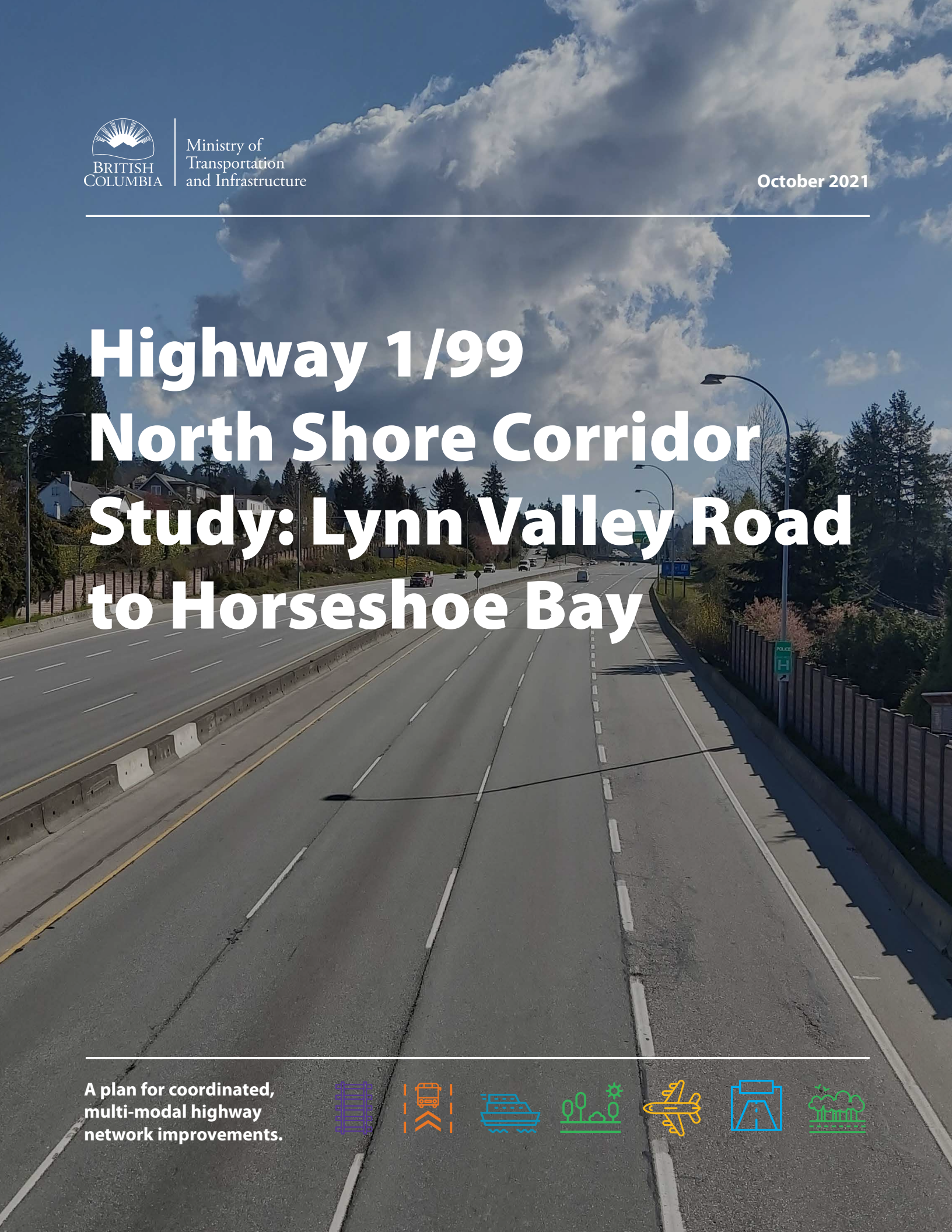


BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

October 2021

Highway 1/99 North Shore Corridor Study: Lynn Valley Road to Horseshoe Bay

A plan for coordinated, multi-modal highway network improvements.

Westview Interchange

Contents

Message from the Minister

The Upper Levels Highway is an important route for commuters in the Lower Mainland and for residents of Metro Vancouver's North Shore. It connects people to their jobs, education and British Columbia's natural attractions, as well as the Horseshoe Bay ferry terminal and Sea to Sky Highway.

Use of the highway has changed over the years, evolving from primarily an intra-regional corridor to one used by people for local trips that begin and end within the North Shore. Without future improvements, congestion levels on Highways 1 and 99 will increase, negatively affecting the quality of life for North Shore residents and others who rely on the highway.

To better plan for the future, the Ministry of Transportation and Infrastructure launched the Highway 1/99 North Shore Corridor Study: Lynn Valley Road to Horseshoe Bay. The study, which began in November 2019, assessed current and anticipated future traffic patterns and identified key mobility and safety challenges between Lynn Valley Road in the District of North Vancouver and Horseshoe Bay in the District of West Vancouver.

By taking a data-driven approach, the study assessed future projected impacts, which helped the Ministry compile a list of potential improvement concepts to be considered for the short, medium, and long-term plans of the highway on the corridor itself and at various interchanges, as well as to active transportation.

Since the beginning of the COVID-19 pandemic, people have adjusted their social habits to connect with their communities and move around through socially distanced active transportation modes. Activities like walking and cycling are good for our own health and the environment, and they also help minimize congestion by encouraging people to leave their cars at home when they can.

As we work to continue safely and conveniently connect people with active transportation beyond the pandemic through the Province's *Move. Commute. Connect.* strategy, future forecasts show an increase in people choosing active transportation. That's why a long-term transportation strategy for active modes, vehicles and transit is needed to solve current challenges on the North Shore and build a more efficient and sustainable network.

The improvement concepts identified in the *Highway 1/99 North Shore Corridor Study: Lynn Valley Road to Horseshoe Bay* will provide local and regional transportation agencies with a reference to continue their own transportation planning activities and help the North Shore, including its three municipalities and various stakeholders, strategize to move forward in a coordinated way.

This study provides us with a range of potential improvements the Ministry may consider implementing. I look forward to working with Indigenous groups, local and regional governments and other transportation agencies as we explore these options, so that we can improve safety, efficiency and accessibility for everyone on the North Shore.

Honourable Rob Fleming
Minister of Transportation and Infrastructure

Introduction

The Highway 1/99 North Shore Corridor Study: Lynn Valley Road to Horseshoe Bay is a high-level assessment of current and anticipated future travel patterns along the Highway 1/99 corridor between Lynn Valley Road in the District of North Vancouver and Horseshoe Bay in the District of West Vancouver. Key challenges with respect to multi-modal mobility and safety for corridor users were identified, and several potential opportunities for active transportation and transit improvements, as well as highway operation safety enhancements were explored, both along the corridor and at interchanges. A total of 16 potential opportunities were identified for future consideration.

The B.C. Ministry of Transportation and Infrastructure (the Ministry) is currently delivering the Highway 1 Lower Lynn Improvements project to upgrade several interchanges at the north end of the Ironworkers Memorial Second Narrows Crossing. The project was designed to improve multi-modal safety and mobility, improve traffic flow during peak times, provide improved local street network connectivity, reduce collisions through geometric improvements to highway facilities, and provide new walking, cycling and transit infrastructure. Notwithstanding these ongoing improvements, the remainder of the Highway 1 corridor on the North Shore (from Lynn Valley Road to Horseshoe Bay) has not been studied at a corridor-level since the mid-1990s when the highway was upgraded to be a free-flow corridor.

The objectives of this planning study were to:

- Undertake a high-level assessment of the current and anticipated future of the corridor's performance by forecasting out to year 2050.
- Based on the outcomes of the current and future performance assessments, develop and evaluate the feasibility of a range of potential improvement opportunities, including shoulder-running bus lanes, highway widening and lane allocation, on-corridor provisions for active transportation, footprint requirements for new or reconfigured interchanges, and other potential improvements.
- Document various improvement opportunities on the North Shore that can provide reference material during the design development phase of potential future projects, with a focus on potential design interdependencies with other improvement opportunities.

The study establishes the range of short- to long-term potential improvements the Ministry may consider implementing over the next 30 years, which in turn provides a foundation for local and regional transportation agencies to continue their own strategic transportation planning activities to address local and sub-regional needs.

Background

Within the study area, Highway 1/99 passes through three municipalities (the District of North Vancouver, the City of North Vancouver and the District of West Vancouver) and the traditional territories of three Indigenous groups (Musqueam Indian Band, Squamish Nation and Tsleil-Waututh Nation). It is a four-lane facility (with a short six-lane section) that features full access control and free-flow conditions; entries to and exits from the highway occur at 13 interchanges/access points.

The highway runs in a generally east-west direction with speed limits up to 90 km/h on the western portion of the corridor and 80 km/h on the eastern portion. Most of West Vancouver is co-signed as Highway 99, as this segment of highway also facilitates connectivity with the Lions Gate Bridge (via Marine Drive and Taylor Way) to the south and the Sea to Sky Highway to the north. Two bus services run along segments of the highway within West Vancouver, and eight interchanges include transit service travelling across the highway. On-corridor shoulder cycling is permitted between Capilano Road and Horseshoe Bay. In addition to sidewalk facilities across the highway at all interchanges and a protected cycling lane on southbound Lynn Valley Road, dedicated active transportation corridor crossings are provided at five locations, with one additional such crossing planned at Casano Drive led by the City of North Vancouver.

Issues Identification & Problem Definition:

Through technical analysis and engagement with Indigenous Groups and stakeholders, the following challenges were identified:

Safety for All Modes of Travel

Through Vision Zero, the Ministry of Transportation and Infrastructure shares a provincial goal towards zero traffic fatalities and zero serious injuries. While safety is a priority on all provincial roads and for all modes of travel, the Highway 1/99 corridor on the North Shore experiences significant safety issues resulting from increasing congestion coupled with challenging horizontal curves and steep grades in some areas. Safety issues are most prevalent at interchanges where vehicles are merging on and off the highway – most notably at Capilano interchange, Lynn Valley Road interchange, Westview Drive Interchange, and the Lonsdale Avenue Interchange.

