BRITISH COLUMBIA

Ministry of Transportation and Infrastructure

HIGHWAY 101
GIBSONS TO SECHELT CORRIDOR STUDY

September 2020

PARSONS

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EXECUTIVE SUMMARY

The Highway 101 Gibsons to Sechelt Corridor Study explored options to improve the safety and operations of the corridor. The objective of the study involved the recommendation of short-, medium-, and long-term improvement options to mitigate any identified existing or future safety or operations deficiencies on the corridor. The key study activities therefore involved an assessment of the existing and future conditions and associated deficiencies through engagement with First Nations and stakeholder municipalities, data analysis, and site visits, the generation of potential improvement options, and finally recommendations for implementation based on evaluation of the potential options.

E1 Study Area and Context

Highway 101, also known as the Sunshine Coast Highway, connects the Langdale Ferry Terminal to the Earl's Cove Ferry Terminal and is the only link between the communities on the Sunshine Coast, including the municipalities of Gibsons and Sechelt. The highway is isolated from the provincial highway network by mountains and bodies of water, therefore requiring access to the highway via one of the ferry routes located at each end of the highway corridor.

The study area focuses on the Highway 101 corridor between the Langdale Ferry Terminal and the southern end of Redrooffs Road. In addition to the highway corridor itself, the study area involved a wider area when considering the extent of some potential improvements.

Both highway safety and operations concerns have been documented in previous traffic and planning studies in the area, and local stakeholders have raised concerns about the existing conditions along the highway route. Many of the issues previously raised with Highway 101 relate to its multi-functional role on the Sunshine Coast. At a regional level, the highway acts as the most direct route between the Langdale Ferry Terminal and destinations on the Sunshine Coast, with many road users expecting higher-speed travel with minimal delays. However, in several segments, the highway also acts as the main street for the local community, with residents prioritizing safety for vulnerable road users and access to destinations.

E2 Study Methodology

The study methodology followed a series of technical analysis steps combined with stakeholder and Indigenous Group engagement. In each phase of the project, the technical work was guided by feedback received during the engagement process, and the technical work was in turn shared with local Indigenous groups, namely shíshálh Nation and Squamish Nation as well as with the key stakeholders: the Town of Gibsons, the District of Sechelt, and the Sunshine Coast Regional District.

The study began with a review of the numerous planning studies that have been conducted for various segments of Highway 101 over the past 25 years, the development of the highway role and function definition, and meetings with local Indigenous Groups and municipalities to understand local priorities and concerns with the corridor. Informed by the engagement outcomes and guided by technical analysis, the problem definition was established to understand the existing and forecasted future conditions along the study including the identification of any deficiencies primarily related to safety and traffic operations. The problem definition analysis was shared with the local municipalities for feedback and to inform the generation of corridor improvements.

Corridor improvement options, developed specifically to mitigate the identified existing and future deficiencies, included new passing lanes, intersection improvements, and potential bypasses of short segments of the existing highway. All of the improvement options under consideration were evaluated with respect to their relative benefits and costs as well as identifying any potential impacts. Prior to finalizing the evaluation of the improvement options, the substantive corridor improvement options were reviewed with the affected Indigenous Groups. Recommendations for possible future implementation were based on the feedback received from the engagement activities as well as the results of the technical analysis. Information sessions with the aforementioned stakeholders were held to present the study in its entirety.

E3 Problem Definition

The highway corridor was analyzed to gain an understanding of the current and future conditions and to also identify any underlying issues affecting corridor capacity, operations, and safety. Key findings of the assessment suggest that some segments of the highway corridor currently have above-average collision rates, while the highway and intersections are functioning with good levels of service.

In the 2035 planning horizon, the assessment suggests that while the two-lane highway will have sufficient capacity to address the forecasted traffic volumes, the lack of passing opportunities between Gibsons and Sechelt results in substandard levels of service. Furthermore, turning movements at some signalized intersections are also forecasted to operate at low levels of service.

KEY TRAFFIC PATTERNS

In order to understand the flow of traffic across the study corridor, especially for the investigation of whether a bypass route is warranted, origin-destination (O-D) trip data was analyzed based on two separate data sources: 2016 census journey to work data, and StreetLight data sourced from smartphones and navigation devices. Both data sources show similar travel patterns along the corridor. In the northbound direction, only 13% of the traffic originating from the Langdale Ferry Terminal and West Howe Sound travel as far west as Sechelt. In the Southbound direction, only 8% of the trips originating in Halfmoon Bay and Sechelt continue all the way to Langdale or West Howe Sound.

In summary, both the census and StreetLight data show that the majority of travel on the Sunshine Coast is made up of short-distance trips between neighbouring municipalities, not across the length of the corridor. As a key finding, an alternate route spanning the study corridor would likely attract low traffic volumes.

SAFETY

To assess the safety performance of the Highway 101 corridor between the Langdale Ferry Terminal and Redrooffs Road in Sechelt, a safety analysis was conducted based on collisions that were recorded in the Collisions Information System (CIS) between 2013 and 2017. The safety analysis was conducted at the corridor level, segment level, and intersection level, and an overview of the corridor-wide collision frequencies and collision types are shown in ***Figure E.1*** and ***Figure E.2***.

Figure E.1: Collision Frequency

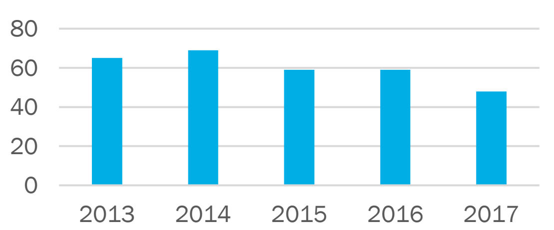
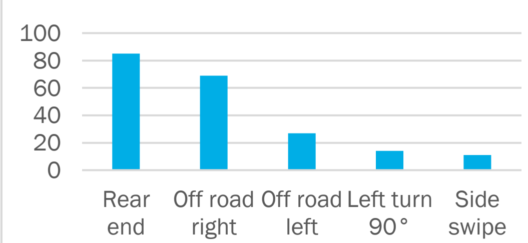


Figure E.2: Collision Types



As the characteristics of the Highway 101 corridor vary between the Langdale Ferry Terminal and Sechelt, the corridor was divided into seven distinct segments. The seven segments were assessed based on collision frequency, collision rate, and collision severity index (CSI) for the five-year period from 2013 to 2017 with traffic volume data obtained from the BC MoTI permanent count station in Roberts Creek. Based on comparisons to provincial averages for similar roadways by service class and volume range, five collision-prone segments were identified in addition to several specific locations where the most collisions were observed.

Collision-Prone Segments:

- Veterans Road to Roberts Creek Road
- Roberts Creek Road to Field Road
- Field Road to Chelpi Avenue
- Chelpi Avenue to Shornecliffe Avenue
- Shornecliffe Avenue to Redrooffs Road

Collision-Prone Locations:

- Lower Road / Highland Road
- Joe Road / Orange Road
- Neilson Road
- Largo Road
- Flume Road / Lockyer Road
- Field Road
- Davis Bay Road
- Bay Road
- Selma Park Road
- Ti'Ta Way
- Shorncliffe Avenue
- Norwest Bay Road
- Hill Road

HIGHWAY LEVEL OF SERVICE

The rural section of the corridor between Gibsons and Sechelt was assessed using both summer and fall volumes from the Roberts Creek count station for performance based on both its volume / capacity ratio and percent time spent following (PTSF). Existing (2018) and forecasted future (2035) volumes are within the capacity of a two-lane highway and four-laning of the corridor is not warranted within the current planning horizon.

The analysis method for two-lane highways from the 2010 Highway Capacity Manual uses PTSF as a measurement for level of service (LOS). The results of the analysis for both the existing and future time frames are shown in ***Table E.1,*** noting that the typical acceptability threshold is LOS D.

Table E.1: Highway Level of Service Analysis Results

From	To	Dir	2018 Summer PM Peak Hr		2035 Summer PM Peak Hr	
			PTSF (%)	LOS	PTSF (%)	LOS
Veterans Road	Roberts Creek Road	NB	79.5	D	94.5	F
Roberts Creek Road	Veterans Road	SB	77.6	D	93.9	E
Roberts Creek Road	Field Road	NB	79.8	D	94.6	F
Field Road	Roberts Creek Road	SB	57.8	C	71	C

With existing (2018) volumes, the results show that the only section and direction of the highway that is not performing at LOS D in the morning, midday, and afternoon peak periods is the southbound segment between Sechelt and Roberts Creek, which is the only segment that has an existing passing lane.

Under the forecasted 2035 volumes, the highway segments without passing lanes are predicted to operate at LOS E and F in the peak periods, due to a lack of passing opportunities. The results of this analysis indicate that improvements to the section of the highway between Gibsons and Sechelt would increase passing opportunities and therefore have a significant impact on the highway level of service in this rural section of the corridor.

INTERSECTION LEVEL OF SERVICE

Because the level of service of the highway in Gibsons, around Roberts Creek, and in Sechelt is governed by the operation of the signalized intersections, the performance of each intersection was analyzed using industry standard intersection capacity analysis software (Synchro) to assess the level of service of the intersection and individual movements.

Under existing conditions, all intersections meet the performance targets and operate under LOS A or B. Under the 2035 forecasted volumes, the westbound left turn at the Wharf Avenue / Dolphin Street intersection in Sechelt operates with unsatisfactory performance with a LOS F in the AM peak hour and LOS E in the PM peak hour.

ACTIVE TRANSPORTATION AND TRANSIT INFRASTRUCTURE

This study identified locations in Gibsons and Sechelt with discontinuous cycling lanes and sidewalks and noted that infrastructure for pedestrians and cyclists along the corridor could be improved along with future road projects. In addition, several locations with insufficient space for buses to safely stop were identified.

PROBLEM DEFINITION SUMMARY

Locations along Highway 101 with deficiencies based on the critical thresholds previously defined for highway performance, intersection performance, and traffic safety in either the existing or future conditions are graphically shown in ***Figure E.3*** and listed below.

- In terms of highway performance, the two primarily rural segments between Field Road and Veterans Road are operating at threshold levels of performance due to the lack of passing opportunities. The segment between Roberts Creek Road and Field Road in the southbound direction includes a passing lane and operates acceptably now and to 2035. Existing and forecasted future volumes are within the capacity of a two-lane highway and four-laning of the corridor is not warranted within the current planning horizon. In addition, the relatively low volume of cross-corridor travel does not warrant the construction of an alternate route or bypass between Langdale and Sechelt.
- While all intersections are operating at acceptable levels under existing conditions, the Wharf Avenue / Dolphin Street intersection was found to have performance deficiencies associated with the westbound left movement under 2035 conditions.
- In terms of traffic safety, five corridor segments were found to be collision prone and thirteen (13) specific locations were identified as having a high frequency of collisions.

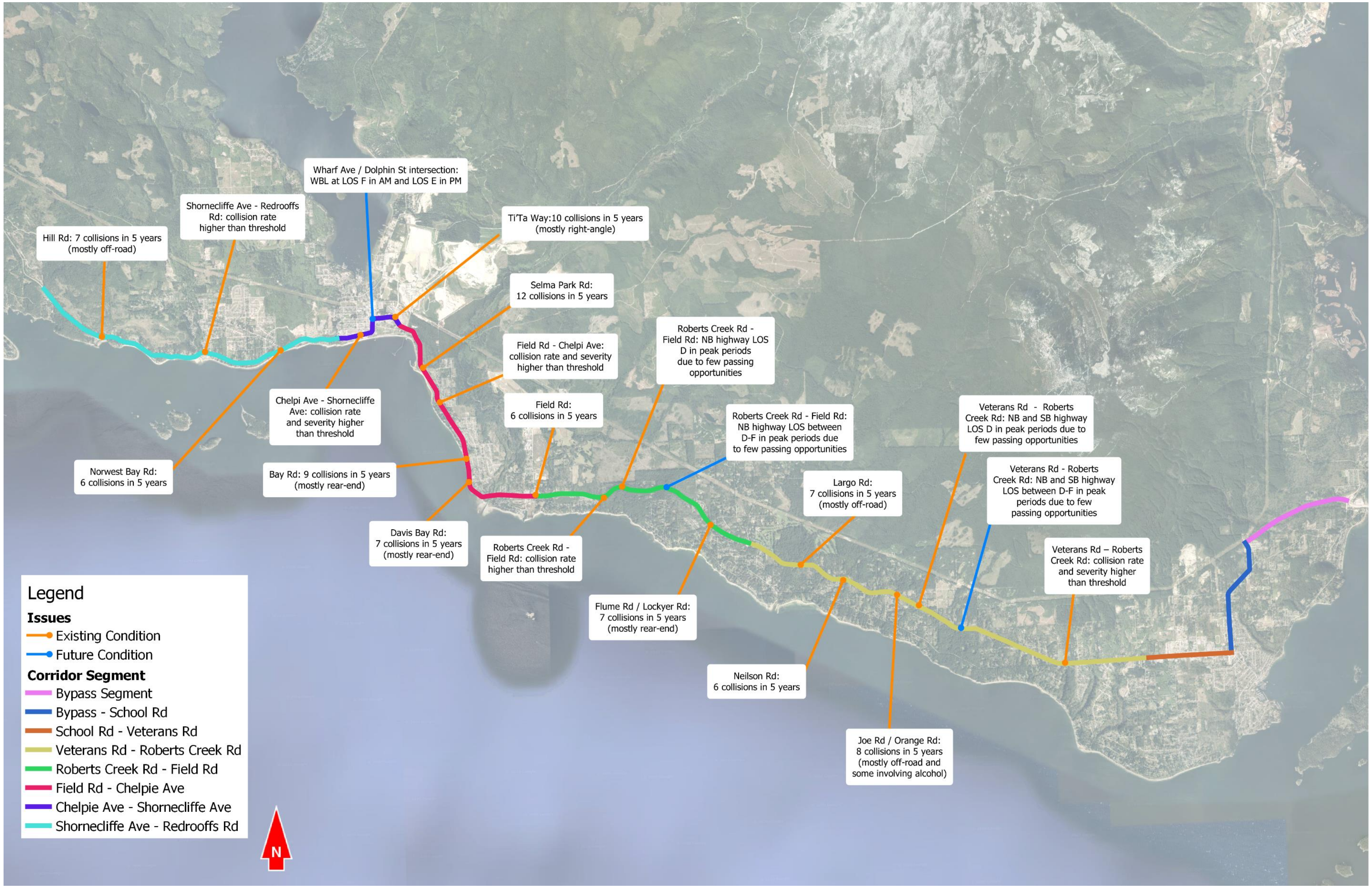


Figure E.3: Summary of Performance and Safety Issues

E4 Option Generation

The potential improvement measures to address these corridor issues identified in the problem definition stage of this study have been separated into three types: passing lanes to address highway level of service issues, intersection Improvements to address capacity and safety issues, and short bypass segments to address intersection capacity and safety issues in the urban area of Gibsons. All of the identified potential improvement options described below and graphically depicted in ***Figure E.4.***

PASSING LANES

To address the highway level of service issues associated with the rural two lane highway section between Gibsons and Sechelt, several passing lane improvement options have been developed:

- **Passing Lane SB-1,** a 1200-metre southbound passing lane extending approximately between Leek Road and Highland Road, identified as Passing Lane SB-1 throughout this report.
- **Passing Lane NB-1,** a 1600-metre northbound passing lane extending approximately between Leek Road and Maskell Road, identified as Passing Lane NB-1 throughout this report.
- **Passing Lane NB-2,** an 1800-metre northbound passing lane extending approximately between Pell Road and Jack Road, identified as Passing Lane NB-2 throughout this report.

The proposed locations for the three potential passing lane options were selected to minimize conflicts with left turn movements that would cross the passing lane segments as well as to minimize the overlap with other intersections and driveways. At this stage of option development, the locations in terms of the actual start and end points should be considered approximate and will likely be adjusted during a future preliminary or detailed design stage once constructability factors such as geotechnical, environmental, and potential property impacts are further investigated.

INTERSECTION IMPROVEMENTS

Based on the results of the problem definition analysis, several intersection locations were identified where improvements could mitigate the traffic operations issues as well as many of the traffic safety issues which were found within the five collision-prone segments or the thirteen collision-prone locations. Improvements at the following locations were developed to address these traffic operations and traffic safety issues.

- Joe Road / Orange Road – add left-turn lanes
- Flume Road – turn restrictions and add left-turn lanes
- Lower Road / Highland Road – add left-turn lanes
- Ti'Ta Way – traffic signal phasing modifications
- Wharf Avenue / Dolphin Street – lane reconfiguration
- Shorncliffe Avenue – traffic signalization and improved channelization
- Hill Road – intersection closure and new Dale Road intersection
- Redrooffs Road – realignment of cross street approaching the intersection

- Davis Bay / Selma Park segment – cross-section upgrade as shown below in ***Figure E.5***, turning restrictions, and turning lanes. As noted above, the collision prone locations associated with the intersections at Davis Bay Road, Bay Road, and Selma Park Road are included as part of these cross section upgrades and intersection improvements.

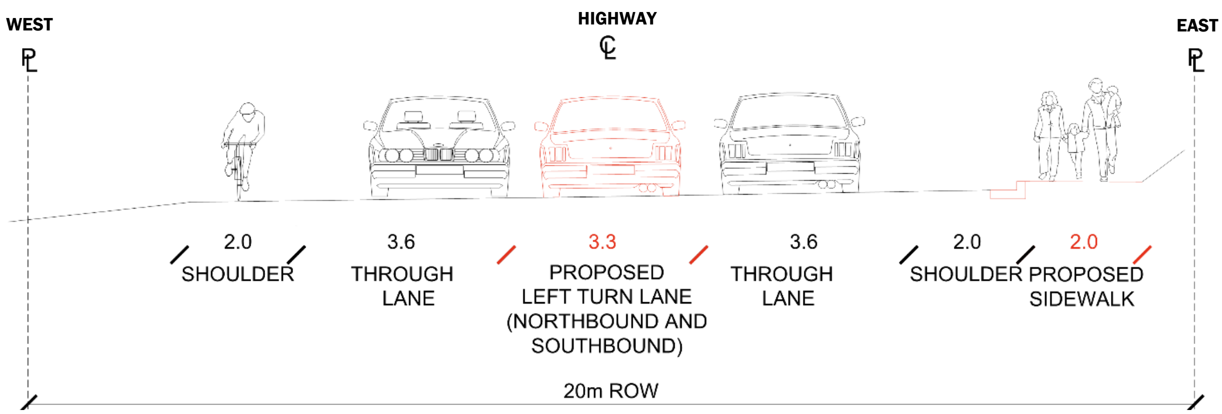


Figure E.5: Proposed Highway 101 Cross-Section in Davis Bay and Selma Park

Due to the diverse range of collision types and the lack of any one collision type being more represented than the others, no mitigation measures were developed at the remaining collision prone locations near Largo Road or Neilson Road, In addition, the collision prone locations near Largo Road and Neilson Road, two rural gravel road connections to Highway 101, are likely related to the immediate segment of highway in the vicinity of the intersections – hence the diverse range of collision types. Similarly, no mitigation measures were developed at the collision prone locations associated with the intersections at Field Road and Norwest Bay Road due to the diverse range of collision types and the lack of over representation of any one collision type.

GIBSONS BYPASS

Three short Gibson bypass options, that would carry through-traffic on an alternative alignment between Langdale and Elphinstone and allow the existing roadway (Gibsons Way) to function as a local access route, were developed as a potential means to improve mobility through Gibsons. The alignments for the three potential bypass options are shown in ***Figure E.4***. However, it is noted that the existing signalized intersections along Gibsons Way are forecast to operate at acceptable levels of service within the 2035 planning horizon, therefore indicating that any potential bypass option is not warranted within this timeframe.

To further defer the need for a potential Gibsons bypass option, minor improvements to several intersections along Gibsons Way are proposed as a means to reduce delays for the highway through movements. Given the significant property constraints related to widening Gibsons Way (Highway 101) through this area, the proposed intersection improvements have been relegated to the side streets and consist of the following components:

- Shaw Road – widening to include a dedicated northbound left turn lane.
- Sunnycrest Road – widening to include a dedicated westbound right turn lane.
- Venture Way / Mahon Road – widening to include a dedicated southbound left turn lane.

Signal timing plan optimization is also recommended at all intersections along Gibsons Way to address the growth in traffic volumes forecasted to 2035.

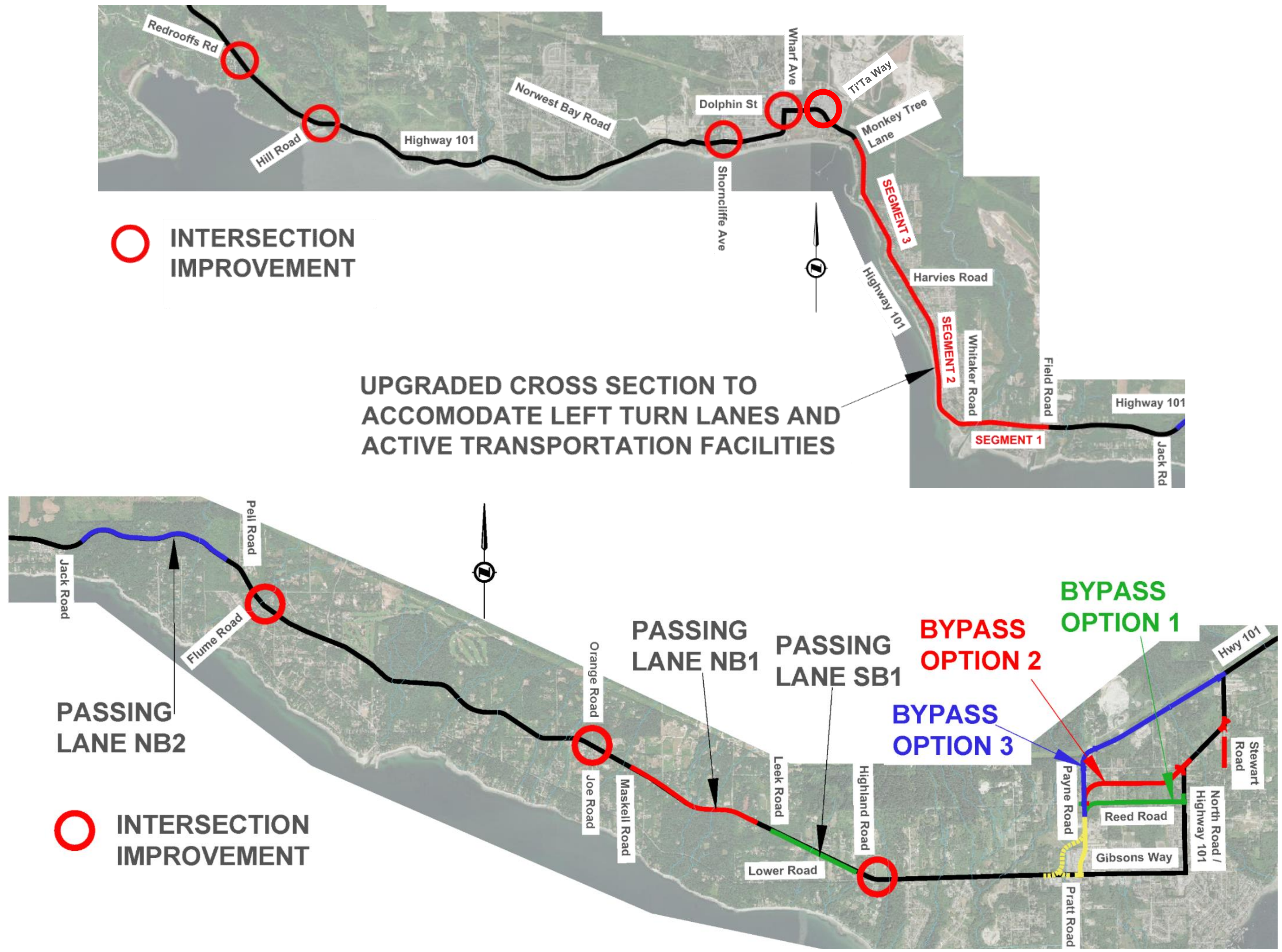


Figure E.4: All Proposed Corridor Improvements Options

E5 Option Evaluation

A set of evaluation criteria was developed to match the scale and location of the improvements being considered, namely, passing lanes, intersection improvements, and short bypasses. A summary of the key results of the option evaluation is presented below for each corridor improvement type.

PASSING LANES

- Passing Lane SB-1, in the segment between Veterans Road and Roberts Creek Road, achieves an acceptable level of service to 2035 with only minor impacts anticipated.
- Passing Lane NB-1, in the segment between Veterans Road and Roberts Creek Road, achieves an acceptable level of service to 2035 with only minor impacts anticipated.
- Passing Lane NB-2, in the segment between Roberts Creek Road and Field Road, achieves an acceptable level of service to 2035 with only minor impacts anticipated. Construction complexity is somewhat higher compared to the other passing lane options.

INTERSECTION IMPROVEMENTS

- The Joe Road / Orange Road intersection improvements can enhance the traffic safety at this location by reducing collisions by 0.8 per year on average with no significant impacts anticipated.
- The Flume Road intersection improvements can enhance traffic safety at this location by reducing collisions by 1.1 per year on average with no significant impacts anticipated.
- The Lower Road / Highland Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.
- The Ti'Ta Way traffic signal phasing modification, to consider a protected left turn phase only, is anticipated to improve the traffic safety at this location given the high amount of right angle collisions.
- The Wharf Avenue / Dolphin Street intersection modifications can improve the operations of the westbound left turn from LOS F and E in the AM and PM peak periods respectively to LOS C with minor impacts to street parking.
- The Shorncliffe Avenue intersection improvements can enhance traffic safety by reducing collisions at this location by 0.5 per year on average with no significant impacts anticipated.
- The Hill Road intersection improvements can enhance traffic safety by reducing collisions at this location by 0.7 per year on average with only minor environmental impacts anticipated.
- The Redrooffs Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.2 per year on average with only minor environmental impacts anticipated.

The multiple intersection and cross section improvements in the Davis Bay and Selma Park sections of the Highway 101 corridor are anticipated to enhance traffic safety by reducing collisions collectively by 6.8 per year on average with no significant impacts anticipated. These sections of Highway 101 also include the collision prone locations associated with the intersections at Davis Bay Road, Bay Road, and Selma Park Road.

GIBSONS BYPASS / GIBSONS WAY INTERSECTION IMPROVEMENTS

The preferred bypass route, of the three alignment options evaluated, was shown to produce significant travel time savings in the long term horizon. However, the preferred option has a significant capital cost and is anticipated to have some environmental impacts as well as property impacts. As noted earlier, consideration for the bypass option is beyond the 2035 planning horizon of this study.

The Gibsons Way intersection improvements, a combination of added lanes at the intersections of Highway 101 with Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road, were assessed and found to produce significant benefits in terms of travel time savings in the medium term for relatively low cost and minimal impacts. Implementation of these intersection improvements would potentially further defer the need for the bypass option.

E6 Recommendations

The outcome of the option evaluation has provided sufficient information to recommend a series of corridor improvements to the segment of Highway 101 between the Langdale Ferry Terminal and Redrooffs Road north of Sechelt. These recommendations will address many of the safety, traffic operations, and active transportation issues identified earlier in the study.

Many of the recommendations stemming from the option evaluation are related to different types of corridor improvements. As such, many of the recommendations are independent of one another. Therefore, the implementation strategy shown below and graphically in ***Figure E.6*** first considers the improvement types in order to identify priorities, and then considers the overall corridor by identifying time frames for potential project implementation:

Short Term Projects:

- Intersection improvements at:
  - Joe Road / Orange Road
  - Shorncliffe Road
  - Lower Road / Highland Road
  - Ti'Ta Way
- Adaptive Signal Control at:
  - Reed Road
  - School Road / North Road
  - Shaw Road
  - Sunnycrest Road
  - Venture Way / Mahan Road
  - Payne Road
- Passing Lane NB-1 (Veterans Road to Roberts Creek Road)

Medium Term Projects:

- Passing Lane SB-1 (Roberts Creek Road to Veterans Road)
- Passing Lane NB-2 (Roberts Creek Road to Field Road)
- Intersection Improvements at:
    - Shaw Road
    - Sunnycrest Road
    - Venture Way / Mahan Road
    - Wharf Avenue / Dolphin Street
    - Flume Road Area
- Davis Bay highway widening and intersection improvements. One package or phased construction:
    - Davis Bay Segment 2
    - Davis Bay Segment 1
    - Davis Bay Segment 3

Long Term Projects:

- Remaining Intersection Improvements not completed in the short or medium terms
- Short Bypass (Gibsons Area) - beyond 2035

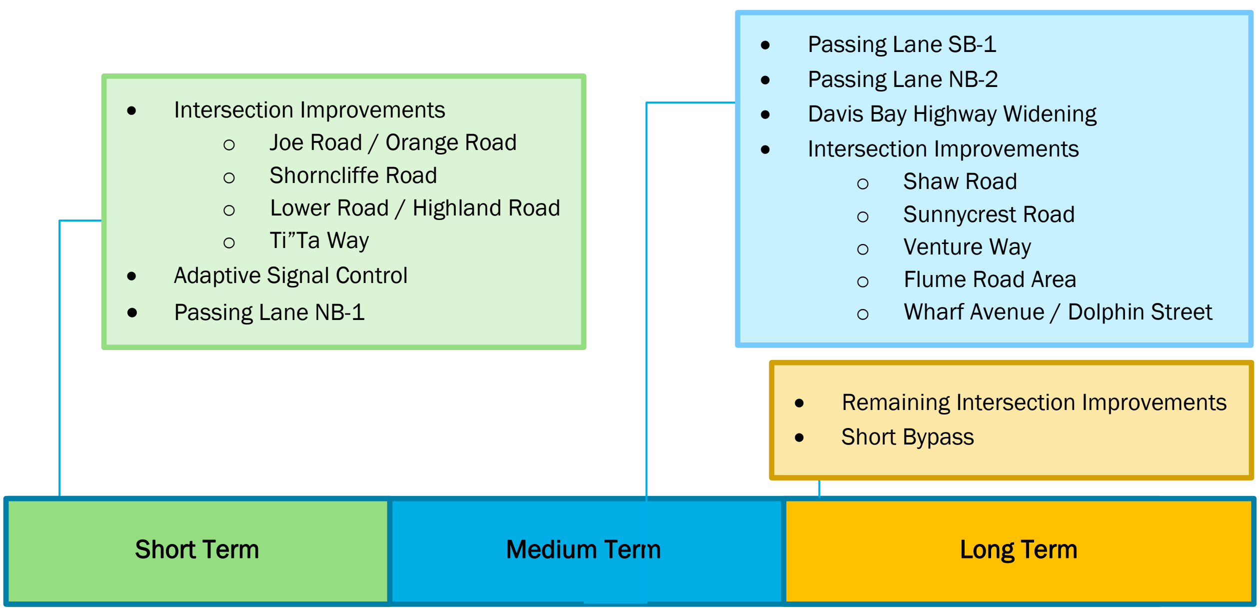


Figure E.6: Implementation Plan and Timeline

1. INTRODUCTION

Highway 101, also known as the Sunshine Coast Highway, connects the Langdale Ferry Terminal to the Earl's Cove Ferry Terminal and is the only link between the communities on the Sunshine Coast, including the municipalities of Gibsons and Sechelt. The highway is isolated from the provincial highway network by mountains and bodies of water, therefore requiring access to the highway via one of the ferry routes located at each end of the highway corridor.

Both highway safety and operation concerns have been documented in previous traffic and planning studies in the area, and local stakeholders have raised concerns about the existing conditions along the highway route. Many of the issues previously raised with Highway 101 relate to its multi-functional role on the Sunshine Coast. At a regional level, the highway acts as the most direct route between the Langdale Ferry Terminal and destinations on the Sunshine Coast, with many road users expecting higher-speed travel with minimal delays. However, in several segments, the highway also acts as the main street for the local community, with residents prioritizing safety for vulnerable road users and access to destinations.

1.1 Study Area

The study area focuses on the Highway 101 corridor between the Langdale Ferry Terminal and the southern end of Redrooffs Road, as shown in ***Figure 1.1***. In addition to the highway corridor itself, the study area may involve a wider area when improvement options are considered in later phases of the corridor study.

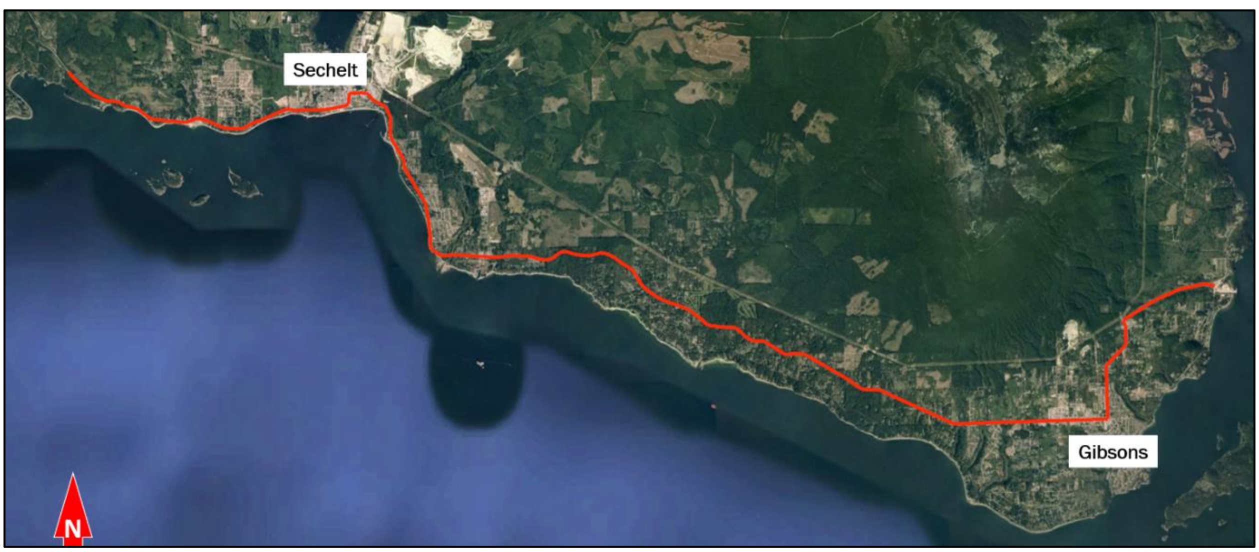


Figure 1.1: Study Area

From south to north, the corridor passes through the West Howe Sound Electoral Area, the Town of Gibsons, Elphinstone Electoral Area, Roberts Creek Electoral Area, District of Sechelt, and shíshálh Nation.

NOTES ON CARDINAL DIRECTIONS

Some previous reports on Highway 101 refer to the highway as an east-west corridor. However, to maintain consistency with previous Ministry of Transportation and Infrastructure (MoTI) documents, this report will refer to the highway as being orientated north-south, with the Langdale Ferry Terminal at the southern end and Redrooffs Road at the northern end of the study area.

1.2 Study Objectives

The objectives of the Highway 101 Corridor Study were as follows, each of which is addressed the sections of this report.

- Assess the existing conditions of the corridor including access, mobility, safety, geometry, structures, drainage, utilities, and environmental.
- Assess the future corridor performance and needs by considering future growth plans. This includes the impact of potential changes to ferry scheduling, seasonal traffic patterns, and local traffic growth.
- Develop a problem definition that characterizes existing and future condition needs assessments related to transportation through the study area.
- Generate options that respond to the problems identified for the short, medium, and long-term horizon.
- Develop an implementation strategy based on the recommendations including, but not limited to, total project cost estimates, phasing, timing, and other dependencies. The strategy will support future corridor needs, including safety, capacity, and reliability improvements, active transportation accommodation, and access management.
- Conduct sufficient engagement with local municipalities, First Nations, and key stakeholders such that there is consensus with the recommendations stemming from the study.

1.3 Study Methodology

The study methodology followed a series of technical analyses steps combined with stakeholder and Indigenous Group engagement. In each phase of the project, the technical work was guided by feedback received during the engagement process, and the technical work was in turn shared with stakeholders, namely shíshálh Nation, Squamish Nation, the Town of Gibsons, the District of Sechelt, and the Sunshine Coast Regional District.

The general methodology undertaken is summarized as follows.

- Because numerous planning studies on the Highway 101 corridor have been completed in the last 25 years, previous reports were compiled and summarized to contextualize the current study.
- The highway role and function were defined.
- Meetings with local indigenous groups and municipalities were held to understand local priorities and concerns with the corridor.

- Informed by the municipal and indigenous engagement, and guided by technical analysis, the problem definition was established to understand existing and forecasted future conditions on the corridor, including the identification of any deficiencies.
- The problem definition analysis was shared with indigenous groups and local municipalities for feedback and to inform the generation of improvement options.
- Improvement options were generated to mitigate the identified existing and future deficiencies, including new passing lanes, intersection improvements, and highway bypasses.
- Through consultations with indigenous groups and technical analysis, the improvement options were evaluated for their relative benefits and costs.
- This report on the evaluation process and study as a whole was prepared.
- Information sessions with stakeholders to present the study in its entirety will be planned for the future.

1.4 Report Outline

The remainder of this report is structured as follows:

- The context of the study is established in Section 2, including a description of Highway 101's role and function and a review of previous studies on the corridor.
- The problem definition is documented in Section 3, including a review of both existing and estimated future conditions and the documentation of existing and future deficiencies on the corridor.
- In Section 4, improvement options that were developed to address the deficiencies identified in the problem definition stage are documented.
- In Section 5, the evaluation framework used to evaluate the prospective improvement options is presented and the option evaluation is documented.
- The report concluded with the recommendations and implementation strategy in Section 6, which builds on the previous sections by recommending a process and timeline for implementing the evaluated improvement options.

2. STUDY CONTEXT

Highway 101 is the only link between the communities on the Sunshine Coast, including the municipalities of Gibsons and Sechelt, and can only be accessed from the rest of the provincial highway network on one of the ferry routes located at each end of the highway corridor. Both highway safety and operation concerns have been documented in previous traffic and planning studies in the area, and local stakeholders have raised concerns about the existing conditions along the highway route. To provide context for the technical analysis, a brief overview of the corridor is provided in this section along with a summary of the findings from several past studies.

2.1 Existing Highway Corridor

Highway 101, also known as the Sunshine Coast Highway, connects Langdale Ferry Terminal to Earl's Cove Ferry Terminal and is the only link between the communities on the Sunshine Coast, including the municipalities of Gibsons and Sechelt. The highway is isolated from the provincial highway network by mountains and bodies of water and vehicles accessing the highway must do so by one of the ferry routes at either end.

Many of the issues with Highway 101 relate to its multifunctional role on the Sunshine Coast. The highway currently acts as the most direct route between the Langdale Ferry Terminal and destinations on the Sunshine Coast, with many road users expecting high-speed travel and low delays. However, in several segments, the highway also acts as the main commercial thoroughfare for the local communities, with residents that prioritize safety for vulnerable road users and access to destinations.

Based on traffic volume data from the Roberts Creek area, vehicle volumes on the highway have been growing steadily for the last several years and have reached approximately 11,000 vehicles per day on average in 2018. Volumes are highly seasonal, with summertime (May – August) volumes typically being 20% - 30% higher than winter volumes, corresponding to an increase in tourism activity. The highway exhibits surges in volumes that correspond to ferry arrivals and departures from the Langdale Ferry Terminal. Surges are more pronounced on the weekend, and during summertime. For the most popular ferry sailing times, southbound surges (i.e. towards the terminal) are distributed over a longer period of time as travellers deliberately arrive at the ferry terminal earlier than normal in order to secure a spot on the next sailing. Smaller vehicles (less than 12.5 metre wheelbase) make up over 99% of all traffic, suggesting the highway is not a major goods movement corridor.

Parallel routes exist along some segments of the highway, although these routes are often fragmented, and do not extend between communities (and sometimes, do not extend through an individual community). As such, the highway is the sole route for connections between communities on the Sunshine Coast, and often also acts as a connection within individual Sunshine Coast communities.

Limited information is available on specific origin-destination trip patterns along the highway corridor. However, 2016 Census Journey to Work data shows that there are approximately 8,500 daily commuting round trips originating on the Sunshine Coast with 89% of these trips destined to a regular place of work on the Sunshine Coast, while the remaining 11% are destined to Metro Vancouver via the Horseshoe Bay Ferry Terminal. Of the approximately 7,500 commuting trips to places of work on the Sunshine Coast, 63% travel in between census subdivisions and are likely to use the highway, while the remaining 37% start and end in the same subdivision and may only use municipal roads. Of the work trips terminating in the Sechelt area, only a very small proportion (less than 10%) are travelling from the Langdale Ferry Terminal or West Howe Sound (i.e. Port Mellon). Similarly, of the work trips terminating at the Langdale Ferry Terminal (i.e. travelling to Metro Vancouver), just under half originate from Roberts Creek or points further west (e.g. Sechelt), however these trips only represent 6% of all trips originating from these areas. Through-trips on the highway (i.e. from Langdale Ferry Terminal to Earls Cove Ferry Terminal) are a relatively small proportion of all highway traffic given the low traffic volumes north of Sechelt. Anecdotally, northbound platoons of vehicles from the Langdale Ferry Terminal have typically dissipated by Redrooffs Road, suggesting that few trips originating at the ferry terminal are travelling beyond Sechelt.

Within urban areas, the highway has a higher density of driveways and connecting roadways and is used to access highway-fronting retail and commercial services. Within Sechelt, the highway also acts as a "Main Street" to support smaller-scale local retail activity, including through the provision of on-street parking.

Although vehicle volumes on the highway are forecast to grow in the future, primarily due to local growth, the types of travel undertaken on the highway are anticipated to remain relatively consistent.

2.2 Role and Function

The terms role and function are often used interchangeably. In assessing the long-term vision for a corridor, the two should be clearly separated. The Role defines the purpose of the highway corridor, for example – a primary trade route, a commuter corridor, etc., while the Function describes how the highway corridor performs and its form (e.g. high-speed limited access, primarily property access, etc.). A corridor like Highway 101 serves many roles, which can be identified through an assessment of current and anticipated future travel patterns. The role first needs to be clearly defined, and priorities placed on the multiple roles, in order to establish the highway function.

Several previous documents characterize the role of Highway 101 in terms of supporting inter- and intra- regional traffic, local community development, and the need to accommodate both private vehicle and sustainable transportation modes. These broad roles are reflective of the current use of the highway but provide minimal guidance in terms of establishing functional objectives. In contrast, other previous studies have established functional objectives for specific study segments or options (e.g. new bypasses), but not necessarily for the highway corridor as a whole.

The role of the province in providing transportation facilities for local and regional travel is a key consideration, particularly given that through traffic is minimal. Traditionally, the province has not considered support of commuter traffic as part of its mandate. However, regionally-generated commuter travel (e.g. Sechelt to Gibsons) is also not the mandate of individual local governments. It is not possible to include connecting communities as part of the provincial mandate yet exclude commuting. Therefore, on the Sunshine Coast, connecting communities, major activity centres and ferry terminals, regardless of trip purpose, is considered within the mandate of the province.

