more centrally located western station would also reduce the time penalty for regional trains as they would not be able to travel at much more than 80 kph as the guideway shifts across South Fraser Way. Backtracking would be minimized to two stations, ones that aren't expecting to serve many passengers.

The ultimate decision, however, should be made only after consultation with leaders, stakeholders and residents of Abbotsford.

## SPUR ALIGNMENT TO ABBOTSFORD INTERNATIONAL

There are two possible routes for the spur to Abbotsford International Airport: along Mt. Lehman Road for the full length and along Fishtrap Creek and then following Mt. Lehman Road to the airport.

The Mt. Lehman Road alignment would be shorter but would run in close proximity to several warehouses, and utilities and would likely require more expropriation and utility relocation. The Fishtrap Creek alignment would largely avoid these utilities and industrial areas, potentially reducing costs.

## ACCOMMODATING REGIONAL AND HIGH-SPEED RAIL NEAR CARVOLTH STATION

There were several options explored in order to accommodate both Regional Rail and High-Speed Rail trains near Carvolth Station.

High-Speed trains will not be stopping at Carvolth Station. Since Highway 1 near 200 Street is not wide enough to accommodate four tracks and a station platform, it was thought that the high-speed rail bypass tracks should run underneath the regional rail tracks. However, the presence of Latimer and Yorkson Creeks within the vicinity of the interchange makes underground construction likely very difficult.

A bypass could be accommodated by having high-speed rail trains continue in the median of Highway 1 while placing the regional rail station on the south side of the highway. A viaduct would need to be built to allow regional rail trains to cross over the highway. To accommodate future rail transit along 200 Street, the station would need to be built under 200 Street. Significant excavation would be required.

Ultimately, it was determined that no bypass would be required for high-speed rail trains. Conflicts could easily be avoided between regional rail and high-speed rail trains on this less busy section of track simply by employing smart scheduling. If regional rail or high-speed rail traffic requires a bypass, the regional rail station could be relocated to the south side of the Highway. However, this is only expected in the far distant further. This modification saves millions of dollars.

NORTH FRASER AXIS

# west coast express 2.0

As the name would suggest, West Coast Express 2.0 is the reimagining of the West Coast Express as a part of a comprehensive regional rail network with all-day service.

Passenger rail service will be redirected off of the congested CP rail corridor onto the trunk of the regional rail network between Lougheed and Commercial-Broadway via a new connecting tunnel. The North Fraser Valley will be served with two branches: one serving Coquitlam Central Station, and the other serving Mission. New dedicated passenger rail tracks will be built where possible and the entire route will be electrified.

This project must be built before the Waterfront Connector in order for rail service to continue to the North Fraser Valley uninterrupted.

## Current Recommended Design

# Anticipated Challenges

## CROWDED CP RAIL CORRIDOR

The CP rail corridor used by the West Coast Express is congested and heavily used by freight trains, preventing improved passenger service. Providing all-day, bi-directional service to residents North of the Fraser will require bypassing the most congested and constrained section between Coquitlam Central and Downtown Vancouver.

## NO OBVIOUS DESTINATIONS/ATTRACTIONS AT THE TERMINUS

There are questions of whether there is enough demand to support a significant expansion of service beyond what is currently provided by the West Coast Express. Though it is possible to expand this service to either Abbotsford or Agassiz, it is unclear if the demand exists.

## ELECTRIFICATION

Regional rail trains on the Port Coquitlam branch will need to cross freight tracks as stations are located on both sides. This will make electrification a challenge as the wires need to run above double-stacked container trains. This challenge can be remedied by installing extended pantographs on trains similarly to those currently employed in India.

# Benefits

## TARGET TRAVEL TIMES

| VAN → COQ | VAN → MPL | VAN → MIS | HSB → COQ |
|---|---|---|---|
| **21.5 min** | **32 min** | **43.5 min** | **33 min** |
| vancouver to coquitlam | vancouver to maple ridge | vancouver to mission | horseshoe bay to coquitlam |

# Specifications

## DISTANCES

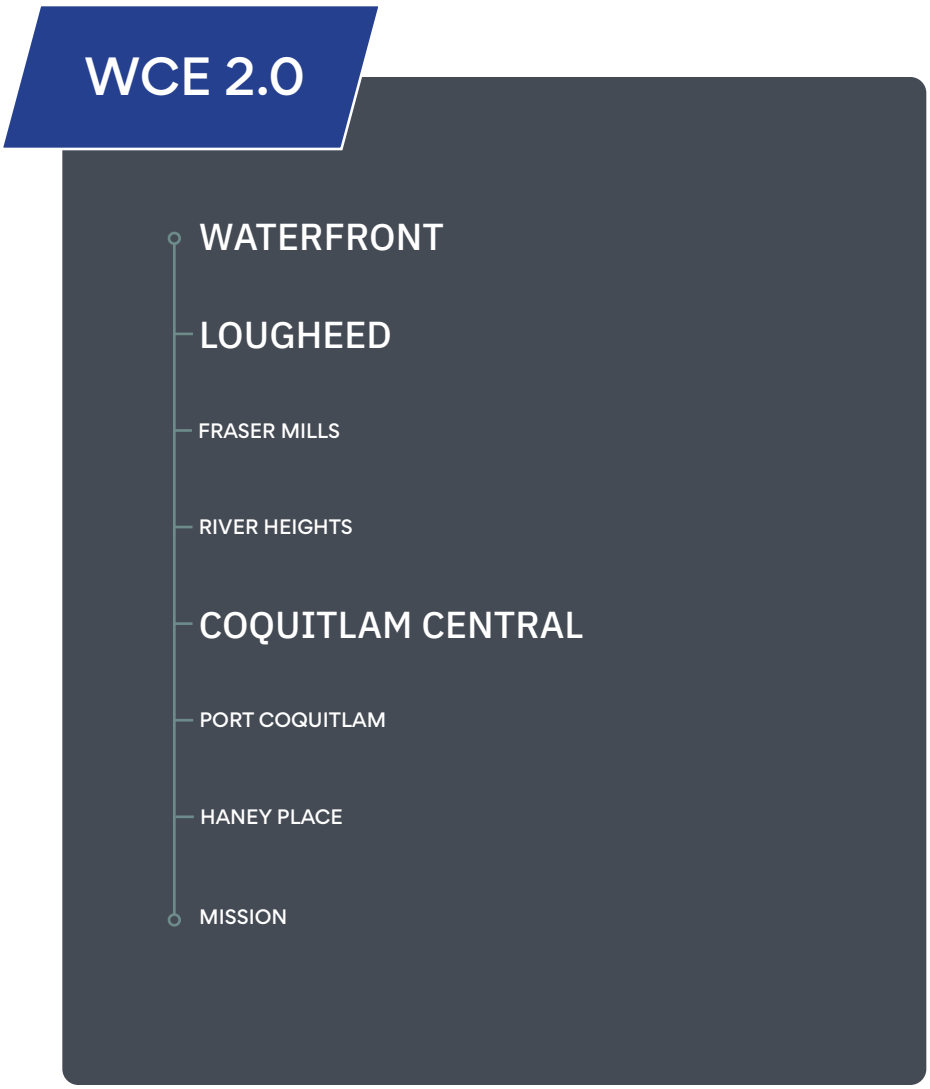
| SEM | AT-GRADE |
|---|---|
| **0.65 km** | **42.3 km** |

# Key Stations

FRASER MILLS

RIVER HEIGHTS

COQUITLAM CENTRAL




## STATIONS FROM PORT COQUITLAM TO MISSION

These stations will require few changes beyond being upgraded with platform screen doors. They will remain Surface Single-Side Platform stations.

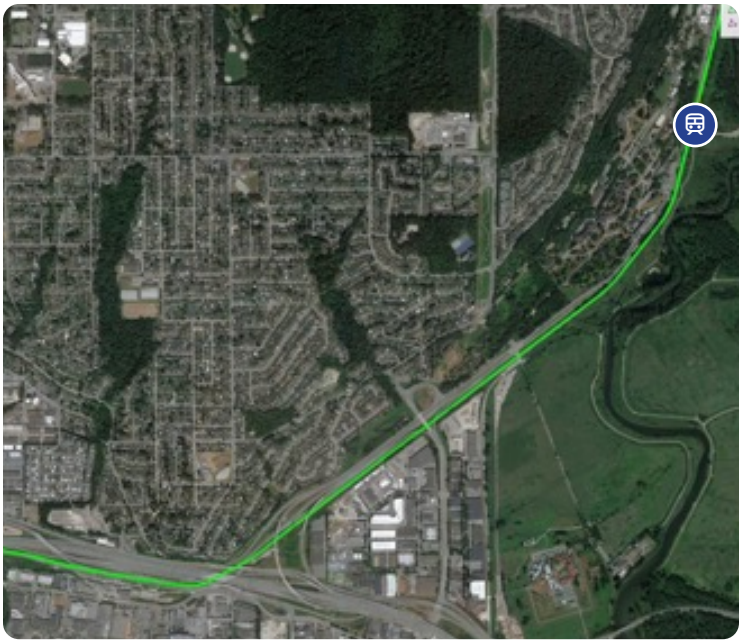
# Recommended Alignment Solutions

## LOUGHEED TO FRASER MILLS


Southeast of Lougheed Station, a 650 m connecting tunnel will be built from the Fraser Tunnel built using the Sequential Excavation Method (SEM). The tunnel will be large enough to accommodate the transition from a stacked configuration to a side-by-side one.

The tunnel will emerge north of the CP rail corridor in the vicinity of Eaglequest Golf Course. The regional tracks will run parallel to King Edward Street. Some minor track relocation may be required.

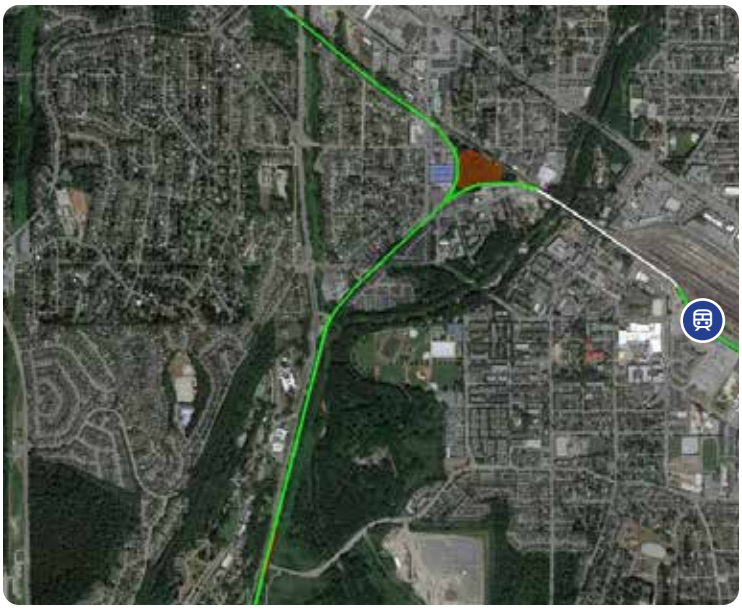
## FRASER MILLS TO RIVER HEIGHTS



Heading east, the regional rail double-track section will continue until where it passes under Highway 1. Some minor track and utility relocation will likely be required here.

Under Highway 1, one or two tracks dedicated to regional rail use will be added depending on the amount of space available. The regional rail tracks will continue north of the CP corridor until Pitt River Road. Level crossings will be preserved as relatively low frequencies are anticipated along this section.

## RIVER HEIGHTS TO COQUITLAM CENTRAL



The double-track section of regional rail will continue north from Pitt River Road for about 800 m where it will narrow to a single dedicated regional rail track. This is due to the narrowing of the right-of-way between Lougheed Highway and the Coquitlam River. Some minor track relocation will be required.

Regional rail trains will continue to run on a dedicated track west of the CP track to the wye. Inside the wye lies a potential OMC site. The dedicated regional rail track will continue from the wye to Coquitlam Central Station, travelling south of the existing freight tracks. Some minor track relocation will be required.

## RIVER HEIGHTS TO PORT COQUITLAM

From the wye east of Coquitlam Central Station, regional rail trains will use the southernmost track to Port Coquitlam Station. No additional tracks will be added in this section as adding an additional track would require building a new bridge and CP reallocating track usage within their own railyard. The existing track will be electrified.

## PORT COQUITLAM TO HANEY PLACE

An additional track will be added along the CP rail ROW from Port Coquitlam to the Pitt River Bridge and from the Pitt River Bridge to Haney Place. Small bridges will need to be built over the Katzie Slough. Electrification will also be added.

## HANEY PLACE TO MISSION

Due to low expected passenger rail traffic along this section, no upgrades will be made to the tracks beyond adding electrification. This segment has double tracks and numerous passing opportunities.

# Key Decision Points

## BUILDING RIVER HEIGHTS STATION

Currently, there is little development or activity situated around the River Heights Station site. However, with new bus routes, it could serve southern Port Coquitlam, an area poorly served by existing transit service.

The station's surroundings also have the potential for growth. The BC Government is currently exploring increasing mental health services at the Riverview Site. In addition, the nearby Kwikwetlem First Nation has plans for growth. A gondola lift service to the station could also be built to help facilitate last-mile connections across the somewhat challenging terrain.

## NEW PITT RIVER RAIL CROSSING

Expected passenger traffic does not justify the construction of a new Pitt River crossing for regional rail trains, an investment that would likely cost hundreds of millions of dollars.

SOUTH FRASER AXIS | NORTH FRASER AXIS

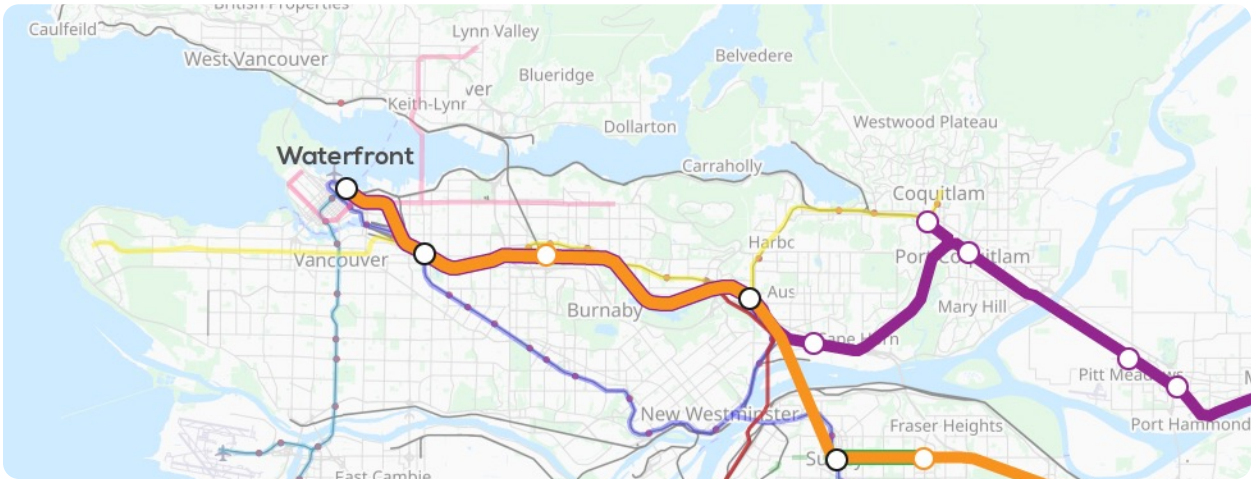
# waterfront connector

Though relatively short in length, the Waterfront Connector will greatly increase the value provided by the Regional Rail network by connecting it with the region's most important transit hub, Waterfront Station. It will also serve as the keystone for the entire regional rail network as it expands.