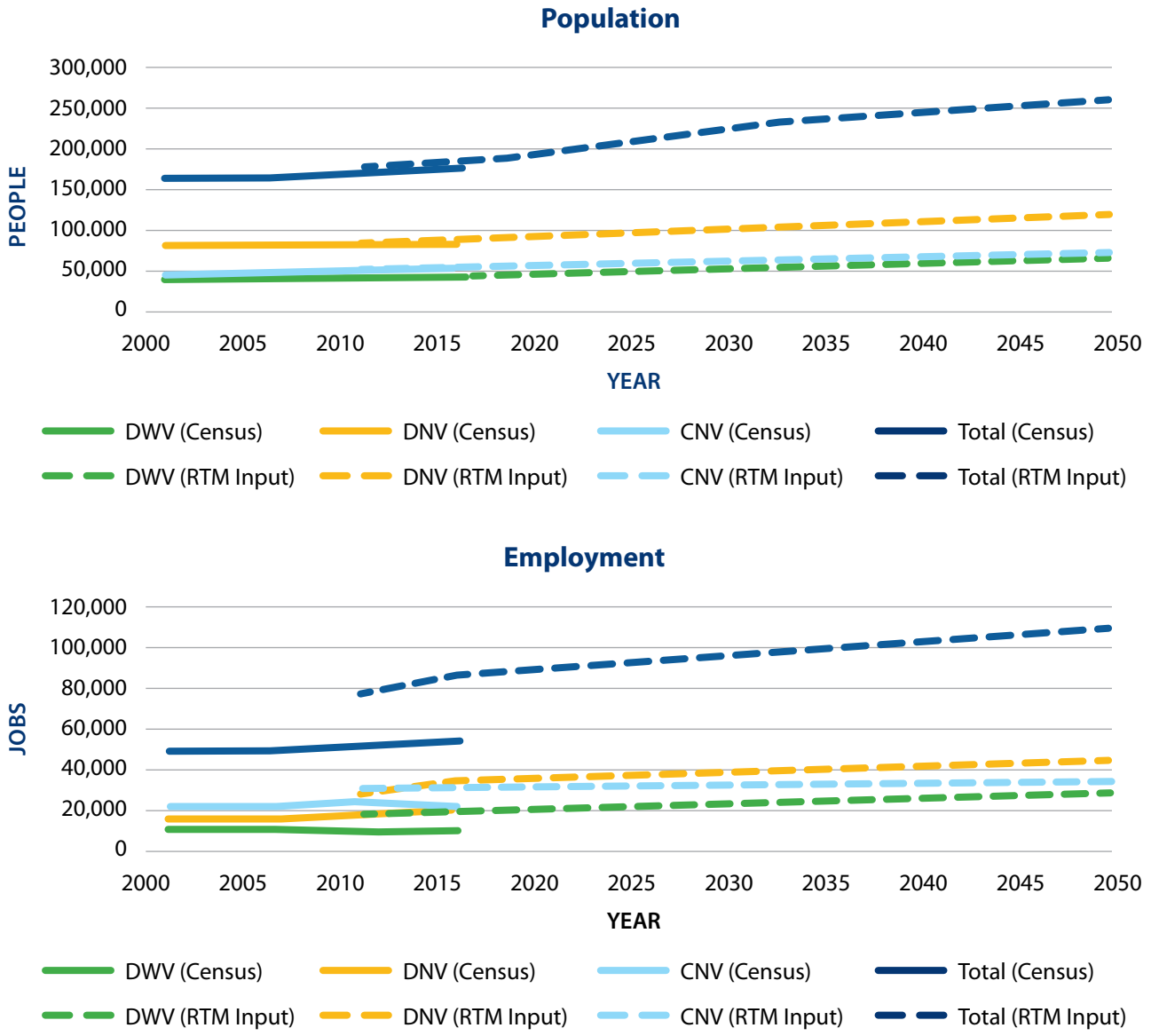
Collision frequency and severity is primarily concentrated in the east, and in the eastbound direction from Taylor Way to Westview Drive and from Lonsdale Ave to Lynn Valley Road. Figure 1 (below) illustrates the location and frequency of collisions on the corridor.

Dedicated active transportation corridor crossings are provided at five locations, with one additional crossing planned at Casano Drive. The study addresses the safety of active transportation facility users by seeking new opportunities for safe walking and cycling infrastructure, and addressing regional parallel and cross-corridor gaps, linking to the municipal cycling network.

Figure 1: Top 10 collision locations (total number of collisions between 2014 and mid 2019)

Population and Employment Imbalance

The North Shore is a significant employment generator. With high housing costs and a limited entry-level housing market in the area, there is a large imbalance between the local working-age population and the jobs available. This gap creates the need for more trips across Burrard Inlet and along the Highway 1 corridor as workers from other locations travel to and from their jobs each day. Without a change in available housing supply, the rate of growth in time spent travelling on the regional network, including on the North Shore, will exceed growth in total person-kilometres travelled, resulting in declining travel speeds throughout the region.



Congestion is already significant enough that North Shore residents' access to employment opportunities by car lags behind the regional average. Normally, this would be due to geographic distance to jobs and the number of jobs available; however, in the case of the North Shore, the challenge is simply congestion. Over time, as congestion worsens, the number of employment opportunities that North Shore residents can reach by auto within a reasonable travel time will decrease. Conversely, accessibility to employment opportunities by transit is anticipated to improve over time but will still lag access by auto. Not only is this a challenge for workers, but also for North Shore employers' ability to access to the regional labour force.

Transit/Active Transportation

Existing transit service along Highway 1/99 through the North Shore is limited, and primarily confined to a single express bus route within the western portion of the study corridor between the Horseshoe Bay ferry terminal and the 15th Street/Cross Creek Road Interchange. The eastern portion of the corridor, which is more congested, does not provide any transit service.

Transit competitiveness is challenging due to historic auto-centric land use decisions, transit stop accessibility, limited amenities at transit stops, transit speed and reliability, and a mismatch between where potential passengers want to travel and where the transit routes actually travel. As vehicle travel reliability continues to decline, the relative competitiveness of transit will increase.

Cycling is permitted along the highway corridor between the Horseshoe Bay ferry terminal and the Capilano Road Interchange and on the north side of the highway between Westview Drive and Taylor Way. Cross-corridor active transit is possible but challenging at the Lynn Valley Road Interchange, Lonsdale Avenue Interchange, Capilano Road Interchange and Taylor Way Interchange.

Provincial, regional and municipal transportation policies all support increasing the mode share of sustainable transportation modes. In its current condition, a modest increase in walking, cycling and transit mode shares on the North Shore is anticipated by 2050 and overall trips will still be well below municipal and regional targets.

Highway Reliability

Most vehicles on the corridor are cars, although HOV trips currently make up 30% to 50% of person-trips, depending on the location and the time of day.

By 2050, the demand for trip-making on the Highway 1/99 corridor within the North Shore is anticipated to grow in the range of 20% to 45%. The eastern portion of the study corridor (from the Capilano River to the Lynn Valley Road Interchange) is busier than the western portion at all times of day and experiences a greater degree of congestion and capacity challenges during rush hours. Without improvements, travel conditions within this eastern section will continue to degrade, particularly in the eastbound direction, where most trips are destined to the Ironworkers Memorial Bridge.

The Highway 1/99 corridor was constructed to support intra-regional or through-trips; however, because the area lacks a continuous parallel municipal road network, it is also used for local trips on the North Shore. About one-quarter to one-third of all trips on the highway are internal within the North Shore. This places additional burden on the interchanges, where most of the collisions happen.

Study Methodology

Technical Process

The study provided a high-level technical assessment of multi-modal mobility and safety to identify existing and anticipated future conditions and challenges along the corridor. Mobility analysis was undertaken using the **Regional Transportation Model (RTM**), a travel demand modelling tool that incorporates information on existing land use, transportation infrastructure and trip-making behaviour. Based on assumed future land use scenarios and transportation networks, the model forecasts future travel patterns across the region over a 30-year planning horizon (i.e., year 2050), including in the study corridor, and can also be used to assess how travel patterns would change in response to new infrastructure.

The RTM was developed based on observed travel behaviour that predates the COVID-19 pandemic. While COVID-19 has resulted in a short-term reduction in peak-hour trip-making, it is speculative as to how long-term trip-making will be affected by higher rates of work-from-home activity, and how the distribution of trip-making over the course of the day could change (and by extension, when and how often the highway is congested).

The population on the North Shore is anticipated to increase by 35% to 40% over the next 30 years. Based on assumed future land uses and population growth, as well as planned changes to the transportation network, RTM forecasts that the demand for trip-making along much of the Upper Levels Highway will grow in the range of 20% to 45% during this timeframe, depending on the specific segment, travel direction and time of day. The results of the RTM were used to identify future pinch points where improvements would be required to effectively serve the growth in demand and was used to test the effectiveness of the potential improvement opportunities identified.

The study also considered historical daily and annual highway corridor travel patterns by collecting data using permanent traffic count stations that operate 24 hours a day, 7 days a week, as well as analyzing historical trends and future forecast trends.

Road safety analysis was primarily undertaken through a review of the observed collision history along the corridor. Based on the findings of this multi-modal mobility and safety analysis, several areas along the highway corridor were identified for development and high-level evaluation of improvement opportunities.

A review of previous studies and reports also assisted in identifying outstanding issues on the highway and provided a basis for technical analysis and engagement discussion to further identify current issues. Specifically, the reports reviewed include:

- Ministry-generated reports and study documents that relate either directly or indirectly to the Highway 1/99 corridor
- Stakeholder-generated reports and studies, primarily documents from TransLink and the three North Shore municipalities

Study Engagement Process

In conjunction with technical analysis, the study team also conducted engagement with:

THREE NORTH SHORE MUNICIPALITIES

- **City of North Vancouver**
- **District of North Vancouver**
- **District of West Vancouver)**

THREE INDIGENOUS GROUPS in whose traditional territories the study corridor is located

- **Squamish Nation**
- **Tsleil-Waututh Nation**
- **Musqueam Indian Band**

TRANSLINK

HUB CYCLING

Input was also received from BC Ferries with respect to the potential changes to traffic patterns that may emerge as a result of long-term upgrades at the Horseshoe Bay ferry terminal.

The highway corridor passes through the core territories of some Indigenous groups, and any concepts developed may be located in areas with archaeological or environmental significance. For all improvement opportunities identified in this report, further development, investigation, engagement and evaluation across a range of financial, transportation, social, environmental, archaeological and economic criteria is required prior to proceeding towards implementation. It is noted that in the event that any improvement concepts were to proceed to implementation in the future, some Indigenous groups have expressed interest in being notified of procurement opportunities.

Future Implementation Phasing

A potential phasing strategy was developed, which categorized each of the potential improvements identified into short-term, medium-term and long-term timelines, based on their complexity, interdependency with other initiatives, and anticipated costs.

Specifically, the phasing framework is as follows:

Short -Term Improvements (0-5 years):

- Address identified on-corridor and cross street network gaps and improvements for active transportation and work with stakeholders to bridge the gap for these facilities.
- Safety, and capacity-based improvements involving ITS applications, minor geometric improvements at on/off ramps to improve merge, weaving issues, or improved signage.