Therefore, the role of Highway 101 is defined as follows:

> ***The primary role of Highway 101 along the Sunshine Coast is to connect Sunshine Coast communities to one another. The secondary roles of the highway are to connect communities to the BC Ferries system in order to provide access to regional / provincial activity centres and other provincial highways, and to provide intra-community connections and access to destinations within communities.***

By identifying connecting communities and activity centres as the primary role, the broad functional objectives to support this include:

- **Mobility** – travel times between communities should be minimized, with some delays accepted through urbanized areas to support strategic access to the communities.
- **Access** – direct access from private properties onto the highway should be avoided wherever feasible, with strategic access to communities and major activity centres of regional / provincial significance via major municipal streets.
- **Network Hierarchy** – the highway should be supported by local streets to provide access to properties, serve intra-municipal local trips and connect to and across the highway without significantly impacting on highway operations.
- **Transit** – the highway should support BC Transit services and enable the provision of appropriate infrastructure at transit stops along the corridor.
- **Cycling** – safe, continuous and direct cycling opportunities should be provided within the corridor or via an adjacent corridor.
- **Pedestrians** – convenient and comfortable crossing opportunities should be provided between key origins and destinations along the corridor such as transit stops and urban areas, and pedestrian facilities should also be provided along the corridor within urban areas.

2.3 Background Reports

Multiple related engineering studies have been conducted in the last 25 years to assess operational and safety improvements to the existing road network on the Sunshine Coast. This section provides a high-level overview of those studies to place the current study in the context of past recommendations, previously identified issues, and other corridor constraints.

Many of the previous studies have focused on the development of a new route north of the existing Highway 101 alignment, but some have proposed improvements to the existing highway. Four of the studies summarized below focus exclusively on the portion of the study area within Gibsons, two concern the portion from Pine Street to Halfmoon Bay, and two cover the whole area of the current study. The studies summarized in this section are organized by topic as follows and summarized in the following subsections.

- Previous Studies on the Gibsons Bypass
- Previous Studies on the Pine Street – Halfmoon Bay Realignment
- Other Previous Studies

2.3.1 Previous Studies on the Gibsons Bypass

GIBSONS BYPASS EXTENSION STUDY (R.F. Binnie & Associates Ltd., 1995)

This study evaluated seven different Bypass alignments between Stewart Road and Conrad Road in Gibsons and a preferred option was identified because of its utilization of land within the B.C. Hydro Right of Way, less costly connection to Payne Road, less severe topography, and less impact on developed properties, the community, and the environment. The option follows the alignment identified in the detailed design by Crippen Consultants between Stewart Road and Gilmour Road.

GIBSONS BYPASS FUNCTIONAL REVIEW (Stanley Consulting, 1998)

This study reviewed the construction of ferry terminal improvements, referred to as Phase 1 of the Gibsons Bypass, and construction of the Bypass from the ferry terminal to Stewart Road, Phase 2. The study concluded that project objectives were achieved, and the Bypass provided improved traffic operations, but the Province did not achieve a positive return on investment between 1995 and 2002. However, a positive return on the investment was projected to 2022. The report also projected a positive return on investment of the Bypass extension, Phase 3 of the Bypass, if it was constructed beyond 2002.

GIBSONS BYPASS EXTENSION PLANNING & DESIGN STUDY (R.F. Binnie & Associates Ltd., 2006)

This study followed up on the 1995 Bypass extension report with new municipal engagement with the Town of Gibsons and the Sunshine Coast Regional District, new data collection, and further conceptual design to identify a new preferred option for the Gibsons Bypass extension. Updated topographical data for the area collected in 1999 was used to develop concepts, including the preferred option developed by Binnie in 1995. The improved digital elevation model indicated that construction costs due to earthworks would be significantly higher than originally calculated and prohibitively costly. As a result, a “Lowerline” alignment was developed as the new preferred option with the Bypass running along the north side of Cemetery Road between Henry Road and North Road.

A benefit cost analysis was conducted by Apex Engineering for this study, calculating a benefit-cost ratio of 1.7, with significant benefits generated by travel time savings. However, the report also included an Economic Analysis Update that used updated and more stable growth projections prepared by the B.C. Ministry of Transportation that determined that a positive NPV was not likely for the Bypass extension and calculated the benefit-cost ratio to be less than 1 in most sensitivity scenarios.

2.3.2 Previous Studies on the Pine Street – Halfmoon Bay Realignment

SUNSHINE COAST REGIONAL HIGHWAY STUDY (R.F. Binnie & Associates Ltd., 1996)

The 1996 study identified alternative alignments for a proposed future highway on the sunshine coast from Pine Street to Trout Lake in Halfmoon Bay. The options and their evaluation results were presented to shíshálh Nation, the District of Sechelt, and the Sunshine Coast Regional District for comments. Comments from the Sechelt Indian Band were not received for the 1996 report.

Based on results of the evaluation criteria and comments from the District of Sechelt and the Sunshine Coast Regional District, a preferred alignment was identified in the report. This study was left in draft form because although the above preferred option was identified in the report, the alignment was not accepted by shíshálh Nation, and the District of Sechelt had issues with the alignment of the preferred option within the Sechelt core.

SUNSHINE COAST REGIONAL HIGHWAY STUDY (R.F. Binnie & Associates Ltd., 1998)

After the 1996 report was published, it was determined that the relocation of the Construction Aggregates plant in the gravel pit required by the preferred alignment would be prohibitively costly. Consequently, a new report was published in 1998 that revisited Section 2 and Section 3 of the original alignment to avoid the gravel pit area and instead utilize the B.C. Hydro Right of Way through shíshálh Nation #2. The report indicated that the updated alignment would have greater probability of gaining support and being accepted by shíshálh Nation than one requiring a new right of way, and the alignment was considered feasible from a technical, property, and environmental perspective by B.C. Hydro, the Ministry of Environment and the Department of Fisheries.

2.3.3 Other Previous Studies

HIGHWAY 101 SAFETY AND OPERATION REVIEW (Urban Systems, 2007)

This review identified safety and operational issues along Highway 101 between North Road in Gibsons and Redrooffs Road in Sechelt. To address these issues, capital improvements to the corridor were identified and a multiple account evaluation and life-cycle cost-benefit analysis were conducted for each identified improvement. The analysis concluded that the following projects would have a benefit-cost ratio of greater than 1, but noted that the cost estimates did not include property acquisition:

- Two cross-section improvement options in Gibsons between North Road and Payne Road / Pratt Road;
- A westbound passing lane between Lower Road and Conrad Road;
- Left-turn lanes at the Joe Road / Orange Road intersection;
- Left-turn lanes, shoulders, and a sidewalk in the Davis Bay and Selma Park area;
- Three alternative highway routing options within the core area of Sechelt; and
- Signalization of the Norwest Bay Road intersection.

Of all the projects, the highest benefit-cost ratio was calculated for the signalization of the Norwest Bay Road intersection because of the relatively low cost and significant travel time savings benefits.

Left turn lanes at the Flume Road / Lockyer Road intersection were also evaluated but found to have a benefit-cost ratio of less than 1.

GIBSONS CORRIDOR COLLISION ANALYSIS (Opus International, 2011)

This analysis reviewed ICBC collision data on Highway 101 following the alteration of laning configuration on Highway 101 in Gibsons between North Road and Pratt Road / Payne Road. The alterations included a reduction of travel lanes from four to two and the addition of left-turn lanes, bus bays, and bike lanes.

Collision data showed an overall 14.6 percent reduction in the average monthly collision rate after the reconfiguration compared to the seven-year period preceding the reconfiguration. In addition, collision types were examined, and it was found that rear-end and single-vehicle collisions increased as a portion of total collisions after the reconfiguration, while all other types decreased. A spatial analysis was conducted and found that while some locations observed a decrease in monthly collision rate after the reconfiguration, some locations observed an increase. An economic analysis, using the value of different collision types, calculated that the cost of collisions increased following the reconfiguration due to the increase in injury-type crashes. However, this increase fell within a range that has been observed in previous years.

The study noted that it was limited by not having collected traffic volume data before and after the laning reconfiguration, and that changes in collision rates could be due to a change in observed traffic volumes.

INTEGRATED TRANSPORTATION STUDY (ISL Engineering, 2011)

This was a comprehensive study prepared for the Sunshine Coast Regional District that identified regional issues with the transportation network between Langdale and Earl's Cove. The Integrated Transportation Study investigated all aspects of the Sunshine Coast transportation system, including intersection geometries, alternative routes, urban congestion, the need for bypasses, active transportation, transit, air and ferry transport, emissions, and communications. The report acknowledged the complexity of the regional transportation issues in the area because of the many stakeholders involved and the competing priorities of the Highway 101 corridor for regional travel and local access.

The study also included the development of an Integrated Transportation Plan to address the identified issues, with a focus on short-term, implementable, and cost-effective recommendations including alternative highway routes, upgraded intersection, active transportation infrastructure, and other policies.

3. PROBLEM DEFINITION

As part of the Highway 101 Corridor Study, the highway corridor was analyzed to gain an understanding of the current and future conditions and to also identify any underlying issues affecting corridor capacity, operations, and safety. The purpose of this section is to summarize the assessment of the highway corridor including a description of the data used, the analysis methodologies, and the key assumptions. The section also summarizes the findings of the analysis and documents any issues that have been identified.

3.1 Corridor Segmentation

Many of the challenges associated with the Highway 101 corridor are related to the variation in highway cross-section and surrounding land uses throughout the study area. To describe the characteristics of the overall highway corridor, the highway was divided into several relatively homogenous segments. The characteristics of each segment are shown in ***Figure 3.1*** and described below, from south to north.

Figure 3.1: Corridor Segmentation

BYPASS SEGMENT

The highway segment between the traffic signal at the Langdale Ferry Terminal and the Stewart Road intersection with the ferry terminal bypass is characterized by a four-lane cross-section including paved shoulders and an 80 km/h speed limit. There are no driveways, intersections, or sharp turns within this segment, but the grade at approximately 7.2% is significant.

BYPASS – SCHOOL ROAD

This rural segment has a two-lane cross-section and a 50 km/h speed limit. The highway has a rural cross section with paved shoulders and open ditches north of Reed Road, but consists of an urban cross section with curb, gutter, and sidewalks south of Reed Road. On-street parking and a high density of private accesses / driveways are present on this segment of the corridor.

SCHOOL ROAD – VETERANS ROAD

The segment through the commercial area of upper Gibsons has an urban cross-section and 50 km/h speed limit, with one through-lane in each direction divided by alternating left-turn bays. A painted bicycle lane / shoulder is located on each side between Sunnycrest Road and Pratt Road / Payne Road, plus curb, gutter, and sidewalk. Within this segment, there are five signalized intersections which are accompanied by a high density of private accesses / driveways.

VETERANS ROAD – ROBERTS CREEK ROAD

The segment between the Town of Gibsons and Roberts Creek has a two-lane rural cross-section, a speed limit of 80 km/h, and a low density of intersecting roads and private accesses / driveways.

ROBERTS CREEK ROAD – FIELD ROAD

Like the previous segment, this segment of highway between Roberts Creek and the District of Sechelt has a two-lane rural cross-section, a posted speed limit of 80 km/h, and a low density of intersecting roads and driveways.

FIELD ROAD – CHELPI AVENUE

The highway segment through the District of Sechelt varies as it travels from Davis Bay, through Selma Park, and then the shíshálh Nation. The Davis Bay section has on-street or surface-lot parking on either side of the highway and a marked cross walk at Westly Road and another adjacent to the pier. Through Selma Park and the shíshálh Nation, the cross-section is rural, however, the density of private accesses / driveways and intersecting roads is high. The posted speed through the overall segment is 50 km/h.

CHELPI AVENUE – SHORNCLIFFE AVENUE

The highway segment through downtown Sechelt is characterized by the adjacent commercial land use and mix of on-street angle parking, parallel parking, and access to surface lots. The section between Chelpi Avenue and Wharf Avenue consists of a four-lane cross section with left turn bays (two-sway left turn lane). North of Wharf Avenue, the highway consists of a two-lane cross section with parallel parking on either side. There are four signalized intersections located within the segment with several other unsignalized intersections with stop control on the side streets. The segment also contains three marked crosswalks and one pedestrian-activated traffic signal. The posted speed limited through this segment is 50 km/h.

SHORNCLIFFE AVENUE – REDROOFFS ROAD

The most northernly highway segment in the study area has a rural two-lane cross section. The posted speed limit is 50 km/h east of approximately McCourt Road, and 60 km/h west to the end of the segment. The density of driveways is relatively high compared to the rural segment between Gibsons and Sechelt.

3.2 Assessment Criteria

In order to assess the performance of the highway, several assessment criteria were identified including:

- Highway Level of Service (LOS)
- Intersection Level of Service (LOS)
- Traffic Safety
- Active Transportation Infrastructure Gaps
- Geometric Issues
- Transit Facilities

A brief description of each assessment criteria is provided below in terms of the general methodology and data inputs.

HIGHWAY LEVEL OF SERVICE

The rural sections of Highway 101 between Gibsons and Sechelt were analyzed using the methodology for two-lane highways described in the 2010 Highway Capacity Manual. Traffic data for the analysis will be taken from a combination of BC MoTI permanent count and short count stations. Aerial photos were referenced for geometric data. The level of service of each rural segment and its associated metric namely, percent time spent following, were calculated, with LOS D representing the threshold for satisfactory performance.

The highway was analyzed for the morning, mid-day, and afternoon peak periods in both the summer and fall seasons. Estimated traffic growth rates were applied to determine projected traffic volumes in the year 2035 and the analysis was repeated for this future horizon year.

INTERSECTION LEVEL OF SERVICE

Because the level of service of the highway in Gibsons, Sechelt, and around Roberts Creek is determined by the operation of the signalized intersections, the performance of those intersections was assessed using industry standard intersection capacity analysis software (Synchro). Lane volumes downloaded from the traffic signal controllers were used in the assessment, and volume-to-capacity ratios were calculated for each approach in addition to lane, approach, and intersection levels of service. A LOS D or volume-to-capacity ratio of 0.9 is used as the threshold for satisfactory performance. These metrics were calculated for the morning, mid-day, and afternoon peak periods.

Existing intersection level of service was assessed using the most recently downloaded loop detector data, and 2035 volumes were estimated using average growth rates of each peak period.

TRAFFIC SAFETY

The safety of each segment of Highway 101 was assessed based on Collisions Information System (CIS) data from the last five years. Recorded collision rates and severity were compared to that of comparable highways around the province, and segments with rates and severity beyond thresholds were identified as having potential safety issues.

In addition to the safety analysis at the segment level, individual intersections and highway curves with a high number of historic collisions were also identified as potential safety issues.

ACTIVE TRANSPORTATION INFRASTRUCTURE GAPS

The completeness and continuity of the active transportation infrastructure was assessed using aerial photos and observations made from site reconnaissance. Gaps in sidewalks and bike lanes between origins and destinations frequented by pedestrians and cyclists were identified.

GEOMETRIC ISSUES

The highway geometry was assessed using the Interactive Highway Safety Design Model (IHSDM) software. IHSDM analyzes the highway alignment and cross section to identify deficiencies in the cross section, horizontal alignment, vertical alignment, and sight distances. Highway segments flagged for geometric improvements were identified.

TRANSIT FACILITIES

The quality of facilities to support transit, including bus stop and shelters, and routes to and from bus stops were assessed using aerial photos and observations made from site reconnaissance.

3.3 Existing Conditions

This section of the report documents the assessment of the highway under existing conditions and traffic volumes. A full description of the existing traffic volumes and patterns using the highway is followed by the assessment of the highway using the previously mentioned assessment criteria.

3.3.1 Existing Traffic Volumes and Patterns

A description of the traffic volumes and key traffic patterns using the highway are provided in terms of the traffic volumes at the key intersections, the permanent traffic count station located approximately midway along the study corridor, ferry traffic patterns at the Langdale Ferry Terminal, and journey to work information extracted from the latest census.

TRAFFIC VOLUMES AT INTERSECTIONS

Because the level of service of the highway in Gibsons, near Roberts Creek, and in Sechelt is governed by the operation of signalized intersections, their performance was analyzed using Synchro. The analysis of intersection level of service relied on loop detector data downloaded from traffic signals in summer or fall 2018 or spring 2019. Historical turning movement data collected for the 2011 Integrated Transportation Study and the 2007 Highway 101 Safety and Operational Review was used to estimate the proportion of traffic making each movement in shared lanes with multiple turning movements. This relies on the assumption that the proportion of traffic in shared lanes making each turning movement has remained constant since 2007 or 2011, and that these proportions remain constant throughout the day. These assumptions are required given the lack of recent turning movement counts in the study area, and the results derived from them are a preliminary analysis into the operation of the signalized intersections.

Because traffic controller download data was only available for a single two-week period, a comparison of summer and fall conditions is not possible for the intersection level of service. In addition, because summer typically represents the worst-case for conditions on Highway 101, intersection analysis relying on data from the fall and spring, as shown ***Table 3.1***, may not be conservative.

Table 3.1: Turning Movement Data Collection Dates

Intersection	Data Collected	Season
Wharf Ave / Dolphin St	March 2019	Spring
Ti'Ta Way (Sxwelatp)	March 2019	Spring
Field Rd	March 2019	Spring
Roberts Creek Rd	March 2019	Spring
Payne Rd and Pratt Rd	March 2019	Spring
Venture Way and Mahan Rd	August 2018	Summer
Sunnycrest Rd	August 2018	Summer
Shaw Rd	August 2018	Summer
School Rd	September 2018	Fall
Reed Rd	March 2019	Spring
Port Mellon Hwy and Marine Dr	March 2019	Spring

Turning movement volumes at all signalized intersections in the study area for which download data was available are shown in ***Figure 3.2*** to ***Figure 3.4.***

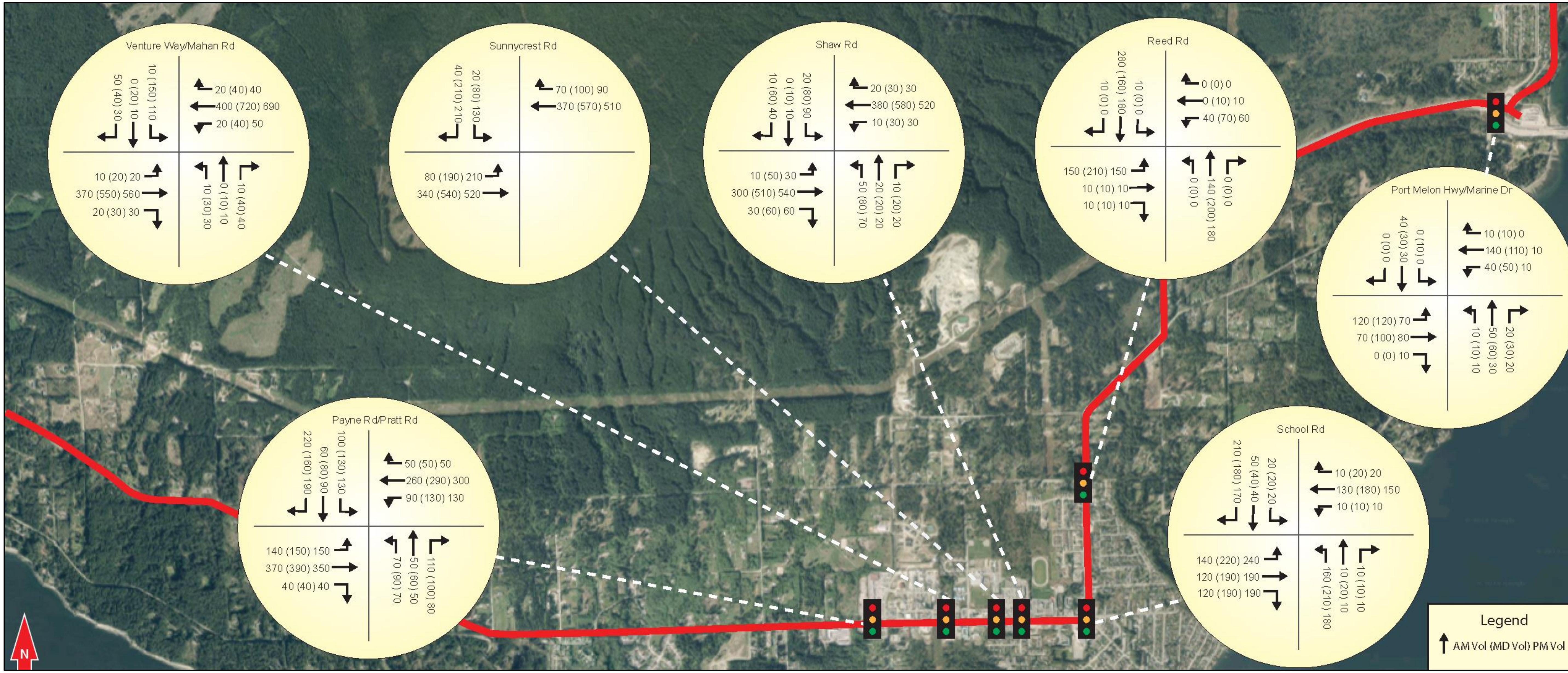


Figure 3.2: Turning Movement Volumes at Signalized Intersections - West Howe Sound and Gibsons – 2018/19

PARSONS

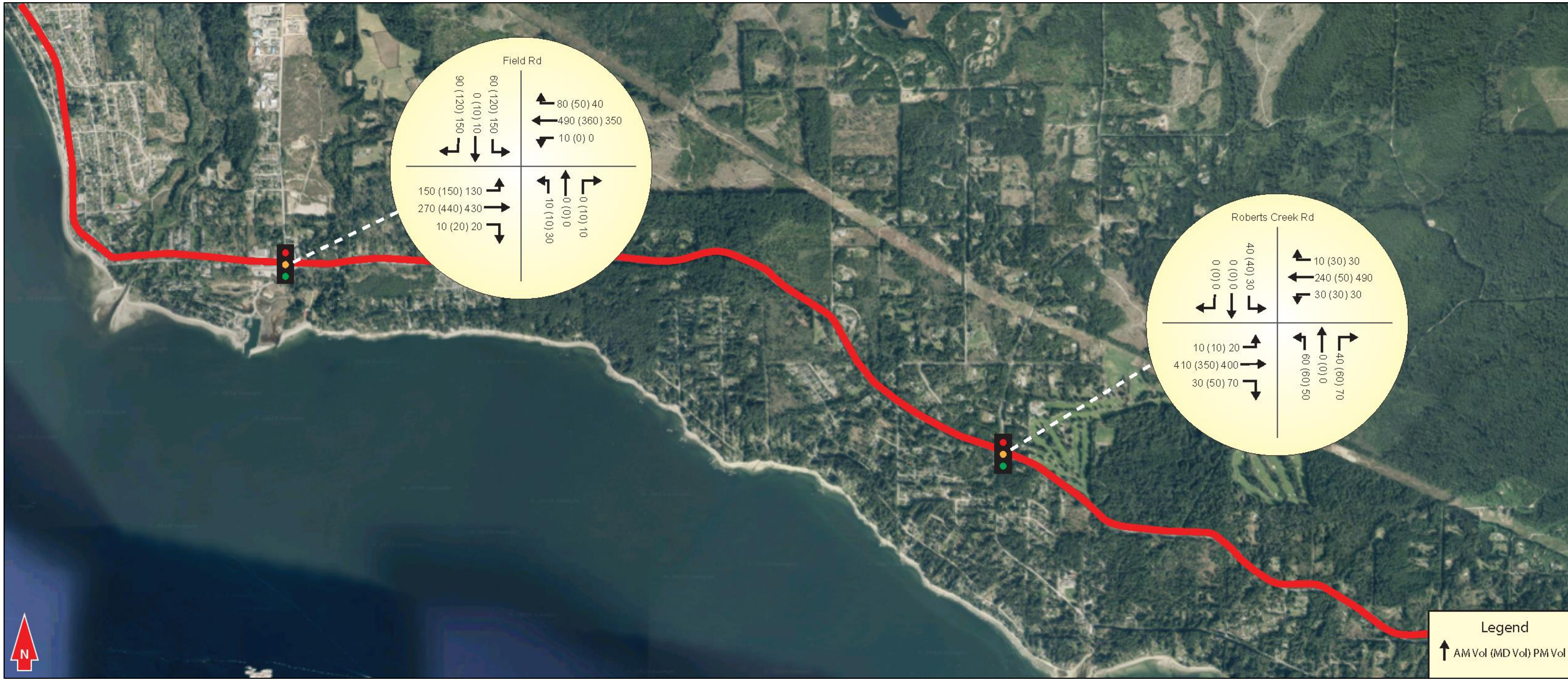


Figure 3.3: Turning Movement Volumes at Signalized Intersections - Roberts Creek and Sechelt – 2018/19

Figure 3.4: Turning Movement Volumes at Signalized Intersections - shíshálh Nation and Sechelt – 2018/19

PERMANENT COUNT STATION

To gain an understanding of traffic volumes and patterns on the Highway 101 corridor, an analysis was conducted using hourly traffic volume data collected by the permanent count station P-15-7NS located near Roberts Creek Road. Data was provided by BC MoTI for the year 2013 to 2018, inclusively. The annual average daily traffic (AADT) by year is depicted in ***Figure 3.5*** below. Traffic volumes increased steadily over the last six years at an average annual growth rate of 2.9%.

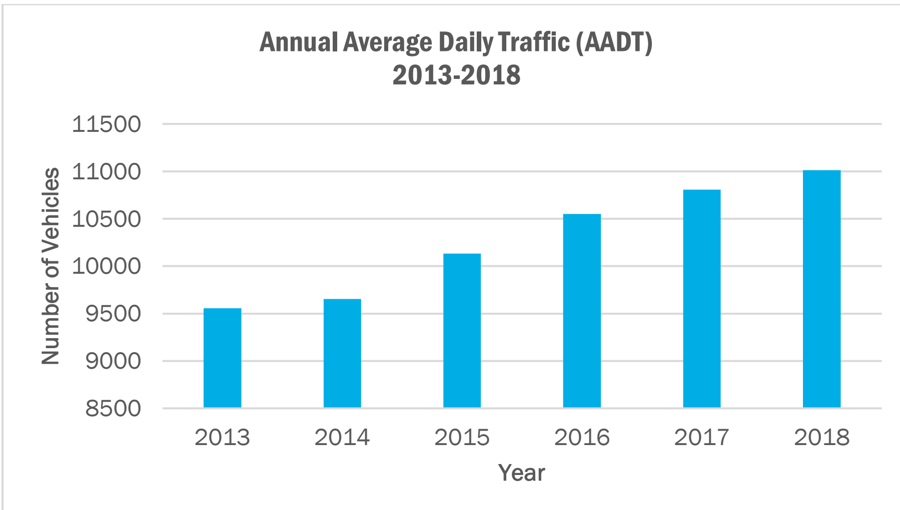


Figure 3.5: Annual Average Daily Traffic Volumes 2013 – 2018

On a monthly basis, August was observed to have the highest monthly average daily traffic volumes, as shown in ***Figure 3.6*** below, reaching approximately 12,800 vehicles on average in 2018.

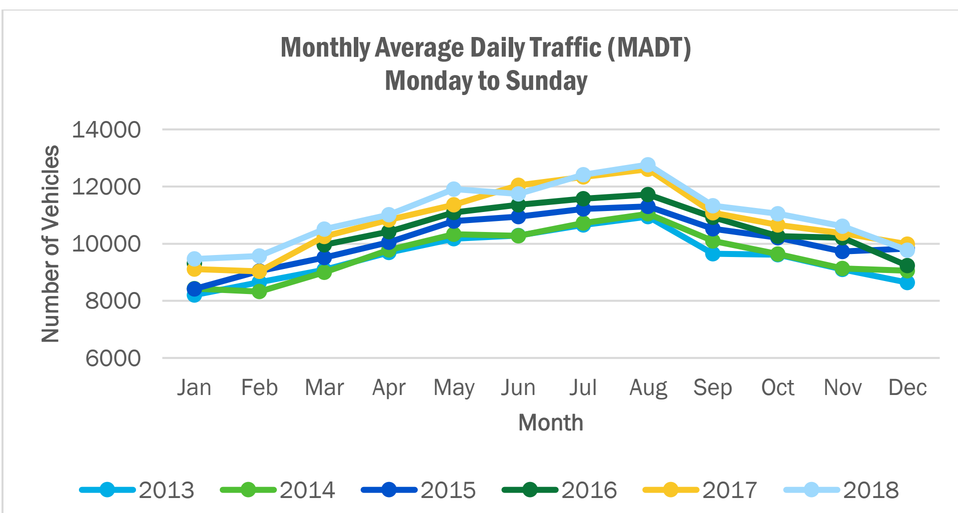


Figure 3.6: Monthly Average Daily Traffic Volumes (Monday to Sunday) 2013 – 2018

To understand seasonal traffic patterns, the hourly traffic volume data was examined under both summer and fall conditions. As ferry traffic contributes to volumes along Highway 101, ferry schedules were considered in the subsequent analysis. BC Ferries operates Route 3 between Horseshoe Bay in West Vancouver and Langdale on the Sunshine Coast, with a crossing time of approximately 40 minutes. The distance between the Langdale Ferry Terminal and the permanent count station in Roberts Creek is approximately 15 km, with a travel time of about 15 minutes under uncongested traffic conditions.

SUMMER CONDITIONS

The average hourly traffic volumes for Friday (the day of the week with highest average volumes) in August are shown in ***Figure 3.7*** and ***Figure 3.8*** below for the northbound and southbound directions, respectively.

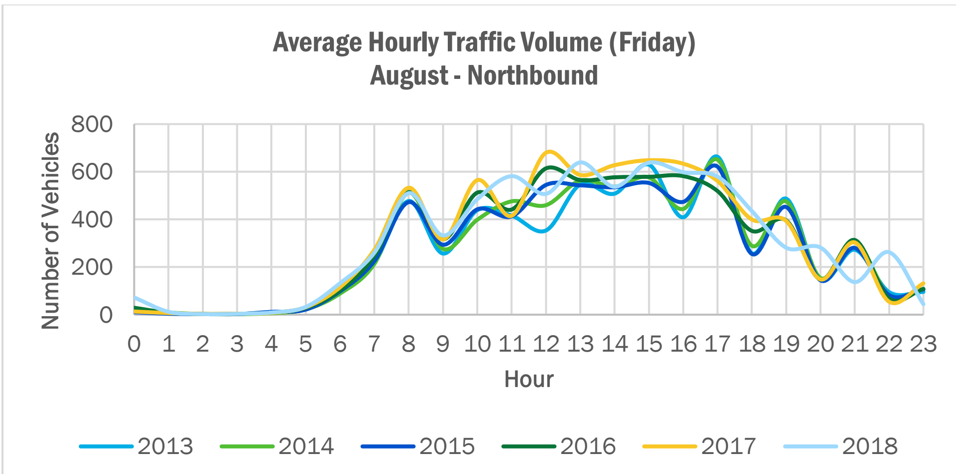


Figure 3.7: Average Hourly Traffic Volumes (Friday), August – Northbound

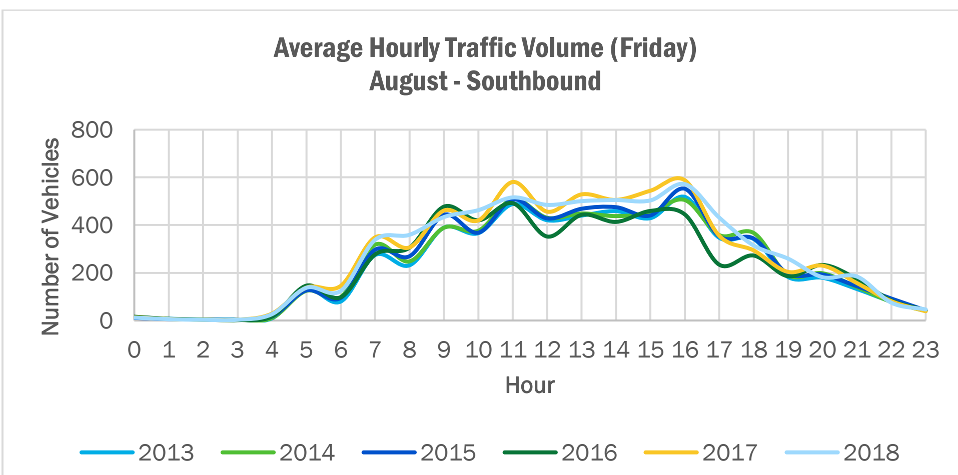


Figure 3.8: Average Hourly Traffic Volumes (Friday), August – Southbound

In the northbound direction, the higher-volume hours in 2018 generally corresponded with the ferry sailing times, with a lag of approximately one hour as observed in the Tuesday and Wednesday patterns. A volume difference of as high as 200 vehicles was observed between the low and high volumes.

In the southbound direction, the higher-volume hours in 2018 generally corresponded with the ferry sailing times, with a lead time ranging from one to two hours depending on the time of day. It was noted that the volumes were steadily high between 11 am to 3 pm, which might be related to frequent sailings in the mid-day period. Also, the hourly variations in 2018 appeared to be less pronounced between 9 am and 3 pm compared to previous years.

FALL CONDITIONS

BC Ferries operates Route 3 on one schedule in the fall and winter months, which generally extend from mid-October to the end of March. To represent fall conditions, hourly traffic volume data collected in November was used, as it was the first full month in which the fall / winter schedule was in effect. It was noted that there were sailing time changes between the 2017 and 2018 winter schedules, with the departure times generally delayed by approximately half an hour. The changes are reflected in the following exhibits, where the higher-volume times in 2018 were shifted to the right compared to 2017.

The average hourly traffic volumes for Friday (the day of the week with highest average volumes in November are shown in ***Figure 3.9*** and ***Figure 3.10*** below for the northbound and southbound directions, respectively.

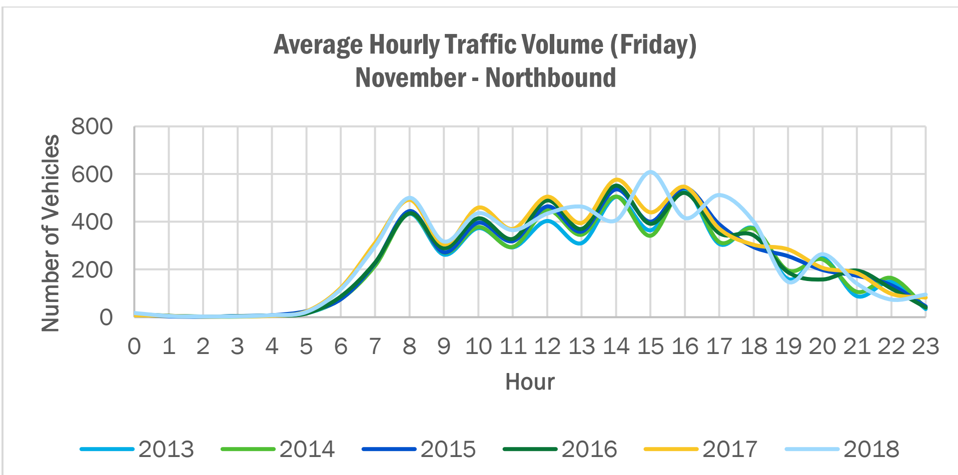


Figure 3.9: Average Hourly Traffic Volumes (Friday), November – Northbound

Similar to the Tuesday and Wednesday observations, the higher-volume hours in 2018 generally corresponded with the ferry sailing times with the one-hour lag in the afternoon only. A volume difference of as high as 200 vehicles (similar to the summer conditions) was observed between the low and high volumes. The same timing trend was not observed in the morning, which might be related to the local traffic being relatively low in that time period.

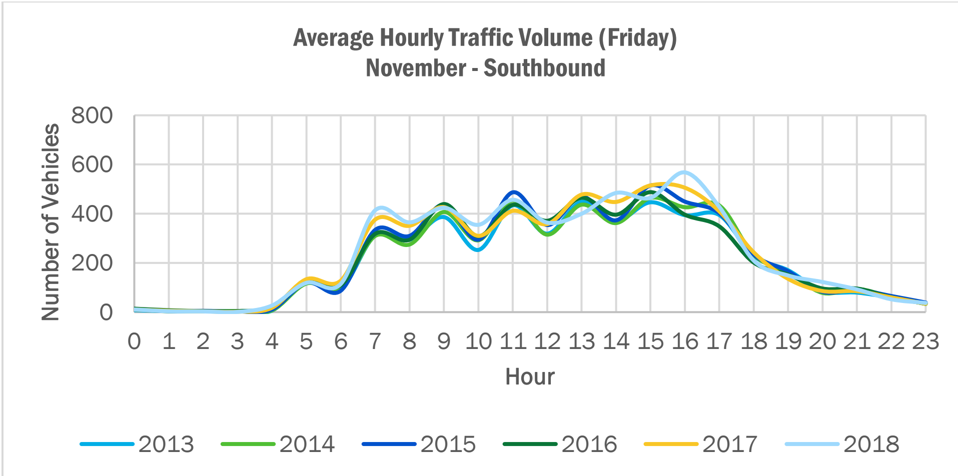


Figure 3.10: Average Hourly Traffic Volumes (Friday), November – Southbound

In the southbound direction, the higher-volume hours in 2018 generally corresponded with the ferry sailing times, with a lead time ranging from one to two hours depending on the time of day.

FERRY TRAFFIC

To assess traffic volumes from BC Ferries Route 3 that travels between Horseshoe Bay in West Vancouver and Langdale in Sunshine Coast, sailing-level traffic data from April 2017 to March 2018 was obtained and analyzed. BC Ferries operates Route 3 on two schedules for the summer months (generally between the end of the school year and the Labor Day long weekend) when demand is high. One of the schedules is for Tuesdays and Wednesdays, and the other is for Thursdays to Mondays with more sailings to accommodate the higher demand on weekends.

The monthly average ferry traffic volumes per sailing are depicted in ***Figure 3.11*** and ***Figure 3.12*** below for the westbound and eastbound directions, respectively. As can be seen in ***Figure 3.11***, for westbound travel from Horseshoe Bay to Langdale, the highest monthly average traffic volumes per sailing were observed in the summer months from May through August. In terms of day of the week, Friday was associated with the highest monthly average traffic volumes per sailing throughout the year, followed by Saturday then Thursday.

Discussions with BC Ferries as part of this study led to the conclusion that an increase in sailing frequency between Horseshoe Bay and Langdale will not occur until the ferry terminal at Horseshoe Bay is upgraded, as this terminal is currently at capacity in terms of the number of sailings per day when considering all routes.

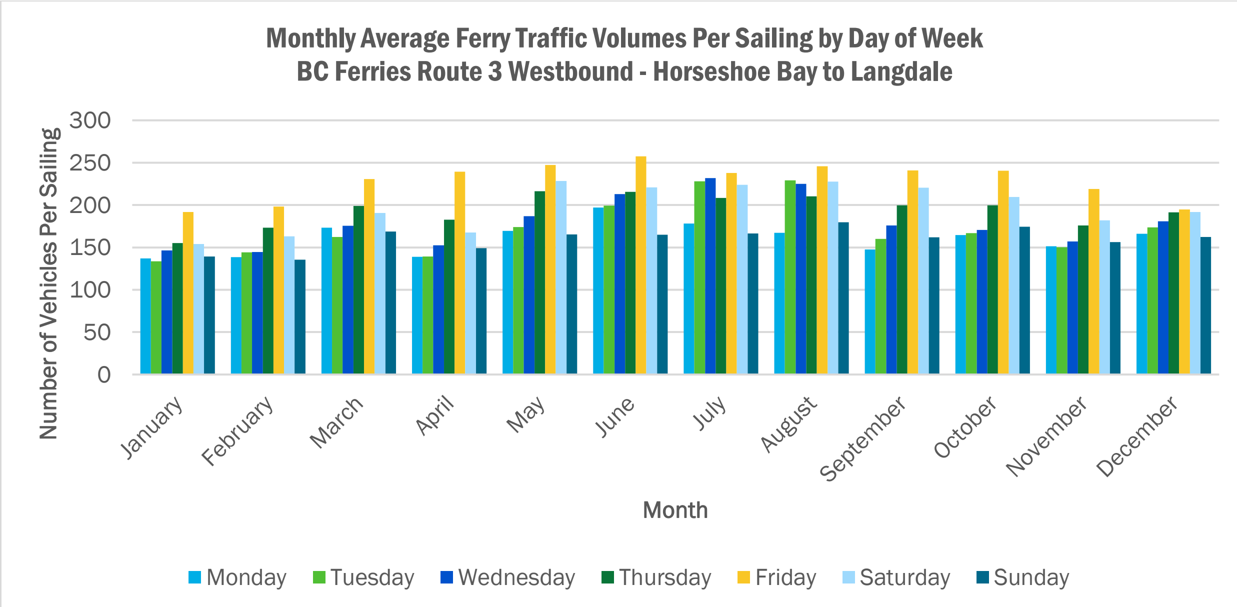


Figure 3.11: Monthly Average Westbound Ferry Traffic Volumes Per Sailing, From Horseshoe Bay to Langdale

Similarly, for eastbound travel from Langdale to Horseshoe Bay, the highest monthly average traffic volumes per sailing were observed in the summer months from May through August, as shown in ***Figure 3.12***. In terms of day of the week, however, Sunday was observed to have the highest monthly average traffic volumes per sailing throughout the year, followed by Monday.

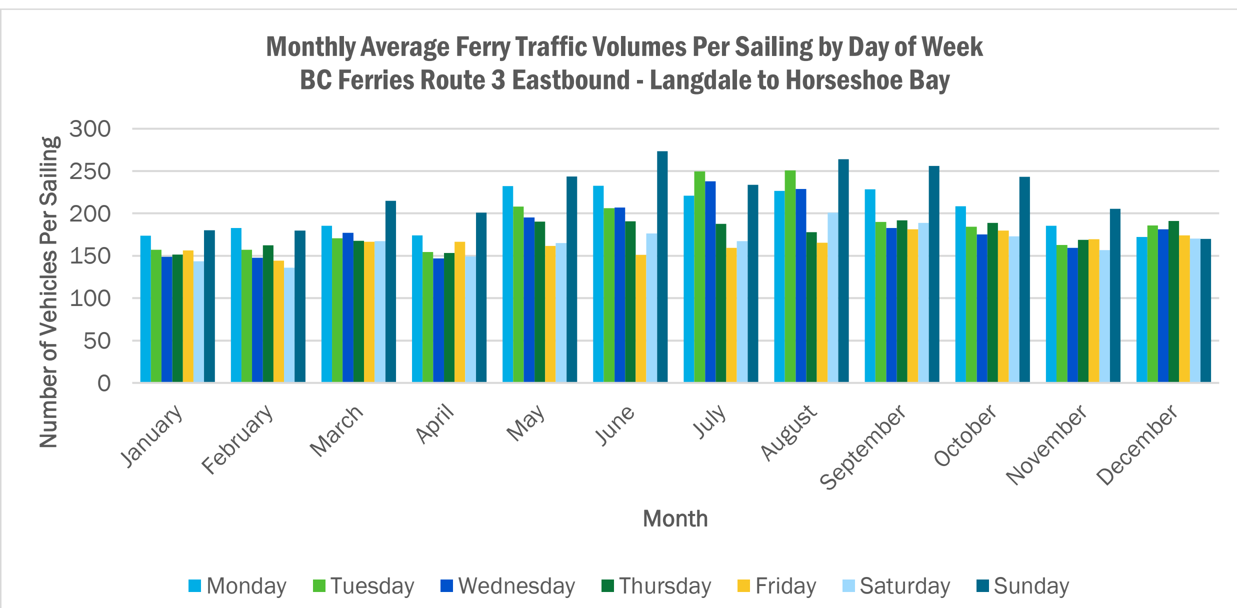


Figure 3.12: Monthly Average Eastbound Ferry Traffic Volumes Per Sailing, From Langdale to Horseshoe Bay

The observations made in the westbound and eastbound directions are consistent with travel patterns of visitors, who tend to travel to Sunshine Coast in the summer months and typically stay for a weekend.