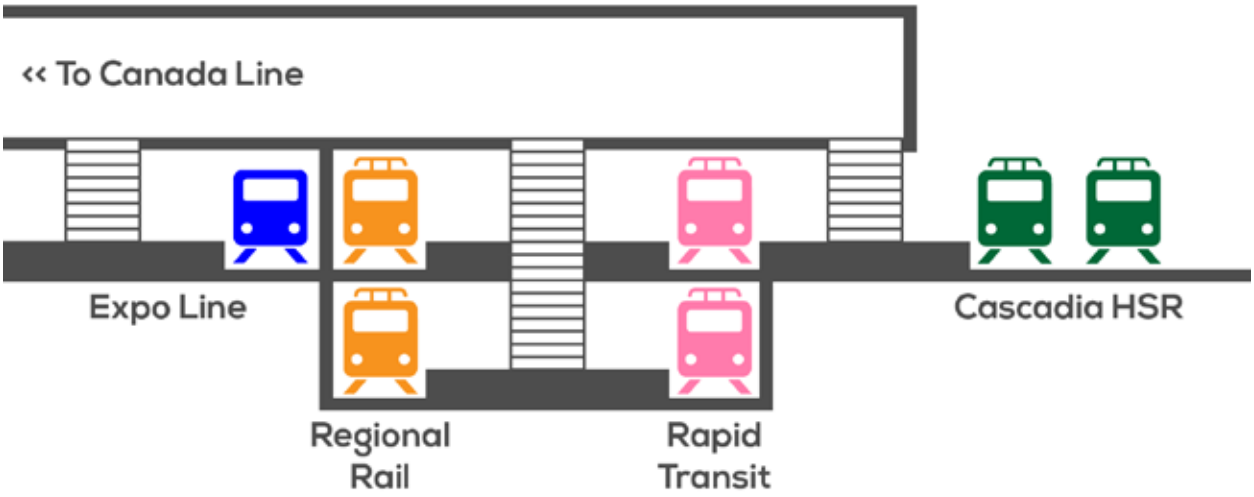
The Waterfront Connector will allow regional rail passengers to easily connect with Expo Line, Canada Line and Seabus services. Passengers will be able to access the heart of Downtown Vancouver seamlessly. (In the case of passengers from the North Fraser after a temporary pause). The Connector will also permit regional rail to serve as a relief line for the Expo Line between Downtown Vancouver and Commercial-Drive Station, the busiest section of the entire Skytrain network.

For part of its length, the Waterfront Connector will share a tunnel with the Hastings Rapid Transit Tunnel. This will reduce the construction costs of both projects. Coordination between the two projects will be vital.

## Current Recommended Design



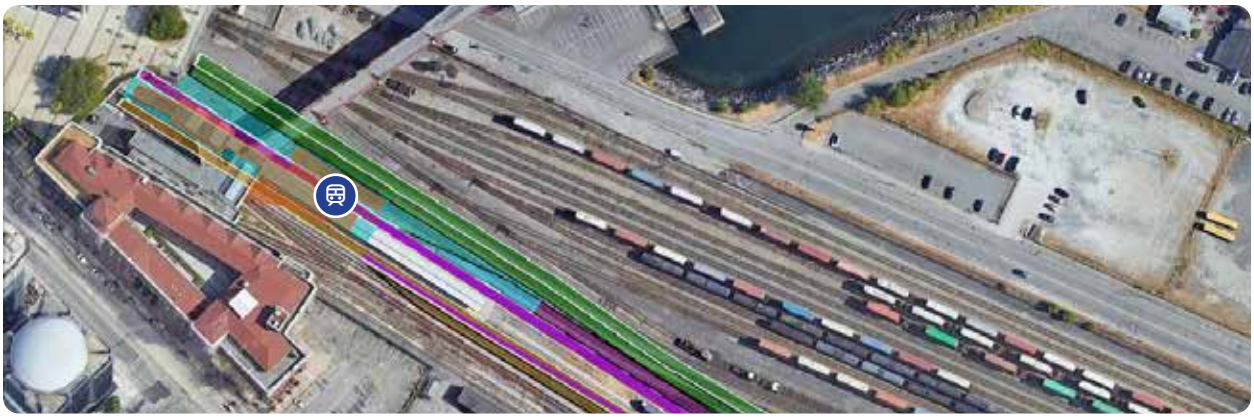
# Waterfront Station




## WATERFRONT STATION PLATFORM CONFIGURATION

Two stacked platforms will service regional rail and rapid transit trains with regional rail trains located to the south and rapid transit trains to the north. This arrangement facilitates convenient cross-platform transfers. A platform for high-speed rail will be built to the north of these platforms along with an additional storage track. A new structure will be built to access both these platforms as well as the high-speed rail platform, mirroring the existing structure.

The design of the station will be compatible with the future Port Lands Vision.



Waterfront Station will be rebuilt in order to accommodate regional rail, rapid transit and high-speed rail services. In total, three new platforms and six new tracks will be built at Waterfront Station with four tracks and two platforms at the surface with another two underground. (One platform and 2 tracks will be built later to accommodate Cascadia High-Speed Rail).

# Recommended Alignment Solutions

## COMMERCIAL-BROADWAY TO WATERFRONT

The first construction priority will be building a new viaduct for Westbound Millennium Line trains. This is necessary to allow Westbound Regional Rail trains to cross under and descend to cut floor level. This viaduct will cross over the freight tracks approximately 200 m west of where the current viaduct does. Similarly, the Regional Rail Eastbound track will extend westward, descending to cut level and travelling under the Millennium Line viaduct.

Both regional rail tracks will be extended westward on both sides of the freight track. Enough room will be provided between them to allow for a second freight track. Both tracks will continue descending until a tunnel portal just east of Clark Drive. (The tunnel portal is built east of Clark Drive in order to avoid conflicts with sewer and gas utilities.)

The Eastbound and Westbound Regional rail tunnels will merge and then continue northwest, initially in a side-by-side configuration and then a stacked configuration as it approaches the Hastings Tunnel. This 2.1-km-long tunnel will be built using SEM and will join the Hastings Tunnel at Princess Street.

Regional Rail services will then share the bored Hastings Tunnel in a stacked configuration to Hastings and Main. From here, a 460-m-long SEM tunnel will connect to the Waterfront Yard north of Carrall Street.

Hastings Rapid Transit and Regional Rail services will share this tunnel using separate tracks (High-Speed Rail will use Regional Rail tracks).

At the Waterfront Yard, Regional Rail, High-Speed Rail and Rapid Transit services will separate. High-Speed Rail services will cross the rapid transit tracks and run on the northernmost tracks, ascending to a 150 m platform at the surface. Hastings Rapid Transit and Regional Rail tracks will ascend north of Cambie Street. The top tracks will be at the surface and use the existing West Coast Express platforms with the bottom tracks directly below them. Additional tracks will be built to allow all services to turn around at Waterfront Station.

# Key Decision Points

## TBM VS. SEM FOR THE STRATHCONA FLATS TUNNEL

From Commercial-Broadway to the Strathcona Flats Tunnel will require a significant grade change. Excavating with a TBM would require a steeper grade as a greater level of overburden is needed. The smallest overburden scenario using twin 6.2 m tunnels (an arrangement that would not provide a crossover nor integrate well with Hasting Tunnel) would require a 3.95% grade change, leaving little design margin.

In addition, 2.1 km is very short for TBM construction, leading to a high cost per kilometre. Even if combined with the tunnel accessing the Waterfront Yard, this length is only just over 2.5 km.

SEM tunnels of the dimensions needed to accommodate tracks in a stacked configuration and only require 3 m of overburden. Not only does this provide a design margin for the descent from Commercial-Broadway station, but it also minimizes the amount of excavation required in the Waterfront Yard. It should be noted though that 2.1 km is at the upper limit of where SEM construction is practical.

## COORDINATING WITH HASTINGS RAPID TRANSIT CONSTRUCTION

Hastings Rapid Transit should be built at the same time as the Waterfront Connector. Construction of the Hastings Tunnel should be coordinated so that the completion of the section to Hastings and Main is completed around the same time as the SEM tunnels are completed.

The Hastings Tunnel will be bored using a 12-m-wide TBM. Ideally, the Hastings Tunnel should be built from Kensington Station to Devonian Park, excavating the southern portion of the downtown loop. (Extracting the TBM at Hastings and Main is not practical and having the TBM terminate at Waterfront Yard would necessitate more excavation.) This 15-km-long bore maximizes the TBM's efficiency. It would also allow for an OMC to be built to serve the Hastings Line at the old Shell site near Kensington Avenue.

A less ideal alternative would be to build a shorter tunnel from a vacant lot east of Kootenay Loop, however, this option would be less efficient as a future tunnel to Kensington would only be 4 km long. It would also require Hastings Rapid Transit to use a Regional Rail OMC, which may be located far away. A Burnaby Regional Rail OMC would likely be a prerequisite for this option.

## ALIGNMENT OF REGIONAL RAIL AND RAPID TRANSIT TO WATERFRONT

Designing the alignment of different transit services to Waterfront Station involves balancing different goals. On the one hand, the amount of tunnelling should be minimized. Cost savings can be derived from sharing the same infrastructure, however, this has to be done while minimizing conflicts and ensuring there is enough capacity for each service.

The least expensive option would be for all trains (rapid transit, regional rail and high-speed rail) to share the same tracks along the Hastings and Waterfront Tunnels. This arrangement would also remove any conflicts for trains travelling on the southern section of the Downtown Rapid Transit Loop.

However, this is anticipated to be one of the busiest sections of the network. With Automatic Train Control, each direction can accommodate 40 trains per hour. During the busiest periods, we can expect rapid trains to use at least 20 of these slots. Around 12 regional rail trains per hour are expected as well, leaving only 8 free slots left. This gives little flexibility and room to respond to disruptions.

Conflicts between rapid transit and regional rail trains could be completely avoided by having regional rail trains run below rapid transit through the Hastings and Waterfront Tunnels. However, this option would complicate the construction of the Hastings and Main station, as platforms would have to be built on both sides, greatly increasing its construction cost.

It would also complicate the construction of the platform arrangement at Waterfront Station. In order to reduce station construction costs by allowing stacked trains west of Waterfront Station, regional rail trains would have to branch off to new platforms north of the existing West Coast Express platforms. Though space for these platforms exists, it is not clear if there is room underneath Granville Square to continue the line further west. Even if it were feasible, a new set of tunnels would be required, increasing costs. In addition, there would be no convenient cross-platform transfers.

Rapid transit could also use a different tunnel when approaching Waterfront Station. Instead of the platforms being located in the railyard with regional rail trains, they could be located in a separate tunnel under Cordova or Hastings Street. This would minimize congestion to only the short shared section of the Hastings Tunnel that is shared.

This, of course, would be more expensive. It would also make transfers between regional rail and rapid transit more difficult (no cross-platform transfers) as well as make those between Hasting Rapid Transit and the Expo Line more difficult (though transfers with the Canada Line would be easier).

For these reasons, the preferred option was selected. It reduces costs by minimizing the number of tunnels, it provides additional capacity by having rapid transit and regional rail services run parallel, it facilitates convenient cross-platform transfers and it minimizes the conflicts between rapid transit and regional rail trains to only those rapid transit trains wishing to use the Downtown Loop.

SEA-TO-SKY AXIS

# waterfront to whistler line

The Waterfront-to-Whistler Line will allow locals and visitors to easily access Horseshoe Bay, Squamish and Whistler using public transit. Once the line is complete, passengers will be able to travel from Mission and Abbotsford to Whistler by rail. In addition, infrastructure built as part of this project can enable rapid transit connections between West Vancouver and the rest of the region.

However, making this a reality comes with significant technical challenges. First, a tunnel has to be built west from Waterfront Station, navigating support pillars and underground parkades. Second, tunnels have to built under the First Narrows and through West Vancouver to Horseshoe Bay, a station that will necessitate a complex, 50-m-tall station structure. Finally, the 105-km-long windy section from Horseshoe Bay to Whistler will need to upgraded to facilitate higher travel speeds.

## Current Recommended Design

# Anticipated Challenges

## NAVIGATING DOWNTOWN

Continuing the regional rail network west of Waterfront station will be challenging. First, the supports of Granville Square need to be navigated. Second, the tunnel must navigate past the underground parkades of office and residential buildings.

## TRAVERSING WEST VANCOUVER

There are few suitable rights-of-way through West Vancouver that also serve important local destinations. The existing CN rail corridor is too narrow and windy to provide efficient passenger rail travel times.

## SNAKING UP THE SEA-TO-SKY

Though an existing rail line exists on the Sea-to-Sky corridor, the route is very windy with many tight turns. Attempting to straighten sections will likely require expensive viaducts or tunnels. Travel times should therefore be reduced using other means, such as tilting trains and track upgrades.