Medium to Long-Term Improvements (5+ years):

- Improvement opportunities for a bus-on-shoulder system, including safe, accessible, and connected bus stops/stations at key locations in conjunction with TransLink service plans and in alignment with the findings from the Burrard Inlet Rapid Transportation study and Integrated North Shore Transportation Planning Project (INSTPP).
- Focus on an Integrated Transportation Development Strategy approach in collaboration with District of North Vancouver, North Vancouver, District of West Vancouver, and TransLink.
- Introduce new multi-modal routes/structures and improve active transportation facilities.
- Interchange reconfiguration and/or replacement and implementation of HOV facilities

It is noted that the potential phasing category assigned to each concept could change subject to further technical investigation and engagement. Additionally, any improvements within the study corridor would need to be considered in the context of potential downstream impacts to existing infrastructure outside of the study area, such as the Ironworkers Memorial Second Narrows Crossing and the ongoing Lower Lynn Improvements project.

Study Findings Summary

The study identified the following 16 potential highway improvement opportunities (see the following sections for more detail on each potential improvement):

Short-Term

- Lynn Valley Road Interchange: Westbound and Eastbound On-Ramp Extensions
- Capilano Road Interchange: North Side Active Transportation Improvements
- Westview Drive Interchange: Eastbound Off-Ramp Shoulder Cycling Extension
- Westview Drive Interchange: Westview Drive and 23rd Street Signal Coordination
- Highway 99 Sea to Sky/Highway 1 Eastbound Merge
- On-Corridor: Active Transportation Improvements between Westview Drive and Pemberton Avenue
- Caulfeild Westbound Ramp Terminal Intersection Improvements
- Taylor Way Interchange Cycling Improvements
- 21st Street and 15th Street Interchanges Improvements

Medium-Term

- Lynn Valley Road Interchange: Eastbound Off-Ramp Extension
- Lonsdale Avenue Interchange: Active Transportation Improvements
- St. Georges Avenue Overpass

Long-Term

- On-Corridor Transit Service with Bus-on-Shoulder
- Lynn Valley Road Interchange: Transit Elements
- Capilano Road Interchange: Bridge Twinning
- Westmount Road Interchange: East-facing Ramps and Road Connection

In some cases, interchanges categorized as long-term opportunities have elements that could be implemented in the short term to provide an interim benefit while still being broadly compatible with longer-term improvements.

On-Corridor Improvements

On-corridor improvements focus on providing more people-moving capacity along the eastern portion of the highway corridor study area (roughly between Capilano River and Lynn Valley Road), where volumes and congestion levels are greatest.

Three potential approaches to increase people-moving capacity were considered:

1) **Bus-on-shoulder**

2) **HOV lanes**

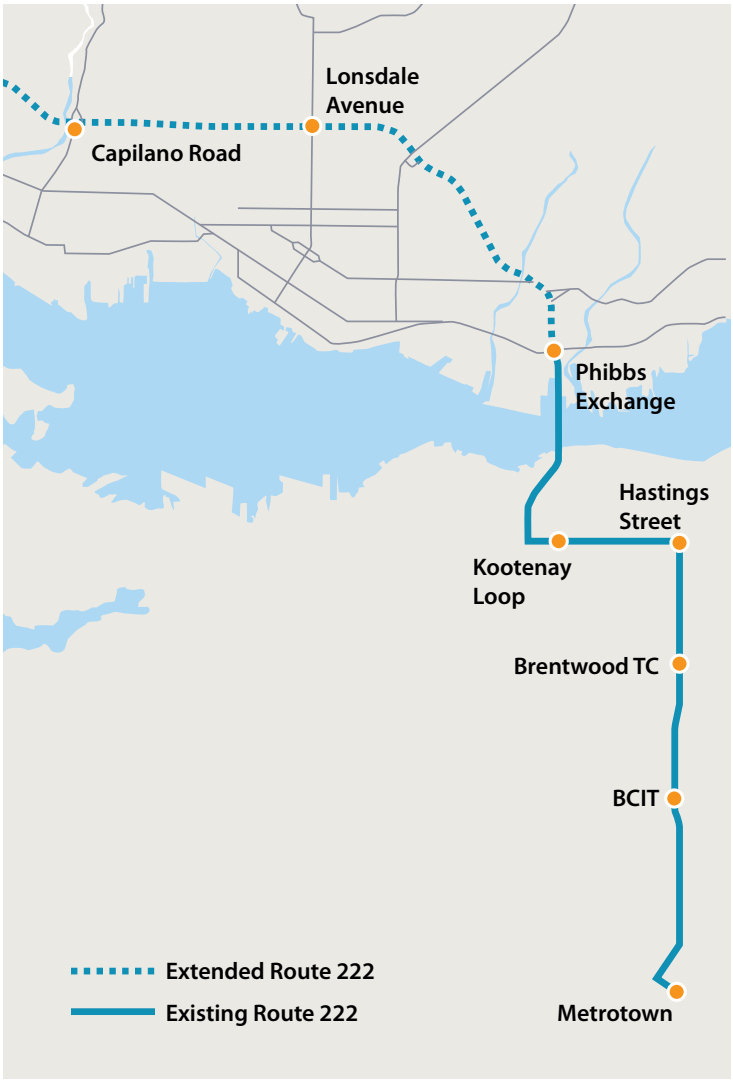
3) **Additional general-purpose lanes**

Bus-on-shoulder lanes emerged as the preferred concept to carry forward.

Bus-On-Shoulder System

Currently, there is no transit service along the eastern portion of the study corridor. Therefore, there are no baseline transit service issues to improve upon in this portion of the corridor; rather, the "issue" is the lack of transit service in the first place.

This potential long-term additional people-moving capacity sub-concept would provide for on-corridor bus service and transit priority measures through a bus-on-shoulder system. Based on discussion with TransLink, for the purposes of conducting an exploratory analysis,



the bus service was assumed to be an extension of the existing Route 222 service between Metrotown and Phibbs Exchange that would provide stops at Capilano Road and Lonsdale Avenue. A stop at Lynn Valley Road was also investigated but would likely require modifications to the interchange.

Potential strengths of the bus-on-shoulder system concept include:

- Providing a transportation method for people without access to a personal vehicle.
- Transit service would provide an alternative for driving, enabling an increase in people-moving capacity while providing an approach that is more consistent with provincial, regional and municipal transportation policies, as well as the general principles of regional land use and affordable housing strategies.
- Transit priority measures would allow buses to bypass congestion, increasing both the speed and reliability of service, and enabling the service to overcome some of the other disadvantages along the corridor.
- Additional bus volumes are low enough that there is no risk that their addition to the traffic stream would contribute to congestion on the approach to the Ironworkers Memorial Bridge.
- Providing transit priority measures to overcome corridor limitations and help catalyze a new transit service has been applied successfully on other corridors, such as the Route 555 service, which runs along Highway 1 between the Carvolth Exchange in Langley and the Lougheed Town Centre SkyTrain Station in Burnaby.
- Bus-on-shoulder requires less widening than a full dedicated bus lane plus a separate shoulder, reducing impacts to private property.
- Reduction in greenhouse gas emissions.

The potential challenges of the bus-on-shoulder system concept include:

- Few high-density activity nodes "on the way" along the corridor to generate transit ridership.
- The study area is not the most congested part of Highway 1 on the North Shore. The segment of highway from Lynn Valley Road to the Ironworkers Memorial Second Narrows Crossing tends to be more congested than the study segment; therefore, the value of the bus-on-shoulder system may be limited unless it is extended further south towards the bridge. For modelling purposes, the assumed extension of the bus-on-shoulder system to Phibbs Exchange will address this issue.
- Bicycles would be unable to use highway shoulders in areas with a bus-on-shoulder system, although the provision of a separate barrier-protected pathway between Capilano Road and Westview Drive is intended to address this issue, which also would help improve the parallel municipal cycling network, which currently is less developed in this area due to the presence of Mosquito Creek and Mackay Creek.

HOV Lanes

This potential long-term additional people-moving capacity sub-concept would provide an additional lane in each direction for high-occupancy vehicles (meaning vehicles with 2+ occupants) and would also include the extended Route 222 transit service. In the existing six-lane segment of the highway near Westview Drive/Lonsdale Avenue, the HOV lane would be facilitated by repurposing an existing general-purpose lane. It would facilitate cycling connectivity between Capilano Road and Westview Drive and would provide transit with a travel time advantage over private vehicles, although to a lesser extent than the bus-on-shoulder system. By enabling transit service and providing a faster dedicated travel lane for high-occupancy vehicles, the HOV lane concept provides the greatest potential for increasing total person-throughput capacity on the study corridor. The technical feasibility of an outside-lane HOV configuration, which facilitates transit service, would need to be further investigated.

Potential strengths of the HOV lane concept include:

- Providing an opportunity to benefit the 30% to 50% of travellers along the corridor who are already travelling via high-occupancy vehicles.
- The HOV lane could also be used to run transit service.

Potential challenges of the HOV lane concept include:

- The configuration as assumed for modelling purposes would introduce additional weaving along the corridor, which could create an operational and potential safety challenge. Providing a median HOV lane instead would address these issues but would create significant challenges with respect to incorporating a transit service.
- The lack of continuity of the HOV lane to/from existing facilities in Vancouver means that the lane would instead act as a queue jumper in the eastbound direction. It would be at risk of becoming a "victim of its own success" and create a merging issue just downstream of the Lynn Valley Road Interchange.

Additional General-Purpose Lanes

This potential long-term additional people-moving capacity sub-concept would widen the remaining existing four-lane sections of the corridor between Taylor Way and Lynn Valley Road to six lanes. Active transportation provisions would be similar to the other two sub-concepts; however, there would be no provision for transit service. This concept would increase highway corridor passenger vehicle trips, some of which are rerouted from the municipal road network, resulting in both increased and reduced traffic volumes on various municipal roads. Mobility benefits for this concept would be relatively evenly split between local trips within the North Shore and longer-distance regional trips. Further operational analysis would be required to confirm potential mobility benefits if this concept were to be pursued further.

Potential strengths of the additional general-purpose lane concept include:

- The additional capacity on the highway corridor is available for use by the greatest number of users; other sub-concepts do not provide additional capacity for single-occupancy vehicles, which is the mode by which the majority of people currently travel along the corridor.
- A potential variation of this concept wherein the additional lanes in each direction are accommodated using a peak hour hard shoulder running system could provide additional capacity while potentially achieving reduced costs and property impacts as compared to a full six-lane cross-section.