On Tuesdays and Wednesdays, the monthly average ferry traffic volumes per sailing arriving from Horseshoe Bay and those departing Langdale were noted to be generally similar throughout the year, reaching approximately 230 and 245 vehicles in July in the westbound and eastbound directions, respectively. The weekday trips may be made primarily by Sunshine Coast residents and augmented by visitor trips in the summer months.

On Fridays, the monthly average ferry traffic volumes per sailing arriving from Horseshoe Bay were notably higher than those departing Langdale, with the volume difference being more significant in the summer months. In particular, approximately 260 vehicles were observed in the westbound direction and 150 vehicles in the eastbound direction in June, with a difference of 110 vehicles. The notable increase in westbound volumes may be attributed to trips made by visitors to Sunshine Coast.

On Saturdays, the monthly average ferry traffic volumes per sailing arriving from Horseshoe Bay were higher than those departing Langdale (although to a lesser extent than those observed on Fridays), with the volume difference being greater in the summer months. For instance, approximately 230 vehicles were observed in the westbound direction and 200 vehicles in the eastbound direction in August, with a difference of 30 vehicles. The increase in westbound volumes may again be attributed to trips made by visitors to Sunshine Coast.

For Sundays, in contrast to Fridays and Saturdays, the monthly average ferry traffic volumes per sailing departing Langdale were notably higher than those arriving from Horseshoe Bay, with the volume difference being more significant from May through September. In particular, approximately 275 vehicles were observed in the eastbound direction and 165 vehicles in the westbound direction in June, resulting in a difference of 110 vehicles. The increase in eastbound volumes leaving Langdale may be attributed to trips made by visitors leaving Sunshine Coast.

In terms of the highest ferry traffic volumes per sailing, as many as 385 vehicles were observed on a single sailing.

ORIGIN-DESTINATION PATTERNS

In order to understand the flow of traffic across the study corridor, especially for the investigation of whether a bypass route is warranted, origin-destination (O-D) trip data was analyzed. The analysis was based on two separate data sources: 2016 census journey to work data, and StreetLight data. Census data is publicly available, standardized across the country, and transparently validated, but the journey to work results have limitations for this analysis that are described in detail later in this section. StreetLight data, described in detail later in this section, is detailed enough to overcome the limitations of the census data, but comes with its own limitations related to sample size and the way it counts trips. For these reasons, the O-D analysis was carried out with both data sources, their results are compared below, and unique insights into travel patterns are extracted from each data source.

CENSUS JOURNEY TO WORK

2016 census journey to work data at the census subdivision level was used, showing the relationship between home location and work location for all employed people having a usual place of work. A limitation of this data set is that is does not include non-work trips, which can make up a substantial amount of travel on the Sunshine Coast, especially in the summer. In addition, because the census data only collects usual place of work, the data does not reflect the behaviour of commuters that change their patterns throughout the week, for example, those that commute between Metro Vancouver and the Sunshine Coast 1-2 time per week. However, this data can paint a broad picture of morning travel on the Sunshine Coast and act as a starting point for further data collection and analysis.

As shown in ***Figure 3.13***, the composition of traffic on the highway at seven screenlines was analyzed. These screenlines are at the boundary between municipalities and electoral areas, represented in census data as census subdivisions. At each screenline, the distribution of trip origins for northbound and southbound morning work trips is reported in ***Figure 3.14*** and ***Figure 3.15***, respectively. In the absence of specific "journey from work" data, we assume that the reverse trips from work to home in the afternoon will take place in the afternoon.

These screenline volume figures rely on several assumptions due to the limitation of the data. First, trips that start and end within the same subdivision are not shown in the graphs under the assumption that these trips primarily use local and collector roads instead of the highway. Second, it is assumed that all trips between census subdivisions do use the highway. Third, it is assumed that all trips to and from Sechelt start or end in the west part of the city, not the areas north or east of the shíshálh Nation.

Figure 3.13: Screenlines for Journey to Work OD Patterns

Figure 3.14 shows that of the 990 work trips going into Sechelt from the south, 30% originate from Metro Vancouver, West Howe Sound, and Gibsons, with the remaining volume originating in Elphinstone, Roberts Creek, and shíshálh Nation. ***Figure 3.14*** also shows that 100% of the work trips traveling north beyond Redrooffs Road into Halfmoon Bay originate in Sechelt.

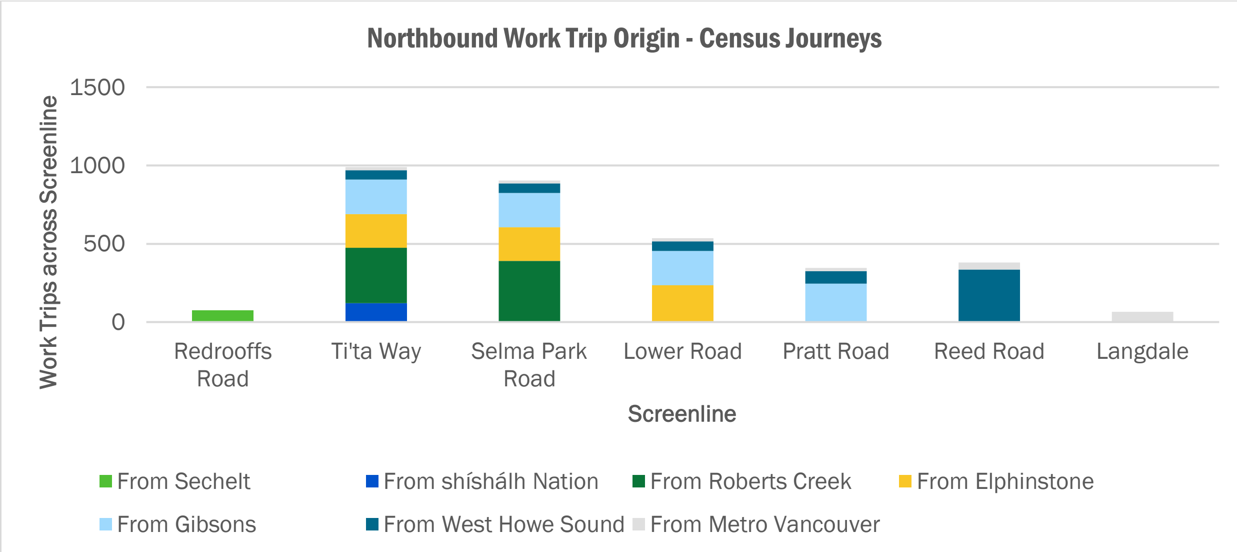


Figure 3.14: Origins of Northbound Work Trips across Screenlines from Census Journey to Work

Figure 3.15 shows that 555 Sunshine Coast residents have their usual place of work in Metro Vancouver. Of those, 31% live in Sechelt and Halfmoon Bay, with the rest living in Roberts Creek, Elphinstone, Gibsons, and West Howe Sound. It is also shown that of the 660 southbound work trips originating in Sechelt, 50% are destined to Metro Vancouver and West Howe Sound. These figures provide a preliminary insight into how an alternative route between Sechelt and Langdale, bypassing Roberts Creek, Elphinstone, and Gibsons would be utilized if constructed.

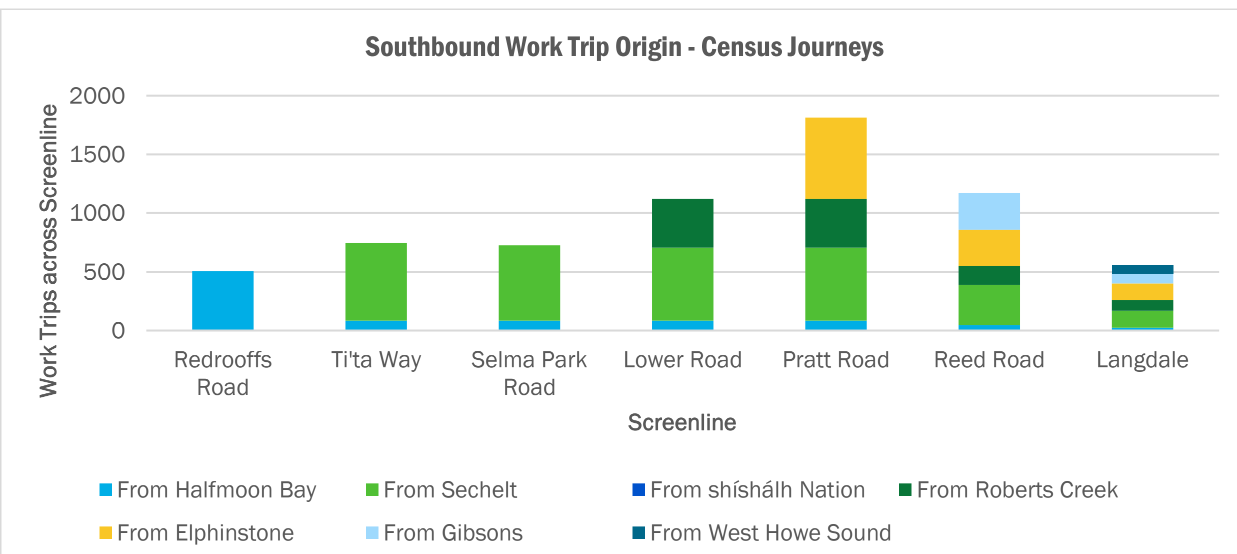


Figure 3.15: Origins of Southbound Work Trips across Screenlines from Census Journey to Work

Figure 3.16 displays the same 2016 census data on a map to illustrate the distribution of work trips around the Sunshine Coast and to Langdale Ferry Terminal of Sechelt residents who work outside of the Town of Sechelt. The figure demonstrates that half of all Sechelt residents that use Highway 101 for their commute to work, travel to West Howe Sound and the Langdale Ferry Terminal, while the other half end their trip in Gibsons or areas west of there.

In addition, 74% of Sechelt residents work within the municipality itself and are likely not using the Highway 101 corridor for their journey to work.

Figure 3.16: Places of Work of Sechelt Residents from Census Journey to Work

STREETLIGHT DATA

StreetLight data is sourced from smartphones and navigation devices passively sharing locations during trips and activities throughout the day. The location data is processed to infer trip origins and destinations. StreetLight data was used in this study to overcome the limitations of the census data because it includes all trip purposes and accounts for variations in commuters' trip patterns throughout the week by including observations from every day. ***Figure 3.17*** and ***Figure 3.18*** show the composition of the traffic stream by trip origin using StreetLight data for comparison with the previous figures showing the same using census data. These charts include all trips in the study area from 6AM-10AM, on Tuesdays, Wednesdays, and Thursdays throughout the area except for in June, July, and August. These parameters were used to get a picture of travel through the Highway 101 corridor on an average weekday.

Magnitudes are not included in these figures because the StreetLight analysis reports results for only a sample of trips taking place on the sunshine coast, whereas the census collects data on the entire population. As a result, the absolute number of trips from both data sets cannot be compared, but the relative proportional composition of the traffic stream by trip origin can be compared. The StreetLight data shows similar travel patterns along the corridor to the census data. In the northbound direction, only 13% of the traffic originating from the Langdale Ferry Terminal and West Howe Sound travel as far west as Sechelt. In the Southbound direction, only 8% of the trips originating in Halfmoon Bay and Sechelt continue all the way to Langdale or West

Howe Sound. In summary, both the census and StreetLight data show that the majority of morning travel on the Sunshine Coast is made up of short-distance trips between neighbouring municipalities, not across the length of the corridor.

The most significant difference between the StreetLight and Census data is the traffic composition at the Pratt Road screenline. That difference is likely due to the ways in which the two datasets observe trip chaining. In reality, many residents of Elphinstone make an intermediate trip into Gibsons in the morning to drop off a child at school. If those travelers than travel west to return home or travel to work in Sechelt, StreetLight will observe the trip chain as being two separate trips, one southbound trip across Pratt Road originating in Elphinstone, and one northbound trip across Pratt Road originating in Gibsons. The census data, however, will observe that trip chain as only a single journey to work originating in Elphinstone, with no travel across the Pratt Road screenline.

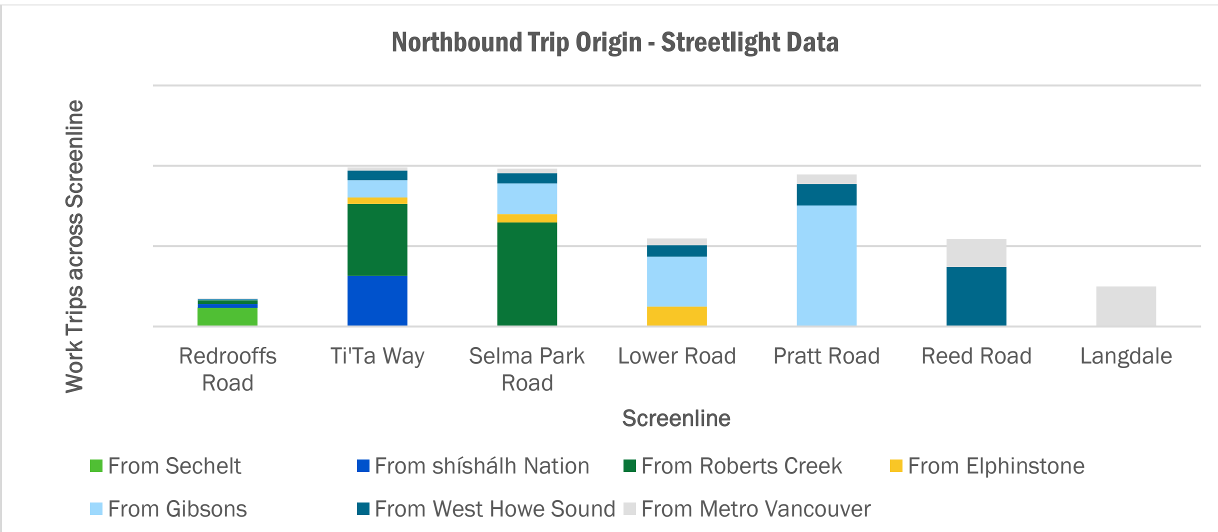


Figure 3.17: Origins of Northbound Morning Weekday Trips across Screenlines from StreetLight Data

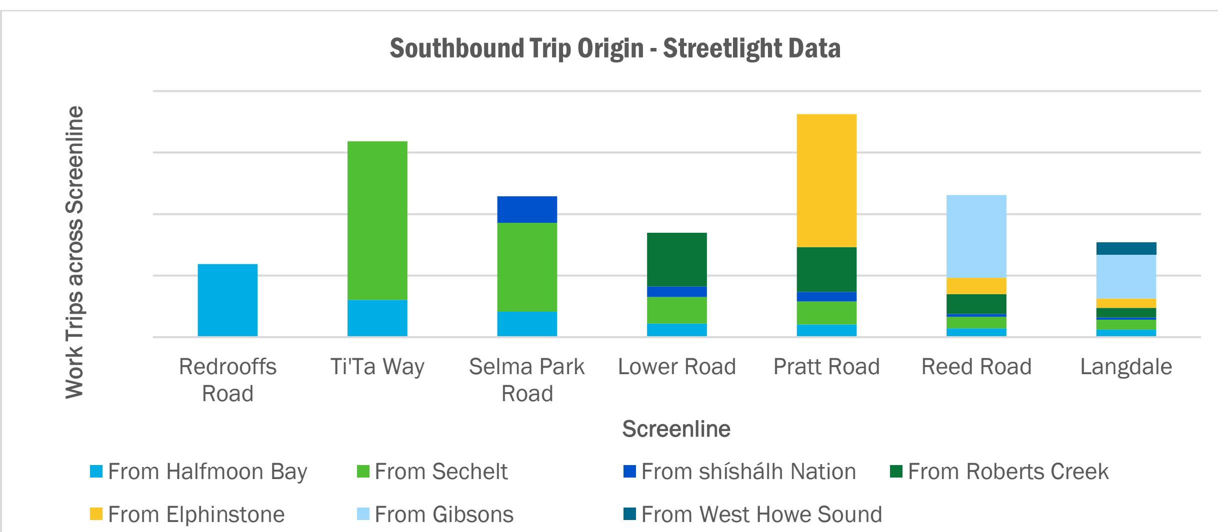


Figure 3.18: Origins of Southbound Morning Weekday Trips across Screenlines from StreetLight Data

3.3.2 Corridor Level of Service Assessment

This subsection describes the results obtained from the highway and intersection performance assessments conducted and identifies locations that are performing below acceptable standards in the existing condition. In addition, gaps in the active transportation infrastructure and deficiencies at the existing transit facilities are identified.

HIGHWAY LEVEL OF SERVICE

The rural section of the corridor between Gibsons and Sechelt was assessed using the methods for two-lane highways from the 2010 Highway Capacity Manual and the results, percent time spent following (PTSF) and level of service are shown in ***Table 3.2*** and ***Table 3.3*** for the summer and fall seasons, respectively. Peak period volumes from the BC MoTI permanent count station were taken from an average Friday in August and November for the summer and fall analyses, respectively. Fridays were used because that is the day of the week on which the highest volumes were observed. The highway between Gibsons and Sechelt was split at Roberts Creek Road since the performance of the highway at that location is determined by the traffic signal.

Table 3.2: 2018 Summer Highway Level of Service

From	To	Dir	AM		MD		PM	
			PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
Veterans Road	Roberts Creek Road	NB	74.1	D	75.9	D	79.5	D
Roberts Creek Road	Veterans Road	SB	73.7	D	78.8	D	77.6	D
Roberts Creek Road	Field Road	NB	74.4	D	76.1	D	79.8	D
Field Road	Roberts Creek Road	SB	54.8	B	59.1	C	57.8	C

Table 3.3: 2018 Fall Highway Level of Service

From	To	Dir	AM		MD		PM	
			PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
Veterans Road	Roberts Creek Road	NB	70.8	D	76.6	D	79.4	D
Roberts Creek Road	Veterans Road	SB	73.7	D	69.8	C	76.4	D
Roberts Creek Road	Field Road	NB	71.2	D	77	D	79.6	D
Field Road	Roberts Creek Road	SB	54.8	B	50	B	57	C

The results show that the only section and direction of the highway that is not performing at threshold (LOS D) is the southbound segment between Field Road and Roberts Creek, which is the only segment that has a passing lane. For the other segments, despite the manageable volumes on the corridor for a typical two-lane highway, the lack of passing opportunities mean that the percent time spent following is consistently above 70%. The lack of passing opportunities are the result of significant opposing direction traffic volume, no passing lanes except southbound between Sechelt and Roberts Creek, and lane markings indicating that 83-93% of each segment is designated as no-passing zones.

The results of this analysis indicate that improvements to this section of the highway that would increase passing opportunities would have a significant impact towards improving the level of service.

INTERSECTION LEVEL OF SERVICE

Because the level of service of the highway in Gibsons, around Roberts Creek, and in Sechelt is governed by the operation of signalized intersections, their performance was analyzed in Synchro and the results are shown in ***Table 3.4*** to ***Table 3.6***. Blank cells in the tables are used for movements that share a lane with another movement. In the case of shared movements, levels of service and volume / capacity ratios are reported on the column for the through movement.

Overall, the signalized intersections in the Highway 101 corridor are meeting the performance targets, with all intersections operating at LOS A or LOS B. In addition, during the morning peak period, all lanes and approaches in the corridor operate at LOS C or better.

In the midday period, the shared eastbound through-left lane and the shared northbound through-right lane at the Wharf Avenue / Dolphin Street intersection operate at LOS D. All other lanes operate at LOS C or better.

In the afternoon peak period, the shared northbound through-right lane at the Wharf Avenue / Dolphin Street intersection operates at LOS D, with all others operating at LOS C or better.

Table 3.4: Intersection Level of Service - 2018 AM

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	29	81	81	191	334	183	183	700	24	98	320	442	148	84	45	277	B (12)
	LOS	C	B	–	B	B	B	–	B	–	C	A	A	B	B	–	B	
	V/C Ratio	0.13	0.4	–	–	0.48	0.4	–	–	–	0.31	0.24	–	0.35	0.18	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	173	375	–	548	–	629	44	673	–	–	–	0	44	–	93	137	B (12)
	LOS	A	A	–	A	–	B	–	B	–	–	–		C	–	A	A	
	V/C Ratio	0.42	0.18	–	–	–	0.43	–	–	–	–	–	–	0.11	–	0.06	–	
Field Rd	Observed Volume	145	267	14	426	6	490	76	572	12	1	2	15	62	3	90	155	B (10)
	LOS	A	A	–	A	B	B	A	B	–	C	A	C	–	C	A	B	
	V/C Ratio	0.25	0.2	–	–	0.01	0.61	0.05	–	–	0.06	0.01	–	–	0.28	0.06	–	
Roberts Creek Rd	Observed Volume	7	405	25	437	33	235	8	276	56	3	43	102	37	2	0	39	A (8)
	LOS	A	A	A	A	A	A	A	A	–	B	–	B	–	B	–	B	
	V/C Ratio	0.01	0.39	0.02	–	0.06	0.23	0.01	–	–	0.3	–	–	–	0.15	–	–	
Payne Rd and Pratt Rd	Observed Volume	140	365	41	546	88	255	45	388	74	50	114	238	102	63	216	381	B (14)
	LOS	A	B	–	B	A	B	–	B	–	C	A	B	C	B	A	B	
	V/C Ratio	0.28	0.58	–	–	0.19	0.5	–	–	–	0.41	0.27	–	0.4	0.16	0.44	–	
Venture Way and Mahan Rd	Observed Volume	7	366	19	392	21	395	21	437	8	4	12	24	6	1	50	57	A (5)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	–	A	–	A	
	V/C Ratio	0.01	0.31	–	–	0.03	0.33	–	–	–	0.08	–	–	–	0.17	–	–	
Sunnycrest Rd	Observed Volume	75	335	–	410	–	369	65	434	–	–	–	0	19	–	39	58	A (5)
	LOS	A	A	–	A	–	A	–	A	–	–	–		B	–	A	A	
	V/C Ratio	0.12	0.26	–	–	–	0.34	–	–	–	–	–	–	0.06	–	0.13	–	
Shaw Rd	Observed Volume	14	302	34	350	10	376	20	406	53	16	12	81	19	2	8	29	A (7)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	B	A	–	A	
	V/C Ratio	0.03	0.32	–	–	0.02	0.37	–	–	–	0.26	–	–	0.07	0.03	–	–	
School Rd	Observed Volume	139	119	119	377	11	127	14	152	161	13	5	179	24	45	208	277	B (12)
	LOS	A	A	–	A	C	C	–	C	–	C	–	C	–	B	A	A	
	V/C Ratio	0.23	0.29	–	–	0.05	0.37	–	–	–	0.52	–	–	–	0.16	0.14	–	
Reed Rd	Observed Volume	151	8	8	167	38	4	1	43	3	136	3	142	6	275	6	287	A (9)
	LOS	–	B	–	B	–	A	–	A	–	A	–	A	–	A	–	A	
	V/C Ratio	–	0.44	–	–	–	0.11	–	–	–	0.19	–	–	–	0.38	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	122	71	2	195	43	143	10	196	9	49	17	75	2	36	0	38	B (10)
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	B	B	–	B	
	V/C Ratio	0.17	0.03	0	–	0.07	0.08	0.01	–	0.03	0.12	0.01	–	0.01	0.09	–	–	

Table 3.5: Intersection Level of Service - 2018 MD

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	50	148	148	346	365	170	170	705	32	128	420	580	173	142	76	391	B (19)
	LOS	C	D	–	D	C	A	–	B	–	D	A	B	C	B	–	C	
	V/C Ratio	0.25	0.78	–	–	0.72	0.39	–	–	–	0.62	0.32	–	0.52	0.38	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	274	560	–	834	–	518	29	547	–	–	–	0	135	–	186	321	B (13)
	LOS	B	A	–	B	–	B	–	B	–	–	–		C	–	A	A	
	V/C Ratio	0.66	0.31	–	–	–	0.46	–	–	–	–	–	–	0.28	–	0.13	–	
Field Rd	Observed Volume	151	437	23	611	3	360	48	411	12	1	6	19	116	6	118	240	B (11)
	LOS	A	A	–	A	B	B	A	B	–	C	A	B	–	C	A	B	
	V/C Ratio	0.24	0.39	–	–	0.01	0.45	0.03	–	–	0.05	0.02	–	–	0.44	0.08	–	
Roberts Creek Rd	Observed Volume	14	345	51	410	34	48	33	115	56	3	64	123	35	2	0	37	A (7)
	LOS	A	A	A	A	A	A	A	A	–	A	–	A	–	B	–	B	
	V/C Ratio	0.02	0.35	0.03	–	0.06	0.05	0.02	–	–	0.33	–	–	–	0.14	–	–	
Payne Rd and Pratt Rd	Observed Volume	154	392	44	590	125	285	50	460	88	59	102	249	129	80	162	371	B (17)
	LOS	A	C	–	B	A	B	–	B	–	C	A	B	C	C	A	B	
	V/C Ratio	0.32	0.63	–	–	0.27	0.57	–	–	–	0.48	0.24	–	0.49	0.2	0.35	–	
Venture Way and Mahan Rd	Observed Volume	21	551	29	601	43	722	38	803	30	13	44	87	149	17	37	203	B (15)
	LOS	A	B	–	B	A	B	–	B	–	B	–	B	–	C	–	C	
	V/C Ratio	0.11	0.58	–	–	0.13	0.76	–	–	–	0.25	–	–	–	0.69	–	–	
Sunnycrest Rd	Observed Volume	185	535	–	720	–	574	101	675	–	–	–	0	80	–	205	285	A (9)
	LOS	B	A	–	A	–	A	–	A	–	–	–		C	–	A	B	
	V/C Ratio	0.55	0.47	–	–	–	0.6	–	–	–	–	–	–	0.32	–	0.52	–	
Shaw Rd	Observed Volume	46	513	57	616	28	575	30	633	75	23	17	115	82	14	55	151	A (9)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	B	A	–	B	
	V/C Ratio	0.13	0.53	–	–	0.07	0.56	–	–	–	0.37	–	–	0.25	0.17	–	–	
School Rd	Observed Volume	224	185	185	594	11	180	20	211	207	16	7	230	21	40	182	243	B (13)
	LOS	B	B	–	A	B	C	–	C	–	C	–	C	–	B	A	A	
	V/C Ratio	0.39	0.44	–	–	0.05	0.48	–	–	–	0.63	–	–	–	0.14	0.12	–	
Reed Rd	Observed Volume	205	11	11	227	65	7	1	73	4	204	4	212	3	158	3	164	B (11)
	LOS	–	B	–	B	–	A	–	A	–	A	–	A	–	A	–	A	
	V/C Ratio	–	0.56	–	–	–	0.19	–	–	–	0.32	–	–	–	0.24	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	117	97	4	218	46	114	10	170	8	59	30	97	12	31	0	43	B (10)
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	B	B	–	B	
	V/C Ratio	0.16	0.04	0	–	0.07	0.07	0.01	–	0.02	0.14	0.02	–	0.04	0.08	–	–	

Table 3.6: Intersection Level of Service - 2018 PM

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	46	126	126	298	415	183	183	781	31	124	410	565	191	146	78	415	B (18)
	LOS	C	C	–	C	C	B	–	B	–	D	A	B	C	B	–	C	
	V/C Ratio	0.26	0.71	–	–	0.78	0.43	–	–	–	0.6	0.31	–	0.56	0.39	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	224	597	–	821	–	558	24	582	–	–	–	0	125	–	222	347	B (13)
	LOS	B	B	–	B	–	B	–	B	–	–	–		C	–	A	A	
	V/C Ratio	0.56	0.33	–	–	–	0.49	–	–	–	–	–	–	0.26	–	0.15	–	
Field Rd	Observed Volume	134	428	23	585	3	350	39	392	26	1	7	34	150	8	153	311	B (12)
	LOS	A	A	–	A	B	B	A	B	–	B	A	B	–	C	A	B	
	V/C Ratio	0.22	0.4	–	–	0.01	0.44	0.03	–	–	0.1	0.02	–	–	0.51	0.1	–	
Roberts Creek Rd	Observed Volume	21	400	69	490	34	485	27	546	51	3	68	122	29	2	0	31	A (7)
	LOS	A	A	A	A	A	A	A	A	–	B	–	B	–	B	–	B	
	V/C Ratio	0.05	0.38	0.05	–	0.06	0.46	0.02	–	–	0.34	–	–	–	0.1	–	–	
Payne Rd and Pratt Rd	Observed Volume	154	351	39	544	128	298	53	479	67	45	78	190	130	86	190	406	B (16)
	LOS	A	B	–	B	A	B	–	B	–	C	A	B	C	B	A	B	
	V/C Ratio	0.34	0.64	–	–	0.3	0.59	–	–	–	0.37	0.2	–	0.48	0.21	0.39	–	
Venture Way and Mahan Rd	Observed Volume	15	561	30	606	48	689	36	773	26	11	38	75	114	13	31	158	B (14)
	LOS	A	B	–	B	A	B	–	B	–	B	–	B	–	C	–	C	
	V/C Ratio	0.06	0.58	–	–	0.14	0.71	–	–	–	0.22	–	–	–	0.56	–	–	
Sunnycrest Rd	Observed Volume	207	515	–	722	–	506	89	595	–	–	–	0	129	–	211	340	B (13)
	LOS	C	A	–	B	–	B	–	B	–	–	–		C	–	A	B	
	V/C Ratio	0.75	0.56	–	–	–	0.65	–	–	–	–	–	–	0.36	–	0.44	–	
Shaw Rd	Observed Volume	33	540	60	633	25	523	28	576	65	20	15	100	86	11	42	139	A (9)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	B	A	–	B	
	V/C Ratio	0.08	0.55	–	–	0.07	0.5	–	–	–	0.33	–	–	0.25	0.14	–	–	
School Rd	Observed Volume	236	188	188	612	11	149	17	177	182	14	6	202	21	38	170	229	B (14)
	LOS	B	B	–	A	C	C	–	C	–	C	–	C	–	B	A	A	
	V/C Ratio	0.35	0.43	–	–	0.06	0.45	–	–	–	0.58	–	–	–	0.14	0.12	–	
Reed Rd	Observed Volume	151	8	8	167	59	7	1	67	4	180	4	188	4	180	4	188	A (9)
	LOS	–	B	–	B	–	A	–	A	–	A	–	A	–	A	–	A	
	V/C Ratio	–	0.45	–	–	–	0.19	–	–	–	0.27	–	–	–	0.26	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	72	79	6	157	8	9	1	18	7	31	17	55	0	34	0	34	A (7)
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	–	B	–	B	
	V/C Ratio	0.08	0.03	0	–	0.01	0.01	0	–	0.02	0.08	0.01	–	–	0.09	–	–	

ACTIVE TRANSPORTATION INFRASTRUCTURE GAPS

Although automobile trips make up the majority of travel on the Sunshine Coast, 10% of residents use active modes for their journey to work, according to the 2016 census. In addition, a survey performed by the B.C. Hub for Active School Travel in 2018 found that over 30% of children at Gibsons Elementary walk or bike to school.

With this significant portion of the population in mind, gaps in active transportation infrastructure were identified during the site visit, from previous reports, and during engagement with municipalities and these issues are summarized below. Mitigation of these issues will be considered as part of other potential projects that may arise from this study.

BICYCLE INFRASTRUCTURE IN GIBSONS

The existing bicycle infrastructure in Gibsons is shown in ***Figure 3.19***. Highway 101 through Gibsons acts as the access link to commercial destinations and both Gibsons Elementary School and Elphinstone Secondary School. Bicycle lanes through the corridor exist in some areas but are not continuous. The advisory bike lanes on Shaw Road are identified with dashed lanes that vehicles cross to avoid oncoming traffic, and the shared lanes on Highway 101 and School Road are identified with sharrows and signage. It is noted that a road rehabilitation project planned for summer 2020 will fill some of these gaps.

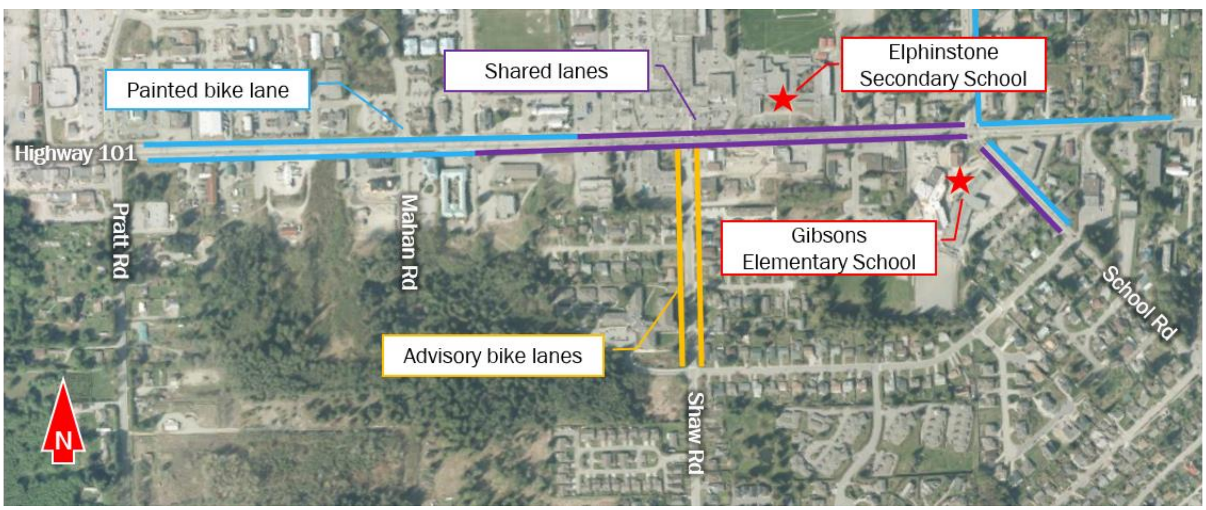


Figure 3.19: Bicycle Infrastructure in Gibsons

WALKING INFRASTUCTURE IN GIBSONS

The existing sidewalks on Highway 101 within and adjacent to Gibsons are shown in ***Figure 3.20***. The extents of the figure are Reed Road to the north and Oceanview Drive to the west because, according to the Town of Gibsons' 2018 Active Travel Project, a significant number of students walk or bike to Gibsons Elementary School or Elphinstone Secondary School from these origins, and the lack of sidewalks or shoulders is a safety concern along the highway. In addition, crosswalk pavement markings along Highway 101 in Gibsons have been reported to be faded.

Figure 3.20: Sidewalks in and around Gibsons

ACTIVE TRANSPORTATION INFRASTRUTURE ON RURAL HIGHWAY SEGMENTS

Throughout the length of the study area corridor, rural segments of Highway 101 have a painted fog line and shoulder on both sides, giving some space for pedestrians and cyclists to travel beside vehicles. However, the shoulder in many sections of the highway is not wide enough for pedestrians and cyclists to remain separated from the vehicle travel lane.

SIDEWALKS IN SECHELT

The commercial built-up areas of Sechelt and the shíshálh Nation have sidewalks on both sides of Highway 101. However, the section of highway south of the Dolphin Street intersection which is fronted by multiple commercial retail businesses has inconsistent sidewalks and curbs to accommodate the mix of parallel parking, angle parking, and access to surface lots, as shown in ***Figure 3.21***. Pedestrian volumes are relatively high on this segment of highway, and the inconsistency in sidewalks in this area can reduce level of service for those walking to commercial destinations in the area.

Figure 3.21: Sidewalks in Downtown Sechelt

GEOMETRIC ISSUES

Horizontal and vertical alignment data provided by BC MoTI was used to build a model of the Highway 101 segments between Gibsons and Sechelt on the Integrated Highway Safety Design Model (IHSDM) software. IHSDM was used to identify deficiencies in curve radius, lane widths, sight distances, and road grades. The model was bounded by Dolphin Street / Wharf Avenue intersection in Sechelt and by the Hillcrest Road intersection in Gibsons.

The assessment identified some potential issues on the corridor, however most of these issues were deemed to not warrant the development of specific mitigation measures as part of the planning study. Instead, mitigation of these potential issues would be considered as part of other potential projects that may arise from this study. Results of the analysis are included in ***Appendix A*** for consideration by the B.C MoTI in being carried forward as part of any future projects and to be confirmed in the field.

TRANSIT FACILITIES

The following infrastructure issues related to transit operations were identified during the site visit, from consultation with local municipalities, BC Transit, and from previous reports.

The left turn onto the highway from Flume Road is challenging for bus operators because of the steep grade of Flume Road. The movement is especially problematic when the pavement is wet, or the bus is fully loaded with passengers.

The following locations, shown in ***Figure 3.22*** do not have sufficient space for buses to safely pull off the highway or for passengers to wait for a bus:

- Cemetery Road northbound
- Byng Road northbound
- Crowe Road northbound
- Pell Road southbound
- Blower Road northbound

Figure 3.22: Locations of Bus Stops with Space Concerns

3.3.3 Corridor Safety Assessment

To assess the safety performance of the Highway 101 corridor between the Langdale Ferry Terminal and Redrooffs Road in Sechelt, Collision Information System data was obtained from the BC MoTI for collisions that occurred along the corridor between 2008 and 2017 inclusively. The CIS system contains data pertaining to collisions that occur on the Landmark Kilometer Inventory (LKI) network and are reported by police officials, which may involve fatality (FAT), personal injury (INJ), or property damage only (PDO) collisions that exceed $1,000. A safety analysis was conducted based on collisions that occurred in the most recent five-year period where data was available, namely between 2013 and 2017 inclusively, to provide an assessment of the more current conditions. The safety review was conducted on three levels, including the corridor level to identify overall collision frequency, severity, and type patterns, the segment level to identify collision proneness based on a comparison with provincial averages of collision rate and collision severity index (CSI), and the location level to identify potential contributing factors for locations associated with higher collision frequency.

CORRIDOR-WIDE ASSESSMENT

A total of 300 collisions occurred along the 34-kilometre segment of Highway 101 between the Langdale Ferry Terminal and Redrooffs Road in Sechelt. Collision frequency generally decreased between 2013 and 2017, as shown in ***Figure 3.23*** below.

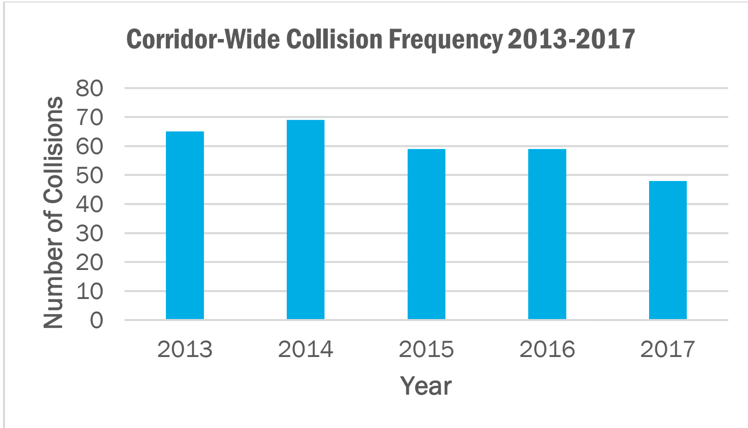


Figure 3.23: Corridor-Wide Collision Frequency – 2013 to 2017

In terms of severity, there were three fatal, 155 personal injury, and 142 property damage only collisions on the corridor between 2013 and 2017, with the overall proportions being 1%, 52%, and 47% for the three types of severity, respectively. The fatal collisions occurred on Highway 101 at Oceanview Drive (approximately 2.0 kilometres north of Gibsons) in 2016, at Leek Drive in Roberts Creek in 2017, and at Mills Road in Sechelt in 2014. In terms of year-to-year patterns, it was noted that personal injury collisions accounted for a much greater proportion than property damage only collisions in 2017 compared to previous years, as illustrated in ***Figure 3.24*** below.

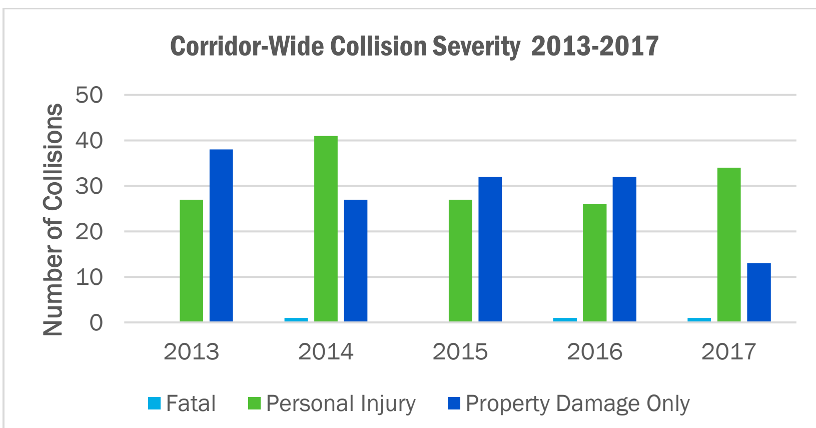


Figure 3.24: Corridor-Wide Collision Severity – 2013 to 2017

In terms of collision types, rear-end, off-road, right angle, head-on, and side swipe collisions were the predominant types on a corridor-wide basis, as shown in ***Figure 3.25*** below.