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench

# Benefits

## TARGET TRAVEL TIMES

| VAN → WIS | VAN → SQH | VAN → HSB |
|---|---|---|
| **1 hr 30 min** | **44 min** | **11 min** |
| vancouver to whistler | vancouver to squamish | vancouver to horseshoe bay |

# Specifications

## DISTANCES

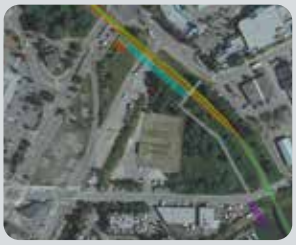
| BORED TUBE | CUT-AND-COVER | VIADUCT | AT-GRADE |
|---|---|---|---|
| **14.9 km** | **260 m** | **620 m** | **102.9 km** |

| SEM |
|---|
| **1.82 km** |

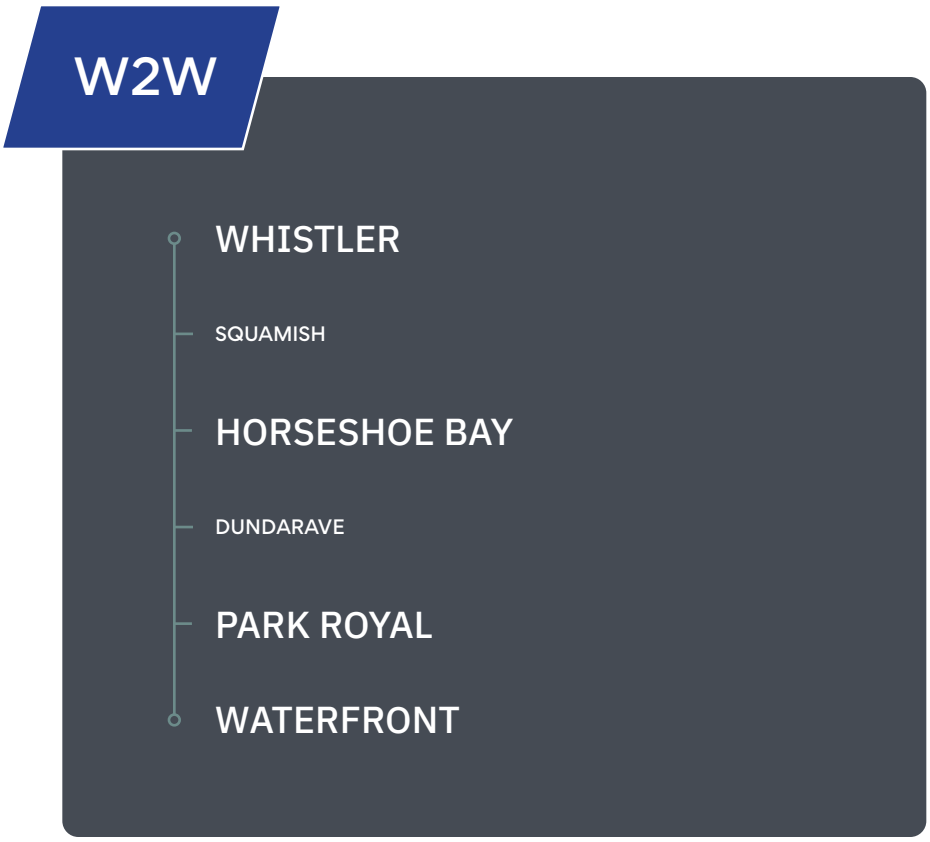
# Key Stations


PARK ROYAL


HORSESHOE BAY


SQUAMISH


WHISTLER

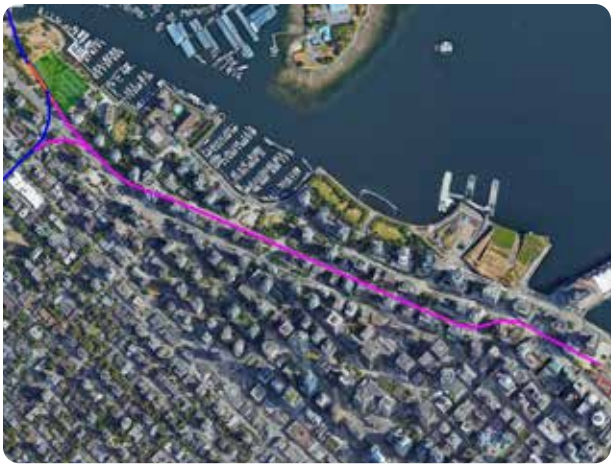

W2W
WHISTLER
SQUAMISH
HORSESHOE BAY
DUNDARAVE
PARK ROYAL
WATERFRONT

# Recommended Alignment Solutions

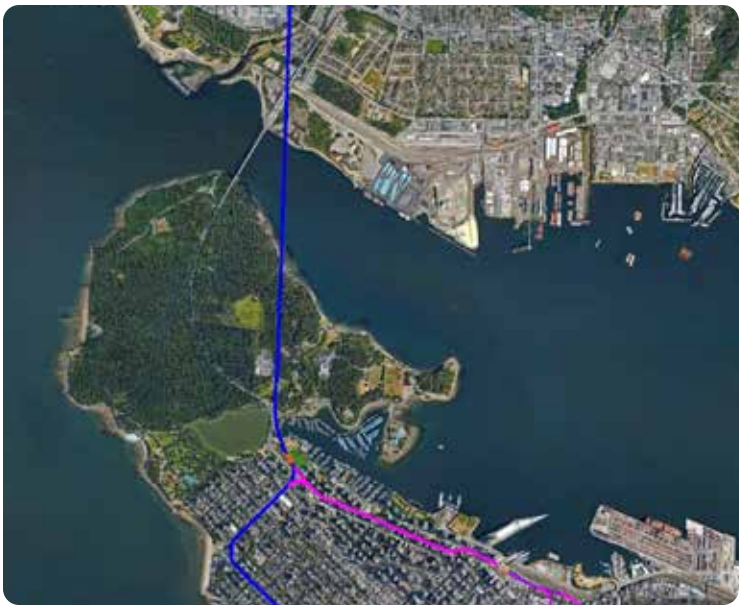
## WATERFRONT TO PARK ROYAL

An SEM tunnel will be built from Watefront Station to Devonian Harbour Park. The most significant challenge will be avoiding the building support pillars while exiting Waterfront Station. The current proposed alignment assumes there is a feasible passage through these pillars and will be refined once detailed building floorplans are made available.

This SEM tunnel will be shared with rapid transit services. The tunnel will transition from Cordova to Hastings Street at Thurlow Street, near the Dunsmuir Tunnel portal.

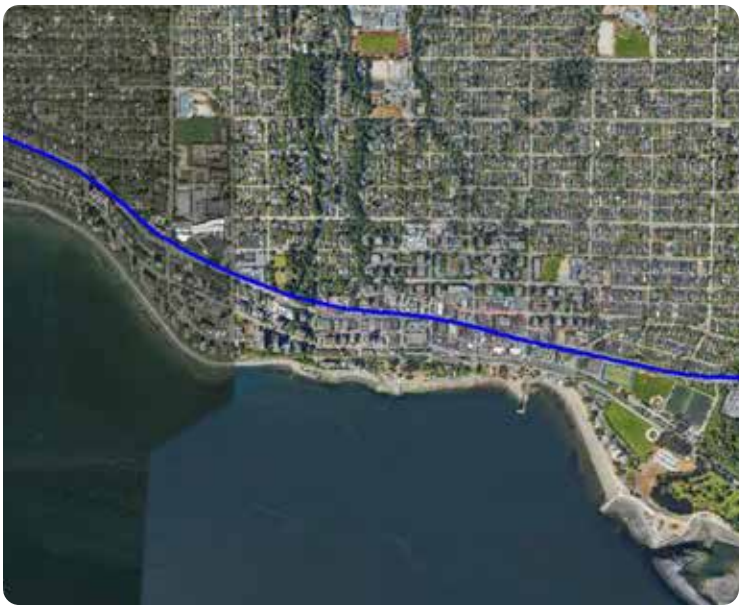


This transition will require tight 125 m curves and locating it at Thurlow Street minimizes the time penalty that comes with this. The tunnel will run along Hastings Avenue, allowing for a future rapid transit station to be built at Coal Harbour Community Centre. It will continue west until it joins Georgia Street where a future Downtown Loop SEM tunnel wil merge with it.  The tunnel will end at the TBM staging pit at Devonian Harbour Park.



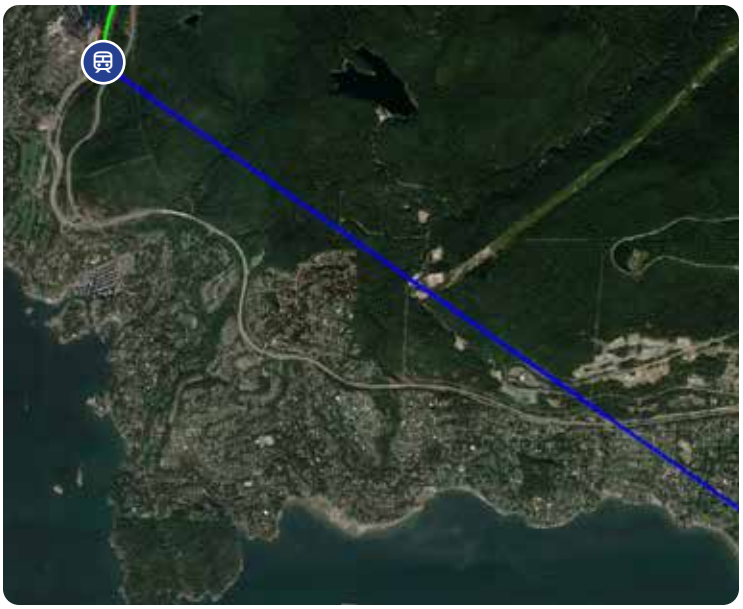
From Devonian Harbour Park, the First Narrows Tunnel will be built. This 12 m TBM tunnel will travel under Stanley Park and above the new water main tunnel. It will run parallel to Pipeline Road enabling the construction of a rapid transit station in Stanley Park. The tunnel will continue north under the First Narrows and then turn west onto Marine Drive at Park Royal Mall. Just to the east of Park Royal Station, a junction with a future SEM tunnel will be built that will allow Burrard Orbital Line trains to serve West Vancouver.

## PARK ROYAL TO DUNDARAVE



The First Narrows TBM tunnel will continue west, travelling under Marine Drive for most of its length. In order to avoid tight curves, it may deviate from being directly under Marine Drive at certain locations.

## DUNDARAVE TO HORSESHOE BAY



The 12 m TBM tunnel will continue west until its extraction pit west of 25 Street. This extraction pit will also serve as the staging pit for the 9m TBM West Vancouver Tunnel and allow trains to transition from a stacked to side-by-side configuration.

The West Vancouver Tunnel will be excavated mainly through stable bedrock. The tunnel will emerge just north of the existing rail tunnel portal. Regional rail tracks will run to the east of the existing freight track in order to minimize conflicts.

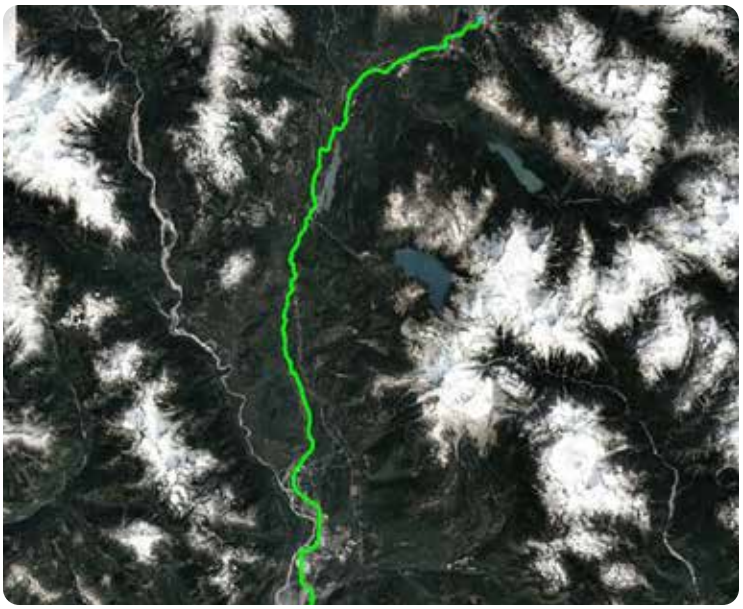
## HORSESHOE BAY TO SQUAMISH

From Horseshoe Bay to Squamish, tracks will need to be electrified and reprofiled. Existing tracks likely do not have a cant above 80 mm. Tight curves (some with a radius of only 150 m) prevent trains from travelling faster than 50 kph. Increasing cant from 80 mm to 180 mm allows tilting trains to travel even these slowest sections at 77 kph. This allows speeds to compete with car travel without requiring major new infrastructure.

Though straight sections may not require reprofiling, for cost estimation it is assumed that this segment will require reprofiling.

A few tunnels may require enlarging to facilitate electrification. In addition, two new short sidings will need to be built, one near Charles Creek and one near Furry Creek.

## SQUAMISH TO WHISTLER



Similar to the section between Horsehoe Bay and Squamish, the entire section from Squamish to Whistler will be electrified and reprofiled. A few tunnels may require slight enlargement for electrification. A new siding will be needed somewhere between Culliton Creek and Cheakamus Falls.

There are several straight sections that permit faster speeds, allowing the route to allow trains from Whistler to travel to Downtown Vancouver in less than 1h30m.

Within Whistler, the alignment will shift from the existing tracks to new tracks between Nita Lake and Alta Lake. Approximately 3.4 km of new single-track will be built along the westside of Highway 99, with most of the alignment within embankments or trenches. Near Whistler Village, the corridor will transfer to a viaduct that will cross over Highway 99 and turn right, running on the south side of Village Gate Boulevard and terminating at an elevated station north of the Gateway Bus Loop.

# Key Decision Points

## ELECTRIFICATION FROM HORSESHOE BAY TO WHISTLER

Given that electrification will cost over $200 M, some may question why electrification is preferred to running diesel multiple units (DMUs) over the same corridor.

DMUs would require additional tunnel ventilation, something that would increase tunneling costs significantly. Though dual-mode trains exist, dual-mode tilting trains appear not to. It is impossible to meet the travel requirements for the corridor without using tilting trains.

Though the cost of electrification is not insignificant, it is less expensive than enlarging tunnels, is more environmental and enables better acceleration performance, something vital for a system that requires frequent stopping.

## WHISTLER TERMINUS LOCATION

Several possible terminus stations were explored for Whistler. This includes the current Rocky Mountaineer Station, at Whistler Village at the location of the Gateway Bus Loop and at a site north of Whistler Village near where the railroad meets Highway 99.

Terminating at the Rocky Mountaineer Station is not feasible as the station is not near any important centre and the track is curved making it unsuitable for a station with platform screen doors.

A terminus at Whistler Village would provide the greatest convenience as Whistler Village is the municipality's hub where most travelers will be going. In addition, it is already a transit hub for local bus routes. It is, however, the more expensive option requiring new infrastructure and costing around $70 M.

A station north of Whistler Village would cost around $34 M, about half the cost of the Whistler Village option. However, the route to the station would be around 1.7 km longer and travel through a section on Alta Lake that may restrict top speeds. In addition, an additional transfer would be required for reaching Whistler Village, making transit less competitive when compared with driving. A gondola could be built between the station site and Whistler Village, however, this would erase the cost difference with the directly to Whistler Village option and require expensive relocation of high-voltage electrical transmission lines.

For these reasons, it is deemed that building a terminus at Whistler Village is the best option.