Lynn Valley Road Interchange

Potential challenges of the additional general-purpose lane concept include:

- This option needs further exploration to ensure alignment with the Ministry Clean BC Strategy. The Ministry recognizes the importance of the Clean BC and the "Roadmap to 2030". Further analysis would be needed to see how this option would fit within the roadmap provided.
- The study area is not the most congested part of Highway 1 on the North Shore. The bridgeheads still govern flow, and the concept may simply result in eastbound vehicles reaching the end of the bridge queue slightly sooner but then waiting longer, resulting in little net benefit.
- Bicycles would not be able to use shoulders simultaneously with shoulder-running vehicles, which could potentially result in the removal of shoulder cycling between Taylor Way and Capilano Road. The feasibility of providing time-of-day/day-of-week restrictions for shoulder cycling on the highway could be explored, but it is anticipated that this could create an enforcement challenge.
- As currently scoped, this concept would also require implementation of the Capilano Road Interchange improvement opportunity, although the scope could be reduced for the additional general-purpose lanes to begin east of Capilano Road instead.

Active Transportation Improvements

As the Province, municipalities and individual residents seek to increase the number of trips taken by active transportation, to help clean our environment and improve overall health, a key driver of this study was to identify opportunities to enhance cycling and walking on the North Shore.

In addition to maintaining shoulder cycling facilities between the Horseshoe Bay ferry terminal and Capilano Road, sidewalks across the highway at all interchanges and cycling across the highway at the Lynn Valley Road, Lonsdale Avenue, Westview Drive, Capilano Road, and Taylor Way interchanges and the planned crossing led by the City of North Vancouver at Casano Drive, the following key potential on-corridor active transportation improvement opportunities were identified:

Replace Pemberton Avenue Overpass:

- Concurrent with replacing the existing structure to accommodate the widened highway cross-section below the new structure can be designed as a walking and cycling connection that meets modern best practices for active transportation facilities, including consideration of appropriate width, grades and lighting. The Casano-Loutet Overpass, planned to be built by the City of North Vancouver in 2021 provides a good design precedent.

Maintain Existing South Side Multi-Use Path Between Pemberton Avenue and Westview Drive:

- This barrier-protected walking and cycling pathway on the south side of Highway 1 is the only paved east-west active transportation connection between W. Queens Road and Larson Road. Widening the highway corridor to accommodate additional laning will need to be done in a manner that maintains this path, which also interfaces with potential improvements at Capilano Road, Westview Drive and Edgemont Boulevard (discussed later in this document). While avoiding the removal of a pathway is not necessarily an "improvement," it avoids a negative impact. Opportunities to widen the path further could be investigated.

Explore a Potential New "North Side" Multi-Use Path between Capilano Road and Westview Drive:

- The study identified an opportunity to explore the feasibility of providing a new multi-use path on the north side of the highway corridor to complement the existing facility on the south side, which would help address the lack of nearby alternative east-west municipal connections. Like the facility on the south side, this facility could be barrier-protected, providing a safe and comfortable experience for people of all ages and abilities. This facility could provide a more direct east-west connection north of the highway corridor that would eliminate the need for pedestrians and cyclists to cross back and forth across the highway corridor as part of their journey. Further investigation is required to confirm the availability of right-of-way for this new path, in context of existing land use and all other improvements identified in this report.

Connectivity to Edgemont Boulevard:

- The existing walking and cycling path on the south side of the highway corridor has a steep sidewalk connection to Edgemont Boulevard, and there is an opportunity to replace this with a path that allows bidirectional walking and cycling. On the north side of the highway corridor there is a sidewalk on the bridge over Mosquito Creek, but no formal connection to Edgemont Boulevard. Providing such a connection in conjunction with other improvements at Westview Drive Interchange *(see Potential Interchange Improvements section)* could improve walking connectivity across Mosquito Creek, as well as potential cycling connectivity if the new north side multi-use path were to be incorporated.

In addition to these on-corridor opportunities, a range of smaller active transportation improvement opportunities have been identified at specific interchanges. These are described in the following section.

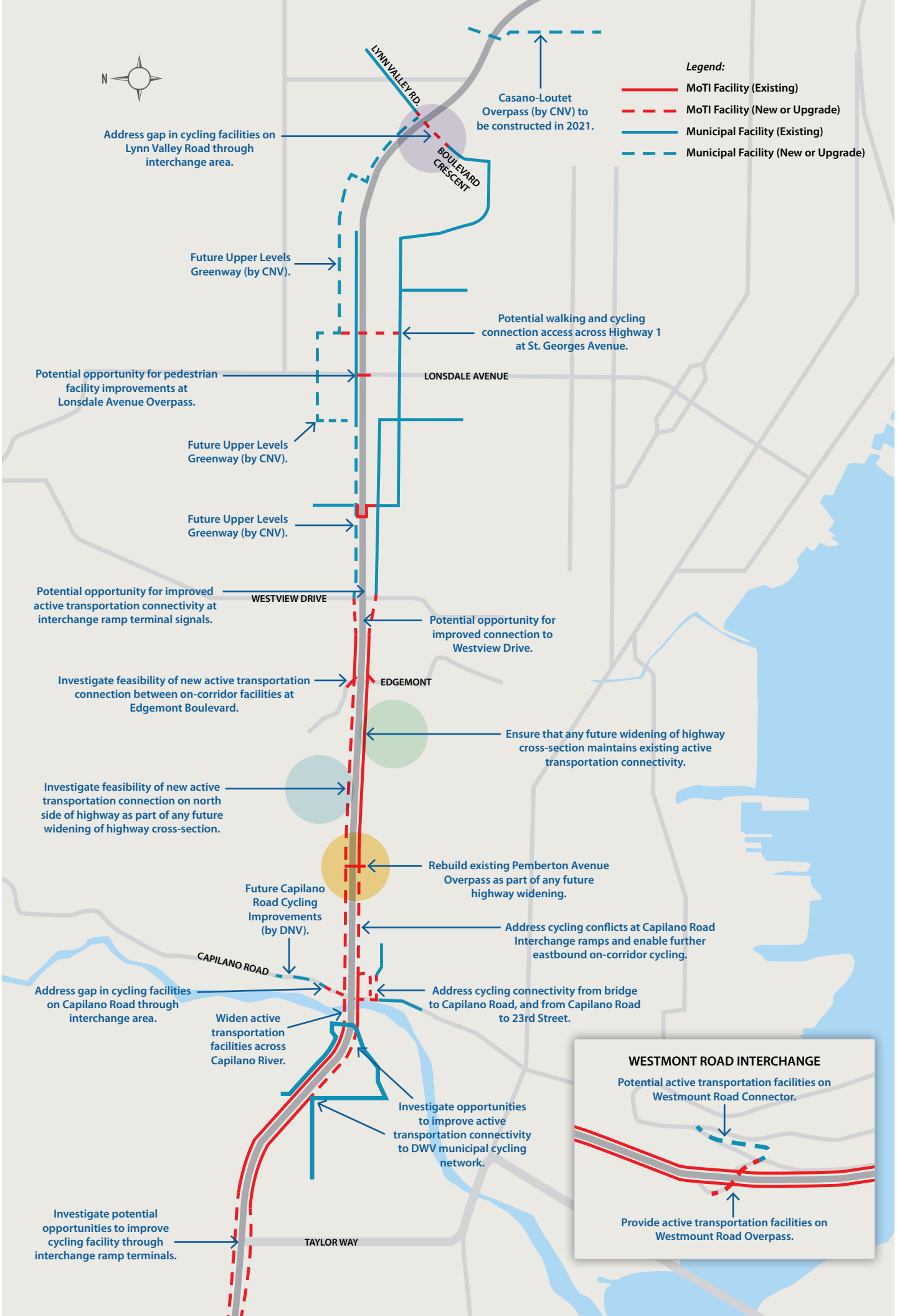


Figure 2: Key Existing and Potential New Improved Opportunities for Provincial and Municipal Active Transportation Infrastructure.

Interchange Improvements

Many of the interchanges and structures along the corridor date to the 1960s, and the final interchange on the corridor at Westview Drive was completed in the mid-1990s. The age of the other interchanges creates considerations with respect to infrastructure lifecycles and states of good repair, geometric designs that may not be consistent with more modern guidelines, and less consideration having been given to sustainable transportation modes in the past.

The descriptions of the improvement opportunities presented here are **concepts** to achieve the desired benefits and should not be interpreted as the final design. For all concepts identified, further development, investigation, **engagement** and evaluation across a range of financial, transportation, social, environmental, archaeological and economic criteria is required prior to proceeding towards implementation.

Lynn Valley Road Interchange

The Lynn Valley Road Interchange (Exit 19) is an unorthodox interchange configuration, with the eastbound on-ramp and off-ramp being a Parclo B2 design and the westbound on-ramp and off-ramp being a pseudo-diamond configuration with separate ramp terminal intersections. The eastbound ramps share a common signalized intersection to the southwest of the highway, and the westbound on-ramp has a yield-controlled intersection immediately to the northeast of the highway. The westbound off-ramp connects to a local street (William Avenue) and the nearest intersection is a local street for which William Avenue has priority through the two-way stop-controlled intersection. A signal is provided roughly 300 metres downstream at the intersection of William Avenue and Lynn Valley Road.

The highway runs above Lynn Valley Road through the interchange. Within the interchange area, Lynn Valley Road has continuous sidewalks on both sides of the roadway, provisions for cycling only in the southwest direction, and two bus services (Route 228 and Route 255). The nearest interchanges are the Lonsdale Avenue Interchange 1.5 kilometres to the west and the Mountain Highway Interchange 1.9 kilometres to the southeast.

Key Opportunities:

- Road safety
- Transit
- Active transportation
- Motor vehicle traffic operations

Existing Lynn Valley Road Interchange

This concept would complete cycling connectivity on Lynn Valley Road and enable an on-corridor bus service to stop at Lynn Valley Road. It also would address safety challenges on the westbound on-ramp and the eastbound off-ramp. It is noted that a detailed design for active transportation improvements at this interchange has been completed.

Potential Short-Term Improvement:

- Extend the westbound on-ramp, which would improve road safety by addressing challenging sightlines and short merging areas.