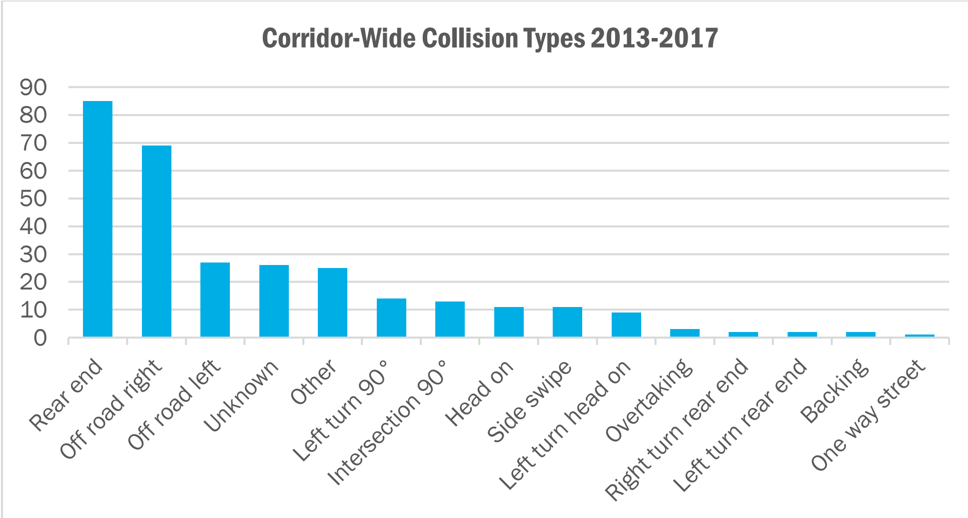


Figure 3.25: Corridor-Wide Collision Types – 2013 to 2017

SEGMENT-BASED ASSESSMENT

As the characteristics of the Highway 101 corridor vary between the Langdale Ferry Terminal and Sechelt, the corridor was divided into seven distinct segments as noted in Section 1.2 to allow for a closer assessment of safety performance as shown in ***Table 3.7*** from south to north.

Table 3.7: Highway Segments for Safety Assessment

From	To	LKI Segment	From KM	to KM	Length (KM)
Port Mellon Hwy / Marine Dr	Stewart Rd	2562	0	2.35	2.35
Stewart Rd	School Rd / Gibsons Way	2562	2.35	4.81	2.46
School Rd / Gibsons Wy	Veterans Rd	2564	0	1.81	1.81
Veterans Rd	Roberts Creek Rd	2564	1.81	10.59	8.78
Roberts Creek Rd	Field Rd	2564	10.59	15.50	4.91
Field Rd	Chelpi Ave	2564	15.50	20.78	5.28
Chelpi Ave	Shorncliffe Ave	2564	20.78	22.37	1.59
Shorncliffe Ave	Redrooffs Rd	2564	22.37	28.65	6.28

The seven segments were assessed based on collision frequency, collision rate, and collision severity index (CSI) for the five-year period from 2013 to 2017. Collision rates consider both collision frequency and exposure in terms of traffic volume and distance. To calculate collision rates, traffic volume data was obtained from the BC MoTI permanent count station P-15-7NS located 4.6 km north of Conrad Road, north of Gibsons, as well as short count stations located along the corridor. Collision severity index, on the other hand, assesses severity using a weighted approach, with greater weights placed on fatalities and personal injury collisions compared to property damage only collisions.

Collision rate and CSI were calculated as follows:

$$Collision\ Rate\ (collisions\ per\ million\ veh\ km) = \frac{Number\ of\ collisions \times 1{,}000{,}000}{AADT \times 365\ days \times 5\ years \times segment\ length}$$

$$CSI = \frac{(100 \times FAT) + (10 \times INJ) + PDO}{FAT + INJ + PDO}$$

Collision frequency, collision rate, and CSI were computed for each of the eight distinct segments and compared to provincial averages for similar roadways by service class and traffic volume range, to determine if the segments were more collision-prone than other similar roadways. The criteria for collision-prone segments are as follows:

$$Collision\ Rate\ \geq Critical\ Collision\ Rate; OR$$
$$CSI\ \geq Threshold\ CSI$$
$$AND$$
$$Collision\ Frequency\ \geq 3/year$$

The critical collision rates and threshold CSI used for comparison represented collisions that occurred between November 1, 2011 to October 31, 2016, the latest available set of calculated provincial rates. The critical collision rates and threshold CSI depend on the highway service class and traffic volume of the segment, both shown in ***Table 3.8*** for each segment of Highway 101. The segment-based safety performance results are summarized in ***Table 3.9*** below.

Table 3.8: Segments Highway Service Class and Traffic Volume Range

From	To	Highway Class	Traffic Volume Range
Port Mellon Hwy / Marine Dr	Stewart Rd	Rural divided expressway, ≥ 4 lanes	5,001-10,000
Stewart Rd	School Rd / Gibsons Wy	Rural undivided arterial, < 4 lanes	5,001-10,000
School Rd / Gibsons Wy	Veterans Rd	Urban undivided arterial, < 4 lanes	10,001-15,000
Veterans Rd	Roberts Creek Rd	Rural undivided arterial, < 4 lanes	10,001-15,000
Roberts Creek Rd	Field Rd	Rural undivided arterial, < 4 lanes	10,001-15,000
Field Rd	Chelpi Ave	Rural undivided arterial, < 4 lanes	10,001-15,000
Chelpi Ave	Shorncliffe Ave	Urban undivided arterial, < 4 lanes	10,001-15,000
Shorncliffe Ave	Redrooffs Rd	Rural undivided arterial, < 4 lanes	10,001-15,000

Table 3.9: Comparison of Collision Frequency, Rate, and Severity by Segments, 2013-2017

From	To	Coll Freq	Coll Freq > 3 / yr?	Coll Rate	Prov Avg Rate	Coll Rate > Prov Avg?	CSI	Prov Avg CSI	CSI > Prov Avg?	Coll Prone?
Port Mellon Hwy / Marine Dr	Stewart Rd	3	No	0.10	0.41	No	1.0	5.9	No	No
Stewart Rd	School Rd / Gibsons Wy	6	Yes	0.20	0.32	No	2.5	6.9	No	No
School Rd / Gibsons Wy	Veterans Rd	13	Yes	0.33	0.53	No	5.2	5.4	No	No
Veterans Rd	Roberts Creek Rd	81	Yes	0.50	0.26	Yes	8.7	7.4	Yes	Yes
Roberts Creek Rd	Field Rd	46	Yes	0.46	0.26	Yes	5.3	7.4	No	Yes
Field Rd	Chelpi Ave	73	Yes	0.67	0.26	Yes	5.4	7.4	No	Yes
Chelpi Ave	Shorncliffe Ave	23	Yes	0.70	0.53	Yes	6.1	5.4	Yes	Yes
Shorncliffe Ave	Redrooffs Rd	53	Yes	0.41	0.26	Yes	7.8	7.4	Yes	Yes

Based on the criteria noted above, the following five segments, shown in ***Figure 3.26,*** were collision-prone compared to other similar roadways in the province:

- Veterans Road to Roberts Creek Road;
- Roberts Creek Road to Field Road;
- Field Road to Chelpi Avenue;
- Chelpi Avenue to Shorncliffe Avenue; and
- Shorncliffe Avenue to Redrooffs Road.

Figure 3.26: Collision-Prone Segments

LOCATION-SPECIFIC ASSESSMENT

Collision frequency between 2013 and 2017 was higher near the following locations, from south to north:

- **Lower Road / Highland Road:** Six collisions occurred near this location;
- **Joe Road/Orange Road:** Eight collisions occurred near this location, with seven off-road and one rear-end collision; three collisions were alcohol related; grade and / or geometry (with a horizontal curve limiting sight distance) may be a contributing factor;
- **Neilson Road:** Six collisions occurred near this location, with three off-road and two head-on collisions; grade and geometry (with a horizontal curve limiting sight distance) may be possible contributing factors;
- **Largo Road:** Seven collisions occurred near this location, with six off-road collisions; grade and lighting may be contributing factors;
- **Flume Road / Lockyer Road:** Seven collisions occurred near this location, with four rear-end and three off-road collisions; grade and / or geometry may be a contributing factor;
- **Field Road:** Six collisions occurred near this location, with two off-road, one rear-end, and one right angle collisions;
- **Davis Bay Road:** Seven collisions occurred near this location, with six rear-end and one off-road collisions; geometry (with a horizontal curve limiting sight distance) may be a contributing factor;

- **Bay Road:** Nine collisions occurred near this location, with five rear-end, one head-on, and one side swipe collisions; grade may be a contributing factor;
- **Selma Park Road:** 12 collisions occurred near this location, with four rear-end, three off-road, two head-on, and one side swipe collisions; grade and / or geometry may be a contributing factor;
- **Ti'Ta Way, main access to Sechelt Hospital:** Ten collisions occurred near this location, with five right angle and one rear-end collisions; grade may be a contributing factor;
- **Shorncliffe Avenue:** Six collisions occurred near this location;
- **Norwest Bay Road:** Six collisions occurred near this location, with three off-road, two rear-end, and one right angle collisions; and
- **Hill Road:** Seven collisions occurred near this location, with five off-road, one rear-end, and one side swipe collisions; grade and / or geometry may be a contributing factor.

3.4 Future Conditions

To assess the conditions of the highway in a scenario where no infrastructure improvements are made but the region continues to grow, the corridor was assessed using projected volumes for the year 2035. The methods for estimating those traffic volumes and the results of the analysis using them are presented in this section.

The official community plans for Gibsons and Sechelt use a horizon year of 2026 and 2031, respectively. Based on these current plans, 2035 was identified as the horizon year for this study to capture the growth planned by the municipalities, but also to ensure that long-term corridor improvement options can be sufficiently assessed.

3.4.1 Future Traffic Volumes

This subsection documents the methods used to estimate highway and intersection volumes in 2035 used in the future year level of service analyses. The methods rely on several assumptions about the available data and its applicability to future conditions which are also documented in this section.

HIGHWAY VOLUME FORECAST METHODOLOGY

Traffic on Highway 101 can be modelled as made up of two primary streams. The first stream is local background traffic travelling to and from Gibsons, Sechelt, and other areas within the Sunshine Coast Regional District. Because the local municipalities and regional district are planning for continued residential growth in the near future, this traffic stream is predicted to continue growing between now and the future horizon year of 2035. The average growth rate measured over the most recent five years can be used to estimate the rate beyond 2018.

The second traffic stream on Highway 101 is made up of vehicles travelling between Metro Vancouver and the Sunshine Coast via Langdale Ferry Terminal. The demand for travel on this ferry route is predicted to increase with population growth both in Metro Vancouver and on the Sunshine Coast. However, based on an engagement meeting with BC Ferries in March 2019, the capacities of Horseshoe Bay and Langdale Ferry Terminals will constrain the number of vehicles using the ferry in the future horizon to approximately the current volume. This is especially true during the daily peak periods, on Fridays, and in the summer when ferries were travelling at capacity for vehicles in 2018.

With the difference in these two traffic streams in mind, 2035 volumes were estimated using the following methodology. 2018 daily traffic profiles from the Roberts Creek permanent count station were analyzed to estimate the split of volume into background and ferry traffic. This was done by measuring the difference between the peaks in hourly volume corresponding to traffic accessing or leaving a ferry at Langdale and the local minima corresponding to hours when ferry traffic is relatively low, as shown in ***Figure 3.27*** to ***Figure 3.30***. Based on the peaks in volume, a daily profile of background volume with no ferry traffic was estimated, and ferry traffic during each of the morning, midday, and afternoon peak hours was calculated. For each peak hour, 2035 traffic was estimated by growing the background traffic using the historical 5-year rate and then adding back the ferry volume.

This process was repeated for both the northbound and southbound directions and both the fall and summer seasons.

$$Ferry\ Volume = Observed\ Volume - Estimated\ Background\ Volume$$

$$Projected\ 2035\ Volume = Estimated\ Local\ Volume \times (1 + 5\ year\ growth\ rate)^{2035-2018} + Ferry\ Volume$$

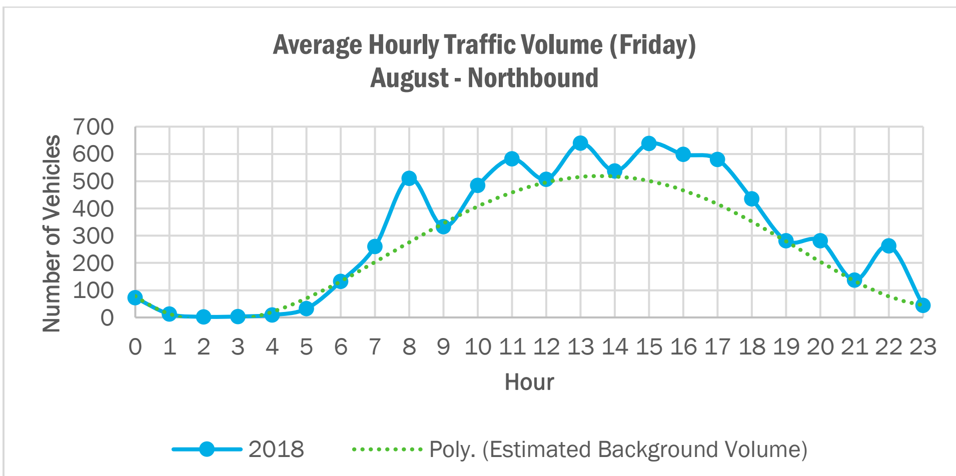


Figure 3.27: Hourly Traffic Volume Including Estimated Background Volume – August Northbound

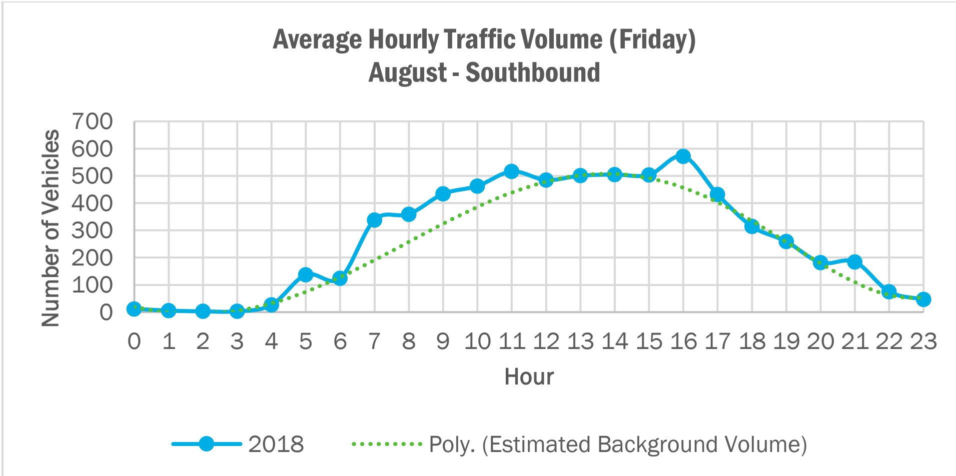


Figure 3.28: Hourly Traffic Volume Including Estimated Background Volume – August Southbound

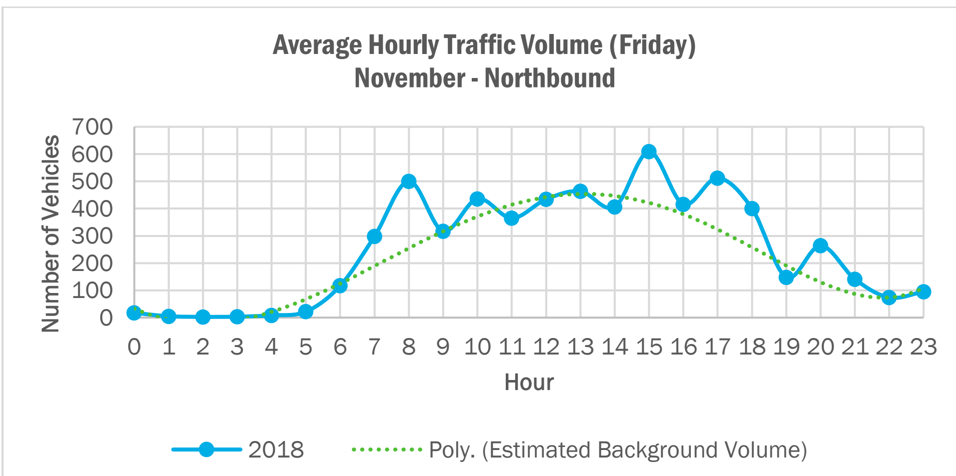


Figure 3.29: Hourly Traffic Volume Including Estimated Background volume – November Northbound

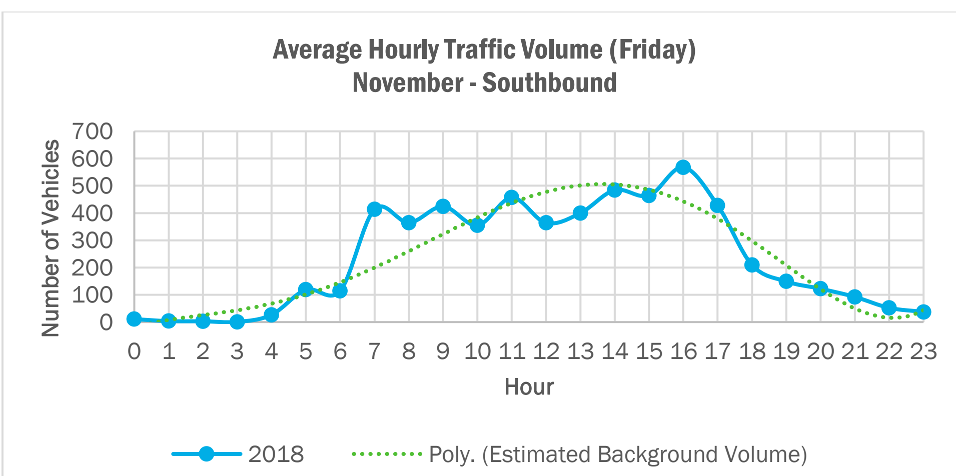


Figure 3.30: Hourly Traffic Volume Including Estimated Background Volume – November Southbound

INTERSECTION TURNING MOVEMENT FORECASTING METHODOLOGY

To predict intersection operation in the future horizon year of 2035, turning movement volumes measured in 2018 and 2019 were escalated using a methodology that considers the mix of local and ferry traffic as described in subsection 4.1.1. However, because traffic travelling to and from Langdale Ferry Terminal is distributed unequally among all turning movement volumes along Highway 101, an adjusted annual growth rate was estimated that takes into account the growth of background traffic and the constant ferry volume to 2035. A growth rate was calculated for each peak period in each direction for both the summer and fall seasons.

$$Adjusted\ Annual\ Growth\ Rate = \left(\frac{Projected\ 2035\ Volume}{Observed\ 2018\ Volume}\right)^{\frac{1}{(2035-2018)}} - 1$$

Once the adjusted annual growth rate was calculated, it was applied to all measured turning movement volumes to project them to 2035 values, simulating the distribution of constant ferry traffic among all intersection turning movements in the region while background traffic grows with the population.

$$\begin{aligned} &Projected\ 2035\ Turning\ Movement\ Volume \\ &\qquad = Observed\ Turning\ Movement\ Volume \\ &\qquad \times (1 + Adjusted\ Annual\ Growth\ Rate)^{2035-Observation\ Year} \end{aligned}$$

ASSUMPTIONS

As with all other analyses in this study, annual growth rates were calculated based on data collected on Fridays because that is the day of the week on which the highest volumes are observed in both the fall and summer seasons. As a result, the 2035 volume projections represent a conservative worst-case scenario of future hourly volumes.

In general, the analyses documented in this report are separated into fall and summer portions. However, turning movement data for each intersection was only available for a single two-week period in either August or September of 2018 or March 2019, as shown in ***Table 3.1*** on page 14. To maintain consistency in the intersection analysis results throughout the corridor, the growth rates calculated for the fall season were applied to all intersections regardless of the season of data collection. In this approach, those intersections where the base turning movement was collected during the summer period, slightly higher future turning movement volume forecasts are anticipated given the higher base volumes typically associated with the summer season.

The approach taken to projecting intersection turning movement volumes to 2035 assumes that ferry traffic is distributed among turning movements at each intersection in proportion to the volume of each movement. In the absence of more detailed origin-destination data for ferry traffic, high turning movement volume is a good proxy for identifying generators and attractors of ferry traffic.

FUTURE VOLUMES

The results of the methods and assumptions described in the above subsections were applied to generate the future traffic volume growth rates and projections shown in ***Table 3.10*** and ***Table 3.11*** for summer and fall, respectively.

Table 3.10: Highway 101 Growth and Projections - Summer

Dir	Peak Hr	Estimated 2018 Volumes			2013-2018 Growth Rate	Estimated 2035 Volumes		Adj Avg Annual Growth Rate
		Background	Background + Ferry	Ferry		Background	Background + Ferry	
NB	8:00 AM	280	500	220	4.3%	569	789	2.7%
	1:00 PM	520	780	260	3.0%	859	1119	2.1%
	4:00 PM	480	660	180	5.1%	1111	1291	4.0%
SB	8:00 AM	260	420	160	4.3%	529	689	3.0%
	1:00 PM	500	680	180	3.0%	826	1006	2.3%
	4:00 PM	460	580	120	5.1%	1065	1185	4.3%

Table 3.11: Highway 101 Growth and Projections - Fall

Dir	Peak Hr	Estimated 2018 Volumes			2013-2018 Growth Rate	Estimated 2035 Volumes		Adj Avg Annual Growth Rate
		Background	Background + Ferry	Ferry		Background	Background + Ferry	
NB	8:00 AM	260	500	240	3.7%	486	726	2.2%
	2:00 PM	460	660	200	0.6%	513	713	0.5%
	4:00 PM	380	560	180	1.4%	485	665	1.0%
SB	8:00 AM	260	500	240	3.7%	486	726	2.2%
	2:00 PM	500	700	200	0.6%	558	758	0.5%
	4:00 PM	440	580	140	1.4%	562	702	1.1%

The 2035 turning movement counts, projected using the adjusted average annual growth rates for the fall period only, were used in the 2035 intersection level of service assessment. The forecasted future turning movement volumes at the key intersections for the AM, Midday, and PM peak hours are shown in ***Figure 3.31*** to ***Figure 3.33.***

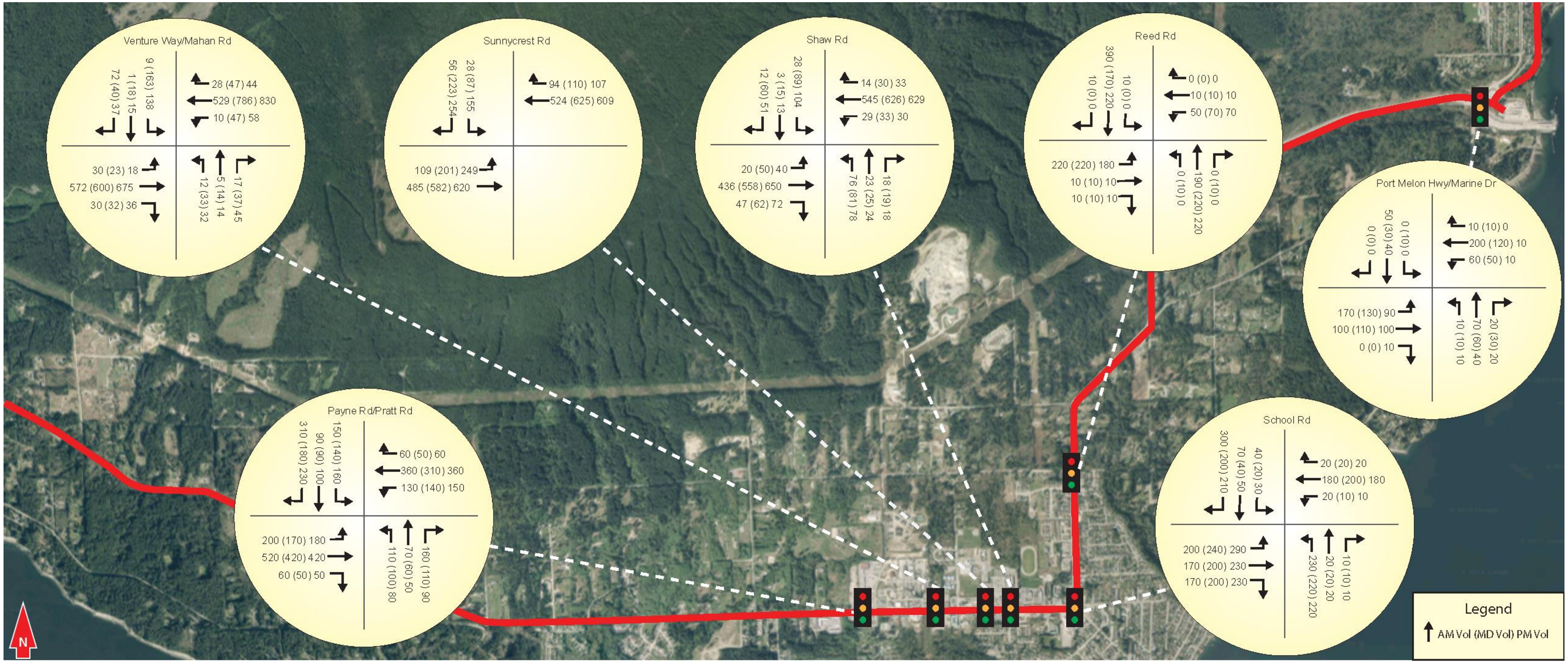


Figure 3.31: Turning Movement Volumes at Signalized Intersections –West Howe Sound and Gibsons - 2035

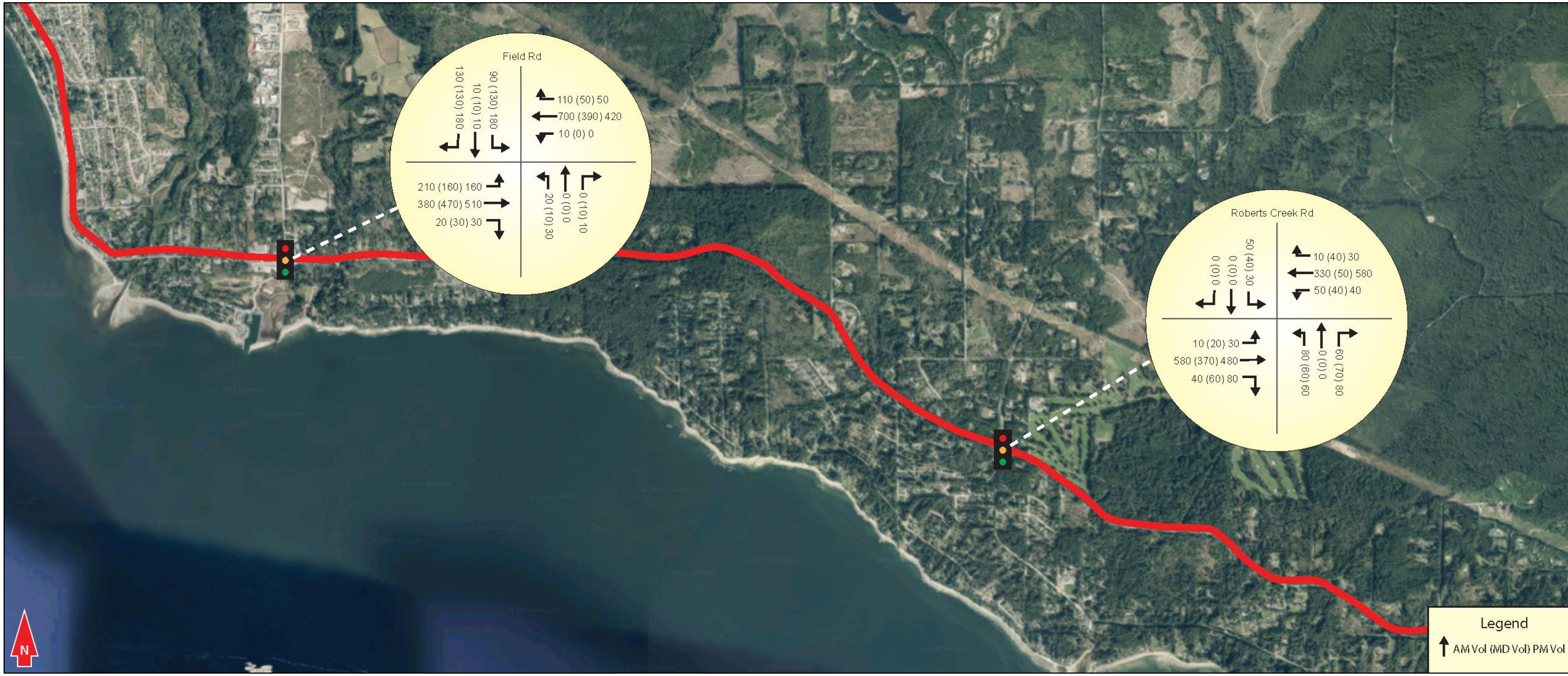


Figure 3.32: 2035 Turning Movement Volumes at Signalized Intersections – Roberts Creek and Sechelt - 2035

Figure 3.33: 2035 Turning Movement Volumes at Signalized Intersections – Sechelt and shíshálh Nation - 2035

3.4.2 Corridor Level of Service Assessment

Results obtained from the highway and intersection performance assessments, undertaken using the forecasted volumes described in the previous section, as well as the identification of any issue locations are presented in this section.

HIGHWAY LEVEL OF SERVICE

The rural segments of the highway between Gibsons and Sechelt were analyzed using the 2010 Highway Capacity Manual as described in Section 3.2 and using 2035 traffic volumes as described in Section 3.4.1. Results of the analyses are shown in ***Table 3.12*** and ***Table 3.13***.

Table 3.12: 2035 Summer Highway Level of Service

From	To	Dir	AM		MD		PM	
			PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
Veterans Road	Roberts Creek Road	NB	86	**E**	85.7	**E**	94.5	**F**
Roberts Creek Road	Veterans Road	SB	84.6	D	88.5	**E**	93.9	**E**
Roberts Creek Road	Field Road	NB	86.1	**E**	85.8	**E**	94.6	**F**
Field Road	Roberts Creek Road	SB	63.9	C	67	C	71	C

Table 3.13: 2035 Fall Highway Level of Service

From	To	Dir	AM		MD		PM	
			PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
Veterans Road	Roberts Creek Road	NB	81	D	78.4	D	83.7	D
Roberts Creek Road	Veterans Road	SB	81	D	72.2	D	80.7	D
Roberts Creek Road	Field Road	NB	81.2	D	78.8	D	83.9	D
Field Road	Roberts Creek Road	SB	60.9	C	53.7	B	60.7	C

The results indicate that all highway segments in both seasons are predicted to operate at or below threshold level except for the southbound segment between Field Road in Sechelt and Roberts Creek Road. The southbound segment between Field Road and Roberts Creek Road is the only segment of the four that contains a passing lane. In all other segments, too few passing opportunities exist for the highway to operate at an acceptable level of service, with percent time spent following estimated to be over 80%. It should be noted, however, the capacity of the two-lane Highway 101 is sufficient to accommodate the growth in traffic volumes, as demonstrated by the LOS C and LOS B performance of the southbound Field Road-Roberts Creek Road segment in the 2035 scenarios.

In order to increase the performance of the highway beyond what is shown in ***Table 3.12*** and ***Table 3.13***, improved passing opportunities should be considered.

INTERSECTION LEVEL OF SERVICE

The results of the Synchro analysis using 2035 turning movement volumes estimated with the methodology described in Section 3.4.1 are shown in ***Table 3.14*** to ***Table 3.16*** for the AM, Midday, and PM peak hours respectively. As noted previously, the future traffic volumes were forecasted using the fall growth rates in order that all of the intersection capacity analysis is consistent throughout the corridor. In this approach, the analysis results may show slightly worse performance for those intersections where the base turning movement counts were collected during the summer period - given the higher base volumes typically associated with the summer season.

In the morning peak period, all intersections perform at LOS C or better overall. The only area of concern in this scenario is the westbound left turn at the Wharf Avenue / Dolphin Street intersection, which is the route of Highway 101 through Sechelt. This turning movement is estimated to operate at LOS F.

In the mid-day peak period, all intersections perform at LOS C or better overall, and all movement perform at LOS D or better.

In the afternoon peak period, all intersections perform at LOS C or better overall. The only area of concern in this scenario is the westbound left turn at the Wharf Avenue / Dolphin Street intersection, which is estimated to operate at LOS E.

Table 3.14: Intersection Level of Service - 2035 AM

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	41	114	114	269	474	259	259	992	35	139	454	628	210	119	64	393	C (30)
	LOS	C	C	–	C	F	B	–	D	–	C	A	A	C	B	–	B	
	V/C Ratio	0.27	0.64	–	–	1.08	0.69	–	–	–	0.58	0.34	–	0.54	0.28	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	246	532	–	778	–	893	62	955	–	–	–	–	62	–	132	194	B (16)
	LOS	C	A	–	B	–	B	–	B	–	–	–	–	C	–	A	A	
	V/C Ratio	0.8	0.26	–	–	–	0.62	–	–	–	–	–	–	0.16	–	0.09	–	
Field Rd	Observed Volume	206	379	20	605	9	696	108	813	18	1	3	22	88	5	128	221	B (16)
	LOS	B	A	–	A	B	C	A	C	–	C	A	C	–	D	A	B	
	V/C Ratio	0.5	0.3	–	–	0.02	0.83	0.07	–	–	0.1	0.01	–	–	0.44	0.09	–	
Roberts Creek Rd	Observed Volume	10	575	35	620	47	334	11	392	80	4	61	145	53	3	0	56	B (10)
	LOS	A	B	A	A	A	A	A	A	–	B	–	B	–	B	–	B	
	V/C Ratio	0.02	0.6	0.02	–	0.14	0.35	0.01	–	–	0.45	–	–	–	0.21	–	–	
Payne Rd and Pratt Rd	Observed Volume	199	517	57	773	125	362	64	551	106	70	162	338	145	89	307	541	B (19)
	LOS	B	C	–	C	B	C	–	B	–	C	B	C	C	C	A	B	
	V/C Ratio	0.49	0.77	–	–	0.42	0.58	–	–	–	0.51	0.34	–	0.54	0.2	0.5	–	
Venture Way and Mahan Rd	Observed Volume	30	572	30	632	10	529	28	567	12	5	17	34	9	1	72	82	A (7)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	–	A	–	A	
	V/C Ratio	0.02	0.48	–	–	0.07	0.52	–	–	–	0.13	–	–	–	0.25	–	–	
Sunnycrest Rd	Observed Volume	109	485	–	544	–	534	94	628	–	–	–	–	28	–	56	84	A (7)
	LOS	A	A	–	A	–	A	–	A	–	–	–	–	B	–	A	B	
	V/C Ratio	0.27	0.40	–	–	–	0.53	–	–	–	–	–	–	0.10	–	0.19	–	
Shaw Rd	Observed Volume	20	436	47	503	14	545	29	588	76	23	18	117	28	3	12	43	A (9)
	LOS	A	A	–	A	A	A	–	A	–	B	–	B	B	A	–	B	
	V/C Ratio	0.05	0.44	–	–	0.03	0.52	–	–	–	0.36	–	–	0.08	0.04	–	–	
School Rd	Observed Volume	202	173	173	548	16	184	20	220	234	18	8	260	35	65	302	402	B (16)
	LOS	B	B	–	B	C	C	–	C	–	C	–	C	–	B	A	A	
	V/C Ratio	0.35	0.42	–	–	0.08	0.54	–	–	–	0.66	–	–	–	0.21	0.2	–	
Reed Rd	Observed Volume	215	12	12	239	54	6	1	61	4	194	4	202	8	390	8	406	B (13)
	LOS	–	B	–	B	–	B	–	A	–	A	–	A	–	B	–	B	
	V/C Ratio	–	0.5	–	–	–	0.13	–	–	–	0.3	–	–	–	0.59	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	173	101	3	277	61	203	14	278	13	70	24	107	3	51	–	54	B (11)
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	B	B	–	B	
	V/C Ratio	0.25	0.04	0	–	0.16	0.2	0.01	–	0.05	0.2	0.02	–	0.01	0.14	–	–	

Table 3.15: Intersection Level of Service - 2035 MD

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	54	159	159	372	393	183	183	759	34	138	453	625	186	153	82	421	
	LOS	C	D	–	D	C	B	–	B	–	D	A	B	C	B	–	C	C (21)
	V/C Ratio	0.27	0.81	–	–	0.8	0.42	–	–	–	0.66	0.34	–	0.58	0.41	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	295	604	–	899	–	558	31	589	–	–	–	–	145	–	200	345	
	LOS	C	B	–	B	–	B	–	B	–	–	–	–	C	–	A	A	B (15)
	V/C Ratio	0.74	0.34	–	–	–	0.49	–	–	–	–	–	–	0.3	–	0.14	–	
Field Rd	Observed Volume	163	471	25	659	3	388	52	443	13	1	6	20	125	7	127	259	
	LOS	A	A	–	A	B	C	A	B	–	C	A	B	–	C	A	B	B (12)
	V/C Ratio	0.29	0.42	–	–	0.01	0.62	0.04	–	–	0.05	0.02	–	–	0.48	0.09	–	
Roberts Creek Rd	Observed Volume	15	372	55	442	37	52	36	125	60	3	69	132	38	2	0	40	
	LOS	A	A	A	A	A	A	A	A	–	A	–	A	–	B	–	B	A (7)
	V/C Ratio	0.02	0.38	0.04	–	0.07	0.05	0.02	–	–	0.35	–	–	–	0.12	–	–	
Payne Rd and Pratt Rd	Observed Volume	166	422	47	635	135	307	54	496	95	63	110	268	139	86	175	400	
	LOS	B	C	–	B	B	B	–	B	–	C	A	B	C	C	A	B	B (18)
	V/C Ratio	0.37	0.7	–	–	0.37	0.55	–	–	–	0.48	0.25	–	0.5	0.2	0.35	–	
Venture Way and Mahan Rd	Observed Volume	23	600	32	655	47	786	47	880	33	14	47	94	163	18	40	221	
	LOS	A	B	–	B	A	B	–	B	–	C	–	C	–	D	–	D	B (19)
	V/C Ratio	0.14	0.61	–	–	0.15	0.79	–	–	–	0.25	–	–	–	0.68	–	–	
Sunnycrest Rd	Observed Volume	201	582	–	783	–	625	110	735	–	–	–	–	87	–	223	310	
	LOS	B	A	–	B	–	A	–	A	–	–	–	–	C	–	A	C	B (11)
	V/C Ratio	0.66	0.50	–	–	–	0.64	–	–	–	–	–	–	0.35	–	0.55	–	
Shaw Rd	Observed Volume	50	558	62	670	30	626	33	689	81	25	19	125	89	15	60	164	
	LOS	A	A	–	A	A	A	–	A	–	C	–	C	A	B	–	A	B (10)
	V/C Ratio	0.15	0.55	–	–	0.08	0.58	–	–	–	0.41	–	–	0.29	0.19	–	–	
School Rd	Observed Volume	243	200	200	643	12	195	22	229	224	17	7	248	23	43	197	263	
	LOS	B	B	–	B	C	C	–	C	–	C	–	C	–	C	A	A	B (18)
	V/C Ratio	0.4	0.47	–	–	0.06	0.56	–	–	–	0.65	–	–	–	0.14	0.13	–	
Reed Rd	Observed Volume	221	12	12	245	70	8	2	80	5	220	5	230	4	171	4	179	
	LOS	–	B	–	B	–	A	–	A	–	B	–	B	–	B	–	B	B (11)
	V/C Ratio	–	0.47	–	–	–	0.16	–	–	–	0.42	–	–	–	0.33	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	126	105	4	235	50	123	11	184	9	64	32	105	13	33	–	46	
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	B	B	–	B	B (10)
	V/C Ratio	0.17	0.04	0	–	0.11	0.09	0.01	–	0.03	0.17	0.02	–	0.04	0.09	–	–	

Table 3.16: Intersection Level of Service 2035 PM

LOCATION	MOE	APPROACH																INTERSECTION OVERALL
		EB				WB				NB				SB				
		EBL	EBT	EBR	Total	WBL	WBT	WBR	Total	NBL	NBT	NBR	Total	SBL	SBT	SBR	Total	
Wharf Ave and Dolphin St	Observed Volume	55	150	150	355	496	218	218	932	37	148	491	676	229	174	94	497	C (28)
	LOS	C	D	–	D	E	B	–	D	–	D	A	B	C	C	–	C	
	V/C Ratio	0.31	0.79	–	–	1.00	0.5	–	–	–	0.7	0.37	–	0.72	0.46	–	–	
Ti'Ta Way (Sxwelatp)	Observed Volume	268	714	–	982	–	668	29	697	–	–	–	–	150	–	266	416	B (15)
	LOS	C	B	–	B	–	C	–	C	–	–	–	–	C	–	A	A	
	V/C Ratio	0.76	0.4	–	–	–	0.58	–	–	–	–	–	–	0.31	–	0.18	–	
Field Rd	Observed Volume	160	511	27	698	4	419	47	470	31	2	8	41	180	9	183	372	B (15)
	LOS	A	B	–	A	B	C	A	C	–	C	A	B	–	C	A	B	
	V/C Ratio	0.35	0.54	–	–	0.01	0.72	0.03	–	–	0.11	0.02	–	–	0.63	0.12	–	
Roberts Creek Rd	Observed Volume	25	479	83	587	41	580	32	653	61	3	81	145	34	2	0	36	A (9)
	LOS	A	A	A	A	A	B	A	A	–	B	–	B	–	B	–	B	
	V/C Ratio	0.07	0.49	0.06	–	0.1	0.59	0.02	–	–	0.43	–	–	–	0.14	–	–	
Payne Rd and Pratt Rd	Observed Volume	184	420	47	651	153	356	63	572	80	54	93	227	156	103	227	486	B (18)
	LOS	B	C	–	B	B	C	–	B	–	C	A	B	C	C	A	B	
	V/C Ratio	0.47	0.7	–	–	0.42	0.64	–	–	–	0.4	0.21	–	0.53	0.23	0.42	–	
Venture Way and Mahan Rd	Observed Volume	18	675	36	729	44	830	58	932	32	14	45	91	138	15	37	190	B (16)
	LOS	A	B	–	B	A	B	–	B	–	B	–	B	–	C	–	C	
	V/C Ratio	0.12	0.66	–	–	0.21	0.82	–	–	–	0.28	–	–	–	0.66	–	–	
Sunnycrest Rd	Observed Volume	249	620	–	869	–	609	107	716	–	–	–	–	155	–	254	409	B (14)
	LOS	C	A	–	B	–	B	–	B	–	–	–	–	D	–	A	C	
	V/C Ratio	0.75	0.52	–	–	–	0.61	–	–	–	–	–	–	0.56	–	0.56	–	
Shaw Rd	Observed Volume	40	650	72	762	30	629	33	692	78	24	18	120	104	13	51	168	B (10)
	LOS	A	A	–	A	A	A	–	A	–	C	–	C	C	A	–	C	
	V/C Ratio	0.11	0.62	–	–	0.10	0.57	–	–	–	0.42	–	–	0.37	0.17	–	–	
School Rd	Observed Volume	286	227	227	740	13	180	20	213	220	17	7	244	25	46	206	277	B (18)
	LOS	B	B	–	B	C	D	–	C	–	C	–	C	–	C	A	A	
	V/C Ratio	0.45	0.52	–	–	0.07	0.55	–	–	–	0.65	–	–	–	0.15	0.14	–	
Reed Rd	Observed Volume	181	10	10	201	71	8	2	81	4	216	4	224	4	215	4	223	A (10)
	LOS	–	B	–	B	–	A	–	A	–	B	–	A	–	A	–	A	
	V/C Ratio	–	0.46	–	–	–	0.19	–	–	–	0.35	–	–	–	0.35	–	–	
Port Mellon Hwy and Marine Dr	Observed Volume	86	95	7	188	10	11	1	22	8	37	20	65	–	41	–	41	A (7)
	LOS	A	A	A	A	B	B	A	B	B	B	A	B	–	B	–	B	
	V/C Ratio	0.1	0.04	0	–	0.02	0.01	0	–	0.02	0.09	0.01	–	–	0.1	–	–	

3.5 Problem Definition Summary

This section identifies the locations with deficiencies based on the critical thresholds previously defined for highway performance, intersection performance, and safety in either the existing or future time frame. A summary of the issue locations can be found in ***Table 3.17*** below.