## UPGRADING THE SEA-TO-SKY CORRIDOR

Electifying and reprofiling the entire Sea-to-Sky corridor is estimated to cost $475 M. This will allow trains to travel from Whistler to Watefront Station in 1h30m while navigating tight curves.

Another possible option is to eliminate those curves by building tunnels and viaducts. Though this may be beneficial for certain short segments, it is also much more expensive. An earlier analysis estimated such upgrades that would yield around a 20 minute time reduction would cost $800-$1 B. Considering that this section will not be heavily used, such an investment makes little sense in the short-term.


BCFerries

TSAWWASSEN AXIS

# tsawwassen to yvr line

The Tsawwassen to YVR Line allows passengers to reach BC's busiest ferry terminal with rapid transit. Ferry passengers will also be able to easily reach flights at YVR. It will also connect currently poorly-served South Richmond and South Delta with high-quality transit.

The Tsawwassen to YVR line is the first part of a north-south regional rail link that reduces the travel from Downtown Vancouver to the Tsawwassen Ferry terminal to ~30 minutes and allows passengers from across the South Coast to easily reach YVR. Initially, the line will be isolated from the regional network. It will connect once the East Vancouver Access project is complete.

The route largely follows Highways 17 and 99. Most of the alignment consists of embankments with viaduct sections for crossing over major roads or railways. Though the alignment only requires relatively short tunneled sections near the airport, an abundance of electrical transmission lines makes determining a precise alignment challenging. It is assumed that the new South Arm of the Fraser River Crossing will be capable of accommodating regional rail.

## Current Recommended Design

# Anticipated Challenges

## CROSSING THE SOUTH ARM OF THE FRASER RIVER

In order to reach South Delta and the Tsawwassen Ferry Terminal, regional rail trains will need to cross the 1.4-km-wide South Arm of the Fraser River. Current and past provincial governments have studied various new bridge and tunnel options for crossing this body of water, however, the current favoured option does not allocate future room for rail transit.

Any new crossing of the South Arm of the Fraser River should be designed with room and gradients to accommodate the Tsawwassen to YVR section of the regional rail network. The cost of doing so is marginal and pales in comparison to the many hundreds of million of dollars required to build a separate regional rail crossing. Therefore, it is highly recommended that Provincial Government revise its current plans and design the new South Arm of the Fraser River Crossing to accommodate regional rail.

## UTILITY RELOCATIONS

Much of the Tsawwassen to YVR project runs parallel to Highway 17, a corridor with significant stretches used for electricity transmission. In some cases, conflicts cannot be avoided and transmission lines will need to be elevated higher or relocated. We do not envision this being a significant cost, however, relocation should be planned and coordinated well in advance of projected construction in order to prevent delays.

## HIGHWAY 17A NARROW SECTION

In the Town of Ladner north of Ladner Trunk Road, there is a section of Highway 17A where there is insufficient room between the highway and neighbouring houses to even accommodate a viaduct. Since Highway 17A isn't a primary conduit for vehicular circulation and many trips are expected to shift to regional rail once it is complete, we recommend that the number of traffic lanes be reduced from 5 to 4 in order to accommodate the support pillars of the regional rail viaduct.

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench

# Benefits

## TARGET TRAVEL TIMES

**BRP → TSF**

**16 min**

bridgeport to
tsawwassen ferry

# Specifications

## DISTANCES

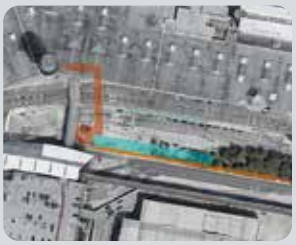
| BORED TUBE | CUT-AND-COVER | ELEVATED | AT-GRADE |
|---|---|---|---|
| **2.6 km** | **860 m** | **7.43 km** | **17.3 km** |

# Key Stations

TSAWWASSEN FERRY

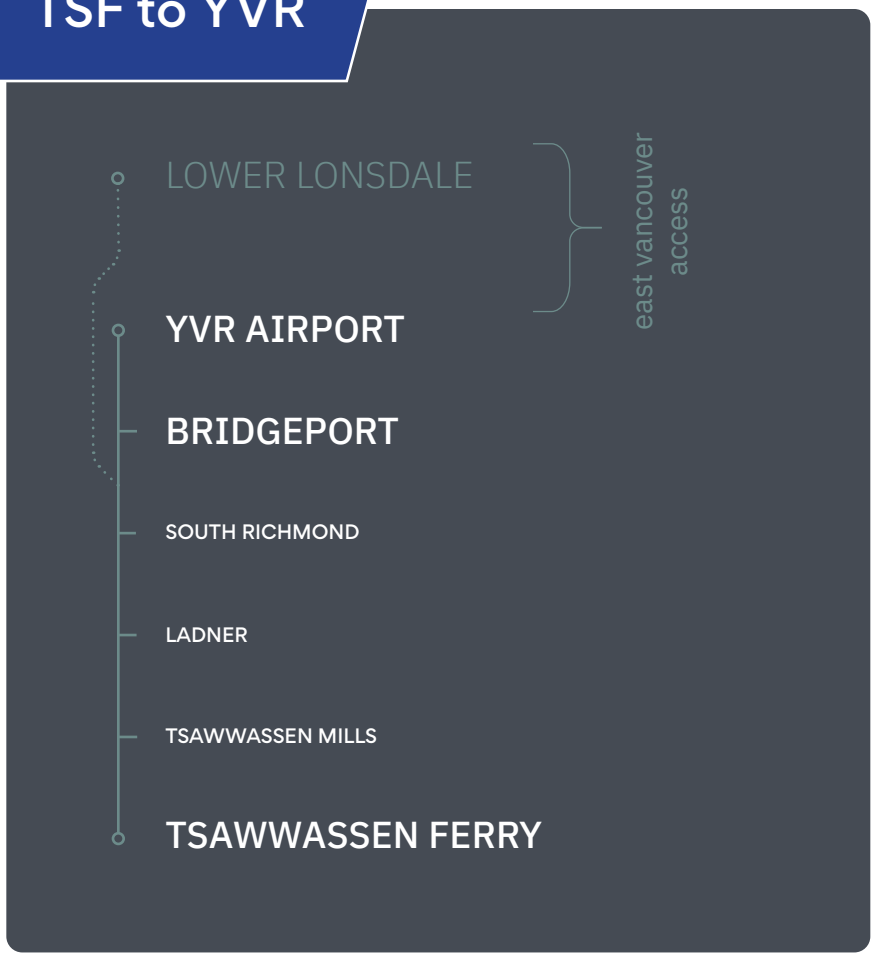
TSAWWASSEN MILLS

BRIDGEPORT



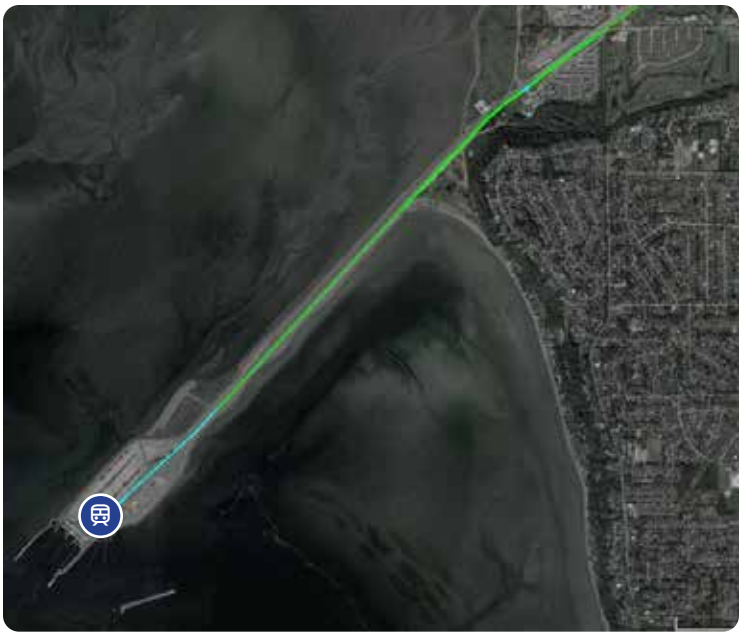
YVR AIRPORT

# TSF to YVR


LOWER LONSDALE
east vancouver access
YVR AIRPORT
BRIDGEPORT
SOUTH RICHMOND
LADNER
TSAWWASSEN MILLS
TSAWWASSEN FERRY

# Recommended Alignment Solutions

## TSAWWASSEN FERRY TO TSAWWASSEN MILLS



From Tsawwassen Ferry, the station tracks will connect to a single-tracked viaduct that will descend to ground level east of the ferry terminal on the south side of the causeway. It will continue in a single track along the causeway in order to reduce the need to widen the causeway. Low frequencies will not require double tracking.

At the end of the causeway, the corridor continues as a double-track on an embankment with viaducts over road crossings. The alignment continues on the south side of Highway 17 in order to avoid conflicts with power lines.

## TSAWWASSEN MILLS TO LADNER

From Tsawwassen Mills, the alignment will continue on an embankment along the south side of Highway 17 with viaducts over major roadways. The rail corridor will cross over Highway 17 as the highway turns north and then run along the west side of Highway 17A. Viaducts will be built over 28 Avenue, BC Rail/Deltaport Way and 34B Avenue. The first and last of these viaducts will require power line relocation. The viaduct over Deltaport Way will be as low as possible in order to avoid the electrical transmission lines, minimizing the amount of utility relocation required.

North of 34B Avenue, the corridor will transition to at-grade. It will continue at ground level until it passes under the pedestrian overpass in South Ladner. As the alignment travels north, it will transition to an elevated viaduct over Ladner Trunk Road.

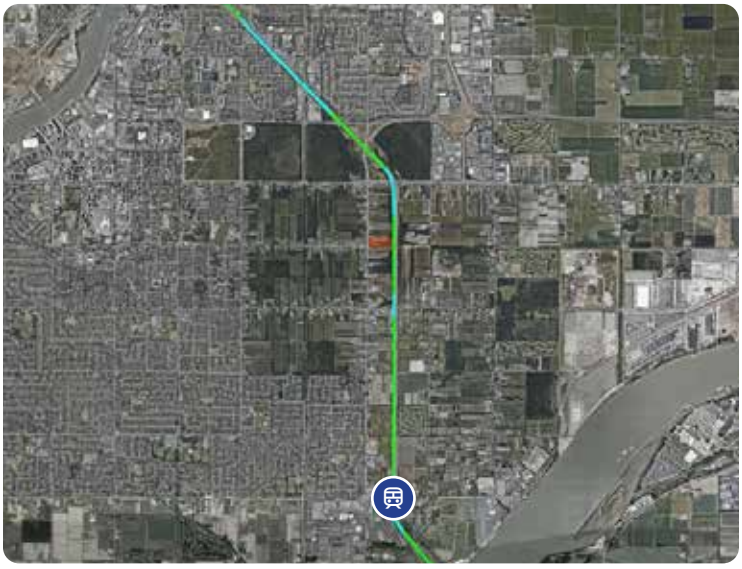
## LADNER TO SOUTH RICHMOND

Heading north from Ladner Station, the alignment will run along the west side of Highway 17A in a viaduct. (The existing pedestrian overpass will need to be demolished). Room will be freed up by reducing Highway 17A from 5 to 4 lanes.

North of Crescent Slough, the corridor will run at-grade until south of Highway 99 where it transitions to a viaduct in order to enter the approaches of the South Arm River Crossing. The transmission lines along the south of Highway 99 will need to be relocated. The corridor will run on the river crossing that has been built to accommodate rail.

On the north side of the river, the corridor will transition to a viaduct that will cross over Highway 99 as it curves to the north. It will run along the west side of Highway 99 to South Richmond Station.

## SOUTH RICHMOND TO BRIDGEPORT



Heading north from Steveston Road, the alignment will transition to at-grade for most of its length, with a viaduct over Blundell Road. An OMC will be built off the corridor near Granville Avenue. South of Westminster Highway, the alignment will transition to a viaduct. (The transmission lines at Westminster Highway will need to be relocated.)

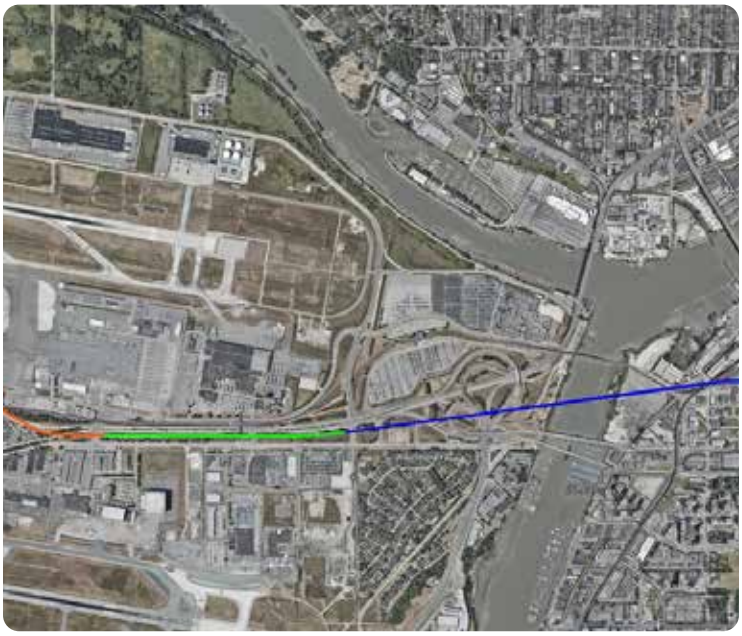
The viaduct will cross over Westminster Highway and into the median of Highway 99, where it will then run at-grade. There will need to be a slight lane realignment to accommodate the corridor through here. It will continue at-grade under N5 Road and the East-West Connector. The corridor will then transition to a viaduct north of the East-West Connector. This is to allow for future connections with the East Vancouver Access Project.

The viaduct will continue north over Shell Road and Cambie Road. South of Sea Island Way, the corridor will shift to the east side of Highway 99. Within the onramp loop, the corridor will transition from a viaduct to a tunnel to the west of the existing transmission lines. Twin 6.2 m TBM tunnels will continue northwest to Charles Street near Bridgeport Station.

## BRIDGEPORT TO YVR

From Bridgeport Station, the TBM tunnels will continue west under the Middle Arm of the Fraser River. The tunnels will emerge just west of Templeton Street, at-grade south of Grant McConachie Way. This will likely be the location of the TBM staging area as there is ample space and disruption is minimized.

This alignment may require the relocation of a water main and the rebuilding of the passageway from Sea Island Centre Station. In addition, the road crossing between Miller Road and Grant McConachie Way near Sea Island Centre station will need to be removed.



To the east of the Airport access loop, the corridor will continue in a cut-and-cover tunnel. This tunnel will cross Grant McConachie Way to the north side and continue west to YVR station.