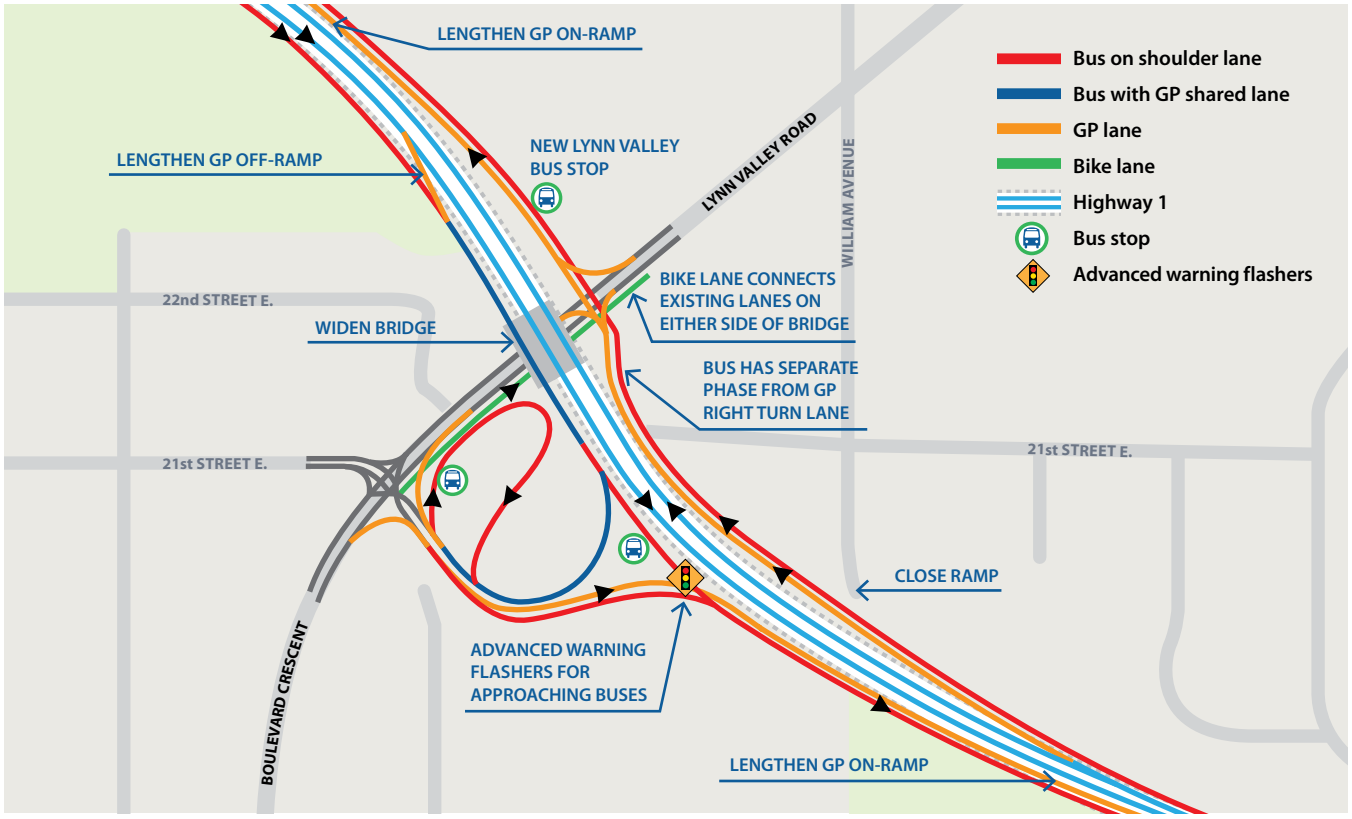
Potential Medium-Term Improvement:

- Extend the eastbound off-ramp diverge point further upstream to provide room for deceleration and additional room for queueing at the ramp terminal intersection, which would improve road safety. This would require widening the bridge structure on which the highway passes over top of Lynn Valley Road.

Potential Long-Term Improvement:

- Realign the westbound off-ramp, providing a bus stop and shoulder on the westbound on-ramp, providing a stop and turnaround at the eastbound off-ramp, and providing a bus shoulder on the eastbound on-ramp. This would enable on-corridor bus service to also stop at Lynn Valley Road (should such a stop be included in the service pattern). support on-corridor transit service (if desired).

Lynn Valley Road Interchange Improvement Concepts – For Discussion Purposes Only



Westview Drive and Lonsdale Avenue Interchanges

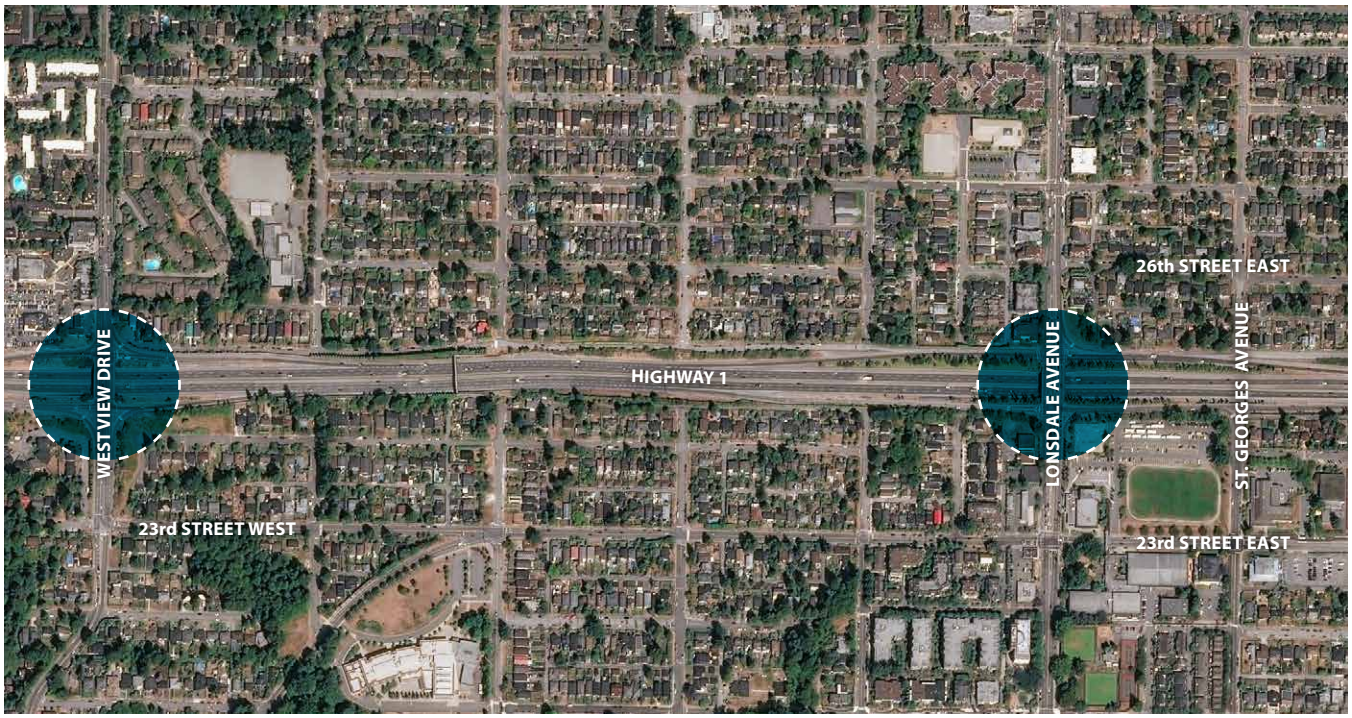
The Westview Drive Interchange and Lonsdale Avenue Interchange are a pair of diamond interchanges servicing City of North Vancouver.

Key Opportunities:

- Motor vehicle traffic operations
- Transit
- Road safety
- Active transportation

The primary potential improvement concept would provide a new multi-modal overpass across Highway 1 at St. Georges Avenue. This would provide a new cross-highway walking and cycling connection, provide increased flexibility for reconfiguring Lonsdale Avenue in the future (e.g., to support improved transit service and/or improvements to walking and cycling conditions), and would provide an alternate route for local traffic to cross the highway. By moving local traffic to the alternate route, turn signals at Westview Drive and Lonsdale Avenue Interchange could be reprogrammed to provide increased priority for interchange ramp movements. Several opportunities for smaller-scale short-term improvements were also identified at the two existing interchanges.

Existing Westview Drive and Lonsdale Avenue interchanges



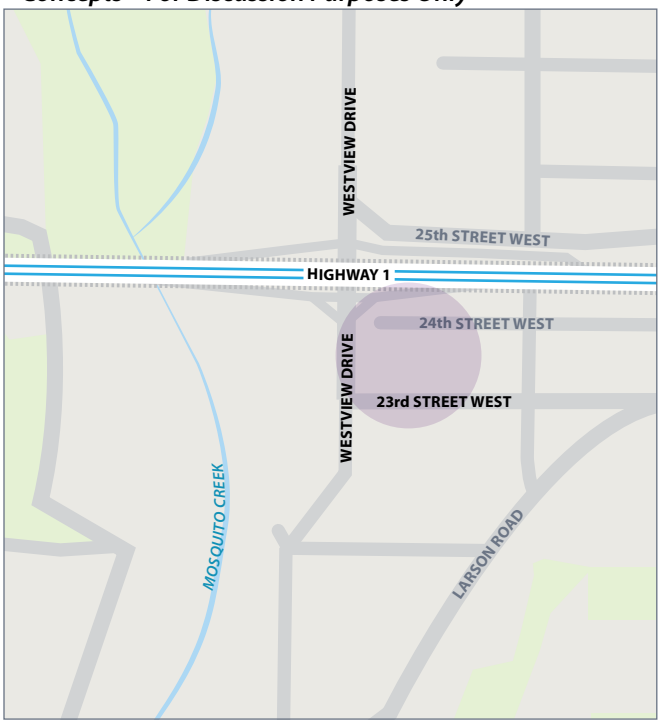
Potential Short-Term Improvement:

- At the Westview Drive Interchange, the eastbound shoulder used for cycling would be extended to the intersection and a new walking/cycling crossing would be built on the south leg of the intersection. The gravel ramp on the east side of Westview Drive would be widened and paved for cycling. This would eliminate part of the "gap" in eastbound cycling connectivity along the south side of Highway 1.
- Improved signal coordination between the Westview Drive eastbound ramp terminal and Westview Drive and 23rd Street would facilitate eastbound right-turning vehicles to then make a southbound left turn onto 23rd Street, improving throughput on the exit ramp and avoiding spillbacks onto the Highway 1 eastbound mainline.