Table 3.17: Summary of Existing and Future Deficiencies

Deficiency	Existing Conditions	Future Conditions
Highway Performance	Veterans Road to Roberts Creek Road: • NB highway at LOS D during peak hours due to few passing opportunities • SB highway at LOS D during peak hours due to few passing opportunities	Veterans Road to Roberts Creek Road • NB highway at LOS E in AM and MD and LOS F in PM in the summer, and at LOS D during peak hours in the fall • SB highway at LOS D in AM, LOS E in MD and PM in the summer and at LOS D during peak hours in the fall
	Roberts Creek Road to Field Road • NB highway at LOS D during peak hours due to few passing opportunities	Roberts Creek Road to Field Road • NB highway at LOS E in AM and MD and LOS F in PM in the summer, and at LOS D during peak hours in the fall • SB highway at LOS D during peak hours in the fall
Intersection Performance	No deficiencies. All movements operating at LOS D or better.	Wharf Avenue and Dolphin Street • WBL movement at LOS F in AM and at LOS E in PM
Safety	Veterans Road to Roberts Creek Road • Collision prone segment with a high frequency of collisions and a higher severity level than the threshold values • Joe Road / Orange Road has a high frequency of collisions with key collision types being off-road and involving alcohol • The segment around Neilson Road has a high frequency of collisions • The segment around Largo Road has a high frequency of collisions • Flume Road / Lockyer Road has a high frequency of collisions with the key collision type being rear-end	N/A
	Roberts Creek Road to Field Road • Collision prone segment with a high frequency of collisions and a higher severity level than the threshold values • High frequency of collisions in the segment around Field Road	

Deficiency	Existing Conditions	Future Conditions
	Field Road to Chelpi Avenue • Collision prone segment with a high frequency of collisions and a higher severity level than the threshold values • High frequency of collisions at Davis Bay Road and Bay Road, with the key collision type being rear-end • Selma Park Road has high frequency of collisions • Ti'Ta Way has a high frequency of collisions with the key collision type being right-angle	
	Chelpi Avenue to Shorncliffe Avenue • Collision prone segment with a high frequency of collisions and a higher severity level than the threshold values	
	Shorncliffe Avenue to Redrooffs Road • Collision prone segment with a high frequency of collisions and a higher severity level than the threshold values • Norwest Bay Road has a high frequency of collisions • Hill Road has a high frequency of collisions with the key collision type being off-road	

From the tables above, the following key points provide an overall summary of the current and future issues along the study corridor:

- In terms of highway performance, the two primarily rural segments between Field Road and Veterans Road are operating at threshold levels of performance due to the lack of passing opportunities. The segment between Roberts Creek Road and Field Road in the southbound direction includes a passing lane and operates acceptably now and to 2035. Existing and forecasted future volumes are within the capacity of a two-lane highway and four-laning of the corridor is not warranted within the current planning horizon. In addition, the relatively low volume of cross-corridor travel does not warrant the construction of an alternate route or bypass between Langdale and Sechelt.

- While all intersections are operating at acceptable levels under existing conditions, the Wharf Avenue / Dolphin Street intersection was found to have performance deficiencies associated with the westbound left movement under 2035 conditions.

- In terms of traffic safety, five corridor segments were found to be collision prone and thirteen (13) specific locations were identified as having a high frequency of collisions.

The above locations are graphically depicted on ***Figure 3.34***. The locations of existing active transportation infrastructure gaps and transit facility issues can be found on ***Figure 3.35***. These locations will be the subject of further investigations to identify potential mitigation measures.

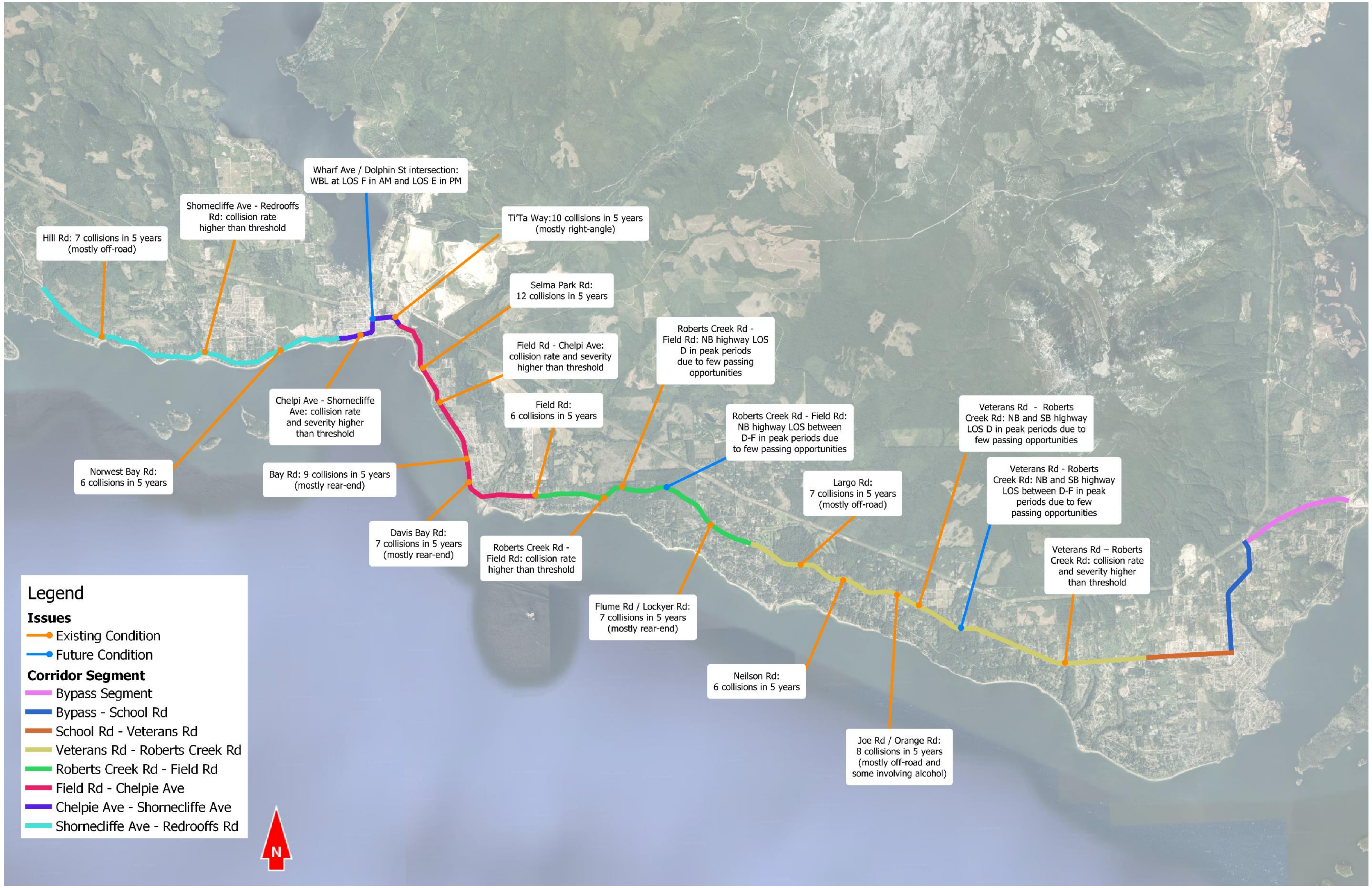


Figure 3.34: Summary of Performance and Safety Issues

Figure 3.35: Summary of Active Transportation and Transit Facility Issues

4. OPTION GENERATION

In previous section of this report, several corridor deficiencies were identified through an assessment of existing traffic patterns, existing and future intersection level of service, and collision history. This section provides a description of the mitigation measures being considered to address the various identified corridor issues.

Given the diversity in the nature as well as the geographic range of the corridor issues identified, the potential improvement measures to address these corridor issues will also vary. In order to efficiently generate a set of issue appropriate improvement options, the corridor issues to be addressed have been divided into three categories, Highway Performance, Intersection Performance, and Safety. As shown in ***Table 4.1***, for each corridor issue category, a corresponding form or type of improvement option has been identified.

Table 4.1: Potential Improvement Option Types

Corridor Issue Category	Existing Deficiencies	Future (2035) Deficiencies	Potential Improvement Options
Highway Performance	Poor highway level of service due to the lack of passing opportunities between Gibsons and Sechelt	Poor highway level of service due to the lack of passing opportunities between Gibsons and Sechelt	• New passing lanes
Intersection Performance		Significant delays at signalized intersections in the urban area of Sechelt	• Intersection improvements to improve operations • Short bypass segment in the urban area of Gibsons to improve mobility by diverting through traffic away from Gibsons Way
Safety	Collision-prone unsignalized intersections and highway segments		• Intersection improvements to improve safety including: o New left-turn lanes o New acceleration and deceleration lanes o Modified geometry and grades o Turn restrictions o New traffic signals o Traffic signal phasing

The options generated under each improvement option type are introduced and described in the following sections as follows:

- **Passing Lanes** to address highway level of service issues.
- **Intersection Improvements** to address capacity and safety issues.
- **Short Bypass** segments to improve overall mobility through the urban area of Gibsons and to potentially enhance traffic safety.

4.1 Passing Lanes

To address the highway level of service issues associated with the two lane highway segment between Field Road and Veterans Road, several passing lane improvement options have been developed. A summary of the underlying corridor issues and the proposed improvement options are described below in the following sections.

4.1.1 Corridor Issue Summary

The rural section of the corridor between Gibsons and Sechelt was assessed using the methods for two-lane highways from the 2010 Highway Capacity Manual, which uses percent time spent following (PTSF) to categorize the level of service. The highway between Gibsons and Sechelt was divided into two segments at Roberts Creek Road since the performance of the highway at that location is determined by the existing traffic signal. Analysis documented in the Problem Definition Report indicated that in both the summer and fall seasons, the highway is performing at LOS D during the weekday peak periods within all segments / directions except the southbound segment between Field Road and Roberts Creek, which is the only segment that has an existing passing lane. Within the other segments / directions, despite the manageable volumes on the corridor for a typical two-lane highway, the lack of passing opportunities resulted in the percent time spent following to be consistently above 70%. The lack of passing opportunities are the result of high opposing direction volumes, no passing lanes except in the southbound direction between Sechelt and Roberts Creek, and a range of between 83-93% of each segment / direction being denoted as no-passing zones as represented by the lane markings.

Through the analysis of the fall and summer scenarios for the future 2035 planning horizon, all of the segments / directions were found to be performing above LOS D during the weekday peak periods with the exception of the southbound segment between Field Road and Roberts Creek, again where there is an existing passing lane.

4.1.2 Improvement Options

Existing and forecasted peak hour traffic volumes do not warrant widening of the highway corridor to four lanes throughout, but rather increased passing opportunities in both directions between Gibsons and Sechelt are necessary to improve the highway level of service above the acceptable threshold. In response, three new passing lanes are proposed and are listed below and graphically depicted in an overview ***Figure 4.1***.

- A 1200-metre southbound passing lane extending approximately between Leek Road and Highland Road, identified as Passing Lane SB-1 throughout this report;
- A 1600-metre northbound passing lane extending approximately between Leek Road and Maskell Road, identified as Passing Lane NB-1 throughout this report; and
- A 1800-metre northbound passing lane extending approximately between Pell Road and Jack Road, identified as Passing Lane NB-2 throughout this report.

It is proposed that the highway widening projects associated with the construction of the passing lanes include a shoulder that allows separation between cyclists / pedestrians and vehicles.

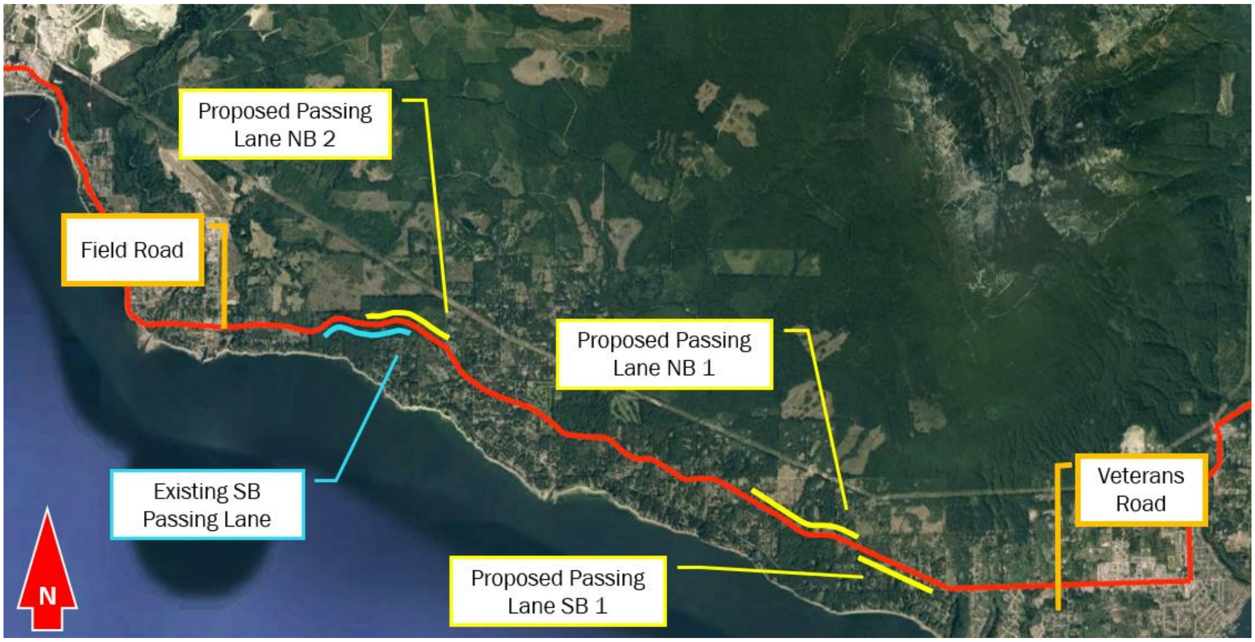


Figure 4.1: Existing and Proposed Passing Lanes Between Gibsons and Sechelt

The proposed locations for the three potential passing lane options were selected to minimize conflicts with left turn movements that would cross the passing lane segments as well as to minimize the overlap with other intersections and driveways. At this stage of option development, the locations in terms of the actual start and end points should be considered approximate and will likely be adjusted during a future preliminary or detailed design stage once factors such as constructability, environmental, or property factors are further defined. Single-line drawings that illustrate each of the three proposed passing lanes in greater are shown in ***Figure 4.2*** to ***Figure 4.4.***

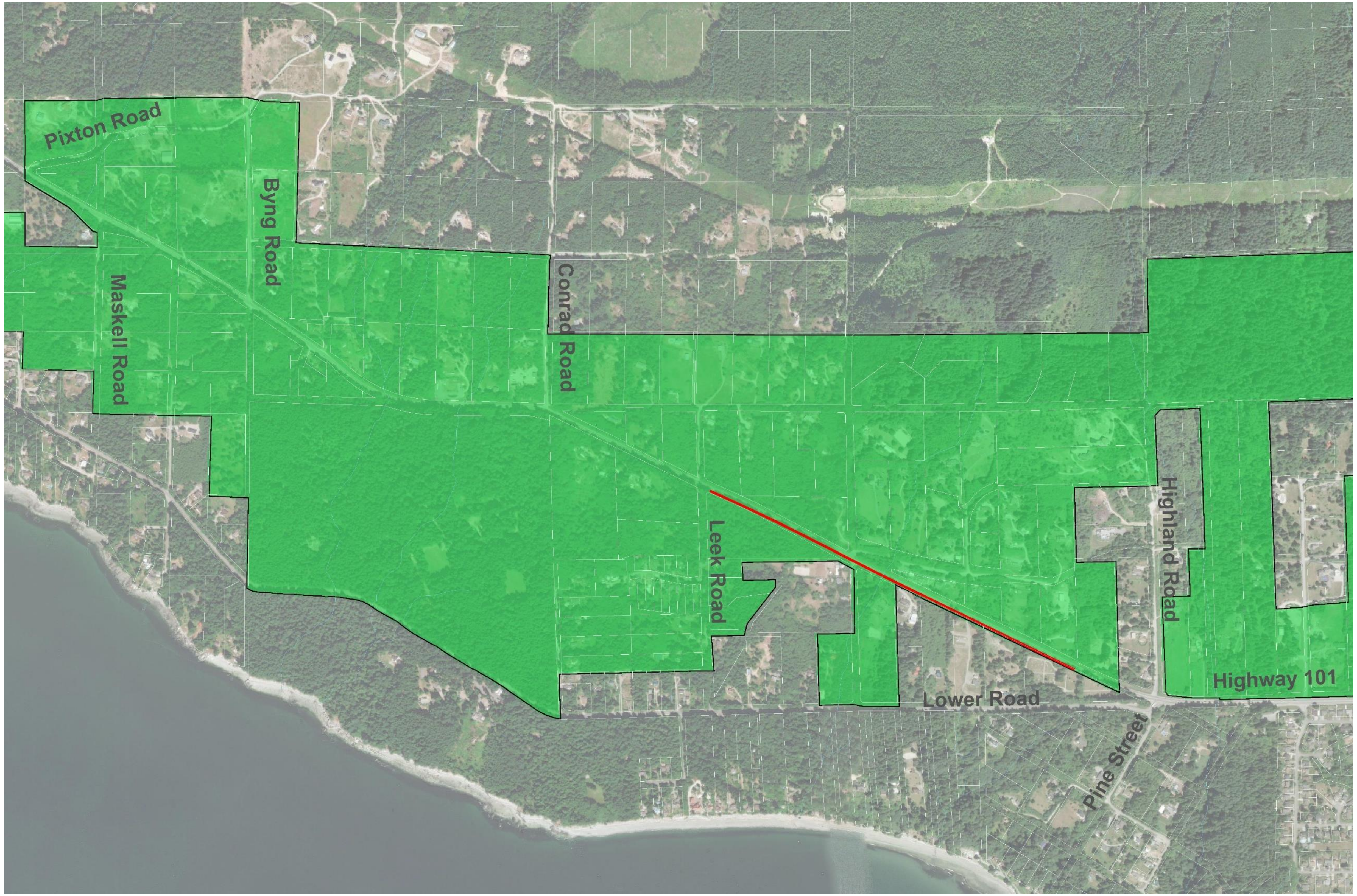


Figure 4.2: Passing Lane SB-1

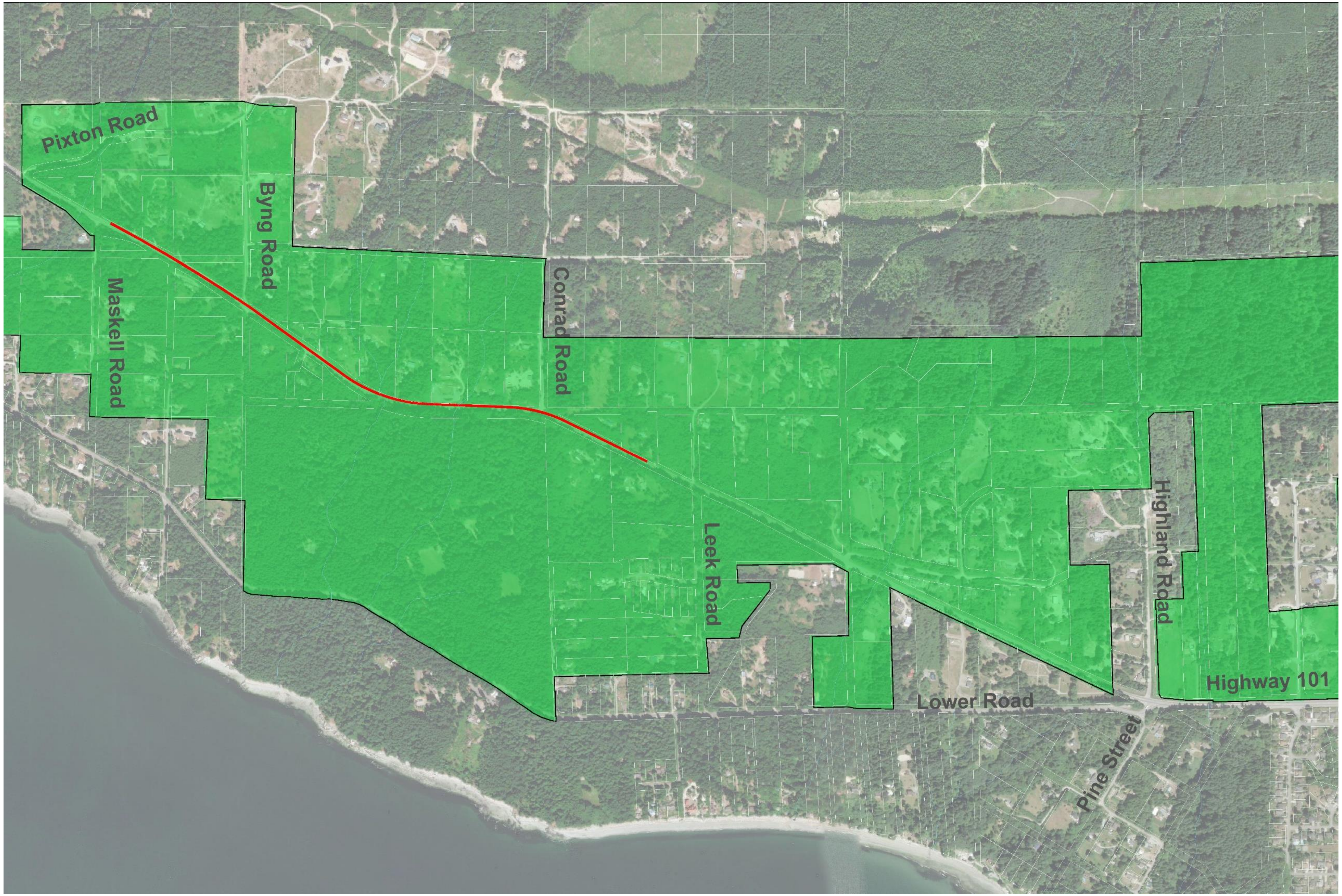


Figure 4.3: Passing Lane NB-1

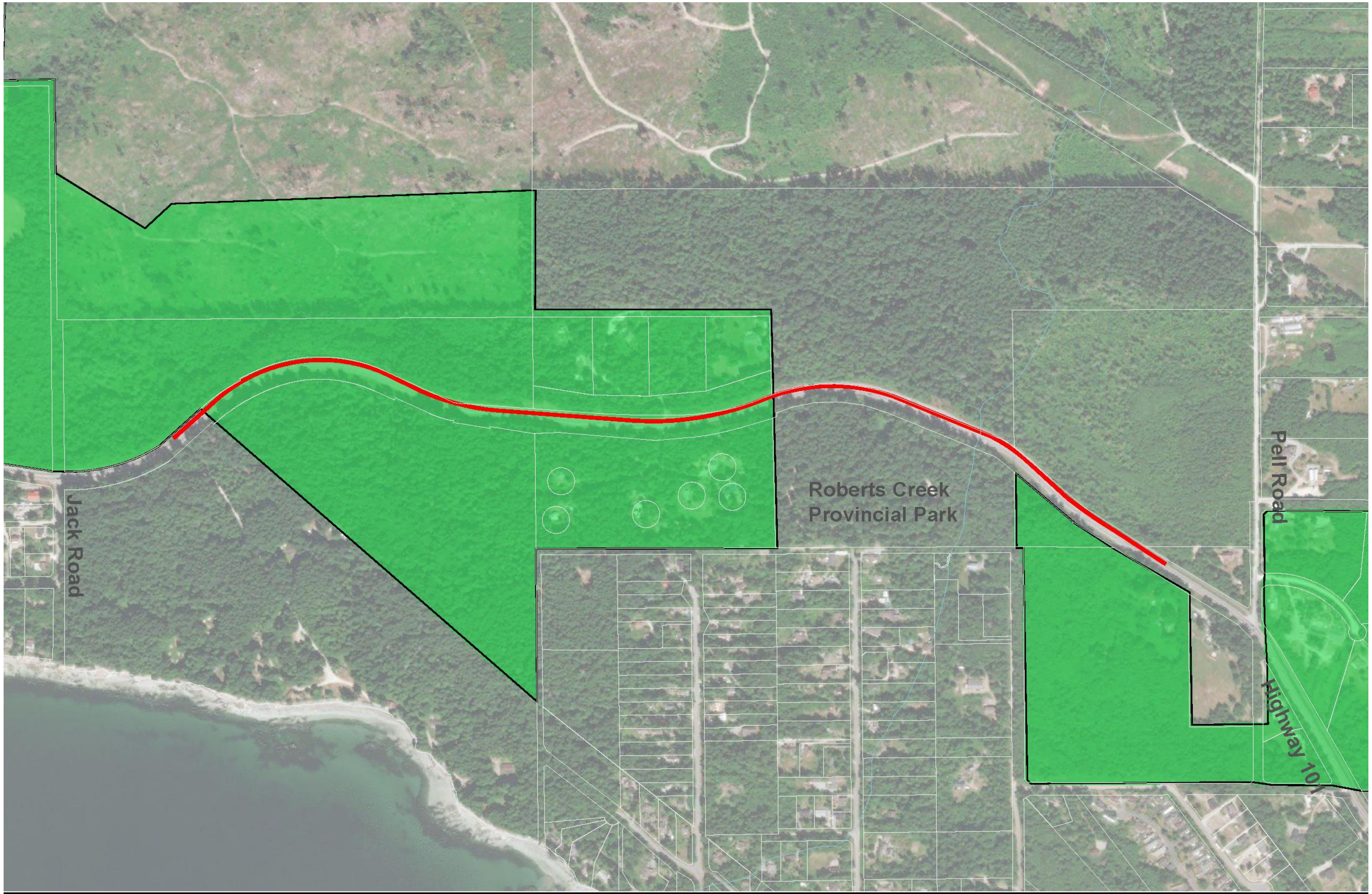


Figure 4.4: Passing Lane NB-2

4.2 Intersection Improvements

Analysis of the recent collision history of the highway study segments, as documented in the Problem Definition Report, identified several collision prone locations where the associated intersections had above-average collision rates. These collisions were sometimes attributed to geometry, grades, lighting, and the lack of turning lanes relative to the speeds and traffic volumes on the highway. In addition, intersection level of service in terms of capacity was identified as an issue at one other intersection along the study corridor. Based on the results of the problem definition analysis, several intersection locations were identified where improvements could mitigate the traffic operations issues as well as many of the traffic safety issues which were found within the five collision-prone segments or the thirteen collision-prone locations.

- Joe Road / Orange Road
- Flume Road
- Lower Road / Highland Road
- Ti"Ta Way
- Wharf Avenue / Dolphin Street
- Shorncliffe Avenue
- Hill Road
- Redrooffs Road

Where applicable, it is proposed that active transportation infrastructure be included in these intersection improvements.

In addition to the above intersections, several corridor improvements were generated for the highway segment between Davis Bay and Selma Park given the various safety issues identified in this area as well as deficient pedestrian facilities. The collision prone locations associated with the intersections at Davis Bay, Bay Road, and Selma Park Road are included as part of these corridor improvements.

Due to the diverse range of collision types and the lack of any one collision type being more represented than the others, no mitigation measures were developed at the other identified collision prone locations near Largo Road or Neilson Road, In addition, the collision prone locations near Largo Road and Neilson Road, two rural gravel road connections to Highway 101, are likely related to the immediate segment of highway in the vicinity of the intersections – hence the diverse range of collision types. Similarly, no mitigation measures were developed at the collision prone locations associated with the intersections at Field Road and Norwest Bay Road due to the diverse range of collision types and the lack of over representation of any one collision type.

The following sections provide a summary of the existing and / or future conditions and descriptions of the proposed improvements being considered for each of the intersections listed above as well as the segment of highway between Davis Bay and Selma Park.

4.2.1 Joe Road / Orange Road

The Joe Road / Orange Road intersection is one of the busiest unsignalized intersections between Gibsons and Sechelt, providing a connection to Lower Road and many residential properties on either side of the highway. It is also one of the most collision-prone locations in the study area, with eight collisions documented between 2013 and 2017, seven of which were classified as "off-road" with one "rear-end" collision type. The existing intersection has no acceleration, deceleration, or turning lanes for vehicles turning on or off the highway, which together likely result in delays for through-traffic and the risk of collisions.

To mitigate the safety and delay issues at the Joe Road / Orange Road intersection, left-turn lanes are proposed along Highway 101 in both directions of travel. Each turn lane would include a 50-metre taper transition, a 100-metre parallel deceleration length, and a 30-metre minimum storage length. A graphical depiction of the proposed left turn lanes is provided in ***Figure 4.5***. It is noted that these improvement concepts were developed in the 2007 Highway 101 Safety and Operational Review prepared for BC MoTI (by Urban Systems).

Figure 4.5: Proposed Left Turn Lanes at Joe Road / Orange Road Intersection

4.2.2 Flume Road

Flume Road is a key connection between the community of Roberts Creek and Highway 101. The intersection is also located along the #1 Langdale / Sechelt bus route in order to provide transit access to the Roberts Creek Provincial Park picnic area. The south leg of the Flume Road / Lockyer Road intersection connects to Highway 101 with a steep grade, causing sightline issues and difficulty turning onto the highway. The intersection has also been identified as a collision-prone location, with seven collisions recorded in 2013-2017. In addition, bus operators have experienced difficulty making the left turn onto Highway 101 at this location, especially when the pavement is wet or when the bus is fully loaded.

To mitigate these issues, the Flume Road leg of the intersection could be regraded to reduce the steepness of the connection to the highway. However, this solution would require significant earthworks and changes to the driveway connections on Flume Road as well as significant changes to the vertical alignment along Highway 101 and Orange Road. To avoid these significant impacts, it is proposed that the Flume Road / Highway 101 intersection be restricted to right in / right out movements, which would effectively shift the left-turning traffic to Marlene Road. This option is consistent with the recent plans by BC Transit and the Sunshine Coast Regional District to move the northbound bus route from Flume Road to Marlene Road. The grade on Marlene Road approaching the highway is approximately 6.0 percent as compared to the approximately 12 percent grade on the Flume Road approach. New signage would be provided on Beach Avenue to direct traffic to use Marlene Road to access Highway 101.

To further mitigate the safety issues at this location as demonstrated by the relatively high number of rear-end and off-road collisions, left turn lanes on Highway 101 in both directions are proposed (southbound at Lockyer Road and northbound at Marlene Road). Each left-turn lane would include a 50-metre transition taper, 100-metre deceleration length, and a minimum 30-metre storage length. A graphical depiction of the proposed improvements is provided in ***Figure 4.6***.

Figure 4.6: Proposed Improvements at the Flume Road / Lockyer Road and Marlene Road Intersections

4.2.3 Lower Road / Highland Road

The intersection of Lower Road / Highland Road is a key connection for motorists and cyclists travelling between Gibsons and Roberts Creek as well as providing access to many residential properties north and south of the highway. The intersection is also along a segment of the highway which has a collision rate and frequency greater than the provincial average for the facility type.

To mitigate the safety issues at this location, and to also reduce delays for southbound vehicles, both a southbound left-turn lane and a southbound deceleration lane are proposed. A graphical depiction of the proposed improvements is provided in ***Figure 4.7***.

Figure 4.7: Proposed Improvements at the Highland Road Intersection

4.2.4 Ti'Ta Way

The signalized intersection on Highway 101 at Ti'Ta Way is the major connection between the highway and shíshálh Nation commercial properties. This intersection provides access to St Mary's Hospital, Tsain-Ko Village Shopping Centre, and several industrial properties related to gravel extraction north of the highway. Ten collisions occurred at this location from 2013 to 2017, half of which were right-angle type related to Highway 101 left turn movements. In addition, a higher than average proportion of injury collisions were observed at the Ti'Ta Way intersection compared to the rest of the study corridor.

To mitigate the safety issues at this intersection, especially the collisions related to the left-turn movements, modifying the signal phasing from protected / permitted left turns to protected only left turns is proposed. This change in the signal phasing is anticipated to eliminate conflicts between the highway left turn movements and the two opposing through lane movements and thereby potentially reducing the risk of collisions as a result.

4.2.5 Wharf Avenue / Dolphin Street

The Wharf Avenue / Dolphin Street intersection with Highway 101 provides access to the urban area of Sechelt in addition to the residential area to the north. The intersection is unique in that vehicles continuing northbound on Highway 101 must make a left turn at the intersection, and those continuing southbound must make a right turn. As a result, the highest volume movements at this intersection are turning, instead of proceeding through as with the other intersections along the study corridor.

Because the westbound left turn lane at this intersection carries the volume of Highway 101 and competes with the eastbound through movement, this movement is forecasted to perform at LOS F in the AM peak hour and LOS E in the PM peak hour in 2035.

To mitigate the traffic operations issue at this intersection, re-designating the lanes on the westbound approach to the intersection is proposed as follows:

- The left lane would remain as a left-turn lane.
- The right or curb lane would become a shared left-through-right turn lane – currently operates as a shared through-right turn lane.
- To accommodate this proposed laning configuration, the signalized intersection would need to operate with split phasing with the westbound movement operating on one phase, the eastbound movement on a second phase, and the north south movements on a third phase.

An additional receiving lane would be added to the south leg of the intersection to accommodate the dual left turn. The existing pavement is wide enough to accommodate this new lane, however, the curb and traffic signal pole on the southwest corner of the intersection would need to be relocated and some of the angle parking would need to be converted to parallel parking. The new lane would function as a drop lane exiting at Cowrie Street, which should provide sufficient distance for the two left turn lanes to merge into the single northbound lane.

In converting the angle parking to parallel parking in the segment along Wharf Avenue to accommodate the short segment of two lanes, the earlier noted deficiencies regarding the lack of defined pedestrian facilities along this segment could also be addressed.

4.2.6 Shorncliffe Avenue

The Shorncliffe Avenue intersection with Highway 101 provides access to several civic and public destinations, including the provincial courthouse, the RCMP station, the aquatic centre, City Hall, the public library and Sechelt Elementary. Shorncliffe Avenue is also one of the main access points to the commercial area of Sechelt from Highway 101. Currently, there is a zebra crosswalk on the east leg with a long crossing distance and sightline issues related to vegetation and horizontal curvature, together resulting in increased exposure to traffic for pedestrians. The intersection is also located on a segment of highway with a collision rate higher than the provincial average for this type of facility.

To mitigate the safety issues at this location, and to increase ease of access to the commercial areas and civic facilities north of the intersection, upgrading the Shorncliffe Avenue intersection to a full signal is proposed. Other changes to the intersection could be made to improve safety including trimming vegetation to improve sightlines and geometry refinements to reduce the pedestrian crossing distance and reduce speeds of westbound right-turning vehicles. A graphical depiction of the proposed improvements is provided in ***Figure 4.8***.

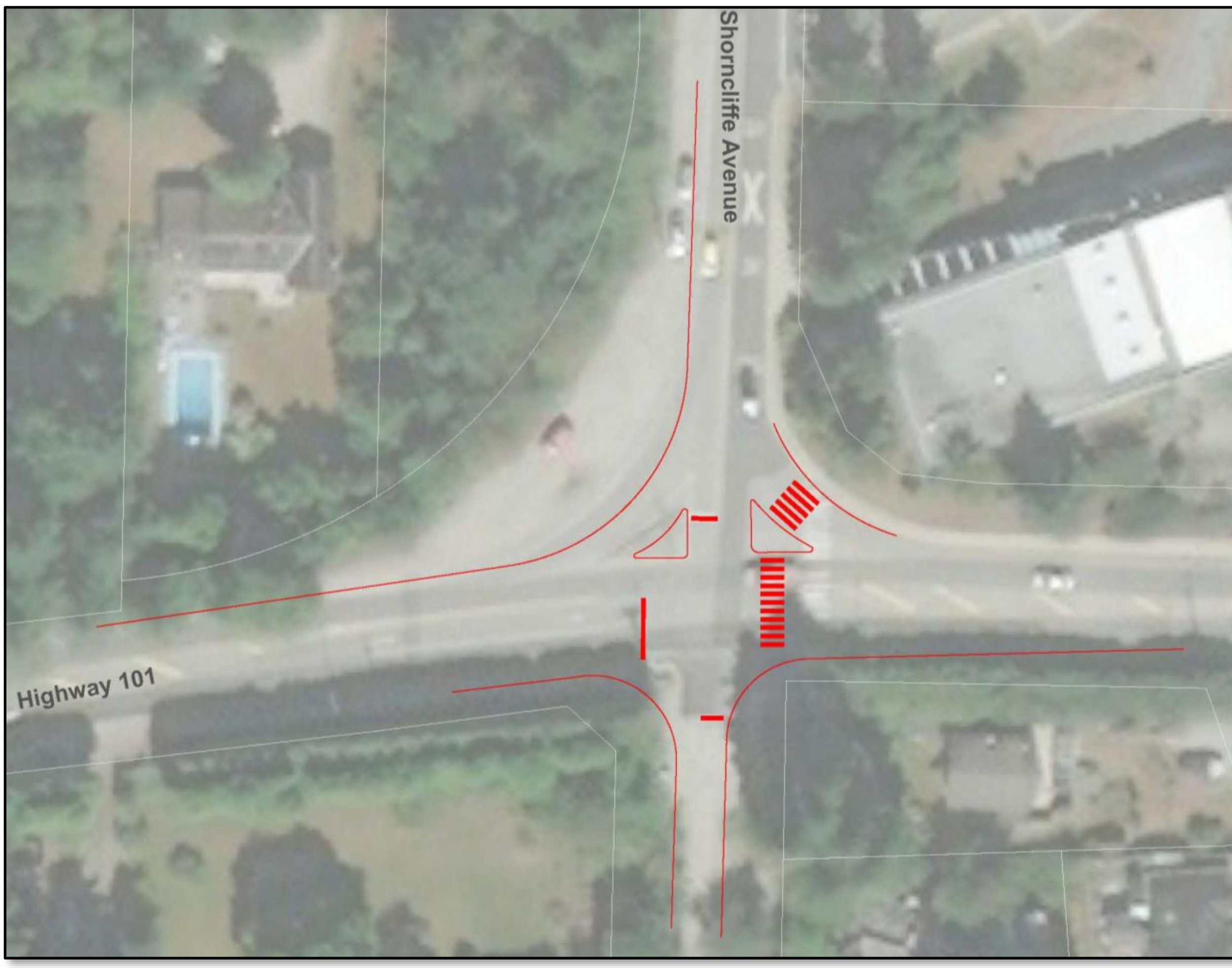


Figure 4.8: Proposed Improvements at the Shorncliffe Avenue Intersection

It is understood that upgrades to the intersection are planned by BC MoTI in conjunction with development of one of the adjacent properties, including improvements to the crosswalk to reduce the pedestrian crossing distance. Coordination will be required to reconcile the suggested improvements in this option and any other intersection improvements brought forward separately by other BC MoTI representatives.

4.2.7 Hill Road

The Hill Road intersection with Highway 101 provides access to a small number of residential properties south of the highway. Despite the relatively low volume of turning movements at this intersection, the intersection is the location of a disproportionately high number of collisions. Seven collisions occurred at the Hill Road intersection between 2013 and 2017, five of which were categorized as "off-road". The steep grade of both the intersecting roads and the skewed geometry of the intersection likely play a role in the collision frequency, demonstrated by the high proportion of collisions occurring in wet conditions.

To mitigate the safety issues at the Hill Road intersection, it is proposed that the Hill Road intersection is closed, and a new intersection formed further north along Highway 101 through an extension of Dale Road. This improvement option provides shallower grades and increased sightlines approaching Highway 101 as compared to a potential realignment of the existing intersection at Hill Road. In addition, it is recommended that a northbound left turn lane be added to Highway 101 along with a southbound deceleration lane. A graphical depiction of the proposed improvements is provided in ***Figure 4.9.***

Figure 4.9: Proposed Improvements at the Hill Road Intersection

4.2.8 Redrooffs Road

The Redrooffs Road intersection with Highway 101 provides access to a large number of residential properties south of the highway in the Sargeant Bay and Halfmoon Bay areas, in addition to Sargeant Bay Provincial Park. The intersection is on a segment of Highway 101 with a collision rate above the provincial average.

Redrooffs Road currently intersects Highway 101 at a very skewed angle, reducing visibility for turning vehicles. In addition, the highway has a relatively steep grade at this location and includes a climbing lane. As a result, vehicles turning left onto Redrooffs Road must use the climbing lane creating a potential for conflict with fast-moving through traffic. These features of the intersection likely contribute to the higher than average collision rate in this segment of Highway 101.

To mitigate the safety issues at the Redrooffs Road intersection, it is proposed that Redrooffs Road immediately south of the highway is realigned to intersect with Highway 101 at 90 degrees. A graphical depiction of the proposed improvements is provided in ***Figure 4.10.***

Figure 4.10: Proposed Improvements at the Redrooffs Road Intersection

4.2.9 Davis Bay and Selma Park

The segment of the highway running through the Davis Bay and Selma Park areas between Field Road and Ti'Ta Way could be categorized as semi-urban, transitioning between the urban area of Sechelt and the rural areas of Elphinstone and Roberts Creek. This segment of Highway 101 is characterized by a high density of driveways and intersections as well as large volumes of turning vehicles.

Highway 101 through Davis Bay is lined by a waterfront tourist area on the west side of the corridor, and a commercial area with hotels, restaurants, and shops on the east side. There are relatively high pedestrian volumes both on the side of, and crossing the highway in the area, and vehicle parking both along the highway and located in off-street facilities. Through Selma Park, the highway climbs through the shíshálh Nation lands and is lined by single-family residential properties with numerous driveways and frequent on-street (highway) parking.