# Key Decision Points

## TSAWWASSEN FERRY ALIGNMENT

The design of Tsawwassen Ferry station and the alignment of regional rail will depend upon what BC Ferries and the Provincial Government permit. It is possible to built the station at-grade instead of elevated and this would reduce the cost of the alignment within the ferry terminal. However, it would require the complete realignment of bus access and parking facilities. Though it is possible the Provincial Government may agree to this, it is much more likely they will be more amenable to the less disruptive elevated option.

A storage track will be provided at Tsawwassen Mills Station. Even though the maximum anticipated frequency is only every 7.5 minutes, a storage track should be provided as it is not possible to provide a storage track at the other ends of routes that reach this station. Having a storage track, although more costly, provides a level of redundancy.

It is planned for the section from Tsawwassen Ferry station to the mainland to be single track. The minimum interval possible along this single-track without conflicts is 1m53s, far lower than the highest frequency anticipated for this section. Making this section single-track instead of double-track reduces the cost of the viaduct to the terminal as well as the cost of widening the causeway.

## TSAWWASSEN MILLS STATION LOCATION

Situating a station on the north side of Highway 17 would allow it to more easily serve the water park and mall. However, locating a station along the north side would require the costly relocation of high-voltage transmission lines.

Instead, Tsawwassen Mills Station will be built on the south side of Highway 17. This allows for the station to be built at-grade and expensive utility relocation is no longer required, reducing costs significantly. New passageways across Highway 17 will provide access to both the water park and Tsawwassen Mills Mall as well as improve connectivity in the community. Locating a station on the south side also better aligns with the Tsawwassen Ferry passenger terminal location.

## ALIGNMENT THROUGH LADNER

The proposed alignment through Ladner will require a redesign and realignment of both Highway 17A and Ladner Trunk Road within the vicinity of Ladner Station. This is especially the case for the northern portion of Highway 17A as a lane needs to be reallocated to accommodate the rail viaduct.

Having the regional rail alignment on the west side of Highway 17A makes the most sense because it minimizes the number of crossings of Highway 17A.

## CROSSING THE SOUTH ARM OF THE FRASER RIVER

It is essential that any future crossing of the South Arm of the Fraser River be designed to accommodate rail transit, whether it is a bridge or a tunnel. Accommodating rail into the design will save hundreds of millions of dollars, the likely cost of a rail-only bridge across the river.


E
VAN
ST

TSAWWASSEN AXIS

# east vancouver access

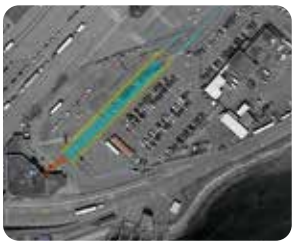
The East Vancouver Access project is a major project that will greatly enhance regional connectivity to Vancouver International Airport and the Tsawwassen Ferry Terminal. Not only will it connect the Tsawwassen-YVR section to the existing regional rail network, it will add a north-south dimension to the predominantly east-west network, greatly enhancing the entire network's utility.

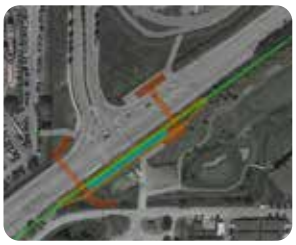
The East Vancouver Access project will mostly be tunneled with an elevated section in Richmond. Flyover viaducts will be built to connect the new corridor with the existing Tsawwassen-to-YVR Line. A TBM tunnel will be built from Richmond under the North of Arm of the Fraser River and then travel through East Vancouver mostly under the Victoria-Commercial Corridor. Connecting tunnels will be built near Commercial-Broadway so that trains along this corridor can serve Waterfront Station, Surrey Central and other important destinations in the existing network. The tunnel is expected to share its entire length with new rapid transit service and several stations are expected to connecting with new, crossing rapid transit lines.

After East Vancouver Access is complete, trains will be able to travel seamlessly from the existing South Fraser, North Fraser and Sea-to-Sky branches to both Vancouver International Airport and the Tsawwassen Ferry Terminal. This means most corners of the region will be conveniently connected with these major transportation nodes. Trips that previously required multiple modes and transfers will now be possible with a single ride on rapid, regional rail service.

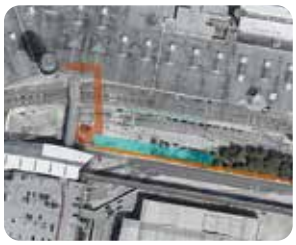
# Current Recommended Design


# Key Stations


TSAWWASSEN FERRY


TSAWWASSEN MILLS


BRIDGEPORT


YVR AIRPORT

# Benefits

## TARGET TRAVEL TIMES

**VAN → TSF**

**33 min**

waterfront to tsawwassen ferry

**BRP → TSF**

**16 min**

bridgeport to tsawwassen ferry

**YVR → YXX**

**51 min**

yvr airport to yxx airport

**VAN → YVR**

**19 min**

vancouver to yvr airport

**SRY → YVR**

**30 min**

surrey to yvr airport

# Specifications

## DISTANCES

BORED TUBE

**10.3 km**

CUT-AND-COVER

**340 m**

ELEVATED

**4.88 km**

AT-GRADE

**390 m**

SEM

**1.13 km**

# Anticipated Challenges

## CROSSING THE NORTH ARM OF THE FRASER RIVER

A connection across the North Arm of the Fraser River will need to be built in order to connect the Fraser Delta section of regional rail with the main network. At the foot of Victoria Drive, the North Arm is approximately 550 m wide. Spanning this body of water with a bridge would eliminate the need for a tunnel portal on the southern bank. However, construction on the northern bank would be complicated. First, building a tunnel portal and station at Victoria-Marine would force platforms for future light rail service further underground, thus increasing costs. Second, the footings of this bridge would be located in the middle of a residential community. Such a design would likely encounter strong resistance from the local community.

## CONNECTING TO THE MAIN NETWORK

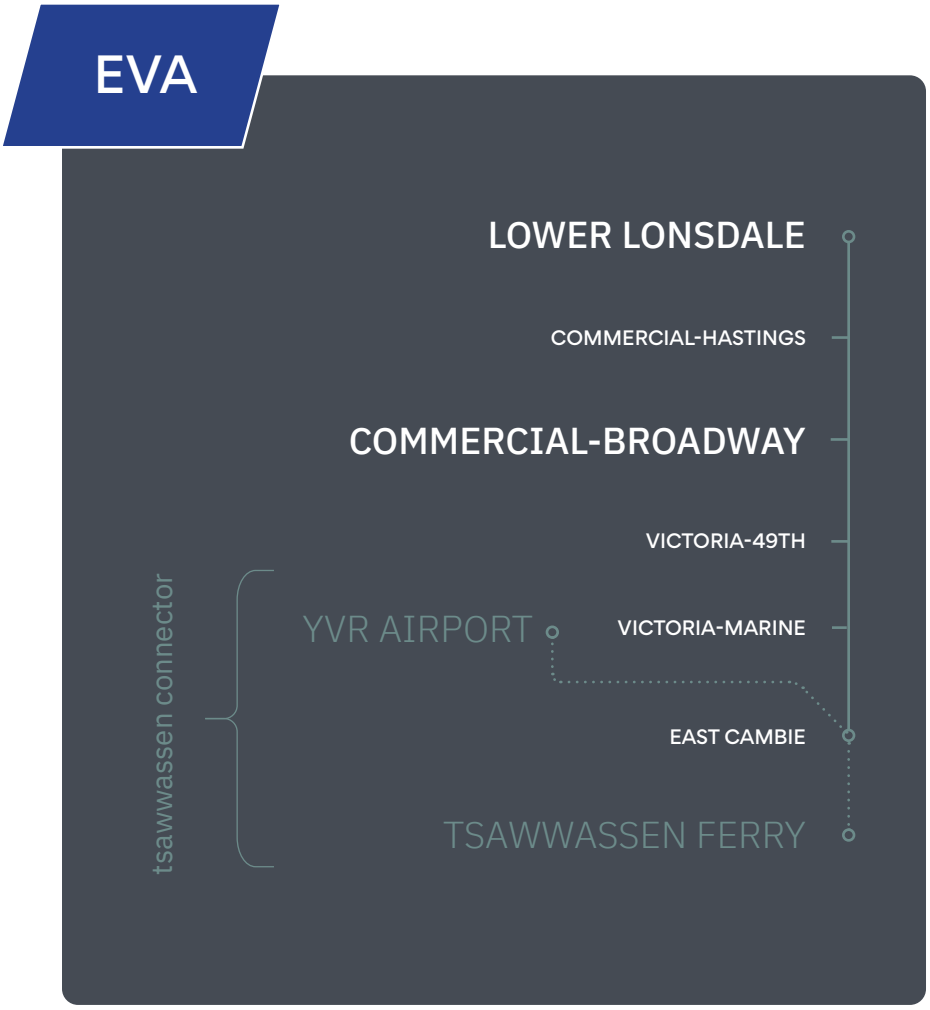
Connecting the East Vancouver Tunnel with the previously-built regional rail network in the Grandview Cut is necessary to allow passengers across the region to be able to conveniently access YVR and the Tsawwassen Ferry Terminal. Several of these tunnels will need to cross under existing tracks within the cut and much of their length will be built through poor ground conditions in the vicinity of Trout Lake. It is recommended that four (4) SEM tunnels be built to allow trains from the Fraser Delta to travel in the directions of Waterfront Station and Surrey Central.

## DEEP PLATFORMS AT COMMERCIAL-BROADWAY

The East Vancouver Tunnel will have to cross under the Grandview Cut as it travels north towards Burrard Inlet. This means that station platforms at Commercial-Broadway be 37 m below street level and around 44 m below the level of the Expo Line platforms. In order to facilitate easy transfers, it is recommended that two (2) 25x25 m shafts be built to accommodate either high-capacity elevators or escalators. This will minimize excavation, thereby reducing costs.

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench


EVA
LOWER LONSDALE
COMMERCIAL-HASTINGS
COMMERCIAL-BROADWAY
VICTORIA-49TH
YVR AIRPORT
VICTORIA-MARINE
EAST CAMBIE
TSAWWASSEN FERRY
tsawwassen connector

# Recommended Alignment Solutions

## CONNECTIONS TO THE TSAWWASSEN-YVR LINE

Trains travelling to and from Tsawwassen Ferry will separate from the Tsawwassen-YVR line near Westminster Highway and travel north following the highway bend to the East-West Connector. Disturbance to the Richmond Nature Park will be minimized. The viaducts will then cross over to the north side of the East-West Connector.

Trains travelling from YVR to East Vancouver Access will travel in a single viaduct that will separate from the Tsawwassen-YVR Line just east of Shell Road. The viaduct will continue on the west side of Highway 99 before bending eastward, crossing over Highway 99. The empty lot north of the East-West Connector will provide the room to accommodate this curve. The viaduct will then continue east and then hop over the connectors from Tsawwassen Ferry before descending and merging with the northbound track.

Trains travelling from East Vancouver Access to YVR will travel west north of the East-West Connector and then head northwest, joining the Tsawwassen-YVR line between Shell Road and the East-West Connector.

Heading north towards East Vancouver, the alignment will continue in a viaduct and then turn north to follow Knight Street. The 250 m radius curve will require building the viaduct over a parking lot. The alignment will continue along the west side of Knight Street to Cambie Road and split into separate viaducts near the station.

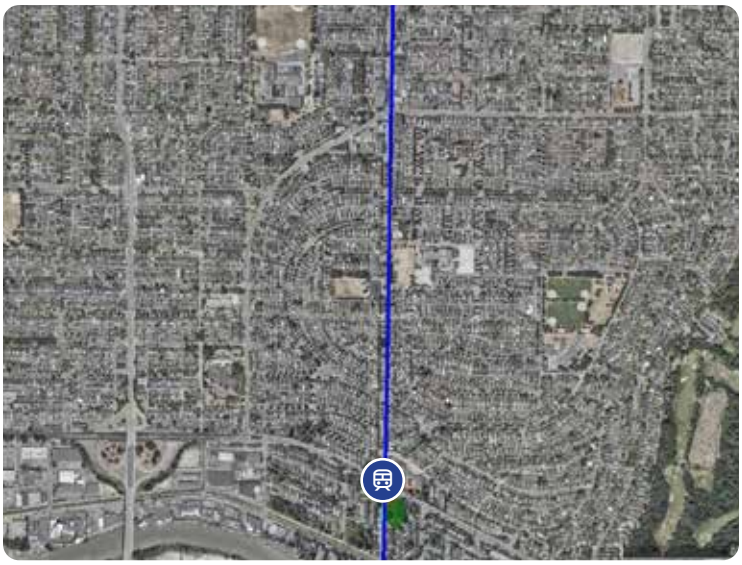
## EAST CAMBIE TO VICTORIA-MARINE

The TBM pit will will be built just to the west of N6 Road. This avoids a potential gas pipeline relocation and the empty sites nearby make it the best for TBM staging. The rail spur to the south will need to be disconnected during construction.

An SEM tunnel to an OMC will be built just to the east of the TBM tunnel portal. This OMC site will primarily serve rapid transit trains.

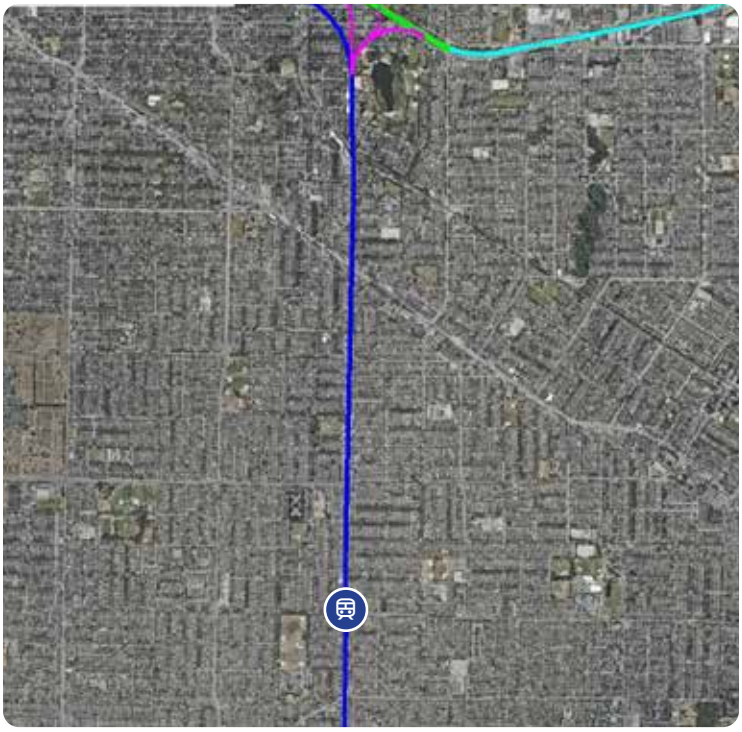
The TBM tunnel will continue north under the North Arm of the Fraser River and travel under Victoria Drive.