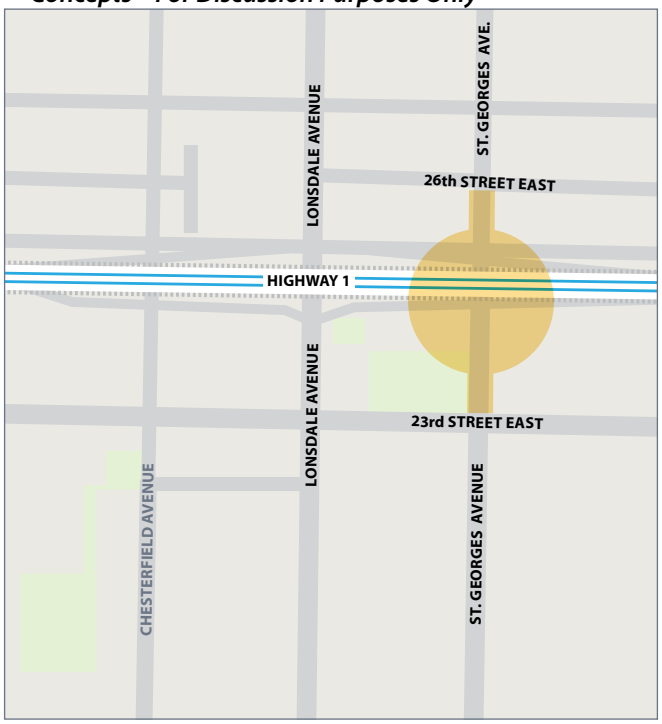
Potential Medium-Term Improvement:

- To address the current gap in cycling facilities at the Lonsdale interchange, a new multi-modal overpass across Highway 1 at St. Georges Avenue would connect 23rd Street to 26th Street. This would provide an alternate route for local vehicle and cyclist trips, alleviating congestion at Lonsdale interchange and providing a safe and convenient route for cyclists.

Westview Drive Interchange Improvement Concepts – For Discussion Purposes Only



Lonsdale Avenue Interchange Improvement Concepts – For Discussion Purposes Only



Capilano Road Interchange

The Capilano Road Interchange (Exit 14) is a Parclo AB style of interchange with the highway running above Capilano Road. The interchange includes two signalized ramp terminal intersections, with the north intersection servicing the westbound on-ramp and off-ramp, and the south intersection servicing the eastbound on-ramp and off-ramp. Within the interchange area, Capilano Road has continuous sidewalks on both sides of the roadway, no provisions for cycling and three bus services (Route 236, Route 245 and Route 247). The nearest full movement interchanges are the Taylor Way Interchange 1.7 kilometres to the west and Westview Drive 2.1 kilometres to the east. The Lloyd Avenue westbound right-in/right-out access is also located 0.9 kilometres to the west, although this movement would likely need to be closed as part of a widening of the highway cross-section through this area.

Key Issues to Address:

- Motor vehicle traffic operations
- Transit
- Road safety
- Local trips and the role and function of the highway
- Active transportation

This potential improvement concept would provide wider walking and cycling facilities across the river, address cycling conflicts with eastbound ramp traffic and enable cycling facilities on Capilano Road underneath the highway. It would provide a shoulder on the bridge(s) in each direction wide enough to future-proof the bridge to accommodate use as a future bus-on-shoulder facility. The concept would also address safety challenges on the westbound on-ramp, the eastbound off-ramp and the horizontal curvature on the west side of the bridge and facilitate local/intra-municipal travel.

Existing Capilano Road Interchange

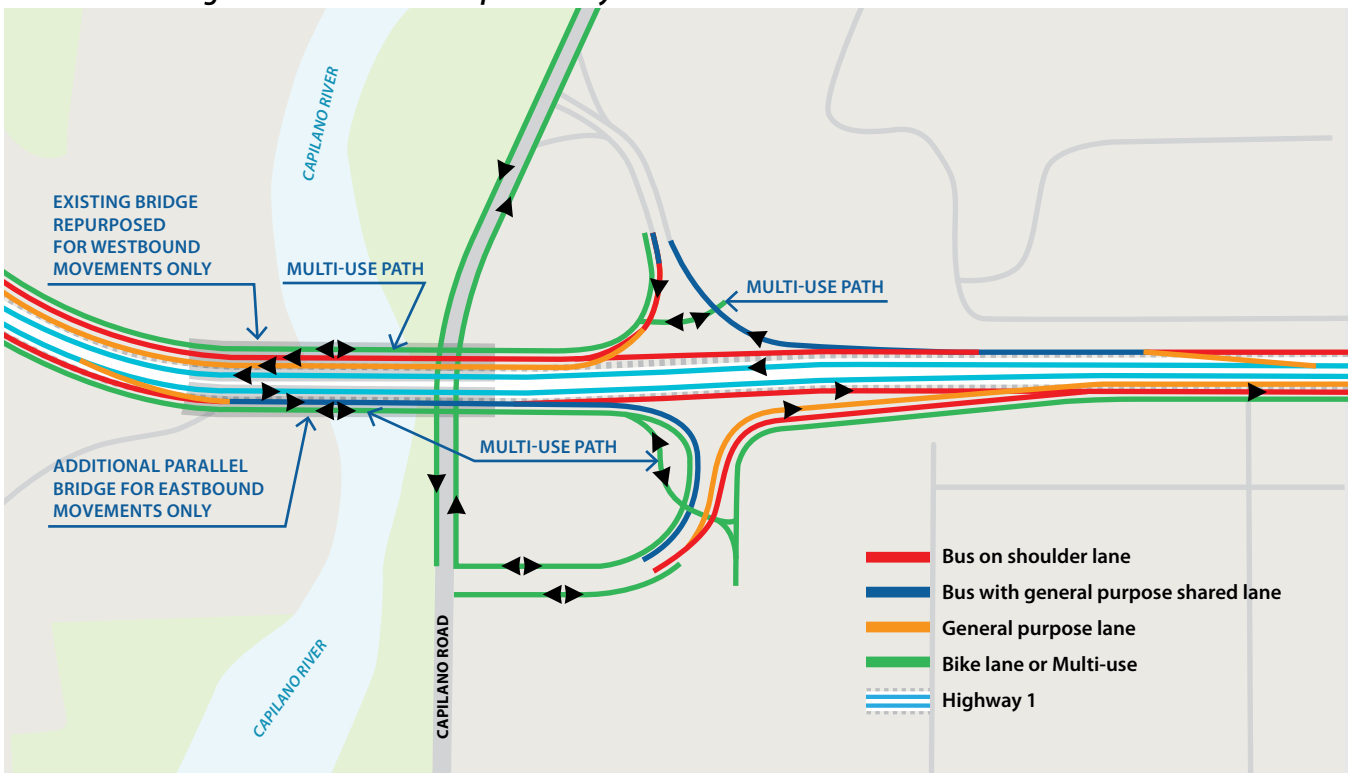
Potential Short-Term Improvements:

- The North Side Active Transportation Improvements concept would extend an existing active transportation path to south of westbound ramp terminal intersection and provide adequate cycling facilities through the intersection and along a segment of Capilano Road within District of North Vancouver jurisdiction to tie in with municipal cycling facilities at Paisley Road. This project would build on the design project currently underway by completing active transportation roads on the section of Capilano Road within the Ministry jurisdiction. This improvement would close the "gap" in existing cycling facilities on Capilano Road. It is noted that a detailed design for active transportation improvements at this interchange has been completed.
- Provide shoulder cycling facilities on the Taylor Way Interchange's ramps and through the ramp terminal intersections to improve cycling connectivity on Highway 1.

Potential Long-Term Improvement:

- The Twin Bridge Structure concept would construct a new bridge over the Capilano River to add new highway lanes between the Capilano River and Taylor Way west-facing ramps. This would improve road safety for the westbound on-ramp and eastbound off-ramp and increase people-moving capacity across Capilano River. It also could support on-corridor transit service (if desired).

Capilano Road Interchange Improvement Concepts, New South Bridge – For Discussion Purposes Only



Taylor Way Interchange Cycling Improvements

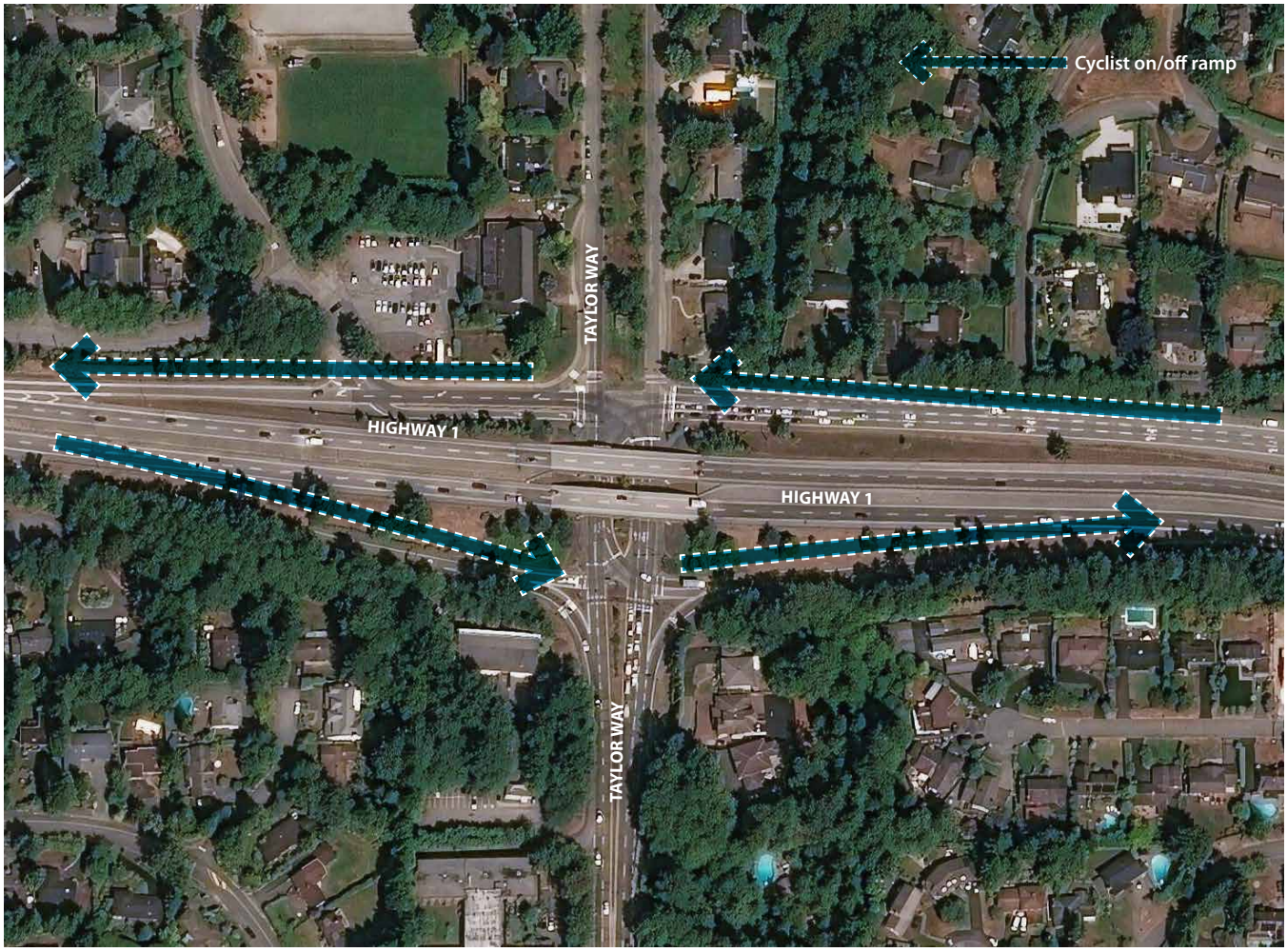
Taylor Way is a key access point for cyclists travelling between downtown Vancouver and Sea to Sky destinations. It is also part of the area of Highway 1 that allows on-highway cycling.