The conditions described above result in delays for through-traffic passing through the area, frequent conflicts with turning vehicles, and an unprotected environment for pedestrians. The intersections of Highway 101 with Field Road, Davis Bay Road, Bay Road, and Selma Park Road were all identified as collision hotspots using 2013-2017 collision data, and the segment as a whole has a higher collision rate than the provincial average.

To mitigate these performance and safety issues through the Davis Bay and Selma Park areas, corridor improvements for the area are recommended, including the incorporation of left-turn lanes, closure or turning restrictions at several intersections, a new traffic signal and crosswalk, the provisions of wider shoulders, and a sidewalk through the corridor. The proposed improvements within this segment of Highway 101 are listed below and summarized graphically in ***Figure 4.11***:

- A new traffic signal, with a pedestrian crosswalk on the north leg, is proposed at Davis Bay Road
- New left turn lanes are proposed at the following locations:
    - Mission Road (Northbound only)
    - Davis Bay Road (Southbound only)
    - Bay Road (Southbound only)
    - Heather Road (Southbound only)
    - Nestman Road (Southbound only)
    - Snodgrass Road (Southbound only)
    - Selma Park Road (Both directions)
    - Monkey Tree Lane South (Southbound only)
- Restrictions to turning movements (Right-in/right out only) are proposed at the following locations:
    - Whitaker Road
    - Westly Road
    - Havies Road
- Closing the intersection with the north entrance of Monkey Tree Lane is proposed

Figure 4.11: Intersection Improvements in the Davis Bay and Selma Park Areas

The proposed highway cross section, shown in ***Figure 4.12,*** would include widening for a 2.0 metre sidewalk on the east side of the road, 2.0 metre paved shoulders on both sides of the road, and two 3.60-metre travel lanes, in addition to the turning lanes specified above. The upgraded cross section is proposed to extend from Field Road to the sand and gravel conveyor belt area immediately north of Monkey Tree Lane.

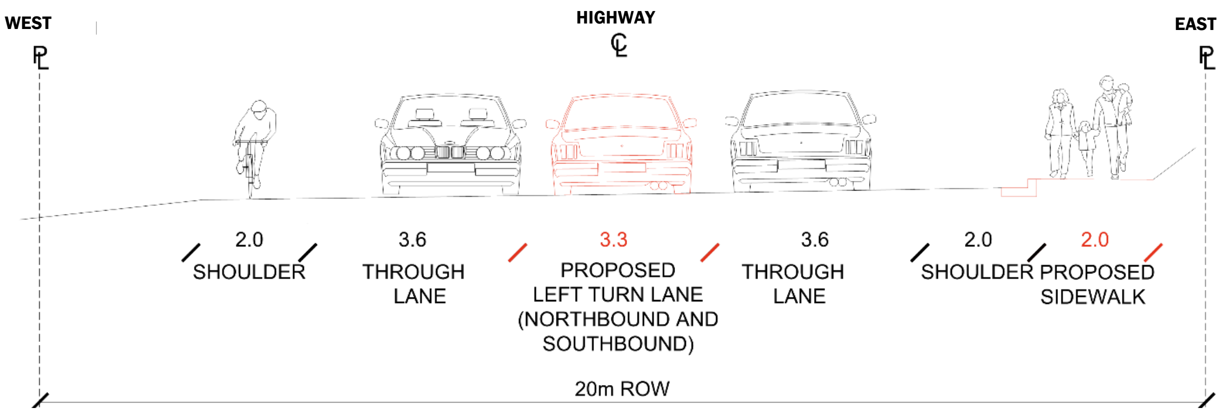


Figure 4.12: Proposed Cross Section Through Davis Bay Segment of Highway 101

4.3 Gibsons Bypass

The current route of Highway 101 passes through the developed area of Gibsons where it traverses six signalized intersections. The earlier findings of the intersection capacity analysis suggest that these six intersections will perform at acceptable levels of service through the 2035 planning horizon. However, in the longer term, the delay resulting from the signalized intersections will reduce mobility for highway users travelling between Langdale or Port Mellon and areas west of Gibsons.

Because Highway 101 through Gibsons was recently modified from a four-lane to a two-lane cross section to improve safety and support multi-modal use, increasing the capacity on the existing highway by adding lanes through Gibsons is not a supported improvement option. The construction of a bypass of the urban areas of Gibsons that would carry through-traffic on an alternative alignment and allow the existing roadway (Gibsons Way) to function as a local access route is a potential improvement option to address the long term mobility of the Highway 101 corridor and enhance traffic safety.

Three bypass options, developed at a preliminary single-line level, involve alignments that connect from the end of the existing bypass segment at either Stewart Road or North Road to a connection point along the existing highway at Payne Road at the western limits of Gibsons. The alignments were designed to minimize property impacts, especially agricultural, and complement ongoing or future land developments while improving travel times and reliability. Option 1A follows Reed Road to Payne Road to bypass the developed areas of Gibsons Way. Option 2A is aligned along the rear property lines of lots on the north side of Reed Road and also connects to Payne Road to bypass the developed areas of Gibsons. Finally, Option 3A follows the south edge of the BC Hydro corridor to connect to Payne Road to bypass Gibsons.

For each option, an alternative connection to Highway 101 at the west end of the proposed bypass alignments was developed to avoid the various accesses associated with the commercial / retail development on the south end of Payne Road. This alternative connection to Highway 101 at the west end of the proposed bypass alignments traverses through several agricultural properties located between Payne Road and Henry Road to connect to the highway immediately west of the existing Payne Road / Pratt Road intersection. This variant to the bypass alignments is denoted as “B” for all three options.

The three options are shown in single-line drawings in ***Figure 4.13*** to ***Figure 4.15*** and are described below:

4.3.1 Option 1

For all options, the bypass is assumed to consist of a two-lane rural highway with limited access and a design speed of 60 km/h.

OPTION 1A

- This bypass alignment deviates from the existing Highway 101 alignment at Reed Road and follows the Reed Road alignment to connect to Payne Road before continuing south to connect to the existing Highway 101 alignment at the Gibsons Way / Payne Road / Pratt Road intersection.
- The bypass alignment connecting Reed Road and Payne Road would be continuous through the inclusion of a 150 metre radius curve. The west leg of Reed Road would be realigned to tie into the bypass alignment as a “T” intersection.
- The eastern terminus of the proposed bypass would continue to use the existing intersection configuration at Reed Road and North Road. Intersection upgrades such as channelization would be included.
- The western terminus of the proposed bypass would continue to use the existing intersection configuration at Payne Road / Gibsons Way / Pratt Road.
- As an option, changes are also proposed at the Highway 101 / North Road / Stewart Road intersection to allow the highway alignment to be the through movement. This reconfiguration of the intersection would include closing Stewart Road at North Road and connecting the isolated segment of Stewart Road to the south segment through a new connector road within the existing right-of-way.

OPTION 1B

- This bypass option follows the same alignment as Option 1A at the eastern terminus.
- At the western terminus, the bypass alignment diverges from the Payne Road alignment (near Woodsworth Road) and connects to Highway 101 immediately west of the existing Gibsons Way / Payne Road / Pratt Road. The connection to Highway 101 at the western terminus is configured to allow the new bypass to represent the through movement. Gibsons Way would therefore be realigned to tie into the proposed bypass alignment as a “T” intersection.

4.3.2 Option 2

For all options, the bypass is assumed to consist of a two-lane rural highway with limited access and a design speed of 60 km/h.

OPTION 2A

- This bypass alignment deviates from the existing Highway 101 alignment at Cemetery Road and follows a new east west alignment located between Cemetery Road and Reed Road. The new bypass alignment would then connect to Payne Road before continuing south to connect to the existing Highway 101 alignment at the Gibsons Way / Payne Road / Pratt Road intersection.
- The bypass alignment connecting to Payne Road would be continuous through the inclusion of a 150 metre radius curve. The north leg of Payne Road would be realigned to tie into the bypass alignment as a "T" intersection.
- The eastern terminus of the proposed bypass would involve the reconfiguration of the Cemetery Road / North Road intersection to allow the bypass alignment to represent the through movement. The south leg of North Road would be connected to Cemetery Road. Intersection upgrades such as channelization would be included.
- The western terminus of the proposed bypass would continue to use the existing intersection configuration at Payne Road / Gibsons Way / Pratt Road.
- As an option, changes are also proposed at the Highway 101 / North Road / Stewart Road intersection to allow the highway alignment to be the through movement. This reconfiguration of the intersection would include closing Stewart Road at North Road and connecting the isolated segment of Stewart Road to the south segment through a new connector road within the existing right-of-way.

OPTION 2B

- This bypass option follows the same alignment as Option 2A at the eastern terminus.
- At the western terminus, the bypass alignment diverges from the Payne Road alignment (near Woodsworth Road) and connects to Highway 101 immediately west of the existing Gibsons Way / Payne Road / Pratt Road. The connection to Highway 101 at the western terminus is configured to allow the new bypass to represent the through movement. Gibsons Way would therefore be realigned to tie into the proposed bypass alignment as a "T" intersection.

4.3.3 Option 3

For all options, the bypass is assumed to consist of a two-lane rural highway with limited access and a design speed of 60 km/h.

OPTION 3A

- This option generally follows the preferred alignment identified in the 2006 Gibsons Bypass Extension Planning & Design Study (R.F. Binnie & Associates Ltd., 2006).
- This bypass alignment deviates from the existing Highway 101 alignment at Stewart Road and would follow an existing highway right of way located immediately south of the BC Hydro corridor. The new bypass alignment would connect to Payne Road before continuing south to connect to the existing Highway 101 alignment at the Gibsons Way / Payne Road / Pratt Road intersection.
- The bypass alignment connecting to Payne Road would be continuous through the inclusion of a 150 metre radius curve.

- The eastern terminus of the proposed bypass would involve changes to existing Highway 101 / Stewart Road intersection to allow the new bypass to form the western leg of an upgraded intersection. Intersection upgrades such as channelization would be included.
- The western terminus of the proposed bypass would continue to use the existing intersection configuration at Payne Road / Gibsons Way / Pratt Road.

OPTION 3B

- This bypass option follows the same alignment as Option 3A at the eastern terminus.
- At the western terminus, the bypass alignment diverges from the Payne Road alignment (near Woodsworth Road) and connects to Highway 101 immediately west of the existing Gibsons Way / Payne Road / Pratt Road. The connection to Highway 101 at the western terminus is configured to allow the new bypass to represent the through movement. Gibsons Way would therefore be realigned to tie into the proposed bypass alignment as a "T" intersection.

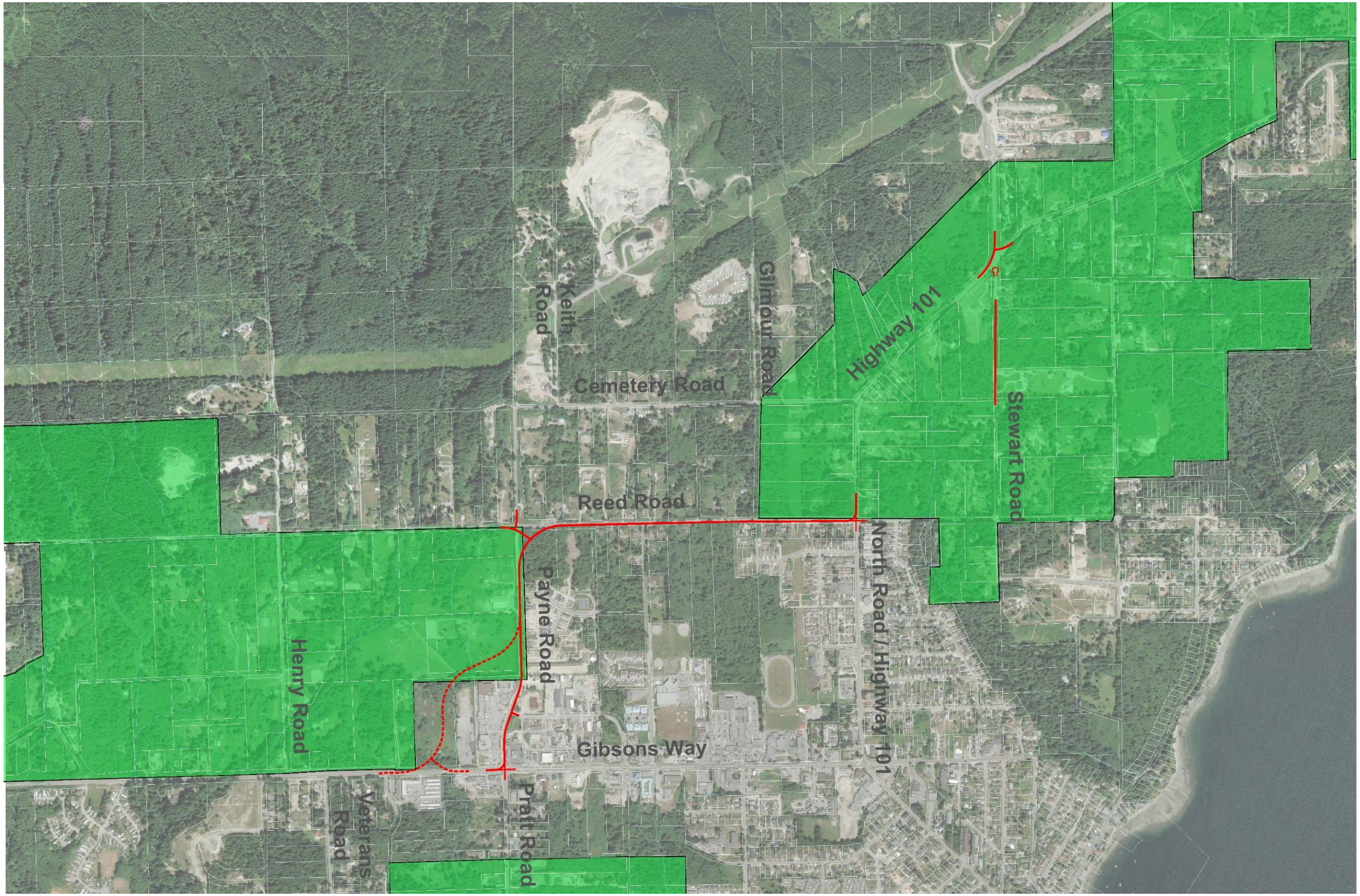


Figure 4.13: Gibsons Bypass Options 1A and 1B

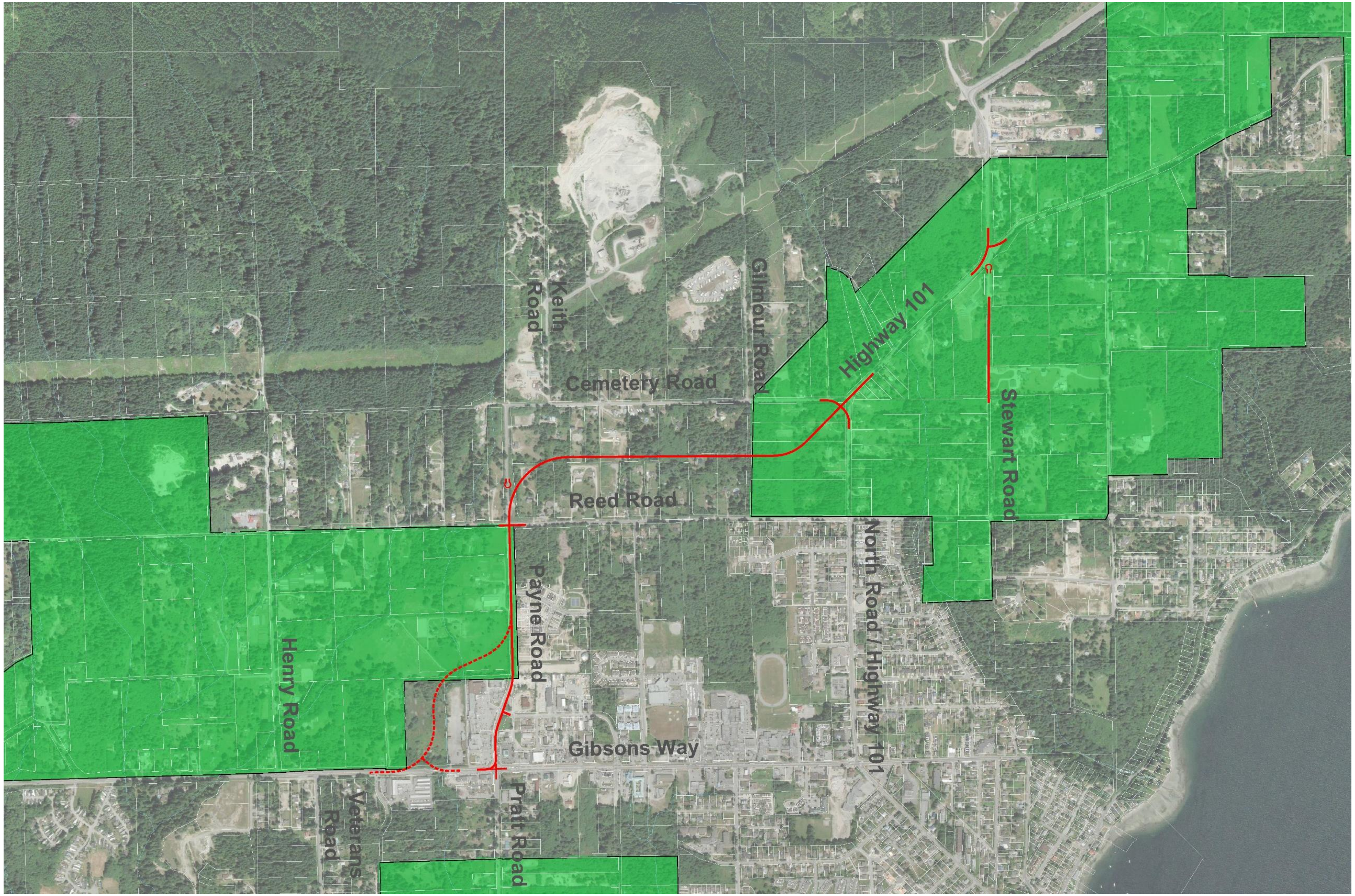


Figure 4.14: Gibsons Bypass Options 2A and 2B

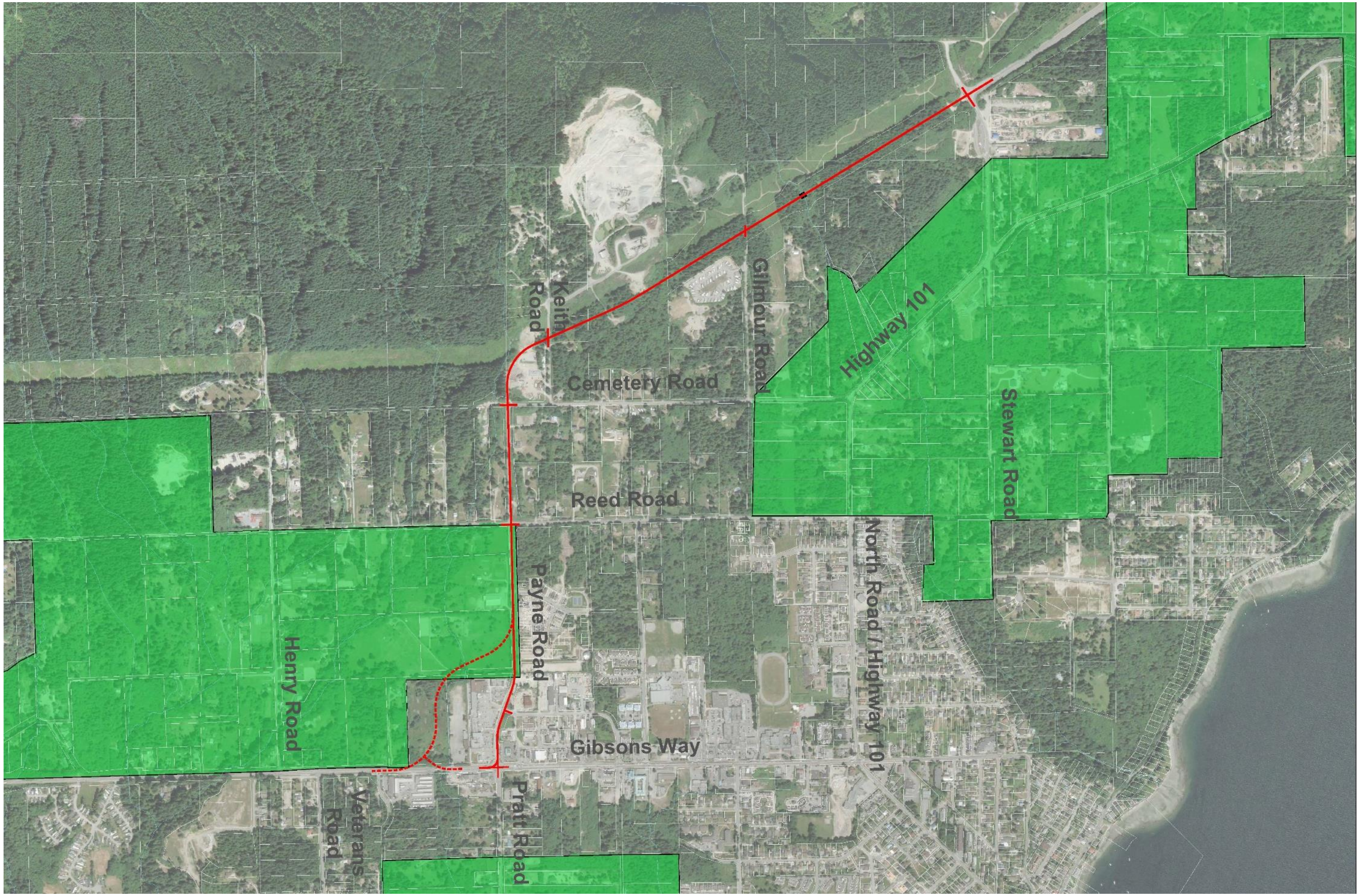


Figure 4.15: Gibsons Bypass Options 3A and 3B

5. OPTION EVALUATION

To assess and compare the relative benefits and costs of each of the improvement options described in the preceding section, they were evaluated using the framework and methodology described in the following subsection.

5.1 Evaluation Framework

To evaluate and / or compare the relative merits and impacts of each improvement option, a set of high-level evaluation criteria was developed based on the Multiple Account Evaluation methodology typically used for Ministry of Transportation and Infrastructure planning studies. However, because the improvements developed in this study differ greatly in their scope, the evaluation framework was customized such that the criteria being proposed are appropriate for evaluating across the various types of improvement options being considered. As introduced in the previous section, Option Generation, the improvement options have been divided into three types, with each type of improvement option to be evaluated independently from the other improvement option types using a subset of the evaluation criteria that is commensurate with the type and scale of the improvements being evaluated.

The three types of improvement options are presented in the following subsections along with the recommended evaluation criteria for each option type. More detailed descriptions of the recommended evaluation criteria are provided, including the proposed evaluation methodology.

5.1.1 Option Categories

Improvement options for the Highway 101 corridor have been divided into the three categories, Passing Lanes, Intersection Improvements, and Short Bypass segments. For each option improvement type, a set of evaluation criteria have been identified as listed below. The recommended criteria for each improvement option type have been selected based on the scale and location of the improvements being considered and represent a combination of quantitative and qualitative indicators. This combination of quantitative and qualitative indicators will provide sufficient comparative information that will assist in determining whether the various improvement options in each category represent an overall benefit compared to the base case and where applicable, which improvement option is preferred.

PASSING LANES

Under this category, the passing lane options will be evaluated to assess the benefits that can be achieved and to identify any impacts as well as the estimated costs to implement the proposed improvements.

- Percent Time Spent Following
- Property Impacts
- Environmental Impacts
- Archeological Impacts
- Constructability
- Access Issues
- Capital Cost

INTERSECTION IMPROVEMENTS

Under this category, the various intersection improvement options will be evaluated to assess the benefits that can be achieved and to identify any impacts as well as the estimated costs to implement the proposed improvements. The evaluation criteria selected for the intersection assessments are listed below:

- Predicted Traffic Safety Performance / Reduction in Collisions
- Volume / Capacity Ratio
- Property Impacts
- Capital Cost

Two of the intersection improvements involve the construction of short segments of new roadway and will therefore be evaluated using the two following additional criteria:

- Environmental Impacts
- Archeological Impacts

SHORT BYPASS OPTIONS

Under this category, the short bypass alignment will be evaluated against the base case. However, additional analysis will also be conducted where intersection improvements along Gibsons Way will be considered as a potential intermediate improvement to Gibsons Way in advance of considering, and as a means of potentially deferring, the need for a short bypass option for the long term planning horizon. The evaluation criteria selected for the short bypass option evaluation are listed below:

- Travel Time Savings
- Predicted Traffic Safety Performance
- Property Impacts
- Community Severance
- Consistency with Community Plans
- Environmental Impacts
- Archeological Impacts
- Constructability
- Capital Cost
- Property Cost
- Maintenance and Rehabilitation Cost
- Salvage Value

5.1.2 Evaluation Criteria

Where possible, a quantitative measurement will be sought for each criterion. However, a qualitative evaluation is used when specific measurements cannot readily be made, but there are obvious benefits or impacts as compared to the base case. For the purposes of this study and any comparative evaluation, the base case represents the existing physical conditions with no improvements into the future planning horizon.

For consistency with business case development, a 25-year analysis period has been assumed for the applicable quantitative related criteria. For those criteria that are reported in monetized values, the values will be brought back to Present Value (PV) 2019$ for comparison purposes using a six percent (6.0%) annual discount rate.

The level of detail that was considered within each criterion in the option evaluation framework is related to the level of development of the options being considered. Most options being considered have been developed to a single-line drawing level of detail. In line with the multiple account evaluation process, the specific criteria have been grouped under the main accounts.

CUSTOMER SERVICE ACCOUNT

CONTROL DELAY

For signalized and unsignalized intersections, the control delay in seconds per vehicle and is one of the determining criteria for the level of service, along with the volume-to-capacity ratio. This criterion will be estimated using the methods from the Highway Capacity Manual. For the bypass options, the impact that traffic diversion to the bypass has on delay at the signalized intersections in Gibsons will be estimated.

VOLUME-TO-CAPACITY RATIO

For signalized and unsignalized intersections, the volume-to-capacity (v/c) ratios will be estimated for each approach using the methods from the Highway Capacity Manual and a level of service will be determined. For the bypass options, the impact that traffic diversion to the bypass has on the v/c ratios at the signalized intersections in Gibsons will be estimated.

TRAVEL TIME SAVINGS

For the bypass options, an estimate of the potential travel time savings will be developed as compared to the base case conditions. The travel time savings will be based on the estimate route travel time between common end points and multiplied by the estimated traffic volumes using the existing route and the bypass routes.

PERCENT TIME SPENT FOLLOWING

For rural two-lane highways, the percent time spent following is the determining criteria for the level of service. This criterion will be calculated for the unsignalized segments between Gibsons and Sechelt using the methods from the Highway Capacity Manual.

PREDICTED TRAFFIC SAFETY PERFORMANCE

For intersection improvements, crash modification factors derived from the Highway Safety Manual will be applied to estimate the change in predicted crash frequency for each improvement option. For passing lane and bypass options, safety performance will be predicted by applying the Interactive Highway Safety Design Model. For the bypass options, the impact that traffic diversion to the bypass has on the safety performance at the signalized intersections in Gibsons will also be estimated.

VOLUME / CAPACITY RATIO

For the one intersection improvement generated to improve traffic operations, the change in v/c ratio will be assessed using a Synchro model of the AM and PM peak hours under the existing geometry and the improved geometry.

SOCIO-COMMUNITY ACCOUNT

PROPERTY IMPACTS

This criterion will consider the additional right-of-way that may be required for each improvement option and quantify the number of individual properties impacted and the total area of the impact. Impacted properties will be identified as either residential, business / commercial, or institutional. Impacts to Agricultural Land Reserve (ALR) or parks will be identified separately as well.

COMMUNITY SEVERANCE

This qualitative criterion will consider the barrier effect of a new higher speed or wider road on the existing community structure and linkages. Lack of connectivity and / or accessibility across the corridor can negatively affect pedestrian, cyclist and local vehicle movements. Severance may also create psychological barriers to trip planning.

CONSISTENCY WITH COMMUNITY PLANS

This qualitative criterion will consider how the improvements conform to the Official Community Plans of the Town of Gibsons, District of Sechelt, and Sunshine Coast Regional District.

ENVIRONMENTAL IMPACTS

This qualitative criterion, based on high-level desk top research, will note and rank the relative severity of impacts to terrestrial environments and aquatic Environments.

ARCHEOLOGICAL IMPACTS

This qualitative criterion, based on high-level desk top research, will note and rank the relative severity of impacts to archeologically or historically significant sites.

CONSTRUCTABILITY

This qualitative criterion will note any significant challenges to the construction of the improvement.

ACCESS ISSUES

This qualitative criterion will note how the improvement affects access to adjacent properties.

FINANCIAL ACCOUNT

CAPITAL COST

The relative construction cost of each option will be assessed at a high level using a conceptual single line drawing and typical unit costs and the methods of Highway Cost Estimating Using the Elemental Parametric Method and a 50% contingency for the conceptual nature of the estimate.

PROPERTY COST

Property costs will be based on a very high-level estimate of the proposed number of properties impacted. This will be an estimate only for the purposes of this study and will not represent market value.

MAINTENANCE AND REHABILITATION COST

Consideration for annual maintenance and rehabilitation costs will be based on a 25-year service life, standard lane-kilometre costs and scheduled rehabilitation for major roadways.

SALVAGE VALUE

The salvage value of the proposed infrastructure for each option at the end of the 25-year analysis period will be reported.

5.2 Option Evaluation

As described in the previous section, a number of mitigation measures were developed to address the existing and anticipated future issues identified along the study corridor between the Langdale Ferry Terminal and Redrooffs Road in Sechelt. Given the diversity in the nature of the corridor issues identified as well as the geographic range of these identified corridor issues, the potential improvement measures to address these corridor issues also varied as follows:

- **Passing Lanes** to address highway level of service issues.
- **Intersection Improvements** to address capacity and safety issues.
- **Short Bypass** segments to improve overall mobility through the urban area of Gibsons and to potentially enhance traffic safety.

A summary of the evaluation of each improvement option, with respect to the three improvement types or measures, is provided in the following subsections.

5.2.1 Passing Lanes

The passing lane options were evaluated to assess the benefits that can be achieved and to identify any impacts as well as the estimated costs to implement the proposed improvements. Each passing lane option was evaluated using the criteria identified above.

PASSING LANE SB-1

Passing Lane SB-1 is a 1200-metre southbound passing lane extending approximately between Leek Road and Highland Road and located between Gibsons and Roberts Creek in the Elphinstone Electoral Area. The evaluation of this proposed passing lane is documented below.

PERCENT TIME SPENT FOLLOWING

Table 5.1 shows that with the construction of Passing Lane SB-1, the highway in the southbound direction between Gibsons and Roberts Creek performs at LOS C with existing traffic volumes and, at worst, LOS D in the 2035 planning horizon in the summer months. The analysis was conducted for the August time period, when the highest monthly average traffic volumes of the year are experienced along the corridor.

Table 5.1: Summer Highway Level of Service Improvements Estimated for Passing Lane SB-1

Analysis Year	Scenario	Dir	AM		MD		PM	
			PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
2018	Existing	SB	73.7	D	78.8	D	77.6	D
2035	Existing	SB	84.6	D	**88.5**	**E**	**93.9**	**E**
2018	New Passing Lane	SB	63.8	C	68.9	C	67.3	C
2035	New Passing Lane	SB	73.9	C	77.6	D	79.7	D

PROPERTY IMPACTS

Passing Lane SB-1 would require the acquisition of a small amount of three residential properties adjacent to the Lower Road / Highland Road intersection. The construction of the passing lane is not expected to impact any structures or affect access to any of the impacted properties in any significant away. The new southbound passing lane is proposed to end approximately 300 metres north of the Highland Road intersection to avoid impacting the adjacent cemetery.

ENVIRONMENTAL IMPACTS

The terrestrial impacts of the passing lane option are:

- Minor tree removal in area with no sensitive habitat features known.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the *Migratory Birds Convention Act*.

All Passing Lane options have similar potential effects on aquatic ecosystems and species:

- Based on the presence of mapped streams or riparian DPAs, if active stream channels are confirmed with field survey effort, all will require either new or upgraded crossing structures and associated mitigation during construction.
- If stream channels are confirmed and fish bearing or connected to downstream fish bearing streams, the need for DFO review is likely. Installation of clear span or open bottom crossings may only require a letter of advice.
- Works may require provincial government authorization under the *Water Sustainability Act.*
- Works may be subject to local government DPA process for works within designated riparian areas.

ARCHEOLOGICAL IMPACTS

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Passing Lane SB-1. The nearest registered archaeological site is DiRv-4, located 450 metres southwest of the study area.

Staff from the Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation archeological advisors could indicate areas of higher potential.

CONSTRUCTABILITY

No significant challenges are expected related to the constructability of Passing Lane SB-1. Only minor tree removal is required for the construction of the new lane. Passing lane options that cross highway culverts will likely need to be upgraded or enlarged in some locations and this construction activity will have some minor to moderate traffic management impacts.

Soils with limited compressibility are expected to underlie the passing lane widening footprint. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

Potential slope hazards may exist along the alignment and maintaining suitable temporary and permanent slope stability of any slopes along the south side will need to be considered during design and construction.

ACCESS ISSUES

Passing Lane SB-1 is not expected to have any significant impact on the access to adjacent properties. Minor adjustments to the driveways of three residential properties will be required.

CAPITAL COST

The capital cost of Passing Lane SB-1, including engineering and construction, is summarized in ***Table 5.2.***

Table 5.2: Capital Cost of Passing Lane SB-1

Item	Cost
Project Management	$475,000
Engineering	$325,000
Construction	$2,450,000
Contingency	$1,600,000
Management Reserve	$250,000
Total Capital Cost*	$5,100,000

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: PASSING LANE SB -1

Passing Lane SB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.

PASSING LANE NB-1

Passing Lane NB-1 is a 1600-metre northbound passing lane extending approximately between Leek Road and Maskell Road and located between Gibsons and Roberts Creek in the Elphinstone Electoral Area. The evaluation of this proposed passing lane is documented below.

PERCENT TIME SPENT FOLLOWING

Table 5.3 shows that with the construction of Passing Lane NB-1, the highway in the northbound direction between Gibsons and Roberts Creek performs at LOS C with existing traffic volumes and, at worst, LOS D in the 2035 planning horizon in the summer months. The analysis was conducted for the August time period, when the highest monthly average traffic volumes of the year are experienced along the corridor.

Table 5.3: Highway Level of Service Improvements Estimated for Passing Lane NB-1

Analysis Year	Scenario	AM		MD		PM	
		PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
2018	Existing	74.1	D	75.9	D	79.5	D
2035	Existing	86	E	85.7	E	94.5	F
2018	New Passing Lane	57.9	C	59.6	C	63.2	C
2035	New Passing Lane	69.8	C	69.6	C	77	D

PROPERTY IMPACTS

The construction of Passing Lane NB-1 is anticipated to take place entirely within the existing road right of way with no permanent impact to adjacent properties.

ENVIRONMENTAL IMPACTS

The terrestrial impacts of the passing lane option are:

- Minor tree removal in area with no sensitive habitat features known.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the Migratory Birds Convention Act.

All passing lane options have similar potential effects on aquatic ecosystems and species:

- Based on the presence of mapped streams or riparian DPAs, if active stream channels are confirmed with field survey effort, all will require either new or upgraded crossing structures and associated mitigation during construction.
- If stream channels are confirmed and fish bearing or connected to downstream fish bearing streams, the need for DFO review is likely. Installation of clear span or open bottom crossings may only require a letter of advice.
- Works may require provincial government authorization under the Water Sustainability Act.
- Works may be subject to local government DPA process for works within designated riparian areas.

ARCHEOLOGICAL IMPACTS

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Passing Lane NB-1. The nearest registered archaeological site is DiRv-4, located 1.24 km southeast of the study area.

Staff from the Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation archeological advisors could indicate areas of higher potential.

CONSTRUCTABILITY

No significant challenges are expected related to the constructability of Passing Lane NB-1. Only minor tree removal and the movement of some hydro poles are required for the construction of the new lane. Highway culverts will likely need to be upgraded or enlarged in some locations and this construction activity will have some minor to moderate traffic management impacts.

Based on the available information, ditch infilling and relatively low height cuts will generally be required along this portion of the alignment for the proposed northbound passing lane.

Soils with limited compressibility are expected to underlie the passing lane widening footprint. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

The potential slope hazards and settlements, as well as the potential impact of increased or concentrated surface runoff within and adjacent to the ravine/gulley crossing near the middle of the passing lane alignment will need to be considered during design. Significant fills may be required through this section.

ACCESS ISSUES

Passing Lane NB-1 will cross Conrad Road, Oldershaw Road, and Byng Road on the right side. Each of these are minor rural roads with low traffic volumes, but the design of the new passing lane should take into consideration southbound traffic that will make left turns across the passing lane.

CAPITAL COST

The capital cost of Passing Lane NB-1, including engineering and construction, is summarized in ***Table 5.4.***

Table 5.4: Capital Cost of Passing Lane NB-1

Item	Cost
Project Management	$625,000
Engineering	$450,000
Construction	$3,200,000
Contingency	$2,125,000
Management Reserve	$325,000
Total Capital Cost*	**$6,725,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: PASSING LANE NB -1

Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.

PASSING LANE NB-2

Passing Lane NB-2 is a 1800-metre northbound passing lane extending approximately between Pell Road and Jack Road and located between Roberts Creek and Sechelt. The evaluation of the proposed passing lane option is documented below.

PERCENT TIME SPENT FOLLOWING

Table 5.5 shows that with the construction of Passing Lane NB-2, the highway in the northbound direction between Roberts Creek and Sechelt performs at LOS C with existing traffic volumes and, at worst, LOS D in the 2035 planning horizon in the summer months. The analysis was conducted for the August time period, when the highest monthly average traffic volumes of the year are experienced along the corridor.

Table 5.5: Highway Level of Service Improvements Estimated for Passing Lane NB-2

Analysis Year	Scenario	AM		MD		PM	
		PTSF (%)	LOS	PTSF (%)	LOS	PTSF (%)	LOS
2018	Existing	74.4	D	76.1	D	79.8	D
2035	Existing	**86.1**	**E**	**85.8**	**E**	**94.6**	**F**
2018	New Passing Lane	58.7	C	63.3	C	63.3	C
2035	New Passing Lane	68	C	70.4	D	73.9	D

PROPERTY IMPACTS

The construction of Passing Lane NB-2 is anticipated to take place entirely within the existing road right of way with no impact to adjacent properties.

ENVIRONMENTAL IMPACTS

The terrestrial impacts of the passing lane option are:

- Buffered footprint within Roberts Creek Provincial Park and may require minor tree removal.
- Buffered footprint overlaps numerous sensitive features (OGMAs and IBA)
- Buffered footprint overlaps observation record for blue-listed snail (threaded vertigo) and may require pre-clearing surveys to confirm absence in areas to be cleared. If present, avoidance and other mitigation/permitting may be required.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the *Migratory Birds Convention Act*.

All passing lane options have similar potential effects on aquatic ecosystems and species:

- Based on the presence of mapped streams or riparian DPAs, if active stream channels are confirmed with field survey effort, all will require either new or upgraded crossing structures and associated mitigation during construction.
- If stream channels are confirmed and fish bearing or connected to downstream fish bearing streams, the need for DFO review is likely. Installation of clear span or open bottom crossings may only require a letter of advice.
- Works may require provincial government authorization under the *Water Sustainability Act.*
- Works may be subject to local government DPA process for works within designated riparian areas.

ARCHEOLOGICAL IMPACTS

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Passing Lane NB-2. The nearest registered archaeological site is DiRw-7, located 670 metres south of the study area.

CONSTRUCTABILITY

No significant challenges are expected related to the constructability of Passing Lane NB-2. Only minor tree removal is required for the construction of the new lane. Highway culverts will likely need to be upgraded or enlarged in some locations and this construction activity will have some minor to moderate traffic management impacts.

Based on the available information, fills (with some possible cuts) will generally be required along this portion of the alignment with some limited ditch infill and cuts expected in the east portion of the alignment for the proposed northbound passing lane.

Soils with limited compressibility are expected to underlie the passing lane widening footprint. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

The potential slope hazards in the area where continuous cracks were noted along the southbound lane will need to be Potential slope hazards may exist along the alignment and maintaining suitable temporary and permanent slope stability of the cut and fill slopes along the north side will need to be considered during design and construction.

The potential slope hazards in the area where continuous cracks were noted along the southbound lane will need to be considered during design.

ACCESS ISSUES

Passing Lane NB-2 will not have any access issues, crossing only one driveway on its right side which would require a minor adjustment to accommodate the new lane.

CAPITAL COST

The capital cost of Passing Lane NB-2, including engineering and construction, is summarized in ***Table 5.6.***

Table 5.6: Capital Cost of Passing Lane NB-2

Item	Cost
Project Management	$700,000
Engineering	$500,000
Construction	$3,600,000
Contingency	$2,400,000
Management Reserve	$375,000
Total Capital Cost*	**$7,575,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: PASSING LANE NB-2

Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated. Construction complexity is somewhat higher compared to the other passing lane options.

PASSING LANES SUMMARY

The option evaluation of the three passing lane options is summarized in ***Table 5.7*** below.

Table 5.7: Passing Lane Option Evaluation Summary

Evaluation Criteria		Passing Lane SB-1	Passing Lane NB-1	Passing Lane NB-2
LOS (2018)	AM	C	C	C
	MD	C	C	C
	PM	C	C	C
LOS (2035)	AM	C	C	C
	MD	D	C	D
	PM	D	D	D
Property Impacts		Minor to 3 properties	None	None
Environmental Impacts		Minor tree removal and possible stream crossing structures.	Minor tree removal and possible stream crossing structures.	Minor tree removal in Provincial Park in possible blue-listed snail habitat. Possible stream crossing structures.
Archeological Impacts		No registered sites or historic places.	No registered sites or historic places.	No registered sites or historic places.
Constructability		No significant challenges.	No significant challenges. Ditch infilling and relatively low height cuts.	No significant challenges. Ditch infilling and relatively low height cuts. The potential slope hazards in the area will need to be considered during design.
Access Issues		Minor adjustments to 3 residential driveways.	Crosses three low-volume roads on the right side.	Minor adjustments to 1 residential driveway.
Capital Cost		$5.100M	$6.725M	$7.575M
Option Summary		Passing Lane SB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.	Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.	Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated. Construction complexity is somewhat higher compared to the other passing lane options.