## VICTORIA-MARINE TO VICTORIA-49TH



From Victoria-Marine Station, the tunnel will continue north under Victoria Drive. The tunnel will climb as much as possible in order to match the steep incline at the surface. It will run towards the eastern side of Victoria Drive in order to facilitate construction of a rapid transit station at 54 Avenue.

## VICTORIA-49TH TO COMMERCIAL-BROADWAY




North of Victoria-49th Station, the alignment will shift to the west side of Victoria Drive in order to facilitate of rapid transit stations at 41 Avenue and Kingsway. The TBM tunnel will continue north until the parking lot at Trout Lake Park where a rapid transit station will be built. The main TBM tunnel will turn northwest and descend before turning back north just south of Commercial-Broadway Station.

The Trout Lake rapid station site will also serve as a staging point for SEM tunnel construction. Several SEM tunnels will be built to connect the East Vancouver Tunnel with the existing regional rail network that travels within the Grandview Cut.

For trains heading from the west to the East Vancouver Tunnel, an SEM tunnel accommodating a single track will be built. It will connect to the bottom half of the East Vancouver Tunnel. Remaining trains will use a stacked SEM tunnel heading northeast.

Just north of Trout Lake Park, a single-track SEM tunnel will branch off from this tunnel and head north to the Grandview Cut. This tunnel will serve inbound trains coming from the East Vancouver tunnel heading west to Waterfront Station and beyond. This alignment will continue under the existing tracks in the cut with a short cut-and-cover section before ascending to cut level and merging with existing westbound regional rail trains.

The stacked SEM tunnel will continue east and then branch into two (2) single-track SEM tunnels near East 12 Avenue. From here, one tunnel will join eastbound trains and the other will travel under existing tracks within the cut before rising to cut surface level and providing a connection between westbound trains and the East Vancouver Tunnel.

## COMMERCIAL-BROADWAY TO COMMERCIAL-HASTINGS

The tunnel will continue north under Commercial Drive travelling on its western side in order to facilitate a rapid transit station at First Avenue. The tunnel will shift east to Salsbury Drive in order to facilitate a connection with a rapid transit line along Hastings.

## COMMERCIAL-HASTINGS TO BURRARD TUNNEL

The TBM tunnel will continue north and then shift westward to its extraction point near the eastern end of the Vanterm cargo terminal. This location minimizes disruption to Port Metro Vancouver and will be where the immersed tunnel crossing Burrard Inlet will begin.

Though it is not part of the regional rail vision, it should be noted that an SEM tunnel will be built to connect the East Vancouver tunnel with the Hastings Tunnel to allow trains to travel between Lonsdale and Downtown Vancouver.

# Key Decision Points

## TBM VS. CUT-AND-COVER ALONG VICTORIA

It is only possible for an approximately 2 km section to be built using cut-and-cover under Victoria Drive. This is because the steep slope at the southern end of Victoria Drive requires a deep tunnel for a large portion of its length, making cut-and-cover impossible. In addition, tunnel staging would be challenging; the surrounding areas are built up and there are no natural sites for excavating a TBM pit. Finally, having a cut-and-cover section would split the East Vancouver Tunnel into two, less efficient tunneling operations. It, therefore, makes the most sense to build the tunnel using one single bore from Richmond to Burrard Inlet.

TSAWWASSEN AXIS

# burrard tunnel

The Burrard Tunnel Project will allow passengers from North Vancouver to easily reach Vancouver International Airport and the Tsawwassen Ferry Terminal. With a transfer at Commercial-Broadway, passengers will be able to easily reach other regional centres such a Surrey Central, Metrotown and Coquitlam Central.

The Burrard Tunnel Project, like many other projects in this vision, is shared between regional rail and rapid transit services. The TBM tunnel will extend from Lower Lonsdale to Lynn Valley and this section will be used exclusively by rapid transit.

## Current Recommended Design

# Anticipated Challenges

## CROSSING BURRARD INLET

Traversing Burrard Inlet is complicated by its width and especially its depth. It is especially deep between Lower Lonsdale and the Downtown Peninsula (the two most important centres on its shoreline), reaching a depth of around 60 m.

However, a few kilometres to the east near the foot of Commercial Drive, the inlet is narrower (1.7 km vs. 3.0 km) and shallower (30 m vs. 60 m). An immersed tunnel in particular would be feasible as it would run along the ocean bottom instead of several metres below it. This, in turn, would minimize the depth of the tunnel on the North Shore and its corresponding stations, reducing costs.

## LOWER LONSDALE HUB

Building a transit hub in Lower Lonsdale is especially challenging for several reasons. First, the hub must provide convenient connections between ferry, bus, regional rail and future North Shore rapid transit. Second, the hub and the tunnels leading into it must navigate the CN rail tunnel that passes under East Esplanade. Third, the tunnels leading in must navigate the parking garages of surrounding buildings. All of these factors make designing an effective transit hub complex.

## LONSDALE SLOPE

The sleep slope from Lower Lonsdale to Central Lonsdale means that a station in Central Lonsdale will be very deep, likely around 50 m below street level . Though extending regional rail service to Lynn Valley is theoretically possible, this is not currently recommended as demand isn't expected to be high and it could greatly increase the cost of intermediate rapid transit stations. (Making Central Lonsdale a shared station and careful schedule coordination could obviate this, however, studying this is not considered a priority at this time.)

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench

# Benefits

## TARGET TRAVEL TIMES

| LLD → YVR | LLD → TSF | LLD → SRY |
|---|---|---|
| **21 min** | **34 min** | **25 min** |
| lower lonsdale to yvr airport | lower londsdale to tsawwassen ferry | lower lonsdale to surrey (includes 5 min transfer) |

# Specifications

## DISTANCES

| BORED TUBE | CUT-AND-COVER | IMMERSED TUNNEL | SHARED |
|---|---|---|---|
| **870 m** | **160 m** | **1.70 km** | **3.70 km** |

| SEM |
|---|
| **100 m** |

# Recommended Alignment Solutions

## BURRARD TUNNEL TO LOWER LONSDALE

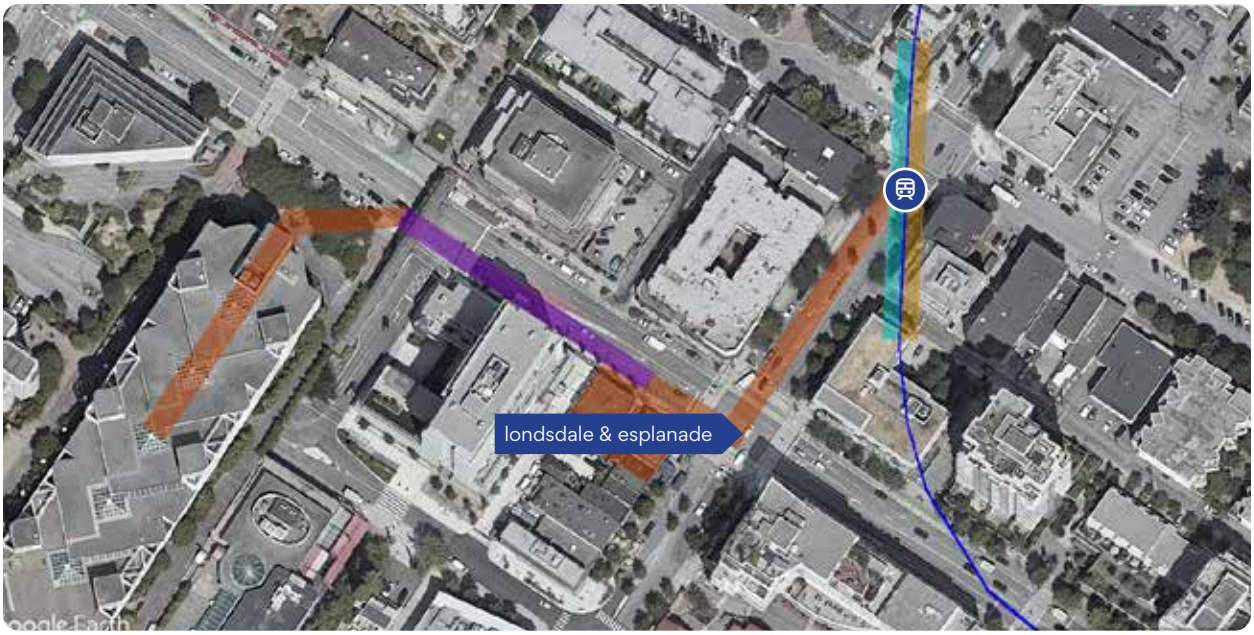
Regional rail will share the Burrard Tunnel and a small portion of the Lonsdale Rapid Transit Tunnel with rapid transit service.

The Burrard Tunnel will consist of an immersed tunnel from the Vanterm Terminal in Vancouver to the Richardson Terminal in North Vancouver. An immersed tunnel at this location avoids the deepest parts of Burrard Inlet and is mostly around 30 m deep along this section. This makes the construction of approach tunnels much more feasible. Small deeper sections can be filled in using spoil from previous excavations.

## TUNNEL STAGING AREA

Construction of the TBM tunnel will staged near the Richardson Terminal at the northern end of the immersed tunnel. A short mined tunnel will be built to connect the immersed tunnel with the TBM tunnel in order to avoid disrupting the rail yard. The TBM tunnel will curve northwest and follow East Esplanade, travelling below the Lonsdale Freight Tunnel and Burrard Orbital Line tunnels. The tunnel will turn north just before Lower Lonsdale Station. (Past Lower Lonsdale Station, the Lonsdale Tunnel will continue to Lynn Valley with only local rapid transit service.)

# Lower Lonsdale Station




Regional rail trains at Lower Lonsdale will use platforms incorporated into the 12-m tunnel. These platforms will connect with the principal entrance at the southwest corner of Lonsdale and Esplanade via an underground passage. The passageway will travel under the Burrard Orbital Line SEM tunnel before rising and connecting with the rapid transit platforms. Another passageway extending west from the rapid transit platforms will connect the station with the Lonsdale Quay bus terminal.

# Key Decision Points

## LOWER LONSDALE STATION LOCATION

One of the challenges of the Burrard Tunnel Project is determining an appropriate location for the Lower Lonsdale Station. The location needs to connect with Lonsdale Quay terminal (which will still be important despite its diminished status) and the future Burrard Orbital Rapid Transit Line. Technically, the station and the tunnels that lead into it will need to avoid underground parkades and minimize the need for sharp curves.

For these reasons the regional rail platforms are aligned north-south to the east of Lonsdale and Esplanade. An underground passage connects these platforms with the primary access to the station and the rapid transit platforms. The more central location also better serves the surrounding neighbourhood than a site closer to the Seabus terminal.

2

# non-core projects

# cascadia high-speed rail

The completion of Cascadia High-Speed Rail largely depends on the actions of government south of the border. The following presents a vision of how the portion within Canada would be built as part of Project Nexus.

Most of the network Cascadia High-Speed Rail would use would have already been built as part of the regional rail network. The only new section that would need to be built are a corridor along 232 Street in Langley Township and bypass tracks.

## Current Recommended Design

# Anticipated Challenges

## SEMIAHMOO PENINSULA SECTION

Amtrak Cascades currently travel on a circuitous route around the Semiahmoo Peninsula, lengthening travel times and causing conflicts with residents. High-speed rail will require a more direct, less disruptive route through the South Fraser valley.

# Specifications

## DISTANCES

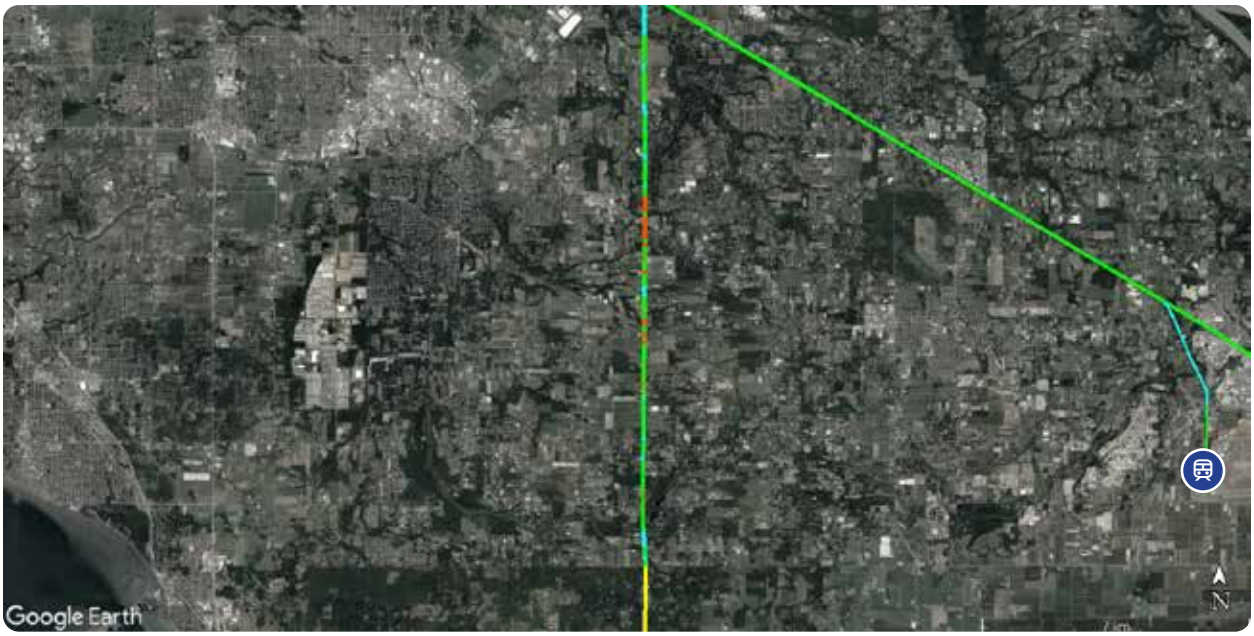
| AT-GRADE | ELEVATED | CUT-AND-COVER |
|---|---|---|
| **9.58 km** | **3.99 km** | **2.19 km** |

## ALIGNMENT LEGEND

- Green = At-Grade
- Cyan = Elevated
- Dark Blue = Bored Tunnel
- Orange = Cut-and-Cover Tunnel
- Pink = SEM Tunnel
- White = Electrification Only
- Purple = Partial Stack
- Yellow = Trench

# Recommended Alignment Solutions

## HIGHWAY 1 TO THE US BORDER




To enable high-speed rail service to Seattle and beyond, a 15.8 km corridor will need to built off the existing regional rail network. Just west of 232 Street, a viaduct with flyovers will be built from the existing regional rail corridor and bend south and continue along the west side of 232 Street. It will transition to an embankment south of Sprinkbrook Road.