Key Issues to Address:

While cycling is allowed on the highway in this area, the existing interchange lacks cycling facilities at the off-ramps and on-ramps. Instead, people cycling must exit the highway via the off-ramp shoulder, pass through the ramp terminal signalized intersection, and re-enter the highway via the on-ramp shoulder.

This potential project requires further scope definition before proceeding.

Existing Taylor Way Interchange



21st Street and 15th Street Interchanges

The 21st Street Interchange and 15th Street/Cross Creek Road Interchange are a pair of diamond interchanges that serve West Vancouver.

Key Opportunities:

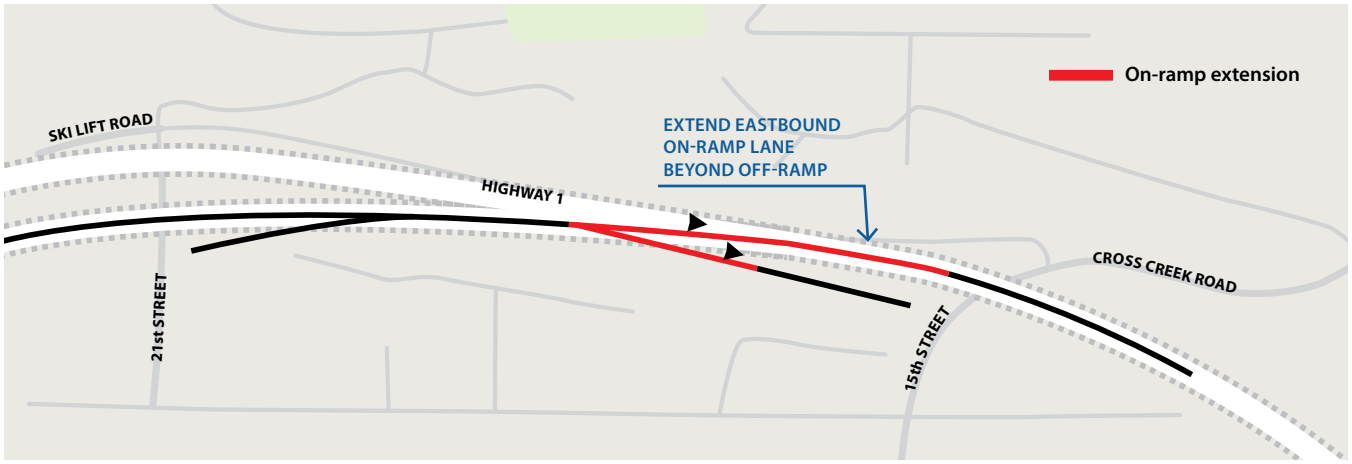
Based on the analysis of volume-to-capacity ratios, the existing interchanges generally function well for both existing and anticipated future conditions. However, the 21st Street and 15th Street interchanges in West Vancouver are spaced only approximately 900 metres apart, and the weaving distance for eastbound movements is only approximately 145 metres. Given this short spacing, weaving operations between the on-ramp of one interchange and the off-ramp of the other interchange can create congestion and safety concerns for on-highway traffic operations.

Potential Short-Term Improvement:

- This smaller-scale improvement would extend the 21st Street Interchange eastbound on-ramp beyond the 15th Street off-ramp to address weaving issues between these two interchanges and help reduce greenhouse gas emissions.

Existing 21st Street and 15th Street Interchanges

21st Street On-Ramp Extension Concept – For Discussion Purposes Only



Westmount Road and Cypress Bowl Road Interchanges

The Westmount Road Interchange and Cypress Bowl Road Interchange are a pair of diamond interchanges servicing West Vancouver.

Key Opportunities:

The Westmount Road and Cypress Bowl Road interchanges were identified as a location for potential improvements primarily in anticipation of future traffic operations challenges stemming from new development along Cypress Bowl Road on the north side of the highway corridor.

The existing Cypress Bowl Road Interchange only provides access to areas on the north side of the highway corridor, including the Cypress Mountain resort, Cypress Provincial Park, developments along Cypress Bowl Road, the municipal operations centre/ works yard, and Mulgrave School. The existing Westmount Road Interchange, with the exception of access to a BC Hydro substation, only provides access to residential areas on the south side of the highway. A steep gated roadway from the Westmount Road Interchange, which runs up to Cypress Bowl Road on the north side of the highway, is not intended for public use.

Existing Westmount Road Interchange

Existing Cypress Bowl Road Interchange

Highway 1 in West Vancouver

This potential improvement concept would upgrade the Westmount Road Interchange to provide improved walking and cycling connectivity across the highway, provide a potential approach for on-corridor transit to service this area (in the event that a transit service to this area is implemented in the future) and provide efficient access to and from new developments on the north side of the highway.

Potential Long-Term Improvement:

- Interchange improvements including new east-facing ramps at Westmount Road Interchange to provide direct access to new development areas, new road connection to Cypress Bowl Road, and widening or replacement of existing bridge structure to provide additional laning and improved multi-modal facilities.

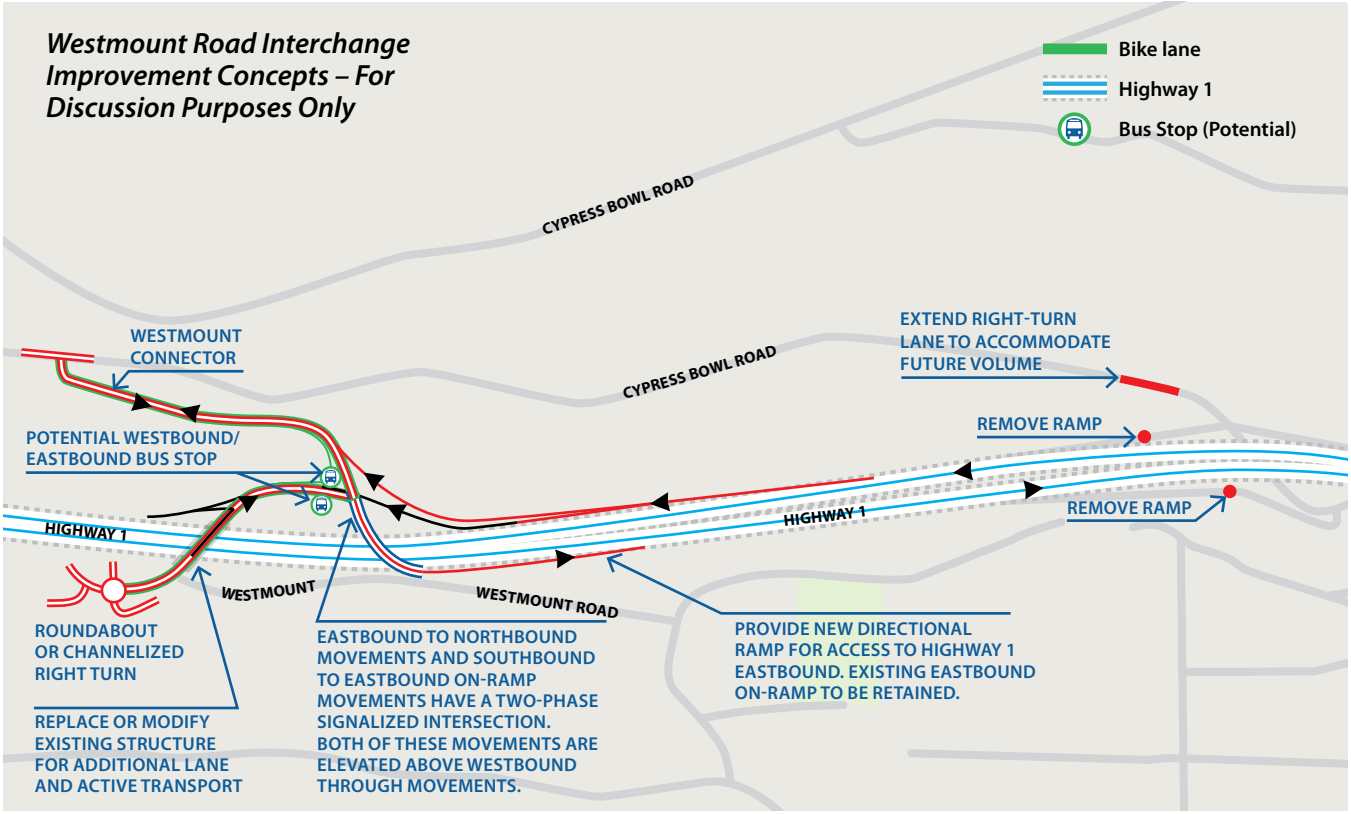
Caulfeild Interchange Westbound Ramp Terminal Intersection Improvements

This split diamond interchange serves as a U-turn route for trips between the Sea to Sky Corridor and the Horseshoe Bay ferry terminal, providing access for southbound Highway 99 travellers to the ferry. It also is the main access route to Rockridge Secondary.