5.2.2 Intersection Improvements

Analysis of the recent collision history of the highway, as documented in the Problem Definition Report, identified intersections with above-average collision rates. These collisions were sometimes attributed to geometry, grades, lighting, and the lack of turning lanes relative to the speeds and volumes on the highway. In addition, intersection level of service in terms of capacity was identified as an issue at several other intersections along the study corridor. Through the analysis conducted as part of the Problem Definition Report, the following intersections were found to have safety issues and / or level of service issues:

- Joe Road / Orange Road
- Flume Road
- Lower Road / Highland Road
- Ti'Ta Way
- Wharf Avenue / Dolphin Street
- Shorncliffe Avenue
- Hill Road
- Redrooffs Road

In addition to the above intersections, several corridor improvements were generated for the highway segment between Davis Bay and Selma Park given the various safety issues identified in this area as well as deficient pedestrian facilities. The collision prone locations associated with the intersections at Davis Bay, Bay Road, and Selma Park Road are included as part of these corridor improvements.

Under this category, the various intersection improvement options were evaluated to assess the benefits that can be achieved and to identify any impacts as well as the estimated costs to implement the proposed improvements. Each intersection improvement option was evaluated by applying the applicable criteria documented earlier.

JOE ROAD / ORANGE ROAD

Left turn lanes on Highway 101, in both directions, at the intersection with Joe Road / Orange Road are proposed.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.52 for adding left turn lanes to both major approaches of the four-way intersection, the left turn lanes are estimated to reduce the collisions at the intersection from 1.6 per year to approximately 0.8 per year on average.

PROPERTY IMPACTS

It is anticipated that the construction of the left turn lanes at Joe Road / Orange Road can take place entirely within the existing road right of way with no impacts to the adjacent properties.

CAPITAL COST

The capital cost of construction and engineering of the left turn lanes at the Joe Road / Orange Road intersection is summarized in ***Table 5.8***.

Table 5.8: Capital Cost of Joe Road / Orange Road Intersection Improvements

Item	Cost
Project Management	$200,000
Engineering	$125,000
Construction	$950,000
Contingency	$625,000
Management Reserve	$100,000
Total Capital Cost*	$2,000,000

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: JOE ROAD / ORANGE ROAD INTERSECTION IMPROVEMENTS:

The Joe Road / Orange Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.8 per year on average with no significant impacts anticipated.

FLUME ROAD

Converting the intersection with Flume Road to right-in, right-out and adding a southbound left turn lane on Highway 101 at Lockyer Road and a Northbound left turn lane at Marlene Road is proposed.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.36 for banning left turns at Flume Road in addition to a collision modification factor of 0.52 for the addition of left turn lanes estimates that the number of collisions at the Flume Road intersection will reduce from 1.4 per year to 0.3 per year.

PROPERTY IMPACTS

The construction of the turn restrictions and left turn lanes would take place entirely within the existing road right of way and would not have any property impacts.

CAPITAL COST

The capital cost of engineering and construction for the improvements at Flume Road are summarized in *Table 5.9.*

Table 5.9: Capital Cost of Flume Road Intersection Improvements

Item	Cost
Project Management	$250,000
Engineering	$175,000
Construction	$1,325,000
Contingency	$875,000
Management Reserve	$150,000
Total Capital Cost*	$2,775,000

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: FLUME ROAD INTERSECTION IMPROVEMENTS:

The Flume Road intersection improvements can enhance traffic safety at this location by reducing collisions by 1.1 per year on average with no significant impacts anticipated.

LOWER ROAD / HIGHLAND ROAD

Both a southbound left-turn lane and a southbound deceleration lane are proposed at the Lower Road / Highland Road intersection with Highway 101.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.72 for adding a left turn lane to a major approach of the four-way intersection, and 0.86 for adding a right turn lane to a major approach, the improvements are estimated to reduce the collisions at the intersection from 1.2 per year to approximately 0.7 per year on average.

PROPERTY IMPACTS

The construction of the turn restrictions and left turn lanes would take place entirely within the existing road right of way and would not have any property impacts.

CAPITAL COST

The capital cost of engineering and construction for the improvements at the Lower Road / Highland Road intersection are summarized in *Table 5.10.*

Table 5.10: Capital Cost of Lower Road / Highland Road Intersection Improvements

Item	Cost
Project Management	$75,000
Engineering	$50,000
Construction	$450,000
Contingency	$300,000
Management Reserve	$50,000
Total Capital Cost*	$925,000

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: LOWER ROAD / HIGHLAND ROAD INTERSECTION IMPROVEMENTS

The Lower Road / Highland Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.

TI'TA WAY

To potentially address the safety issues at this intersection, a protected-only left turn phase is proposed.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.95 for modifying the signal phasing from protected / permitted left turns to protected only left turns, the improvement is estimated to reduce the collisions at the intersection from an average of 2.0 per year to approximately 1.9 per year on average.

PROPERTY IMPACTS

There will be no property impacts with this improvement.

CAPITAL COST

The capital cost of engineering and implementation of this traffic signal modification is minor with anticipated costs likely less than $50,000. The majority of the costs are associated with the inclusion of a left turn traffic signal head and potential modifications to the existing traffic signal pole.

EVALUATION SUMMARY: TI'TA WAY INTERSECTION IMPROVEMENTS

The Ti'Ta Way intersection improvements are anticipated to enhance traffic safety at this location by reducing collisions by 0.1 per year on average with no significant impacts anticipated. While the magnitude of the reduction in collisions for the improvement is small, the high proportion of injury collisions historically observed at this intersection combined with the low cost of the traffic signal modification suggests that this improvement will provide reasonable value with respect to the potential benefit /cost ratio.

WHARF AVENUE / DOLPHIN STREET

Reconfiguring the westbound approach to the Wharf Avenue / Dolphin Street intersection (along Highway 101) to allow for a double left turn is proposed. Work will also include modifications to Wharf Avenue to accommodate the dual left turn lanes.

VOLUME / CAPACITY RATIO

The changes to the volume / capacity ratios of all the movements for the Wharf Avenue / Dolphin Street intersection improvements with 2035 traffic volumes are shown in ***Table 5.11.*** The reconfigured westbound approach significantly improves the performance of the westbound left turn with only minor impacts to the other movements and an overall reduction in delay for the intersection.

Table 5.11: Volume to Capacity Ratios and Levels of Service of the Wharf Avenue / Dolphin Street Intersection Improvements

Lane/Movement	Existing		Improved	
	2035 AM	2035 PM	2035 AM	2035 PM
WBL	1.08 (F)	1.00 (E)	0.65 (C)	0.67 (C)
WBTR	0.65 (C)	0.50 (B)	0.69 (C)	0.60 (C)
EBL	0.27 (C)	0.31 (C)	0.32 (C)	0.31 (C)
EBTR	0.64 (C)	0.79 (D)	0.73 (D)	0.81 (D)
NBTL	0.58 (C)	0.70 (D)	0.63 (D)	0.71 (D)
NBTR	0.34 (A)	0.37 (A)	0.34 (A)	0.37 (A)
SBL	0.54 (B)	0.72 (C)	0.56 (C)	0.64 (C)
SBTR	0.28 (B)	0.46 (B)	0.29 (B)	0.43 (B)
Intersection LOS	C	C	B	C

PROPERTY IMPACTS

The addition of the new receiving lane on the south leg of the intersection would require the conversion of some existing angle parking to parallel parking.

CAPITAL COST

The capital cost of engineering and construction for the improvements at the Wharf Avenue / Dolphin Street intersection are summarized in ***Table 5.12***. The proposed works include modifications to the curb in the southwest quadrant of the intersection, including relocation of the existing traffic signal pole. Further modifications along Wharf Avenue are required to incorporate a second lane to receive traffic from the dual left turn lanes. These modifications include removing the angled parking and replacing this with parallel parking which has been assumed to be implemented through paint markings and signing. However, allowances for curb and gutter have been provided in the cost estimates.

Table 5.12: Capital Cost of Wharf Avenue/ Dolphin Street Intersection Improvements

Item	Cost
Project Management	$20,000
Engineering	$20,000
Construction	$130,000
Contingency	$70,000
Management Reserve	$10,000
Total Capital Cost*	**$250,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: WHARF AVENUE DOLPHIN STREET INTERSECTION IMPROVEMENTS

The Wharf Avenue / Dolphin Street intersection improvements can enhance overall traffic operations for the intersection and specifically for the westbound left turn movement which was forecasted to operate at an unsatisfactory level of service by 2035. The anticipated impacts include minor construction along Wharf Avenue to accommodate the receiving lanes for the dual left turn lanes which will require reallocation of the existing angled parking for parallel parking.

SHORNCLIFFE AVENUE

Upgrading the Shorncliffe Avenue intersection to include a full traffic signal is proposed, in addition to improving the geometry for several right turn movements.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision factor of 0.56 for installing a traffic signal at a rural stop controlled intersection, the improvement at Shorncliffe Avenue is expected to reduce the number of collisions per year from 1.2 to approximately 0.7 per year average.

PROPERTY IMPACTS

There is sufficient road right of way at the intersection to install the full traffic signal and to accommodate the changes in the lane geometry. Therefore, the proposed construction is not anticipated to have any property impacts.

CAPITAL COST

The capital cost of construction and engineering of the upgraded Shorncliffe Avenue intersection is summarized in *Table 5.13.*

Table 5.13: Capital Cost of Shorncliffe Avenue Intersection Improvements

Item	Cost
Project Management	$150,000
Engineering	$100,000
Construction	$825,000
Contingency	$525,000
Management Reserve	$100,000
Total Capital Cost*	**$1,700,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: SHORNCLIFFE AVENUE INTERSECTION IMPROVEMENTS

The Shorncliffe Avenue intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.

HILL ROAD

Closing the existing Hill Road intersection and construction a new intersection connecting Highway 101 to Dale Road is proposed. In addition, a northbound left turn lane at the new intersection is proposed.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.83 for correcting the skew angle of the existing three-leg intersection of 45 degrees, and 0.56 for adding a left-turn lane to one major approach is expected to reduce the number of collisions per year from 1.4 to 0.7.

PROPERTY IMPACTS

The construction of the new intersection connection will require the acquisition of the majority of one undeveloped property west of the existing extent of Dale Road.

CAPITAL COST

The capital cost of the new road connection to Hill Road, including engineering and construction, is summarized in ***Table 5.14.***

Table 5.14: Capital Cost of the Hill Road Intersection Improvements

Item	Cost
Project Management	$250,000
Engineering	$150,000
Construction	$1,300,000
Contingency	$850,000
Management Reserve	$125,000
Total Capital Cost*	**$2,675,000**

**Depicted costs do not represent total project costs*

ENVIRONMENTAL IMPACTS

The terrestrial impacts of the intersection option are:

- Potential effects on terrestrial ecosystems due to required vegetation clearing and ground disturbance with potential to alter or remove undeveloped mature forested and red-listed ecosystems.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the *Migratory Birds Convention Act*.

The aquatic impacts of the intersection option are:

- Minor overlap of buffered footprint and low likelihood of effects on Cairns Creek and marine shoreline.
- Hill Road works may be subject to local government DPA process for works within designated marine shoreline and riparian area.

ARCHEOLOGICAL IMPACTS

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, the intersection at Hill Road. The nearest registered archaeological site is DiRx-10, located 330 metres east of the study area.

EVALUATION SUMMARY: HILL ROAD INTERSECTION IMPROVEMENTS:

The Hill Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.7 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated with respect to a currently undeveloped property.

REDROOFFS ROAD

It is proposed that Redrooffs Road immediately south of the highway is realigned to intersect with Highway 101 at 90 degrees.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

Using a collision modification factor of 0.83 for correcting the skew angle of the existing three-leg intersection of 45 degrees, the number of collisions at Redrooffs Road is expected to decrease from 1.2 to 1.0 per year.

PROPERTY IMPACTS

Construction of the realigned intersection would require the acquisition of a small area of the undeveloped property east of the existing Redrooffs Road intersection.

CAPITAL COST

The capital cost of the new road connection at Redrooffs Road, including engineering and construction, is summarized in ***Table 5.15.***

Table 5.15: Capital Cost of the Redrooffs Road Intersection Improvements

Item	Cost
Project Management	$75,000
Engineering	$50,000
Construction	$325,000
Contingency	$225,000
Management Reserve	$50,000
Total	$725,000

**Depicted costs do not represent total project costs*

ENVIRONMENTAL IMPACTS

The terrestrial impacts of the intersection option are:

- Potential effects on terrestrial ecosystems due to required vegetation clearing and ground disturbance with potential to alter or remove undeveloped mature forested and red-listed ecosystems.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the *Migratory Birds Convention Act*.

The Redrooffs Road Option does not overlap with any aquatic features.

ARCHEOLOGICAL IMPACTS

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Intersection Redrooffs Road. The nearest registered archaeological site is DiRx-10, located 380 metres southwest of the study area.

EVALUATION SUMMARY: REDROOFFS ROAD INTERSECTION IMPROVEMENTS:

The Redrooffs Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.2 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated.

DAVIS BAY AND SELMA PARK

Multiple new left-turn lanes, turning restrictions, and a new traffic signal are recommended for the Davis Bay and Selma Park areas of the Highway 101 Corridor.

PREDICTED TRAFFIC SAFETY PERFORMANCE / REDUCTION IN COLLISIONS

The estimated reduction in collisions based on collision modification factors at all of the proposed improved intersections is summarized in ***Table 5.16.***

Table 5.16: Davis Bay Selma and Park Improvements Traffic Safety Performance

Intersection	Improvement	Existing Collisions per Year	Collision Modification Factor	Improved Collisions per Year
Mission Road	NB left-turn lane	0.4	0.56	0.22
Davis Bay Road	Traffic signal and SB left-turn lane	1.4	0.31	0.43
Bay Road	SB left turn lane	1.8	0.56	1.01
Heather Road	SB left turn lane	0.7	0.56	0.39
Nestman Road	SB left turn lane	0.7	0.56	0.39
Snodgrass Road	SB left turn lane	1.0	0.56	0.56
Selma Park Road	SB and NB left turn lanes	2.4	0.52	1.25
Monkey Tree Lane South	SB left turn lane	1.4	0.56	0.78
Whitaker Road	Right-in/right-out	0.5	0.36	0.18
Westly Road	Right-in/right-out	0	0.36	0.00
Havies Road	Right-in/right-out	0.5	0.36	0.18
Monkey Tree Lane North	Closure	1.4	0	0.00
Total		12.2		5.4

PROPERTY IMPACTS

The construction of the improvements are anticipated to take place entirely within the existing right of way and are therefore not expected to have any permanent impact to the adjacent properties.

CAPITAL COST

The capital casts of the intersection improvements in Davis Bay and Selma Park are summarized in ***Table 5.17***.

Table 5.17: Davis Bay and Selma Park Capital Costs

Intersection	Improvement	Capital Cost
Mission Road	NB left-turn lane	$200,000
Davis Bay Road	Traffic signal and SB left-turn lane	$500,000
Bay Road	SB left turn lane	$200,000
Heather Road	SB left turn lane	$200,000
Nestman Road	SB left turn lane	$200,000
Snodgrass Road	SB left turn lane	$200,000
Selma Park Road	SB and NB left turn lanes	$400,000
Monkey Tree Lane South	SB left turn lane	$200,000
Whitaker Road	Right-in/right-out	$50,000
Westly Road	Right-in/right-out	$50,000
Havies Road	Right-in/right-out	$50,000
Monkey Tree Lane North	Closure	$50,000
Highway Widening	Widen shoulders (2 m), add pathway	$5,000,000
	Sub Total	**$7,300,000**
	Contingency (50%)	**$3,650,000**
	Total Capital Cost*	**$11,000,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: DAVIS BAY AND SELMA PARK INTERSECTION IMPROVEMENTS:

The multiple intersection improvements in the Davis Bay and Selma Park areas can improve traffic safety by reducing collisions by 6.8 per year on average with no significant impacts anticipated.

INTERSECTION OPTION SUMMARY

The evaluation of the intersection improvement options is summarized in ***Table 5.18*** below.

Table 5.18: Intersection Improvement Option Evaluation Summary

Evaluation Criteria	Joe Road / Orange Road	Flume Road	Lower Road / Highland Road	Ti'Ta Way	Wharf Avenue / Dolphin Street	Shorncliffe Avenue	Hill Road	Redrooffs Road	Davis Bay and Selma Park
Predicted Safety Performance	Reduce annual collisions by 0.8	Reduce annual collisions by 1.1	Reduce annual collisions by 0.5	Reduce annual collisions by 0.1	-	Reduce annual collisions by 0.5	Reduce annual collisions by 0.7	Reduce annual collisions by 0.2	Reduce annual collisions by 6.8
Volume / Capacity Ratio	-	-	-	-	Improved from 1.08 (F) to 0.65 (C) in the AM peak hour and from 1.00 (E) to o.67 (C) in the PM peak hour for WBL, and an overall reduction intersection delay.	-	-	-	-
Property Impacts	None	None	None	None	Loss of some street parking	None	One full undeveloped property	One partial property	None
Capital Cost	$2,000,000	$2,775,000	$925,000	$50,000	$250,000	$1,700,000	$2,675,000	$725,000	$11,000,000
Environmental Impacts	-	-	-	-	-	-	Vegetation clearing avoiding breeding bird window and minor overlap with Cairns Creek with low likelihood of effects.	Vegetation clearing avoiding breeding bird window.	-
Archeological Impacts	-	-	-	-	-	-	No registered sites or historic places.	No registered sites or historic places.	-
Option Summary	The Joe Road / Orange Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.8 per year on average with no significant impacts anticipated.	The Flume Road intersection improvements can enhance traffic safety at this location by reducing collisions by 1.1 per year on average with no significant impacts anticipated.	The Lower Road / Highland Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.	The Ti'Ta Way intersection improvements are anticipated to enhance traffic safety at this location by reducing collisions by 0.1 per year on average for low cost and with no significant impacts anticipated.	The Wharf Avenue / Dolphin Street intersection improvements can enhance overall traffic operations for the intersection and specifically for the westbound left movement which was forecasted to operate at an unsatisfactory level of service by 2035. The anticipated impacts include minor construction along Wharf Avenue to accommodate the receiving lanes for the dual left turn lanes which will require reallocation of the existing angled parking for parallel parking.	The Shorncliffe Avenue intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.	The Hill Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.7 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated with respect to a currently undeveloped property.	The Redrooffs Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.2 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated.	The multiple intersection improvements in the Davis Bay and Selma Park areas can improve traffic safety by reducing collisions by 6.8 per year on average with no significant impacts anticipated.

5.2.3 Short Gibsons Bypass

The earlier findings of the intersection capacity analysis suggest that the signalized intersections along Gibsons Way will perform at acceptable levels of service through the 2035 planning horizon, therefore indicating that any potential bypass option is not warranted within this timeframe. However, in the longer term, the delay resulting from the signalized intersections will reduce mobility for highway users travelling between Langdale or Port Mellon and areas west of Gibsons.

Because Highway 101 through Gibsons was recently modified from a four-lane to a two-lane cross section to improve safety and support multi-modal use, increasing the capacity on the existing highway by adding lanes through Gibsons is not a supported improvement option. The construction of a bypass of the urban areas of Gibsons that would carry through-traffic on an alternative alignment and allow the existing roadway (Gibsons Way) to function as a local access route is a potential improvement option to address the long term mobility of the Highway 101 corridor and enhance traffic safety.

Prior to evaluating the three bypass options, a set of potential interim improvements were developed and evaluated as a means of enhancing the mobility of the existing highway corridor through the urban area of Gibsons which together, could further defer the need for a potential bypass option. These interim improvements, consisting of minor improvements to several key intersections along Gibsons Way to reduce delays for the highway through movements, were evaluated in a similar manner as the other intersection improvements being considered along the highway corridor along with an assessment of the overall changes in mobility as measured by travel time through Gibsons.

POTENTIAL INTERIM MEASURES - GIBSONS WAY INTERSECTION IMPROVEMENTS

As an interim measure to the Gibsons bypass options, minor improvements to the signalized intersections along Gibsons Way are proposed to improve mobility through Gibsons and specifically the highway through movements. These improvements could potentially further defer the need for a potential bypass option in the long term planning horizon. The minor intersection improvements are being considered along Highway 101 at Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road.

The proposed suite of improvements is made up of the following components:

- Widening of the south leg of the Shaw Road intersection to include a dedicated northbound left turn lane.
- Widening of the east leg of the Sunnycrest Road intersection to include a dedicated westbound right turn lane.
- Widening of the north leg of the Venture Way / Mahon Road intersection to include a dedicated southbound left turn lane.

These intersection improvements are forecasted to be able to reduce delay along Gibsons Way in the medium term for relatively low cost when compared to the bypass options.

To measure the benefits of these proposed intersection improvements, the methods of the Highway Capacity Manual were used to measure the control delay at each of the three intersections with and without the improvements using both 2019 and 2035 turning movement volumes. The results of the analysis are shown in ***Table 5.19.***

Table 5.19: Effect of Gibsons Way Intersections Improvements on Delay on Corridor

Analysis Year	Scenario	AM +PM Peak Hour System Total Delay (hours)
2019	Existing	5
2035	Existing	14
2019	Improved	3
2035	Improved	9

The results of the Highway Capacity analysis shown in ***Table 5.19*** were monetized on a daily basis by expanding the peak hour delays based on the measured ratio of peak hour volume to daily volume. The results of the expansion and monetization are shown in ***Table 5.20***, including the monetized annual travel time savings. These travel time savings are approximately a quarter of that of the Gibsons bypass options (see subsequent section).

Table 5.20: Monetized Travel Time Savings of the Gibsons Way Intersection Improvements

Year		Gibsons Way Intersection Improvements
2019	Average AM + PM Peak Hour Travel Time Savings (Hours)	2
	Average Daily Travel Time Savings (Hours)	15
	Average Daily Travel Time Savings (2019$)	$300
	Annual Travel Time Savings (2019$)	$100,000
2035	Average AM + PM Peak Hour Travel Time Savings (Hours)	5
	Average Daily Travel Time Savings (Hours)	40
	Average Daily Travel Time Savings (2019$)	$800
	Annual Travel Time Savings (2019$)	$280,000

The capital cost and property cost of the Gibsons Way intersection improvements are both shown in ***Table 5.21***.

Table 5.21: Property Cost and Capital Cost of Gibsons Way Intersection Improvements

	Gibsons Way Intersection Improvements
Project Management	$50,000
Engineering	$25,000
Construction	$200,000
Contingency	$150,000
Management Reserve	$25,000
Sub Total Capital Cost	**$450,000**
Property	**$400,000**
Total Capital Cost + Property	**$950,000**

**Depicted costs do not represent total project costs*

EVALUATION SUMMARY: GIBSONS WAY INTERSECTION IMPROVEMENTS:

The Gibsons Way intersection improvements, a combination of added lanes at the intersections of Highway 101 with Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road, produce significant benefits to travel time savings in the short and medium term for relatively low cost as compared to the bypass options.

EVALUATION OF THE SHORT BYPASS OPTIONS

The three bypass options (different alignments) were evaluated against the base case using the criteria previously listed and the results are summarized in the following subsections.

TRAVEL TIME SAVINGS

The travel time savings resulting from each bypass option were estimated using origin-destination data from StreetLight and travel time data from Google. It was assumed that all trips that travel from Langdale or West Howe Sound to the rest of the Sunshine Coast, with the exception of Gibsons, would use the bypass. In addition, these same trips travelling in the reverse direction were assumed to use the short bypass. The number of daily bypass trips and also local trips in Gibsons that use Highway 101 were calculated using 2019 origin-destination data from StreetLight and shown in ***Table 5.22.***

Table 5.22: Bypass and Gibsons Estimated Trips

Type of Trip	2019 StreetLight Annual Average Daily Trips
Bypass Northbound	3,793
Bypass Southbound	4,915
Local Gibsons	5,379

To estimate the time savings that could be achieved by the bypass, the existing travel time of some representative trips were extracted from Google and are shown in ***Table 5.23*** below. The trips from the terminus of the existing bypass at Stewart Road to the intersection of Highway 101 and Payne Road currently take approximately 4.0 minutes and would be replaced by the proposed bypass. The trips from the intersection of Highway 101 / School Road to the intersection of Highway 101 / Payne Road were taken as the representative local Gibsons trip, which is shortened from approximately 3.0 minutes in the peak hours and from approximately 2.5 minutes in the shoulder periods to approximately 2.0 minutes without congestion.

Table 5.23: Representative Travel Times for Bypass Trips

Trip Origin	Trip Destination	Conditions	Travel Time
Existing bypass terminus at Stewart Road	Highway 101 / Payne Road	Average	4 minutes
Highway 101 / School Road	Highway 101 / Payne Road	Peak	3 minutes
Highway 101 / School Road	Highway 101 / Payne Road	Shoulder	2.5 minutes
Highway 101 / School Road	Highway 101 / Payne Road	Off-peak	2 minutes

The estimated travel time on the proposed bypass options based on the existing high-level designs are shown in ***Table 5.24.*** Each bypass Option B adds 0.2 minutes to the travel time of its associated Option A alignments. Travel time savings for each option, shown in ***Table 5.25***, were estimated by assuming that all of the daily trips between Langdale and West Howe Sound and the rest of the corridor are shortened due to the new bypass route, and the local Gibsons trips are shortened because congestion is reduced due to the bypass traffic avoiding Gibsons. The monetary value of the time savings was calculated using the value of travel time of (2018)$18.49 from the Default Values of Benefit Cost Analysis, converted to (2019)$18.86 using an extrapolation of Statistics Canada's change in consumer price index between the years. The process was repeated for the 2035 horizon year by using an average of the adjusted growth rates calculated as documented in Section 3.4.1 of this report.

Table 5.24: Bypass Options Travel Time

	Bypass Options			
	1A	2A	3A	B
Travel Time (minutes)	3.5	3.4	3.2	+0.2

Table 5.25: Bypass Options Travel Time Savings

Year		Bypass Options			
		1A	2A	3A	B
2019	Average Daily Travel Time Savings (Hours)	121	135	165	-29
	Average Daily Travel Time Savings (2019$)	$2,300	$2,600	$3,100	-$500
	Annual Travel Time Savings (2019$)	$800,000	$900,000	$1,100,000	-$200,000
2035	Average Daily Travel Time Savings (Hours)	148	165	201	35
	Average Daily Travel Time Savings (2019$)	$2,800	$3,100	$3,800	-$700
	Annual Travel Time Savings (2019$)	$1,000,000	$1,100,000	$1,400,000	-$200,000

PROPERTY IMPACTS

The impacts of the three bypass options to adjacent properties are summarized in ***Table 5.26,*** based on the single line drawings superimposed on the cadastral plans.

Table 5.26: Property Impacts of Bypass Options

		Bypass Options			
		1A	2A	3A	B
Properties with partial impact	Non- ALR	2	1	1	0
	ALR	5	4	0	0
	Total	**7**	**5**	**1**	**0**
Properties with full impact	Non- ALR	0	1	2	+2
	ALR	0	0	0	+1
	Total	**0**	**1**	**2**	**+3**

COMMUNITY SEVERANCE

The qualitative assessment of community severance caused by each bypass option is summarized in ***Table 5.27*** below.

Table 5.27: Community Severance of Bypass Options

	Bypass Options			
	1A	2A	3A	B
Level of community severance	Moderate impact	Minor impact	Neutral	Minor impact
Creates a barrier for access between	Rural properties north of Reed Rood and the developed part of Gibsons.	Rural addresses of Cemetery Road and those north of there, and the developed part of Gibsons.	Very few developed properties north of the Hydro corridor	Rural properties west of Payne Road and the urban area of Gibsons.

CONSISTENCY WITH COMMUNITY PLANS

Option 1A

Option 1 is somewhat consistent with the SCRD's OCP. Reed Road is currently designated as a major collector road, and so the construction of a bypass route along Reed Road would likely represent a minor adjustment.

Option 2A

Option 2 is the least consistent with the SCRD's OCP of the three bypass options. The area between Reed Road and Cemetery Road where the bypass would be constructed is designated as residential land use.

Option 3A

Option 3 is the most consistent with the SCRD's OCP for the Elphinstone area. In the OCP, the bypass is drawn along the BC Hydro corridor similar to Option 3 for this study.

Option B

The B version of each bypass option have some conflict with the Gibsons Official Community Plan since the properties where the western terminus would be constructed west of the existing shopping centre at the intersection of Highway 101 and Payne Road are designated as Mixed-Use Commercial or Service Commercial / Business Centre.

ENVIRONMENTAL IMPACTS

Option 1A

The terrestrial impacts of the bypass option are:

- This bypass option will require relatively more tree removal than any of the passing lane options, in areas with no sensitive habitat features known.
- This bypass option would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the Migratory Birds Convention Act.

Bypass Option 1A has low potential for effects on aquatic ecosystems and species:

- Minor overlap of buffered footprint and low likelihood of effects on Chaster Creek tributary.
- Works may be subject to local government DPA process for works within designated riparian area.

Option 2A

The terrestrial impacts of the bypass option are:

- This bypass option will require relatively more tree removal than passing lane options, in areas with no sensitive habitat features known
- This bypass option would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the Migratory Birds Convention Act.
- This bypass option is in proximity to a great blue heron nest that may require timing and setback considerations during construction.

Bypass Option 2A has low potential for effects on aquatic ecosystems and species:

- Minor overlap of buffered footprint and low likelihood of effects on Chaster Creek tributary.
- Works may be subject to local government DPA process for works within designated riparian area.

Option 3A

The terrestrial impacts of the bypass option are:

- Bypass Option 3A would require relatively more tree removal than other bypass options, in areas containing riparian habitat.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the Migratory Birds Convention Act.

Among the three options, Option 3A has the highest potential for effects on aquatic ecosystems and species:

- Confirmed need for new crossing structure within undisturbed riparian forested area for salmonid-bearing Gibson Creek.
- The need for DFO review is likely based on new Gibson Creek crossing required. Installation of clear span or open bottom crossings may only require a letter of advice.
- Works will require provincial government authorization under the Water Sustainability Act.
- Works may be subject to local government DPA process for works within designated riparian areas.

Option B

The terrestrial impacts of the alternative bypass option are:

- Bypass Option B is similar to 1A and 2A and would require relatively more tree removal than passing lane options, in areas with no sensitive habitat features known.
- Would potentially need to consider timing of site clearing activities to avoid the breeding bird window and potential effects on active nests or individuals to avoid contravention of the Migratory Birds Convention Act.
- The alignment is in proximity to a great blue heron nest that may require timing and setback considerations during construction.

This alternative has the potential for effects on aquatic ecosystems and species:

- If active stream channel confirmed with field survey effort at Chaster Creek tributary, will potentially require stream channel realignment and associated mitigation during construction.
- Works will require provincial government authorization under the Water Sustainability Act.
- Works may be subject to local government DPA process for works within designated riparian areas.

ARCHEOLOGICAL IMPACTS

Option 1A

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Bypass 1A. The nearest registered archaeological site is DiRu-95, located 1.0 km southeast of the study area, and protected historical site DiRu-97 is located 950 metres to the southeast.

Staff from Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation expects to participate in any archeological investigations that me be undertaken, and the Nation's archeological advisors could indicate areas of higher potential.

Option 2A

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Bypass 2A. The nearest registered archaeological site is DiRu-95, located 1.0 km southeast of the study area, and protected historical site DiRu-97 is located 950 metres to the southeast.

Staff from Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation expects to participate in any archeological investigations that me be undertaken, and the Nation's archeological advisors could indicate areas of higher potential.

Option 3A

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Bypass 3A. The nearest registered archaeological site is DiRv-1, located 1.67 km southeast of the study area.

Staff from Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation expects to participate in any archeological investigations that me be undertaken, and the Nation's archeological advisors could indicate areas of higher potential.

Option B

Based on the review of the PHR, there are no registered archaeological sites or historic places, and no previous archaeological study areas with available spatial data in, or within 100 metres of, Bypass B. The nearest registered archaeological site is DiRv-1, located 1.93 km southeast of the study area.

Staff from Squamish Nation have indicated that there could be archeology even in areas with no registered sites, especially around the village site in Gibsons. Squamish Nation expects to participate in any archeological investigations that me be undertaken, and the Nation's archeological advisors could indicate areas of higher potential.

CONSTRUCTABILITY

A desktop review of the constructability of each bypass options was conducted using geology mapping, Google Earth imagery, historical photos, and topography.

Option 1A

Based on the available information, a combination of cuts and fills will be required along the bypass alignment.

Soils with limited compressibility are expected to underlie the bypass alignment. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

Potential slope hazards may exist along the alignment and maintaining suitable temporary and permanent slope stability of any slopes will need to be considered during design and construction.

Option 2A

Based on the available information, a combination of cuts and fills will be required along the bypass alignment.

Soils with limited compressibility are expected to underlie the bypass alignment. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

Potential slope hazards may exist along the alignment and maintaining suitable temporary and permanent slope stability of any slopes will need to be considered during design and construction.

Demolition of existing structures and removal of existing foundations will be required within the new right of way portion of the bypass alignment.

Option 3A

Based on the available information, a combination of cuts and fills will be required along the bypass alignment.

Soils with limited compressibility are expected to underlie the bypass alignment. However, stripping of any surface organic topsoil and weak/soft surface layers would need to be removed during construction. The existing soil and/or bedrock are expected to provide good support for the road embankments, following stripping and sub-excavation of any topsoil and weaker surface soils.

Potential slope hazards may exist along the alignment and maintaining suitable temporary and permanent slope stability of any slopes will need to be considered during design and construction.

The potential slope hazards and settlements, as well as the potential impact of increased or concentrated surface runoff within and adjacent to the deep ravine crossing near the eastern portion of the bypass alignment will need to be considered during design.

Slope and other geohazards would need to be considered along the base of Mt. Elphinstone situated about 300 metres north of the portion of the bypass alignment that parallels the BC Hydro right of way. There is an existing gravel pit north of the BC Hydro right of way which some geotechnical reports may have been completed could be a source of geotechnical information during the design stage.

Option B

Other than those already discussed above, there are no anticipated constructability considerations for the B variations of each option.

CAPITAL COST

The capital cost of each bypass option based on typical unit costs for grade and paving construction using the Elemental Parametric Method of Highway Cost Estimating is shown in ***Table 5.28.***

Table 5.28: Capital Cost of Bypass Options

	Bypass Options			
	1A	2A	3A	B
Project Management	$1.075M	$1.525M	$1.700M	$0.425M
Engineering	$0.700M	$0.975M	$1.075M	$0.275M
Construction	$5.600M	$8.125M	$9.000M	$2.175M
Contingency	$3.675M	$5.300M	$5.875M	$1.425M
Management Reserve	$0.550M	$0.800M	$0.900M	$0.225M
Total	$11.600M	$16.725M	$18.550M	$4.525M

PROPERTY COST

The cost of acquiring property for each option is shown in ***Table 5.29*** below. Property cost estimation was conducted at a high level for this planning study where it was assumed that each property acquisition would involve approximately $100,000 to account for acquisition administrative costs, in addition to the property value.

Table 5.29: Property Costs of Bypass Options

	Bypass Options			
	1A	2A	3A	B
Property Cost	$1.1M	$5.4M	$3.3M	+$4.3M

MAINTENANCE AND REHABILITATION COST

Roadway maintenance and resurfacing costs were estimated based on lane-kilometers of roadway in each bypass option, summarized in ***Table 5.30*** below. Annual maintenance costs and scheduled rehabilitation costs were then monetized using the factors provided in BC MoTI's Default Values for Benefit Cost Analysis 2018, namely (2018$)5,099 per Lane-km per year for maintenance and (2018$)100,000 per Lane-km for resurfacing every 15 years. The number shown for Option B represents the additional surface of each B option compared to the associated Option A.

Table 5.30: Maintenance and Rehabilitation of Bypass Options

	Bypass Options			
	1A	2A	3A	B
Road Surface (ln-km)	4.0	5.1	5.1	+1.4
Annual Maintenance Cost	$20,000	$30,000	$30,000	+$10,000
Resurfacing Cost every 15 Years	$400,000	$500,000	$500,000	+$100,000

PRESENT VALUE AND BENEFIT-COST

To compare the relative benefits and costs of each bypass option, the timing of the expenditures and benefits were considered and the present values of each were calculated, summarized in ***Table 5.31.***

The analysis relies on the following assumptions (analysis purposes only):

- Construction of the bypass would take place in 2030 and 2031;
- Travel time savings benefits begin accruing in 2032;
- The analysis ends in 2057 once 25 years of benefits have accrued; and
- A discount rate of 6% for future costs and benefits is applied.

Table 5.31: Benefit Cost Analysis of Bypass Options

	Bypass Options			
	1A	2A	3A	B
Present value of costs	$12.3M	$21.2M	$20.9M	+$8.4M
Present value of benefits	$14.1M	$15.9M	$19.2M	-$3.4M
Benefit-cost ratio	1.15	0.75	0.92	-

INDIGENOUS CONSIDERATIONS

Based on discussions with shíshálh Nation and Squamish Nation in both the problem definition and option generation phases of this study, considerations that inform the evaluation of the bypass options are summarized below.

Option 1A

shíshálh Nation's concern in the context of the Gibsons bypass is related to the reliability of the highway, and whether an alternative route is available in case of a collision on the highway. Since the existing Highway 101 route will be an alternative to bypass Option 1A, this option is an improvement from the base case in terms of reliability.

Squamish Nation is interested in the opportunity for cultural recognition if one of the bypass options is constructed. For example, it would be beneficial for a member artist or architect to create murals or other cultural artwork along the route. There would be opportunities for this kind of cultural recognition on bypass Option 1A at Stewart Road, along Reed Road, or along Payne Road.

Squamish Nation is also interested in the opportunity to display the names of members who would work on the eventual construction of the Gibsons bypass, and this would be feasible for Option 1A.

Squamish Nation has expressed concern over the impact of any projects to the Chekwelp 26 reserve, which will be unaffected by Option 1A.

Squamish Nation has expressed concern over the environmental impacts related to tree removal from the bypass project. The construction of Option 1A will involve the least tree removal of all the “A” bypass options.

The construction of Option 1A would involve drainage infrastructure to manage stormwater, one of Squamish Nation’s concerns associated with growth and development on the corridor.

Option 2A

shíshálh Nation’s concern in the context of the Gibsons bypass is related to the reliability of the highway, and whether an alternative route is available in case of a collision on the highway. Since the existing Highway 101 route will be an alternative to bypass Option 2A, this option is an improvement from the base case in terms of reliability.

Squamish Nation is interested in the opportunity for cultural recognition if one of the bypass options is constructed. For example, it would be beneficial for a member artist or architect to create murals or other cultural artwork along the route. There would be opportunities for this kind of cultural recognition on bypass Option 2A at Stewart Road, along the properties behind Reed Road, or along Payne Road.

Squamish Nation is also interested in the opportunity to display the names of members who would work on the eventual construction of the Gibsons bypass, and this would be feasible for Option 2A.

Squamish Nation has expressed concern over the impact of any projects to the Chekwelp 26 reserve, which will be unaffected by Option 2A.

Squamish Nation has expressed concern over the environmental impacts related to tree removal from the bypass project. The construction of Option 2A will involve more tree removal than bypass Option 1A, but less than Option 3A.

The construction of Option 2A would involve drainage infrastructure to manage stormwater, one of Squamish Nation’s concerns associated with growth and development on the corridor.

Option 3A

shíshálh Nation’s concern in the context of the Gibsons bypass is related to the reliability of the highway, and whether an alternative route is available in case of a collision on the highway. Since the existing Highway 101 route will be an alternative to bypass Option 3A, this option is an improvement from the base case in terms of reliability.

Squamish Nation is interested in the opportunity for cultural recognition if one of the bypass options is constructed. For example, it would be beneficial for a member artist or architect to create murals or other cultural artwork along the route. There would be opportunities for this kind of cultural recognition on bypass Option 1A at Stewart Road, along the hydro corridor, or along Payne Road.

Squamish Nation is also interested in the opportunity to display the names of members who would work on the eventual construction of the Gibsons bypass, and this would be feasible for Option 3A.

Squamish Nation has expressed concern over the impact of any projects to the Chekwelp 26 reserve, which will be unaffected by Option 3A.

Squamish Nation has expressed concern over the environmental impacts related to tree removal from the bypass project. The construction of Option 3A will involve the most tree removal of all the “A” bypass options.

The construction of Option 3A would involve drainage infrastructure to manage stormwater, one of Squamish Nation’s concerns associated with growth and development on the corridor.

Option B

shíshálh Nation’s concern in the context of the Gibsons bypass is related to the reliability of the highway, and whether an alternative route is available in case of a collision on the highway. Since the existing Highway 101 route will be an alternative to bypass Option B, this option is an improvement from the base case in terms of reliability.

Squamish Nation is interested in the opportunity for cultural recognition if one of the bypass options is constructed. For example, it would be beneficial for a member artist or architect to create murals or other cultural artwork along the route. There would be opportunities for this kind of cultural recognition on bypass Option B at Payne Road or at the existing highway.

Squamish Nation is also interested in the opportunity to display the names of members who would work on the eventual construction of the Gibsons bypass, and this would be feasible for Option B.

Squamish Nation has expressed concern over the impact of any projects to the Chekwelp 26 reserve, which will be unaffected by Option B.

Squamish Nation has expressed concern over the environmental impacts related to tree removal from the bypass project. The construction of “B” options will involve more tree removal than the “A” options.

The construction of Option B would involve drainage infrastructure to manage stormwater, one of Squamish Nation’s concerns associated with growth and development on the corridor.

GIBSONS BYPASS OPTION EVALUATION SUMMARY

The evaluation of the bypass options is summarized in ***Table 5.32*** below. The evaluation results for the qualitative criteria are summarized in relation to existing conditions.