Over 60% of the alignment is built in either a cut or an embankment, shifting from one to the other depending on the topography with a few extended tunnel and viaduct sections. Care is taken to minimize disruption to existing properties, though a few driveways will need to be relocated and a few buildings will need to be demolished.

# chilliwack extension

The Chilliwack Extension would extend from Abbotsford Central Station to Chilliwack, allowing residents from Chilliwack to reach Downtown Vancouver in less than an hour. The extension should be relatively inexpensive to build as most of the alignment would run at-grade along the median of Highway 1.

## Current Recommended Design

# Specifications

## DISTANCES

| AT-GRADE | ELEVATED | CUT-AND-COVER |
|---|---|---|
| **9.58 km** | **3.99 km** | **2.19 km** |

# Recommended Alignment Solutions

## ABBOTSFORD CENTRAL TO CHILLIWACK

From Abbotsford Central, the alignment travels at-grade between the Southern Railway and CPR tracks. It continues southeast at-grade until South Fraser Way where it transitions to a viaduct. It then crosses South Fraser Way running along the westside of Sumas Way providing enough room for a future rapid transit station and bypass tracks.

Continuing south past Marshall Road, the viaduct crosses Sumas Way and runs on the westside of Delair Road as a single-track. The viaduct continues south and then curves east onto the median of Highway 1 where it then transitions to ground level. It continues along the median of Highway 1 at-grade with minor bridges over the Sumas River and Sumas Lake Canal.

Before Highway 1 bends east near the Vedder River, the corridor transitions to a viaduct and crosses over the westbound highway lanes. This allows the alignment to avoid a series of tight curves. The alignment then crosses the Vedder River and curves eastward, loosely following Dyke Crest Road at grade. It then follows on the north side of Highway 1 before flying over the CN rail corridor. It then returns to ground level on a new track north of the existing track. After a series of small bridges across the Chilliwack River, the track terminates at Old Yale Road.

# Key Stations

## CHILLIWACK STATION

The preferred option for Chilliwack Station is positioning the station platform north of the regional rail track and under Old Yale Road. Structures built on either side of the road would connect it with the rail platform below. New bus stops would be built on the overpass, allowing passengers to conveniently transfer to and from the train station.

# Key Decision Points

## CN FLYOVER

West of Chilliwack, the regional rail alignment crosses the CN freight railway. At this location, the regional rail alignment could simply cross the freight railway at the surface or travel over it, something that will add millions to the cost.

Although the frequency for this leg is quite low, a disruption here could cascade and effect the rest of the regional rail network. Here the added expense of constructing a flyover is deemed necessary.

## CHILLIWACK STATION LOCATION

There are two possible sites where the Chilliwack station could be located: under Yale Road or west of Young Road. The Young Road option involves building a relatively simple single-platform station whereas the Yale Road option would involved building structures to connect the station with the road and bus stops above.

The Yale Road option, though being more expensive, would offer better potential bus connections and is located closer to Chilliwack General Hospital. Therefore, this should be the preferred option if municipality chooses to contribute.

3

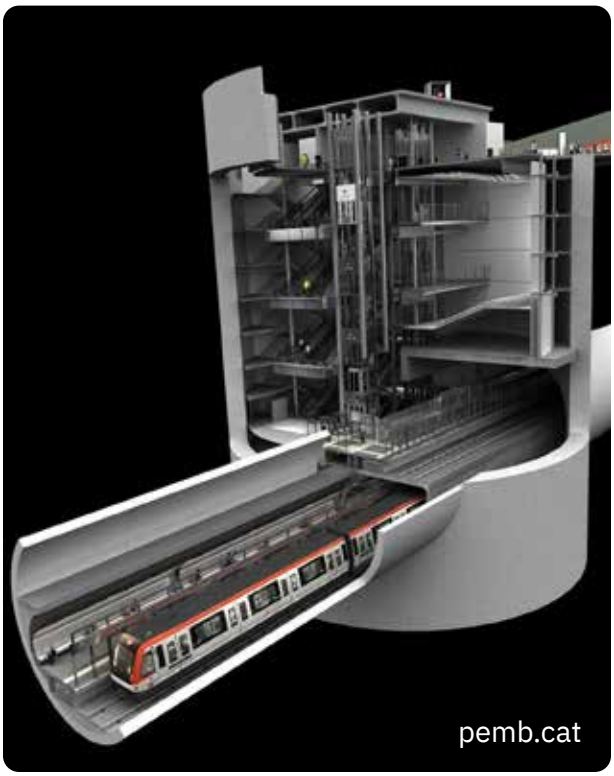
# key concepts

# station design

## Underground Station Design Concepts

Underground stations are often the largest contributor to underground transit construction costs. Contrary to conventional wisdom, tunneling in itself is not incredibly costly if well-designed and efficiently built.

As a way of reducing the cost of the project to ensure its feasibility, a great deal of care has been put into station design. Generally, Project Nexus underground stations adhere to a few key principles in order to reduce cost:




### STANDARDIZED DESIGN

Using standardized designs simplifies design and construction, reducing costs.

### CUT-AND-COVER OVER MINING

Stations should be built using cut-and-cover techniques over mining wherever possible as it is far less expensive.

### MINIMIZE EXCAVATION

Station costs are proportional to the amount to earth that needs to be excavated.

### SHALLOWER THE BETTER

The more shallow a station, the more likely cut-and-cover techniques can be used. If cut-and-cover is used, less material needs to be excavated.

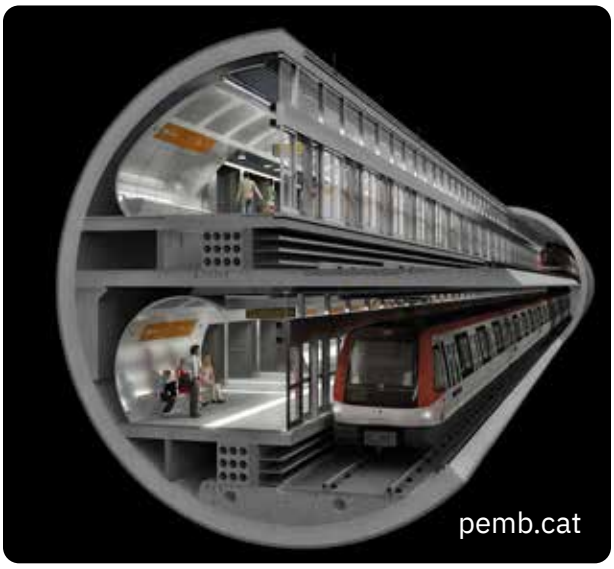
# wide-bore tunnels

## Wide-bore Benefits

The use of wide-bore tunnels is one of the most important measures that will make regional rail in the Lower Mainland viable. Wide-bore tunnels permit multiple transit services to use the same infrastructure, reducing costs and maximizing utility. They can also significantly reduce station construction costs, the largest cost when building underground transit.

A wide-bore tunnel can accommodate up to four tracks in a 2x2 configuration. They allow for different transit services to use the same tunnel, either in a stacked or side-by-side configuration.

Wide-bore tunnels are still useful when only accommodating two tracks. When the tracks are in a stacked configuration, the additional space can be used for switches between the tracks or for station platforms. This can significantly reduce station construction costs, especially in dense urban areas.




MVX Nexus extensively employs wide-bore tunnels, simplifying design and construction as well as taking advantage of the cost-reduction benefits of mass production.

4

# financing

# The Value of MVX Nexus

A proposal of this scale is like nothing ever envisioned for the South Coast, as a Society we understand the complexity and the costs that Nexus presents. In saying this, however, it would be irresponsible to note the benefits that Nexus would usher in for the economic engine of BC.

While Nexus is envisioned as a long-term ultimate build out best-case-scenario, even portions of the total vision would be incredibly beneficial for social equity in providing high quality, fast, and dignified connectivity to the most under-served parts of the South Coast that are experiencing the most growth. In designing growing communities around reliable and fast rail service with technology better suited to medium distance than Skytrain, the cost to service these areas is less both from the perspective of an individual household and a public dollars. From the individual household's perspective a network like MVX Nexus presents a viable case to forgo additional car ownership and its associated costs, and the time lost by commuting when this time could be better spent in other ways. It would further provide access to more affordable housing without compromising on commute time. From a public dollars perspective, MVX Nexus can create compact, walkable communities that are more cost-effective to serve by utility providers and public services such as waste management, transit, libraries, and fire. These example benefits are not exhaustive.

Importantly, MVX Nexus is not simply a tool for commuting. It provides all-day bidirectional connectivity to regional nodes beyond the Metro Core, which serves groups that have been historically under-served such as new Canadians, women, students, and essential service workers that may also provide childcare, rely on trip-chaining. Furthermore, the flexibility of fast all-day connectivity serves the new reality of work outside the traditional '9-to-5' where remote work and flexible workdays continue to become more common.

MVX Nexus is a region-shaping tool and a catalyst for investment. Building lasting infrastructure is a signal of long-term commitment in a local area (moreso than bus service which can easily be changed) that the private sector can rely on. This is also a way of directing urban growth, containment, and private investment to where it is most appropriate.

As outlined in this section, a number of revenue tools and funding mechanisms can be used to share capital costs over the long-term. It should be noted that the benefits of such an investment far outweigh the costs when factoring in macroeconomic factors and the triple bottom line of environment, economics, and social equity. Similarly large investments in roadway infrastructure are often seen as foregone conclusions but may be less appropriate and offer somewhat lesser value than rail, especially in urban settings and for transporting people over goods.

# Land Value Capture Mechanisms

Land Value Capture (LVC) is one approach that could be used to offset the cost of MVX Nexus. It could take shape in one or more of the following ways as discussed in this section.

LVC is a policy approach used to recover and reinvest land value increases that result from public investment and government actions. Land value capture is rooted in the notion that public action should generate public benefit. LVC tools would primarily apply when a rail network such as MVX Nexus is delivered by the public sector. Delivery by the private sector would likely not be eligible to use LVC tools unless a contribution is made using public funds to support its delivery.

## BENEFITTING AREA TAX (BAT)

BAT is a tax surcharge to properties that benefit from MVX Nexus used to fund its delivery. In some cases, these are called betterment taxes, special service area taxes, local improvement taxes, or special assessment districts. Several US jurisdictions charge additional property taxes on property in defined transit service areas.

## TIERED DEVELOPMENT COST CHARGES (DCCS)

DCCs can be used, in concert with local authorities, at the time of permit approval, to raise monies to pay the capital cost of MVX Nexus delivery costs. In BC, these are called DCCs or DCLs in the City of Vancouver.

DCCs are infrastructure cost recovery mechanisms. They collect revenue from new development projects to offset costs to pay for public networks such as roads, water, sewer, parks, or in the case of MVX Nexus, regional rail infrastructure and stations.

## COMMUNITY AMENITY CONTRIBUTIONS SHARING/ DENSITY BONUSING

Public (funding) benefits in exchange for new development entitlements (density/height), usually at rezoning. Many places use density bonusing or negotiated contributions in lieu at the time of rezoning to obtain public benefits or amenities. Commonly these are called Community Amenity Contributions (CACs) or may be referred to as density bonusing in BC.

## PROPERTY TRANSFER TAX REVENUE SHARING

A property transfer tax, also known as a real estate transfer tax, is a tax levied by some governments or jurisdictions a property changes ownership from one party to another. It is typically calculated based on the purchase price or the assessed value of the property

Use of revenues raised from a property transfer taxes may vary depending on the jurisdiction, but could be used as a source of revenue for MVX Nexus.

Presently, only the Province has the authority to levy property transfer taxes.

According to a 2020 report published by Coriolis and Wollenberg Munro Consulting, in 2017 it was estimated that Metro Vancouver generated over 75% of the Provincial revenue from this tax (which generates ~$2 billion per year). On behalf of local governments and regional agencies Metro Vancouver has been lobbying the Province to share these revenues. There is also a compelling case to be made that some of the revenue could be used to fund transit on the South Coast, including a project like MVX Nexus.

## DELIVERY & PARTNERSHIP APPROACHES

It should be noted that many of these tools rely on public delivery methods and the partnership of jurisdictional authorities.

It should be further noted that these options are not an exhaustive list and are meant to highlight some available land value capture mechanisms to raise funds for MVX Nexus.


Phillip Pessar

# Private Delivery and Operation

Private railways have successfully delivered exceptionally high value infrastructure investment and services historically. This should be abundantly clear for a place like Canada. Recently, private rail operators have begun raising funds and successfully delivering high-value rail projects in the US. One such company, Brightline, owns and operates a rail service in Florida between Miami and West Palm Beach since 2018 and continuing to Orlando in 2023. and continues to expand its service offering including a recently approved railway between Los Angeles and Las Vegas.

# Direct Development

Direct development is a tool that could be used in where the delivering agency is simultaneously a land developer and uses real-estate sales or rental income to generate revenue for infrastructure capital costs. This usually takes the form of developing land that is already in the possession of the delivering agency, is acquired via expropriation, and/or is the 'leftover' land that is not used for rail infrastructure or stations itself.

## WHAT THIS COULD LOOK LIKE

Agencies around the world have leveraged direct development to offset the operating and capital costs for rail transit by constructing residential and commercial properties to sell or lease. In this case, the operating agency or their subsidiary fulfills the role of a developer and/or property manager that develops and maintains a portfolio of real-estate.

Given the value uplift that transportation infrastructure often creates, and the 'leftover' land that remains immediately adjacent to rail stations, this is an exceptional revenue-generating tool. It has been employed in Hong Kong and, more recently, TransLink in BC has unveiled their new Real Estate Development Program.

This program marks TransLink's entry in this space and tap into this potential revenue stream while aiding regional growth objectives and providing purpose-built rental near transit. The first direct development involvement project by TransLink is a partnership with PCI along the Broadway Subway at Arbutus Station.

Similar initiatives can be used as a funding mechanism to deliver the MVX Nexus network. This model has been successfully employed by both public and private sectors.

# Federal Government Financing Tools

The Government of Canada has financing options that a project like MVX Nexus would be able to use to raise funds. Two of these methods are outlined below.

## GREEN BONDS

Since Budget 2021, the Federal Government announced that it intends to issue green bonds to mobilize capital in support of climate and environmental objectives.

The Green Bond Framework identifies eligible expenditures for allocation to a green bond which include clean transportation, among eight other options.

In March 2022, the Government of Canada issued the first 7.5 year, $5B Green Bond.