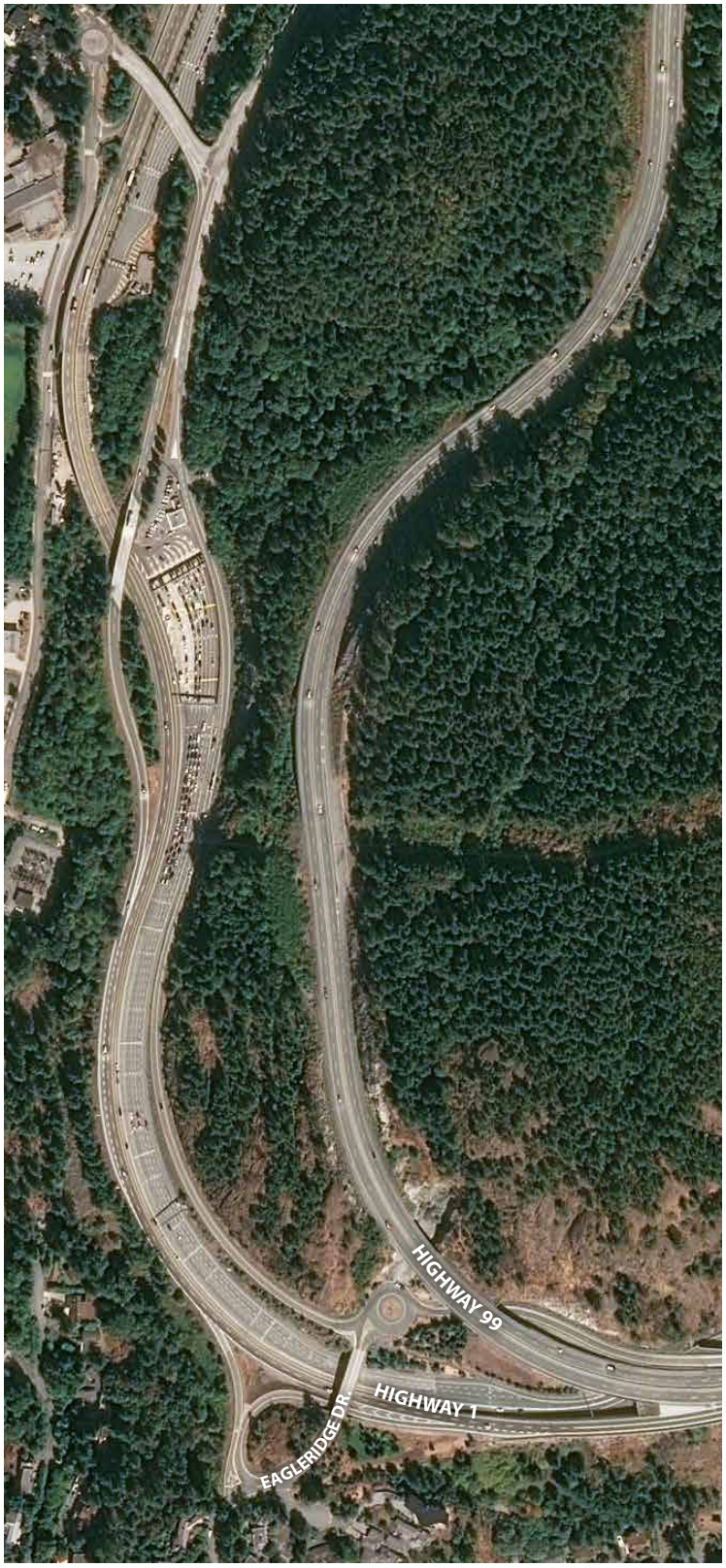
Key Issues to Address:

Identified by stakeholders as an important short-term improvement, the interchange regularly experiences queue spillbacks onto Highway 1 westbound in the morning as people bound for Rockridge Secondary line up to access the school parking and drop-off areas.

While deemed important, this potential project requires further scope definition before proceeding.



Existing Highway Configuration



Highway 99 Sea to Sky/Highway 1 Eastbound Merge

In the Horseshoe Bay area, the Highway 1 mainline through the North Shore (which is also co-signed as Highway 99 beginning at Taylor Way) transitions directly to Highway 99 along the Sea to Sky Corridor. Continuity along Highway 1 occurs via off-ramps and on-ramps to and from the Horseshoe Bay ferry terminal.

Key Opportunities:

In the eastbound direction, peak-day travel demand on ferry capacity is not necessarily a major issue at the Horseshoe Bay Ferry Terminal because this excess demand simply results in sailing waits at the Departure Bay, Langdale and Snug Cove ferry terminals. However, eastbound Highway 99 merging operations with Highway 1 traffic from BC Ferries Horseshoe Bay terminal are challenging.

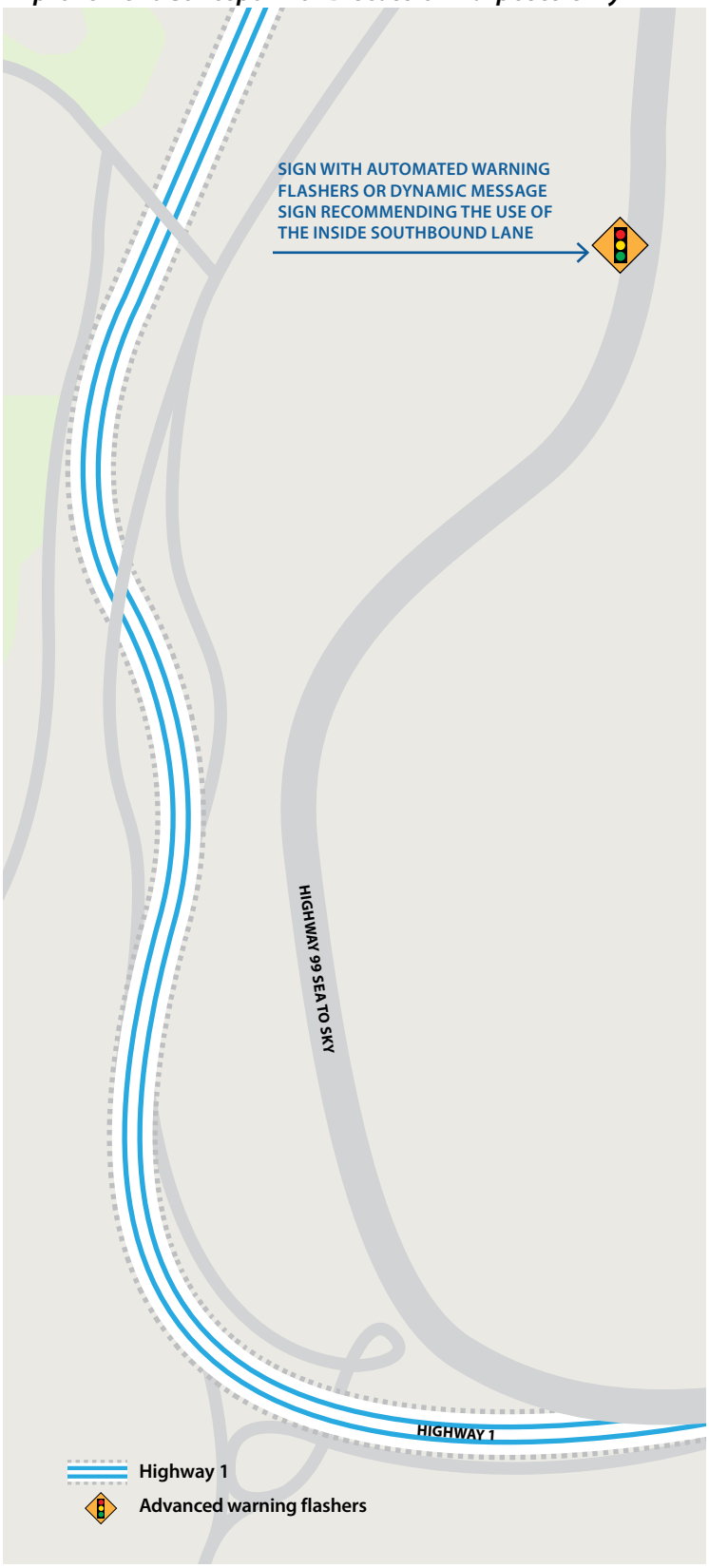
Based on discussions with BC Ferries, no significant increase in overall vehicular volumes is anticipated at this terminal. However, an opportunity for a second exit ramp was identified as part of the Horseshoe Bay Terminal Development Plan, which would better accommodate simultaneous unloading of multiple ferries, that causes higher surge volumes at certain times of the day. In addition to more of these occasional high-intensity surges in the future, volumes on the Highway 99 Sea to Sky Corridor are also anticipated to increase. This is particularly a challenge as peak travel days/times on the ferry tend to also correspond to peak travel days on the Highway 99 Sea to Sky Corridor. Road signs on the Highway 99 Sea to Sky Corridor encouraging traffic to keep right unless overtaking, while generally beneficial for higher operations, creates a condition where vehicles are disproportionately in the right lane near the merge with Horseshoe Bay traffic, which reduces available gaps for ferry traffic to merge.

This smaller-scale potential improvement concept would provide automated warning flashers or dynamic message signage on Highway 99 southbound, upstream of the merge point, to warn users of the surge in ferry traffic volumes, to suggest shifting to the inside lane and to facilitate smoother merging.

Potential Short-Term Improvement:

- Electronic road signs to advise southbound drivers on Sea to Sky of large volumes of merging ferry traffic. This is intended to smooth merging at times of year when both Sea to Sky and ferries have heavy volumes (e.g., summertime).

Highway 99 Sea to Sky/Highway 1 Eastbound Merge Improvement Concept – For Discussion Purposes Only



Next Steps

The Highway 1/99 North Shore Corridor Study: Lynn Valley Road to Horseshoe Bay identifies a range of potential long-term improvement opportunities for the highway corridor in general as well as several key interchanges that the Ministry may consider implementing in the short- to long-term to make the North Shore Corridor more safe, efficient and accessible for all modes of transportation. It also serves as a basis for local and regional transportation agencies to continue their own strategic transportation planning activities.

Additionally, several specific areas of interest have been identified as requiring further consideration, including:

- **On-corridor improvement opportunities** should be considered in conjunction with the findings from the Integrated North Shore Transportation Planning Project (INSTPP) process and follow-up initiatives.
- **For any improvement opportunities involving new transit service,** further work by TransLink is required to validate and further assess the assumptions, feasibility, performance and cost of such a service. The feasibility of continuing the bus-on-shoulder system between Lynn Valley Road and Phibbs Exchange would also need to be confirmed.
- **In the event that plans for either an HOV or additional general-purpose lane** were to advance, further assessment would be required to assess the potential impacts against the generated benefits.
- **The study highlights several opportunities** to improve active transportation connectivity both along and across the highway corridor. Further consideration of the identified active transportation connectivity opportunities by municipal and regional transportation agencies is required to ensure the ongoing development of an active transportation network that provides seamless connectivity and consistent quality of facilities across the North Shore.
- **Coordination with local and regional government agencies** regarding potential interchange improvements is required to help guide transportation and land use/development planning adjacent to the interchanges so that they remain compatible with potential future interchange footprints.
- **For all improvement opportunities** outlined in this report, further development, investigation, engagement and evaluation across a range of financial, transportation, social, environmental, archaeological and economic criteria are required prior to implementation.

Highway 1 at Marine Drive in Horseshoe Bay

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