Table 5.32: Bypass Option Evaluation Summary

Evaluation Criteria		Bypass 1A	Bypass 2A	Bypass 3A	Bypass B
Average Daily Travel Time Savings (Hours)	2019	121	135	165	-29
	2035	148	165	201	35
Property Impacts		Minor impacts to 7 properties, 2 in ALR.	Minor impacts to 5 properties, 4 in ALR. Acquisition of 1 full property	Minor impacts to 1 property and acquisition of 2 full properties.	Acquisition of 3 full additional properties, 2 in ALR.
Community Severance		Somewhat worse ◔	Somewhat worse ◔	Neutral ○	Somewhat worse ◔
Consistency with Community Plans		Somewhat worse ◔	Somewhat worse ◔	Somewhat better ◕	Somewhat worse ◔
Environmental Impacts		Some tree removal with requirements to consider breeding bird window. Minor overlap with Chaster Creek Somewhat worse ◔	Some tree removal with requirements to consider breeding bird window. Proximity to blue heron nest. Minor overlap with Chaster Creek Somewhat worse ◔	Most tree removal with requirements to consider breeding bird window. Crossing of Gibsons creek Somewhat worse ◔	Somewhat worse ◔
Archeological Impacts		No overlap with registered sites or historic places. Neutral ○	No overlap with registered sites or historic places. Neutral ○	No overlap with registered sites or historic places. Neutral ○	No overlap with registered sites or historic places. Neutral ○
Constructability		Supportive soil and straightforward construction	Supportive soil and straightforward construction, including the demolition of existing structures.	Supportive soil, construction will have to consider a nearby ravine and Mount Elphinstone.	No additional considerations
Capital Cost		$11.600M	$16.725M	$18.550M	$4.525M
Property Cost		$1.1M	$5.4M	$3.3M	+$4.3M
Maintenance and Rehabilitation Cost		$20,000 annually $400,000 every 15 years	$30,000 annually $500,000 every 15 years	$30,000 annually $500,000 every 15 years	+$10,000 annually +$100,000 every 15 years
Benefit-Cost Ratio		1.15	0.75	0.92	-
Indigenous Considerations		No impact to nearby reserve, improvement in drainage infrastructure, alternative highway route, and opportunities for cultural recognition. Somewhat better ◕	No impact to nearby reserve, improvement in drainage infrastructure, alternative highway route, and opportunities for cultural recognition. Somewhat better ◕	No impact to nearby reserve, improvement in drainage infrastructure, alternative highway route, opportunities for cultural recognition, and significant tree removal. Somewhat better ◕	No additional considerations
Option Summary		Option 1 A is the lowest cost option with the lowest, but significant travel time benefits, and minor impacts. The alignment has some significant conflicts with plans for development in Gibsons and may result in access issues along Reed Road.	Increased costs relative to Option 1A are not offset by minor increase in travel time benefits, resulting in the lowest benefit-cost ratio, but still greater than 1. Impacts are minor. Option 2A is a good candidate for implementation if the conflicts between development and Option 1A are found to be too great.	The high capital cost of Option 3A is combined with the highest travel time savings to result in a high benefit-cost ratio. Aquatic impacts and constructability considerations are greater than the other bypass options, but mitigation strategies are straightforward and achievable. The increased cost, complexity, and required mitigation can be worthwhile to achieve the travel time savings and avoid conflict with existing and future development.	The B variation of each option has increased cost and reduced travel time savings compared to the A variations. However, it is more consistent with development plans in the area of Payne Road and Highway 101 than the A bypass variations.

5.3 Evaluation Summary

The results of the summary of all passing lane, intersection, and bypass options are summarized in the following subsections.

5.3.1 Passing Lanes

Passing Lane SB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.

Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated.

Passing Lane NB-1 achieves an acceptable level of service to 2035 with only minor impacts anticipated. However, construction complexity is anticipated to be somewhat higher compared to the other passing lane options.

5.3.2 Intersection

The Joe Road / Orange Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.8 per year on average with no significant impacts anticipated.

The Flume Road intersection improvements can enhance traffic safety at this location by reducing collisions by 1.1 per year on average with no significant impacts anticipated.

The Lower Road / Highland Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.

The Ti'Ta Way intersection improvements are anticipated to slightly enhance the traffic safety at this intersection with no impacts anticipated.

The Wharf Avenue / Dolphin Street intersection improvements can enhance overall traffic operations for the intersection and specifically for the westbound left movement which was forecasted to operate at an unsatisfactory level of service by 2035.

The Shorncliffe Avenue intersection improvements can enhance traffic safety at this location by reducing collisions by 0.5 per year on average with no significant impacts anticipated.

The Hill Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.7 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated with respect to a currently undeveloped property.

The Redrooffs Road intersection improvements can enhance traffic safety at this location by reducing collisions by 0.2 per year on average with only minor environmental impacts anticipated. Only minor property impacts are anticipated.

The multiple intersection improvements in the Davis Bay and Selma Park areas can improve traffic safety by reducing collisions by 6.8 per year on average with no significant impacts anticipated.

5.3.3 Short Gibsons Bypass and Potential Interim Improvements

Option 1A is the lowest cost option with the lowest, but still significant travel time benefits, and minor impacts. Successful implementation of Option 1A will need to consider the implication of access issues along Reed Road and the effect of this alignment on future development in Gibsons.

The increased costs of Option 2A relative to Option 1A are not offset by minor increases in travel time benefits, resulting in the lowest benefit-cost ratio. Impacts are anticipated to be minor. Option 2A is a good candidate for implementation if the conflicts between future development are found to be too great with respect to Option 1A.

The high capital cost of Option 3A is combined with the highest travel time savings to result in a high benefit-cost ratio. Aquatic impacts and constructability considerations are greater than the other bypass options. The increased cost, complexity, and required mitigation may be worthwhile to achieve the travel time savings and avoid conflict with existing and future development.

The increased cost and reduced travel time savings of the B variation of each option, suggest that this variant may be less favourable than the A options from these two perspectives. However, this variation in the alignment represents a viable alternative if current and future development in the area of Payne Road and Highway 101 conflicts with the implementation of the alignment of the A bypass options.

The Gibsons Way intersection improvements, a combination of added lanes at the intersections along Highway 101 at Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road, produce significant benefits with respect to travel time savings along Highway 101 (Gibsons Way). These improvements, to be considered in the medium to long term, will provide enhanced mobility along Gibsons Way and defer the potential implementation of any bypass option to the long term planning horizon, beyond 2035.

6. RECOMMENDATIONS

The outcome of the option evaluation has provided sufficient information to formulate several recommendations for improving the Highway 101 corridor between the Langdale Ferry Terminal and Redrooffs Road north of Sechelt. These recommendations will address many of the safety, traffic operations, and active transportation issues identified earlier in the study.

6.1 Recommendations

The various improvement options considered in the option evaluation were categorized into three areas:

- Passing Lanes to address highway level of service issues.
- Intersection Improvements to address safety and capacity issues.
- Short bypass routes to address mobility as well as traffic safety through the urban area of Gibsons.

For each of these improvement types, the following recommendations have been made. Where appropriate, it is recommended that active transportation infrastructure is included in the construction of the improvements.

PASSING LANES

- Passing Lane NB-1, between Veterans Road and Roberts Creek Road, is recommended to be implemented as this potential project improves the operations along the highway in the northbound direction and has limited impacts, including moderate implementation costs.
- Passing Lane NB-2, between Roberts Creek Road and Field Road, is recommended to be implemented as this potential project improves the operations along the highway in the northbound direction and has limited impacts, including moderate implementation costs.
- Passing Lane SB-1, between Roberts Creek Road and Veterans Road, is recommended to be implemented as this potential project improves the operations along the highway in the southbound direction and has limited impacts, including moderate implementation costs.

INTERSECTION IMPROVEMENTS

The evaluation of the various improvement options has confirmed that the proposed intersection modifications are beneficial in improving intersection safety and level of service. The following intersections improvements are therefore recommended:

- Joe Road / Orange Road – add left turn lanes in both directions of travel on Highway 101.
- Lower Road / Highland Road – add southbound left turn lane and southbound right turn lane.
- Flume Road – add southbound left turn lane at Lockyer Road (opposite Flume Road) and a northbound left turn lane at Marlene Road.
- Ti'Ta Way – traffic signal phasing changes to consider a protected only phase for the highway left turn movement.

- Wharf Avenue / Dolphin Street – intersection modifications to permit dual westbound left turn movements.
- Shorncliffe Road – signalization and channelization to improve traffic and pedestrian safety.
- Hill Road – closure of the existing intersection and development of a new connection to Highway 101 as an extension of Dale Road.
- Redrooffs Road – realignment of the cross street to improve the approaching angle with Highway 101.
- Davis Bay Area:
  - Mission Road – new northbound left turn lane
  - Whitaker Road – restrict movements to right in / right out only
  - Westly Road – restrict movements to right in / right out only
  - Davis Bay Road – new southbound left turn lane and install traffic signals
  - Bay Road - new southbound left turn lane
  - Heather Road – new southbound left turn lane
  - Havies Road – restrict movements to right in / right out only
  - Nestman Road – new southbound left turn lane
  - Snodgrass Road – new southbound left turn lane
  - Selma Park Road – new southbound and northbound left turn lanes
  - Monkey Tree Lane South – new southbound left turn lane
  - Monkey Tree Lane North - close intersection
  - Widened the highway cross section to include a 2.0 metre sidewalk on the east side of the road along with 2.0 metre paved shoulders on both sides of the road between Field Road and Monkey Tree Lane. These cross section changes would be in addition to the turning lanes specified above.

SHORT BYPASS

Through the 2035 planning horizon, the signalized intersections in Gibsons are forecasted to perform at satisfactory levels of service during the fall analysis period. The bypass options generated and evaluated for this study could improve mobility along Highway 101 through the urban areas of Gibsons in the long term time frame, beyond 2035.

Through the comparative option evaluation, Bypass Option 3B was identified as providing the best value amongst the three options assessed. This eastern most bypass option has the least impacts to existing properties, has a comparable implementation costs to the other bypass options, limited environmental impacts, and provides the most benefits compared to the other options. Notably, although the A variation of the option would result in more travel time benefits for less cost, the potential conflict with development plans in Gibsons are significant.

However, to further defer the potential long term future implementation of a short bypass of Gibsons, several intersection improvements along Gibsons Way have been identified to enhance the mobility of the existing Highway 101 route by reducing travel times in the medium and long term time frames. These improvements at Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road would include turning lane enhancements on the cross streets to permit additional green time to be allocated to the highway through movements.

6.2 Implementation Strategy

Many of the recommendations stemming from the option assessment are related to different types of corridor improvements. As such, many of the recommendations are independent of one another. Therefore, the implementation strategy first considers the improvement types in order to identify priorities, and then considers the overall corridor using the following time frames for potential project implementation:

- Short Term
- Medium Term
- Long Term (beyond 2035)

IMPLEMENTATION STRATEGY FOR INDIVIDUAL PROJECT TYPES

PASSING LANES

From the analysis of the existing corridor, the existing highway is operating satisfactorily under current traffic demands. However, as per the future traffic analysis, all three passing lanes should be implemented by the 2035 planning horizon to address the identified operating deficiencies between Veterans Road and Field Road. As such, it is recommended that the three passing lanes be implemented in the short and medium terms, and definitely prior to the 2035 planning horizon noting that the highway level of service will likely be identified as unsatisfactory prior to the 2035 planning horizon. Individually, the following priorities amongst the three passing lane projects are recommended:

- Passing Lane NB-1 — Short Term
- Passing Lane SB-1 — Medium Term
- Passing Lane NB-2 — Medium Term

INTERSECTION IMPROVEMENTS

The independent intersection improvements should be considered over the short and medium terms. Where possible, the intersection improvements should be tied to other corridor improvement projects resulting from adjacent developments that may be directly / indirectly impacting the highway corridor. The independent intersection improvements include:

- Joe Road / Orange Road
- Lower Road / Highland Road
- Flume Road area
- Ti'Ta Way
- Wharf Avenue / Dolphin Street
- Shorncliffe Road
- Redrooffs Road
- Hill Road

In the Davis Bay area, numerous intersection improvements involving the addition of left turn bays as well as increasing the overall cross section of the highway to accommodate pedestrians and cyclists have been recommended. Given the close spacing of some of the intersections and the desire to have a consistent cross section through this entire area, it is recommended that widening of the highway and the intersection improvements be considered either as one complete construction package (approximately 5.1 km in length) or potentially delivered under three logical phases as follows:

- Davis Bay Segment 1: Field Road to Whitaker Road
- Davis Bay Segment 2: Whitaker Road to Havies Road (priority section)
- Davis Bay Segment 3: Havies Road to Monkey Tree Lane

The three segments have been proposed based on consistency of the adjacent land uses and the high active transportation activities in the middle segment, Segment 2 between Whitaker Road and Havies Road.

SHORT BYPASS

Due to the higher costs associated with the potential short bypass project, the short bypass of the urban area of Gibsons is recommended for implementation in the long term horizon - beyond 2035. This extended time frame will provide the BC MoTI with sufficient time to advance the planning and functional design of the project and consult with the Squamish First Nation, local stakeholders, and eventually the public.

In the interim, minor intersection improvements along Gibsons Way are recommended in the medium term, namely at Shaw Road, Sunnycrest Road, and Venture Way / Mahon Road.

Furthermore, to address the existing traffic operations issues at the various traffic signalized intersections along Gibsons Way due to traffic volume surges related to the ferry operations, adaptive signal control is recommended. Adaptive signal control allows the signal time plan to dynamically adjust to approaching traffic demands, thus optimizing the overall traffic signal operations based on current traffic demand conditions. The adaptative signal control should be considered at the following intersections along Highway 101:

- Reed Road
- School Road / North Road
- Shaw Road
- Sunnycrest Road
- Venture Way / Mahan Road
- Payne Road

POTENTIAL PROJECT IMPLEMENTATION TIMELINE SUMMARY

The following lists provides a summary of the timeline for the recommended implementation of the various corridor improvements / potential projects:

SHORT TERM PROJECTS:

- Intersection improvements at:
  - Joe Road / Orange Road
  - Shorncliffe Road
  - Lower Road / Highland Road
  - Ti'Ta Way
- Adaptive Signal Control at:
  - Reed Road
  - School Road / North Road
  - Shaw Road
  - Sunnycrest Road
  - Venture Way / Mahan Road
  - Payne Road
- Passing Lane NB-1 (Veterans Road to Roberts Creek Road)

MEDIUM TERM PROJECTS:

- Passing Lane SB-1 (Roberts Creek Road to Veterans Road)
- Passing Lane NB-2 (Roberts Creek Road to Field Road)
- Intersection Improvements at:
  - Shaw Road
  - Sunnycrest Road
  - Venture Way / Mahan Road
  - Wharf Avenue / Dolphin Street
  - Flume Road Area
- Davis Bay highway widening and intersection improvements. One package or phased construction:
  - Davis Bay Segment 2
  - Davis Bay Segment 1
  - Davis Bay Segment 3

LONG TERM PROJECTS (beyond 2035):

- Remaining Intersection Improvements not completed in the short or medium terms
- Short Bypass (Gibsons Area)

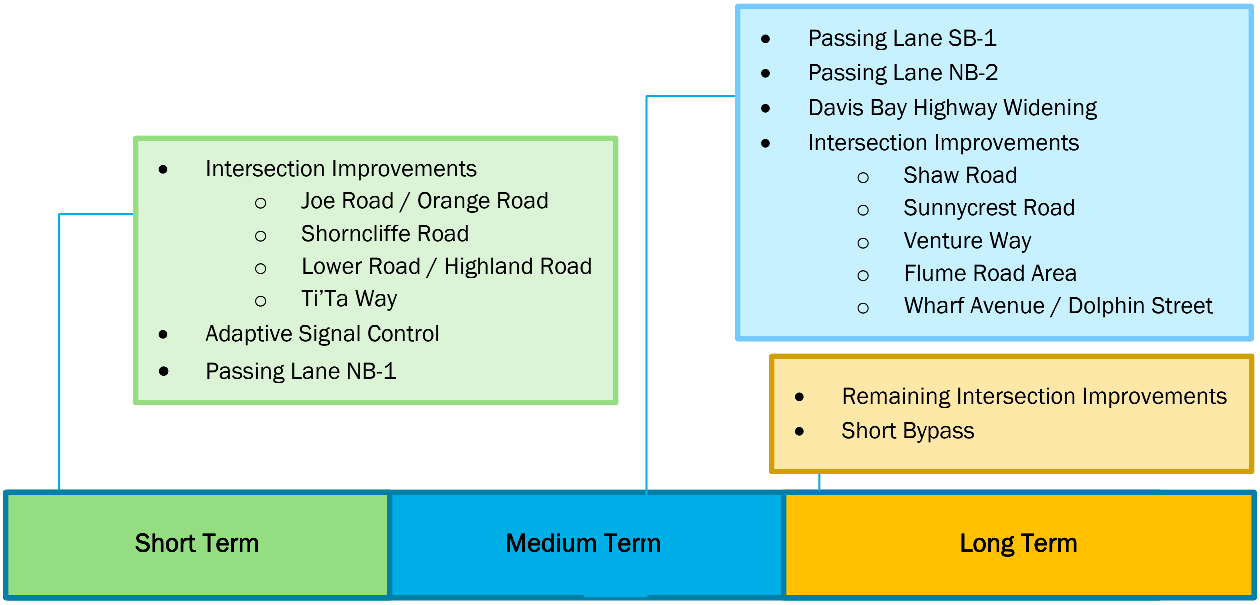


Figure 6.1: Implementation Plan and Timeline

Appendix A

Highway Geometric Issues

Horizontal and vertical alignment data provided by BC MoTI was used to build a model of the Highway 101 segments between Gibsons and Sechelt on the Integrated Highway Safety Design Model (IHSDM) software. IHSDM was used to identify deficiencies in curve radius, lane widths, sight distances, and road grades. The model was bounded by Dolphin Street / Wharf Avenue intersection in Sechelt and the by the Hillcrest Road intersection in Gibsons.

The assessment identified some potential issues on the corridor, but nothing that would need to be addressed at the planning study level. Results of the analysis are to be carried forward as part of any future projects and to be confirmed in the field.

In this section, references to the “right” side of the road indicate the direction of increasing stations, which is in the southbound direction in this study. Conversely, references to the “left” side of the road indicate the direction of decreasing stations, equivalent to the northbound direction in this study.

HIGHWAY ALIGNMENT AND CROSS SECTION

The highway alignment, including vertical and horizontal curves, was automatically generated on the IHSDM based on the AutoCAD centreline data provided by BC MoTI, which was in turn derived from LiDAR captured and processed data.

The highway lanes were manually coded based on Google Satellite and Street View. The entire highway segment was found to have a width of 3.75 metres on both sides. A 3.6 metre wide passing lane was also coded on the right side of the highway from Station 7+300.000 to Station 8+900.000. All turning lanes and acceleration lanes were also included in the model.

The highway shoulder was measured at various points (using Google) and an average 1.5 metre wide paved shoulder was used in the model. A two (2.0) percent slope was coded for the length of the corridor.

Posted speeds along Highway 101 were coded based on signage observations from Google Street View.

No passing zones were also manually coded based on painted centreline on Google Street View.

ANALYSIS RESULTS

The design criteria used in the geometric design review of the existing highway was the BC MoTI design criteria for Rural Arterial Undivided highways. For this analysis, the existing design information utilized the IHSDM to represent the present conditions. The design review was confined to the centerline design elements such as horizontal curve radius, maximum grade, and minimum sight distances since only the centerline horizontal alignment and vertical profile were based on actual data. The IHSDM analysis results revealed that certain segments of the existing highway alignment do not achieve current BC MoTI guidelines. The results of the analysis are summarized in ***Table A.1***, with more detailed results of the analysis for each design element throughout the rest of this subsection.

Table A.1: Existing Highway Design Criteria Achievement Analysis

Design Element	Present Conditions	BC MoTI / TAC Guideline Criteria	Comments / Notes
Design Classification	RAU	RAU	Rural Arterial Undivided highway
Posted Speed	50 km/h 60 km/h 70 km/h 80 km/h	50 to 80 km/h	Criteria for Posted Speed from TAC Geometric Design Guidelines to be the selected Design Speed
Assumed Design Speed	50 km/h 60 km/h 70 km/h 80 km/h	70 to 90 km/h	Criteria from BC MoTI TAC Supplement, Table 430.A
Basic Lanes	2	2	
Minimum Radius			Criteria from BC MoTI TAC Supplement, Table 330.A (for +0.06 m/m Superelevated Section)
50 km/h	70 m	90 m	
60 km/h	115 m	130 m	
70 km/h	N/A	190 m	
80 km/h	100 m	250 m	
Maximum Grade	12.22%	6%	Criteria from TAC Geometric Design Guidelines, Table 2.1.3.1
Minimum SSD			Criteria from BC MoTI TAC Supplement, Table 330.F (based on tail light height of 660 mm) Generally, obstructions beyond the shoulder on horizontal curves are cited as possible sources of sight distance limitations, which need to be confirmed onsite.
50 km/h	50 m	65 m	
60 km/h	50 m	85 m	
70 km/h	N/A	105 m	
80 km/h	50 m	130 m	
Minimum PSD			Criteria from TAC Geometric Design Guidelines Table 2.5.5
50 km/h	50 m	160 m	
60 km/h	50 m	200 m	
70 km/h	N/A	240 m	
80 km/h	50 m	275 m	

For horizontal curves along Highway 101, the design element reviewed was the minimum curve radius. The analysis of minimum curve radius assumes a maximum superelevation of 0.06 m/m. Based on this assumption, the highway segments which do not meet the minimum horizontal curve radius are shown in ***Table A.2***.

Table A.2: Identified Radius of Curve Deficiencies

Start Sta.	End Sta.	Road (M)	BC MoTI Guidelines	Speed (Km/H)
4+792.414	4+843.631	70	79	50
6+888.096	6+916.900	250	252	80
7+083.518	7+117.680	250	252	80
7+254.218	7+439.516	250	252	80
7+670.688	7+823.043	200	252	80
7+957.011	7+985.355	125	252	80
8+298.893	8+355.287	250	252	80
8+616.558	8+729.099	200	252	80
8+901.113	9+012.337	250	252	80
9+420.368	9+514.250	250	252	80
9+929.132	9+982.589	250	252	80
10+262.593	10+292.555	250	252	80
11+465.378	11+498.339	250	252	80
12+759.282	12+810.548	115	123	60
16+020.435	16+054.991	100	252	80

The design element reviewed for vertical curves was tangent grade. Highway 101 segments with grades that exceed the desired maximum grade are shown in ***Table A.3***.

Table A.3: Identified Tangent Grade Deficiencies

Start Sta.	End Sta.	Road Grade (%)	BC MoTI Guidelines	Speed (Km/H)	Length (M)
160.318	177.551	7.85	7	50	17.23
794.769	869.944	7.83	7	50	75.17
2+353.645	2+358.634	8.09	7	50	4.99
3+564.122	3+600.000	10.45	7	60	62.71
3+600.000	3+626.827	10.45	7	50	62.71
6+254.939	6+272.735	11.97	7	60	17.8
7+669.325	7+808.865	6.71	6	80	139.54
8+048.865	8+136.294	12.22	6	80	87.43
11+435.368	11+500.000	7.06	5	80	257.05

In performing a sight distance analysis, the IHSDM assumes drivers cannot see beyond the edge of the road shoulder when viewing through the inside of a horizontal curve, as trees, bushes, road cut embankments or other obstructions may be blocking sight lines. Therefore, for sight distance deficiencies related to horizontal road alignment, the IHSDM identifies potential deficiencies which need to be confirmed onsite. However, for sight distance deficiencies that are related to vertical alignment, the IHSDM analysis is more likely to be accurate. The Highway 101 segments with potential stopping sight distance deficiencies, as identified by the IHSDM, are shown in ***Figure A.1***.

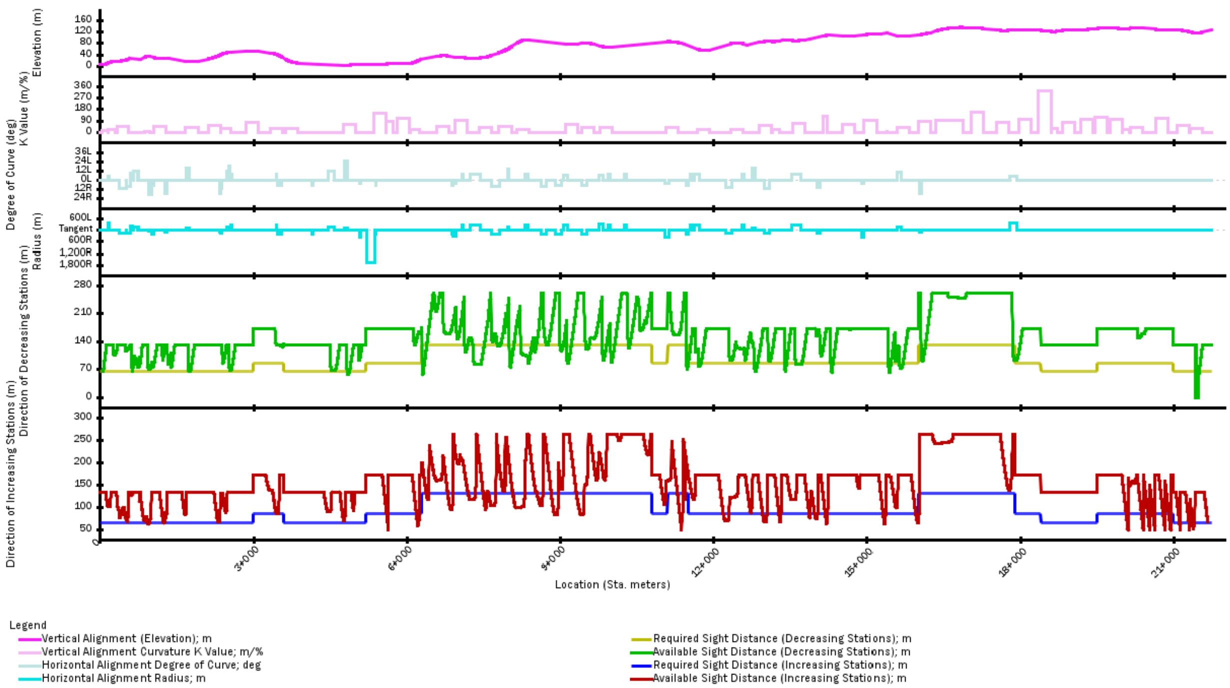


Figure A.1: Identified Potential Stopping Sight Distance Deficiencies

The Highway 101 segments with potential stopping sight distance deficiencies, as identified by the IHSDM, are further described in ***Table A.4*** with the potential source of the limited sight distance identified in the comment column.

Table A.4: Identified Potential Stopping Sight Distance Deficiencies

Start Sta.	End Sta.	Travel Direction	Road SSD (M)	BC MoTI Guidelines SSD (M)	Speed (Km/H)	Comment
922	958	Southbound	62	65	50	Horizontal curve potentially limiting sight distance
1+238.000	1+252.000	Southbound	64	65	50	Horizontal curve potentially limiting sight distance
5+612.000	5+646.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
6+196.000	6+250.000	Southbound	58	85	60	Vertical curve limiting sight distance
6+394.000	6+432.000	Southbound	116	130	80	Horizontal curve potentially limiting sight distance
6+812.000	6+908.000	Southbound	94	130	80	Horizontal curve potentially limiting sight distance
7+214.000	7+348.000	Southbound	116	130	80	Horizontal curve potentially limiting sight distance
7+510.000	7+576.000	Southbound	94	130	80	Horizontal curve potentially limiting sight distance
7+614.000	7+748.000	Southbound	104	130	80	Horizontal curve potentially limiting sight distance
8+070.000	8+298.000	Southbound	98	130	80	Vertical curve limiting sight distance
8+542.000	8+654.000	Southbound	104	130	80	Horizontal curve potentially limiting sight distance
8+822.000	8+956.000	Southbound	82	130	80	Horizontal curve potentially limiting sight distance
9+318.000	9+466.000	Southbound	82	130	80	Horizontal curve potentially limiting sight distance
10+606.000	10+684.000	Southbound	50	130	80	Horizontal curve potentially limiting sight distance
10+740.000	10+796.000	Southbound	96	130	80	Horizontal curve potentially limiting sight distance
11+324.000	11+430.000	Southbound	72	130	80	Vertical curve limiting sight distance

Start Sta.	End Sta.	Travel Direction	Road SSD (M)	BC MoTI Guidelines SSD (M)	Speed (Km/H)	Comment
12+194.000	12+306.000	Southbound	70	85	60	Horizontal curve potentially limiting sight distance
12+964.000	13+050.000	Southbound	68	85	60	Horizontal curve potentially limiting sight distance
13+286.000	13+324.000	Southbound	66	85	60	Vertical curve limiting sight distance
13+878.000	13+896.000	Southbound	76	85	60	Horizontal curve potentially limiting sight distance
13+986.000	14+042.000	Southbound	74	85	60	Horizontal curve potentially limiting sight distance
14+194.000	14+240.000	Southbound	62	85	60	Vertical curve limiting sight distance
15+308.000	15+358.000	Southbound	62	85	60	Vertical curve limiting sight distance
15+952.000	15+998.000	Southbound	64	85	60	Horizontal curve potentially limiting sight distance
16+000.000	16+018.000	Southbound	66	130	80	Horizontal curve potentially limiting sight distance
20+078.000	20+112.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
20+378.000	20+412.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
20+502.000	20+536.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
20+602.000	20+636.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
20+802.000	20+836.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
20+912.000	20+946.000	Southbound	50	85	60	Horizontal curve potentially limiting sight distance
21+122.000	21+136.000	Southbound	50	65	50	Horizontal curve potentially limiting sight distance
21+308.000	21+322.000	Southbound	50	65	50	Horizontal curve potentially limiting sight distance
21+376.000	21+412.000	Southbound	52	65	50	Horizontal curve potentially limiting sight distance
1+738.000	1+752.000	Northbound	64	65	50	Horizontal curve potentially limiting sight distance
4+838.000	4+882.000	Northbound	58	65	50	Horizontal curve potentially limiting sight distance
6+306.000	6+396.000	Northbound	58	130	80	Vertical curve limiting sight distance
7+142.000	7+194.000	Northbound	114	130	80	Horizontal curve potentially limiting sight distance
7+304.000	7+524.000	Northbound	82	130	80	Horizontal curve potentially limiting sight distance
7+792.000	7+834.000	Northbound	128	130	80	Horizontal curve potentially limiting sight distance
7+996.000	8+082.000	Northbound	76	130	80	Horizontal curve potentially limiting sight distance
8+222.000	8+438.000	Northbound	86	130	80	Vertical curve limiting sight distance
8+488.000	8+526.000	Northbound	114	130	80	Horizontal curve potentially limiting sight distance
8+994.000	9+052.000	Northbound	116	130	80	Horizontal curve potentially limiting sight distance
9+122.000	9+212.000	Northbound	86	130	80	Horizontal curve potentially limiting sight distance
9+500.000	9+560.000	Northbound	120	130	80	Horizontal curve potentially limiting sight distance
9+822.000	9+902.000	Northbound	92	130	80	Horizontal curve potentially limiting sight distance
9+984.000	10+060.000	Northbound	88	130	80	Horizontal curve potentially limiting sight distance
10+332.000	10+356.000	Northbound	124	130	80	Horizontal curve potentially limiting sight distance
11+470.000	11+498.000	Northbound	70	130	80	Vertical curve limiting sight distance
11+500.000	11+506.000	Northbound	80	85	60	Vertical curve limiting sight distance
11+616.000	11+634.000	Northbound	84	85	60	Horizontal curve potentially limiting sight distance
11+698.000	11+752.000	Northbound	82	85	60	Horizontal curve potentially limiting sight distance
12+804.000	12+864.000	Northbound	66	85	60	Horizontal curve potentially limiting sight distance
13+396.000	13+432.000	Northbound	66	85	60	Vertical curve limiting sight distance
13+614.000	13+734.000	Northbound	82	85	60	Horizontal curve potentially limiting sight distance
14+302.000	14+346.000	Northbound	62	85	60	Vertical curve limiting sight distance
15+412.000	15+462.000	Northbound	62	85	60	Vertical curve limiting sight distance
15+632.000	15+700.000	Northbound	72	85	60	Horizontal curve potentially limiting sight distance

Start Sta.	End Sta.	Travel Direction	Road SSD (M)	BC MoTI Guidelines SSD (M)	Speed (Km/H)	Comment
16+054.000	16+136.000	Northbound	90	130	80	Horizontal curve potentially limiting sight distance
17+852.000	17+898.000	Northbound	94	130	80	Horizontal curve potentially limiting sight distance

The available passing sight distance was generated automatically by IHSDM based on the horizontal and vertical curvature of the highway, the input lane and shoulder characteristics, and parameters or driver's eye height, object height, and maximum sight distance. A value is generated for every 10 metre segment of the highway, which is then compared to the required passing sight distance as per the BC MoTI guidelines. Highway 101 segments with potential passing sight distance deficiencies are shown in ***Figure A.2*** and listed in ***Table A.5***.

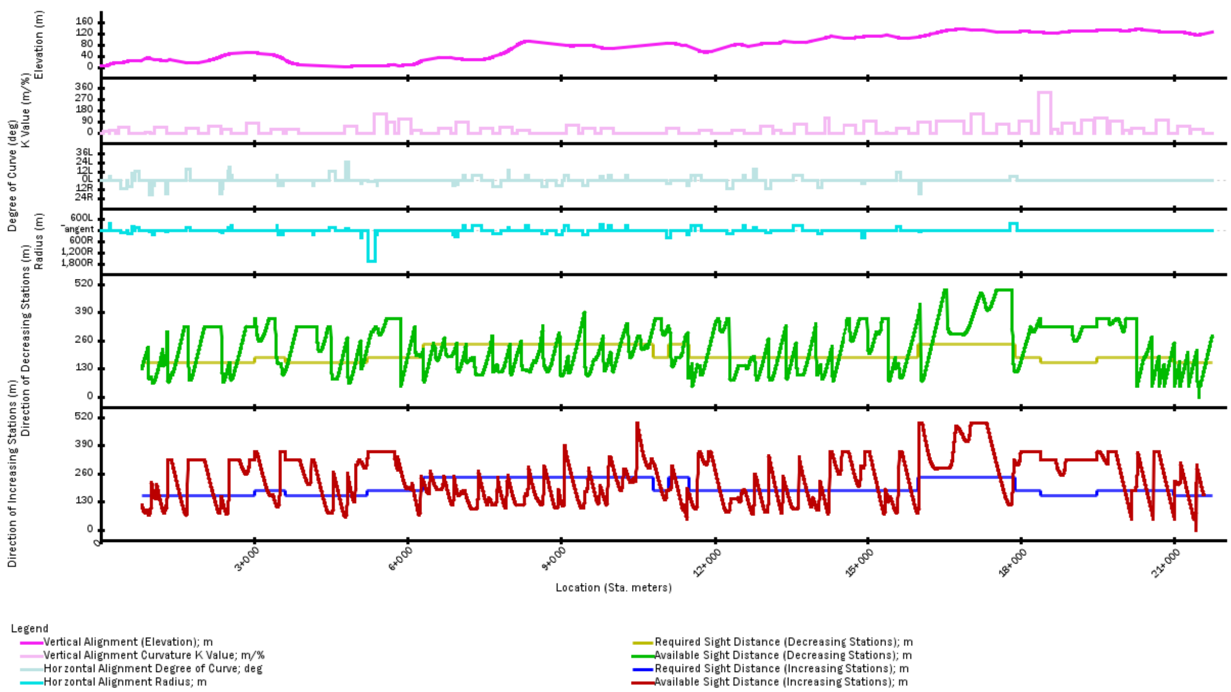


Figure A.2: Identified Potential Passing Sight Distance Deficiencies

Table A.5: Identified Potential Passing Sight Distance Deficiencies

Start Sta.	End Sta.	Travel Direction	Road PSD (M)	BC MoTI Guidelines PSD (M)	Speed (Km/H)	Comment
800	992	Southbound	70	160	50	Vertical curve limiting sight distance
1+046.000	1+088.000	Southbound	142	160	50	Horizontal curve potentially limiting sight distance
1+142.000	1+300.000	Southbound	76	160	50	Horizontal curve potentially limiting sight distance
1+550.000	1+696.000	Southbound	70	160	50	Horizontal curve potentially limiting sight distance
2+204.000	2+500.000	Southbound	72	160	50	Horizontal curve potentially limiting sight distance
3+234.000	3+502.000	Southbound	106	200	60	Vertical curve limiting sight distance
4+338.000	4+540.000	Southbound	76	160	50	Horizontal curve potentially limiting sight distance
4+658.000	4+818.000	Southbound	60	160	50	Horizontal curve potentially limiting sight distance

Start Sta.	End Sta.	Travel Direction	Road PSD (M)	BC MoTI Guidelines PSD (M)	Speed (Km/H)	Comment
4+912.000	4+972.000	Southbound	128	160	50	Vertical curve limiting sight distance
5+958.000	6+078.000	Southbound	188	200	60	Horizontal curve potentially limiting sight distance
6+100.000	6+256.000	Southbound	68	200	60	Vertical curve limiting sight distance
6+300.000	8+360.000	Southbound	98	275	80	Horizontal curve potentially limiting sight distance
8+378.000	8+660.000	Southbound	116	275	80	Horizontal curve potentially limiting sight distance
8+696.000	9+066.000	Southbound	100	275	80	Horizontal curve potentially limiting sight distance
9+178.000	9+532.000	Southbound	100	275	80	Horizontal curve potentially limiting sight distance
9+546.000	9+920.000	Southbound	118	275	80	Horizontal curve potentially limiting sight distance
10+034.000	10+216.000	Southbound	182	275	80	Horizontal curve potentially limiting sight distance
10+244.000	10+248.000	Southbound	274	275	80	Horizontal curve potentially limiting sight distance
10+270.000	10+470.000	Southbound	222	275	80	Horizontal curve potentially limiting sight distance
10+542.000	10+798.000	Southbound	50	275	80	Horizontal curve potentially limiting sight distance
10+800.000	10+802.000	Southbound	192	200	60	Horizontal curve potentially limiting sight distance
10+944.000	11+098.000	Southbound	140	200	60	Horizontal curve potentially limiting sight distance
11+100.000	11+158.000	Southbound	186	275	80	Vertical curve limiting sight distance
11+192.000	11+498.000	Southbound	92	275	80	Vertical curve limiting sight distance
11+500.000	11+666.000	Southbound	98	200	60	Horizontal curve potentially limiting sight distance
12+088.000	12+782.000	Southbound	72	200	60	Horizontal curve potentially limiting sight distance
12+858.000	13+052.000	Southbound	82	200	60	Horizontal curve potentially limiting sight distance
13+188.000	13+332.000	Southbound	80	200	60	Vertical curve limiting sight distance
13+394.000	13+646.000	Southbound	98	200	60	Horizontal curve potentially limiting sight distance
13+782.000	14+056.000	Southbound	90	200	60	Horizontal curve potentially limiting sight distance
14+088.000	14+246.000	Southbound	74	200	60	Vertical curve limiting sight distance
15+206.000	15+608.000	Southbound	72	200	60	Vertical curve limiting sight distance
15+844.000	15+998.000	Southbound	78	200	60	Horizontal curve potentially limiting sight distance
16+000.000	16+016.000	Southbound	86	275	80	Horizontal curve potentially limiting sight distance
17+568.000	17+866.000	Southbound	116	275	80	Horizontal curve potentially limiting sight distance
20+026.000	20+260.000	Southbound	50	200	60	Horizontal curve potentially limiting sight distance
20+452.000	20+600.000	Southbound	50	200	60	Horizontal curve potentially limiting sight distance
20+866.000	20+998.000	Southbound	66	200	60	Horizontal curve potentially limiting sight distance
21+000.000	21+014.000	Southbound	50	160	50	Horizontal curve potentially limiting sight distance
21+280.000	21+432.000	Southbound	50	160	50	Horizontal curve potentially limiting sight distance
800	832	Northbound	130	160	50	Horizontal curve potentially limiting sight distance
926	1+156.000	Northbound	64	160	50	Vertical curve limiting sight distance
1+214.000	1+250.000	Northbound	142	160	50	Horizontal curve potentially limiting sight distance
1+302.000	1+468.000	Northbound	68	160	50	Horizontal curve potentially limiting sight distance
1+718.000	1+858.000	Northbound	76	160	50	Horizontal curve potentially limiting sight distance
2+366.000	2+508.000	Northbound	70	160	50	Horizontal curve potentially limiting sight distance
2+520.000	2+662.000	Northbound	80	160	50	Horizontal curve potentially limiting sight distance

Start Sta.	End Sta.	Travel Direction	Road PSD (M)	BC MoTI Guidelines PSD (M)	Speed (Km/H)	Comment
3+432.000	3+598.000	Northbound	104	200	60	Vertical curve limiting sight distance
3+600.000	3+660.000	Northbound	116	160	50	Horizontal curve potentially limiting sight distance
4+504.000	4+702.000	Northbound	82	160	50	Horizontal curve potentially limiting sight distance
4+826.000	4+980.000	Northbound	66	160	50	Horizontal curve potentially limiting sight distance
5+078.000	5+136.000	Northbound	130	160	50	Vertical curve limiting sight distance
5+866.000	6+014.000	Northbound	50	200	60	Horizontal curve potentially limiting sight distance
6+160.000	6+280.000	Northbound	188	200	60	Horizontal curve potentially limiting sight distance
6+300.000	7+648.000	Northbound	68	275	80	Horizontal curve potentially limiting sight distance
7+656.000	8+612.000	Northbound	104	275	80	Horizontal curve potentially limiting sight distance
8+650.000	8+938.000	Northbound	116	275	80	Horizontal curve potentially limiting sight distance
8+974.000	9+344.000	Northbound	98	275	80	Horizontal curve potentially limiting sight distance
9+456.000	9+816.000	Northbound	98	275	80	Horizontal curve potentially limiting sight distance
9+826.000	10+198.000	Northbound	118	275	80	Horizontal curve potentially limiting sight distance
10+314.000	10+494.000	Northbound	182	275	80	Horizontal curve potentially limiting sight distance
10+522.000	10+526.000	Northbound	274	275	80	Horizontal curve potentially limiting sight distance
10+548.000	10+748.000	Northbound	222	275	80	Horizontal curve potentially limiting sight distance
10+872.000	11+020.000	Northbound	50	200	60	Horizontal curve potentially limiting sight distance
11+136.000	11+426.000	Northbound	140	275	80	Horizontal curve potentially limiting sight distance
11+474.000	11+498.000	Northbound	86	275	80	Vertical curve limiting sight distance
11+500.000	11+868.000	Northbound	94	200	60	Vertical curve limiting sight distance
12+290.000	12+984.000	Northbound	78	200	60	Horizontal curve potentially limiting sight distance
13+060.000	13+260.000	Northbound	76	200	60	Horizontal curve potentially limiting sight distance
13+396.000	13+538.000	Northbound	82	200	60	Vertical curve limiting sight distance
13+596.000	13+848.000	Northbound	100	200	60	Horizontal curve potentially limiting sight distance
13+986.000	14+260.000	Northbound	84	200	60	Horizontal curve potentially limiting sight distance
14+298.000	14+452.000	Northbound	74	200	60	Vertical curve limiting sight distance
15+410.000	15+810.000	Northbound	72	200	60	Vertical curve limiting sight distance
16+046.000	16+300.000	Northbound	74	275	80	Horizontal curve potentially limiting sight distance
17+846.000	17+898.000	Northbound	118	275	80	Horizontal curve potentially limiting sight distance
17+900.000	18+050.000	Northbound	116	200	60	Horizontal curve potentially limiting sight distance
20+280.000	20+464.000	Northbound	50	200	60	Horizontal curve potentially limiting sight distance
20+568.000	20+954.000	Northbound	50	200	60	Horizontal curve potentially limiting sight distance
21+006.000	21+114.000	Northbound	50	160	50	Horizontal curve potentially limiting sight distance
21+120.000	21+228.000	Northbound	50	160	50	Horizontal curve potentially limiting sight distance
21+282.000	21+390.000	Northbound	50	160	50	Horizontal curve potentially limiting sight distance
21+442.000	21+442.000	Northbound	134	160	50	Horizontal curve potentially limiting sight distance