## CANADA INFRASTRUCTURE BANK

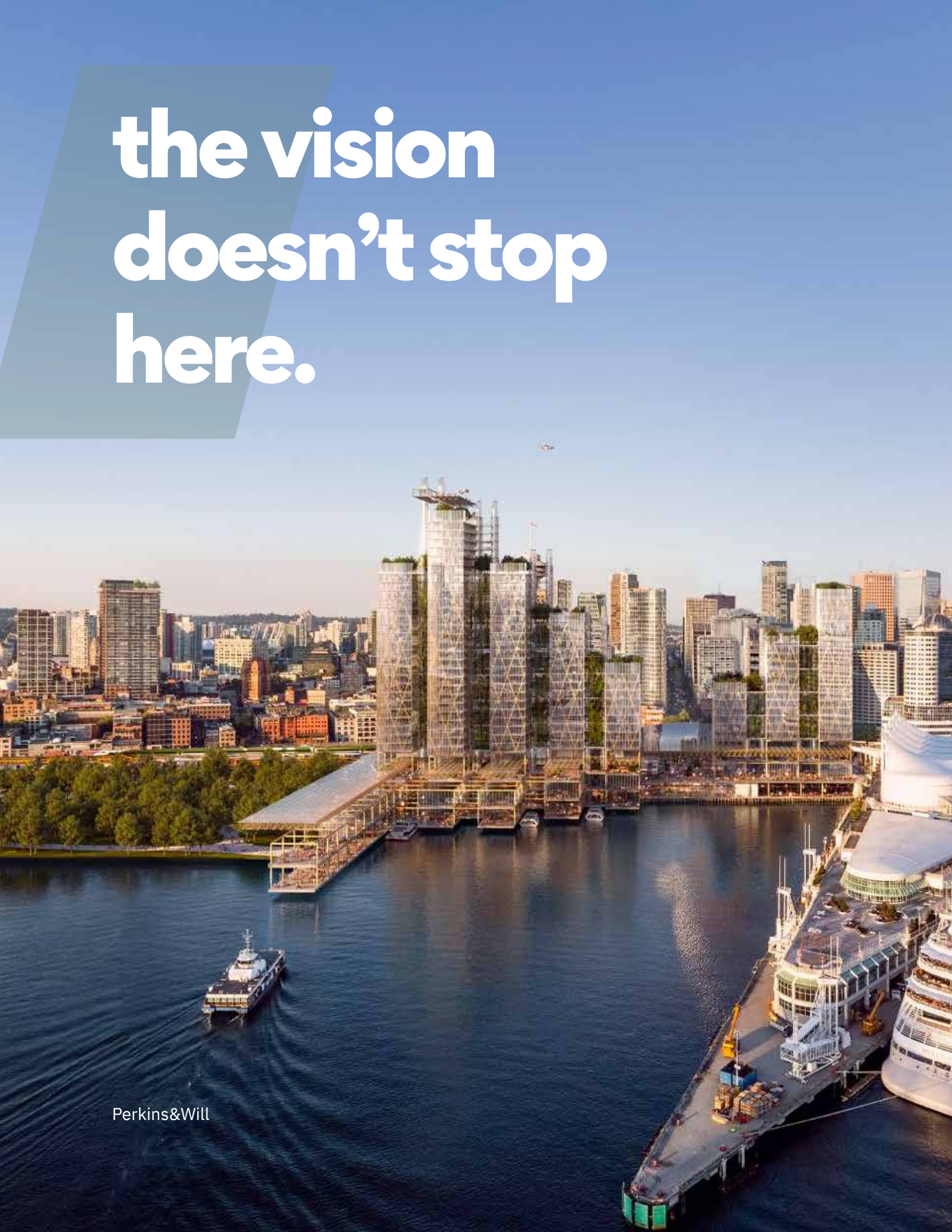
The Canada Infrastructure Bank (CIB) invests $35 billion in revenue-generating infrastructure which benefits Canadians and attracts private capital. The CIB catalyzes private investment in projects that support economic growth, which MVX Nexus would qualify for.

The CIB directly outlines that they are working on investment opportunities in green infrastructure, clean power, public transit, trade and transportation and broadband infrastructure. MVX Nexus would be a public transit investment opportunity.

5

# next steps

# the vision doesn't stop here.



Perkins&Will

# The MVX Collective Society is not alone in this space.

A number of public and private sector agencies and companies are exploring or advancing transformative, travel time competitive rail transport solutions. There is clear acknowledgment that a paradigm shift is necessary to move away from relying exclusively on auto transport for everyone's needs. Below are some similar scale projects to the vision presented by MVX Nexus. Metro Vancouver is making great investments in rapid transit, and we need to keep pace for the wider South Coast where growth is outpacing the Metro Core— our region is bigger than Metro Vancouver and it's imperative to extend affordable, time-competitive, and dignified transportation alternatives car ownership.

## CALGARY-BANFF RAIL LINK


Liricon Capital

According to the Government of Alberta, Liricon Capital is proposing to build a rail link that will allow passengers to travel between the Calgary International Airport and Banff train station. Details include twinning the rail track along the CP Rail corridor to accommodate passenger trains.

## BRIGHTLINE WEST


Brightline West

Brightline West is a proposed privately run high-speed rail route linking Las Vegas Valley and the Greater Los Angeles. The line will connect with Los Angeles' existing commuter rail network. Brightline West is intended to provide an alternative to air and automobile travel.

## QUEBEC CITY-WINDSOR HFR


VIA Rail

Via Rail HFR is a project in the procurement stages to improve connectivity on the Quebec City-Windsor Corridor, which includes Toronto and Montréal. Under VIA HFR, trains would run on dedicated passenger tracks, improving service reliability since the trains would not have to compete with freight trains.

# What needs to happen to get the South Coast on track

This is a big plan. This is an expensive plan. This is an achievable plan if the public supports it and there is a champion to make it happen at the decision maker level. As a nonprofit society, our role is to advocate for a regional rail vision, but we can't do it alone. This is how we get the South Coast on track.

## CRITICAL STEPS:

**Make rail a provincial priority**

It will be important to renegotiate and/or re-establish operating rights to existing rail rights-of-way that have been assigned to private operators for long-term contracts precluding robust regional rail service from materializing.

**Perform more in-depth analysis**

Before anything can proceed, project credibility must be established. Perform a more in-depth study that consists of a parametric cost estimate as well as more detailed ridership estimates should be completed. This study must consider the state of the South Coast given contemporary realities of inflation, population growth, macroeconomic factors, projected demand, full lifecycle cost, and financing options. This is not an exhaustive list of considerations.

**Agree on funding and management framework**

Whether publicly, privately, or jointly delivered, the ultimate model will determine how MVX Nexus advances. An independent authority should determine the ultimate delivery and could be supported through a mix of funding sources that is comprised of public and private sector members. It will be important to establish what degree of foreign investment would be tolerated early in the process.

**Elect leaders that support bold solutions**

Decision makers at all governance levels in many jurisdictions support the principle of better, congestion-free, and more sustainable transportation for the South Coast. If candidates and those who hold office are made aware of the desire to invest in the future of sustainable transportation and are willing to change the status-quo, transformational connectivity offered by MVX Nexus would build momentum.

**Subsidize active transportation in a way similar to roads**

Re-direct or match road financing subsidy to other transportation options, and account for a full economic analysis. When the full life cycle cost and economic benefit of rail transportation is considered, it is often far greater value than roadway infrastructure. Furthermore, roadways should not be accepted as a given solution to meet transportation needs; detailed multiple-account evaluations comparing rail with roadways in urban areas will often yield higher performance outcomes and better economic value. In many cases, the extent of public engagement on roadway projects is less protracted than that alternative transportation methods. A complete network such as MVX Nexus is a tried and tested approach in many contexts around the world which does not merit comparatively more apprehensiveness when compared to business as usual project such as roads and highways. Make rail a provincial priority

**Agreements-in-principle with and between South Coast Local Governments and First Nations**

The South Cost will need to work together in ways that it never has before, and beyond established regional boundaries. All implicated stakeholders must understand and agree to work towards a shared vision. This may involve establishing agreements-in-principle to establish a South Coast regional rail network and may involve establishing a body to oversee its delivery and/or administration.

**Precursory development agreements**

A major solution to sourcing funds for major infrastructure projects such as an MVX Nexus axis could come from development through land-value capture mechanisms. Land use designations should reflect future transportation plans enabling development agreements to advance with certainty and to provide assurance that land-value capture revenues will be in place.

**Infrastructure BC rail transit technical expertise**

The Provincial Government will instrumental in playing a formative role in the creation of a South Coast regional rail network. This will require immense leadership and technical expertise in rail transit. It will be important to establish a team that has experience and the capability to regulate and/or oversee rail as a Provincial transportation priority.

**Getting rail in the new Massey Tunnel Crossing**

Much of the South Fraser network relies on the ability to install or retrofit rail into the new Massey Crossing. Without this foresight, the Tsawwassen to YVR line will likely be deferred for an entire generation or indefinitely.

# Our collective future with fast, reliable rail on the South Coast

MVX Nexus is a visionary plan for building a better future for all South Coast residents, visitors, and businesses. It challenges the status quo by presenting a new option for getting around the region. It also provides a more thoughtful solution to long-term growth than building or widening highways which could be equally as expensive and lead to more traffic.

## WITH A REGION CONNECTED BY RAIL:

**Access for all**

Independence is gained and rail is an enabler for those who aren't able to drive such as those who are too young, who are living with a disability, or prefer to forgo the cost of driving. Young people feel a sense of belonging and connection with their surrounding communities because they are able to go places on their own developing an appreciation for their surrounding communities and enabling learning through way-finding skills, real-world experience, and important life skills that taking transit can teach.

**Our region feels closer**

Growth centres outside the Metro Core are connected and viable as places to live, work, and play. Additional housing options are available and within reach for young professionals, new families, new Canadians, and workers a wider range of incomes and skillsets. Fast, all-day regional rail connections make places like Chilliwack or Squamish feel as close as a Skytrain ride today.

**Growth is thoughtful**

Investing where the region can best serve its people is a key way to amplify private-sector development and capture benefit for investment in building more housing stock where it's needed most.

**Traffic is optional**

A never before available option now provides residents and visitors with a frictionless and effortless way to connect to the people and places they love without worrying about traffic impacting their plans or their punctuality. The growing concerns that other transportation modes face doesn't affect those who choose to travel by rail, and frees up valuable roadway capacity for those who really need it.

**Winter weather doesn't slow us down**

As winter weather events become more commonplace on the South Coast, rail transportation can be a reliable alternative to other options that become snarled. Regional rail can be designed to spec for weather extremes as climate change becomes more pronounced keeping our region moving and causing fewer headaches.

**Transportation is greener (and powered by hydro power)**

When electrified rail is available, a responsible zero-carbon option is available to meet most people's daily needs. Given that a majority of electricity in BC is generated by hydro power, this means that trains would largely be powered sustainably with falling water and operate free from particulate and carbon emissions.

# related projects

## Rapid Transit Projects

Throughout this document, there are references made to ‘cost sharing’ with other projects. These rapid transit projects are listed and described in brief below.

### SURREY-NEWTON-GUILDFORD (SNG) RAPID TRANSIT

Surrey-Newton-Guildford (SNG) Rapid Transit would connect Newton and Guildford Town Centres with Surrey City Centre. This route was part of a canceled LRT proposal and is currently served by the R1 Rapidbus route.

SNG Rapid Transit could be built in conjunction with Phase 2 of the Cascadia HSR project. The underground tunnel along 104 Avenue would be used by Cascadia HSR, South Fraser Regional Rail and SNG Rapid Transit. SNG Rapid Transit is envisaged sharing tracks with regional rail services.

### HASTINGS-LONSDALE

This rapid transit project would involve rapid transit service east from Waterfront Station with two branches: one heading east along Hastings to Kootenay Loop (and possibly Kensington Mall) and another that would turn north near Commercial Drive to serve North Vancouver. This extension would serve important regional centres such as Lower Lonsdale and Lynn Valley as well as major attractions such as Hastings Racecourse and the Pacific National Exhibition. The Hastings Branch would eventually connect with the North Shore Circumferential Line at both Lower Lonsdale and Kootenay Loop as well as the Victoria-Commercial Line at Commercial-Hastings Station.

## WEST VANCOUVER-DOWNTOWN LOOP

The West Vancouver - Downtown Loop line would connect West Vancouver with Downtown Vancouver and provide rapid transit service to the underserved West End. It would also serve important civic attractions such as Stanley Park and English Bay Beach.

This rapid transit project would share most of its infrastructure with the Sea-to-Sky Regional Rail project. Rapid transit and regional tracks would share the same tunnel from Dundarave to just west of Waterfront Station, with rapid transit service traveling stacked on the southern-western tracks. This would allow Downtown Loop trains to branch easily on and off without needing expensive flyovers.

## NORTH SHORE CIRCUMFERENTIAL LINE

The North Shore Circumferential Line is a 43 km line that would connect with many existing and proposed rapid transit routes, providing rapid transit service to new areas and significantly improving the overall connectivity of the network. It would run from Dundarave in West Vancouver and eventually terminate at UBC, connecting with other rapid transit lines at Lower Lonsdale, Kootenay Loop, Brentwood, Metrotown, Oakridge and West-41st. It would also serve major regional attractions such as Lonsdale Quay, the Pacific National Exhibition, BCIT and Punjabi Market.

## ABBOTSFORD RAPID TRANSIT

Abbotsford Rapid Transit would utilize the same elevated corridor used by South Fraser Regional Rail services, allowing passengers to easily traverse the city by transit. Passing tracks would be built at rapid transit stations allowing the two services to coexist. Eventually, service would extend from Abbotsford International Airport through Central Abbotsford to a station near the junction of Sumas Way and Marshall Rd.

## VICTORIA-COMMERCIAL RAPID TRANSIT

Victoria-Commercial Rapid Transit would run from Lynn Valley in the District of North Vancouver to Victoria-Marine Station in the southeast of Vancouver and would likely employ Skytrain technology. It would share tunnels for most of its length. From the North Shore to Vancouver, it would share the Burrard Inlet Tunnel with the Lonsdale Line and in Vancouver it would share the Tsawwassen Connector Tunnel, with the exception of the section near Commercial-Broadway station where it would travel in its own dedicated tunnel. This line would serve a corridor currently served by the 20 bus route, one of the region’s busiest. This rapid transit line would be 16.3 km long, with 8.3 km shared with the Lonsdale Line.

# MVX is a nonprofit society.

## Consider investing in the future of mobility on the South Coast and support our work.

If you share the vision for rail on the south coast, consider joining as a member, making a donation, or purchasing merchandise. Supporting the Society helps to pay for our statutory fees and to advance our mission. You can learn more and join at mvx.vision.

**mvx.vision**